

Post-Remedial Care Plan

DuPont Towanda Site
Towanda, Pennsylvania

Submitted on behalf of:
E.I. du Pont de Nemours and Company

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Project Number: 60561243.18010
Date: September 2018

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1.0 Introduction

This Post-Remedial Care Plan has been prepared by AECOM for the E.I. du Pont de Nemours and Company (DuPont) Towanda site in Towanda, Pennsylvania to facilitate withdrawal of Hazardous and Solid Waste Amendments (HSWA) Corrective Action Permit Number PAD 003 038 056.

DuPont has satisfied all permit conditions, documented in a letter to United States Environmental Protection Agency (EPA) Region 3 dated July 1, 2018. ~~The purpose of this plan is to summarize ongoing remedial expectations following withdrawal of the Permit.~~

Section 2 of this plan provides a brief site history, summarizes remedial investigations and interim measures, and lists the final remedy objectives. Section 3 details ongoing remedial expectations. Section 4 lists the references cited in this document.

2.0 Background

2.1 Site History

The DuPont Towanda site is located on Patterson Boulevard and New James Street in North Towanda Township, Bradford County, Pennsylvania (see Figure 1). The plant has been in operation since the early 1940s and consists of office, manufacturing, and maintenance buildings.

X-ray screen manufacturing operations began in the early 1940s, and the manufacturing of coated films and wet-processing solutions began in the 1960s. Television phosphors (black and white) were manufactured at the site from 1954 to 1958. Photosensitive polymer coatings were produced at the site from 1967 to 1974. The plant continued expanding manufacturing, adding an additional extrusion coating line in the early 1980s and converting to flammable solvent coating lines in the 1990s. The main product mix continued to serve printed circuit and flexible circuit board manufacturers and the proofing and imaging businesses. In recent years, the site has continued to serve these businesses with next generation offerings while expanding into newer technology such as fuel cell components. A new multi-functional coating facility was completed in 2007 and is producing coated materials for the flat panel display and photovoltaic solar panel markets.

2.2 Site Investigations and Interim Remedial Measures

In July 1990, the Pennsylvania Department of Environmental Resources (PADER) issued a Resource Conservation and Recovery Act (RCRA) permit to DuPont for corrective action and hazardous waste storage, treatment, and disposal. Under this permit, four investigations of solid waste management units (SWMUs) were conducted. These investigations consisted of a verification investigation, a supplemental verification investigation, a RCRA facility investigation (RFI), and a supplemental RFI.

In August 1994, DuPont Environmental Remediation Services (DERS) submitted a supplemental RFI report to the EPA. Engineering-Science completed the supplemental RFI under subcontract to DERS. Based on a meeting held with the EPA on July 27, 1994, the supplemental RFI completed the investigation requirements of the corrective action permit, and DuPont implemented interim remedial measures (IRMs) that consisted of removing methylene chloride from shallow well MW-06A for reclamation, monitoring groundwater in selected wells, and testing deep well MW-06C for possible casing leakage because of methylene chloride detections.

Methylene chloride was reclaimed from monitoring well MW-06A beginning in April 1995 using an existing steam stripper and a nitrogen stripper recovery system. DuPont and EPA agreed that groundwater removal in MW-06A would cease when the plant stopped using methylene chloride in the manufacturing process. The process ended in November 1996. The casing leakage test of well MW-06C was completed in January 1996. Test results indicated that casing leakage was not responsible for the occurrence of methylene chloride observed in well MW-06C. Instead, a nearby water exploration boring drilled in the 1970s and backfilled with gravel was determined to be a local conduit, allowing methylene chloride migration into the lower aquifer.

DuPont attempted to locate the water exploration boring using visual reconnaissance, geophysical techniques, and excavations. Although some historical water exploration

wells were found, DuPont was unsuccessful in locating the water exploration boring in the vicinity of well MW-06C.

In an effort to evaluate the monitored natural attenuation (MNA) processes at the site, DuPont prepared an *Evaluation of Intrinsic Bioremediation Report* (DERS, 1997). This report relied on a weight-of-evidence approach by evaluating a variety of parameters. Results indicated a high degree of microbial activity and demonstrated the effectiveness of bioremediation on the constituents of concern at the site. As a result of this evaluation, it was determined that natural attenuation plays a critical role in the degradation of methylene chloride and chloroethenes (e.g., trichloroethene, cis-1,2-dichloroethene, and vinyl chloride) at the site.

In December 2006, DuPont installed two additional deep groundwater monitoring wells, MW-18 and MW-19, to monitor the lower aquifer. The two wells were installed to gather further information regarding the groundwater flow in the lower aquifer on the site and to collect supporting evidence that the known contamination in the area of MW-08 was not migrating vertically beyond the capture zone of pumping well SW-04. DuPont collected samples from the wells in January and May 2007. Laboratory analytical results from those sampling events indicated that no contamination is migrating vertically beyond the capture zone of pumping well SW-04.

In August 2008, EPA issued a Statement of Basis (SB; EPA, 2008a) that summarized the information gathered during facility investigations and proposed a final corrective measure for the site of MNA and institutional controls. On December 22, 2008, EPA accepted the proposed final corrective measure for the site in a Final Decision and Response to Comments (FDRTC; EPA, 2008b) and modified the corrective action permit accordingly. The SB is included with this plan as Appendix A, and the FDRTC as Appendix B.

2.3 Final Remedy Objectives

The objectives of the final remedy are as follows:

- Implement and maintain institutional controls at the facility in accordance with the HSWA Corrective Action Permit (PAD 003 038 056), modified on December 22, 2008.
- Conduct MNA until DuPont demonstrates to the satisfaction of EPA that the groundwater cleanup standards selected in the FDRTC are achieved and maintained at the facility for three consecutive years or until EPA determines that an alternative remedy is necessary to achieve and maintain the groundwater cleanup standards for the site.

For groundwater, the clean-up standards are the maximum contaminant levels (MCLs) promulgated at 40 CFR Part 141 for site-related constituents: methylene chloride, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride. After MCLs are achieved and maintained at the facility for three consecutive years, DuPont may request termination of corrective action for groundwater contamination at the site.

3.0 Ongoing Remedial Expectations

Following withdrawal of the HSWA Corrective Action Permit, final remedial measures will continue at the site until EPA determines that groundwater cleanup standards have been met and maintained for three consecutive years for the site-related constituents listed in Section 2.3. These measures are summarized in this section.

3.1 Institutional Controls

On December 1, 2011, EPA approved the Environmental Covenant detailing activity and use limitations for the Towanda site. These limitations are as follows:

- Groundwater beneath the property shall not be used for potable purposes or any other use that could result in human exposure unless the use is required by the final remedy.
- Well drilling on the property is prohibited without prior EPA approval to prevent inadvertent exposure to the contaminated groundwater and adverse effects to the final remedy.

The document allows DuPont to request termination of the covenant after detections of site-related constituents in groundwater are below the MCLs for three consecutive years. The complete Environmental Covenant is included in this plan as Appendix C.

3.2 Groundwater Monitoring – MNA

Groundwater sampling is conducted once every fifth quarter at the site in accordance with the 2016 *Quality Assurance Project Plan* (QAPP; AECOM, 2016; see Appendix D). The QAPP functions as the site Sampling and Analysis Plan.

Samples from 11 monitoring wells are analyzed for volatile organic compounds (VOCs). The groundwater monitoring system consists of the following 11 wells [ten program-specific monitoring wells and one production well (SW-04)] as shown in Figure 2:

- MW-03C
- MW-06A
- MW-06C
- MW-07
- MW-08
- MW-15
- MW-16
- MW-17
- MW-18
- MW-19
- SW-04

Groundwater levels are measured at all sampling wells and at select wells that are on-site but are not part of the sampling program. Groundwater elevations are used to produce shallow and deep zone groundwater contour maps indicating groundwater flow direction. Analytical results and groundwater contour maps are provided to EPA in reports generated after each groundwater monitoring event.

3.3 General Requirements

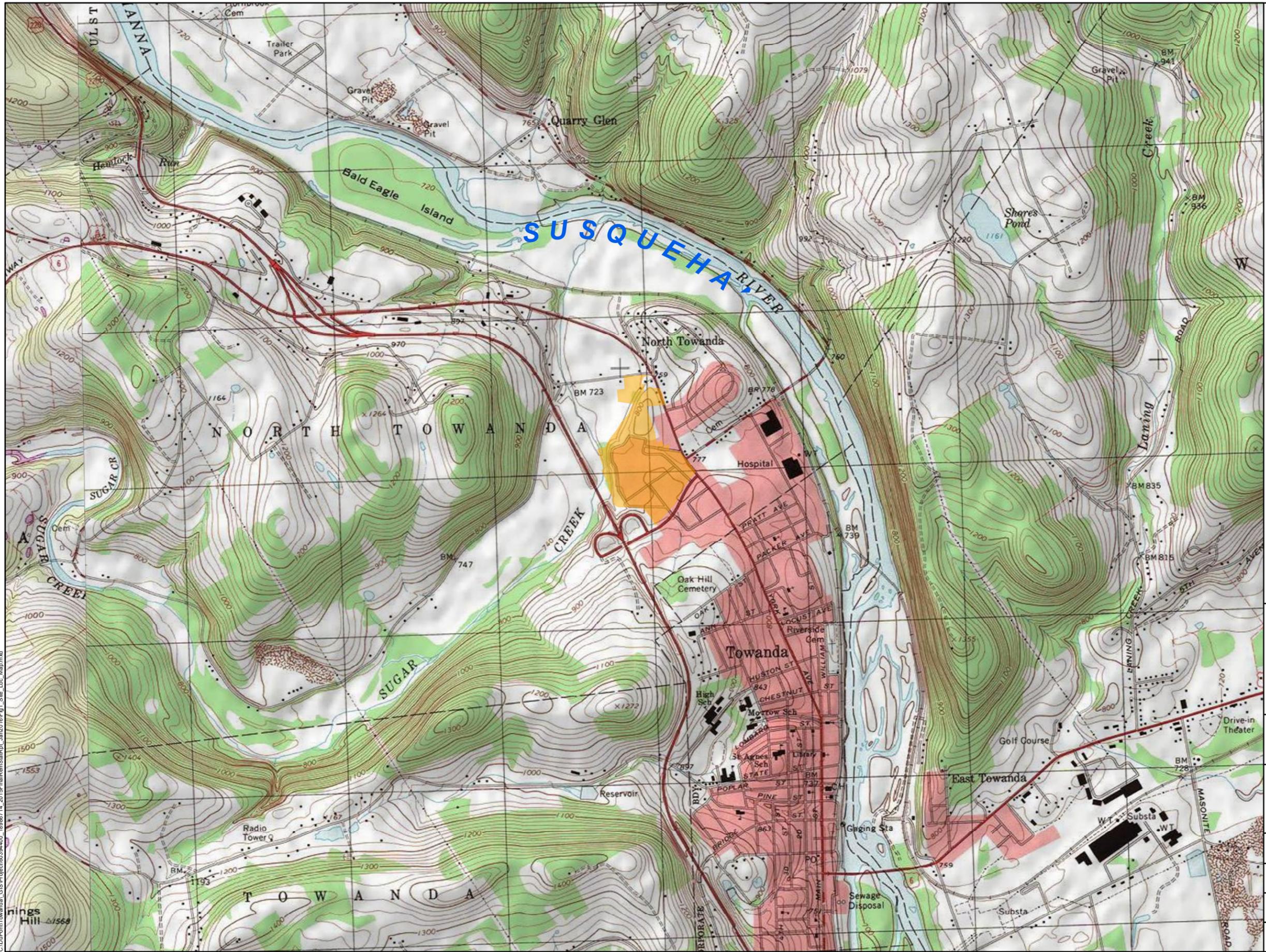
In addition to the final remedy components, DuPont will continue to observe several elements of the withdrawn HSWA Corrective Action Permit. These elements are as follows:

- If at any time a new release is identified on-site that is presenting or may present an imminent and substantial hazard to human health or the environment, DuPont will take necessary actions to address the release and will notify EPA of the source, nature, extent, and amount of the release.
- DuPont will continue to allow EPA and its authorized representatives access to the site at all reasonable times for purpose of monitoring compliance with the final remedy.
- DuPont will continue to demonstrate financial assurance for completion of the corrective measures selected in the Final Decision and Response to Comments (EPA 2008) until such time as the remedy has been completed.

4.0 References

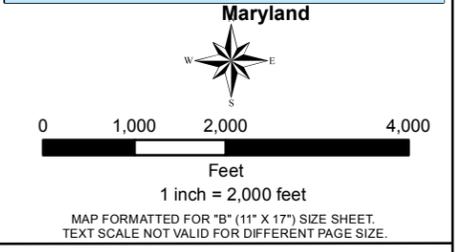
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Figures



Legend
 Towanda Property Outline

NOTES:
 Source: USA Topo Maps, Copyright:© 2013 National Geographic Society, i-cubed
 Map Scale: 1:24,000
 Map Projection: NAD83 Pennsylvania North State Plane feet



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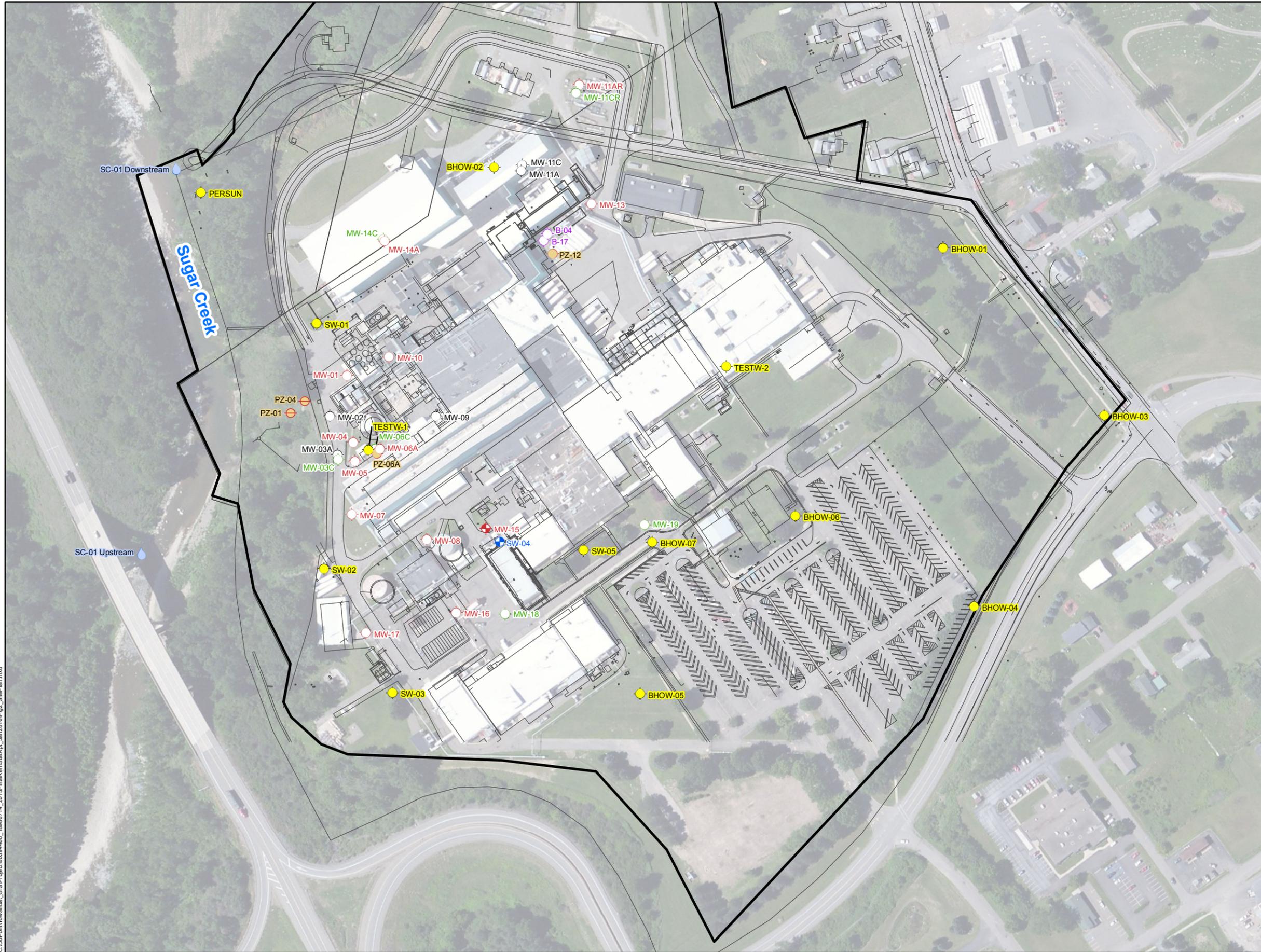
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SITE LOCATION MAP

2015 Final Remedy Status Report
 DuPont Towanda Site
 Towanda, Pennsylvania

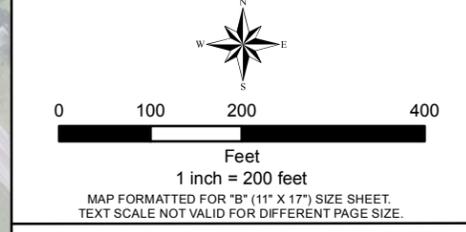
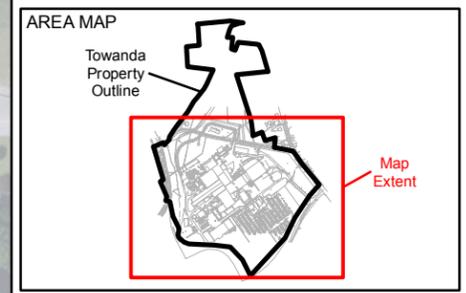
TASK NUMBER: 18986714.15007	PROJECT NUMBER: 60394400
DESIGNED BY: GCD	DATE: 1/6/2016
DRAWN BY: CAD	FIGURE NUMBER: 1
DATA QUALITY CHECK BY: CLM	

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- Legend**
- Shallow Monitoring Well
 - Deep Monitoring Well
 - Abandoned Monitoring Well
 - Pre RFI Monitor Well
 - Plant Production Well
 - Historical Water Exploration Well or Boring
 - Piezometer
 - Surface Water Sample Location (Approximate)
 - Basemap Feature
 - Towanda Property Outline

NOTES:
 2011 Aerial Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
 Map Scale: 1:2,400
 Map Projection: NAD83 Pennsylvania North State Plane feet



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SITE PLAN

2015 Final Remedy Status Report
 DuPont Towanda Site
 Towanda, Pennsylvania

TASK NUMBER: 18986714.15007	PROJECT NUMBER: 60394400
DESIGNED BY: GCD	DATE: 1/6/2016
DRAWN BY: CAD	FIGURE NUMBER: 2
DATA QUALITY CHECK BY: CLM	

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Appendices

Appendix A

Statement of Basis



UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION III

STATEMENT OF BASIS

E.I. DU PONT DE NEMOURS AND COMPANY

TOWANDA, PENNSYLVANIA

EPA ID NO. PAD 003 038 056

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Figure 1 - Map of the Plant Layout

ACRONYMS

AOC	Area of Concern
AR	Administrative Record
CFR	Code of Federal Regulations
CMP	Corrective Measures Plan
CMS	Corrective Measures Study
DNAPL	Dense Non-Aqueous Phase Liquids
EPA	Environmental Protection Agency
IC	Institutional Control
IM	Interim Measure
MCL	Maximum Contaminant Level
MeCl	Methylene Chloride
OHM	O.H. Materials Co.
PADEP/R	the Pennsylvania Department of Environmental Protection/Resources
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SB	Statement of Basis
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
U.S.C.	United States Code
VOC	Volatile Organic Compound

I. Introduction

A. Facility Name and Location

The United States Environmental Protection Agency (EPA) has prepared this Statement of Basis (SB) for the E.I. du Pont de Nemours and Company facility (hereinafter referred to as the Facility or DuPont) located in Towanda, Pennsylvania. The Facility is located on Patterson Boulevard in North Towanda, Towanda Township, Bradford County, Pennsylvania and is bordered by Route 6 on the east, Patterson Boulevard on the south, and Sugar Creek on the west-northwest. Topographically, the Facility is located on a glacial terrace approximately 70 feet above Sugar Creek. The Facility covers 51 acres. See Figure 1 for a map of the plant layout.

B. Purpose of Document/Proposed Remedy

The purpose of this SB is to summarize investigation results and remedial actions performed at the Facility and to describe and solicit comments on EPA's proposed final remedy. Based on a review of past and present environmental practices, soil and groundwater sampling activities, historical investigations and remedial activities performed at the Facility, EPA is proposing Monitored Natural Attenuation with Institutional Controls as the Final Remedy. Natural attenuation refers to a system where a variety of physical, chemical, or biological processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. As decomposition of the contaminants takes place, compounds called "breakdown products" are produced. Ultimately, the breakdown products are also decomposed resulting in compounds which are not a threat to human health or the environment. Monitored Natural Attenuation simply refers to the act of collecting samples to "monitor" the natural attenuation process.

Because contamination will remain in the groundwater at the Facility, EPA's proposed final remedy includes Institutional Controls (ICs). ICs are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. The proposed ICs are:

- an environmental covenant prohibiting the use of groundwater beneath the Facility for potable purposes or any other use that could result in human exposure, unless such use is required by the Final Remedy,
- an environmental covenant restricting well drilling without prior EPA approval shall be placed on the Facility to prevent inadvertent exposure to the contaminated groundwater and adverse affects to the final remedy, and
- in the event DuPont intends to sell part or all of the Facility, DuPont will notify EPA and demonstrate that the prospective purchaser is aware of the restrictions placed on groundwater use.

The Facility is subject to the Corrective Action program under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901 to 6992k.

The Corrective Action program is designed to ensure that facilities have investigated and cleaned up, if necessary, any releases of hazardous waste and constituents from any solid waste management unit.

In the Commonwealth of Pennsylvania, EPA has delegated most of the RCRA permitting program to the Pennsylvania Department of Environmental Protection (PADEP) based upon promulgated State regulations which are equivalent to, or more stringent than, the federal requirements. EPA has not yet delegated the RCRA Corrective Action requirements, under which this SB has been prepared, to PADEP. In Pennsylvania, EPA administers the RCRA Corrective Action program with authority to require environmental investigations and remedial actions at any facility that applies for a hazardous waste operating permit or otherwise operated under RCRA interim status.

PADEP issued the Facility a RCRA hazardous waste operating permit on July 31, 1990 for the storage of hazardous waste. On July 31, 1990, EPA issued a HSWA Corrective Action Permit (I.D. #PAD 003038056) (HSWA Permit) to the Facility which required the Permittee to investigate the extent of environmental contamination at the Facility and evaluate remedy options. The HSWA Permit expired on July 30, 2000 and its conditions have been continued under 40 C.F.R. Section 270.51. EPA intends to modify the Facility's HSWA Permit to include the components of EPA's Final Remedy.

C. Importance of Public Input

The public may participate in the remedy selection process by reviewing this SB and documents contained in the Administrative Record (AR) for the Facility and/or submitting written comments to EPA during the public comment period. The information presented in this SB can be found in greater detail in the work plans and reports submitted by DuPont to EPA, site inspections, EPA policies, and EPA guidelines which can be found in the AR. To gain a more comprehensive understanding of the RCRA activities that have been conducted at the Facility, EPA encourages anyone interested to review the AR. The AR and index are available for public review at the EPA Region III Office in Philadelphia as described in Section VI of this document.

As discussed in further detail in Section VI, below, EPA will address all significant comments submitted in response to the proposed remedy described in this SB. EPA will make a Final Remedy Decision and issue a Final Decision and Response to Comments (FDRTC) after it considers information submitted during the public comment period. If EPA determines that new information or public comments warrant a modification to the proposed remedy, EPA may modify the proposed remedy or select other alternatives based on such new information and/or public comments.

II. Facility Background

A. Site History

The Facility has been in operation since the early 1940's when DuPont began manufacturing X-ray screens. In the 1960's, DuPont began manufacturing coated films and wet-

processing solutions at the Facility. Television phosphors (black and white) were manufactured at the Facility from 1954 to 1958 and photosensitive polymer coatings were produced from 1967 to 1974. Currently, the Facility manufactures fuel cell components, coated films, and flexible circuit materials.

B. Summary of Environmental Investigations

On October 7, 1983, DuPont submitted to the Pennsylvania Department of Environmental Resources (PADER), which was subsequently renamed PADEP, a report describing a methylene chloride (MeCl) spill which occurred on the northeast side of the Facility. DuPont subsequently determined that the spill resulted from a leaking MeCl supply line.

On March 8, 1985, EPA requested information from DuPont regarding the Solid Waste Management Units (SWMU's) at the Facility. Subsequently, DuPont conducted and submitted a RCRA Facility Assessment (RFA) to EPA in which it described and recommended remedial actions all SWMUs identified at the Facility.

As required by the HSWA Permit, DuPont conducted the following four investigations at the Facility: a verification investigation (VI), a supplemental verification investigation (SVI), a RCRA Facility Investigation (RFI), and a supplemental RFI.

In 1991 DuPont performed the VI to investigate potential releases of hazardous waste at the Facility. EPA approved the final VI Report on September 6, 1991. The EPA-approved VI Report recommended that an RFI be conducted and that groundwater be further investigated in five areas where volatile organic compounds (VOCs) were detected above applicable screening levels developed by DuPont and approved by EPA. The VOCs detected above the screening criteria were benzene; 1,2-dichloroethane, MeCl and trichloroethylene (TCE).

DuPont conducted the SVI simultaneously with the VI to investigate high levels of VOCs detected in one HydroPunch sample taken in the area of Tanks A through F and the Solvent Reclamation Still. The results of the SVI were included in DuPont's RFI work plan submitted to EPA on February 28, 1992. EPA approved the RFI work plan on May 18, 1992. Based on the SVI, DuPont concluded that benzene, MeCl, and TCE were present in some wells above the respective screening levels for those contaminants. DuPont used the results of the VI and SVI to select locations for the installation of additional monitoring wells during the RFI.

In February 1992, DuPont detected MeCl in groundwater seeps from the bluff rising above Sugar Creek. DuPont submitted a Groundwater Seep Corrective Measures Plan (CMP) to EPA on May 13, 1992 proposing the installation of groundwater collection sumps to remediate the groundwater seeps. EPA approved DuPont's CMP on May 26, 1992.

DuPont performed the RFI to determine the type and extent of contamination at the Facility. As part of the RFI, DuPont presented a hydrogeologic conceptual model of the Facility developed with the aid of a computer program. The conceptual model was prepared to show the three dimensional flow system of groundwater under natural conditions as well as pumping conditions. The model portrayed a system where nearly all the groundwater originating from the

Facility discharges to Sugar Creek or seeps near the base of the bluff rising above Sugar Creek. The model also conceptualizes downward vertical hydraulic gradients between the glacial till (upper aquifer) and the silt and sand unit (lower aquifer). The flow in the silt and sand unit then becomes more horizontal due to its higher conductivity. Ultimately, Sugar Creek comprises the primary discharge of both the shallow and deep groundwater beneath the Facility with apparent influence by the nearly continuous plant production well. During the RFI, DuPont detected VOCs at concentrations of MeCl, TCE, and 1,2-dichloroethylene exceeding their respective MCLs in shallow groundwater in three areas at the Facility. The RFI recommended that additional data be obtained near Monitoring Well (MW)-8 to define the extent of VOC contamination in the shallow groundwater. DuPont submitted the final RFI Report to EPA in September 1993 and a Supplemental RFI Report in 1994. As part of the supplemental RFI, DuPont investigated the extent of VOC contamination near MW-8 and defined a boundary on the downgradient extent of the VOC contamination.

Based on the investigatory reports mentioned above and a July 27, 1994 meeting between DuPont and EPA, DuPont agreed to commence clean up of some of the releases of hazardous constituents before EPA selected a Final Remedy. These activities in which a facility performs short-term actions to control ongoing risks before a final remedy is selected are called Interim Measures (IM). The IMs are discussed in the next section.

DuPont submitted a study entitled Corrective Measures Study (CMS) to EPA on August 29, 1994. The CMS provided recommendations for Corrective Action at the Facility. The recommendations included reclaiming MeCl from MW-6A, instituting groundwater monitoring, evaluating the occurrence of MeCl in MW-6C, and monitoring the seep collection system. While EPA did not consider this document to be a corrective measures study since it described an interim remediation measure, EPA approved the remediation plans contained in the CMS on October 17, 1994.

DuPont submitted an *Evaluation of Intrinsic Bioremediation* report to EPA on July 23, 1997. This report detailed laboratory experiments through microcosm studies using soil and groundwater from the Facility. Along with groundwater monitoring and analysis, the laboratory experiments provided direct evidence that indigenous microbes are degrading MeCl in groundwater. Based upon the presented lines of evidence, intrinsic bioremediation is causing the degradation of MeCl and chloroethenes at the Facility and preventing their migration.

On August 13, 1998, DuPont provided EPA with a report evaluating the feasibility of using air sparging to remediate the source areas at the Facility. The report concluded that air sparging, which introduces oxygen into the subsurface, would likely suppress the ongoing anaerobic biological degradation resulting in the possible migration of site contaminants. More importantly, however, the low hydraulic conductivity would prevent effective implementation of this technology.

Also, in late 2006 to early 2007, DuPont conducted an investigation of the glacial silt and sand aquifer to determine whether contaminated groundwater was migrating beyond the immediate area where natural attenuation was occurring. Results from this investigation were presented to EPA in the *1st Half 2007 Interim Remedial Measure Status Report* which was

approved by EPA on October 11, 2007. Laboratory analytical results indicate that no contamination is migrating vertically beyond the capture zone of pumping well SW-04.

C. Summary of Interim Measures

Based on the investigatory reports detailed above, DuPont instituted IMs to remediate the contaminated groundwater beneath the Facility.

Activities taken on the northeast side of the Facility to remediate the MeCl spill were performed under PADER direction prior to EPA involvement at the Facility. In 1983, DuPont installed a groundwater recovery system consisting of 72 wells to remediate the groundwater. A combined approach utilizing air-stripping and associated soil flushing was employed. Biological remedial methods were then employed to achieve an even more stringent cleanup level. With the approval of PADER, DuPont discontinued groundwater remediation in June 1988. Based on results from the RFI, it appeared that some residual MeCl was still present in the shallow groundwater. A sharp decrease in MECl by four orders of magnitude was observed following a pump test performed in May, 1993. This decrease was confirmed by two additional rounds of sampling in July and August, 1993. It was determined that this residual area was small and that the pumping eliminated the bulk of this contamination. Overall, remedial efforts were successful in reducing contaminant levels from 1400 milligrams per liter (mg/L) to 0.004 mg/L.

In 1992 in accordance with the EPA-approved CMP, DuPont installed a groundwater collection pump to remediate contaminated groundwater found seeping from old drainage pipes on the western side of the Facility near the base of the bluff rising above Sugar Creek.

During the Facility investigations, two major areas of groundwater contamination were discovered. One area is centered around MW-6A in the upper aquifer and, to a lesser extent, MW-6C in the lower aquifer. The contamination in this area consisted primarily of MeCl. DuPont agreed to pump the MeCl contaminated water from MW-6A and transport it to the on-site MeCl recycling area which was part of DuPont's established operating procedures. DuPont agreed to continue this activity until MeCl use at the Facility ceased.

The MeCl recovery system operated from April 1995 to November 1996 and removed about 190 pounds of MeCl. Since November 1996, DuPont has monitored the presence of MeCl in the groundwater. The area of contaminated groundwater has remained small and there is no evidence that contamination has moved off-site. Furthermore, monitoring data have also shown that as of November 2001 and November 2003, MeCl has been nondetect in MW-6C and MW-6A, respectively.

Since MeCl no longer seeps from the pipes and has been non-detect since November 2003 in MW-6A and November 2001 in MW-6C, and the Facility no longer uses MeCl, EPA allowed DuPont to remove the pipes and the collection system of the MeCl recovery system.

The second area of groundwater contamination is in the upper aquifer centered around MW-8 and primarily consists of chlorinated degreasing solvents such as TCE and the compounds that form when chlorinated solvents decompose in the environment, namely cis-1,2-

dichloroethene, vinyl chloride, and ethene. This area of contamination is also small, is not moving off-site, and appears to be responding positively to natural attenuation.

III. Summary of Environmental Issues

A. Contaminated Media

The only medium contaminated at the Facility is the groundwater. The principal contaminants identified in the groundwater are MeCl, TCE, and the usual breakdown products of TCE: cis-1,2-dichloroethene, vinyl chloride, and ethene. The areas of contamination at the Facility are small, localized, and not migrating off-Site from the Facility.

B. Summary of Facility Risks

1. Potential Receptors in Contact with Groundwater – Environmental investigations performed by DuPont at the Facility show that groundwater contamination is not migrating off-site. Therefore, since there are no drinking water wells at the Facility, the only possible groundwater receptors would be workers who would be exposed to groundwater during installation of wells within the defined areas of on-site contamination. The ICs proposed will prohibit the installation of drinking water wells within these defined areas and, thus, eliminate this pathway. In addition, a Health and Safety Plan will be required which will alert any worker to the contamination and ensure appropriate Personal Protective Equipment will be worn and preventive exposure measures will be taken. Furthermore, EPA proposes to require DuPont to file deed notices to notify prospective purchasers that the groundwater underlying the Facility is contaminated.

2. Drinking Water Wells in the Vicinity of the Facility – In November 2006, EPA conducted a visual drinking water well survey in the vicinity of the Facility. No private wells were observed directly adjacent to the Facility. One private well was observed on the Susquehanna River side of Towanda in the vicinity of the public drinking water wells. The Towanda Public Drinking Water Wells are located in this same area and draw water from the aquifer beneath the aquifer where the highest contamination is located on the DuPont property. EPA has determined that Facility-related contamination is not migrating from the Facility, and, therefore, is not a threat to either of these receptors. This survey was supplemental to the well survey already performed during the RFI which noted that the closest groundwater users in the area are public water supply and industrial wells located approximately 3000 feet from the Facility along the Susquehanna River.

The Towanda Borough is aware of the groundwater contamination at the Facility. Towanda Borough routinely tests the water and has not detected the presence of any Facility-related contaminants further supporting EPA's finding that groundwater contamination is not migrating off-site or affecting the public drinking water supply.

IV. Proposed Remedy Performance Standards

EPA is proposing Monitored Natural Attenuation with Institutional Controls as the Final

Remedy for the Facility. For groundwater, the groundwater cleanup standards consist of the respective Maximum Contaminant Levels (MCLs) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1, for the constituents methylene chloride; trichloroethylene; cis-1,2-dichloroethene; and vinyl chloride. DuPont will be required to sample the monitoring well network in accordance with the Sampling and Analysis Plan (SAP) presented in the November 1, 1995 Interim Remedial Measures Status report. Any modification to the sampling plan will have to be approved by EPA prior to implementation.

Additionally, part of DuPont's conceptual model is that any groundwater, along with any contaminants, that migrates will be captured within the radius of influence of SW-04, the currently operational production pumping well. Therefore, if in the future this well were to stop pumping before the groundwater constituents meet their respective cleanup levels, DuPont will need to submit a plan to assure that human health and the environment are not being adversely impacted.

If DuPont determines, on the basis of analytical results, that the concentration of each constituent has not exceeded its respective cleanup level for three continuous years, DuPont may request in writing, for EPA approval, that corrective action for groundwater contamination at the Facility be terminated.

V. Evaluation of EPA's Proposed Remedy Selection

This section provides a description of the criteria EPA used to evaluate the proposed remedy consistent with EPA guidance. The criteria are applied in two phases. In the first phase, EPA evaluates three remedy threshold criteria as general goals. In the second phase, for those remedies which meet the threshold criteria, EPA then evaluates seven balancing criteria to determine which proposed remedy alternative provides the best relative combination of attributes.

A. Threshold Criteria

EPA's evaluation of the threshold criteria is as follows:

1. Protect Human Health and the Environment - EPA is satisfied with the determination that Monitored Natural Attenuation with ICs is and will be protective of human health and the environment. There are no human health threats associated with domestic uses of the contaminated groundwater originating from the Facility because groundwater is not used for drinking water purposes. In addition, due to biological activity, the contaminants in the groundwater at the Facility are decomposing rapidly enough to prevent the contaminants and the breakdown products from migrating from the Facility.

Even though there are no current consumptive uses of Facility-contaminated groundwater, it is EPA's goal that groundwater be restored to drinking water standards to be

protective of potential future use. Until groundwater is restored to drinking water standards, EPA is proposing to require ICs, as necessary, to prevent consumptive use of the groundwater.

2. Attainment of Media Cleanup Standards - The proposed Monitored Natural Attenuation with ICs will attain the media cleanup criterion by restoring groundwater to drinking water standards. Under EPA's proposed remedy, DuPont will be required to monitor groundwater until the concentration of each constituent does not exceed the constituent's respective Maximum Contaminant Level (MCL) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1, for three continuous years.

DuPont will be required to sample the monitoring well network in accordance with the SAP presented in the November 1, 1995 Interim Remedial Measures Status report. Any modification to the SAP will have to be approved by the EPA prior to implementation.

3. Controlling Source of Releases - Since DuPont ceased using MeCl in its operations in 1996, the source for MeCl has been eliminated. The re-routing of the drainage pipes to the sump for collection and transfer to the on-site treatment area addressed the issue of MeCl seeping into Sugar Creek. Moreover, the area where the highest concentrations of MeCl were found has responded to natural attenuation as well as other technologies. Monitoring data have shown that as of November 2003 and November 2001, MeCl has been non-detect in MW-6A and 6C, respectively.

With respect to the second area of groundwater contamination in the upper aquifer centered around MW-8, chlorinated solvents and compounds that form when chlorinated solvents decompose in the environment are found in the shallow and deep aquifers with the former evaporation pond as the most likely source. The evaporation pond was closed in 1974; soil was excavated and the area was filled with gravel effectively eliminating the source. Natural Attenuation will complete remediation of the residual compounds.

B. Balancing/Evaluation Criteria

1. Long-Term Reliability and Effectiveness - The long-term reliability and effectiveness standard is intended to address protection of human health and the environment over the long term. DuPont has demonstrated that, due to biological activity, the contaminants in the groundwater are decomposing rapidly enough to prevent the contaminants or the breakdown products from migrating beyond the Facility boundary. EPA expects this natural attenuation process to continue. DuPont will continue to monitor the groundwater to demonstrate that this attenuation process continues until the groundwater cleanup standards are met.

2. Reduction of Toxicity, Mobility or Volume of Waste - For this criterion, remedies that employ treatment and/or source removal and containment that are capable of permanently reducing the overall risk posed by the remediation wastes are preferred. Natural attenuation, by definition, refers to a system where a variety of physical, chemical, or biological processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. EPA's proposed remedy will, therefore, accomplish this

criterion.

3. Short-Term Effectiveness - The proposed remedy is expected to meet the short-term effectiveness criterion. The short-term effectiveness criterion is intended to address hazards posed during the implementation of the remedy. Short-term effectiveness is designed to take into consideration the impact on site workers and nearby residents during construction before the final cleanup levels are met. The only possible exposures to groundwater at the Facility is to workers taking environmental samples or to workers excavating soil in the vicinity of the contaminated plume. DuPont will be required to submit a Health and Safety Plan to EPA that provides for proper worker training and the wearing of protective clothing if exposure to contaminated groundwater is expected.

4. Implementability -. The proposed remedy is fully implementable. The implementability criterion addresses the regulatory constraints in employing the cleanup approach. Natural attenuation has been proven to be occurring at the Facility due to naturally occurring microbes. All necessary components of the monitoring network are in place and are currently operational; therefore, no new regulatory constraints are anticipated.

5. Cost - EPA's overriding mandate under RCRA is protection of human health and the environment. However, EPA believes that cost is an appropriate consideration when selecting among alternatives that achieve the cleanup requirements. EPA's experience in the Superfund program has shown that in many cases several different approaches will offer equivalent protection of human health and the environment, but may vary widely in cost. All necessary components of the monitoring network at the Facility are in place and are currently operational. The only recurring costs are operational and maintenance (O&M) and reporting costs of the monitoring network.

DuPont has submitted a cost estimate for the proposed remedy of Monitored Natural Attenuation with ICs of \$21,750 per year.

6. Community Acceptance - The Community acceptance of EPA's proposed remedy will be evaluated based on comments received during the public comment period and will be described in the FDRTC.

7. State Acceptance - State acceptance will be evaluated based on comments received from PADEP during the public comment period and will be described in the FDRTC.

PADEP has been involved with the actions of the Facility jointly with the EPA since 1990. PADEP's Environmental Cleanup Program previously raised concerns that the conceptual model utilized for this Facility has not been documented to be accurate and, therefore, has allowed some unknown contaminant mass to escape into the bedrock aquifer. PADEP requests that to remedy this, bedrock wells need to be installed to determine the quality of the water. During the RFI, EPA decided to forego installing bedrock wells. Furthermore, there are no data to suggest that the conceptual model included as part of the RFI is inaccurate. Refer to Section

IIB for a description of the conceptual model.

EPA continues to disagree that bedrock wells are necessary considering the analytical data available since monitoring began. EPA did, however, agree that further investigation into the silt and sand aquifer was necessary. In response, DuPont agreed to install two additional wells that monitored the groundwater zone immediately above bedrock. EPA has concluded that the analytical results from these wells are below any level that would represent a threat to human health or the environment, or otherwise impair the use of this aquifer for off-site groundwater users.

VI. Public Participation

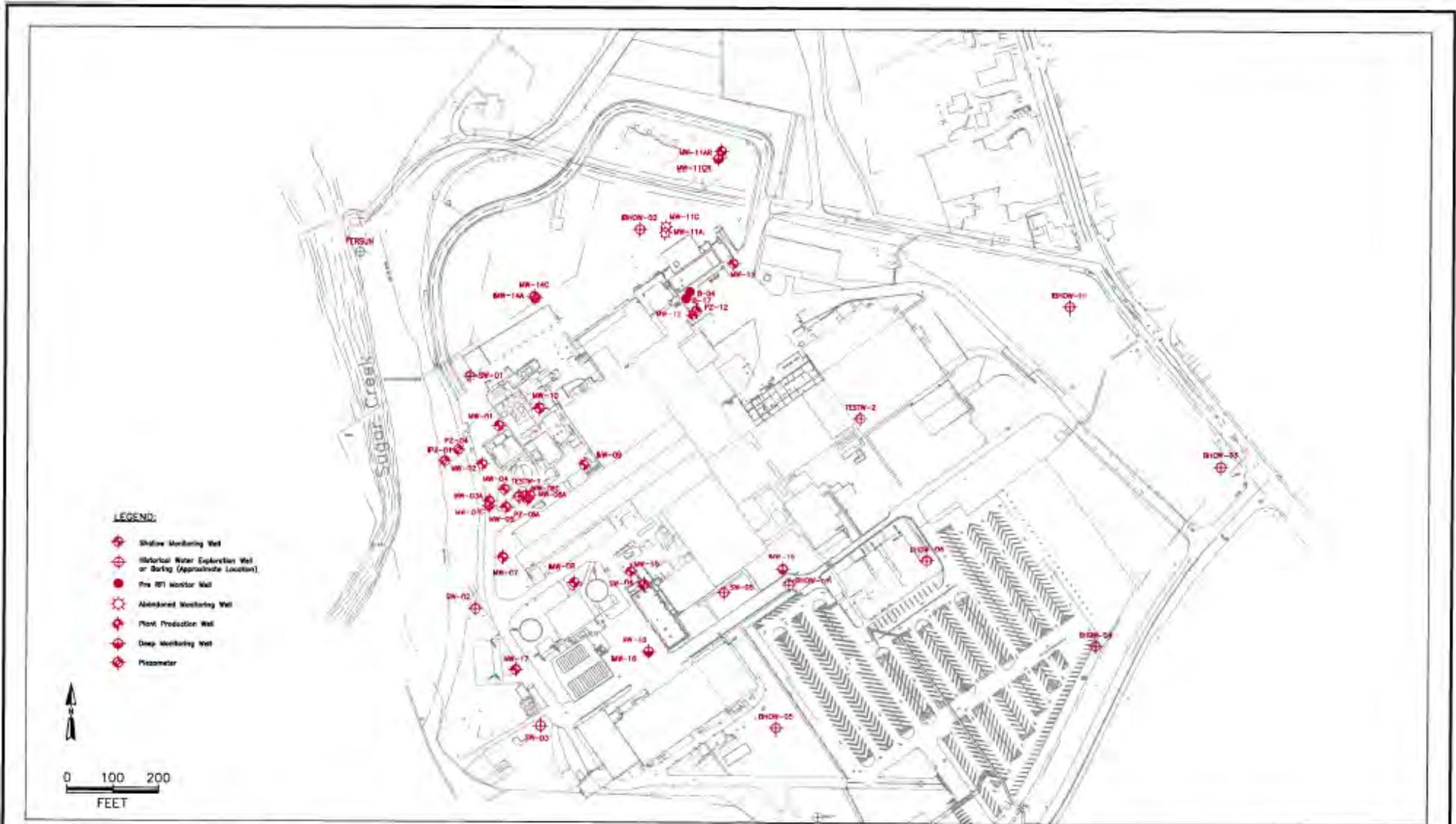
EPA is requesting comments from the public on its proposal that Monitored Natural Attenuation with Institutional Controls become the Final Remedy at the DuPont Facility in Towanda, Pennsylvania. The public comment period will last forty-five (45) calendar days from the date that this SB is published in a local newspaper. Comments should be submitted by mail, fax, e-mail, or phone to the addresses listed below.

A public hearing will be held upon request. Requests for a public hearing should be made to Mr. Kevin Bilash of the EPA Regional Office (215-814-2796). A hearing will not be scheduled unless requested.

The Administrative Record contains all information considered by EPA when making this proposal to require Monitored Natural Attenuation and Institutional Controls at the Facility. The Administrative Record is available at the following location:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact: Mr. Kevin Bilash (3LC30)
Phone: (215) 814-2796
Fax: (215) 814 - 3113
Email: bilash.kevin@epa.gov

After evaluation of the public's comments, EPA will prepare a Final Decision and Response to Comments that identifies the final selected remedy. The Response to Comments will address all significant written comments and any significant oral comments generated at the public meeting, if requested. This Final Decision and Response to Comments will be made available to the public. If, on the basis of such comments or other relevant information, significant changes are proposed to be made to the corrective measures identified by EPA in this SB, EPA may seek additional public comments.



Corporate Remediation Group

An Alliance between
DuPont and ORR Diamond
Borley Mill Plaza, Building 27
Wilmington, Delaware 19825



TITLE:
DuPont Towanda
Site Base Map

DATE:	DEL	DESC:	FILE NUMBER:
PREP:	EAH	APPRO:	TAE
DATE:	1/6/03	REV:	0
			FIGURE NO.: 1

Appendix B

Final Decision and Response to Comments



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

FINAL DECISION AND RESPONSE TO COMMENTS

E.I. du Pont de Nemours and Company
Towanda, Pennsylvania
EPA ID NO. PAD003038056

I. FINAL DECISION – Monitored Natural Attenuation with Institutional Controls

The United States Environmental Protection Agency (EPA) has selected Monitored Natural Attenuation with Institutional Controls as the Final Remedy for the E.I. du Pont de Nemours and Company facility located at Patterson Boulevard, Towanda, Pennsylvania (the Facility or DuPont). Because contamination will remain in the groundwater at the Facility, EPA is requiring institutional controls. Institutional controls are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. The required institutional controls are:

- a. an environmental covenant to be entered pursuant to the Pennsylvania Uniform Environmental Covenants Act, 27 Pa. C.S. Sections 6501-6517, (UECA) and to be recorded with the deed for the Facility property. The Environmental Covenant is required to include the following restrictions:
 - i. a restriction on the use of groundwater beneath the Facility for potable purposes or any other use that could result in human exposure, unless such use is required by the Final Remedy, and

- ii. a restriction on well drilling at the Facility without prior EPA approval, to prevent inadvertent exposure to the contaminated groundwater and adverse affects to the Final Remedy.
- b. in the event DuPont intends to sell part or all of the Facility, DuPont will notify EPA and demonstrate that the prospective purchaser is aware of the restrictions described in paragraphs I.a.i. and ii., immediately above.

This Final Decision and Response to Comments (Final Decision) will be enforceable through a Permit Modification. The Permit Modification will be signed concurrently with this Final Decision and both will become effective upon signature. The Final Decision will be incorporated into the Permit Modification and made a part thereof.

II. PUBLIC COMMENT PERIOD

In August 2008, EPA issued a Statement of Basis (SB) which summarized the information gathered during the environmental investigations at the Facility and proposed Monitored Natural Attenuation with Institutional Controls as the Final Remedy. In conjunction with the SB, EPA issued a draft Permit Modification under which EPA proposed to implement the Final Remedy. Consistent with public participation provisions under the Resource Conservation and Recovery Act (RCRA), EPA requested comments from the public on the proposed remedy as described in the SB and on the draft Permit Modification. The commencement of a joint thirty (30)-day public comment period was announced in The Daily Review on August 11, 2008. The public comment period ended on September 25, 2008. EPA received two comments, which were subsequently amended, from the Pennsylvania Department of Environmental Protection (PADEP) on its proposed remedy and draft Permit Modification. The SB is hereby incorporated into this Final Decision by reference and made a part hereof as Attachment A.

III. RESPONSE TO COMMENTS

EPA received two comments from PADEP on September 24, 2008. Those comments and EPA's response to those comments follow.

Comment 1: There is a lack of historical information in the document. The known impacts to Towanda's Public Supply Well # 1 in 1983 should be included in the document. Although some of our records have been purged for this period of time, we do have ancillary information indicating that Towanda's well was impacted and that DuPont was the apparent source of that contamination. This is important to acknowledge that a groundwater pathway exists between the DuPont facility and the Towanda groundwater supply well, and what remedial efforts were implemented to abate the problem. Does EPA or DuPont have any information that they could provide for this document to clarify how the impact to the groundwater supply well was evaluated and abated?

EPA response: EPA reviewed its files in an attempt to locate information relating to this comment. No information was located. EPA then contacted DuPont and PADEP to obtain the ancillary information referred to in the comment. DuPont did not locate any information relating to this comment. PADEP informed EPA that the ancillary information was a press release discussing one incident in which methylene chloride was reportedly detected in a sample result. PADEP field personnel involved with the incident recall that the sample result was a false positive, i.e., the laboratory reported methylene chloride contamination in a sample when in fact there was none. PADEP subsequently amended its comment on November 13, 2008 as follows:

Amended Comment 1: After discussion with EPA and indirectly with DuPont, and discussion with PADEP field staff, it was determined that the 1983 press release found in the PADEP files which lead to the original comment #1 below, in fact was a false positive sample result. There is no known additional historical information that confirms the public well impact. Although the groundwater pathway is a potential pathway from the DuPont facility to the Towanda Public Supply Wells, there is no information to suggest that it was a completed pathway in 1983.

EPA response: EPA agrees with PADEP's comment that the groundwater pathway is a potential pathway from the Facility to the Towanda Public Supply Wells. As a point of clarification, PADEP believes, as stated in Amended Comment #2, below, that the pathway is complete through the bedrock aquifer. However, EPA has determined that the pathway is complete through the silt and sand aquifer from which Towanda's Water Authority wells are pumping. In November 2007, DuPont installed two wells in the silt and sand aquifer to monitor this pathway. Sample results from those wells have been non-detect for the contaminants of concern since sampling began in 2007.

Comment 2: Acknowledging impact to the Towanda supply well and review of the related environmental information provided by DuPont, the Environmental Cleanup Program of this office had been requesting additional monitoring wells be constructed into the bedrock in or around this facility in order to validate the hydraulic and analytical information used in the conceptual model. At a minimum, please include the "hydraulic relationships" in Section V, B, # 7 of the document for reasons why we believe the conceptual model may not be accurate. Not only do we know that some mass of the contaminants escaped and impacted the bedrock aquifer, as verified with the impacts to the Towanda water supply well # 1, hydraulic relationships under non pumping and pumping conditions warrant an evaluation of the vertical hydraulic head potentials for this site. Although the DuPont supply well may have been an area of capture for contamination, it did not contain all of the lost material. Can you provide a paragraph in the document on how the hydraulic evaluation was completed and why this compliments the analytical information.

EPA response: PADEP's request to validate the hydraulic and analytical information used in the conceptual model is based on the false assumption that there was an impact in 1983 to Towanda's Public Supply Well # 1, see EPA's response to Comment #1 above. EPA's files show that it had contacted the Towanda Borough Water Authority Supervisor

on January 13, 2006 at which time the Supervisor explained that there has never been a detection of methylene chloride in sampling results. The sampling frequency originally was weekly, then quarterly, then annually and is now once every three years per PADEP requirements. On November 5, 2008 EPA also reviewed the PADEP Drinking Water Reporting System which confirmed that methylene chloride has not been detected during the reporting periods in the database from February 2003 to March 2007.

Amended Comment 2: As a result of the information presented above, the remaining comment to be clarified is that pertaining to Section V, B, #7 of the Statement of Basis. PADEP Northcentral Regional Office's Environmental Cleanup Program had concerns that dissolved as well as Dense Non Aqueous Phase Liquids (DNAPL) may have migrated into the bedrock. In order to resolve this issue the PADEP was requesting additional monitoring wells be placed into bedrock to conclude on the validity of the hydraulic assumptions made in the conceptual model which inhibited dissolved and DNAPL migration into the bedrock. EPA has concluded that the additional monitoring wells are not necessary due to the information obtained during the investigative process.

EPA response: EPA agrees with this comment.

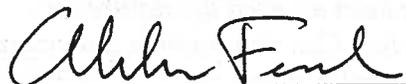
Based on the comments provided, the amended comments provided, and the fact that EPA received no other comments from any other source, the remedy proposed in the SB should remain unchanged, and, therefore, EPA selected Monitored Natural Attenuation with Institutional Controls as described herein as the Final Remedy for the Facility.

IV. AUTHORITY

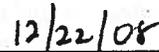
EPA is issuing this Final Decision under the authority of the Solid Waste Disposal Act, as amended by RCRA, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901 to 6992k.

V. DECLARATION

Based on the Administrative Record compiled for the Corrective Action at the E.I. du Pont de Nemours and Company facility, EPA has determined that the Final Remedy selected in this Final Decision and Response to Comments is protective of human health and the environment.



Abraham Ferdas, Director
Land & Chemicals Division
U.S EPA Region III



Date



STATE OF TENNESSEE

COMMISSIONERS OF REVENUE

MEMPHIS

Attachment A



UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION III

STATEMENT OF BASIS

E.I. DU PONT DE NEMOURS AND COMPANY

TOWANDA, PENNSYLVANIA

EPA ID NO. PAD 003 038 056

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Figure 1 - Map of the Plant Layout

ACRONYMS

AOC	Area of Concern
AR	Administrative Record
CFR	Code of Federal Regulations
CMP	Corrective Measures Plan
CMS	Corrective Measures Study
DNAPL	Dense Non-Aqueous Phase Liquids
EPA	Environmental Protection Agency
IC	Institutional Control
IM	Interim Measure
MCL	Maximum Contaminant Level
MeCl	Methylene Chloride
OHM	O.H. Materials Co.
PADEP/R	the Pennsylvania Department of Environmental Protection/Resources
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SB	Statement of Basis
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
U.S.C.	United States Code
VOC	Volatile Organic Compound

I. Introduction

A. Facility Name and Location

The United States Environmental Protection Agency (EPA) has prepared this Statement of Basis (SB) for the E.I. du Pont de Nemours and Company facility (hereinafter referred to as the Facility or DuPont) located in Towanda, Pennsylvania. The Facility is located on Patterson Boulevard in North Towanda, Towanda Township, Bradford County, Pennsylvania and is bordered by Route 6 on the east, Patterson Boulevard on the south, and Sugar Creek on the west-northwest. Topographically, the Facility is located on a glacial terrace approximately 70 feet above Sugar Creek. The Facility covers 51 acres. See Figure 1 for a map of the plant layout.

B. Purpose of Document/Proposed Remedy

The purpose of this SB is to summarize investigation results and remedial actions performed at the Facility and to describe and solicit comments on EPA's proposed final remedy. Based on a review of past and present environmental practices, soil and groundwater sampling activities, historical investigations and remedial activities performed at the Facility, EPA is proposing Monitored Natural Attenuation with Institutional Controls as the Final Remedy. Natural attenuation refers to a system where a variety of physical, chemical, or biological processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. As decomposition of the contaminants takes place, compounds called "breakdown products" are produced. Ultimately, the breakdown products are also decomposed resulting in compounds which are not a threat to human health or the environment. Monitored Natural Attenuation simply refers to the act of collecting samples to "monitor" the natural attenuation process.

Because contamination will remain in the groundwater at the Facility, EPA's proposed final remedy includes Institutional Controls (ICs). ICs are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. The proposed ICs are:

- an environmental covenant prohibiting the use of groundwater beneath the Facility for potable purposes or any other use that could result in human exposure, unless such use is required by the Final Remedy,
- an environmental covenant restricting well drilling without prior EPA approval shall be placed on the Facility to prevent inadvertent exposure to the contaminated groundwater and adverse affects to the final remedy, and
- in the event DuPont intends to sell part or all of the Facility, DuPont will notify EPA and demonstrate that the prospective purchaser is aware of the restrictions placed on groundwater use.

The Facility is subject to the Corrective Action program under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901 to 6992k.

The Corrective Action program is designed to ensure that facilities have investigated and cleaned up, if necessary, any releases of hazardous waste and constituents from any solid waste management unit.

In the Commonwealth of Pennsylvania, EPA has delegated most of the RCRA permitting program to the Pennsylvania Department of Environmental Protection (PADEP) based upon promulgated State regulations which are equivalent to, or more stringent than, the federal requirements. EPA has not yet delegated the RCRA Corrective Action requirements, under which this SB has been prepared, to PADEP. In Pennsylvania, EPA administers the RCRA Corrective Action program with authority to require environmental investigations and remedial actions at any facility that applies for a hazardous waste operating permit or otherwise operated under RCRA interim status.

PADEP issued the Facility a RCRA hazardous waste operating permit on July 31, 1990 for the storage of hazardous waste. On July 31, 1990, EPA issued a HSWA Corrective Action Permit (I.D. #PAD 003038056) (HSWA Permit) to the Facility which required the Permittee to investigate the extent of environmental contamination at the Facility and evaluate remedy options. The HSWA Permit expired on July 30, 2000 and its conditions have been continued under 40 C.F.R. Section 270.51. EPA intends to modify the Facility's HSWA Permit to include the components of EPA's Final Remedy.

C. Importance of Public Input

The public may participate in the remedy selection process by reviewing this SB and documents contained in the Administrative Record (AR) for the Facility and/or submitting written comments to EPA during the public comment period. The information presented in this SB can be found in greater detail in the work plans and reports submitted by DuPont to EPA, site inspections, EPA policies, and EPA guidelines which can be found in the AR. To gain a more comprehensive understanding of the RCRA activities that have been conducted at the Facility, EPA encourages anyone interested to review the AR. The AR and index are available for public review at the EPA Region III Office in Philadelphia as described in Section VI of this document.

As discussed in further detail in Section VI, below, EPA will address all significant comments submitted in response to the proposed remedy described in this SB. EPA will make a Final Remedy Decision and issue a Final Decision and Response to Comments (FDRTC) after it considers information submitted during the public comment period. If EPA determines that new information or public comments warrant a modification to the proposed remedy, EPA may modify the proposed remedy or select other alternatives based on such new information and/or public comments.

II. Facility Background

A. Site History

The Facility has been in operation since the early 1940's when DuPont began manufacturing X-ray screens. In the 1960's, DuPont began manufacturing coated films and wet-

processing solutions at the Facility. Television phosphors (black and white) were manufactured at the Facility from 1954 to 1958 and photosensitive polymer coatings were produced from 1967 to 1974. Currently, the Facility manufactures fuel cell components, coated films, and flexible circuit materials.

B. Summary of Environmental Investigations

On October 7, 1983, DuPont submitted to the Pennsylvania Department of Environmental Resources (PADER), which was subsequently renamed PADEP, a report describing a methylene chloride (MeCl) spill which occurred on the northeast side of the Facility. DuPont subsequently determined that the spill resulted from a leaking MeCl supply line.

On March 8, 1985, EPA requested information from DuPont regarding the Solid Waste Management Units (SWMU's) at the Facility. Subsequently, DuPont conducted and submitted a RCRA Facility Assessment (RFA) to EPA in which it described and recommended remedial actions all SWMUs identified at the Facility.

As required by the HSWA Permit, DuPont conducted the following four investigations at the Facility: a verification investigation (VI), a supplemental verification investigation (SVI), a RCRA Facility Investigation (RFI), and a supplemental RFI.

In 1991 DuPont performed the VI to investigate potential releases of hazardous waste at the Facility. EPA approved the final VI Report on September 6, 1991. The EPA-approved VI Report recommended that an RFI be conducted and that groundwater be further investigated in five areas where volatile organic compounds (VOCs) were detected above applicable screening levels developed by DuPont and approved by EPA. The VOCs detected above the screening criteria were benzene; 1,2-dichloroethane, MeCl and trichloroethylene (TCE).

DuPont conducted the SVI simultaneously with the VI to investigate high levels of VOCs detected in one HydroPunch sample taken in the area of Tanks A through F and the Solvent Reclamation Still. The results of the SVI were included in DuPont's RFI work plan submitted to EPA on February 28, 1992. EPA approved the RFI work plan on May 18, 1992. Based on the SVI, DuPont concluded that benzene, MeCl, and TCE were present in some wells above the respective screening levels for those contaminants. DuPont used the results of the VI and SVI to select locations for the installation of additional monitoring wells during the RFI.

In February 1992, DuPont detected MeCl in groundwater seeps from the bluff rising above Sugar Creek. DuPont submitted a Groundwater Seep Corrective Measures Plan (CMP) to EPA on May 13, 1992 proposing the installation of groundwater collection sumps to remediate the groundwater seeps. EPA approved DuPont's CMP on May 26, 1992.

DuPont performed the RFI to determine the type and extent of contamination at the Facility. As part of the RFI, DuPont presented a hydrogeologic conceptual model of the Facility developed with the aid of a computer program. The conceptual model was prepared to show the three dimensional flow system of groundwater under natural conditions as well as pumping conditions. The model portrayed a system where nearly all the groundwater originating from the

Facility discharges to Sugar Creek or seeps near the base of the bluff rising above Sugar Creek. The model also conceptualizes downward vertical hydraulic gradients between the glacial till (upper aquifer) and the silt and sand unit (lower aquifer). The flow in the silt and sand unit then becomes more horizontal due to its higher conductivity. Ultimately, Sugar Creek comprises the primary discharge of both the shallow and deep groundwater beneath the Facility with apparent influence by the nearly continuous plant production well. During the RFI, DuPont detected VOCs at concentrations of MeCl, TCE, and 1,2-dichloroethylené exceeding their respective MCLs in shallow groundwater in three areas at the Facility. The RFI recommended that additional data be obtained near Monitoring Well (MW)-8 to define the extent of VOC contamination in the shallow groundwater. DuPont submitted the final RFI Report to EPA in September 1993 and a Supplemental RFI Report in 1994. As part of the supplemental RFI, DuPont investigated the extent of VOC contamination near MW-8 and defined a boundary on the downgradient extent of the VOC contamination.

Based on the investigatory reports mentioned above and a July 27, 1994 meeting between DuPont and EPA, DuPont agreed to commence clean up of some of the releases of hazardous constituents before EPA selected a Final Remedy. These activities in which a facility performs short-term actions to control ongoing risks before a final remedy is selected are called Interim Measures (IM). The IMs are discussed in the next section.

DuPont submitted a study entitled Corrective Measures Study (CMS) to EPA on August 29, 1994. The CMS provided recommendations for Corrective Action at the Facility. The recommendations included reclaiming MeCl from MW-6A, instituting groundwater monitoring, evaluating the occurrence of MeCl in MW-6C, and monitoring the seep collection system. While EPA did not consider this document to be a corrective measures study since it described an interim remediation measure, EPA approved the remediation plans contained in the CMS on October 17, 1994.

DuPont submitted an *Evaluation of Intrinsic Bioremediation* report to EPA on July 23, 1997. This report detailed laboratory experiments through microcosm studies using soil and groundwater from the Facility. Along with groundwater monitoring and analysis, the laboratory experiments provided direct evidence that indigenous microbes are degrading MeCl in groundwater. Based upon the presented lines of evidence, intrinsic bioremediation is causing the degradation of MeCl and chloroethenes at the Facility and preventing their migration.

On August 13, 1998, DuPont provided EPA with a report evaluating the feasibility of using air sparging to remediate the source areas at the Facility. The report concluded that air sparging, which introduces oxygen into the subsurface, would likely suppress the ongoing anaerobic biological degradation resulting in the possible migration of site contaminants. More importantly, however, the low hydraulic conductivity would prevent effective implementation of this technology.

Also, in late 2006 to early 2007, DuPont conducted an investigation of the glacial silt and sand aquifer to determine whether contaminated groundwater was migrating beyond the immediate area where natural attenuation was occurring. Results from this investigation were presented to EPA in the *1st Half 2007 Interim Remedial Measure Status Report* which was

approved by EPA on October 11, 2007. Laboratory analytical results indicate that no contamination is migrating vertically beyond the capture zone of pumping well SW-04.

C. Summary of Interim Measures

Based on the investigatory reports detailed above, DuPont instituted IMs to remediate the contaminated groundwater beneath the Facility.

Activities taken on the northeast side of the Facility to remediate the MeCl spill were performed under PADER direction prior to EPA involvement at the Facility. In 1983, DuPont installed a groundwater recovery system consisting of 72 wells to remediate the groundwater. A combined approach utilizing air-stripping and associated soil flushing was employed. Biological remedial methods were then employed to achieve an even more stringent cleanup level. With the approval of PADER, DuPont discontinued groundwater remediation in June 1988. Based on results from the RFI, it appeared that some residual MeCl was still present in the shallow groundwater. A sharp decrease in MECl by four orders of magnitude was observed following a pump test performed in May, 1993. This decrease was confirmed by two additional rounds of sampling in July and August, 1993. It was determined that this residual area was small and that the pumping eliminated the bulk of this contamination. Overall, remedial efforts were successful in reducing contaminant levels from 1400 milligrams per liter (mg/L) to 0.004 mg/L.

In 1992 in accordance with the EPA-approved CMP, DuPont installed a groundwater collection pump to remediate contaminated groundwater found seeping from old drainage pipes on the western side of the Facility near the base of the bluff rising above Sugar Creek.

During the Facility investigations, two major areas of groundwater contamination were discovered. One area is centered around MW-6A in the upper aquifer and, to a lesser extent, MW-6C in the lower aquifer. The contamination in this area consisted primarily of MeCl. DuPont agreed to pump the MeCl contaminated water from MW-6A and transport it to the on-site MeCl recycling area which was part of DuPont's established operating procedures. DuPont agreed to continue this activity until MeCl use at the Facility ceased.

The MeCl recovery system operated from April 1995 to November 1996 and removed about 190 pounds of MeCl. Since November 1996, DuPont has monitored the presence of MeCl in the groundwater. The area of contaminated groundwater has remained small and there is no evidence that contamination has moved off-site. Furthermore, monitoring data have also shown that as of November 2001 and November 2003, MeCl has been nondetect in MW-6C and MW-6A, respectively.

Since MeCl no longer seeps from the pipes and has been non-detect since November 2003 in MW-6A and November 2001 in MW-6C, and the Facility no longer uses MeCl, EPA allowed DuPont to remove the pipes and the collection system of the MeCl recovery system.

The second area of groundwater contamination is in the upper aquifer centered around MW-8 and primarily consists of chlorinated degreasing solvents such as TCE and the compounds that form when chlorinated solvents decompose in the environment, namely cis-1,2-

dichloroethene, vinyl chloride, and ethene. This area of contamination is also small, is not moving off-site, and appears to be responding positively to natural attenuation.

III. Summary of Environmental Issues

A. Contaminated Media

The only medium contaminated at the Facility is the groundwater. The principal contaminants identified in the groundwater are MeCl, TCE, and the usual breakdown products of TCE: cis-1,2-dichloroethene, vinyl chloride, and ethene. The areas of contamination at the Facility are small, localized, and not migrating off-Site from the Facility.

B. Summary of Facility Risks

1. Potential Receptors in Contact with Groundwater – Environmental investigations performed by DuPont at the Facility show that groundwater contamination is not migrating off-site. Therefore, since there are no drinking water wells at the Facility, the only possible groundwater receptors would be workers who would be exposed to groundwater during installation of wells within the defined areas of on-site contamination. The ICs proposed will prohibit the installation of drinking water wells within these defined areas and, thus, eliminate this pathway. In addition, a Health and Safety Plan will be required which will alert any worker to the contamination and ensure appropriate Personal Protective Equipment will be worn and preventive exposure measures will be taken. Furthermore, EPA proposes to require DuPont to file deed notices to notify prospective purchasers that the groundwater underlying the Facility is contaminated.

2. Drinking Water Wells in the Vicinity of the Facility – In November 2006, EPA conducted a visual drinking water well survey in the vicinity of the Facility. No private wells were observed directly adjacent to the Facility. One private well was observed on the Susquehanna River side of Towanda in the vicinity of the public drinking water wells. The Towanda Public Drinking Water Wells are located in this same area and draw water from the aquifer beneath the aquifer where the highest contamination is located on the DuPont property. EPA has determined that Facility-related contamination is not migrating from the Facility, and, therefore, is not a threat to either of these receptors. This survey was supplemental to the well survey already performed during the RFI which noted that the closest groundwater users in the area are public water supply and industrial wells located approximately 3000 feet from the Facility along the Susquehanna River.

The Towanda Borough is aware of the groundwater contamination at the Facility. Towanda Borough routinely tests the water and has not detected the presence of any Facility-related contaminants further supporting EPA's finding that groundwater contamination is not migrating off-site or affecting the public drinking water supply.

IV. Proposed Remedy Performance Standards

EPA is proposing Monitored Natural Attenuation with Institutional Controls as the Final

Remedy for the Facility. For groundwater, the groundwater cleanup standards consist of the respective Maximum Contaminant Levels (MCLs) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1, for the constituents methylene chloride; trichloroethylene; cis-1,2-dichloroethene; and vinyl chloride. DuPont will be required to sample the monitoring well network in accordance with the Sampling and Analysis Plan (SAP) presented in the November 1, 1995 Interim Remedial Measures Status report. Any modification to the sampling plan will have to be approved by EPA prior to implementation.

Additionally, part of DuPont's conceptual model is that any groundwater, along with any contaminants, that migrates will be captured within the radius of influence of SW-04, the currently operational production pumping well. Therefore, if in the future this well were to stop pumping before the groundwater constituents meet their respective cleanup levels, DuPont will need to submit a plan to assure that human health and the environment are not being adversely impacted.

If DuPont determines, on the basis of analytical results, that the concentration of each constituent has not exceeded its respective cleanup level for three continuous years, DuPont may request in writing, for EPA approval, that corrective action for groundwater contamination at the Facility be terminated.

V. Evaluation of EPA's Proposed Remedy Selection

This section provides a description of the criteria EPA used to evaluate the proposed remedy consistent with EPA guidance. The criteria are applied in two phases. In the first phase, EPA evaluates three remedy threshold criteria as general goals. In the second phase, for those remedies which meet the threshold criteria, EPA then evaluates seven balancing criteria to determine which proposed remedy alternative provides the best relative combination of attributes.

A. Threshold Criteria

EPA's evaluation of the threshold criteria is as follows:

1. **Protect Human Health and the Environment** - EPA is satisfied with the determination that Monitored Natural Attenuation with ICs is and will be protective of human health and the environment. There are no human health threats associated with domestic uses of the contaminated groundwater originating from the Facility because groundwater is not used for drinking water purposes. In addition, due to biological activity, the contaminants in the groundwater at the Facility are decomposing rapidly enough to prevent the contaminants and the breakdown products from migrating from the Facility.

Even though there are no current consumptive uses of Facility-contaminated groundwater, it is EPA's goal that groundwater be restored to drinking water standards to be protective of potential future use. Until groundwater is restored to drinking water standards, EPA is proposing to require ICs, as necessary, to prevent consumptive use of the groundwater.

2. **Attainment of Media Cleanup Standards** - The proposed Monitored Natural Attenuation with ICs will attain the media cleanup criterion by restoring groundwater to drinking water standards. Under EPA's proposed remedy, DuPont will be required to monitor groundwater until the concentration of each constituent does not exceed the constituent's respective Maximum Contaminant Level (MCL) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1, for three continuous years.

DuPont will be required to sample the monitoring well network in accordance with the SAP presented in the November 1, 1995 Interim Remedial Measures Status report. Any modification to the SAP will have to be approved by the EPA prior to implementation.

3. **Controlling Source of Releases** - Since DuPont ceased using MeCl in its operations in 1996, the source for MeCl has been eliminated. The re-routing of the drainage pipes to the sump for collection and transfer to the on-site treatment area addressed the issue of MeCl seeping into Sugar Creek. Moreover, the area where the highest concentrations of MeCl were found has responded to natural attenuation as well as other technologies. Monitoring data have shown that as of November 2003 and November 2001, MeCl has been non-detect in MW-6A and 6C, respectively.

With respect to the second area of groundwater contamination in the upper aquifer centered around MW-8, chlorinated solvents and compounds that form when chlorinated solvents decompose in the environment are found in the shallow and deep aquifers with the former evaporation pond as the most likely source. The evaporation pond was closed in 1974; soil was excavated and the area was filled with gravel effectively eliminating the source. Natural Attenuation will complete remediation of the residual compounds.

B. Balancing/Evaluation Criteria

1. **Long-Term Reliability and Effectiveness** - The long-term reliability and effectiveness standard is intended to address protection of human health and the environment over the long term. DuPont has demonstrated that, due to biological activity, the contaminants in the groundwater are decomposing rapidly enough to prevent the contaminants or the breakdown products from migrating beyond the Facility boundary. EPA expects this natural attenuation process to continue. DuPont will continue to monitor the groundwater to demonstrate that this attenuation process continues until the groundwater cleanup standards are met.

2. **Reduction of Toxicity, Mobility or Volume of Waste** - For this criterion, remedies that employ treatment and/or source removal and containment that are capable of permanently reducing the overall risk posed by the remediation wastes are preferred. Natural attenuation, by definition, refers to a system where a variety of physical, chemical, or biological processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. EPA's proposed remedy will, therefore, accomplish this criterion.

3. **Short-Term Effectiveness** - The proposed remedy is expected to meet the short-term effectiveness criterion. The short-term effectiveness criterion is intended to address hazards posed during the implementation of the remedy. Short-term effectiveness is designed to take into consideration the impact on site workers and nearby residents during construction before the final cleanup levels are met. The only possible exposures to groundwater at the Facility is to workers taking environmental samples or to workers excavating soil in the vicinity of the contaminated plume. DuPont will be required to submit a Health and Safety Plan to EPA that provides for proper worker training and the wearing of protective clothing if exposure to contaminated groundwater is expected.

4. **Implementability** -. The proposed remedy is fully implementable. The implementability criterion addresses the regulatory constraints in employing the cleanup approach. Natural attenuation has been proven to be occurring at the Facility due to naturally occurring microbes. All necessary components of the monitoring network are in place and are currently operational; therefore, no new regulatory constraints are anticipated.

5. **Cost** - EPA's overriding mandate under RCRA is protection of human health and the environment. However, EPA believes that cost is an appropriate consideration when selecting among alternatives that achieve the cleanup requirements. EPA's experience in the Superfund program has shown that in many cases several different approaches will offer equivalent protection of human health and the environment, but may vary widely in cost. All necessary components of the monitoring network at the Facility are in place and are currently operational. The only recurring costs are operational and maintenance (O&M) and reporting costs of the monitoring network.

DuPont has submitted a cost estimate for the proposed remedy of Monitored Natural Attenuation with ICs of \$21,750 per year.

6. **Community Acceptance** - The Community acceptance of EPA's proposed remedy will be evaluated based on comments received during the public comment period and will be described in the FDRTC.

7. **State Acceptance** - State acceptance will be evaluated based on comments received from PADEP during the public comment period and will be described in the FDRTC.

PADEP has been involved with the actions of the Facility jointly with the EPA since 1990. PADEP's Environmental Cleanup Program previously raised concerns that the conceptual model utilized for this Facility has not been documented to be accurate and, therefore, has allowed some unknown contaminant mass to escape into the bedrock aquifer. PADEP requests that to remedy this, bedrock wells need to be installed to determine the quality of the water. During the RFI, EPA decided to forego installing bedrock wells. Furthermore, there are no data to suggest that the conceptual model included as part of the RFI is inaccurate. Refer to Section IIB for a description of the conceptual model.

EPA continues to disagree that bedrock wells are necessary considering the analytical data available since monitoring began. EPA did, however, agree that further investigation into

the silt and sand aquifer was necessary. In response, DuPont agreed to install two additional wells that monitored the groundwater zone immediately above bedrock. EPA has concluded that the analytical results from these wells are below any level that would represent a threat to human health or the environment, or otherwise impair the use of this aquifer for off-site groundwater users.

VI. Public Participation

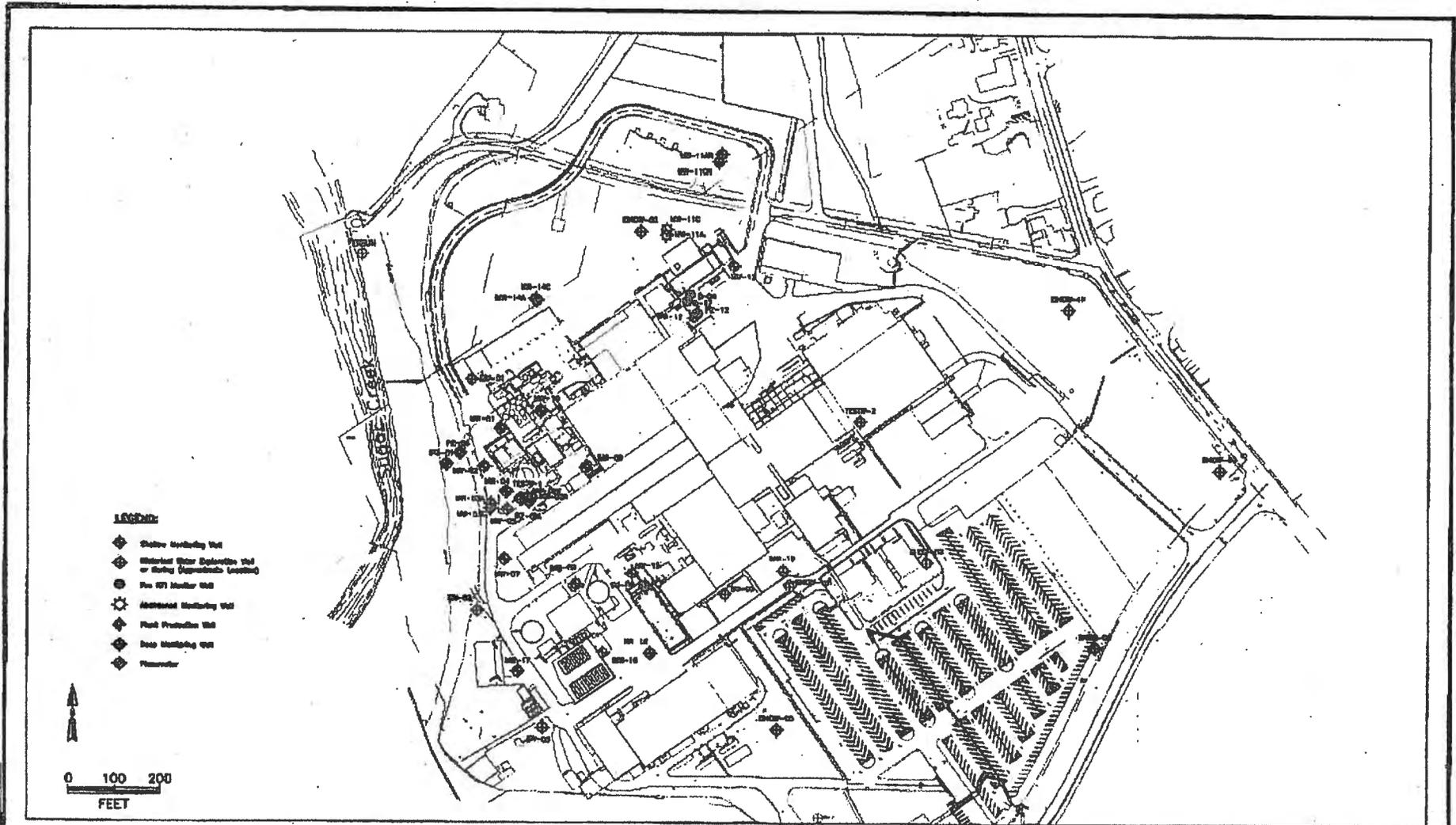
EPA is requesting comments from the public on its proposal that Monitored Natural Attenuation with Institutional Controls become the Final Remedy at the DuPont Facility in Towanda, Pennsylvania. The public comment period will last forty-five (45) calendar days from the date that this SB is published in a local newspaper. Comments should be submitted by mail, fax, e-mail, or phone to the addresses listed below.

A public hearing will be held upon request. Requests for a public hearing should be made to Mr. Kevin Bilash of the EPA Regional Office (215-814-2796). A hearing will not be scheduled unless requested.

The Administrative Record contains all information considered by EPA when making this proposal to require Monitored Natural Attenuation and Institutional Controls at the Facility. The Administrative Record is available at the following location:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact: Mr. Kevin Bilash (3LC30)
Phone: (215) 814-2796
Fax: (215) 814 - 3113
Email: bilash.kevin@epa.gov

After evaluation of the public's comments, EPA will prepare a Final Decision and Response to Comments that identifies the final selected remedy. The Response to Comments will address all significant written comments and any significant oral comments generated at the public meeting, if requested. This Final Decision and Response to Comments will be made available to the public. If, on the basis of such comments or other relevant information, significant changes are proposed to be made to the corrective measures identified by EPA in this SB, EPA may seek additional public comments.



- LEGEND**
- ◆ Shallow Monitoring Well
 - ◆ Shallow Water Collection Well or Spring (Superficial Aquifer)
 - ◆ No. 071 Monitor Well
 - ⊗ Methanol Monitoring Well
 - ◆ Fuel Protection Well
 - ◆ Deep Monitoring Well
 - ◆ Reservoir



0 100 200
FEET

Corporate Remediation Group
an Alcoa Business
DuPont and EAF Division
DuPont UP Plant, Building 27
Towanda, Delaware 19382

TITLE
DuPont Towanda
Site Base Map

DATE	DEL	DES.	FILE NUMBER
1/8/03	EAM	TAE	71289010
	REV: 0		FIGURE NO
			21

Appendix C

Environmental Covenant



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029
December 1, 2011**

Mr. Tom A. Ei
Du Pont Corporate Remediation Group
Chestnut Run Plaza, Building 715
4417 Lancaster Pike
Wilmington, DE 19805

RE: Final Environmental Covenant approval

Dear Mr. Ei:

The U.S. Environmental Protection Agency (EPA) has signed and notarized DuPont's Environmental Covenant for the facility located at New James Street and Patterson Boulevard in Towanda, PA 18848-9784. Enclosed please find both original copies. Please proceed with the recording and proof sent to EPA.

If you have any questions, please contact me at 215-814-2796 or bilash.kevin@epa.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Kevin Bilash", with a horizontal line underneath.

Kevin Bilash,
RCRA Project Manager

cc: Mr. Dave Garg – PADEP (w/o enclosures)
File

GRANTOR: E. I. du Pont de Nemours and Company

PROPERTY ADDRESS: New James Street and Patterson Boulevard
Bradford County, Towanda, PA 18848-9784

PARCEL ID NUMBER: 51-073.00-003-000-000

ENVIRONMENTAL COVENANT

This Environmental Covenant is executed pursuant to the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501 - 6517 (UECA). This Environmental Covenant subjects the Property identified in Paragraph 1 to the activity and/or use limitations in this document. As indicated later in this document, this Environmental Covenant has been approved by the United States Environmental Protection Agency (EPA).

1. **Property affected.** The property affected (Property) by this Environmental Covenant is located in Towanda Township, Bradford County.

The postal street address of the Property is: RR1, Box 15.
 The County Parcel Identification No. of the Property is: 51-073.00-003-000-000.
 The latitude and longitude of the center of the Property affected by this Environmental Covenant is: latitude 41 49' 08" North and longitude 76 27' 25" West.
 The Property has been known by the following name: DuPont Towanda Plant.

A complete description of the parcels of the Property is attached to this Environmental Covenant as Exhibit "A". A map of the Property is attached to this Environmental Covenant as Exhibit "B -1" and Exhibit "B-2".

The area described above is a polygon, the vertices of which have the following geographic coordinates (longitude and latitude, with a datum of WGS1984):

LONGITUDE	LATITUDE	COORDINATE NUMBER	COMMENT
-76.4558418	41.7824951	C-1	
-76.4561972	41.7830305	C-2	begin circular arc to left, radius 430.0 feet
-76.456253	41.783108		along circular arc to left, radius 430.0 feet
-76.456317	41.783182		along circular arc to left, radius 430.0 feet
-76.456388	41.783252		along circular arc to left, radius 430.0 feet
-76.456466	41.783319		along circular arc to left, radius 430.0 feet
-76.456551	41.78338		along circular arc to left, radius 430.0 feet
-76.456641	41.783437		along circular arc to left, radius 430.0 feet
-76.4567363	41.7834878	C-3	end arc
-76.4574633	41.7835594	C-5	
-76.4586527	41.7836076	C-6	
-76.4588575	41.7836694	C-7	

-76.4590866	41.7838293	C-8	
-76.4591437	41.7839154	C-9	
-76.4590856	41.7841362	C-10	
-76.4593613	41.7845699	C-11	
-76.4594729	41.7850647	C-12	
-76.4596706	41.7851127	C-13	
-76.4596096	41.7852393	C-14	
-76.459924	41.7857625	C-15	
-76.4597683	41.785839	C-16	
-76.4602151	41.786967	C-17	
-76.4597465	41.7871099	C-18	
-76.4597076	41.7870221	C-19	
-76.4595186	41.7871633	C-20	
-76.4594617	41.7872114	C-95	
-76.459456	41.7872957	C-96	
-76.459271	41.7875326	C-97	
-76.4590471	41.78775	C-98	
-76.4588133	41.7879614	C-99	
-76.4586107	41.7881472	C-54	
-76.4583254	41.7884999	C-55	
-76.4581502	41.788643	C-56	
-76.4578467	41.7889418	C-57	
-76.4577171	41.7890951	C-58	
-76.4574138	41.7895766	C-59	
-76.4585646	41.7897109	C-72	
-76.4586212	41.7903905	C-73	
-76.4580255	41.7904276	C-74	
-76.4580826	41.7911136	C-75	
-76.4580865	41.7911603	C-76	
-76.4565805	41.7912542	C-77	begin circular arc to right, radius 355.86 feet
-76.456482	41.791258		along circular arc to right, radius 355.86 feet
-76.456384	41.791255		along circular arc to right, radius 355.86 feet
-76.456287	41.791248		along circular arc to right, radius 355.86 feet
-76.45619	41.791235		along circular arc to right, radius 355.86 feet
-76.456095	41.791216		along circular arc to right, radius 355.86 feet
-76.4560019	41.7911924	C-78	end arc
-76.4561802	41.7911602	C-79	
-76.4564402	41.7911132	C-80	
-76.456523	41.7910832	C-81	
-76.4565604	41.7910416	C-82	
-76.4566126	41.7909719	C-83	
-76.4566519	41.7908915	C-84	
-76.4567194	41.7906959	C-85	
-76.4564776	41.790689	C-86	
-76.4565333	41.7902836	C-87	
-76.4563839	41.7902412	C-88	
-76.4562465	41.7905122	C-93	
-76.4553787	41.7904394	C-94	

-76.4552721	41.7904304	C-90	begin circular arc to right, radius 2228.87 feet
-76.455212	41.790316		along circular arc to right, radius 2228.87 feet
-76.4551557	41.7902017	C-91	end arc
-76.4548685	41.7894985	C-103	
-76.454962	41.7894927	C-104	
-76.4557848	41.7894418	C-105	
-76.456333	41.789408	C-61	
-76.4556988	41.7878499	C-62	
-76.4556242	41.7873978	C-64	
-76.4556081	41.7873064	C-68	
-76.4551933	41.7874224	C-69	
-76.4550565	41.7871254	C-101	
-76.4545905	41.7872202	C-102	
-76.454651	41.7868792	C-100	
-76.4537703	41.7867546	C-36	begin circular arc to left, radius 821.5 feet
-76.453686	41.786644		along circular arc to left, radius 821.5 feet
-76.453594	41.786538		along circular arc to left, radius 821.5 feet
-76.453494	41.786435		along circular arc to left, radius 821.5 feet
-76.4533854	41.7863369	C-40	end arc
-76.452601	41.7855885	C-45	
-76.4530625	41.7852034	C-46	begin circular arc to left, radius 1215.92 feet
-76.453192	41.785091		along circular arc to left, radius 1215.92 feet
-76.453314	41.784974		along circular arc to left, radius 1215.92 feet
-76.453429	41.784853		along circular arc to left, radius 1215.92 feet
-76.453537	41.784729		along circular arc to left, radius 1215.92 feet
-76.453638	41.784601		along circular arc to left, radius 1215.92 feet
-76.4537298	41.7844698	C-47	end arc
-76.4542007	41.7837661	C-48	begin circular arc to right, radius 1075.92 feet
-76.454287	41.783644		along circular arc to right, radius 1075.92 feet
-76.454381	41.783525		along circular arc to right, radius 1075.92 feet
-76.454483	41.78341		along circular arc to right, radius 1075.92 feet
-76.454591	41.783298		along circular arc to right, radius 1075.92 feet
-76.454707	41.783191		along circular arc to right, radius 1075.92 feet
-76.454829	41.783087		along circular arc to right, radius 1075.92 feet
-76.454957	41.782988		along circular arc to right, radius 1075.92 feet
-76.455091	41.782893		along circular arc to right, radius 1075.92 feet
-76.455231	41.782803		along circular arc to right, radius 1075.92 feet
-76.455377	41.782719		along circular arc to right, radius 1075.92 feet
-76.455528	41.782639		along circular arc to right, radius 1075.92 feet
-76.455683	41.782565		along circular arc to right, radius 1075.92 feet
-76.4558418	41.7824951	C-1	end arc

2. **Property Owner/GRANTOR.** E. I. du Pont de Nemours and Company is the owner of the Property (Owner). The mailing address of the Owner is: 1007 Market Street, Wilmington, DE 19898, Attn: Real Estate, with copy to: Patterson Blvd, RR1, Box 15, Towanda, PA 18848.

3. **Holder/GRANTEE.** The following is the "Holder", as that term is defined in 27 Pa. C.S. § 6501, of this Environmental Covenant: E. I. du Pont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.

4. **Description of Contamination & Remedy.** The only medium contaminated at the Property is the groundwater. The contaminants identified in the groundwater are methylene chloride (MeCl₂), trichloroethene (TCE) and the usual breakdown products of TCE: cis-1,2-dichloroethene, and vinyl chloride. The areas of contamination at the Property are small localized, and not migrating off the Property.

On December 22, 2008, EPA issued a Final Decision and Response to Comments (FDRTC) in which it selected Monitored Natural Attenuation with Institutional Controls as the Final Remedy for the Property. The FDRTC can be found in the Administrative Record, the location of which is identified below. Natural attenuation refers to a system where a variety of physical, chemical, or biological processes act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. As decomposition of the contaminants takes place, compounds called "breakdown products" are produced. Ultimately, the breakdown products are also decomposed resulting in compounds which are not a threat to human health or the environment. Monitored natural attenuation simply refers to the act of collecting samples to "monitor" the natural attenuation process.

The groundwater cleanup standards for the Property consist of the respective Maximum Contaminant Levels (MCLs) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. Section 300g-1. The Owner will be required to sample the monitoring well network until each of the contaminants listed above has not exceeded its respective MCL for three continuous years and the owner receives EPA written approval that corrective action for groundwater contamination at the Property be terminated.

Because contamination will remain in the groundwater at the Property during the natural attenuation process, EPA is requiring the activity and use limitations listed in Paragraph 5, below.

The Administrative record pertaining to the Final Remedy selected in the FDRTC is located at U.S. Environmental Protection Agency, Region III, 1650 Arch Street, Philadelphia, PA 19103.

5. **Activity & Use Limitations.** The Property is subject to the following activity and use limitations, which the Owner and each subsequent owner of the Property shall abide by:

- i. Groundwater beneath the Property shall not be used for potable purposes or any other use that could result in human exposure unless such use is required by the Final Remedy, and
- ii. Well drilling on the Property is prohibited without prior EPA approval to prevent inadvertent exposure to the contaminated groundwater and adverse affects to the Final Remedy.

6. **Notice of Limitations in Future Conveyances.** Each instrument hereafter conveying any interest in the Property subject to this Environmental Covenant shall contain a notice of the activity and use limitations set forth in this Environmental Covenant and shall provide the recorded location of this Environmental Covenant.

In the event Owner intends to sell part or all of the Property, Owner will notify EPA and the Pennsylvania Department of the Environment (the Department) at least thirty (30) calendar days prior to such sale and provide written documentation to EPA and the Department which demonstrates that the Owner has provided notice to the buyer of the restrictions placed on groundwater use.

7. **Compliance Reporting.** Every third January following the effective date of this Environmental Covenant, the Owner and each subsequent owner shall submit, to EPA and the Department, written documentation stating whether or not the activity and use limitations in this Environmental Covenant are being abided by.

In addition, within thirty (30) calendar days after any of the following events, the current owner of the Property shall submit, to the Department and any Holder listed in Paragraph 3, written documentation: noncompliance with the activity and use limitations in this Environmental Covenant; transfer of the Property; changes in use of the Property; or filing of applications for building permits for the Property and any proposals for any work, if the building or proposed work will affect the contamination on the Property subject to this Environmental Covenant.

8. **Access by the Agencies.** In addition to any rights already possessed by EPA and the Department, this Environmental Covenant grants to EPA and the Department a right of access to the Property in connection with implementation or enforcement of this Environmental Covenant.

9. **Recordation & Proof & Notification.** Within thirty (30) days after the date of EPA's approval, the Owner(s) shall file this Environmental Covenant with the Recorder of Deeds for Bradford County, and send a file-stamped copy of this Environmental Covenant to EPA and the Department within sixty (60) days of recordation. Within that time period, the Owner(s) also shall send a file-stamped copy to each of the following: Towanda Township and Bradford County; the Holder identified in this Environmental Covenant; each person holding a recorded interest in the Property, and each person in possession of the Property.

10. **Termination or Modification.** This Environmental Covenant may only be terminated or modified in accordance with Section 9 of UECA, 27 Pa. C.S. § 6509. The Owner may request termination of this Environmental Covenant when it determines, on the basis of analytical results, that each of the contaminants listed in Paragraph 4, above, has not exceeded its respective MCL for three (3) continuous years and receives EPA's written approval that corrective action for groundwater contamination at the Property be terminated.

11. Agencies' addresses. Communications with EPA and the Department regarding this Environmental Covenant shall be sent to:

Director, Land and Chemicals Division
U.S. Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

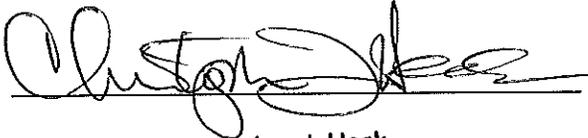
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P. O. Box 8471
Harrisburg, Pennsylvania 17105-8471

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ACKNOWLEDGMENTS by Owner in the following form:

Date: Sept. 27, 2011

E. I. DU PONT DE NEMOURS AND COMPANY, "Grantor"

By: 

Name: Christopher J. Heck
Manager - Corporate Real Estate

Title: and Strategic Planning

#

STATE OF DELAWARE, COUNTY OF NEW CASTLE; SS.

ON this 27th day of September, 2011, before me, the undersigned officer, personally appeared Christopher J. Heck, as Manager of E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, known to me (satisfactorily proven) to be the person who signed the foregoing Environmental Covenant, and acknowledged before me that he/she, as such officer and with full authority to do so, executed the same for and on behalf of said corporation for the purposes therein contained.

WITNESS my hand and Notarial Seal, the day and year aforesaid.



NOTARY PUBLIC

Print or Imprint Name and

Date Commission Expires:

CAROLE L. WEBBER
NOTARY PUBLIC
STATE OF DELAWARE
My commission expires May 2, 2015

ACKNOWLEDGMENTS by Holder in the following form:

Date: Sept. 27, 2011

E. I. DU PONT DE NEMOURS AND COMPANY, "Grantee"

By: 

Name: Christopher J. Heck
Manager - Corporate Real Estate

Title: and Strategic Planning

#

STATE OF DELAWARE, COUNTY OF NEW CASTLE; SS.

ON this 27th day of September, 2011, before me, the undersigned officer, personally appeared Christopher J. Heck, as Manager of E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, known to me (satisfactorily proven) to be the person who signed the foregoing Environmental Covenant, and acknowledged before me that he/she, as such officer and with full authority to do so, executed the same for and on behalf of said corporation for the purposes therein contained.

WITNESS my hand and Notarial Seal, the day and year aforesaid.



NOTARY PUBLIC

Print or Imprint Name and

Date Commission Expires:

CAROLE L. WEBBER
NOTARY PUBLIC
STATE OF DELAWARE
My commission expires May 2, 2015

APPROVED by the United States Environmental Protection Agency

Date: 11/28/11

By: Abraham Ferdas
Name: Abraham Ferdas
Title: Director, Land and Chemicals Division

COMMONWEALTH OF PENNSYLVANIA)
COUNTY OF PHILADELPHIA) SS:

On this 28 day of November, 2011, before me, the undersigned officer, personally appeared Abraham Ferdas, who acknowledged himself to be the Director, Land and Chemicals Division of the United States Environmental Protection Agency, Region III, whose name is subscribed to this Environmental Covenant, and acknowledged that he executed same for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

Paul J. Manietaro
Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
Paul J. Manietaro, Notary Public
City of Philadelphia, Philadelphia County
My commission expires August 29, 2013

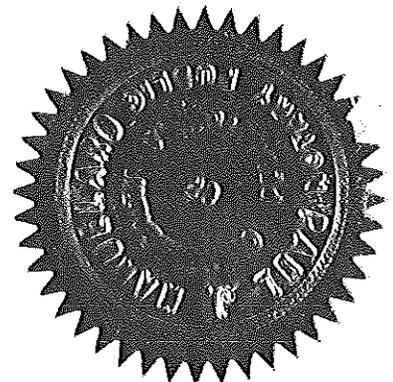


EXHIBIT A
DESCRIPTIONS OF THE PROPERTY

P 2007

T H I S D E E D

MADE This 30th day of June A. D. one thousand nine hundred and forty three.

BETWEEN The Patterson Screen Company, a corporation organized under the Laws of the Commonwealth of Pennsylvania, with its principal office and place of business in the Borough of Towanda, County of Bradford and State of Pennsylvania, party of the first part, grantor,

-A N D-

E. I. du Pont De Nemours and Company, a Delaware corporation, with principal office and place of business at Wilmington in the State of Delaware, party of the second part, grantee.

WITNESSETH: That in consideration of the sum of One Dollar and other good and valuable consideration in hand paid, the receipt whereof is hereby acknowledged, the said grantor does hereby grant and convey to the said grantee, its successors and assigns, All those certain lots, pieces or parcels of land situate in North Towanda Township, Bradford County, Pennsylvania, bounded and described as follows:

LOT NO. 1. Beginning at a piece of iron pipe driven in the center of James Street at the southwestern corner of land conveyed by D. O. Hollon to Juell J. Talada; thence by the line of said Talada's lot north twenty eight (28) degrees west one hundred eighty (180) feet to a piece of iron pipe driven for a corner of same in the center of an alley twenty (20) feet wide; thence by the line of lands of said Talada and Grace Condon along the center of said alley, twenty (20) feet wide, north sixty two (62) degrees east four hundred twenty two and one-fourth (422 $\frac{1}{4}$) feet to a piece of iron pipe driven for a corner; thence by the line of land of George S. Johnson north twenty eight (28) degrees west one hundred eighty (180) feet to a piece of iron pipe driven for a corner in the center of a street forty (40) feet wide called Hollon Street; thence along the center of said street and land of said George S. Johnson, north sixty two (62) degrees east fifty six (56) feet to an iron bolt with a square head driven for a corner; thence by the line of the Mill lot of said George S. Johnson north seventy two (72) degrees fifteen (15) minutes west one hundred fifty seven and nine-tenths (157.9) feet to an iron bolt with a square head driven for a corner; thence by the line of said Johnson's Mill lot, north seventeen (17) degrees forty five (45) minutes east one hundred fifty (150) feet to an iron bolt with a square head driven for a corner on the south side of Race Street; thence by the south line of said Race Street north

seventy two (72) degrees fifteen (15) minutes west one hundred thirty eight (138) feet to an iron bolt with a square head driven for a corner in the south line of said Race Street at the corner of lot owned by Mrs. Katherine E. Granger in the center of a street forty (40) feet wide called Church Street; thence by the center line of said Church Street and lot owned by said Mrs. Granger, south seventeen (17) degrees forty five (45) minutes west one hundred fifty (150) feet to an iron bolt with a square head driven for a corner; thence by the line of lot owned by the said Mrs. Granger north seventy two (72) degrees fifteen (15) minutes west one hundred forty five and two-tenths (145.2) feet to an iron bolt with a square head driven for a corner; thence by the line of the same lot north seventeen (17) degrees forty five (45) minutes east one hundred fifty (150) feet to an iron bolt driven for a corner in the south line of said Race Street; thence along line of lands owned by _____ White and Ed Barnes south sixty three (63) degrees fifteen (15) minutes west eight hundred sixty five (865) feet more or less to Sugar Creek; thence up said Creek its several courses to the line of Mrs. May Adams Maurice; thence along the line of Mrs. Maurice south seventeen and three-fourths (17 $\frac{3}{4}$) degrees west about one hundred ten (110) feet to the north line of a strip of land one (1) rod wide conveyed by D. O. Hollon to Jack Rutty for a road etc. as therein contained by deed dated June 19, 1894, and recorded October 27, 1894, in the office for the recording of deeds in Deed Book No. 204 at page 300; thence along the north line of the strip of land one (1) rod wide conveyed as above for a road, north sixty two (62) degrees ~~east~~ west one thousand two hundred (1,200) feet to a point in the west line of said Juell J. Talada's land sixteen and one-half (16 $\frac{1}{2}$) feet from the piece of iron pipe in the center of said James Street, the place of beginning, containing twenty two (22) acres, be the same more or less, etc.

Excepting and reserving therefrom the premises sold to Katherine E. Granger by deed dated June 17, 1919, and recorded in Bradford County Deed Book 336 page 118 and bounded as follows: On the north by Race Street; on the east by lands of George Johnson; on the south by lands of A. J. Bailey; on the west by lands of Manford Granger, same being one hundred fifty (150) feet deep from the center of the public highway and otherwise bounded as above.

Being the same premises conveyed by A. J. Bailey et ux to The Patterson Screen Company by deed dated July 9, 1940, and recorded in the Recorder's Office of said County in Deed Book 406 page 48.

LOT NO. 2. Beginning at a point along West James Street and an alley, three hundred forty five (345) feet west of iron pin at the northwest corner of the lot formerly of Shively, later Manford Granger; thence in a general westerly direction along said James Street and alley to the line of John Coates; thence in a general southerly direction along said Coates line to the line of lands of Elsbree Estate; thence in a general easterly direction along the line of said Elsbree Estate to a point three hundred fifty (350) feet west of the line of land formerly of Shively, later Manford Granger; thence in a general northerly direction along said line to the place of beginning at West James Street and alley, containing four (4) acres, more or less.

Being the same premises conveyed by Albert A. Strauss et al to The Patterson Screen Company by deed dated May 8, 1943, and recorded in the said Recorder's Office in Deed Book 416 page 96.

This conveyance is also to include and carry all the right,

16

BOOK 595 PAGE 646
DEED

from

FREDERICK WILLIAM GARDNER and
LILA V. GARDNER, his wife

to

E. I. DU PONT DE NEMOURS AND COMPANY

THIS DEED, made this 16th day of June, 1969,
between FREDERICK WILLIAM GARDNER and LILA V. GARDNER, his wife,
of Race Street, North Towanda Township, Pennsylvania (GRANTORS),
and E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation,
of Wilmington, Delaware (GRANTEE),

W I T N E S S E T H :

That in consideration of the sum of Ten Dollars (\$10.00)
and other good and valuable considerations, in hand paid, the re-
ceipt whereof is hereby acknowledged, the said GRANTORS do hereby
grant and convey to the said GRANTEE, its successors and assigns,

ALL THAT CERTAIN lot or piece of ground located
in North Towanda Township, Bradford County, Pennsyl-
vania, described according to a survey and plan made
by George K. Jones, County Surveyor, of Sayre, Penn-
sylvania, dated May 8, 1969, as follows:

BEGINNING at an iron pin in the South line of
Race Street and being the Northeast corner of George
Landon; thence South 68° 10' East 305.3 feet along
South line of Race Street to an iron pin; thence
along lands of Pauline Sands and Raymond Baumunk
South 66° 23' West 135.98 feet and South 66° 41' West
74.03 feet to an iron pin; thence along lands of E.
I. du Pont de Nemours and Company North 68° 10' West
157.7 feet to an iron pin; thence along lands of
George Landon North 21° 50' East 149.4 feet to the
place of beginning.

CONTAINING 34,612.51 square feet of land.

BEING the same premises which the Commissioners
of Bradford County conveyed by their deed dated Decem-
ber 23, 1942, recorded February 26, 1943, in Bradford
County aforesaid in Deed Book 415, page 161, to
Frederick William Gardner and Dorothy E. Gardner, his
wife, and said Dorothy E. Gardner died July 1, 1955,
whereupon said Frederick William Gardner as surviving
tenant by the entireties became the sole owner in fee

0.795 acres

P3494

DEED

from

BOOK 588 PAGE 118

RAYMOND H. BAUMUNK, and
ROSEMARY BAUMUNK, his wife

to

E. I. DU PONT DE NEMOURS AND COMPANY

THIS DEED, made this 6th day of October,
1969, between RAYMOND H. BAUMUNK and ROSEMARY BAUMUNK, his wife,
of R. D. 1, Towanda, Pa., Pennsylvania
(GRANTORS), and E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware
corporation, of 1007 Market Street, Wilmington, Delaware 19898
(GRANTEE),

W I T N E S S E T H :

That in consideration of the sum of Ten Dollars (\$10.00)
and other good and valuable considerations, in hand paid, the re-
ceipt whereof is hereby acknowledged, the said GRANTORS do hereby
grant and convey to the said GRANTEE, its successors and assigns,

ALL THAT CERTAIN lot or piece of ground located
in North Towanda Township, Bradford County, Pennsyl-
vania, described according to a survey and Plan No.
6954, dated May 8, 1969, made by George K. Jones,
County Surveyor, of Sayre, Pennsylvania, as follows:

BEGINNING at an iron pin being the South line
of lands formerly of Fred Gardner, now of GRANTEE
herein, and being the Northwest corner of Pauline
Sands, said iron pin being South 62° West 135.98
feet from the South line of Race Street; thence from
said point of beginning

1. South 28° East 180 feet to a bolt; thence
2. Along lands of Joseph LeStrange and Raymond
Baumunk South 62° West 130 feet to an iron bar; thence
3. Along lands of GRANTEE, North 28° West 180
feet to a point; thence
4. North 62° East 130 feet to an iron pin and
place of beginning.

CONTAINING 23,400.73 square feet of land.

0.537 acre

BEING the same premises which Marian Lafy, also
known as Marian E. Lafy, a widow, by her deed dated
January 19, 1968, recorded January 19, 1968, in Brad-
ford County, Pennsylvania, in Deed Book 587, Page 275,
granted and conveyed to Raymond H. Baumunk and Rosemary
Baumunk, his wife, in fee.

P3495

DEED BOOK **596** PAGE **472**

from

OSCAR W. FULLER and
NELLIE FULLER, his wife

to

E. I. DU PONT DE NEMOURS AND COMPANY

THIS DEED, made this 1st day of August, 1969,
between OSCAR W. FULLER and NELLIE FULLER, his wife, of West
James Street, Towanda, Pennsylvania (GRANTORS), and E. I.
DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of
Wilmington, Delaware (GRANTEE),

W I T N E S S E T H :

That in consideration of the sum of Ten Dollars
(\$10.00) and other good and valuable considerations, in hand
paid, the receipt whereof is hereby acknowledged, the said
GRANTORS do hereby grant and convey to the said GRANTEE, its
successors and assigns,

ALL THAT CERTAIN lot or piece of ground lo-
cated in North Towanda Township, Bradford County,
Pennsylvania, described as follows:

BEGINNING at the common intersection of the
centerline of James Street (40 feet wide) and the
easterly line of lands of E. I. du Pont de Nemours
and Company, thence

(1) North 28° West, 180 feet along said
easterly line of lands of E. I. du Pont de Nemours
and Company to a point in the centerline of what
was formerly designated on the map of D. O. Hollon's
Subdivision in North Towanda Township, recorded in
Deed Book 155, Page 552, as a 20-foot wide alley
but never opened or used as such, to the intersec-
tion of said easterly line of lands of E. I. du Pont
de Nemours and Company and the southerly line of
lands of the latter; thence

(2) North 62° East, 150 feet along the center-
line of said formerly designated alley and said
southerly line of E. I. du Pont de Nemours and

*D. O. Hollon's
0.62 A.*

P3495

Company to an iron pin in the westerly line of lands of Alfred Talada; thence

(3) South 28° East, 180 feet along said westerly line of lands of Alfred Talada, passing through an iron pin to a point in the centerline of James Street; thence

(4) South 62° West, 150 feet along the centerline of James Street to the point and place of Beginning.

0.620 ACRES CONTAINING 27,000 square feet of land.

BEING the same premises which Thomas E. Fuller and wife by their deed dated July 29, 1967, recorded July 31, 1967, in Bradford County aforesaid, in Deed Book 584, Page 468, granted and conveyed to Oscar W. Fuller and Nellie Fuller, his wife, GRANTORS herein, in fee.

AND the said GRANTORS will warrant generally the property hereinabove described and hereby conveyed.

AND GRANTORS release and quitclaim to GRANTEE all that certain tract of land situated in North Towanda Township, Bradford County, Pennsylvania, bounded and described as follows:

COMMENCING at a point in the centerline of James Street (40 feet wide) at the point of beginning of the tract of land hereinbefore conveyed, thence along the easterly line aforesaid of land of said E. I. du Pont de Nemours and Company North 28° West, 180 feet to the intersection of said easterly line with the centerline of the formerly designated 20-foot wide alley mentioned in the description of the tract of land hereinbefore conveyed, the point of BEGINNING, and from said point of beginning

(1) North 62° East, 422.25 feet along the centerline of said alley to a point; thence

(2) North 28° West, 183.00 feet to an old iron pipe in the center of Hollons Street (40 feet wide) as shown on the map of Hollon's Subdivision, hereinbefore referred to; thence

(3) North 62° East, 56.00 feet along the centerline of said Hollons Street to an iron pin; thence

(4) North 72° 15' West, 441.1 feet to an iron pin, a corner of land of George D. Landon and wife; thence

(5) South 09° 08' 20" East, 527.27 feet to

the point of Beginning.

IN WITNESS WHEREOF, the said GRANTORS have caused these presents to be duly executed the day and year first above written.

Sealed and Delivered in the Presence of:

Charles Suplee

Oscar W. Fuller (SEAL)
Oscar W. Fuller

Judith J. Suplee

Nellie Fuller (SEAL)
Nellie Fuller



COMMONWEALTH OF PENNSYLVANIA)
COUNTY OF BRADFORD) SS.

On this 1st day of AUGUST, 1969, before me, the undersigned officer, personally appeared OSCAR W. FULLER and NELLIE FULLER, his wife, known to me (or satisfactorily proven) to be the persons whose names are subscribed to the

within instrument and acknowledged that they executed the same for the purposes therein contained.



F. Richard Coolbaugh
F. RICHARD COOLBAUGH, Notary Public
Towanda, Bradford Co., Pa.
My Commission Expires January 15, 1973

The address of the GRANTEE is
1007 Market Street
Wilmington, Delaware 19898

0.462 ACRES

This Deed,

Prop. 3602

Made the 18th day of January in the year of our Lord one thousand nine hundred and seventy-one (1971)

Between GEORGE ROSS BACON and SUSANA BACON, a/k/a SUSAN J. BACON, his wife, 867 25th Avenue North, St. Petersburg, Florida -----GRANTORS

AND

E. I. DU PONT DE NEMOURS & COMPANY, a Corporation organized and existing under the laws of the State of Delaware and having its principal office in Wilmington, Delaware -----GRANTEE

Witnesseth, that in consideration of Ten Thousand (\$10,000.00) ----- Dollars,

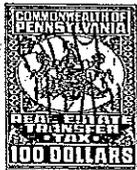
in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee its Successors ~~Heirs~~ and Assigns,

All that certain lot, piece or parcel of land situate, lying and being in the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

Beginning at a corner in the west line of York Avenue and South line of Race Street; thence North 72-3/4 degrees West along line of said Race Street, 190 1/2 feet to a corner in the east line of a twenty foot alley; thence Southerly along East line of said alley to an angle thereof at a corner of Lot #16 in D. O. Hollon's Subdivision; thence Easterly along said Lot #16, 30 feet to a corner of Lot #2; thence South 62 degrees East along the north line of said lot 200 feet to the west line of York Avenue; thence North 31 1/2 degrees West along same 38-3/4 feet to the place of beginning. Being Lots Nos. 3 and 4 of said Subdivision as will more fully appear by reference to D. O. Hollon's Map of same recorded in Bradford County Deed Book 155 at page 552.

Being the same lands as conveyed by George Ross Bacon and Susana Bacon, his wife, to George Ross Bacon and Susana Bacon, his wife, as tenants by the entireties, by deed dated March 31, 1938 and recorded the same date in Bradford County, Pennsylvania in Deed Book 398 at page 143.

FURTHER, the herein Grantors release and quitclaim unto the herein Grantee, its successors and assigns, any and all right, title and interest they may have in and to the streets and alleys as set forth on the D. O. Hollon Subdivision of North Towanda as recorded in the Recorder's Office of Bradford County in Deed Book Vol. 155 at page 552.



Towanda
CANTON AREA SCHOOL DISTRICT
REALTY TRANSFER TAX
DECLARED VALUE 10,000.00
TAX @ 1% 100.00
TAX PAID 100.00

Raymond J. Bradley
Clerk of Deeds of Bradford County
Towanda

0.418 ACRES

This Deed,

Prop. 3603

Made the 28th day of January in the year of our Lord one thousand nine hundred and Seventy-one.

Between PAULINE SANDS a/k/a PAULINE M. SANDS and CHARLES C. SANDS, her husband, of R. D. 1, Towanda, Pennsylvania -----GRANTORS

and

E. I. du PONT de NEMOURS & COMPANY, a Delaware Corporation, of 1007 Market Street, Wilmington, Delaware 19898 -----GRANTEE

Witnesseth, that in consideration of (\$20,000.00) Twenty Thousand and no/100 Dollars,

in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee, its successors ~~xxxx~~ and Assigns,

All that certain lot, piece or parcel of land situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and State of Pennsylvania, bounded and described as follows, to wit:-

Being Lots Nos. 5 and 6 Block No. 1 of D. O. Hollon's Subdivision of North Towanda as recorded in the Recorder's Office of Bradford County in Deed Book Vol. 155 page 552 and being bounded and described as follows:-

BEGINNING at the northeast corner of Lot No. 5 at the intersection of the south line of Hollon Street and a twenty foot alley; thence Westerly along the south line of Hollon Street 152.6 feet to the Northeast corner of Lot No. 7 of Block No. 1; thence Southerly along the East line of said Lot No. 7, 160 feet to the southeast corner of said lot and the center line of a twenty foot alley; thence Easterly along the center line of said alley 92.7 feet to the southeast corner of Lot No. 5 in the west line of the first mentioned alley 20 feet; and thence Northerly along the west side of said alley 171.5 feet to the place of beginning.

BEING part of the lands as conveyed by Manford Granger et ux to Susie M. Northrup by deed dated Nov. 6, 1946 and recorded the same date in Bradford County Deed Book 439 at page 420, which said deed erroneously included within its description Lots 5, 6 and 7 of Block 1, instead of just Lots 5 and 6 of Block 1. Susie M. Northrup conveyed all her right, title and interest in and to Lot No. 7 Block 1 to Randolph Lafy et ux by deed dated Apr. 21, 1965 and recorded the same date in Bradford County Deed Book 572 at page 316.

Susie M. Northrup died testate Sept. 17, 1966 and by her Last Will and Testament, probated Sept. 21, 1966, and recorded in Bradford County Register's Docket 73 at page 481, devised the subject lands to Pauline Sands, in fee. A Certificate of Award of Real Estate, relative to the Estate of the said Susie M. Northrup, dec'd., dated July 6, 1967 and recorded the same date in Bradford County Deed Book 584 at page 62, awarded the subject lands to Pauline Sands, but again erroneously included by description Lot No. 7 of Block 1. The description set forth hereinabove has been corrected to exclude the said Lot No. 7 Block 1.

This Deed,

Made the 24th day of November in the year of our Lord one thousand nine hundred and Seventy (1970).

Between ALFRED J. WRISLEY, widower, of North Towanda Township, Bradford County, Pennsylvania -----GRANTOR

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware Corporation, of 1007 Market Street, Wilmington, Delaware 19898 -----GRANTEE

Witnesseth, that in consideration of: (\$18,500.00) Eighteen Thousand Five Hundred and no/100 -----Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantor does hereby grant and convey to the said Grantee, its successors ~~heirs~~ and Assigns,

All those certain lots, pieces or parcels of land situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:-

FIRST LOT: Bounded on the North by an alley and the Ross Estate; East by Alex Mitchell lands; South by James Street; and West by Randolph Lafy lot.

BEING Lot #16 on Map of D. O. Hollon's Subdivision of North Towanda as recorded in Deed Book 155 at page 552. The said lot fronting 65 feet on James Street and being 180 feet deep from the center of James Street to the center of said twenty-foot alley.

BEING the same lot conveyed by Gordon Hawkins and Louise Hawkins, his wife, to Alfred J. Wrisley and Amanda M. Wrisley, his wife, by deed dated Jan. 17, 1940 and recorded Jan. 18, 1940 in Bradford County Deed Book 404 at page 441.

The above-described FIRST LOT is more completely and accurately described as follows:-

BEGINNING at a point in the center line of James Street, said point being the southeast corner of the lot herein described and the southwesterly corner of the lands now or late of Alex Mitchell Estate; thence running along the center line of James Street in a Westerly direction 69.6 feet to a point for a corner; thence running along the easterly line of Second Lot herein after described in a Northerly direction 180 feet to a point for a corner; thence running along the southerly line of lands now or late of Pauline and Charles Sands in an Easterly direction approximately 45 feet to a point in the easterly line of an alley twenty-feet wide extending along the westerly side of lot now or late of Ross Bacou to Race Street; thence running along the easterly line of said alley in a Southwesterly direction approximately 15 feet to a corner of lands now or late of said Bacon; thence in a Southeasterly direction along the line of lands of said Bacon 29 feet more or less to a common corner of the herein lot, lands of said Bacon and lands of said Mitchell Estate; thence running along the westerly line of lands of said Mitchell Estate in a Southerly direction 150 feet more or less to the center of said

James Street, the place of beginning.

BEING and intending to describe Lot #16 of D. O. Hollon's Subdivision of North Towanda Township as recorded in Bradford County Deed Book 155 at page 552.

SECOND LOT: BEGINNING at a corner of Lot #16, now in the possession of Addie Snyder; thence running in center of James Street 65 feet; running along line of Lot #15, 180 feet to the center of a twenty-foot alley; thence along said alley 65 feet and then running 180 feet to the place of beginning.

The above described SECOND LOT is more completely and accurately described as follows:-

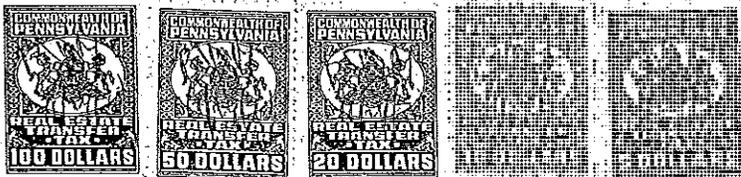
BEGINNING at a point in the center line of James Street, said point being the southwest corner of Lot #16 as conveyed by Gordon Hawkins et ux to Alfred J. Wrisley and wife by deed dated Jan. 17, 1940 and recorded Jan. 18, 1940 in Bradford County Deed Book 404 at page 441; thence along the center line of said James Street, in a westerly direction, 65 feet to a point for a corner; thence along the easterly line of lands now or late of Joseph LeStrange, Jr., in a northerly direction, 180 feet to a point for a corner in line of lands of Pauline and Charles Sands, now or formerly; thence along the southerly line of lands now or late of said Sands, in an easterly direction, 65 feet to a point for a corner; thence along the westerly line of other lands of said Wrisley, in a southerly direction, 180 feet to the place of beginning.

BEING and intending to describe Lot #15 of D. O. Hollon's Subdivision of North Towanda Township as recorded in Bradford County Deed Book 155 at page 552.

BEING the same lands as conveyed by Louise Hawkins, widow, by her Attorney-in-Fact under Power-of-Attorney dated Apr. 5, 1970 and recorded Nov. 12, 1970 in Bradford County Power-of-Attorney Book 30, Frederika Wallace to Alfred J. Wrisley by deed dated Nov. 17, 1970 and recorded Nov. 19, 1970 in the Office of the Recorder of Deeds of Bradford County, wherein a further explanation and chain of title is set forth.

Further, in connection herewith, see quitclaim deed from Marion E. Lafy, widow, to the herein Grantee, dated Nov. 2, 1970 and recorded Nov. 4, 1970 in Bradford County Deed Book 603 at page 1029.

The said Amanda M. Wrisley has become deceased, as of the 22nd day of February, 1967.



0.269 ACRES

This Deed,

Prop. 3605

Made the 8th day of September in the year of our Lord one thousand nine hundred and Seventy-one.

Between JOSEPH A. LeSTRANGE, Jr. and LINDA C. LeSTRANGE, his wife, of James Street, Towanda, Bradford County, Pennsylvania----- GRANTORS

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898 ----- GRANTEE



Witnesseth, that in consideration of (\$2,100.00) Two Thousand One Hundred ----- and ----- no/100 ----- Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee and their Heirs and Assigns,

All that certain lot, piece or parcel of land situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

BEGINNING at the southeast corner of other lands of Randolph B. Laff et ux in the center line of James Street, being Lot No. 13 on D. O. Hollon's map recorded in Deed Book 155 at pg. 553 and being the Southwest corner of the lot about to be conveyed; thence Northerly along the east side of Lot No. 13, 180 feet to the center line of a twenty-foot alley; thence Easterly along the center line of the said alley, 65 feet to the northwest corner of Lot No. 15 on the said map; thence in a Southerly direction along the west line of Lot No. 15, 180 feet to the center line of James Street; thence Westerly along the center line of James Street to the place of beginning. BEING Lot No. 14 as shown on the said Hollon Map. Together with all their right, title and interest in and to the streets and alleys as set forth on said Map.

BEING the same lands which are the subject of a Quiet Title action brought to No. 348 April Term 1971 in the Court of Common Pleas of Bradford County and final judgment recorded in the Office of the Recorder of Deeds of Bradford County the 7th day of September, 1971 in Deed Book 608 at page 772.

Also being the same lands which are the subject of a quit-claim deed from William F. Ortman and Helen W. Ortman, his wife, and Gertrude A. Murphy, widow, to Joseph A. LeStrange, Jr. dated April 14, 1971 and recorded May 10, 1971 in Bradford County Deed Book 606 at page 493.

Also being the same lands as conveyed by John J. Fedorchak, et ux, to Joseph A. LeStrange, Jr. by deed dated February 27, 1968 and recorded February 28, 1968 in Bradford County Deed Book 587 at page 739.

BOOK 636 PAGE 334

PROP: 3648
①

QUITCLAIM DEED

THIS DEED, made this 24TH day of JUNE, 1975, between PENNSYLVANIA ELECTRIC COMPANY, a Pennsylvania corporation, of 1001 BROAD STREET JOHNSTOWN PA. 15907, of ~~707 Main Street, Towanda, Pennsylvania 16940~~, of the one part (GRANTOR), and E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898, of the other part (GRANTEE),

W I T N E S S E T H :

That in consideration of the sum of Ten Dollars (\$10.00), the receipt of which is hereby acknowledged, GRANTOR releases and quitclaims to GRANTEE, its successors and assigns, forever, all right, title and interest it may have in and to the following described real estate situate, lying and being in North Towanda Township, Bradford County, Pennsylvania, by virtue of an easement granted to Northern Pennsylvania Power Company by Martha J. Ward by document dated January 15, 1943, and recorded in the office of the Register and Recorder, Bradford County, Pennsylvania, in Deed Book 412, page 91, and easement granted by Martha J. Ward by document dated December 14, 1943, and recorded in the aforesaid Office in Deed Book 412, page 146, to-wit:

BEGINNING at Station 13+28.92, Legislative Route No. 212, U.S. Traffic Route No. 6, and being North 38° 55' 34" West, a distance of 71.08 feet from the centerline of proposed James Street; thence

1. South 41° 04' 26" West 188.57 feet along the northerly right of way line of said proposed James Street to a point marked by a pin set; thence
2. 324.34 feet, still continuing along said right of way line on a curve to the left, whose radius is 1215.92 feet, to a point marked by a pin set; thence
3. South 25° 47' 26" West 286.78 feet, still along said right of way line, to a point marked by a pin set; thence
4. 654.13 feet, still along said right of way line, on a curve to the right, whose radius is

1075.92 feet, to a point marked by a pin set at the intersection of said northerly right of way line of proposed James Street and the easterly right of way line of a proposed ramp leading from relocated U.S. Route 220 to said proposed James Street; thence

5. North 27° 14' 19" West along said right of way line of said proposed ramp, 217.86 feet to a point marked by a pin set; thence

6. 385.03 feet along the easterly boundary line of said ramp, on a curve to the left, having a radius of 430.00 feet, to a point marked by a pin set in the southerly boundary line of other land of E. I. du Pont de Nemours and Company; thence

7. North 54° 25' 24" East 1239.40 feet through land of E. I. du Pont de Nemours and Company to a point marked by a pin found at the intersection of the southerly boundary line of land of E. I. du Pont de Nemours and Company and the westerly boundary line of land of M. H. Schmieg; thence

8. South 38° 55' 34" East 80.00 feet along said westerly line of land of M. H. Schmieg to a point marked by a pin set; thence

9. North 54° 25' 24" East 200.00 feet along the southerly line of land of M. H. Schmieg to a point marked by a pin set in the centerline of Legislative Route No. 212, U.S. Traffic Route No. 6, at Station 12+59.77; thence

10. South 38° 55' 34" East 69.15 feet along the centerline of said Route to the point of beginning.

CONTAINING 11.445 acres according to a survey thereof by L. LeRoy Shaylor & Associates, Registered Surveyors, dated December 23, 1971, revised June, 1972.

BEING the same property conveyed to E. I. du Pont de Nemours and Company by deed from Marion H. Schmieg, widow, dated December 28, 1971, filed for record December 30, 1971, in Deed Book 610, page 818, of the Office of Register and Recorder, Bradford County, Pennsylvania.

IN WITNESS WHEREOF, said GRANTOR has caused this Quitclaim Deed to be executed by its duly authorized officer, attested by its Secretary, and the corporate seal affixed, the

Prop # 3648

This Deed,

Made the 28th day of December in the year of our Lord one thousand nine hundred and seventy-one.

Between MARION H. SCHMIEG, Widow, of North Towanda Township, Bradford County, Pennsylvania,..... GRANTOR

AND

E. I. DU PONT De NEMOURS AND COMPANY, a corporation organized and existing under the laws and statutes of the State of Delaware, having its principal office and place of business at 1007 Market Street, Wilmington, Delaware,..... GRANTEE

Witnesseth, that in consideration of twenty-five thousand dollars (\$25,000.00) Dollars,

in hand paid, the receipt whereof is hereby acknowledged; the Grantor does hereby grant and convey to the said Grantee its successors ~~Heirs~~ and Assigns,

All that tract or parcel of land situate in the Township of North Towanda, Bradford County, Pennsylvania, bounded and described as follows:

BEGINNING at Station 13+28.92, Legislative Route #212, U. S. Traffic Route #6 and being North 38° 55' 34" West a distance of 71.08 feet from the proposed center line of James Street, thence South 41° 04' 26" West along the Northerly Right of Way line of said James Street, a distance of 188.57 feet to a pin set; thence along a curve to the left whose radius is 1215.92 and still continuing along said Right of Way a distance of 324.34 feet to a pin set; thence South 25° 47' 26" West and still continuing along said right of way a distance of 286.78 feet to a pin set; thence along a curve to the right whose radius is 1075.92 and still continuing along said right of way, a distance of 654.13 feet to a pin set at the intersection of said James Street and the Right of Way of the proposed Ramp "B"; thence North 27° 14' 19" West along the Right of Way of said Ramp "B" a distance of 217.86 feet to a pin set; thence along a curve to the left whose radius is 430.00 feet and still continuing along the right of way of Ramp "B" a distance of 385.03 feet to a pin set on the Southerly property line of E. I. Du Pont De Nemours & Company; thence North 54° 25' 24" East along said southerly property line and the Northerly property line of Marion H. Schmieg, a distance of 548.39 feet to a pin found being the southeast corner of E. I. Du Pont De Nemours & Company; thence North 54° 25' 24" East along the Southerly property lines of Bradco Supply Company, R. Brink, W. Cook and J. Curry and northerly line of said Schmieg, a distance of 691.01 feet to a pin set; thence South 38° 55' 34" East along westerly line of other land of said Schmieg, a distance of 80.00 feet to a pin set; thence North 54° 25' 24" East along the Southerly line of other land of said Schmieg, a distance of 200.00 feet and through a pin set, to Station 12+59.77 in the center line of Legislative Route #212 and U. S. Traffic Route #6; thence South

(continued)

38° 55' 34" East along said Traffic Route, a distance of 69.15 feet to the point of beginning.

CONTAINING 11.445 acres of land, be the same more or less, as surveyed in November, 1971, by L. LeRoy Shaylor, Registered Surveyor. This survey was based on a survey made by the Pennsylvania Department of Transportation, as shown on a map prepared for Route #1088, Section A 10 R/W, sheet 115 of 130 and all hubs as set by said Department are shown on Map #7171 as found.

BEING a portion of the premises conveyed by Martha I. Kirby, unmarried, to Edward J. Schmiege and Marion H. Schmiege, his wife, by deed dated May 7, 1951 and recorded May 18, 1951 in Bradford County Deed Book 474 at page 345.

Edward J. Schmiege died 4-28-68 Title to the herein described premises thereby vested in Marion H. Schmiege as the surviving tenant of the tenants by the entireties.

SUBJECT, however, to the rights-of-way of Pennsylvania Electric Company and Glavérack Rural Electric Cooperative, Inc., as more fully set forth on above-recited Survey, for electric transmission lines and installations.

Jawanda
GANTON AREA SCHOOL DISTRICT
REALTY TRANSFER TAX

DECLARED VALUE 25,000.00
TAX @ 1% 250.00
TAX PAID 250.00

Raymond J. Bradley
Recorder of Deeds of Bradford County
Agent For Ganton Area School District



BOOK 637 PAGE 572

DEED

THIS DEED dated September 12, 1975, between MARION H. SCHMIEG, unmarried, of North Towanda Township, Bradford County, Pennsylvania, grantor herein (SCHMIEG), and E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898, grantee herein (DU PONT),

W I T N E S S E T H :

That in consideration of One Dollar (\$1.00) in hand paid, the receipt whereof is hereby acknowledged, SCHMIEG does hereby grant and convey to DU PONT, its successors and assigns,

ALL THAT PARCEL OF LAND located in North Towanda Township, Bradford County, Pennsylvania, bounded and described as follows:

COMMENCING at the point of intersection of the centerline of U.S. Route 6 with the centerline of proposed new James Street; thence North $38^{\circ} 55' 34''$ East 220.23 feet along the centerline of said U.S. Route 6 to a point in said centerline of said U.S. Route 6, a corner of land of SCHMIEG and land late of J. Curry, now of DU PONT; thence South $54^{\circ} 25' 24''$ West 1439.40 feet along the boundary between said land of SCHMIEG and said land of DU PONT and through land of DU PONT to a pin marking the point of BEGINNING; thence

1. South $54^{\circ} 25' 24''$ West 63.00 feet along a line between the southerly boundary of land of DU PONT and the northerly boundary of the land hereby conveyed to a point marked by a pin; thence

2. South $83^{\circ} 19' 18''$ East 200.00 feet along the proposed amended easterly right of way line of a ramp leading from relocated U.S. Route 220, to a point marked by a pin set in a line between land of DU PONT and the present easterly right of way line of said ramp; thence

3. 160.03 feet along said present easterly right of way line of said ramp on the arc of a curve to the left having a radius of 430.00 feet, to the point of beginning.

CONTAINING 0.099 acre.

Imp 3666

6/9/72

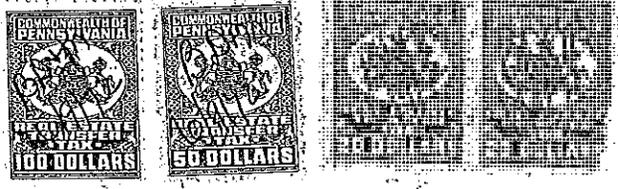
This Deed,

Made the 9th day of June in the year of our Lord one thousand nine hundred and Seventy-two.

Between GRACE TALADA, widow, of North Towanda Township, Bradford County, Pennsylvania ----- GRANTOR

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of Wilmington, Delaware ----- GRANTEE



Witnesseth, that in consideration of (\$19,000.00) Nineteen Thousand and no/100 ----- Dollars,

in hand paid, the receipt whereof is hereby acknowledged; the Grantor do es hereby grant and convey to the said Grantee, its successors ~~Heirs~~ and Assigns,

All that certain lot, piece and parcel of land situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:-

BEGINNING at a point in the center line of James Street at the southeasterly corner of lot acquired by Du Pont from Oscar W. Fuller et ux by deed recorded in Bradford County Deed Book 596 at page 472; thence North 28 degrees West 180 feet, along the easterly line of formerly Fuller lot, to a point in the center line of what was formerly designated on the map of D. O. Hollon's Subdivision in North Towanda Township, recorded in Deed Book 155 at page 552, as a 20-foot wide alley, but never opened or used as such; thence North 62 degrees East 222 1/4 feet, along the southerly line of lands of E. I. Du Pont de Nemours and Company, to a point South 62 degrees West 50 feet from the southwesterly corner of lot heretofore conveyed by Raymond Baumunk et ux to Du Pont by deed recorded in Bradford County Deed Book 598 at page 118, and being the northwesterly corner of other lands of said Baumunk; thence South 28 degrees East 180 feet, along the westerly line of other lands of said Baumunk to a point in the center line of James Street; thence South 62 degrees West 222 1/4 feet, along the center line of James Street, to the place of beginning.

BEING part of the lands conveyed by Anna E. Talada, widow, et al to Albert F. Talada and Grace Talada, his wife, by deed dated Nov. 15, 1939 and recorded Dec. 1, 1939 in Bradford County Deed Book 404 at page 246, and including within the boundaries set forth above a 40 foot wide Street, formerly designated on D. O. Hollon's Subdivision in North Towanda Township, as Church Street, but never opened or used as such. The herein Grantor does hereby release and quitclaim any right, title or interest she may have in and to said Church Street - unopened and in and to any other unopened streets and alleys set forth on said D. O. Hollon's Subdivision Map.

The said Albert F. Talada died intestate Apr. 22, 1964 and thus vesting title to all but a 2/27ths interest in the above described lands in Grace Talada as surviving tenant by the entireties. The remaining 2/27ths interest, which did not pass by the entireties, has been awarded to Grace Talada through a Court Order made May 1, 1972 and filed in the Court of Common Pleas of Bradford County - Orphans' Court Division, to No. 2 May Term, 1972, under Sec. 202

This Deed, 6/14/72

Made the 14th day of June in the year of our Lord one thousand nine hundred and seventy-two (1972)

Between RAYMOND H. BAUMUNK and ROSEMARY BAUMUNK, his wife, of North Towanda Township, Bradford County, Pennsylvania - - GRANTORS

AND

E. I. du Pont de Nemours & Co., a Delaware Corporation, of Wilmington, Delaware - - - - - GRANTEE



Witnesseth, that in consideration of Thirty Thousand (\$30,000.00) - - - Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee, its successors ~~Heirs~~ and Assigns,

All that certain piece or parcel of land situate in the Township of North Towanda, County of Bradford and State of Pennsylvania, bounded and described as follows:

BEGINNING at a point in the center line of James Street, being the most southwesterly corner of the land about to be described, and being in line of land of A. F. Talada; thence North 24 degrees 30 minutes West 180 feet to a pin for a corner in the center line of a 20 foot alley; thence North 65 degrees 30 minutes East along the center line of said alley 50 feet to a monument; thence North 24 degrees 30 minutes West 180 feet to a pin for a corner in the center line of Hollon Street; thence along the center line of Hollon Street, North 65 degrees 30 minutes East 130 feet to a pin for a corner in line of lands now or lately of Susie M. Northrup; thence South 24 degrees 30 minutes East 180 feet to a pin for a corner in the center line of the said 20 foot alley; thence South 65 degrees 30 minutes West 65 feet along the center line of the said alley to a pin for a corner; thence South 24 degrees 30 minutes East 180 feet to the center line of James Street; thence South 65 degrees 30 minutes West 115 feet to the place of beginning.

The foregoing lands are more fully portrayed on the Plot of a Survey made by George K. Jones, County Surveyor, June 14, 1967, being #6178.

Being the same lands conveyed by Marion Lafy to the grantors by deed dated January 19, 1968 and recorded in Bradford County, Pennsylvania in Deed Book 587 at page 275, excepting and reserving therefrom, however, a portion of the said lands previously conveyed by the grantors to the above named grantee by deed dated October 6, 1969 and recorded October 15, 1969 in Bradford County, Pennsylvania in Deed Book 598 at page 118.

Grantors also convey to the grantee all their right, title and interest in and to West James Street and in and to any and all roads, streets, or alleys in the D. O. Hollon's subdivision.

Reference is made to a certain deed from Marion E. Lafy et al to the grantors dated June 5, 1972 and recorded in Bradford County, Pennsylvania in Deed Book 613 at page 238 which deals with certain corrective action on the title to the within real estate.

9/14/72 (6)

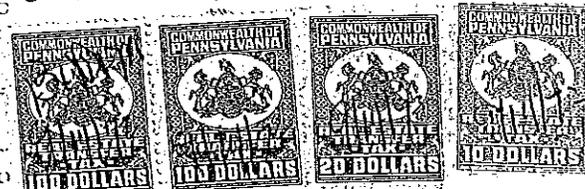
This Deed,

Made the 14th day of September in the year of our Lord one thousand nine hundred and Seventy-two (1972).

Between WILLIAM M. HOLLENBACK and LINDA L. HOLLENBACK, his wife, of R. D. #1, Towanda, Bradford County, Pennsylvania
..... GRANTORS

AND

E. I. duPont de NEMOURS & COMPANY, a corporation organized and existing under the laws and statutes of the State of Delaware having its principal office and place of business at 1007 Market Street, Wilmington, Delaware, GRANTEE



Witnesseth, that the said part y of the first part, for and in consideration of the sum of Twenty-three thousand (\$23,000.00).....

Dollars, lawful money of the United States unto them well and truly paid by the said part y of the second part, the receipt whereof is hereby acknowledged, does hereby grant, bargain, sell, alien, enfeoff, release, convey and confirm unto the said part y of the second part, its successorsand Assigns,

All that certain lot, piece or parcel of land, lying and being in the Township of North Towanda, Bradford County, Pennsylvania, bounded and described as follows:

BEGINNING at the intersection of U. S. Route 6 centerline and West James Street centerline, the northeast corner of the lands about to be described; thence South 38° 55' 34" East, along the centerline of said Route 6, a distance of 96.14 feet to a point the northeast corner of the lands of John B. Curry; thence South 54° 31' 19" West along the north line of lands of said Curry, a distance of 181.63 feet to a pipe found the southeast corner of the lands of Richard Packard; thence North 39° 09' 31" West, along the east line of lands of said Packard and through a pipe found, a distance of 95.93 feet to a point in the centerline of West James Street; thence North 54° 26' 45" East along the centerline of said West James Street, a distance of 182.01 feet to the point of beginning:

CONTAINING 0.401 acres of land, to be the same, more or less, as surveyed in August 1972 by L. LeRoy Shaylor Registered Professional Engineer.

BEING and intending to describe the same lands as conveyed by F. M. Saxe et ux to William M. Hollenback and Linda L. Hollenback, his wife by deed dated May 17, 1968, and recorded the same date in Bradford County Deed Book 588 at page 861.

-over-

This Deed,

11/5/72 (5)

Made the 5th day of November in the year of our Lord one thousand nine hundred and seventy-two (1972)

Between RICHARD B. PACKARD, single, of R.D. #1, James Street, Towanda, Pennsylvania, JANET A. COLLINS, formerly JANET A. PACKARD, and JAMES C. COLLINS, her husband, of 55 James Street, Torrington, Connecticut -----GRANTORS



A
N
D

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware Corporation of 1007 Market Street, Wilmington, Delaware -----GRANTEE

Witnesseth, that in consideration of Eighteen Thousand Five Hundred (\$18,500.00) Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee... its successors and assigns,

All that tract or parcel of land situate in the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

BEGINNING at a point in the center line of West James Street, South 54 degrees 26 minutes 45 seconds West, 182.01 feet from the intersection of the center lines of West James Street and U.S. Route 6, said point also being the Northeast corner of the lands about to be described; thence South 39 degrees 09 minutes 31 seconds East, 95.93 feet along the West line of land late of William Hollenback, now of E. I. DuPont DeNemours & Company, to a pipe found on the North line of land of John B. Curry; thence South 54 degrees 28 minutes 09 seconds West, 60.70 feet along the North line of lands of said Curry to a pipe found the Southeast corner of lands of Walter Cook; thence North 39 degrees 19 minutes 27 seconds West, 95.92 feet along the Eastern line of lands of said Cook and through a pin found to the center line of West James Street; thence North 54 degrees 26 minutes 45 seconds East, 60.98 feet along the center line of said West James Street to the point of beginning.

CONTAINING 0.134 acres of land, more or less.

Survey by L. LeRoy Shaylor Associates, Number 3872, dated October 5, 1972, entitled "lands to be acquired by E. I. DuPont DeNemours and Company, North Towanda Township, Bradford County, Pennsylvania."

BEING the same parcel of land conveyed to Richard B. Packard and Janet A. Packard, his wife, by David S. Packard and Beverly W. Packard, his wife, by deed dated July 30, 1968 and recorded the same day in Bradford County Deed Book 589 at page 962 et seq.

Janet A. Packard obtained a final decree in divorce from Richard B. Packard on August 29, 1972 to No. 105 July Term, 1972 in The Court of Common Pleas of Bradford County, Pennsylvania. Janet A. Packard then later married James C. Collins.

11/16/72 (3)

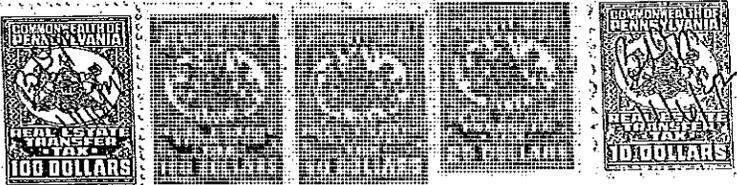
This Deed,

Made the 16th day of November in the year of our Lord one thousand nine hundred and Seventy-two (1972).

Between JOHN R. CURRY and SANDRA E. CURRY, his wife, of North Towanda Township, Bradford County, Pennsylvania,
..... GRANTORS

AND

AND COMPANY,
E. I. du PONT de NEMOURS / a Delaware Corporation,
of 1007 Market Street, Wilmington, Delaware,
..... GRANTEE



Witnesseth, that the said part y of the first part, for and in consideration of the sum of Twenty-eight thousand (\$28,000.00).....

Dollars, lawful money of the United States unto them well and truly paid by the said part y of the second part, the receipt whereof is hereby acknowledged, do hereby grant, bargain, sell, alien, enfeoff, release, convey and confirm unto the said part y of the second part, its successors and Assigns,

All that tract or parcel of land situate in the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

BEGINNING at a point in the centerline of U. S. Route 6, South 38° 55' 34" East 96.14 feet from the intersection of the centerlines of U. S. Route 6 and West James Street, said point being the northeast corner of the lands about to be described; thence

1. South 38° 55' 34" East 99.0 feet along the centerline of U. S. Route 6 to the northern line of lands of Marion H. Schmieg; thence

2. South 54° 25' 24" West 439.76 feet along the northern line of lands of Marion H. Schmieg and E. I. duPont de Nemours and Company to a pin found at the southeast corner of lands of Walter Cook; thence

3. North 37° 38' 40" West 99.15 feet along the eastern line of lands of said Cook to another corner of lands of said Cook; thence

4. North 54° 22' 27" East 195.22 feet along the southern line of lands of said Cook to a pipe found, the southwest corner of lands of Richard Packard; thence

5. North 54° 28' 09" East 60.70 feet along the southern line of lands of said Packard to a pipe found, the southwest corner of lands late of William Hollenback, now of E. I. duPont de Nemours and Company; thence

-continued-

P.3692

1037

6. North 54° 31' 19" East 181.63 feet along the southern line of lands late of said Hollenback, now of E. I. du Pont de Nemours and Company, to the point of beginning.

CONTAINING 0.998 acres of land.

BEING the same premises conveyed by Anne B. Broschart, Widow to John R. Curry and Sandra E. Curry, his wife by deed dated April 29, 1965 and recorded April 29, 1965, in Bradford County Deed Book 572 at page 462.

The herein description is according to Survey #3872 made by L. Leroy Shaylor & Assoc. Oct. 5, 1972.

This Deed, 11/15/72

Made the 16th day of November in the year of our Lord one thousand nine hundred and seventy-two (1972).

Between WALTER E. COOK and JOYCE B. COOK, his wife, of R. D. 1, Towanda, Bradford County, Pennsylvania GRANTORS

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898 GRANTEE



Towanda Area Sch. Dist
REALTY TRANSFER TAX

DECLARED VALUE 22,500.-
TAX @ 1% 225.-
TAX PAID 225.-

Raymond J. Bradley
Recorder of Deeds of Bradford County

Witnesseth, that in consideration of Twenty-two Thousand Five Hundred and 00/100 (\$22,500.00) Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee its successors ~~Heirs~~ and Assigns,

All those tracts or parcels of land situate in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

TRACT NO. 1

BEGINNING at a point in the center line of West James Street South 54 degrees 26 minutes 45 seconds West 242.99 feet from the intersection of the center lines of West James Street and U. S. Route 6, said point being the northeast corner of the lands about to be described; thence (1) South 39 degrees 19 minutes 27 seconds East, 95.92 feet along the western line of lands of Richard Packard to a pipe found on the northern line of lands of John B. Curry; thence (2) South 54 degrees 22 minutes 27 seconds West 195.22 feet along the northern line of lands of said Curry to a point on the eastern line of Tract No. 2 herein conveyed; thence (3) North 35 degrees 33 minutes 15 seconds West 95.90 feet along the eastern line of said Tract No. 2 through a found pin to the center line of West James Street; thence (4) North 54 degrees 26 minutes 45 seconds East 188.91 feet along the center line of said West James Street to the point of beginning.

0.442
0.229
0.671

CONTAINING 0.442 Acres of land.

TRACT NO. 2

BEGINNING at a point in the center line of West James Street, South 54 degrees 26 minutes 45 seconds West 431.90 feet from the intersection of the center lines of West James Street and U. S. Route 6, said point being the northeast corner of the lands about to be described; thence

(over)

- (1) South 35 degrees 33 minutes 15 seconds East 95.90 feet along the western line of Tract No. 1 through a found pin to a point at the northwest corner of the lands of John B. Curry; thence
- (2) South 37 degrees 38 minutes 40 seconds East 99.15 feet along the western line of lands of said Curry to a pin found on the northern line of lands of E. I. du Pont de Nemours and Company; thence
- (3) South 53 degrees 42 minutes 57 seconds West 54.15 feet along the northern line of lands of said E. I. du Pont de Nemours and Company to a steel post, the southeast corner of lands of Robert Brink; thence
- (4) North 35 degrees 22 minutes 48 seconds West 195.97 feet along the eastern line of lands of said Brink through a found pin to the center line of West James Street; thence
- (5) North 54 degrees 26 minutes 45 seconds East 49.94 feet along the centerline of said West James Street to the point of beginning.

CONTAINING 0.229 Acres of land.

BEING the same lands conveyed to the herein Grantors, Walter E. Cook et ux, from John H. Granger et ux et al, by deed dated August 30, 1967 and recorded September 1, 1967 in Bradford County Deed Book 585 at page 29.

The herein set forth descriptions are according to Survey #3872 made by L. Leroy Shaylor & Assoc. Oct. 5, 1972.

This Deed, 11/17/72

Made the 17th day of November in the year of our Lord one thousand nine hundred and seventy-two (1972).

Between ROBERT J. BRINK and GERALDINE S. BRINK, his wife, of R. D. #1, Towanda, Bradford County, Pennsylvania GRANTORS

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898 GRANTEE



Towanda, Acad. Sch. Dist.
REALTY TRANSFER TAX

DECLARED VALUE 19,000.-
TAX @ 1% 190.-
TAX PAID 190.-

Raymond J. Bradley
Recorder of Deeds of Bradford County



Witnesseth, that in consideration of Nineteen Thousand and 00/100 Dollars, (\$19,000.00) Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee its successors ~~Heirs~~ and Assigns,

All that tract or parcel of land situate in the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

BEGINNING at a point in the center line of West James Street, South 54 degrees 26 minutes 45 seconds West, 481.84 feet from the intersection of the center lines of West James Street and U.S. Route 6, said point being the north-east corner of the lands about to be described; thence (1) South 35 degrees 22 minutes 48 seconds East, 195.97 feet along the western line of lands of Walter Cook to a steel post on the northern line of lands of E. I. du Pont de Nemours and Company; thence (2) South 54 degrees 08 minutes 14 seconds West, 51.65 feet along the northern line of lands of E. I. du Pont de Nemours and Company to a steel post, the southeast corner of lands of Francis Pentz; thence (3) North 35 degrees 29 minutes 44 seconds West 195.95 feet along the eastern line of lands of said Pentz and through a steel bolt found to the center line of West James Street; thence (4) North 54 degrees 26 minutes 45 seconds East 52.04 feet along the center line of West James Street to the point of beginning.

CONTAINING 0.233 Acres of land.

BEING the same lands conveyed to the herein Grantors, Robert J. Brink et ux, by John H. Granger et ux et al by deed dated August 20, 1965 and recorded August 30, 1965 in Bradford County Deed Book 574 at page 695.

The herein set forth description is according to Survey #3872 made by L. Leroy Shaylor & Assoc. Oct. 5, 1972.

Prop. 3695

3/16/73

This Deed, (A)

Made the 16th day of March A. D. 19 73
between the Corporation by the name, style and title of D. W. MILLER INDUSTRIES, INC., a Pennsylvania corporation, with its principal place of business at 106 Pennsylvania Avenue, Huntingdon, Pennsylvania 16652, and a local office at R. D. #1, Towanda, Bradford County, Pennsylvania 18848 -----GRANTOR

of the one part and E. L. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, with its principal place of business at 1007 Market Street, of the City ----- of Delaware ----- County of -----

in the State of Delaware of the other part
Witnesseth, that the said D. W. Miller Industries, Inc. GRANTOR
consideration of the sum of One Hundred Seventy-five Thousand and no/100 ----- Dollars, lawful money of the United States, to it in hand paid by the said E. I. Du Pont De Nemours and Company ----- for and in

at the time of the execution hereof, the receipt whereof is hereby acknowledged, has granted, bargained, sold, aliened, encoffed, released and confirmed, and by these Presents does grant, bargain, sell, alien, encoff, release and confirm unto the said E. I. DU PONT DE NEMOURS AND COMPANY, its Successors -----

and Assigns, -----

all that certain piece or parcel of land, situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:-

BEGINNING at a point in the centerline of West James Street, South 54 degrees 26 minutes 45 seconds West, 533.88 feet from the intersection of the centerlines of West James Street and U. S. Route 6, said point being the northeast corner of the lands about to be described; thence

1. South 35 degrees 29 minutes 44 seconds East, 195.95 feet along the west line of lands formerly of Robert Brink, a now of E. I. du Pont de Nemours and Company, and through a steel bolt found to a steel post found on line of other lands of E. I. du Pont de Nemours and Company; thence

2. South 54 degrees 31 minutes 37 seconds West, 345.45 feet along said line of lands of E. I. du Pont de Nemours and Company to a concrete monument found, being a corner of the lands of E. I. du Pont de Nemours and Company; thence

3. North 35 degrees 35 minutes 26 seconds West, 195.16 feet still along lands of E. I. du Pont de Nemours and Company and through a steel pin found to the centerline of West James Street; thence

4. North 54 degrees 26 minutes 45 seconds East 345.77 feet along the centerline of West James Street to the point of beginning.

CONTAINING 1.551 Acres of land, according to Survey #3872 made by L. LeRoy Shaylor & Assoc., Oct. '5, 1972.

BEING and intending to describe the same lands as conveyed by Francis R. Pentz and Helen M. Pentz, his wife, to D. W. Miller Industries, Inc. by deed dated July 22, 1969 and recorded July 23, 1969 in Bradford County Deed Book 596 at page 219.

(continued)

This Deed,

Made the 26th day of September in the year of our Lord one thousand nine hundred and seventy-three (1973).

Between VERNE LOTT, single, of RD 2 Wyalusing, Pennsylvania.....
.....GRANTOR

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware corporation, of 1007 Market Street, Wilmington, Delaware 19898.....GRANTEE



Witnesseth, that in consideration of One Thousand Three Hundred and No/100(\$1,300.00)..... Dollars, in hand paid, the receipt whereof is hereby acknowledged; the Grantor do hereby grant and convey to the said Grantee its successors ~~Heirs~~ and Assigns,

All that certain lot, piece or parcel of land situate, lying and being in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and State of Pennsylvania, bounded and described as follows:

BEGINNING at a found monument situate in the Southerly right-of-way line of Race Street marking a common corner of the lands herein described and other lands of the herein grantee; thence South 63 degrees 29 minutes 11 seconds West 121.26 feet along the Northwesterly line of other lands of the herein grantee to a set pin; thence along the Easterly line of lands now or late of Robert L. Karpauitz North 32 degrees 19 minutes East 86.84 feet to a set pin in the Southerly right-of-way line of said Race Street; thence along the Southerly right-of-way line of said Race Street South 72 degrees 45 minutes 57 seconds East 65.0 feet to the point and place of beginning.

CONTAINING 2,725.01 square feet or 0.063 Acres of land according to Survey number 6873 made by L. L. Shaylor & Associates September 20, 1973.

BEING the same lands as conveyed by Robert Lee Coats et ux to the herein grantor by deed dated July 15, 1968 and recorded August 16, 1968 in Bradford County Deed Book 590 at page 178.

Verne Lott
REALTY TRANSFER TAX

DECLARED VALUE 1300.00
TAX @ 1% 13.00
TAX PAID 13.00

Edward J. Remick
Recorder of Deeds of Bradford County

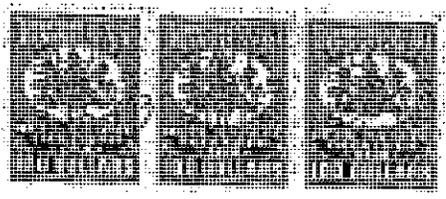
This Deed,

Made the 15th day of November in the year of our Lord one thousand nine hundred and seventy-three (1973).

Between ROBERT L. KARPAUITZ and ESTHER J. KARPAUITZ, his wife, of R. D. #1, Towanda, Bradford County, Pennsylvania....
.....GRANTORS

AND

E. I. DuPONT DeNEMOURS AND COMPANY, a Delaware Corporation, of 1007 Market Street, Wilmington, Delaware 19898..GRANTEE



Witnesseth, that in consideration of Thirty-Thousand (\$30,000)..... Dollars,
in hand paid, the receipt whereof is hereby acknowledged; the Grantors do hereby grant and convey to the said Grantee, its Heirs and Assigns,

All that certain lot, piece or parcel of land situate, lying and being in the Township of North Towanda, County of Bradford and State of Pennsylvania, bounded and described as follows:

BEGINNING at a set pin in the Southerly line of Race Street, said pin marking the Northwesterly corner of the lot herein described and the Northeasterly corner of lands now or late of Joseph Stroud; thence along the Southerly right-of-way of said Race Street South 69° 17' 57" East 135.40 feet to a set pin marking the Northeasterly corner of the lot herein conveyed and the Northwesterly corner of lands conveyed by Verne Lott to the herein grantee; thence along the Westerly line of said Lott to E. I. DuPont DeNemours and Company lands South 32° 19' West 86.84 feet to a set pin; thence along other lands of said E. I. DuPont DeNemours and Company South 63° 29' 11" West 189.67 feet to a set pin; thence along the Easterly line of lands of said Stroud North 23° 29' 12" East 5.82 feet to a found post; thence continuing along the Easterly line of said Stroud, North 23° 29' 12" East 218.70 feet to a set pin; the place of beginning.

CONTAINING 19,444.91 square feet of land or 0.446 acres of land according to survey #7173 made by L. L. Shaylor and Associates September 20, 1973.

BEING the same lands as conveyed by Robert Lee Coates et ux to the herein grantors by deed dated July 30, 1968 and recorded October 14, 1968 in Bradford County Deed Book 591 at Page 422.

Towanda Area School
REALTY TRANSFER TAX

DECLARED VALUE 30,000
TAX @ 1% 300.-
TAX PAID 300.-

Raymond J. Bradley
Recorder of Deeds of Bradford County

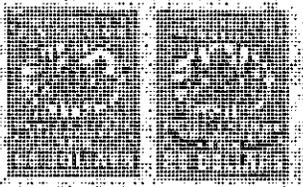
This Deed,

Made the 18th day of December in the year of our Lord one thousand nine hundred and Seventy-five.

Between HAROLD L. BIXBY and MARGARET F. BIXBY, his wife, of Towanda Borough, Bradford County, Pennsylvania -----GRANTORS

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware Corporation, of 1007 Market Street, Wilmington, Delaware 19898 -----GRANTEE



Witnesseth, that in consideration of (\$7,000.00) Seven Thousand and no/100 -----

----- Dollars,
in hand paid, the receipt whereof is hereby acknowledged; the Grantor^s do hereby grant and convey to the said Grantee, Its Successors ~~Heirs~~ and Assigns,

All that tract or parcel of land situate in NORTH TOWANDA TOWNSHIP, Bradford County, and Commonwealth of Pennsylvania, bounded and described as follows:-

BEGINNING at a point in the centerline of Race Street, said point being the northwest corner of lands of Joseph R. Stroud and the northeast corner of the parcel of land described herein, and running thence from said point of beginning

1. Along the westerly line of said lands of Stroud and through a set pin, South 21 degrees 02 minutes 55 Seconds West, a distance of 458.21 feet to a set pin in the northerly line of lands of E. I. du Pont de Nemours and Company; thence
2. Along the northerly line of said lands of E. I. du Pont de Nemours and Company, South 63 degrees 29 minutes 11 seconds West, a distance of 117.00 feet to a pin found, corner of lands of Willard Persun; thence
3. Along the easterly line of said lands of Willard Persun and through a North 9 degrees 07 minutes 37 seconds East set pin at the base of a 24-inch witnessed oak, a distance of 491.43 feet to a point in the centerline of Race Street; thence
4. Along the centerline of Race Street the following courses and distances:
North 74 degrees 47 minutes 55 seconds East 78.60 feet;
South 81 degrees 57 minutes 05 seconds East 75.00 feet; and
South 69 degrees 27 minutes 05 seconds East 44.00 feet to the point

and place of beginning.

(continued) 738

RECORDED

This Deed

SEP 23 1976

REGISTER & RECORDER
Per SHIRLEY ROCKEFELLER

Made the 23rd day of September in the year of our Lord one thousand nine hundred and Seventy-six.

Between WILLARD G. PERSUN, single, of North Towanda Township, Bradford County, Pennsylvania -----GRANTOR

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware Corporation, of 1007 Market Street, Wilmington, Delaware 19898 -----GRANTEE



Witnesseth, that in consideration of (\$10,000.00) Ten Thousand and no/100 -----

----- Dollars,
in hand paid, the receipt whereof is hereby acknowledged; the Grantor does hereby grant and convey to the said Grantee, its Successors ~~Heirs~~ and Assigns,

All that tract or parcel of land situate in NORTH TOWANDA TOWNSHIP, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:-

BEGINNING at a point in the centerline of Race Street, said point being the northwest corner of a 1.544 acre parcel of land conveyed by Harold L. Bixby and Margaret F. Bixby, his wife, to E. I. du Pont de Nemours and Company by deed dated December 18, 1975 and recorded in the Recorder's Office of Bradford County, Pennsylvania, in Deed Book 638, Page 738, and running thence from said point of beginning

1. Along the westerly line of said 1.544 acre parcel of land South 9 degrees 07 minutes 37 seconds West, a distance of 491.43 feet to a pin found in the northerly line of other lands of E. I. du Pont de Nemours and Company; thence

2. Along the northerly line of said other lands of E. I. du Pont de Nemours and Company and crossing Sugar Creek South 63 degrees 29 minutes 11 seconds West, a distance of 182.00 feet to a pin set; thence

3. Along what was the center line of Sugar Creek in 1952, but is now the west bank of said Creek, North 9 degrees 45 minutes 29 seconds West, a distance of 428.70 feet to a pin set; thence

4. Crossing Sugar Creek and along the southerly line of lands now or formerly of Fred Isbell North 74 degrees 35 minutes 15 seconds East, a distance of

(continued)

138.00 feet to a pin found; thence

5. Still along the same, South 11 degrees 34 minutes 45 seconds East, a distance of 33.72 feet to a pin found in the extension of the center line of Race Street; thence

6. Along the center line of Race Street, North 51 degrees 47 minutes 55 seconds East, a distance of 72.83 feet to a spike found; thence

7. Still along the center line of Race Street, North 48 degrees 17 minutes 24 seconds East, a distance of 123.48 feet to a point; thence

8. Still along the center line of Race Street, North 61 degrees 35 minutes 12 seconds East, a distance of 27.56 feet to the point and place of beginning.

CONTAINING 2.31 Acres of land, be the same more or less, as surveyed by Mark O. Shaylor, Pennsylvania licensed surveyor, in August, 1976, numbered 4476.

BEING the same lands conveyed by Willard G. Persun and Grace E. Persun, his wife, to Willard G. Persun by Deed dated Nov. 14, 1969 and recorded Dec. 1, 1969 in Bradford County Deed Book 598 at page 815.

1:12 P.M.

FEB 28 1978

This Deed,

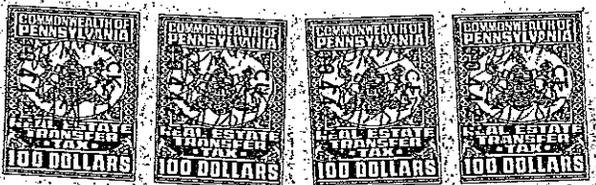
Made the 28th day of February
 Lord one thousand nine hundred and Seventy-eight.

REGISTER & RECORDER
 Per SHIRLEY ROCKEFELLER
 in the year of our

Between AGNES C. MITCHELL, widow, of North Towanda Township, Bradford County,
 Pennsylvania -----GRANTOR

and

E. I. DU PONT DE NEMOURS AND COMPANY, a Delaware Corporation of 1007
 Market Street, Wilmington, Delaware 19898 -----GRANTEE



Witnesseth, that in consideration of Forty Thousand and no/100 -----
 -----(\$40,000.00) ----- Dollars,

in hand paid, the receipt whereof is hereby acknowledged; the Grantor do es
 hereby grant and convey to the said Grantee, its Successors ~~Heirs~~ and Assigns,

All THAT CERTAIN tract or parcel of land situate, lying and being in NORTH TOWANDA
 TOWNSHIP, BRADFORD COUNTY, PENNSYLVANIA, bounded and described as follows:-

BEGINNING at the point of intersection of the center-
 lines of West James Street and U.S. Route 6, and running thence from
 said point of Beginning -

1. Along the centerline of West James Street, South 54 degrees
 23 minutes 30 seconds West 201.06 feet to a point; thence

2. Along the line of other lands of E. I. du Pont de Nemours
 and Company, North 39 degrees 06 minutes 30 seconds West 150.04 feet
 to a point; thence

3. Still along the same, North 54 degrees 23 minutes
 30 seconds East, at 179.90 feet passing the southwesterly line of U.S.
 Route 6, a distance of 204.94 feet to a point in the centerline of
 U.S. Route 6; thence

4. Along the centerline of U.S. Route 6 on a curve to the
 left having a radius of 821.50 feet, an arc distance of 150.06 feet, to
 the point and place of beginning (Chord bearing and distance, South
 37 degrees 37 minutes 43 seconds East 149.85 feet).

CONTAINING within said bounds 0.598 Acres of land,
 be the same more or less, as surveyed in December, 1977, by Shaylor
 & Shaylor, 204 Main Street, Towanda, Pennsylvania, being Survey Map
 #7577.

BEING and intending to describe Lots Nos. 1 and 2 as shown
 on D. O. Hollon's Subdivision as recorded Feb. 29, 1884 in Bradford
 County Deed Book 155 at page 552.

ALSO, being the same lands as awarded to Agnes C. Mitchell
 from the Estate of Alexander J. Mitchell, deceased, by Certificate of Award

Towanda, Pa

P-4033 (2)

RECORDED
2:42 P.M.
JAN 19 1984
REGISTER & RECORDER
L. C. BAILEY ROCKEFELLEN

This Deed,

1/9/84

Made the 9th day of January in the year of our Lord one thousand nine hundred and eighty-four (1984)

Between ALMA H. STROUD, widow, of North Towanda Township, Bradford County, Pennsylvania-----GRANTOR

AND

E. I. DU PONT DE NEMOURS AND COMPANY, with its principal office at 1007 Market Street, Wilmington, Delaware 19898-----GRANTEE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF REVENUE
REALTY TRANSFER TAX
JAN 9 '84
500.00
RB.11354

Witnesseth, that in consideration of Fifty Thousand (\$50,000.00) Dollars,

in hand paid, the receipt whereof is hereby acknowledged; the Grantor do es hereby grant and convey to the said Grantee its Heirs and Assigns.

All that piece and parcel of land situate in the Township of North Towanda, Bradford County, Commonwealth of Pennsylvania, bounded and described as follows:

Lot No. 1. Beginning at the Northwest corner of lot of land formerly of George E. Foster, now of Leonard Barnes; thence southerly along said Barnes' west line 13.2 perches to land formerly of D.O. Hollon, now of E. I. DuPont de Nemours & Co.; thence westerly by lands of said Hollon about 7.6 perches to a corner; thence northerly on line parallel with said Leonard Barnes' west line about 19.3 perches to the south line of the public road; and thence easterly by the same 85 feet to the place of beginning. Containing .82 square rods, be the same more or less.

^{1492 ACRES}
Lot No. 2. Also another lot beginning in the center of the road leading to Burlington from North Towanda, at the Northwest corner of lot of the grantors herein; thence along the West line of said lot about 19 rods and 5 feet to a corner on lands formerly of Charles R. Brown, now of DuPont de Nemours & Co.; thence along the line of said lands, South 62 degrees West, 27.2 rods to a corner near the East bank of Sugar Creek; thence along Myers Mill Race South 12 degrees 20' east 28 rods to a corner in the center of the Burlington Road above mentioned; and thence along said road North 23 degrees East 7.8 rods to a corner and thence along said lot South 70 degrees East 17.4 rods or thereabouts to the place of beginning. (See exception and reservation below.) Containing about 3 acres and 120 rods more or less. ^{3,720 ACRES}

Lot No. 3. Beginning at an iron stake set in the line between the land of grantor and John Bailey; thence along line of John Bailey South to the highway leading from North Towanda to Burlington; thence East along said highway about two rods to the West line of Race Road; thence North along the West line of Race Road to an iron stake; thence in a westerly direction to the place of beginning.

Excepting and reserving from Lot #2 aforesaid, a triangular piece of land about 92 feet by about 114 feet and running about 152 feet along the center of the old road running from North Towanda to Burlington. The piece of land was conveyed by Leonard Strope et ux to Leonard McNeal in 1946 by deed not yet recorded.

Excepting the following adverse conveyances:

1. Deed from Joseph Robert Stroud and Alma H. Stroud, his wife, to Harold Bixby and Margaret Bixby, his wife, dated December 1, 1956 and recorded in Bradford County Deed Book 518 at Page 310.
2. Deed from Joseph Robert Stroud and Alma H. Stroud, his wife, to Willard G. Persun and Grace E. Persun, his wife, dated December 1, 1956 and recorded in Bradford County Deed Book 520 at Page 405.

THE ABOVE TRACT OF LAND IS MORE ACCURATELY DESCRIBED AS FOLLOWS:

All that tract or parcel of land situated in North Towanda Township, Bradford County, Pennsylvania, Bounded and described as follows:

Beginning at a pin (DuPont corner number C-26) found in the north-erly line of lands of DuPont, said pin at the southwest corner of the parcel herein described, and being N 55° 55' 03" E, a distance of 349.80 feet from DuPont corner number C-15.

Thence N 13° 07' 51" E, along the lands of DuPont, passing through a pipe found on the south side of Race Street, a distance of 458.20 feet to a point in the centerline of Race Street. Said point at DuPont corner number C-25.

Thence S 72° 26' 19" E, with the centerline of Race Street, a distance of 195.58 feet to a point. At the northeast corner of the parcel herein described.

Thence S 13° 28' 04" W, through a pin (DuPont corner number C-28) at the south side of Race Street, and along the lands of DuPont, a distance of 233.91 feet to a pin found. DuPont corner number C-27.

Thence S 55° 55' 03" W, continuing along the land of DuPont, a distance of 285.04 feet to the place of beginning.

Said tract or parcel of land containing 1.542 acres of land, to be the same, more or less, as surveyed in November of 1983, by Mark O. Shaylor and Associates. Pennsylvania L.L.S. number 18102E.

BEING a part of the same premises which Joseph Robert Stroud and Alma H. Stroud, his wife, by their deed dated July 10, 1947 and recorded in the Office for the Recording of Deeds in and for Bradford County in Deed Book 445 at Page 452 granted and conveyed unto Joseph Robert Stroud and Alma H. Stroud, his wife.

The said Joseph Robert Stroud while seized thereof departed this life June 26, 1976, whereupon by operation of law the entire fee vested in Alma H. Stroud, widow, and Grantor herein.

No. Towanda Twp. Supv. & Towanda
 REALTY TRANSFER TAX Area Sch.
 DECLARED VALUE 50,000.00
 TAX @ 1% 500.00 Dist.
 TAX PAID 500.00
 Shirley Rockefeller
 Treasurer of Bradford County

Ywp 4142
BRADFORD COUNTY

This Deed

RECORDED
SEP 16 1988
SHIRLEY ROCKEFELLER
RECORDER
TIME 2:30 P.M.

MADE the 16th day of September, in the year nineteen hundred and eighty-eight (1988);

BETWEEN HENRY C. DUNN of 317 Main Street, Towanda Borough, Bradford County, Pennsylvania, and LAWRENCE TAMA of North Towanda Township, Bradford County, Pennsylvania, t/d/b/a "Dunn and Tama," as tenants in Co-Partnership,

Parties of the First Part, GRANTORS

AND

E. I. DUPONT DE NEMOURS and COMPANY, a Delaware corporation with its principal place of business at 1007 Market Street, Wilmington, Delaware 19898,

Party of the Second Part, GRANTEE

WITNESSETH, that in consideration of FOUR HUNDRED SIXTY THOUSAND DOLLARS (\$460,000.00), in hand paid, the receipt whereof is hereby acknowledged, the said Grantors do hereby grant and convey to the said Grantee, its successors and assigns,

ALL that certain piece or parcel of land together with improvements thereon, situate, lying and being in North Towanda Township, Bradford County, Pennsylvania, bounded and described as follows:

BEGINNING at a point in the centerline of Race Street (a/k/a Twp. Road #557), said point being a common corner of the lands herein conveyed and lands now or late of Fred Gardner; thence the following courses and distances along the centerline of said street: (1) North 66 degrees 45 minutes West 250 feet; (2) North 61 degrees 20 minutes West 84 feet; (3) North 62 degrees West 100 feet; (4) North 77 degrees 30 minutes West 100 feet; (5) South 73 degrees 20 minutes West 100 feet; (6) South 49 degrees 05 minutes West 100 feet to a point for a corner; thence North 15 degrees East 30 feet to a point, said point being at the intersection of the northerly right-of-way line of Twp. Road #557 with the centerline of an "Old Township Road;" thence the following courses and distances along the centerline of said "Old Township Road" and also being the easterly line of lands now or late of Joseph R. Stroud and lands now or late of Roy White: (1) North 41 degrees 15 minutes East 100 feet; (2) North 48 degrees 35 minutes East 100 feet; (3) North 50 degrees 35 minutes East 100 feet; (4) North 44 degrees 50 minutes East 100 feet; (5) North 37 degrees 35 minutes East 100 feet; (6) North 48 degrees 35 minutes East 200 feet; (7) North 40 degrees 20 minutes East 100 feet; (8) North 34 degrees 50 minutes East 100 feet; (9) North 34 degrees East 100 feet to a point for a corner; thence the following courses and distances along the southerly line of lands now or late of Dawes Markwell: (1) South 57 degrees East 187 feet, through a pin situate in the easterly right-of-way line of said "Old Township Road," to a pin; (2) South 84 degrees 45 minutes East 128.3 feet to a pin for a corner; thence along the westerly line of lands now or late of James F. McCarthy, South 7 degrees 30 minutes East 594 feet to a pin marking a common corner of the lands herein conveyed, lands now or late of Chester Steinbacher and lands now or late of Fred Gardner; thence along the northerly line of lands now or late of Fred Gardner, South 65 degrees 30 minutes West 425 feet, through a pin situate in the northerly right-of-way line of Race Street (a/k/a Twp. Highway #557) to the center of said Street, the place of beginning.

BEING AND INTENDING TO DESCRIBE 10.9 acres of land according to Survey #2238 made by George K. Jones, County Surveyor, June 9, 1952, which said Survey plots two contiguous tracts of land (one of 4.66 acres and one of 6.24 acres) and the herein description is a composite of the two plots.

EXCEPTING AND RESERVING, however, from the hereinbefore described premises, a lot of land containing 0.76 acres conveyed by Northeast Developers, Inc., to Willard G. Persun by deed dated August 6, 1976, and recorded August 6, 1976, in Bradford County Deed Book 642 at Page 551, described as follows:

BEGINNING at a point in the centerline of Township Road No. T-557, said point being the following courses and distances along the centerline of said Township Road No. T-557 from the common intersecting point of the centerline of said Township Road No. T-557 and the line of lands late of Frederick Gardner; North 66 degrees 45 minutes West 250 feet; North 61 degrees 20 minutes West 84 feet; and North 62 degrees West 100 feet to the point of beginning; thence from said point of beginning the following courses and distances along the centerline of Township Road No. T-557: North 77 degrees 30 minutes West 100 feet; South 73 degrees 20 minutes West 100 feet; and South 49 degrees 05 minutes West 100 feet to a nail in the centerline of Township Road No. T-557; thence North 15 degrees East 30 feet to line of lands, now or late of Joseph Stroud; thence the following courses and distances along line of lands of said Joseph Stroud and along the centerline of abandoned road: North 41 degrees 15 minutes East 100 feet; North 48 degrees 35 minutes East 100 feet; North 50 degrees 35 minutes East 100 feet; and North 44 degrees 50 minutes East 76 feet to a hub in the centerline of said abandoned road; thence South 49 degrees 06 minutes East 105 feet through other lands of the herein Grantor, Northeast Developers, Inc., to an iron pin; thence South 31 degrees 32 minutes West 171.8 feet through other lands of the herein Grantor, Northeast Developers, Inc., and through an iron pin at or near the Northerly right-of-way line of Township Road No. T-557 to the centerline of Township Road No. T-557, the point of beginning. CONTAINING 0.76 acres of land, be the same more or less.

The foregoing description is according to survey by Leonard T. Carver, dated July 23, 1976.

BEING the same land conveyed by Northeast Developers, Inc., to Henry C. Dunn and Lawrence Tama, t/d/b/a "Dunn and Tama," by deed dated February 27, 1981, and recorded February 27, 1981, in Bradford County Deed Book 674 at Page 389.

Henry C. Dunn and Lawrence Tama also grant and convey to E.I. DuPont de Nemours and Company, its successors and assigns, an easement for ingress, egress and regress, by foot and by vehicle, over, across and upon the portion of the above described lands conveyed to Willard G. Persun which lie within an abandoned road mentioned in that conveyance. The said easement runs from Township Road No. T-557 and along the westerly side of the lands conveyed to Willard G. Persun, as recited in that Deed, and as reserved by Northeast Developers, Inc., therein.

A more modern description of the property above described is as follows:

BEGINNING at a point in the centerline of Race Street at the southeast corner of the lands of Willard G. Persun; thence North 19 degrees 43 minutes 30 seconds East, along the lands of Willard G. Persun, a distance of 17.0 feet to a pipe found; thence continuing at North 19 degrees 43 minutes 30 seconds East, along the lands of said Persun, a distance of 155.92 feet to a pipe found; thence North 52 degrees 43 minutes 13 seconds West, continuing along the lands of said Persun, a distance of 105.0 feet to a pin set in the approximate center of an abandoned roadbed; thence with the centerline of an abandoned roadbed and along the lands of Fred Isbell the following five courses: (1) North 30 degrees 20 minutes 17 seconds East, a distance of 150.26 feet to a pin set, (2) North 41 degrees 38 minutes 16 seconds East, a distance of 70.71 feet to a pin set, (3) North 36 degrees 23 minutes 43 seconds East, a distance of 136.77 feet to a pin set, (4) North 31 degrees 28 minutes 55 seconds East a distance of

P4142

66.09 feet to a pin set, (5) North 24 degrees 22 minutes 53 seconds East a distance of 193.99 feet to a pin set; thence South 67 degrees 23 minutes 30 seconds East, with a fence line along the lands of David Lee Houck, et ux., a distance of 173.47 feet to a pipe found; thence North 85 degrees 56 minutes 20 seconds East, with a fence line along the lands of Melvin B. Shultz, et ux., a distance of 135.83 feet to a pipe found at a fence corner; thence South 17 degrees 47 minutes 47 seconds East, with a fence line, along the lands of Jay S. MacMorran, et ux., a distance of 593.50 feet to a pipe found at a fence corner; thence South 55 degrees 37 minutes 30 seconds West, with a hedgerow, along the lands of Lila Gardner, a distance of 397.36 feet to a pin found; thence continuing at South 55 degrees 37 minutes 30 seconds West, along the lands of Lila Gardner, a distance of 27.64 feet to a point in the centerline of Race Street; thence North 76 degrees 58 minutes 13 seconds West, with the centerline of Race Street, a distance of 250.0 feet to a point; thence North 73 degrees 02 minutes 18 seconds West, continuing with the centerline of Race Street, a distance of 184.13 feet to the place of beginning. Said tract or parcel containing 10.167 acres of land to be the same, more or less, as surveyed in August of 1988, by Mark O. Shaylor, PA DLS:18102E Survey #4088.

REALLY TRANSFER TAX SEP 16 '08 300.00 RB.11354

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF REVENUE REALTY TRANSFER TAX SEP 16 '08 300.00 RB.11354

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF REVENUE REALTY TRANSFER TAX SEP 16 '08 300.00 RB.11354

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF REVENUE REALTY TRANSFER TAX SEP 16 '08 100.00 RB.11354

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF REVENUE REALTY TRANSFER TAX SEP 16 '08 300.00 RB.11354

North Towanda Twp. & Towanda Area Sch. Dist. REALTY TRANSFER TAX DECLARED VALUE 460,000 TAX @ 1% 4,600 TAX PAID 4,600 Shirley Rockefeller Recorder of Deeds of Bradford County

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF REVENUE REALTY TRANSFER TAX SEP 16 '08 300.00 RB.11354

AND the said Grantors will Generally WARRANT AND FOREVER DEFEND the property hereby conveyed.

IN WITNESS WHEREOF, the said Grantors have hereunto set their hands and seals, the day and year first above written.

Sealed and delivered in the presence of:

DUNN and TAMA

Signatures of grantors with "By:" and "Partner" labels and "(SEAL)" markings.

CERTIFICATE OF RESIDENCE

I hereby certify that the precise residence of the Grantee herein is as follows:

1007 Market Street Wilmington, Delaware 19898

Signature of Attorney or Agent for Grantee

Pop. No. 4171

Phil's Indentures

Made the 26th day of July, in the year of one thousand nine hundred and eighty-nine (1989)

Between WILLARD G. PERSUN, single, of North Towanda Township, Bradford County, Pennsylvania, party of the first part, GRANTOR,

A N D

E. I. du PONT de NEMOURS & COMPANY, a Delaware corporation of Wilmington, Delaware, party of the second part, GRANTEE.

RECORDED
WILMINGTON COUNTY
09 JUL 26 PM 2:21
SHEILEY RECORDS ELLER

Witnesseth, That the said party of the first part, for and in consideration of the sum of SEVENTY-FIVE THOUSAND DOLLARS (\$75,000.00)

unto him well and truly paid by the said party of the second part, at or before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged has granted, bargained, sold, aliened, enfeoffed, released, conveyed and confirmed, and by these presents does grant, bargain, sell, alien, enfeoff, release, convey and confirm, unto the said party of the second part, its successors and assigns, forever:

All that certain piece or parcel of land situate, lying and being in NORTH TOWANDA TOWNSHIP, Bradford County, Pennsylvania, bounded and described as follows:

BEGINNING at a point in the center line of Township Road No. T-557, said point being the following courses and distances along the center line of said Township Road No. T-557 from the common intersecting point of the center line of said Township Road No. T-557 and line of lands late of Frederick Gardner, North 66 degrees 45 minutes West 250 feet; North 61 degrees 20 minutes West 84 feet; and North 62 degrees West 100 feet to the point of beginning; thence from said point of beginning the following courses and distances along the center line of Township Route No. T-557; North 77 degrees 30 minutes West 100 feet; South 73 degrees 20 minutes West 100 feet; and South 49 degrees 5 minutes West 100 feet to a nail in the center line of Township road No. T-557; thence North 15 degrees East 30 feet to line of lands, now or late of Joseph Stroud; thence the following courses and distances along line of lands of said Joseph Stroud and along the center line of abandoned road; North 41 degrees 15 minutes East 100 feet; North 48 degrees 35 minutes East 100 feet; North 50 degrees 35 minutes East 100 feet; and North 44 degrees 50 minutes East 76 feet to a hub in the center line of said abandoned road; thence South 49 degrees 6 minutes East 105 feet through other lands of former Grantor, Northeast Developers, Inc., to an iron pin; thence South 31 degrees 32 minutes West 171.8 feet through other lands of former Grantor, Northeast Developers, Inc., and through an iron pin at or near the Northerly right-of-way line of Township Road No. T-557 to the center line of Township Road No. T-557, the point of beginning. CONTAINING 0.76 acres of land, be the same more or less.

Gift Deed

Prop No 4179
D-4179

Made the 17th day of November 89 NOV 17 PM 12:17, in the year of one thousand nine hundred and eighty-nine (1989) SHIRLEY ROCKEFELLER RECORDER

Between LILA V. GARDNER, Widow, of North Towanda Township, Bradford County, Pennsylvania, by her attorney-in-fact, JOAN G. COOLEY, pursuant to a Power of Attorney dated June 19, 1979, and recorded in the Register and Recorder's Office of Bradford County in Book 30, Page 261, and TIMOTHY B. FRANKLIN and SRISUPARB FRANKLIN, his wife, of North Towanda Township, Bradford County, Pennsylvania, parties of the first part, Grantors,

AND

E. I. duPont deNemours & Company, a Delaware corporation of Wilmington, Delaware, party of the second part, Grantee,

Witnesseth, That the said parties of the first part, for and in consideration of the sum of Fifteen Thousand (\$15,000.00) Dollars, unto them well and truly paid by the said party of the second part, at or before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged have granted, bargained, sold, aliened, enfeoffed, released, conveyed and confirmed, and by these presents do grant, bargain, sell, alien, enfeoff, release, convey and confirm, unto the said party of the second part, its successors and assigns, forever:

All those two certain lots, pieces or parcels of land situate in the TOWNSHIP OF NORTH TOWANDA, County of Bradford and State of Pennsylvania, and bounded and described as follows, to wit:

(1) BEGINNING in the center of Race Street in the west line of land deeded to G. C. Hollon; thence along the center of said Race Street north 72½° west one hundred sixty-six and six tenths (166.6) feet to a corner; thence by lands formerly of D. O. Hollon north 50° west one hundred twelve and nine tenths (112.9) feet to a post; thence by the same north 76½° east one hundred twenty-two (122) feet to a corner of G. C. Hollon's land; and thence by the same south 12° 20' east one hundred ninety-six and one-half (196½) feet to the place of beginning. Containing about one-half (½) acre.

0.50 ACRE

(2) BEGINNING at a corner in the center of Race Street and running thence northeasterly along line of lands formerly of Ruddy and Hollon three hundred seventy-five (375) feet more or less to line of lands of the Estate of William Foster, deceased; thence along that line about four hundred twenty-two (422) feet to the center of said Race Street; and thence along the center of said Race Street about four hundred (400) feet to the place of beginning.

BEING the same premises granted and conveyed unto FREDERICK W. GARDNER and LILA GARDNER, his wife, by Deed of of FREDERICK W. GARDNER and LILA GARDNER, his wife, dated January 24, 1974, and recorded in the Register and Recorder's Office of Bradford County in Book 626, Page 1114. Thereafter, the said FREDERICK W. GARDNER died thereby vesting sole title to the above-described real estate in the said LILA GARDNER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF REVENUE
REALTY TRANSFER TAX NOV 17 '89
150.00
PS. 11354

P4179

EXCEPTING AND RESERVING therefrom, all that certain piece, parcel and lot of land conveyed by LILA V. GARDNER, by her attorney-in-fact, JOAN G. COOLEY, to TIMOTHY B. FRANKLIN, ET UX, dated April 30, 1980, and recorded in the Register and Recorder's Office of Bradford County in Book 668, Page 992.

The said TIMOTHY B. FRANKLIN, and SRISUPARB FRANKLIN, his wife, join in this Deed to extinguish the right of first refusal granted to them in Deed Book 668, Page 992 to purchase the within described property.

The above-described property is also more particularly bounded and described in accordance with that certain survey of Mark O. Shaylor, R.S., Survey No. 4689, dated August 30, 1989, and which is based upon true north as follows:

BEGINNING AT A POINT IN THE CENTERLINE OF Race Street, said point being at the southeast corner of the lands of E. I. duPont deNemours & Company and being duPont corner number C-49.

Thence N 55°37'30"E, along the lands of duPont, a distance of 27.64 feet to a pin. Said pin at duPont corner number C-63.

Thence continuing at N 55°37'30"E, along the lands of duPont, a distance of 397.36 feet to a pipe. Said pipe being at duPont corner number C-62.

Thence S 7°53'33"E, along the lands of Richard Dieffenbach, a distance of 165.99 feet to a pin.

Thence S 82°33'29"W, along the lands of Timothy B. and Srisuparb Franklin, a distance of 39.30 feet to a pin.

Thence S 5°35'46"E, continuing along the lands of Franklin, a distance of 106.72 feet to a pin.

Thence continuing at S 5°35'46"E, along the lands of Franklin, a distance of 25.98 feet to a point in the centerline of Race Street.

Thence N 79°56'44"W, along the centerline of Race Street, a distance of 352.96 feet to the place of beginning.

Said tract, parcel of lot of land containing 53,598.40 square feet of land or 1.230 acres, to be the same, more or less as surveyed in August of 1989 by Mark O. Shaylor, R.S. Survey No. 4689.

N. Tawanda Trent
 REALTY TRANSFER TAX *Feb. Deed*
 DECLARED VALUE 150,000
 TAX @ 1% 150
 TAX PAID 150
Shirley Rockefeller
 Recorder of Deeds of Bradford County

Gift Deed

Page No. 4180

Made the 17th day of November 89 NOV 17 PM 12:16 in the year of one thousand nine hundred and eighty-nine (1989) SHIRLEY ROCKEFELLER RECORDER

Between TIMOTHY B. FRANKLIN and SRISUPARB FRANKLIN, his wife, of North Towanda Township, Bradford County, Pennsylvania, parties of the first part, Grantors,

AND

E. I. duPont deNemours & Company, a Delaware corporation of Wilmington, Delaware, party of the second part, Grantee,

COMMONWEALTH OF PENNSYLVANIA
 DEPARTMENT OF REVENUE
 REALTY TRANSFER NOV 17 '89
 750.00
 88.11354

~~Cite~~ That the said parties of the first part, for and in consideration of the sum of Seventy-Five Thousand (\$75,000.00) Dollars unto them well and truly paid by the said party of the second part, at or before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged have granted, bargained, sold, aliened, enfeoffed, released, conveyed and confirmed, and by these presents do grant, bargain, sell, alien, enfeoff, release, convey and confirm, unto the said party of the second part, its successors and assigns, forever:

All that certain lot, piece or parcel of land situate in the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows, to wit:

BEGINNING at a point in the center line of Race Street, thence along lands of Frederick and Dorothy Gardner, through a pin, North 5 degrees 12 minutes and 0 seconds East, 132.70 feet to a pin, thence South 86 degrees 38 minutes and 45 seconds East, 39.30 feet to a pin, thence along lands of Richard Dieffenbach, South 2 degrees 25 minutes 35 seconds West, 33.60 feet to a pin, thence North 79 degrees 26 minutes and 41 seconds East, 120.75 feet to a pin, thence South, along lands of Dorothy Isbell and Burton Pierce, 9 degrees 4 minutes and 25 seconds East, 196.50 feet, through a pin, to a point in the center line of Race Street, thence, along the center line of Race Street, North 69 degrees, 14 minutes and 25 seconds West, 213.40 feet to the point of beginning.

CONTAINING 26,725 square feet (or 0.614 acres). This description is in accordance with a survey of Anthony Aloysi, P.E., dated April 14, 1980.

BEING the same premises granted and conveyed unto the within Grantors by Deed of LILA V. GARDNER, by her attorney-in-fact, JOAN G. COOLEY, dated April 30, 1980, and recorded in the Register and Recorder's Office of Bradford County in Book 668, Page 992.

P4180

The above-described property is also more particularly bounded and described in accordance with the certain survey of Mark O. Shaylor, R.S., Survey No. 4689, dated August 30, 1989, and which is based upon true north as follows:

Beginning at a point in the centerline of Race Street; said point being at the southeast corner of lands of Lila V. Gardner and at the southwest corner of the parcel herein described.

Thence N 5°35'46"W, along the lands of Lila V. Gardner, a distance of 25.98 feet to a pin.

Thence continuing at N 5°35'46"W, along the lands of Gardner, a distance of 106.72 feet to a pin.

Thence N 82°33'29"E, continuing along the lands of Gardner, a distance of 39.30 feet to a pin.

Thence S 8°22'11"E, along the lands of Richard Dieffenbach, a distance of 33.60 feet to a pin.

Thence N 68°38'55"E, continuing along the lands of Dieffenbach, a distance of 120.75 feet to a pin.

Thence S 19°52'11"E, along the lands of Dorothy Isbell, and Burton Pierce, a distance of 170.43 feet to a pin.

Thence continuing at S 19°52'11"E, along the lands of Isbell and Pierce, a distance of 26.07 feet to a point in the centerline of Race Street.

Thence N 80°02'07"W, along the centerline of Race Street, a distance of 213.40 feet to the place of beginning.

Said tract, parcel or lot of land containing 26,724.90 square feet of land or 0.614 acres to be the same, more or less.

N. Towanda Sherwood
 REALTY TRANSFER TAX *715.000*
 DECLARED VALUE 715,000
 TAX @ 1% 7150
 TAX PAID 7150
Shirley Rockefeller
 Recorder of Deeds of Bradford County

P 4191

Gift Indenture

Made the 28th day of March, in the year of
one thousand nine hundred and ninety (1990)

Between DAVID LEE HOUCK and BRENDA W. WEBSTER HOUCK, his wife,
of North Towanda Township, Bradford County, Pennsylvania, parties
of the first part, Grantors,

A N D

E. I. duPont deNemours & Company, a Delaware Corporation of
Wilmington, Delaware, party of the second part, Grantee

RECORDED
BRADFORD COUNTY

90 MAR 28 PM 1:58

SHIRLEY ROCKEFELLED
REGISTRAR

Witnesseth, That the said parties of the first part for and in
consideration of the sum of Fifty Thousand (\$50,000.00)

unto them well and truly paid by the said party of the second part, at or
before the sealing and delivery of these presents, the receipt whereof is hereby
acknowledged have granted, bargained, sold, aliened, enfeoffed, released,
conveyed and confirmed, and by these presents do grant, bargain, sell, alien,
enfeoff, release, convey and confirm, unto the said party of the second part, its
successors and assigns, forever:

All those certain lots, pieces or parcels of land situate, lying
and being in North Towanda Township, Bradford County, Pennsylvania,
bounded and described as follows:

LOT NO. 1: BEGINNING at a point in the center line of Legislative
Route #08191, said point being the most northwesterly corner of
lands hereby described, said point also being at the northeasterly
corner of lands now or late of Clifford and Geraldine Darrow;
thence from said point of beginning, South 76 degrees 28 minutes
East 425.0 feet along the center line of Legislative Route #08191
to a point in the center line of Legislative Route #08191; thence
South 45 degrees 38 minutes West 64.1 feet to a point; thence
the following courses and distances along lands now or late of Karl
and Frances Williams: South 40 degrees 59 minutes West 29 feet;
South 31 degrees 49 minutes West 31.2 feet; South 26 degrees 12
minutes West 73.7 feet to a found maple tree, hacked; South 76
degrees 07 minutes East 66 feet to a found iron pin; South 17
degrees 35 minutes West 148.5 feet to a found iron pin and South 57
degrees 31 minutes East 43.6 feet to a found iron pin in line of
lands now or late of Gregory and Lorraine Kissell; thence South 32
degrees 29 minutes West 69.8 feet along line of lands of said
Kissell to a found iron pin, said found iron pin being at the
southwesterly corner of lands of said Kissell and at the north-
westerly corner of lands now or late of Melvin and Thelma Shultz;
thence South 32 degrees 29 minutes West 260.2 feet along line of
lands of said Shultz to a found iron pin at the northeasterly
corner of lands now or late of Bob Travis; thence North 62 degrees
00 minutes West 487.7 feet along line of lands of said Travis to
an iron pin; thence North 10 degrees 00 minutes East 266.4 feet to
an iron pin, said iron pin being at the southwesterly corner of
lands now or late of Clifford and Geraldine Darrow; thence South 77
degrees 03 minutes East 163.0 feet along the southerly line of
lands of said Darrow to a point, said point being at the south-
easterly corner of lands of said Darrow; thence North 10 degrees
00 minutes East 267.5 feet along the easterly line of lands of said

Darrow, through an iron pin at or near the southerly right-of-way line of Legislative Route #08191 to a point in the center line of Legislative Route #08191, the point of beginning. Containing 6.5 acres

LOT NO. 2: BEGINNING at a point in the center line of Legislative Route #08191, said point being South 76 degrees 28 minutes East 425.9 feet along the center line of Legislative Route #08191 from the common intersecting point of the center line of Legislative Route #08191 and the northeasterly corner of lands now or late of Clifford and Geraldine Darrow; thence from said point of beginning, South 83 degrees 04 minutes East 181.3 feet to a point at or near the northerly right-of-way line of Legislative Route #08191; thence South 88 degrees 08 minutes West 123.1 feet to an iron pin; thence South 75 degrees 57 minutes West 251.1 feet to a point and thence North 45 degrees 38 minutes East 45.8 feet to the center of Legislative Route #08191, the point of beginning.

The foregoing descriptions are according to a survey by Leonard T. Carver dated September 12, 1985, and revised October 14, 1985, Map #1121-110.

BEING the same premises granted and conveyed unto the within Grantors by deed of Harry S. Mitchell and Florence P. Mitchell, his wife, dated November 1, 1985, and recorded in the Register and Recorder's Office of Bradford County in Record Book 15, Page 691.

The above described two (2) parcels of land are more particularly bounded and described in accordance with that certain survey of Mark O. Shaylor, R.S. Survey No. 6489 dated December 29, 1989, and which is based upon true north as follows:

BEGINNING at a pin at the southeast corner of the parcel herein described, said pin being a common property corner with the lands of E. I. duPont deNemours & Company. Thence N 67° 23' 30" W, with a fence line along the lands of duPont, a distance of 173.47 feet to a pin located in the centerline of an old roadbed. Thence N 81° 59' 30" W, along the lands of Robert Travis, a distance of 317.62 feet to a pin found. Thence N 4° 25' W, with a hedgerow along the lands of Fred Isbell, a distance of 248.11 feet to a pin set. Thence N 88° 22' 59" E, along other lands of Fred Isbell, a distance of 163.0 feet to a pin set. Thence N 4° 25' W, continuing along the lands of Fred Isbell, a distance of 250.44 feet to a found pin. Thence continuing at N 4° 25' W, along the lands of Fred Isbell, a distance of 17.06 feet to a point in the centerline of S.R. 3022. Thence N 88° 22' 59" E, with the centerline of S.R. 3022, a distance of 412.10 feet to a point. Thence on a curve to the right with a radius of 355.86 feet, an arc distance of 160.75 feet to a point, the arc subtends on a chord of S 82° 43' 50" E, a distance of 159.39 feet. Thence along the southerly and then the easterly side of an old mill road and along the lands of Karl J. and Frances M. Williams, the following 7 courses: (1) S 75° 34' 09" W, a distance of 50.0 feet to a pin; (2) S 75° 34' 09" W, a distance of 72.95 feet to a large maple; (3) S 63° 22' 41" W, a distance of 25.09 feet to a point; (4) S 33° 03' 51" W, a distance of 18.28 feet to a point; (5) S 28° 25' 12" W, a distance of 29.11 feet to a point; (6) S 19° 14' 31" W, a distance of 31.18 feet to a point; (7) S 13° 37' 29" W, a distance of 73.65 feet to a large maple. Thence S 88° 40' 35" E, continuing along the lands of said Williams a distance of 66.0 feet to a pin. Thence S 5° 01' 11" W, continuing along the lands of said Williams, a distance of 148.50 feet to a pin. Thence S 70° 04' 52" E, continuing along the lands of said Williams, a distance of 43.58 feet to a pin. Thence S 19° 55' 08" W, along the lands of Elizabeth L. Drislane, a distance of 69.80 feet to a 3" pipe. Thence S 20° 39' 54" W, along the lands of Melvin B. and Thelma M. Shultz, a distance of 264.38 feet to a pin at the place of beginning. Containing 6.67 acres.

H	19643
03-28-90 14:00SHIRLEY OI	3856
REC OF DEEDS	\$13.50
STATE .50	\$0.50
TOWANDA AREA	\$250.00
N TOWANDA	\$250.00
CASH	\$514.00

BOOK 148 PAGE 328

This Deed

RECORDED
BRADFORD COUNTY
JUN 13 1990

Made the 11th day of June 1990 in the year of our Lord one thousand nine hundred and ninety (1990)

SHIRLEY ROCKEFELLER
June RECORDER

Between ELIZABETH L. DRISLANE, single, of R. D. 1, Towanda, Pennsylvania 18848 ----- GRANTOR

- A N D -

E. I. duPont deNemours & Company, a Delaware corporation of Wilmington, Delaware ----- GRANTEE

Witnesseth, that in consideration of Forty-two Thousand and no/100 ----- Dollars, (\$42,000.00) ----- in hand paid, the receipt whereof is hereby acknowledged; the Grantor do es hereby grant and convey to the said Grantee, its Successors ~~Heirs~~ and Assigns,

All that certain lot, piece or parcel of land lying and being situate in the TOWNSHIP of NORTH TOWANDA, County of Bradford and Commonwealth of Pennsylvania, bounded and described as follows:

BEGINNING in the center of the public highway leading from Towanda to Ulster at the Southeast corner of a lot formerly owned by Fancis Ward, now Melvin Shultz; thence southwardly along the center of said highway five perches to a corner; thence westwardly on a right angle about twenty-two perches to the east line of lands formerly owned by Harriet Hinds, now Karl J. Williams; thence northwardly by said lot formerly owned by Francis Ward, now Melvin Shultz about ten and four-fifths perches to a corner; thence eastwardly by lands formerly of Francis Ward, now Melvin Shultz, seventeen and three-tenths perches to the place of beginning. CONTAINING one acre be the same more or less.

BEING the same premises as conveyed by Mabel K. Herman, single, to Elizabeth L. Drislane, by Deed dated July 15, 1981, recorded August 3, 1981 in Bradford County Deed book 677 at Page 35.

The above-described parcel of land is more particularly bounded and described in accordance with that certain survey of Mark O. Shaylor, Registered Surveyor, Survey No. 2090, dated April 20, 1990, and which is based upon true north as follows:

BEGINNING at a point in the center line of S. R. 0006, said point being at the southeast corner of lands of Frances M. Williams; thence with the center line of S.R. 0006 on a curve to the right, with a radius of 2,228.87 feet an arc distance of 89.21 feet to a point (chord bearing South 21° 41' 52" East, a distance of 89.20 feet.); thence South 81° 05' 47" West, along the lands of Melvin B. and Thelma M. Shultz, a distance of 26.29 feet to a pin found; thence continuing at South 81° 05' 47" West, along the lands of Shultz, a distance of 336.97 feet to a 3 inch pipe found; thence North 19° 55' 08" East, along the lands of E. I. Du Pont De Nemours and Company, a distance of 69.80 feet to a pin; thence continuing at North 19° 55' 08" East, along the lands of Frances M. Williams a distance of 105.62 feet to a pipe;

thence South 84° 27' 26" East, continuing along the lands of Williams, a distance of 238.13 feet to a pin set; thence continuing at South 84° 27' 26" East, along the lands of Williams, a distance of 29.26 feet to the place of beginning.

SAID LOT OR TRACT OF LAND CONTAINING 38,518.04 square feet or 0.884 acres of land to be the same, more or less.

#	21700
06-11-90 14:23EILEEN 001	7580
REC OF DEEDS	\$13.00
STATE .50	\$0.50
TOWANDA AREA	\$210.00
N TOWANDA	\$210.00
CASH	\$433.50

#	21700
06-11-90 14:23EILEEN 001	7581
STATE R.T.T.	\$420.00
CHK	\$420.00
PAY TO THE ORDER OF	
DEPARTMENT OF REVENUE	
BUR OF IND. TAXES	
TOWANDA, PA/BRADFORD	
CHK	\$420.00
06-11-90 14:23EILEEN 001	7581

P 30014

Gift Indenture

Made the 15th day of November, in the year of one thousand nine hundred and ninety-one (1991)

Between BURTON J. PIERCE and EULETA M. PIERCE, his wife, of the Township of North Towanda, County of Bradford and Commonwealth of Pennsylvania, parties of the first part, Grantors

A N D

E. I. duPONT deNEMOURS & COMPANY, a Delaware corporation, of Wilmington, Delaware, party of the second part, Grantee

Witnesseth, That the said parties of the first part, for and in consideration of the sum of Forty Thousand Dollars (\$40,000.00)

unto them well and truly paid by the said party of the second part, at or before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged have granted, bargained, sold, aliened, enfeoffed, released, conveyed and confirmed, and by these presents do grant, bargain, sell, alien, enfeoff, release, convey and confirm, unto the said party of the second part, its successors and assigns, forever:

All that certain piece, parcel or tract of land or lot, lying and being in the Township of North Towanda, County of Bradford and State of Pennsylvania, same being bounded and described as follows:

Beginning at a stake two (2) feet North of Lane's Corner; thence by Lane's land South twelve and one-half (12½) degrees West one hundred twenty-seven and one-half (127½) feet to the center of Race Street; thence along the center of said Race Street North seventy-two and one-half (72½) degrees West eighty-five (85) feet; thence by line of land now or formerly of John F. Ruddy North twelve (12) degrees, twenty (20) minutes West eighty-two (82) feet to a corner; thence East by lands now or formerly of G. C. Hollon one hundred twenty-eight and one-half (128½) feet to the place of beginning and supposed to contain about one-quarter (¼) of an acre of land being the same more or less.

BEING the same premises granted and conveyed unto the within Grantors by deed of J. Allen Horton, et ux, et al, dated August 6, 1954, and recorded in the Register and Recorder's Office of Bradford County in Deed Book 499, Page 504.

The above-described property is more particularly bounded and described in accordance with that certain survey of George K. Jones & Associates Surveyors, Survey No. 11077, dated September 1991, and which is based upon true North as follows:

BEGINNING at a point in the centerline of Race Street, said point being the Southeast corner of lands described and also being 245.49 feet from the centerline of Route 6 along Race Street; thence along centerline of said Race Street; North 78 degrees 58 minutes 03 seconds West 85 feet to a point in the Southwest corner of lands being described, thence through a found pin and along other lands of E. I. duPont deNemours & Company; North 19 degrees 52 minutes 11 seconds West 82 feet to a pin in the Northwest corner of lands

P50014

BOOK 194 PAGE 300

described, thence along lands of Curtis Thrush, North 73 degrees 55 minutes 36 seconds East 131.72 feet to a pin in the Northeast corner of lands herein described and being in the South line of Curtis Thrush and the Northwest corner of other lands owned by Ambrose Beeman Jr., thence along Ambrose Beeman Jr., South 6 degrees 42 minutes 26 seconds West 130.75 feet to the point and place of beginning. Containing 10,929.62 square feet.

0.257 ACRE

#	35975
11-15-91 13:54	MARY H. 01 32462
REC OF DEEDS	\$13.00
STATE .50	\$0.50
TOWANDA AREA	\$200.00
N TOWANDA	\$200.00
CASH	\$413.50
#	35975
11-15-91 13:55	MARY H. 01 32463
STATE R.T.T.	\$400.00
CHK	\$400.00
PAY TO THE ORDER OF	
DEPARTMENT OF REVENUE	
BUR OF IND. TAXES	
TOWANDA, PA/BRADFORD	
CHK	\$400.00
11-15-91 13:55	MARY H. 01 32463

RECORDED
BRADFORD COUNTY
91 NOV 15 PM 1:41
MARLEY ROCKEFELLER
RECORDER

EXHIBIT B
MAPS OF THE PROPERTY

COORDINATES OF DUPONT GRID MONUMENTS	
NORTH/SOUTH	EAST/WEST
2364.0198 /	2671.7322 /
3656.5245	2977.4616
3977.3379	3424.2848
3611.8214	3586.6877
3145.1837	3036.8886
4302.2415	3198.8852
4670.7235 /	2256.7111 /
4861.5643	2255.6979

04	PROPERTY ACQUISITION (NORTH)
03	PROPERTY ACQUISITION (SOUTH)
01	PROPERTY SURVEY (SOUTH)
SH.	TITLE

TOWANDA SITE-6920
IMAGING SYSTEMS-680
PLOT PLAN
PROPERTY SURVEY
NORTH SECTION

EXHIBIT B-2

DUPONT TOWANDA PLANT
NORTH SECTION

CAD DWG.: DO NOT MODIFY MANUALLY

REVISED BY DATE	REFERENCE DRAWINGS	PROJECT	SCALE	DATE
	SHAYLOR #2898 TP-2731-18-2	PROJECT	1"=100'	05-02-98
	SHAYLOR #6489	DRAWN	NANCINI	
	SHAYLOR #2889	CHECKED		
	SHAYLOR #4888	APPROVAL - INITIAL		
	SHAYLOR #4689			
<p>THIS DRAWING HAS BEEN FURNISHED BY E.I. DUPONT DE MEMPHIS & CO. THE INFORMATION AND KNOW-HOW THEREON MAY NOT BE USED FOR THE DRAWING REPRODUCED WITHOUT THE WRITTEN PERMISSION OF DU PONT. ALL REPRODUCTIONS IN WHOLE OR IN PART, INCLUDING VENDOR'S SHOP DRAWINGS, SHALL BEAR OR REFER TO THIS STAMP.</p>		<p>E.I. du Pont de Nemours & Company Plant Engineering Section TP01148602</p>		
<p>2</p>		<p>PLANT ENGINEERING SECTION</p>		
		<p>TP01148602 </p>		

Appendix D

Quality Assurance Project Plan



DuPont Corporate Remediation Group
Chestnut Run Plaza 730
974 Centre Road
P.O. Box 2915
Wilmington, DE 19805

February 3, 2016

Kevin Bilash, Environmental Engineer
Mail Code: 3WC22
U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

**2016 Final Remedy Groundwater Monitoring Quality Assurance Project Plan
DuPont Towanda Plant
Towanda, Pennsylvania
Permit No. PAD 00 303 8056**

Dear Mr. Bilash:

Attached is the revised Quality Assurance Project Plan (QAPP) for the Final Remedy Groundwater Monitoring at the DuPont Towanda site in Towanda, Pennsylvania, for your review.

As detailed in this QAPP, groundwater monitoring will now occur once every five quarters instead of the previous semi-annual sampling event. This schedule change was approved by the EPA in a letter dated October 2015. The first sampling event under this new QAPP, upon EPA approval, will be in the first quarter of 2017.

DuPont will continue to monitor the groundwater at the facility to demonstrate that the natural attenuation process is continuing and submit annual reports documenting current groundwater quality at the site until the groundwater cleanup standards are achieved in accordance with the corrective action permit, dated December 22, 2008.

If you have any questions, please contact me at 302-999-3866 or Gregg Donahue (AECOM) at 302-781-5897.

Sincerely,

A handwritten signature in black ink, appearing to read "Jacob Larsen".

Jacob Larsen

cc: A.J. Brandt, DuPont Towanda (letter only)
G. Donahue, AECOM (letter only)



Environment

Submitted on behalf of
E.I. du Pont de Nemours and
Company

Submitted by
AECOM
Sabre Building
Suite 300
4051 Ogletown Road
Newark, DE 19713

Quality Assurance Project Plan

Final Remedy Groundwater Monitoring
DuPont Towanda Facility
Towanda, Pennsylvania

Project #: 60394400
February 2016

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Title and Approval Page

Site Name: DuPont Towanda Facility
 Site Location: Towanda, Pennsylvania
 Document Title: Quality Assurance Project Plan for Final Remedy Groundwater Monitoring
 Revision: 0
 Lead Organization: DuPont Corporate Remediation Group (CRG)
 Preparer: AECOM
 Date of Preparation: January 22, 2016

Approvals:

 Job Larsen, DuPont Project Director	Date
Gregg Donahue, Project Manager	Date
Candia Carle, AECOM Project Quality Assurance Manager	Date
Kevin Bilash, EPA Region 3 Site Manager	Date
Nancy Bornholm, Project Manager, Eurofins-Lancaster Laboratories	Date
Kathleen Loewen, QA Officer, Eurofins-Lancaster Laboratories	Date

QAPP Document Distribution

1. Jacob Larsen – DuPont CRG
2. Gregg Donahue – AECOM
3. Candia Carle – AECOM
4. Kevin Bilash – EPA Region 3
5. Nancy Bornholm – Eurofins Lancaster Laboratories
6. Kathleen Loewen – Eurofins Lancaster Laboratories

List of Acronyms and Abbreviations

Acronym	Explanation
ADQM	Analytical Data Quality Management
CFR	Code of Federal Regulations
C-O-C	Chain of Custody
CRG	DuPont Corporate Remediation Group
DDR	DuPont Data Review
DQO	Data Quality Objective
DUP	Duplicate
DUS	Data Usability Summary
EB	Equipment Blank
EDD	Electronic Data Deliverable
EIM	Environmental Information Manager
EPA	U.S. Environmental Protection Agency
GC/MS	Gas Chromatograph/ Mass Spectrometer
HASP	Health and Safety Plan
HCl	HydroChloric Acid
HSWA	Hazardous and Solid Waste Amendments
ID	Identification
ISO	International Organization for Standardization
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
MNA	Monitored Natural Attenuation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ND	Non-Detect
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NTU	Nephelometric Turbidity Unit
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery
RCRA	RCRA Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative percent difference
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
TB	Trip Blank
VOA	Volatile Organic Analyte
VOC	Volatile Organic Compound

1.0 Project Management

This Quality Assurance Project Plan (QAPP) is written to present policies, project organization, functional activities, and Quality Assurance/Quality Control (QA/QC) measures intended to achieve the project data quality objectives for sampling activities associated with the Final Remedy groundwater monitoring at the E.I. du Pont de Nemours and Company (DuPont) Towanda Facility, located in Towanda, Pennsylvania (the site; see Figure 1). This QAPP is intended to meet the requirements for conducting the work in accordance with generally accepted QA/QC field and laboratory procedural protocols for collecting environmental measurement data.

This QAPP has been prepared in general accordance with the following guidance documents:

- U.S. Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA/240/B-1/003, March 2001)
- EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/240/R-02/009, December 2002)

1.1 Project Organization

The DuPont Corporate Remediation Group (CRG) in Wilmington, Delaware, will be the lead organization for managing this project. AECOM will conduct the Final Remedy groundwater monitoring at the facility. Laboratory analytical testing of groundwater samples will be conducted at Eurofins Lancaster Laboratories, located in Lancaster, Pennsylvania. The contract laboratories will be accredited as required by EPA Region 3 and the Commonwealth of Pennsylvania, as appropriate. Eurofins Lancaster Laboratories is accredited by the National Environmental Laboratory Accreditation Conference (NELAC).

A description of the program organization and the responsibilities associated with the positions are described in the paragraphs below. The persons described will be charged with ensuring the collection of usable data and assessing measurement systems for precision and accuracy.

An organizational chart for the project is shown in Figure 2. Contact information for key project personnel is provided in Appendix A. Responsibilities for project team members are summarized below.

The **DuPont CRG Project Director**, Jacob Larsen, is responsible for the execution of the overall project, including correspondence with and coordinating activities with EPA Region 3.

The **AECOM Project Manager**, Gregg Donahue, will manage personnel involved in the project and will be responsible for cost and schedule tracking. The Project Manager will also provide technical guidance to the project team and manage the preparation of all project deliverables. The Project Manager is the focal point for all on-site project communication and problem resolution. Issues related to field sampling and on-site activities are relayed to the Project Manager via the Field Team Leader. Issues concerning the laboratory analysis of project samples or data quality are transmitted to the Project Manager by the Project Quality Assurance Manager. It is the responsibility of the Project Manager to keep the Project Director informed of any issues involving scope, budget, or significant technical concerns. The Project Manager also immediately advises

the Health and Safety Officer of any concerns, occurrences, or issues involving personnel safety and welfare.

The **Laboratory Project Manager**, Nancy Bornholm of Eurofins Lancaster, will oversee performance of all analytical tests conducted as part of the project. The Laboratory Project Manager is responsible for providing the Project Quality Assurance Manager a confirmation of sample receipt within one working day of sample receipt and for notifying the Project Quality Assurance Manager of any sample integrity issues [holding time exceedance, chain-of-custody (C-O-C) discrepancies, etc.] promptly when discovered. The Laboratory Project Manager is also responsible for submitting the final data package, including hardcopy deliverable and electronic data deliverable (EDD), within the requested turnaround time.

The **Project Quality Assurance Manager**, Candia Carle, will place orders for sample coolers and containers, track sample receipt and data package deliverables for the project, verify completeness of the data packages (hardcopy and EDD), verify that the hardcopy and EDD match, maintain the project database, and maintain copies of the analytical reports. The Project Quality Assurance (QA) Manager will notify the AECOM Project Manager of sample integrity issues and data package deliverable issues. All members of the project team will be copied on any such notifications. The Project QA Manager will notify the Laboratory Project Manager of sample receipt issues, data turnaround issues, and data package discrepancies or omissions. The Project QA Manager will evaluate if sampling procedures, laboratory analyses, and project documentation conducted as part of the project are in accordance with this QAPP. The Project Quality Assurance Manager will be responsible for having the EDD loaded into the DuPont analytical database and evaluating the laboratory data using the DuPont Data Review (DDR) software. Based on the DDR findings and review of the hardcopy data report, the Project QA Manager will prepare a data usability summary (DUS). The Project Quality Assurance Manager will submit original copies of all hardcopy laboratory deliverables to the AECOM Project Manager following data review.

Technical Support Personnel will perform sample collection in accordance with this QAPP. Technical support personnel will be responsible for organizing and coordinating sampling activities and will update the AECOM Project Manager on project progress. Staff personnel will coordinate ordering the appropriate number of sample containers and coolers from the analytical laboratory with the Project Quality Assurance Manager. After samples are collected, the staff personnel are responsible for providing the Project QA Manager with a copy of the C-O-C form within one working day of sample delivery to the analytical laboratory. At the end of each sampling event, the staff personnel will deliver copies of all logbook pages and sample collection forms completed during that event to the AECOM Project Manager.

The **Health and Safety Officer**, Kathy Sova, AECOM, is the health and safety officer for the project. She will be responsible for developing, reviewing, and approving of the project health and safety plan (HASP). She will ensure that the project HASP is consistent with applicable state and federal regulations and will also be responsible for implementing the HASP.

1.2 Project Background

The DuPont Towanda facility is located on Patterson Boulevard and James Street in North Towanda Township, Bradford County, Pennsylvania (see Figure 1). The facility has been in operation since the early 1940s and consists of office, manufacturing, and maintenance buildings.

X-ray screen manufacturing operations began in the early 1940s, and the manufacture of coated films and wet-processing solutions began in the 1960s. Television phosphors (black and white) were manufactured at the site from 1954 to 1958. Photosensitive polymer coatings were also produced at the site from 1967 to 1974. The plant continued expanding manufacturing, adding an additional extrusion coating line in the early 1980s and converting to flammable solvent coating lines in the 1990s. The main product mix continued to serve the printed circuit and flexible circuit board manufacturers and the proofing and imaging businesses. In recent years, the site has continued to serve these businesses with next generation offerings while expanding into newer technology such as fuel cells components. A new multifunctional coating facility was completed in 2007 and is producing coated materials for the flat panel display and photovoltaic solar panel markets.

In July 1990, the EPA issued a Resource Conservation and Recovery Act (RCRA) permit to DuPont for corrective action and waste minimization. Under this permit, four investigations of solid waste management units (SWMUs) were conducted. These investigations consisted of a verification investigation, a supplemental verification investigation, a RCRA facility investigation (RFI), and a supplemental RFI. A Corrective Measures Study was submitted in July 1997. The proposed final corrective measure for the site is intrinsic bioremediation (monitored natural attenuation).

In a letter dated December 29, 2008, the EPA issued to DuPont a Permit Modification and Final Decision for Corrective Action and Waste Minimization under the Hazardous and Solid Waste amendments of 1984. The Towanda Final Remedy is monitored natural attenuation (MNA) with institutional controls. Additional discussion of the site setting, topography, geological/hydrogeological and past investigations are presented in the *2014 Final Remedy Status Report* (AECOM, 2015).

The EPA approved a modification request for the reduction in groundwater sampling frequency at the Towanda facility in a letter dated October 15, 2015. Sampling frequency was reduced from semi-annual sampling to once per five quarters because nine of the wells sampled do not have increasing trends and minimal information can be obtained by continuing the semi-annual sampling. Upon EPA approval of this QAPP, the next sampling event will occur in the first quarter of 2017.

1.3 Project Description

Groundwater is collected from the sampling locations provided in Table 1 to monitor groundwater quality at the site. These data are evaluated to determine the effectiveness of the Final Remedy. The objectives of the final remedy are as follows:

- Implement and maintain institutional controls at the facility per the Hazardous and Solid Waste Amendments (HSWA) Permit.
- Conduct MNA until groundwater cleanup standards are achieved and maintained for three years or until EPA determines that an alternative remedy is necessary to achieve this at the site.

Additional information on the project is presented in the *2014 Final Remedy Status Report* (AECOM, 2015).

1.4 Quality Objectives and Criteria

The purpose of this QAPP is to provide the requirements for collecting and analyzing groundwater samples to provide data to support the site Final Remedy and the modified sampling schedule. The well locations included in this program are identified in Table 1.

Table 2 lists the specific target compounds and associated reporting limits used for this program. The data quality objectives (DQOs) ensure that the data for these compounds will be collected or developed in accordance with procedures appropriate for its intended use and that the data will be of known and documented quality that will withstand legal and scientific scrutiny.

DQOs for this project were developed in accordance with the guidance in EPA document *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (QAMS-005/80). The DQOs comply with the guidance in EPA document *Data Quality Objectives for Hazardous Waste Site Investigations* (EPA QA/G-4HW, January 2000). When data are collected during site monitoring, the EPA recommended systematic planning tool is the DQO process. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making:

1. State the problem.
2. Identify the decision.
3. Identify inputs to the decision.
4. Define the boundaries of the study.
5. Develop a decision rule.
6. Specify tolerable limits on decision errors.
7. Optimize the design for obtaining data.

The steps applicable to the collection of environmental data to support characterization of the site are discussed below.

1.4.1 Step 1: State the Problem

The most important activities in this step are as follows:

- Establish the planning team.
- Describe the problem.
- Identify available resources.

Establish the Project Team

The planning team is composed of project management and technical staff. Project management includes the DuPont Project Director who is responsible for coordinating efforts to meet EPA requirements. The Project Director is familiar with the problem and the budgetary/time constraints involved with site characterization activities. The primary decision-maker is the DuPont Project Director. The technical staff is knowledgeable about technical issues such as representative sampling, analytical, and QA/QC procedures. The technical staff includes the field sampling crew with groundwater

sampling experience, a chemist with environmental laboratory and QA/QC expertise, and a project manager with experience in remedial action. Figure 2 presents the organization of the project team, and Section 1.1 (Project Organization) discusses specific duties of the key project team members.

Describe the Problem

Groundwater sampling is required at the site to collect and evaluate the impact of target volatile organic compounds (VOCs) on groundwater as part of the Final Remedy (MNA).

Identify Available Resources

The available resources to implement this QAPP include project management, technical staff, and the environmental laboratory contractor.

1.4.2 Step 2: Identify the Decision

The essential components of this step are as follows:

- Identify the principal study questions.
- Define alternative actions.
- Develop a decision statement.

Identify the Principal Study Question

The principal study question for this project is:

- Have the concentrations of target VOCs in the groundwater continued to decrease over time?

Define Alternative Actions

The alternative actions that could result from the resolution of the principal study question are to collect groundwater samples and continue monitoring the progress of VOCs degradation in the groundwater at the site as part of the Final Remedy.

Develop a Decision Statement

The principal study question and the alternative action comprise the decision statement for the project:

- Determine if target VOCs in the groundwater continue to decrease in concentration over time.

1.4.3 Step 3: Identify Inputs to the Decision

In Step 3 of the DQO process, the information needed to resolve the decision statement is identified, including decision values and analytical methodology. The following components of this step are addressed:

- Identify the information needed.
- Determine the sources of the information.
- Identify sampling and analysis methods.

Identify the Information Needed

Analytical results for the VOCs in groundwater for the target compounds identified in Table 2 are needed to resolve the principal study questions. Specifically:

- Are the concentrations of target VOCs in the groundwater at the site continuing to decrease in concentration?

Determine the Sources of the Information

The analytical results will be obtained from the most current versions of analytical methods contained in the following sources:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846); Method 8260B: Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*

Identify Sampling and Analysis Methods that can meet the Data Requirements

Field sampling data will be recorded on the Field Book Collection Form included in Appendix B. Details on sample ID completion are included in Appendix C. An example of typical standard operating procedures (SOPs) for low-flow groundwater sampling and the collection of field data measurements are included in Appendices D and E. Actual SOPs for field analysis will vary depending on the specific brand of water quality meter used. The field team will follow the manufacturers recommended SOP for calibration and meter operation for the type of water quality meter used during each sampling event. A description of the quality control characteristics for the field and laboratory analytical methods is included in Table 3. SW-846 Method 8260B will be used for the analysis.

1.4.4 Step 4: Define the Boundaries of the Study

The data for site monitoring should be collected from a well-defined target population using methods that minimize biases in sampling and produce representative samples. Defining the boundaries of the study defines the requirements to obtain representative samples. The elements of Step 4 include the following:

- Define the target population
- Specify the spatial boundaries.
- Specify the temporal boundaries.
- Determine the practical constraints on collecting the data.
- Determine the smallest sub-population, area, volume, or time for which separate decisions must be made.

Define the Target Population

The target populations for the study are concentrations of target VOCs in groundwater at the site. Target VOCs for the program are listed in Table 2.

Specify the Spatial Boundaries

Groundwater samples will be collect from the monitoring wells identified in Table 1. Figure 1 shows a map layout of the site.

Specify the Temporal Boundaries

Sampling will be conducted every 5th quarter. The first sampling event that follows this 5th quarter monitoring frequency will be in the first quarter of 2017. Sampling will end when EPA has determined there is no further need to sample.

Determine the Practical Constraints on Collecting the Data

A potential constraint on collecting samples from monitoring wells is the volume of available groundwater for sample collection due to low static groundwater elevations in proximity to the monitoring well. Should a scheduled sample not be available due to low water level, the field notes must document this circumstance.

Determine the Smallest Sub-Population

The smallest sub-population that will be used for evaluation of VOCs will be the 120 mL needed to fill the three volatile organic analyte (VOA) vials, which represents the quality and nature of the sample at the time of the sampling event.

1.4.5 Step 5: Develop a Decision Rule

In this step, the DQO process develops a decision rule based on previous components of the process and the elements listed below:

- Specify the statistical parameter that characterizes the population.
- Confirm that the action levels are above the measurement detection limits.
- Provide statement of the Decision Rule.

Specify the Statistical Parameter that Characterizes the Population

The maximum concentration of each analyte for each area or sampling location will be used to evaluate monitoring results.

Data collected during the sampling event will be evaluated against overall program objectives as well as any individual location or area-specific objectives of the Final Remedy.

Confirm that the Action Levels are above the Measurement Detection Levels

Table 2 lists the proposed reporting limits for this program.

Provide the Statement of the Decision Rule

The inputs from the previous four steps are integrated into a comparison of historical data. Analytical data for groundwater samples collected in a given sampling event will be compared to historical data to look for trends in the degradation of target chlorinated VOCs at the site.

1.4.6 Step 6: Specify Tolerable Limits on Decision Errors

In accordance with EPA guidance, Step 6 specifies quantitative performance goals for choosing between alternative actions in the Decision Rule developed in Step 5. Tolerable limits are the QC criteria that are specific to SW-846 Method 8260B.

1.4.7 Step 7: Optimize the Design for Obtaining the Data

Sample locations have been determined to the extent that there is no migration of contamination beyond the capture zone of pumping well SW-04 and that the site is sufficiently characterized. Groundwater monitoring will continue at the existing well locations (see Table 1).

1.4.8 Training/Certification

The project files shall contain the documentation of training specified in 29 Code of Federal Regulations (CFR) 1910.120(e) for all persons working on-site. The level of training required is dependent upon the person's on-site activities and potential for exposure to hazardous substances and/or other hazards encountered during the operations. Specialized training required by DuPont will also be documented and retained in the project files.

1.5 Documentation and Records

This section describes the process for maintaining document control of the QAPP, as well as field records and laboratory deliverables.

1.5.1 Document Control

The Project QA Officer and other signatories shall approve revisions to the QAPP. Whenever revisions are made or addenda added to the QAPP, a document control system shall be put into place to ensure 1) all parties holding a controlled copy of the QAPP receive the revisions or addenda, and 2) outdated material is removed from circulation. Project personnel holding controlled copies of the QAPP will provide certification that they have read, understood, and updated their copies of these documents. This certification will be maintained in the project files.

1.5.2 Field Logbook

The sampling team will maintain a detailed logbook. The signature of the author and the date of entry, the project name and number and the location will accompany all entries in this log. At the beginning of each sampling day, the designated team member will start the daily log by entering the date and time, the locations to be sampled, weather conditions, field team present, and any potential problems. Other information to be entered into the field logbook includes observations of field activities taking place, progress, and any problems, summary of equipment preparation procedures and a description of any equipment problems (including corrective action), reference to SOPs, and explanations of any deviations from the QAPP. Detailed records describing groundwater sample collection will be logged on the forms included in Appendix B or on equivalent forms. At the end of the field investigation, the field sampling team will deliver copies of all logbook pages and sample collection forms completed during the investigation to the Project Manager.

1.5.3 Sample Log

The Technical Support Personnel, or designated representative, will be responsible for keeping a sample log to record information regarding each sample. The sample log may be maintained in the field logbook. The required information will include, but is not limited to, the following:

- Project number
- Facility location
- Sample location description
- Sample ID
- Analyses requested

- Time, date, sampler name
- Equipment used to collect the sample

1.5.4 Laboratory Deliverables

The laboratory Project Manager will provide the data package described below to the Project QA Manager within the specified turnaround time. The laboratory is responsible for providing what is commonly referred to as a Level 2 data package. Each data package should contain the case narrative, C-O-C forms, and the reportable and supporting quality control (QC) data described below.

Completed Documentation

The data package should include copies of the completed field C-O-C forms and documentation, and should also include forms that the laboratory uses to document sample condition upon receipt.

Sample Identification Cross-Reference

Sample identification cross-reference information facilitates the correlation of field and laboratory sample IDs as well as the association of field samples with a particular laboratory batch. The data package should include a listing of field sample IDs cross-referenced to the associated laboratory sample IDs. The data package should include an easy and unambiguous means of associating a specific QC sample: for example, the laboratory duplicate, the matrix spike/matrix spike duplicate (MS/MSD) samples, and the laboratory control sample (LCS) with specific field samples.

Test Reports for Samples

Sample test reports provide specific information for each sample regarding analytical results and methods. The data package should include the test reports for all reported data. Analytical results (i.e., detected results and non-detected results) should be adjusted as necessary for dilution factor and/or sample size adjustments.

Surrogate Recovery Data

The data package will include the surrogate recovery data. The surrogate data can be included on the test report for each sample, or can be included on a summary form, provided that the surrogate results are clearly and unambiguously linked to the sample from which the results were measured. The surrogate data should include the percent recovery (%R) and the laboratory's QC limits.

Laboratory Blank Samples

The data package should include test reports or summary forms for all laboratory method blanks associated with the sample analyses. Blank sample test reports should contain all of the information (e.g., surrogate data) specified for environmental sample test reports/summary forms. Sample data will not be blank corrected.

Laboratory Control Samples

The data package should include the LCS test reports or LCS result summary forms. A LCS should be included in every preparation batch and taken through the entire analytical process. The LCS samples should contain the target compounds identified for the project applicable to EPA Method 8260B. The LCS test report, or LCS results summary form, should include the amount of each analyte added, the %R of the amount measured relative to the amount added, and QC limits for each compound in the LCS.

Matrix Spike Samples

The project MS/MSD samples should be spiked with the project-specified compounds. The project MS/MSD summary forms should include identification of the compounds in the spike solution, the amount of each compound added to the MS and the MSD, the parent sample concentration, the concentration measured in both the MS and MSD, the calculated %R and relative percent difference (RPD), and the QC limits for both %R and RPD. The form should also include the laboratory batch number and the laboratory identification number of the sample spiked.

Narrative

The laboratory should document and report all observed problems and/or anomalies observed by the laboratory that might have an impact on the quality of the data.

1.5.5 Report Preparation

Upon completion of field sampling, laboratory analysis, and data evaluation, a report will be prepared to document field activities, discuss data collected during the investigation, and compare the data to historical data to look for trends in the degradation of target VOCs at the site.

1.5.6 Electronic Data Deliverables

The Project Quality Assurance Manager will manage data for the project in the DuPont CRG Environmental Information Manager (EIM) database. The laboratory will submit EDDs in a format suitable for input into the DuPont CRG EIM database, as described in Appendix F.

1.5.7 Archival Requirements

Both hardcopy and electronic data must be archived by the laboratory for a minimum of ten years and made available by the laboratory upon request by the EPA or DuPont. Field records must be archived by CRG for a minimum of ten years from the date of report submittal and made available upon request by the EPA.

Samples are held at the laboratory for a limited time following laboratory report generation (e.g., 30 days) in accordance with the individual laboratory's SOP and practical space constraints. Groundwater samples for VOCs fall outside of holding time 14 days after collection.

2.0 Data Generation and Acquisition

The elements in this group address aspects of data generation and acquisition. This section describes the appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities.

Site-specific field procedures are described in Section 3 of the *2014 Final Remedy Status Report* (AECOM, 2015). The following procedures supplement the site-specific ones.

2.1 Sampling Process Design

Relevant components of the following elements of the sampling design are included in Table 1:

- Samples to be collected
- Sampling locations
- Field and laboratory measurement parameters of interest

2.1.1 Sample Naming

Sample labels will clearly identify the particular sample and include the following:

- Facility name (location code) and sample ID
- Time and date sample was taken
- Sample preservation
- Analysis requested.

Sample identification numbers will be assigned, when possible, prior to sample collection in accordance with the DuPont CRG sample identifier coding system to facilitate loading of samples and results into the EIM database.

Example sample IDs for use in this project are as follows:

- TOW-G-MW-06C: Sample collected from monitoring well 06C
- TOW-G-MW-06C-MS: Sample collected from monitoring well 06C for matrix spike
- TOW-G-MW-06C-MSD: Sample collected from monitoring well 06C for matrix spike duplicate
- TOW-G- SW-04-DUP: Sample collected from pumping well 04 for field duplicate
- TOW-K-TBLK1: First trip blank (TB) sample collected
- TOW-K-EQBLK1: First equipment blank (EB) sample collected

2.2 Sampling Methods

The project involves sampling of groundwater. Sampling methodologies to be used for this program are described in Sections 3.2 and 3.3 of the *2014 Final Remedy Status Report* (AECOM, 2015).

2.2.1 Preliminary Activities

The following preliminary activities will be completed before sampling personnel enter the field to ensure proper preparation for each sampling event:

- Coordination between sampling and laboratory personnel will be established so that sample integrity is retained at all times during the sampling event.
- The laboratory will be notified of each upcoming sampling event. The laboratory will then prepare the list of parameters to be analyzed for each sampling location, the replicate requirements, and the number of extra bottles needed, if any. The laboratory manager will specify the quality control testing.
- All proper field forms (i.e., field logbooks, custody seals, and C-O-C forms) will be prepared for use to enable proper documentation of the sampling event.
- A preliminary inspection and calibration of all field equipment will be performed to ensure accurate measurements of field parameters (i.e., pH, specific conductance, dissolved oxygen, turbidity, and temperature).
- All field personnel will be trained in the sampling protocols contained herein.

The following steps will be performed before beginning each sampling event to ensure sampling is implemented correctly and safely:

- The sample location will be identified.
- All equipment to be used during the sampling event will be inspected, pre-cleaned, and decontaminated.
- Field meters to be used during sampling (i.e., pH and specific conductance meters) will be checked to ensure proper calibration and precision response. Buffer and standard solutions will be laboratory checked to ensure their accuracy.
- All forms to be used in the field (e.g., field logbook and C-O-C forms) will be assembled.
- Sampling personnel will review sampling protocols. In addition, health and safety protocols will be reviewed to help ensure that no injuries occur during the sampling event.

2.2.2 General Instructions for All Sampling

Sample containers will contain hydrochloric acid preservative and will not be pre-rinsed with site water prior to sample collection. Latex or nitrile gloves will be worn during sampling activities and replaced between samples. All samples will be held in a cooler, chilled (temperature ranging from not frozen to 6°C) with wet ice from collection to shipping.

The field team leader will be responsible for sampling and laboratory coordination. The laboratory will provide necessary sample containers with the shipping containers (i.e., shuttles or coolers). Containers and preservative added to the containers will be in accordance with EPA SW-846 Method 8260B. All samples will be shipped at approximately 4°C (temperature ranging from not frozen to 6°C).

Field equipment will consist of some or all of the following:

- Field sampling record

- Sufficient ice to maintain the samples at approximately 4°C (temperature ranging from not frozen to 6°C)
- Water Quality meter that includes a multi-probe Sonde with a conductivity meter, pH meter, temperature probe, Redox probe, dissolved oxygen probe, and a turbidity meter with a Flow-Thru cell. (i.e., YSI-6920 water quality meter or similar)
- Pumps and/or bailers for purging
- Rope
- Stainless-steel or polypropylene leader to attach rope to sampling device
- Low flow pumps and polyethylene tubing for sample collection
- Water Level Indicator

Preparing for sampling includes acquiring all of the necessary monitoring equipment listed above and site-specific information to perform the required monitoring.

2.2.3 Water-Level Measurements and Well Purging

Prior to purging, each well will be opened to vent any gases that may accumulate inside the well casing. A battery powered water level indicator will be used to measure the depth to water in each of the monitoring wells. The water level indicator probe will be cleaned prior to each use with an Alconox[®] detergent/water mixture, followed by a distilled/deionized water rinse.

Each of the monitoring wells to be sampled, with the exception of the production well, will be purged using a low flow procedure. For the purposes of this investigation, low flow is defined as purging at a rate low enough (typically less than 1 gallon per minute) to obtain a stable water level, minimizing the effect of drawdown in the well casing. Purging will be accomplished by placing a 2-inch submersible pump with polyethylene discharge tubing in the screen zone of each well. The discharge tubing, coming out of the well, will be directly connected into a fully enclosed low-flow cell. The low-flow cell contains water quality probes to obtain field parameter measurements.

Once purging begins, field parameter measurements will be monitored until the meter readings become stable. Field parameters included pH, temperature, specific conductivity, dissolved oxygen, and redox. Meter readings will be recorded every three minutes until three consecutive readings within 10% of one another are achieved. Color, turbidity, and odor were also noted in the field logbook during purging. The submersible pump will be cleaned prior to each use with Alconox detergent/water mixture, followed by a distilled/deionized water rinse.

The production well will be purged and sampled directly from a sample port. Water will be purged for 5 minutes to clear the sample port prior to sampling.

2.2.4 Groundwater Sampling

Groundwater will be sampled from the wells listed in Table 1. To the extent possible, monitoring wells will be purged and sampled beginning from the least suspected to most suspected contaminated well to minimize the potential for cross-contamination, when sampling equipment is to be re-used.

Prior to sampling, monitoring wells will be purged using low-flow methodology as detailed above. All monitoring wells will be purged with low-flow type submersible or peristaltic pumps (dependent on water depth) with a flow rate of between 0.1 and 0.5 liters per minute with drawdown not to exceed 0.3 feet. If the well runs dry during purging, the well will be sampled after the well has recharged. The water level in the well will be measured periodically during purging. The pump setting for the monitoring wells will be set to a minimal flow rate favorable to collecting samples for VOCs.

During well purging, pH, specific conductance, turbidity, dissolved oxygen, oxidation/reduction potential, color, odor, and temperature will be measured at regular intervals until stabilization is reached. Stabilization will be considered achieved when three consecutive readings of each indicator parameter, taken at three to five minute intervals are within the following limits:

- pH (+/- 0.1 units)
- Specific conductance (within 3%)
- Turbidity [10% for values greater than 5 Nephelometric Turbidity Units (NTUs)]
- Temperature (within 3%)

Indicator parameter instrumentation will be calibrated daily, at a minimum. Once purging is complete, the well will be sampled through the discharge tubing of the pump by directly filling the laboratory-supplied sample containers.

Sample containers will be filled completely to eliminate potential for headspace in the vials. After the sample containers are filled, they will be labeled appropriately and placed in a sample cooler containing wet ice. Samples will be stored at approximately 4°C (temperature ranging from not frozen to 6°C) during storage and shipment.

The following procedure will be followed during groundwater sampling:

1. Remove the bottle cap and fill from the bailer or discharge tubing. Do not use a secondary container to fill the bottle.
2. Recap the sample bottle.
3. Affix a sample label, unless the label was affixed by the laboratory.
4. Place the sample in a cooler of ice.
5. Complete the C-O-C form.

To ensure against cross-contamination between groundwater sampling locations, the sampler collecting the groundwater samples will wear clean, disposable latex or nitrile gloves and will limit his/her contact with the samples. When possible, laboratory-cleaned or disposable sampling equipment should be used (e.g., discharge tubing). Sample bottles and containers will be prepared by the contracted laboratory and will be sealed to ensure cleanliness. Sample bottles will not be cleaned or reused in the field. Monitoring instruments and sample pumps will be cleaned in accordance with Section 2.2.6 of this QAPP.

Groundwater samples will be analyzed for the analytes listed in Table 2.

2.2.5 Containers, Preservatives and Holding Times

Table 4 lists containers, preservatives, and holding times applicable to this project. Sampling containers will be purchased pre-cleaned and treated according to EPA

specifications, and supplied by the laboratory in sample kits packaged in the appropriate shipping coolers. Preservatives will also be provided by the laboratory and supplied in the sample containers whenever possible.

Sample containers should be filled to the preferred volume listed in Table 4; however, if the yield is insufficient to collect the preferred volume, at least the minimum volume listed in Table 4 must be collected for the requested analysis to be performed. If only the minimum sample is collected, the laboratory may have insufficient sample volume in cases where a dilution or reanalysis is required, which may require a re-sampling event. Whenever possible, the preferred volume should be submitted for analysis.

Samples are collected into VOA vials preserved with HydroChloric Acid (HCl) to a pH<2. The pH will be measured when the samples arrive at the laboratory.

2.2.6 Decontamination

All equipment in direct contact with the material to be sampled will be decontaminated prior to sampling to prevent cross-contamination of samples collected. In addition, care will be taken to prevent anything that could affect its composition from contacting a sample or sample area.

Sample bottles and containers will be prepared by the contracted laboratory and sealed to ensure cleanliness. Sample containers will not be cleaned in the field, and will not be re-used.

Sampling equipment will include tubing and pumps. All of these items will come in direct contact with the sample and have potential to impact analytical results. Therefore, care will be taken to ensure the cleanliness of all sampling equipment. When possible, laboratory-cleaned or disposable sampling equipment will be used (e.g., bailers for sampling wells). Clean polyethylene tubing will be used for each sample collected.

Procedures for the decontamination of protective equipment and personal protection clothing to avoid transfer of contaminants from clothing to the body are discussed in the HASP.

To the extent that it is economically feasible and technically acceptable, disposable personal protective equipment will be used.

2.2.9 Waste Management

All disposable equipment and other materials that are not decontaminated for reuse will be disposed of in accordance with the waste management procedures identified in the *Project-Specific Waste Management Plan for Semi-Annual Groundwater Monitoring* (URS, 2013).

2.3 Sampling Handling and Custody

Following sample collection, sample container will be sealed, wiped to remove any moisture, and the completed sample label is affixed. It is recommended that the C-O-C form be completed as samples are collected.

Samples will be packaged with bubble wrap to prevent breakage or damage, and packed carefully in iced coolers. Samples will be shipped to the laboratory via overnight commercial carrier. A copy of the C-O-C form will be faxed or e-mailed to the Project QA Manager by the field sampling team within one working day of sample shipment.

Sample custody will be initiated in most cases by the laboratory with the selection and preparation of sample containers. To reduce the chance for error, the number of personnel assuming custody of the samples and sample containers will be held to a minimum.

On-site monitoring and sampling data will be controlled and entered onto the appropriate field log. Personnel involved in the custody and transfer of samples will be trained on the procedures and their importance and purpose prior to sampling initiation.

2.3.1 Chain of Custody

Sample custody procedures are summarized below. In accordance with EPA guidelines, C-O-C procedures are intended to maintain and permanently document sample possession from the time of collection to disposal. A sample is considered to be under a person's custody if one or more of the following occur:

- It is in that person's possession.
- It is in that person's view, after being in that person's possession.
- It was in that person's possession and was locked up by them to prevent tampering.
- It has been placed in a designated secure area by that person.

2.3.2 Field Chain of Custody

A C-O-C form will accompany the sample container from the initial sample container selection and preparation at the laboratory to sample collection and preservation in the field to the return of the samples to the laboratory. The C-O-C form will trace the path of each individual sample container by means of a unique identification number. When possible, sample designation/location numbers will be pre-printed by the laboratory on the C-O-C form and bottle labels.

The AECOM QA Manager will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival. Sample shipping containers (i.e., shuttles or coolers) will be provided by the laboratory. The shipping containers will be insulated. A sample container partially filled with water will be included in each shuttle to serve as a temperature blank. All sample bottles within each shipping container will be individually controlled and labeled. Sample identification labels will be provided by the laboratory. All sample bottle labels will include the following information:

- Site name
- Sample number
- Analysis required (VOCs)
- Preservatives (HCl)
- Signature of custodian
- Date of receipt and relinquishment
- Sampling dates and times
- Sample type and quantity

- Method of shipment and courier name(s), if applicable

Personnel receiving the sample containers will verify the integrity of the seals on each cooler. Shuttles with broken seals will be returned to the laboratory with the contents unused, assuming the cooler is intact. The receiving personnel will break the seal, inspect the contents for breakage, and sign the C-O-C form to certify receipt of the sample containers. A temporary seal then will be affixed to each cooler.

Once sample containers are filled, they will be placed immediately in the cooler on ice to maintain the samples at approximately 4°C (temperature ranging from not frozen to 6°C). The field sampler will check the sample designation/location number in the space provided on the C-O-C form for each sample, on the preprinted C-O-C form. Date and time of sample collection will be entered by the field sampler. The C-O-C forms will be signed and placed in the cooler. The samples should be shipped to the laboratory on the same day as they were collected and will be delivered to the laboratory no later than 72 hours after sample collection. The cooler with samples will be shipped to the laboratory using an overnight express service.

The “remarks” column of the C-O-C form will be used to record specific considerations associated with sample acquisition such as sample type, container type, sample preservation methods, and analysis to be performed. The source of reagents, field blank water, and supplies will be documented on the C-O-C form or in the field notebook. The laboratory will maintain a file of the completed original forms. Copies will be submitted as part of the final analytical report. If samples are split and sent to different laboratories, each sample will receive a unique C-O-C form.

2.3.3 Laboratory Chain of Custody

The laboratory Quality Assurance Manual and associated laboratory SOPs shall specify the laboratory sample handling and custody requirements. These requirements should be consistent with NELAC. The laboratory sample custodian will receive and sign the C-O-C form for the laboratory and record the date and time of receipt. The laboratory log-in record will explicitly state the condition of the sample containers, any evidence of damage, preservation, and the completeness of accompanying records. After inspection, each sample will be logged in and assigned a unique laboratory sample ID. In addition, the following information will be entered in the Laboratory Information Management System (LIMS) for each sample:

- Field sample ID
- Laboratory sample ID
- Date received
- Project name and number
- Collection date
- Sample type
- Analyses to be performed

The condition, temperature, and appropriate preservation of samples shall be checked and documented on the C-O-C form. Preservation of the sample containers shall be checked at the laboratory after sample analysis.

After sample log-in is complete, a copy of the C-O-C record, with laboratory sample numbers and notations of any discrepancies will be sent to the Project QA Manager to

be entered into the project file. The original C-O-C form will be filed in the laboratory with the shipper's waybill or airbill attached. The Laboratory Project Manager will report any problems or discrepancies immediately to the Project Quality Assurance Manager. The Laboratory Project Manager is responsible for sending a confirmation of sample receipt within one working day of sample receipt to the Project QA Manager by fax or e-mail. The original copy of the C-O-C form will be included with the final data package submitted to the Project Quality Assurance Manager.

While at the laboratory, samples will be stored in a limited-access, temperature-controlled area. Refrigerators, coolers, and freezers will be monitored for temperature daily. The acceptance criteria for refrigerator and cooler temperatures shall be 0.5 to 6°C, and the acceptance criteria for freezer temperatures shall be less than 0°C.

2.4 Analytical Methods

The target VOC list for this project is listed in Table 2. The analytical results will be obtained from the most current versions of analytical methods contained in the following sources:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846); Method 8260B.*

Eurofins-Lancaster Laboratories will perform all analytical testing, documentation, and reporting. Specific laboratory operations are governed by the laboratory's Quality Assurance Plan, which controls all laboratory activities from the arrival of samples to the reporting of reviewed analytical data. Supplemental QC criteria are provided in the individual methods and the laboratory's SOPs used during the analyses of the samples. The laboratory's SOPs will be made available for review upon request.

Laboratory QC acceptance criteria may be stricter than that specified in this QAPP. If the laboratory QC acceptance criteria are less strict, then the acceptance criteria specified in this QAPP shall be the default criteria for the project. Usability of the laboratory data will be evaluated against the criteria specified in this QAPP.

2.5 Quality Control

For each batch of samples, sufficient QC samples will be collected and analyzed to ensure that the appropriate QC measures described in the following sections will be attained. QC samples will be handled, preserved, and documented in exactly the same manner as those of the sample batch. To minimize bias in the laboratory, field QC samples will be submitted to the laboratory as blind samples using identification codes in the same form as regular samples but identifiable only by select non-laboratory project staff. Field QC samples include trip blanks, equipment blanks and field duplicates. Laboratory QC samples include laboratory control samples, laboratory blanks, and MS/MSD samples. Surrogate recoveries are used to evaluate the method performance for individual samples.

Table 3 summarizes project quality control samples and associated performance criteria for the laboratories. Quality control performance criteria for field measurements are summarized in Table 5.

2.5.1 Trip Blanks

Trip blanks are prepared prior to the sampling event by the analytical laboratory using Type II reagent-grade water. Trip blanks are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the investigative samples and sent for analysis. At no time after their preparation are the sample containers to be opened before they reach the laboratory. If multiple shipments of samples are required, trip blanks are to be provided per shipment but not per cooler.

2.5.2 Equipment Blanks

Equipment blanks are defined as samples that are obtained by running Type II reagent-grade deionized water over/through non-disposable, reusable sample collection equipment after it has been cleaned (i.e., rinse water will be pumped through the sample pump and tubing.). Type II reagent-grade deionized water will be obtained from the laboratory or an equivalent from a commercially available source. These samples will be used to determine whether decontamination procedures were adequate. One equipment blank will be collected each day sampling activities occur.

2.5.3 Field Duplicates

Field duplicate samples are two samples collected simultaneously in separate containers from the same source under identical conditions. One duplicate sample will be collected for each batch of groundwater samples at the site. The duplicate sample provides a measure of precision, or reproducibility of the sample result. During data review, precision as RPD will be calculated according to the following equation:

$$RPD = \frac{|R_1 - R_2| * 200}{(R_1 + R_2)}$$

Where:

R_1 = result from sample 1

R_2 = result from sample 2

When the result for one or both of the field duplicates is non-detect (ND), the precision for the pair will not be determined. If one or both samples have reported concentrations of less than 5X the analyte practical quantitation limit (PQL), the difference between the two must be within the PQL. Field duplicate samples will be collected and analyzed for all analytical parameters associated with the sampling event.

2.5.4 Laboratory Blank Samples

Analytical results for laboratory blanks provide a means to evaluate laboratory precision and bias, and other potential contamination and carry-over problems. Laboratory blanks are carried through applicable sample preparation and analysis procedures. Laboratory blanks are analyzed for all parameters associated with the sampling event.

2.5.5 Laboratory Control Samples

LCS are analyte-free water that is spiked with the target VOCs specified in Table 2. The LCS is spiked at the approximate midpoint of the calibration curve and is carried through the entire sample analysis procedure. LCS results are used to assess method/laboratory accuracy.

2.5.6 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. MS/MSD samples are spiked and analyzed by the laboratory to facilitate identification of effects of the particular matrix of interest on analytical results, particularly biasing of results. Sufficient sample volume will be collected (triple the normal sample volume for groundwater samples) for one sample in the set of samples so that MS/MSD samples can be prepared for analysis. MS/MSD samples are spiked at the approximate mid-point of the calibration curve. MS/MSD samples are analyzed for the target VOCs.

2.5.7 Surrogates

Surrogate recovery data are used to evaluate the precision of the analytical method on a specific sample. Surrogates are compounds similar to the target VOCs in chemical composition and behavior but are not normally found in environmental samples. Appropriate surrogates for EPA SW-846 Method 8260B are listed in the laboratory SOPs. Surrogates are typically spiked into all field samples and laboratory quality control samples that are analyzed for VOCs.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

The purpose of this element is to specify procedures used to verify that instruments and equipment are maintained in sound operating condition and are capable of acceptable performance. A program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments.

2.6.1 Instrument/Equipment Testing and Inspection

A calibration program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. Field team members familiar with field calibrations and equipment operations will maintain instrument proficiency by performing the prescribed calibration procedures outlined in the operation and field manuals accompanying the field monitoring instruments.

The water quality meter will be calibrated for the following parameters: pH, conductivity, and temperature. The water quality meter will be calibrated prior to each day's use according to the manufacturer's instructions. More frequent calibrations will be performed as necessary to maintain analytical integrity. The pH meter will be calibrated at a minimum of two values that bracket the anticipated pH values of the samples to be analyzed and that are three pH units or more apart. The conductivity meter will be calibrated using a standard solution of known conductivity.

Following calibration, each instrument will be tagged identifying the person who calibrated the instrument and the calibration date. Calibration records for each field instrument used during the investigation will be maintained, and copies of the records will be stored in the project QA files.

Specific calibration procedures for individual analytical instruments are described in the field and laboratory SOPs.

2.6.2 Instrument/Equipment Maintenance

All field equipment will be subjected to a routine maintenance program before and after each use. The routine maintenance program for each piece of equipment will be in

accordance with the manufacturer's operations and maintenance manual. All equipment will be cleaned and checked for integrity after each use. Repairs will be performed immediately after any defects are observed and before the item of equipment is used again. Equipment parts with a limited life (e.g., such as batteries, membranes, and some electronic components) will be periodically checked and replaced or recharged as necessary according to the manufacturer's specifications.

Each piece of field equipment will have its own log sheet that contains the equipment identification number, information on maintenance procedures, and the date and nature of the last maintenance. Because most equipment will be used on an irregular, as-needed basis, all equipment will be properly stored when not in use.

Laboratory equipment maintenance will be regularly performed by the subcontracted laboratory. It will be the laboratory's responsibility to maintain and document the maintenance of properly functioning equipment so that the data are usable and reproducible. Upon request, a description of the laboratory's equipment, maintenance procedures will be provided by the subcontracted laboratory.

2.7 Instrument Calibration and Frequency

The purpose of this element is to define calibration procedures that will be used to generate environmental measurements. Specific requirements for calibration of analytical instruments are described in the field and laboratory SOPs.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

The purpose of this element is to establish and document a system for inspecting and accepting supplies and consumables that may affect the quality of the project data. Laboratory or field consumables or supplies that will come into contact with samples must be documented to be free of contamination prior to use. Examples of consumables and supplies include latex or nitrile gloves, glassware, soap or detergent, sample containers, reagents, and reagent water. Field consumables and supplies are also demonstrated to be free of contamination through the collection of equipment blanks. Laboratory consumables and supplies are demonstrated to be free of contamination through the preparation and analysis of laboratory blanks. The laboratory Quality Assurance Manual should identify critical supplies, such as calibration gases or standards, solvents or reagents, and the acceptance criteria for these supplies.

2.9 Data Acquisition Requirements

This element describes the types of non-measurement data needed for project implementation or decision-making. Non-measurement data may include computer databases, programs, literature files, and historical databases. This type of non-measurement data is not required for this phase of the project, however, each set of new monitoring data will be evaluated against historical data obtained for the same locations as a means of identifying sampling and/or analytical anomalies or trends.

2.10 Data Management

This element describes the project data management process, including standard record-keeping procedures and data storage and retrieval from electronic media.

2.10.1 Logbooks and Forms

Laboratory and field records shall be maintained by appropriate personnel and shall be sufficiently detailed to allow for reconstruction of the collection, handling, preparation, and analysis procedures performed on the samples. These procedures shall be documented in logbooks or on forms. It is sufficient to identify the SOPs and record any deviation from the SOPs in the logbooks or on the forms. Logbook pages and forms shall be initialed and dated by the person making the entry. Entries shall be legible. If errors are made, the error is crossed out with a single line, initialed, and dated by the person making the correction. Maintenance and calibration records must be traceable to the person using the instrument and to the specific instrument.

2.10.2 Data Storage and Retrieval

Field records and laboratory records shall be archived for a minimum of ten years from the date the record was generated. Software and hardware used to generate, store, and retrieve the records shall be kept on file with the records.

Samples and sample extracts are held at the laboratory for a limited period of time following laboratory report generation (e.g., 30 days) in accordance with the individual laboratory's SOP and practical space constraints.

3.0 Assessment and Oversight

A technical systems audit of field activities is an on-site, qualitative review of the sampling system to ensure that the activity is being performed in compliance with this QAPP. A technical systems audit of field sampling activities is not planned during groundwater sampling activities. DuPont conducts routine on-site technical systems audits of its primary contract laboratories, typically on a biennial schedule.

4.0 Data Review and Usability

The elements of this group address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines if the data conform to the specified criteria and satisfy the project objectives.

4.1 Data Review, Verification and Validation

The review performed on the data at each level shall be documented, beginning with the laboratory's review of the analytical results through the independent data review performed by the data user, and finally review by the appropriate regulatory agency. The intent is to capture the review effort of each party to minimize duplicative efforts, to ensure that critical elements of the review process are not overlooked, and to set in place a system that can be audited or inspected.

4.1.1 Laboratory Review

The laboratory utilized for this project shall have implemented a quality assurance program that meets the requirements of a recognized organization such as an appropriate state agency, National Environmental Laboratory Accreditation Program (NELAP), or International Organization for Standardization (ISO). The laboratory shall review the data for technical acceptance.

The laboratory analyst is responsible for the reduction of raw data and shall clearly identify any problems or anomalies that might affect the quality of the data. The analyst shall review 100 percent of the data and shall verify that data reduction protocols are correct. At least 10% of the data shall be reviewed independently by a senior analyst or by the supervisor of the laboratory analyst. Both the analyst and independent review shall include the following:

- Calibrations and calibration verifications
- Instrument and system performance checks
- Blanks
- LCS recoveries and precision
- MS/MSD recoveries and precision
- Duplicate sample precision
- Compound identification and quantification
- Surrogate recoveries
- Internal standard areas

The laboratory QA personnel shall review the completed data packages and perform a reasonableness check review on the completed data packages. The QA personnel shall ensure that all deliverables are present, that qualifiers have been applied to the data and that nonconformance and other issues have been address in the case narrative. Either the independent reviewer or the laboratory QA personnel shall perform a QA check on 100% of hand-entered data and 5% of electronically transferred data. The laboratory will attempt to transfer as much data as possible by electronic means to minimize the potential for transcription errors.

4.2 Verification and Validation Methods

Data verification is the process of verifying that qualitative and quantitative information generated relative to a given sample is complete and accurate.

4.2.1 DuPont In-House Review Process

As discussed in Section 1.5, the laboratory data deliverables will be submitted to the Analytical Data Quality Management (ADQM) Group in both hardcopy and electronic data formats. Upon receipt of the deliverables package, the ADQM group will perform the following data review functions:

- Load the electronic data into the DuPont CRG Locus EIM database to facilitate the semi-automated review process and accessibility of the project data.
- Perform a completeness check of project data to ensure that all requested samples were analyzed and the test results were reported.
- Conduct a QC review of laboratory data to evaluate batch integrity per SW-846 guidance and to ensure that QC acceptance criteria exceptions (versus laboratory and/or project limits) are properly documented via data qualifiers and/or narrative comments.
- Evaluate 100 percent of project laboratory data via the DuPont semi-automated in-house DDR, which applies data usability qualifiers based on the specific project and/or laboratory QC limits; holding time criteria; equipment, trip, and laboratory method blank detections; and quantitation between the MDL and PQL. This automated process, essentially equivalent to a summary level data validation, is described in more detail in Appendix G.

The project Quality Assurance Manager or project chemist will oversee the in-house data review process, coordinate any questions and/or data resubmittals that may be required, and prepare the Data Usability Summaries for the project team.

4.2.2 Data Usability Summary (DUS)

The Project QA Manager will generate a usability summary that contains a review of the deficiencies identified in the data, qualifiers identifying biases and unreliable data, assessments of field and laboratory performance, overall precision and accuracy, representativeness and completeness of the data set. The DUS should provide the following information:

- Samples and analytical parameters reviewed
- Field data reviewed
- QC parameters reviewed
- Review criteria for each QC parameter
- Specific samples and constituents that did not meet criteria and applied qualifiers
- Overall usability of the data set

The DUS will be included in the final report(s) submitted for the project.

4.3 Reconciliation with Data Quality Objectives

Final project reports will include a discussion of the uncertainty associated with results qualified as estimated, which may affect the usability of the data in meeting data quality objectives. The QA section of project reports will include an evaluation of how representative the analytical results are of the medium being evaluated, based on measures such as sampling design, replicate analyses, and quality control results, and a discussion on the sufficiency of the valid dataset for meeting project objectives

5.0 References

AECOM. 2015. *2014 Final Remedy Status Report*. DuPont Towanda Facility, Towanda, Pennsylvania. March.

EPA. 2001. *Requirements for Quality Assurance Project Plans*, EPA QA/R-5, (EPA/240/B-1/003). March.

EPA. 2002. *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (EPA/240/R-02/009). December.

URS. 2013. *Project-Specific Waste Management Plan for Semi-Annual Groundwater Monitoring*, Towanda, Pennsylvania. May

Tables

Table 1
Summary of Sampling Locations
Quality Assurance Project Plan Final Remedy Groundwater Sampling
DuPont Towanda Facility
Towanda, Pennsylvania

Sample		Analysis of Groundwater	EPA Method
No.	Location		
TOW-G-MW-17	Monitoring Well MW-17	X	SW-846 8260B
TOW-G-MW-18	Monitoring Well MW-18	X	SW-846 8260B
TOW-G-MW-19	Monitoring Well MW-19	X	SW-846 8260B
TOW-G-MW-03C	Monitoring Well MW-03C	X	SW-846 8260B
TOW-G-MW-07	Monitoring Well MW-07	X	SW-846 8260B
TOW-G-MW-06C	Monitoring Well MW-06C	X	SW-846 8260B
TOW-G-MW-06C-MS	Matrix Spike of MW-06C	X	SW-846 8260B
TOW-G-MW-06C-MSD	Matrix Spike Duplicate of MW-06C	X	SW-846 8260B
TOW-G-MW-06A	Monitoring Well MW-06A	X	SW-846 8260B
TOW-G-TBLK-1	Trip Blank #1	X	SW-846 8260B
TOW-G-EQBLK-1	Equipment Blank #1	X	SW-846 8260B
TOW-G-MW-15	Monitoring Well MW-15	X	SW-846 8260B
TOW-G-MW-16	Monitoring Well MW-16	X	SW-846 8260B
TOW-G-SW-04	Pumping Well SW-04	X	SW-846 8260B
TOW-G-SW-04-DUP	Field duplicate of Pumping Well SW-04	X	SW-846 8260B
TOW-G-MW-08	Monitoring Well MW-08	X	SW-846 8260B
TOW-G-TBLK-2	Trip Blank #2	X	SW-846 8260B
TOW-G-EQBLK-2	Equipment Blank #2	X	SW-846 8260B

Note: Sampling locations may be revised or updated as necessary to meet project objectives.

Table 2
Target Compound List - Volatile Organic Compounds
Quality Assurance Project Plan Final Remedy Groundwater Sampling
DuPont Towanda Facility
Towanda, Pennsylvania

Compound	Reporting Limit	Units
1,1,1-Trichloroethane	5.0	ug/l
1,1,2,2-Tetrachloroethane	5.0	ug/l
1,1,2-Trichloroethane	5.0	ug/l
1,1-Dichloroethane	5.0	ug/l
1,1-Dichloroethene	5.0	ug/l
1,2-Dichloroethane	5.0	ug/l
1,2-Dichloropropane	5.0	ug/l
2-Butanone	10	ug/l
2-Hexanone	10	ug/l
4-Methyl-2-pentanone	10	ug/l
Acetone	20.0	ug/l
Benzene	5.0	ug/l
Bromochloromethane	5.0	ug/l
Bromodichloromethane	5.0	ug/l
Bromoform	5.0	ug/l
Bromomethane	5.0	ug/l
Carbon Disulfide	5.0	ug/l
Carbon Tetrachloride	5.0	ug/l
Chlorobenzene	5.0	ug/l
Chloroethane	5.0	ug/l
Chloroform	5.0	ug/l
Chloromethane	5.0	ug/l
cis-1,2-Dichloroethene	5.0	ug/l
cis-1,3-Dichloropropene	5.0	ug/l
Dibromochloromethane	5.0	ug/l
Ethylbenzene	5.0	ug/l
Methylene Chloride	5.0	ug/l
Styrene	5.0	ug/l
Tetrachloroethene	5.0	ug/l
Toluene	5.0	ug/l
trans-1,2-Dichloroethene	5.0	ug/l
trans-1,3-Dichloropropene	5.0	ug/l
Trichloroethene	5.0	ug/l
Vinyl Acetate	1.5	ug/l
Vinyl Chloride	5.0	ug/l
Xylene (Total)	5.0	ug/l

Table 3
Quality Control Performance Criteria
Quality Assurance Project Plan Final Remedy Measure Groundwater Sampling
DuPont Towanda Facility
Towanda, Pennsylvania

Type	QC Check	Frequency	Data Quality Indicator (DQI)	Acceptance Criteria	Corrective Action (CA)	Person Responsible for (CA)
Field	Field Duplicate	1 per set of samples	Precision	RPD < 30% (water matrix)	N/A	N/A (Evaluation by Project Chemist)
Field	Trip Blank	1 per cooler containing volatiles	Accuracy/ Bias	Target Analytes <PQL	Evaluate results for field samples	Project Chemist
Field	Equipment Blank	1 per day or 20 samples	Accuracy/ Bias	Target Analytes <PQL	Evaluate results for field samples	Project Chemist
Field	Temperature Blank	1 per cooler	Accuracy/ Bias	4°C ± 2°C	1. Contact PM 2. Evaluate need for resampling	Project Chemist
Laboratory	Matrix Spike (MS)	1 per 20 or less sample batch	Accuracy/ Bias	Within current Laboratory control limits	Evaluate based on LCS, other QC results, narrate	Analyst
	Matrix Spike Duplicate (MSD)	1 per 20 or less sample batch	Precision			
Laboratory	Method Blank	1 per 20 sample batch	Accuracy/ Bias	<PQL	1. Re-prep and re-analyze blank samples if necessary	Analyst
Laboratory	Surrogate spikes	All samples analyzed for VOCs	Accuracy/bias	within current laboratory control limits for method	1. Re-prep and re-analyze non-compliant sample(s) 2. Narrate	Analyst
Laboratory	Laboratory Control Sample (LCS)	1 per 20 sample batch	Sensitivity	within current laboratory control limits	Reanalyze sample; evaluate; narrate	Analyst

Table 4
Containers, Preservatives, and Holding Times
Quality Assurance Project Plan Final Remedy Groundwater Sampling
DuPont Towanda Facility
Towanda, Pennsylvania

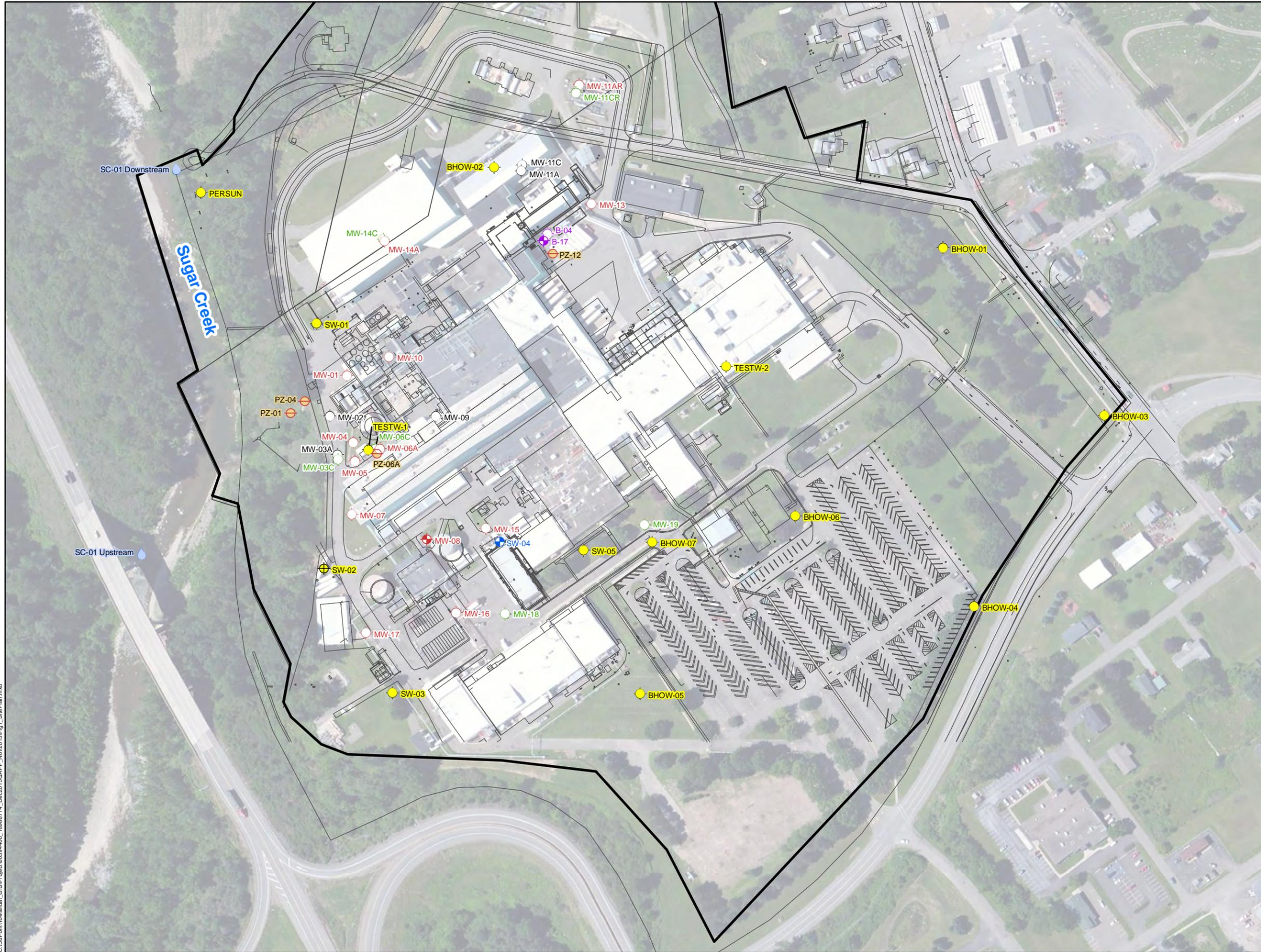
Analytical Parameter	Matrix	EPA Method	Minimum Volume/Mass	Sampling Container	Preservatives	Holding Time ¹
Volatile Organic Compounds	Water	8260B	40 ml	3 x 40 ml VOA Glass with Teflon® lined cap.	HCl pH<2; cool to 4°C	14 days

¹Holding time calculated from time of sample collection until sample analysis.

Table 5
Field Measurement Equipment Quality Control
Quality Assurance Project Plan Final Remedy Groundwater Sampling
DuPont Towanda Facility
Towanda, Pennsylvania

Parameter Analytical Method	Achievable Sensitivity/Lower Quantitation Limit	Precision QC Check	Precision Acceptable Criteria	Accuracy/Bias QC Check	Accuracy/Bias Accuracy Criteria	Corrective Action (CA)	Person Responsible for (CA)
pH SW-846 9040B	0.2 pH units	Replicate Measurements	RPD>20%	Calibration with pH buffer solutions (4, 10, plus 7)	Slope between 90-102	1. Check with new buffer 2. Repair/replace meter 3. Recalibrate	Field Team Member
Conductivity SW-846 9050A	0.1 uohm/cm	Replicate Measurements	RPD>20%	Calibration with KCl standard.	±5% of standard	1. Evaluate 2. Recalibrate	Field Team Member
Temperature SW-846 170.1	0.1°C	Replicate Measurements	RPD>20%	Calibration against pH meter temp. temp. probe	±0.1°C	1. Recalibrate 2. Replace thermometer	Field Team Member
Dissolved Oxygen SM 4500-OC	200 ug/l	Replicate Measurements	RPD>20%	Calibration with standard solution	Per manufacturer's operation manual	1. Evaluate 2. Recalibrate	Field Team Member
Oxidation-Reduction Potential (ORP)	N/A	Replicate Measurements	RPD>20%	Calibration with iodine solution	Per manufacturer's operation manual	1. Evaluate 2. Recalibrate	Field Team Member
Turbidity EPA 180.1	0.2 NTU	Replicate Measurements	RPD>20%	Calibration with standard solution	Per manufacturer's operation manual	1. Evaluate 2. Recalibrate	Field Team Member

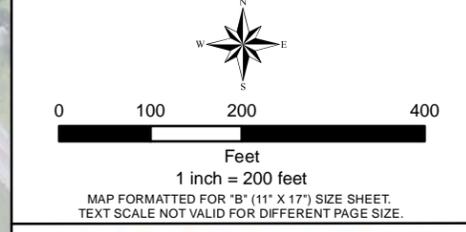
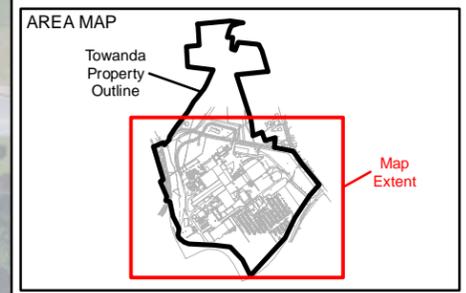
Figures



Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Abandoned Monitoring Well
- Pre RFI Monitor Well
- Plant Production Well
- Historical Water Exploration Well or Boring
- Piezometer
- Surface Water Sample Location (Approximate)
- Basemap Feature
- Towanda Property Outline

NOTES:
 2011 Aerial Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
 Map Scale: 1:2,400
 Map Projection: NAD83 Pennsylvania North State Plane feet



AECOM

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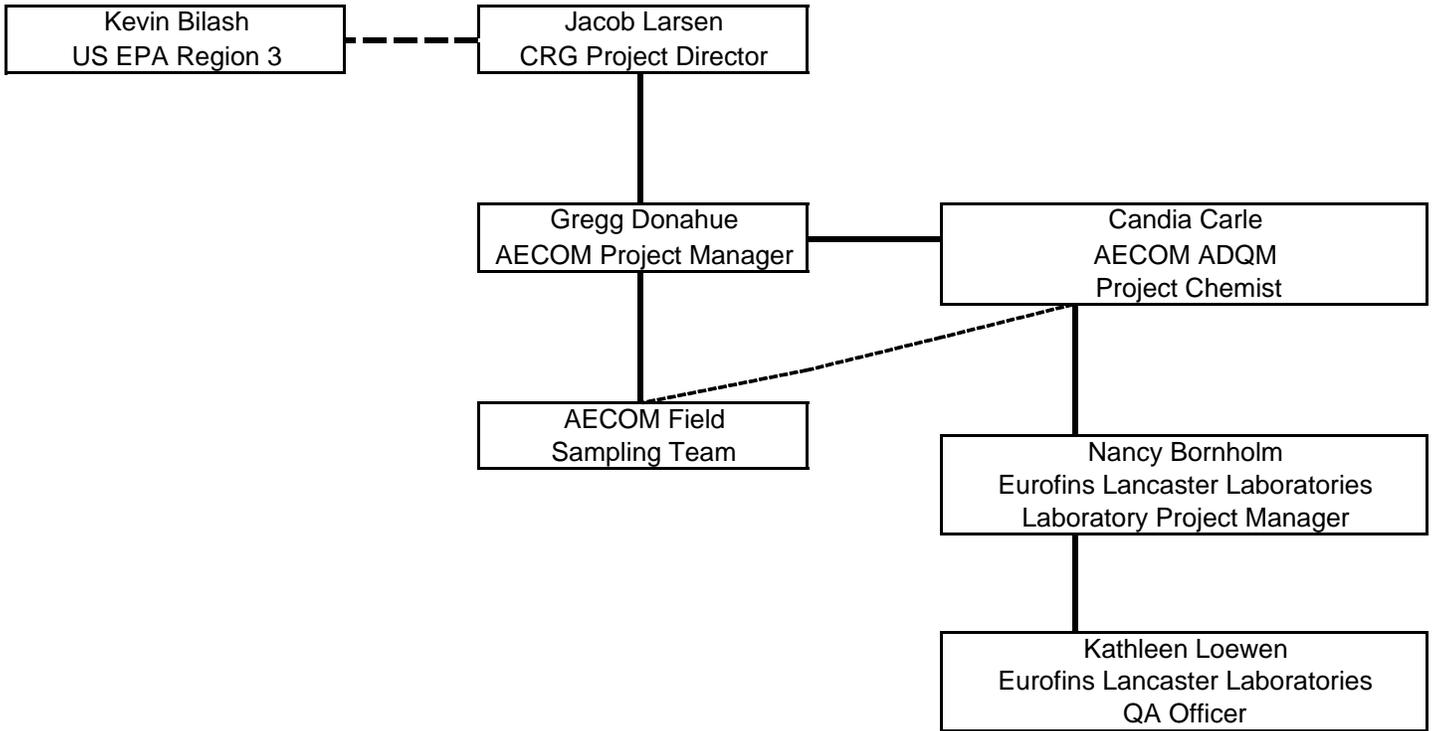
SITE PLAN

DuPont Towanda Site
 Towanda, Pennsylvania

TASK NUMBER: 18986714.15006	PROJECT NUMBER: 60394400
DESIGNED BY: GCD	DATE: 11/19/2015
DRAWN BY: CAD	FIGURE NUMBER: 1
DATA QUALITY CHECK BY: NDKW	

C:\DuPont\Towanda\GIS\Project\60394400_18986714_Dr20150APP_Nov2015\Fig1_SitePlan.mxd

Figure 2
Project Organization Chart
Quality Assurance Project Plan Final Remedy Groundwater Sampling
DuPont Towanda Facility, Towanda, Pennsylvania



Appendices

Appendix A

Contact Information

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Appendix B

Groundwater Sample Field Book Collection Form

Appendix C

Standard Operating Procedure for Completing Chain of Custody

Corporate Remediation Group Chain-of-Custody Standard Operating Procedure

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish a Corporate Remediation Group (CRG) chain-of-custody (COC) standard for tracking samples from the field to the laboratory. An essential part of any sampling/analytical scheme is ensuring the integrity of the sample from collection to data reporting. The possession and handling of samples should be traceable from the time of collection through analysis and final disposition. (SW846, Chapter 9, Section 9.2.2.7).

General Information

The COC is a legal document/record that must include facility name, facility address, sample identification, dates and times of collection of samples, matrix of the sample, and details of possession (signatures of the personnel involved in the possession of the sample, including the dates of possession).

The COC also typically includes the sample analysis request, which may include laboratory name, laboratory address, contact person name/telephone number, requested analysis, number of bottles, sample preservation, reporting instructions, project or sampling event name, and field information.

Objectives of Using the COC

The objectives of using a COC are to demonstrate the chain of possession of the samples and order services from the laboratory. The following items will facilitate meeting these objectives:

- A COC must accompany every sample delivery to a laboratory, regardless of whether samples are shipped via commercial carrier, transported via laboratory courier, or hand-carried to the laboratory by the sampling team.
- Every field sample must be assigned a field sample identification number (FSID), and that FSID must be on an associated COC.
- The COC is specific to each shipping cooler. Every field sample in a cooler must have a FSID on a COC in that cooler.
- The COC must be legible and accurate.

Procedures for Completing the COC

The policy is to use either Option A or Option B as stated below.

Option A (Pre-Printed COC originated by Laboratory Personnel)

This is the preferred method for initiation of the COC, originated at the laboratory with pre-determined FSID and other requested fields. See Figure 1 for an example of COC Option A.

Laboratory personnel will do the following:

- Originate the pre-printed COC by relinquishing the bottles with a signature. The pre-printed COC contains the following information: header information (e.g., facility name, facility

address, facility supervisor, project name), FSID (e.g., 2H14GWMON-MW1), sample depths (if applicable), sample type, volume, preservative (if applicable), quantity, bottle type, method, and/or analyte.

- If the field sample IDs are known at the time of bottle preparation, pre-print FSID (e.g., 2H14GWMON-MW1) on the COC. If the FSIDs are **not** known at the time of bottle preparation, leave the FSID blank.
- The project team may request that only one sample location be entered on a COC form. This has the benefit of allowing the field team to collect the samples in any order they choose and will facilitate shipping samples from the site the day that they are collected.

Field personnel will do the following:

- If a sample is pre-printed on the COC but will not be collected:
 1. Cross out the sample on the COC.
 2. Date and initial the cross-out and identify the reason on the COC (e.g., well is dry).
- If an extra sample is collected that was not pre-printed on the laboratory relinquished COC, add this sample to a separate blank COC (not the COC that was relinquished by laboratory personnel).
- If all of the samples listed on the laboratory relinquished COC cannot be collected in one day, use Option B.

Option B (Pre-Printed/Blank COC Originated in the field)

- Laboratory personnel issue COC forms with the bottles. These forms can be pre-printed or left blank.
- Field personnel will do the following:
 1. Collect the samples and write the FSID on the COC.
 2. Write the date and time of sample collection on the COC.
 3. Enter the remaining information on the COC [i.e., sample type, volume, preservative (if applicable), quantity, bottle type, method, and/or analyte (if not already pre-printed on the COC)].
 4. Once the samples are ready to be shipped to the laboratory and all of the aforementioned information has been entered for the samples collected, relinquish the samples to the laboratory with his/her signature, date, and time (see Figure 2 for examples of Option B).

Signatures

Option A

If laboratory personnel initiate the COC:

1. Laboratory personnel relinquish the bottles with a signature.
2. Field personnel receive the cooler(s) from the courier (i.e., Laboratory/Federal Express/UPS). Field personnel will sign for the shipment if received directly from a courier.
3. Field personnel:
 - Check contents of cooler against COC.
 - Sign the COC in the “Received By” box.

- Relinquish the samples to the laboratory once they have finished sampling.
4. Laboratory personnel:
 - Cross-out the unused “Received By/Relinquished By” boxes prior to signing.
 - Sign the COC upon receipt of the samples.
 5. Field personnel file and keep the Federal Express/UPS bill of lading **to** and **from** the site (if used).

Option B

If laboratory personnel did not initiate the COC:

1. Field personnel sign the COC upon completion of sampling in the Relinquished By box.
2. Laboratory personnel sign the COC upon receipt of the samples and cross-out the unused “Received By/Relinquished By” boxes.
3. Field personnel file and keep the Federal Express/Airborne bill of lading **from** the site (if used).

“Cross Outs” on COC

- If corrections are made to the COC while in the field, field personnel must date and initial the item that was crossed out.
- If corrections are to be made to the COC **after** it has left the field, Analytical Data Quality Management (ADQM) personnel:
 1. Document the error. This can be an email between the project team and ADQM or other written communication.
 2. Either ADQM or the project team marks up the COC field copy. All of the corrections will be dated and initialed.
 3. Send an email with the reason for the correction and the corrected COC to the person requesting the correction (if other than ADQM personnel) for signature.
- Once the requestor has reviewed the documentation, he/she sends an email acknowledging the correction back to ADQM personnel with a signature on the corrected COC.
- ADQM keeps the original with the file and sends a copy to the laboratory and to the project manager.

Trip Blank Collection Date and Time

The trip blank for volatile organic compounds (VOCs) is originated in the laboratory and sent to the field with the sample bottles for field collected VOCs. The laboratory does not add a date and time for the collection of the VOC. However, the Locus EIM database requires both date and time for all field samples. Therefore, field personnel will use the date and time of the first collected VOC as the sample collection time for the trip blank.

Location of COC With Respect To Cooler

Laboratory personnel:

1. Print the COC on thermal paper (or duplicate copies) so that all parties handling the samples can maintain a copy in their files.

2. Place all copies of original COC or form (which will become a COC once a signature has been added) inside a zip-lock plastic bag, and pack inside the top of the cooler when shipped to the field.

Field personnel:

1. Place the original COC and laboratory copy inside a sealed zip-lock plastic bag, and pack in the top of the cooler containing the samples listed on that COC. The zip-lock bag may also be taped to the inside of the cooler lid.
2. Keep one copy of the COC for their files.

Bottle Labels

Field personnel must make sure that the bottle label contains the FSID, the preservative added, the number of bottles, the analyses, and whether or not the sample is filtered. The information on the bottle label must match the information on the COC.

Date/Time of Sample Collection

Field personnel must:

1. Write the date on COC as MM/DD/YY (e.g., 8/31/14).
2. Write the time on COC in 24-hour or military time (e.g., 1330). The time of collection is recorded as the time the sample was initially taken. A separate time of collection is not required for each parameter (e.g., time for volatiles, time for semi-volatiles, etc.) The date and time of collection of field duplicate samples, and matrix spike/matrix spike duplicate samples must be the same date and time as the original sample.

Custody Seals

Laboratory personnel include custody seals with each cooler shipment.

Field personnel:

1. Pack the samples on ice in the cooler. It is recommended that a large heavy plastic bag be used to enclose all samples, ice, and packing material. The bag should be sealed prior to enclosing the zip-lock bag with the COC form.
2. Once the cooler is ready for shipment, tape the custody seals to the broad side of the cooler lid opposite the hinges in such a way that the seals will be broken if the cooler is opened.
3. Sign and date the custody seals prior to shipment to the laboratory. If field personnel break the seals of the cooler prior to shipment (e.g., to re-ice the samples), field personnel must attach another set of seals to the cooler with the field personnel's signature and the date.
4. If specified in the QAPP, attach custody seals to the bottles. Place the seal over the cap of the bottle and down both sides in such a way that, if the cap is unscrewed, the seal will be broken.

Cooler Numbers

ADQM personnel may instruct the laboratories to write cooler numbers on coolers and associated COC forms containing samples to be analyzed for volatiles (e.g., label attached with cooler number or cooler number written directly on cooler).

Special Requests/Concerns

Field personnel should use comment section of the COC for special requests/concerns such as “analyze within 7 days” and “high field PID readings.”

DuPont Sample Numbering Scheme for Locus EIM				
Updated 11/02/2012				
Samples in EIM must be unique across a site so the following schemes will be used.				
Environmental Sample Scheme				
EEEEEE-LLLLLLLLLL[-CCCC][-DDDDD][-A]				
Elements in brackets are optional. Include dashes if used. Sample numbers must remain unique.				
Event (E6) - 6 characters. See Event Abbreviations below for valid values and format)				
Location name (L10) - up to 10 characters to indicate sample location.				
Code (C4) – OPTIONAL; up to 4 characters. See Code Abbreviations below for valid values and format)				
Depth (D5) – OPTIONAL; up to 5 characters (See Depth Code Format Examples)				
Reserved for ADQM (A1) – OPTIONAL; Reserved for ADQM use only to further differentiate samples if necessary.				
These plus hyphens = a total of 30 characters, if all pieces fully utilize the allotted amount.				
A “real life” example sample ID might be: RI0912-SWMU163-04-ZD-124.0				
for a dissolved dup soil sample at 124 feet, collected at SWMU163-04 during the September 2012 remedial investigation event.				
Blank Sample Scheme				
BB-MMDDYY[-A]				
Elements in parentheses are optional. Sample numbers must remain unique.				
Blank sample type (B) - EB, FB, TB or SB				
Date (MMDDYY) - Date in MMDDYY format - 6 characters				
Sequence code (A) - Sequence code for multiple samples on same date; e.g. A, B, C)				
In the following discussion about two digit years the following convention will be used.				
YY=51-99	Convention is 1951-1999			
YY=00-50	Convention is 2000-2050			
Event Abbreviation List (2 chars)				
Code	Description	Code Abbreviation List (4 chars or 1 char multiples)		
AA	Ambient Air Sampling	ACR	A	Acryline/Acrylonitrile Sample
BG	Biological Sampling	COMP	C	Composite Sample
BI	Biota Sampling	DIS	Z	DiZZolved Sample
DG	Discharge to Groundwater Permit Sampling	DUP	D	Duplicate Sample
DW	Drinking Water Sampling	MS	M	Matrix Spike Sample
EF	Effluent Sampling	MSD	S	Matrix Spike Duplicate Sample
GW	GW Monitoring Project Sampling	Blank Sample Abbreviations (2 chars)		
HS	Hygiene Sampling	Code	Description	
IA	Indoor Air Sampling	EB	Equipment Blank	
IN	Investigation Sampling (alternate to Remedial Investigation)	FB	Field Blank	
LF	Landfill Sampling	TB	Trip Blank	
NP	NPDES Sampling	SB	Storage Blank	
NR	Non-routine Sampling	Date Abbreviation (4 chars, YY=2 digit year)		
P1	Phase 1 Investigation Sampling	Code	Description	
P2	Phase 2 Investigation Sampling	1HYY	1st Half	
P3	Phase 3 Investigation Sampling	2HYY	2nd Half	
P4	Phase 4 Investigation Sampling	1QYY	1st Quarter	
P5	Phase 5 Investigation Sampling	2QYY	2nd Quarter	
PA	Permit Application Sampling	3QYY	3rd Quarter	
PM	Permit Sampling	4QYY	4th Quarter	
PW	Pore Water Sampling	01YY	January	
PX	Post Excavation Sampling	02YY	February	
RI	Remedial Investigation	03YY	March	
SD	Sediment Sampling	04YY	April	
SG	Soil Gas Sampling	05YY	May	
SL	Sludge Sampling	06YY	June	
SR	Soil Reuse Sampling	07YY	July	
SS	Soil Sampling	08YY	August	
ST	Stormwater Sampling	09YY	September	
SW	Surface Water Sampling	10YY	October	
VI	Vapor Intrusion Sampling	11YY	November	
WC	Waste Characterization Sampling	12YY	December	
WT	Wetlands Sampling			
Depth Code Format Examples				
Code	Description			
124.5	Sample taken at TOP depth of 124.5 feet			
10	Sample taken at TOP depth of 10 feet			
A	Sample taken at first planned interval. Actual depths recorded in EIM depth fields.			
B	Sample taken at second planned interval. Actual depths recorded in EIM depth fields.			
Depth codes in the Sample ID are for field sampling convenience only.				
Actual TOP and BOTTOM depths and UNITS will always be recorded in the appropriate EIM data field for the sample.				
How do the depths get from the field into EIM?				

Appendix D

Low Flow Groundwater Sampling Protocol

Low Flow Groundwater Sampling Standard Operating Procedure Final Remedy Groundwater Sampling Towanda, PA

Introduction

The standard operating procedure (SOP) presents guidelines for purging monitoring wells and collecting groundwater samples for chemical analysis using low flow techniques. Low flow techniques allow samples to be collected with minimal alterations to water chemistry through low water-level drawdowns and low pumping rates, ideally less than 500 milliliters per minute (ml/minute).

Procedure

Equipment

The following equipment is needed for low flow purging/sampling:

- Extraction Device: Adjustable-rate, submersible or bladder pumps are preferred, but a peristaltic pump may also be used.
- Tubing: Tubing with an inner diameter of 1/4 inch or 3/8 inch is preferred because it will help ensure that the tubing remains liquid-filled when operating at very low pumping rates.
- Water Level Measuring Device: The device should be capable of measuring to 0.01-foot accuracy.
- Flow Measuring Supplies: The supplies must have a way to measure purge flow rate (i.e., a graduated cylinder and a stopwatch).
- Power Source: The power source is needed to run the pump (generator, battery, air source, etc.).
- Field Parameter Monitoring Instruments: Water Quality Meters to measure required field parameters are needed.
- Flow Cell: The cell must have openings in the cap for inserting meter probes, must have a volume of less than 1 liter (500 ml is preferred), and must be constructed to prevent air bubbles from becoming trapped in the cell. Certain types of water quality meters come with a flow cell made by the manufacturer.
- Decontamination Supplies: These supplies should include a non-phosphate detergent (Alconox) and de-ionized water.
- Sample Bottles: Bottles include ones for QA/QC samples (field blanks, equipment blanks, MS/MSDs, duplicate samples, etc.), along with any other necessary sampling supplies (filters, extra bottles, ice, labels, etc.).
- Paperwork: This should including a logbook, well location map, field data/notes from last sampling event, chains-of-custody, HASP, WMP, SOW, PSA, all required permits, and any other necessary forms or paperwork.
- Keys: These should include keys to unlock the wells, gates, chains, or any other locks that may need to be opened during the sampling event.
- PID: A Photo Ionization Detector may be needed to detect levels of VOCs.

Pre-Sampling Activities

A round of water level and total well depth measurements should be performed for all wells (in the shortest amount of time possible) before beginning any purging or sampling activities. During the round of water levels, it is also advisable to check for any problems that might interfere with the sampling event (and possibly require different or specialized equipment). These could include any damage to a well or well cap, overgrowth, treacherous site conditions (snow, ice, mud, etc.), or hard to reach locations.

At each well, before collecting any samples, it is important to fill out the field logbook with the site/job name, the date, the time of day, the well ID, the weather, the analyses to be sampled, the names of field personnel, and any other important observations. During purging and sampling, record all measurements and times (water levels, flow rates, purge start/stop time, sample time, field parameter measurements, PID measurements, etc.) in the field logbook.

Purging and Sampling Procedure

To prevent cross-contamination, wells should be sampled in order of increasing (least to most) contamination (known or anticipated) or as specified in the work plan:

1. Open the well cap – Be sure to watch out for pinch points and wear proper hand protection at all times. Immediately upon opening the well, measure the breathing zone and the inside of the well casing with a PID (if necessary). Record these measurements.
2. Install the pump – Attach the appropriate tubing to the pump and lower the pump, tubing and electrical line slowly into the well to the middle of the zone to be sampled. The pump intake should be kept at least two feet above the bottom of the well to minimize disturbance of particles that may be present at the bottom of the well. Secure the tubing to the outside of the well casing with rope or duct tape, if necessary, to ensure that the pump remains at the proper depth.
3. Attach a flow cell to the end of the tubing. Insert meter probes into the flow cell.
4. If a gasoline generator will be used to operate the pump, it should be placed downwind at least 30 feet away from the well, so as not to contaminate the samples with exhaust fumes.
5. Measure the water level – Do this before starting the pump.
6. Purge the well – Start the pump at its lowest setting, and slowly increase the speed until discharge occurs. The pumping rate should be reduced to the minimum capabilities of the pump. Collect discharge water into a bucket. Monitor and record the water level.
7. When the water level has stabilized, begin to monitor field parameters. The meter probes must be submerged in water at all times. Field parameter measurements should be taken every 3 to 5 minutes, making sure that an amount of water equal to at least three times the volume of the flow cell is discharged between each set of field parameter measurements. Record measurements in the field logbook.

Purging is considered complete (and sampling may begin) when the field parameters have stabilized. Stabilization occurs when at least three consecutive readings (taken at 3 to 5 minute intervals) are within the following limits:

- ~ Turbidity – Within 10% for values greater than 1 NTU
- ~ DO – Within 10%
- ~ Specific Conductance – Within 3%

- ~ Temperature – Within 3%
- ~ pH – ± 0.1 unit
- ~ ORP (Redox) – ± 10 millivolts

All discharge water must be collected and properly disposed (in accordance with the Waste Management Plan).

8. Collect samples – Remove the tubing from the flow cell before sampling (water to be collected for samples must not have passed through the flow cell). Put on a clean pair of gloves. Fill all sample bottles and all quality control sample bottles by allowing the pump discharge to flow slowly down the inside of the container with minimal turbulence. The sample bottles must be filled in the following order, which takes the volatilization sensitivity of groundwater samples into consideration:
 - Volatile Organics (VOC)
 - Purgeable Organic Carbons (POC)
 - Purgeable Organic Halogens (POX)
 - Total Organic Halogens (TOX)
 - Total Organic Carbon (TOC)
 - Base Neutrals/Acid Extractables
 - TPHC/Oil & Grease
 - PCBs/Pesticides
 - Total Metals
 - Dissolved Metals*
 - Phenols
 - Cyanide
 - Sulfate and Chloride
 - Turbidity
 - Nitrate and Ammonia
 - Preserved Inorganics
 - Radionuclides
 - Non-Preserved Inorganics
 - Bacteria

*Filter Samples (if necessary) – If dissolved samples are needed, the water must be filtered with an appropriate filter (0.45 μm is frequently used). Pre-rinse the filter with approximately 25 to 50 ml of groundwater before collecting the sample. Preserve the filtered water sample immediately.

9. For equipment that will not be dedicated to the well for future sampling events, use equipment blanks. At least 1 equipment blank is required for each day that non-dedicated equipment is used. The analytical laboratory that is performing the groundwater analysis will provide demonstrated analyte-free water. This water must be passed through the tubing and sampling equipment and collected. If sampling equipment is dedicated to a well for multiple rounds of sampling, no equipment blanks are required. In this case, if field conditions warrant, a field blank may be collected. Field blanks are collected by pouring analyte-free water directly into the sample bottle. The equipment

blank or field blank will be analyzed for all the same parameters as the groundwater samples. Note in the field book at which well the equipment or field blank was taken.

10. Fill out the chain-of-custody (C-O-C) for the sample. See the Chain-of-Custody Standard Operating Procedure for instructions on filling out a C-O-C.
11. Wells with a low recharge rate may become dewatered during purging. When this occurs, sample the well as soon as it has recovered sufficiently to produce enough water to fill the sample bottles. Calculate the recharge rate of the well by measuring how long (in ft/sec or ft/min) it takes for the water level to rise a set distance (0.1 ft or 1.0 ft). Multiply this by the appropriate conversion factor for the casing diameter of the well (0.163 gal/ft for a 2" casing, 0.653 gal/ft for a 4" casing) to get the recharge rate in gal/min. When the well has sufficiently recharged, samples may be collected even if the indicator field parameters have not stabilized.
12. Remove pump and tubing – After samples have been collected, the tubing may be dedicated to the well for the next sampling event (hang the tubing inside the well) or may be properly discarded.
13. Close the well – Make sure it is securely locked.

Decontamination

All non-disposable sampling equipment must be decontaminated prior to use in the first well and after each well is sampled. Use de-ionized water and a non-phosphate detergent solution (such as Alconox) for decontamination. Two-inch submersible pumps require at least a 10-gallon flush with de-ionized water during the decontamination procedure.

References

The following sources were used in developing this guideline:

DuPont CRG, April 2001, Standard Operating Procedure for Groundwater Well Purging Using Micro Purging Techniques, Guideline No. 1202a.

EPA Region 1, July 1996, Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, Revision 2.

EPA Region 2, Ground Water Sampling Procedure: Low Stress (Low Flow) Purging and Sampling.

NJDEP. January 1996 Draft, Low Flow Purging and Sampling Procedure for the Collection of Ground Water Samples.

NJ Department of Environmental Protection and Energy. May 1992, Field Sampling Procedures Manual.

Appendix E

Field Analysis Standard Operating Procedures

URS Diamond
Portable Water Analysis
Standard Operating Procedures
January 7, 1999
(Revised May 24, 2004)

Scope and Application

This standard operating procedure (SOP) is to ensure the proper use and calibration of portable water analysis equipment. Samples must be analyzed within 15 minutes of being collected.

Instruments:

pH

Method: EPA 150.1

Instrument: Orion Model 250A+ pH meter with pH electrode or equivalent.

Reagents: 4 and 7 buffer (10 buffer may also be used depending on the anticipated pH range of samples).

Calibration Procedure:

A two-point calibration must be performed. Document a description of the buffer solutions being used (manufacture, expiration date, date received, date opened). Place all buffer solutions in a clean plastic beaker. If a magnetic stirrer is available, place the beaker on a magnetic stirrer. Using a Teflon® coated stir bar, stir the sample gently to minimize the air transfer rate of the buffer. If a magnetic stirrer is not available, gently swirl the beaker or probe during the calibration.

Meter must be calibrated each day of use.

- 1) Place the electrode into pH 7 buffer. Use a sufficient volume of the buffer to cover the sensing elements.
- 2) Press **2nd**, then press the **CAL** key.
- 3) When the electrode is stable, ready will appear and the value for the buffer is displayed flashing. Record the actual value.
- 4) Press **YES**.
- 5) Rinse the electrode in deionized water and place the electrode into pH 4 (or pH 10) buffer.
- 6) When the electrode is stable, ready will appear and the value for the buffer is displayed flashing. Record the actual value.
- 7) Press **YES**.

- 8) The relative slope will be displayed with SLP.
- 9) Record the name of analyst, date, time of calibration, and slope in a bound field notebook.
- 10) The slope must be between 92 and 102. If it is not, recalibrate the meter. Document all attempts to calibrate the meter.
- 11) After several attempts to obtain a slope between 92 and 102 or, if it has taken longer than ten minutes to complete the calibration, the probe may need to be serviced or replaced. (see trouble shooting)
- 12) Place the probe in one of the buffers used to calibrate the meter.
- 13) Record the value in the field note book
- 14) Discard the buffer after using.

Samples will be collected into a clean plastic beaker. Gently swirl the beaker or probe during the measurement.

pH Measurement Procedure:

- 1) Calibrate the instrument as above, each day, before any samples are collected.
- 2) If the probe is used for longer than three hours, the pH 7 buffer must be checked. If the pH differs by more than ± 0.20 pH units the meter shall be re-calibrated.
- 3) Place the electrode into the sample using a sufficient volume to cover the sensing elements. Be sure to swirl or stir the sample.
- 4) Once the meter stabilizes, ready will appear on the screen.
- 5) Record the name of analyst, date, time of analysis, and value observed in a bound field notebook
- 6) Rinse the probe in deionized water before measuring the pH of another sample.

Storage:

Place the end of the probe into the storage cap filled with 4 buffer and one drop of Ag/AgCl filling solution.

Trouble-Shooting:

If the meter takes more than 5 minutes to calibrate or the slope is outside the acceptable range, the following trouble shooting steps should be taken:

1. Check the Ag/AgCl filling solution in the probe to make sure it is at least 3/4 filled, and make sure the hole on the top of the probe is open (if a refillable electrode).
2. If probe is a low maintenance triode, which has been in service for more than 6 months, discard the probe and replace it with a refillable pH electrode.
3. Check the buffer solution. Change the display to mV (press the mode key until the arrow on the display is above mV). Immerse the probe in 7 buffer, the value should be 0 mV \pm 30 mV. Rinse the probe with deionized water, then immerse the probe in

the other buffer. The value of 4 buffer should be +177mV (acceptable range 147 to 207) and 10 buffer should be -177mV (acceptable range -147 to -207).

If the temperature display on the pH meter is only reading 25°C (77°F) and you are sure that the temperature is fluctuating, remove and reinsert the temperature connection. If it still reads 25°C (77°F), the temperature sensor of the probe is broken, and the probe should be discarded.

Cleaning:

Rinse the probe with deionized water. Inspect probe for scratches, cracks or deposits. If there are scratches or cracks in the bulb, replace the probe. If the probe has deposits built up on the bulb, soak the probe in 0.1M HCL or 0.1M HNO₃ for half an hour. Then make a solution of household detergent and hot water. Vigorously stir the probe for 15 minutes. Rinse with deionized water and return to buffer solution. Retry calibration procedure.

If the calibration or pH measurement still continues to take greater than 5 minutes and trouble-shooting and/or cleaning do not fix the problem, discard the probe and obtain a new probe. Record in you meter box when the new probe was put into service.

Reference

1. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, p 150.1 1-3, Revised March 1983.
2. Portable pH/ISE Meters Instruction Manual, Orion Research Incorporated, 1991.

Dissolved Oxygen

Method: EPA 360.1

Instrument: Orion Model 830A or 835A Dissolved Oxygen Meter or equivalent.

Calibration Procedure:

- 1) Make sure the dissolved oxygen probe is clean and dry.
- 2) Insert the probe into the calibration chamber. Insure that the chamber is wet and has been given sufficient time to reach equilibrium (usually 10-15 minutes or when the measurement stops drifting).
- 3) Press the **CAL** key. **CAL** will display flashing above the AirCal prompt.
- 4) Press the **CAL** key again to activate the calibration process. The display will flash an hourglass while calibration is running.
- 5) Once calibration is complete, the calibration slope will be displayed.
- 6) Press the **CAL** key to accept the slope and return to measurement mode. Pressing the **MEAS** key will abort the calibration and reinstate the old calibration data.
- 7) Sign, date and record the slope in a bound field notebook. The slope must be between 60% and 120%. If it is not or if it has taken longer than 5 minutes to complete the calibration, the D.O. membrane may need to be serviced or replaced.

Dissolved Oxygen Measurement Procedure:

Samples will be collected into a clean plastic beaker. Gently swirl the beaker or probe during the measurement. Be sure to minimize the air transfer rate of the sample.

- 1) Calibrate the instrument as above, each day, before any samples are collected.
- 2) If the probe is used for longer than three hours, the meter should be re-calibrated.
- 3) Place the electrode into the sample using a sufficient volume to cover the sensing elements.
- 4) Press the **MEAS** key to access the measuring mode.
- 5) The meter will stabilize. The main display indicates the measured dissolved oxygen, and the secondary display shows the temperature.
- 6) Signature, date, time of analysis, and D.O. value must be recorded in a bound field notebook.
- 7) Rinse the probe in deionized water between uses.

Trouble-Shooting:

Various error messages may be displayed on the meter. The causes for each error message and the appropriate action that should be taken to correct the error message can be found in the instruction manual.

In order to test the accuracy of the Model 830 and 835 D.O. meters, a Winkler titration test is run every week as follows:

Method: EPA 360.2

Instrument: LaMotte Dissolved Oxygen Water Quality Test Kit
Winkler Titration, Azide Modification Test

Reagents: Manganous Sulfate Solution

Alkaline Potassium Iodide Azide
Sulfamic Acid Powder
Sulfuric Acid, 1:1
Sodium Thiosulfate, 0.025 N
Starch Indicator Solution
Spoon, 1.0 g, plastic
Direct Reading Titrator
Titration Tube, 20 ml glass, w/cap
Water Sampling Bottle, 60 ml, glass

Test Procedure:

1. Collecting the Water Sample:
 - Rinse the water sample bottle with the sample water.
 - Cap the bottle, and submerge it to the desired depth.
 - Remove the cap and allow the bottle to fill. Tap the sides of the bottle to remove any air bubbles.
 - Replace the cap while the bottle is still submerged.
 - Retrieve the bottle making sure that no air bubbles are trapped inside.

2. Adding the Reagents:
 - Remove the cap from the bottle.
 - Immediately add 8 drops of Manganese Sulfate Solution AND 8 drops of Alkaline Potassium Iodide
 - Cap the bottle and mix by inverting several times. A precipitate will form.
 - Allow the precipitate to settle below the shoulder of the bottle.
 - Immediately use the 1.0 g spoon to add one level measure of Sulfamic Acid Powder.
 - Cap and gently invert the bottle to mix the contents until the precipitate and the reagent have totally dissolved. The solution will be clear yellow to orange if the sample contains dissolved oxygen.

3. The Titration:
 - Fill the titration tube to the 20 ml line with the fixed sample. Cap the tube.
 - Depress plunger of the Titration Tube.
 - Insert the titrator into the plug in the top of the Sodium Thiosulfate, 0.025N titrating solution.
 - Invert the bottle and slowly withdraw the plunger until the bottom of the plunger is opposite the zero mark on the scale.
 - Turn the bottle upright and remove the titrator.
 - Insert the titrator into the opening of the titration tube cap.
 - Slowly depress the plunger to dispense the titrating solution until the yellow-brown color changes to a very pale yellow. Gently swirl the tube during the titration to mix the contents.
 - Carefully remove the titrator and cap. Do not disturb the titrator plunger.
 - Add 8 drops of Starch Indicator Solution. The sample should turn blue.
 - Cap the titration tube. Insert the tip of the titrator into the opening of the titration tube cap.

- Continue titrating until the blue color disappears and the solution becomes colorless.
- Record the test result where the titrator tip meets the scale. Record as ppm dissolved oxygen. Each minor division on the titrator scale equals 0.2 ppm.

To qualify as an EPA accepted test, and to achieve the greatest accuracy, the Sodium Thiosulfate Solution, 0.025N must be standardized quarterly following the procedures outlined in the LaMotte Dissolved Oxygen Water Quality Test Kit Instruction Manual.

References

1. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, p 360.1 1-2, Revised March 1983.
2. Models 835A and 830A Dissolved Oxygen Meters Instruction Manual, Orion Research Incorporated, 1999.
3. LaMotte Dissolved Oxygen Water Quality Test Kit Instruction Manual, pp 4-10, January 2001.

Specific Conductivity

Instrument: Orion Model 135A Conductivity Meter or equivalent.

Method: EPA 120.1

Reagents: At least 5 different conductivity standards. Use 1413 $\mu\text{S}/\text{cm}$, and usually 10 $\mu\text{S}/\text{cm}$, 100 $\mu\text{S}/\text{cm}$, 1000 $\mu\text{S}/\text{cm}$, and 10,000 $\mu\text{S}/\text{cm}$ are used.

A temperature-specific conductivity standard table (specific for each calibration standard used) is also needed.

Calibration Procedure:

Place the 1413 $\mu\text{S}/\text{cm}$ standard solution (or another standard if 1413 $\mu\text{S}/\text{cm}$ is not available) into a plastic beaker. Document a description of the standard solution being used (manufacture, expiration date, date received, date opened). Care should be taken to use fresh conductivity standards and to prohibit impurities from getting into the solutions.

- 1) Immerse the probe into the 1413 $\mu\text{S}/\text{cm}$ standard solution using a sufficient volume to cover the sensing elements.
- 2) Press **cal** key to activate calibration.
- 3) Press the **cal** key again to confirm the 0.01-mol/KCL level for the 1413 $\mu\text{S}/\text{cm}$ standard.
- 4) During calibration the lower line indicates the temperature. The automatic drift check measures the stability of conductivity and temperature. The hourglass flashes during this automatic drift check.
- 5) When the measured values are stable, the temperature-compensated table value of the KCL solution is displayed. The measured conductivity value flashes.
- 6) Confirm it with the **cal** key.
- 7) The determined cell constant is displayed for a few seconds, then the meter switches back to measuring mode.
- 8) Record signature, date, time of calibration, and final measurement of the standard solution in a bound field notebook.
- 9) If a solution other than 1413 $\mu\text{S}/\text{cm}$ is used, when the measured conductivity value flashes (after Step 5 above), find the conductivity value which belongs to the displayed measuring temperature on the table included with the calibration solution. Set the temperature-compensated conductivity in the meter using the **▲** and **▼** keys, then confirm it with the **cal** key.

Monthly, a 3-point calibration should be performed. Follow the above steps for calibration. Then, record in a bound field notebook the value of the cell constant and the value the meter reads when the probe is in the 1413 $\mu\text{S}/\text{cm}$ standard solution. Place the probe into two other standard solutions (rinsing with deionized water and drying the probe between each solution). Record the value of the standard and the actual value that the meter reads in a bound field notebook. If the actual meter readings are far from the standard values, the probe may need to be serviced or replaced. When a new probe is put into service, or if a probe appears to be having trouble, a 5-point calibration should be done. Follow instructions for the 3-point calibration, but use 5 standards, recording all standard and actual values in a bound field notebook.

Conductivity Measurement Procedure:

Samples will be collected into a clean plastic beaker for measurement.

- 1) Calibrate the instrument as above, each day, before any samples are collected.
- 2) If the probe is used for longer than three hours, the meter should be re-calibrated.
- 3) Place the electrode into the sample using a sufficient volume to cover the sensing elements.

- 4) The meter will stabilize within 2 minutes.
- 5) Signature, date, and time of analysis must be recorded in a bound field notebook.

Rinse the probe in deionized water between uses.

Trouble-Shooting:

If a measured value lies outside the ranges accepted by the meter, an error message appears and measured value display flashes. A table listing each error, possible causes, and the appropriate action(s) that should be taken to correct the error can be found in the instruction manual.

Reference

1. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, p 120.1 1-3, Revised March 1983.
2. Models 128, 130 and 135 Conductivity Meters Instruction Manual, Orion Research Incorporated, 1995.
3. Models 135A and 136S Conductivity Meter Instruction Manual, Orion Research Incorporated, 1999.

Chlorine, Residual Disinfectant

Instrument: Hach Pocket Colorimeter or equivalent.

Method: SDW 4500 CL-G /WPP-330.5

Reagents: DPD Free Chlorine Reagent Foil Pillows

DPD Chlorine Secondary Standards – blank, 0.20 ± 0.09 mg/l Chlorine, 0.83 ± 0.10 mg/l Chlorine, 1.51 ± 0.11 mg/l Chlorine

Calibration Procedure:

Document a description of the standard solution being used (manufacture, expiration date, date received, date opened).

Initial Standard Value Determination (Instrument Specific):

- 1) Place the sample blank in the cell compartment and cover with the instrument cap; wipe off any moisture on the outside of the blank vial.
- 2) Press **ZERO** key. After approximately 2 seconds, the display will read 0.00.
- 3) Place the first standard (0.20 ± 0.09) in the cell compartment.
- 4) Press the **READ** key. Record the instrument reading. The reading should be within the tolerance limits listed above as specified on the Certificate of Analysis (included in secondary standards kit).
- 5) Record the actual value obtained on the Certificate of Analysis and on the standard in the area provided.
- 6) Repeat steps 3-5 for all standards.

After the initial standard value determination, the instrument must be calibrated each day of use for all standards.

Chlorine Measurement Procedure:

- 1) Fill a clean sample cell with 10 ml of untreated sample.
- 2) Clean the outside of the sample cell with an alcohol wipe.
- 3) Place the sample blank in the cell compartment and cover with the instrument cap.
- 4) Press the ZERO key. After approximately 2 seconds, the display will read 0.00.
- 5) Remove the blank from the cell compartment, and add the contents of one pillow of DPD Chlorine Reagent to the untreated 10 ml sample.
- 6) Cap and gently shake the cell for 20 seconds.
- 7) Clean the outside of the sample cell with an alcohol wipe.
- 8) Place the sample cell containing the prepared sample into the cell compartment and cover with the instrument cap.
- 9) Press the **READ** key. The display will read the chlorine results in milligrams per liter.
- 10) Signature, date, and time of analysis must be recorded in a bound field notebook.

Trouble-Shooting:

Make sure that all reagents are not out of date. Expired DPD free chlorine reagent pillows and calibration standards can skew test results.

Reference

1. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, p 330.5 1-3, Revised March 1983.
2. Pocket Colorimeter Chlorine (Cl₂) Instruction Manual, Hach Company, 1995.

Turbidity

Instrument: Cole Parmer Model 8391-50 Turbidity Meter or equivalent.

Method: EPA 180.1

Reagents: 0.1, 10, and 20 NTU primary standard

This method is applicable for turbidity in the range of 0 to 40 nephelometric turbidity units (NTU). Samples with higher turbidity values may be diluted to within the acceptable range.

Calibration: (Follow the manufacturer's operating instructions).

Document a description of the standard solutions being used (manufacture, expiration date, date received, date opened).

- 1) Clean the cuvette filled with primary standard with an alcohol wipe. Any one of the primary standards above should be used.
- 2) Place the cuvette into the test well and cover with the light shield.
- 3) Adjust the **CAL** control to set the display to the recorded value.
- 4) Signature, date, standard used, and time of analysis must be recorded in a bound field notebook.

Turbidity Measurement Procedure:

- 1) Calibrate the instrument and perform necessary QA/QC analyses (LRB, IPC, CB).
- 2) Completely fill sample Turbidity cuvette with sample (rinse the cuvette twice with the liquid to be tested).
- 3) Gently swirl the sample, to thoroughly disperse the solids.
- 4) Clean the outside of cuvette with an alcohol wipe.
- 5) Align the sample cuvette in the Turbidity meter after the air bubbles disappear.
- 6) Set the range 0-20 NTU (or higher if needed). Read and record the turbidity.
- 7) Signature, date, time of analysis, and all QA/QC analyses must be recorded along with the turbidity in a bound field notebook.

Quality Assurance / Quality Control (QA/QC):

In order to assess the levels of contamination coming from the laboratory, at least one Laboratory Reagent Blank (LRB) must be analyzed with each batch of samples. The LRB should be treated exactly as a sample would be treated (coming into contact with all the same equipment, solvents, reagents, etc.).

Both an Instrument Performance Check Solution (IPC) (a mid-range check standard) and a Calibration Blank (CB) must be analyzed immediately following daily calibration, after every ten samples, and at the end of sampling each day. Every analysis of the IPC and CB must verify that the turbidity meter is within $\pm 10\%$ of calibration. If it is not within $\pm 10\%$, stop sampling, troubleshoot the problem, and recalibrate the meter if necessary. All samples taken since the last acceptable IPC and CB analysis must then be reanalyzed.

Keep the analysis data of the LRB, the IPC and the CB in the field book with the sample data.

Trouble-Shooting:

Make sure that primary standards are not out of date. Expired standards can skew calibration results. Be sure to wipe excess moisture from the outside of the sample vial. Moisture build up on the sample cuvette can negatively affect test results. Be sure to properly charge the turbidity meter, especially after periods of extended use.

Reference

1. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020, p 180.1 1-4, Revised March 1983.
2. Turbidimeter Models 8391-40/8391-45, 8391-50/8391-55 Instruction Manual, Cole-Parmer Instrument Company, 1997.
- 3.

Redox

Instrument: Orion Model 250A meter with a Redox electrode.

Calibration Procedure:

Make a standard solution of two ounces of Iodine with sixteen ounces of distilled water. Place standard in a clean plastic beaker.

- 1) Set the function switch to the millivolt mode.
- 2) The solution should be at room temperature.
- 3) Place the electrode into Iodine solution. Use a sufficient volume of the standard to cover the sensing elements.
- 4) When the electrode is stable, ready will appear and the value for the standard is displayed.
- 5) The meter should read 447mV; +/- 1.6 mV
- 6) Rinse the electrodes in deionized water.
- 7) Sign, date and record the reading in a bound field notebook.
- 8) If it is not in range or it has taken longer than ten minutes to obtain a reading, the probe may need serviced or replaced.
- 9) Discard the solution after using.

Samples will be collected into a clean plastic beaker and placed on a magnetic stirrer. Using a Teflon® coated stir bar, stir the sample gently to minimize the air transfer rate of the sample.

Redox Measurement Procedure:

- 1) Calibrate the instrument as above, each day, before any samples are collected.
- 2) If the probe is used longer than three hours, the meter shall be referenced with the solution.
- 3) Place the electrode into the sample using a sufficient volume to cover the sensing elements.
- 4) Once the meter stabilizes, 'ready' will appear on the screen along with the value of the sample.
- 5) Sign, date and record the value in a bound field notebook.
- 6) Rinse the probe in deionized water between samples.

Reference

1. Portable Platinum Redox Electrode Instruction Manual, Orion Research Incorporated, 1997.

Appendix F

DuPont Electronic Data Deliverable (EDD) Format

DuPont Standard EIM EDD Format

Revisions to DuPont Standard EIM EDD Format Dated 7/30/13

Field 12, METHOD_DETECTION_LIMIT – description has been clarified to report MDL only for MDL projects. Leave MDL field null for TICs and PQL projects.

Revisions to DuPont Standard EIM EDD Format Dated 2/4/2013

Under General EDD Information, an example has been added to 1.b to clarify the statement.
Field 7, PARAMETER_CODE – description has been updated to more fully explain how TICs are to be reported.
Field 9, LAB_RESULT – description has been updated.
Field 16, LAB_QUALIFIER – description has been updated (EDD and lab report must match).
Field 32, FILTERED_FLAG – description has been updated (applies to filtered either in field or lab)
Field 39, SAMPLE_DATE – description has been updated (applies to both field and lab generated samples)

Introduction

The DuPont Corporate Remediation Group (CRG) maintains a corporate environmental database that stores field data, analytical results, QA/QC results, water levels, and other information resulting from the activities of DuPont environmental projects. Much of this data is provided by analytical labs or sampling contractors performing analytical and sampling services for DuPont. DuPont has implemented the Locus Environmental Information Management (EIM) system as the corporate database. To optimize loading data generated by these contractors, an EDD file format has been developed for importing laboratory analytical data into the Locus EIM database. Following is a description of the Locus EIM EDD specification (EIM EDD) for DuPont contractors.

General EDD Information

In general, EIM EDDs will be uploaded by the laboratory that does the sample analysis. Locus EIM user accounts and training will be provided to laboratories. The EIM EDD must match the hardcopy report in terms of samples, tests, analytes, and results. Also, DuPont generally requires the lab composite results such that only one result is reported for each analyte (i.e., the lab submits only the result judged best when a sample is re-analyzed for particular analytes due to exceeding calibration range, etc.). However, there may be cases where regulations require results from all runs be submitted. These cases will be specified by the project chemist during project setup.

Normally, all data for a particular sample delivery group will be contained in one file. This group is normally referred to as a lot (or group), which makes up a normal reporting/invoicing group and usually consists of samples for a given project and site that the lab has received in one day, including all

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associated QC samples and results. Note that QC results may be contained in more than one EDD if field samples from different lots were analyzed in the same QC batch.

Samples taken for matrix spike/matrix spike duplicates (MS/MSD) and laboratory replicates (REP) are QC samples that have field samples, and are subject to the following controls:

1. If the field sample is from DuPont and is in the current lot for the current project, then:
 - a. The parent or un-spiked sample and result information should be included in the EIM EDD and;
 - b. The FIELD_SAMPLE_ID for the MS, MSD, and REP samples should be included for those records. If the DuPont sample is used as the parent for the MS/MSD/REP, the field sample ID must be the same as parent sample ID. There should be no MS, MSD, or REP in the FIELD_SAMPLE_ID. For example, for an MS sample, the FIELD_SAMPLE_ID must be NR0513-LHWABLDG (same as parent) not NR0513-LHWABLDG-MS.
2. If the parent field sample is not from a DuPont site, or is from a DuPont site but not the current site and project, then:
 - a. The field sample and result should not be included, and;
 - b. The FIELD_SAMPLE_ID must be null for the MS, MSD, and REP samples, but these QC samples must have the ORIGINAL_LAB_RESULT result as per the spec.
3. Lab originated (QA/QC) samples such as lab control spikes or method blanks should not have a FIELD_SAMPLE_ID populated in the edd.

QA/QC results involving relative percent recoveries and relative percent differences, e.g. MS/MSDs, REPs, lab control spikes and lab control spike duplicates (LCS/LCSD), and surrogates must also include these recoveries and differences plus the maximum and minimum recoveries and differences that are acceptable, as applicable. For example, an MS sample requires a result, the relative percent recovery, and the maximum and minimum permissible relative percent recovery. An MSD sample requires a result, the relative percent recovery, the relative percent difference, the maximum and minimum permissible relative percent recovery, and the maximum permissible relative percent difference.

EDD Specification Details

The following list outlines the requirements associated with generating EDDs for DuPont's implementation on Locus' EIM system.

- The EDD must be an ASCII file with no header or footer.
- Each record must be alike with respect to format.
- Every analytical result is represented by a single record.
- The record format of the EDD is positional and therefore, each field must be listed in the order specified in Table 1.
- The length of each field must not exceed the width specified in the "Length" column of Table 1, or the data will be truncated.
- Every field must be separated by a semi-colon.
- Null or blank fields must be delimited.
- Each record (last record excluded) must be terminated with a carriage return.

- Required fields are indicated in **bold** in Table 1.
- Non-required fields may be populated depending on the project circumstances, or the particular data being reported. These requirements are described in Table 1 in the “Field Contents” column and in footnotes at the bottom of table.
- The column titled “VVL” represents if a data field contains lookup valid values. These values are provided in the valid value attachment and can be accessed in EIM through your Lab View.
- No data in any field in the EDD should be enclosed in quotation marks.

Table 1: The EDD record format is defined as follows:

Table 1. DuPont EIM EDD format				
Field	Field Name	Length	VVL	Field Contents
1	SITE_ID	10	Yes	Identification ID assigned to the project site in EIM. Has list of values. This will be supplied by the project chemist.
2	<i>FIELD_SAMPLE_ID</i>	C30	No	Field Sample number or identifier. Must be left blank for lab-originated samples (e.g., lab control samples, method blanks, blank spikes, etc.). Should be populated for lab duplicates and matrix spikes and duplicates (if the sample that is spiked is the client sample).
3	LAB_ID	C10	Yes	Code or identifier for a lab. Has list of values. This will be supplied by the project chemist.
4	ANALYTICAL_METHOD	C30	Yes	Analytical method used. Has list of values.
5	ANALYSIS_DATE	Date	No	Date of analysis, MM/DD/YYYY.
6	ANALYSIS_TIME	Time	No	Time of analysis (HH:MM), military time.
7	PARAMETER_CODE	C12	Yes	Analyte CAS Number or other code (for those parameters that do not have a CAS Number). Has list of values. For TICs (RESULT_TYPE_CODE = TIC): <ul style="list-style-type: none"> • If a positive identification is not made (e.g., Unknown), use “TIC” for PARAMETER_CODE and report PARAMETER_NAME, concentration and retention time as appropriate. • If a positive identification for a TIC is made, use the CAS Number of the identified constituent and report PARAMETER_NAME, concentration and retention time as appropriate. • If no TICs are found, use “NOTICS” for the PARAMETER_CODE, “No TICs Found” as PARAMETER_NAME, “NA” for RETENTION_TIME (Field17) and “ND” for LAB_RESULT (Field 9). • If reporting a Targeted TIC, use EVS number (CASNO created by DuPont) for PARAMETER_CODE. Report parameter name as compound (targeted TIC). Example ALLYL ALCOHOL (Targeted TIC). If compound not detected enter “NA” in RETENTION_TIME (Field17) and “ND” in LAB_RESULT (Field 9). If compound detected, report concentration and retention time as appropriate. RESULT_TYPE_CODE should be set to “TRG”.
8	RESULT_TYPE_CODE	C5	Yes	Code identifying the type of result (TIC, SU, SPK, etc.).

Table 1. DuPont EIM EDD format				
Field	Field Name	Length	VVL	Field Contents
				Has list of values.
9	LAB_RESULT	C10	No	Analytical result. Required of all samples except surrogates and spikes. If not detected, enter the laboratory reporting limit here (MDL or PQL as appropriate). If detected above the MDL and below the reporting limit, enter the result in this field and a "J" in LAB_QUALIFIER. Laboratory will only report one result per sample per parameter unless otherwise instructed by client. Refer to description for Field 7, PARAMETER_CODE for reporting results for TICs.
10	DETECT_FLAG	C1	Yes	Coded value (Y or N) indicating whether an analyte was detected in the sample. Required all analytical results.
11	LAB_UNITS	C10	Yes	Unit of measure of the result. Has list of values. Enter the units associated with the entry in the LAB_RESULT or SPIKED_RESULT column.
12	METHOD_DETECTION_LIMIT	C10	No	Method detection limit. For PQL projects and TICs, leave null. Required for all non-spiked samples for MDL projects.
13	LAB_REPORTING_LIMIT [LAB_DETECTION_LIMIT] – Column Name in EIM	C10	No	Actual reporting limit (i.e., PQL) realized by the lab, adjusted for preparation, dilution, etc. Required for all non-spiked samples. For TICs leave NULL.
14	LAB_MATRIX	C10	Yes	Matrix of sample as analyzed by the lab. Has list of values.
15	LAB_SAMPLE_ID	C20	No	Internal ID assigned by lab to a sample.
16	LAB_QUALIFIER	C10	No	Laboratory qualifier. Qualifier must match lab report. If a laboratory qualifier is entered in the EDD, this qualifier must also appear in the laboratory report, and visa versa.
17	RETENTION_TIME	Time	No	Retention time (MM:SS), required for TICS only. For others enter NA or leave blank.
18	DILUTION_FACTOR	C7	No	Dilution factor if the sample was diluted.
19	PREP_METHOD	C20	No	Preparation method (if applicable).
20	PREP_DATE	Date	No	Date of preparation MM/DD/YYYY (if applicable).
21	PREP_TIME	Time	No	Time of preparation HH:MM (if applicable).
22	ANALYSIS_LOT_ID	C20	No	Laboratory analysis batch number or ID.
23	INSTRUMENT	C20	No	Lab defined identifier for instrument on which analysis was performed.
24	PREP_AMOUNT [INITIAL_PREP_AMOUNT] – Column Name in EIM	C10	No	Amount of sample used in the preparation.
25	PREP_UNITS [INITIAL_PREP_AMOUNT_UNITS] Column Name in EIM	C10	Yes	Unit or measure of sample preparation amount. Has list of values (Lab_Unit valid values).
26	PREP_AMT_BASIS	C5	No	The basis of the weight of the amount of the sample prepared: W or D are the only valid values.
27	SAMPLE_DELIVERY_GROUP	C20	No	Laboratory sample delivery group (i.e., lot).

Table 1. DuPont EIM EDD format				
Field	Field Name	Length	VVL	Field Contents
28	LAB_BLANK_SAMPLE_ID	C20	No	ID of laboratory method blank that is associated with the sample identified in the FIELD_SAMPLE_ID and/or LAB_SAMPLE_ID fields. Can be left blank if only one method blank is run with a given prep or analysis lot.
29	ERROR	C10	No	+/- 2-sigma error (pertains to radiological results only)
30	PARAMETER_NAME	C60	No	Name of parameter. Any correct synonym is acceptable. TICs may have values such as Unknown, Long Branch Alkane, etc. If no TICs found, report "No TIC Found".
31	ANALYSIS_TYPE_CODE	C5	Yes	Coded value specifying type of analysis (e.g., Initial, Reanalysis, Re-extraction, Dilution, etc.). Has list of values. INIT is most common type.
32	FILTERED_FLAG	C1	Yes	Flag to identify whether sample was filtered in the field or by the lab. The only valid values are Y or N.
33	LEACHED_FLAG	C1	Yes	Flag to identify whether sample was leached prior to being analyzed. The only valid values are Y and N.
34	LEACHATE_METHOD	C20	Yes	Method used to leach a sample (if applicable).
35	LEACHATE_DATE	Date	No	Sample leachate date MM/DD/YYYY (if applicable).
36	LEACHATE_TIME	Time	No	Sample leachate time (if applicable) HH:MM, military time.
37	SAMPLE_PREP_LOT_ID	C20	No	Laboratory prep lot number or ID (if applicable).
38	LEACHATE_LOT_ID	C20	No	Laboratory leachate lot number or ID (if applicable)
39	SAMPLE_DATE	Date	No	Date sample was collected (field sample) or created in the lab (lab generated QC samples): MM/DD/YYYY
40	SAMPLE_PURPOSE	C5	Yes	Coded value identifying purpose of the sample. (e.g., regular sample, Lab Control Samples, Lab Control Sample Duplicates, Method Blanks, Lab Duplicates or Replicates, etc.) or lab-transformed samples (e.g., Matrix Spikes and Duplicates). Has list of values.
41	ORIGINAL_LAB_RESULT	C10	No	The concentration of the analyte in the original (unspiked) sample. Should be populated only for matrix spikes and duplicates (MS, MSD, and REPs).
42	SPIKE_ADDED	C10	No	Amount of spike added to sample. Applicable only to spiked samples or surrogates.
43	SPIKED_RESULT	C10	No	Concentration of the analyte in the spiked sample. Applicable only to spiked samples or surrogates.
44	SPIKE_RECOVERY	C10	No	Percent recovery. Applicable only to spiked samples or surrogates.
45	RPD	C10	No	Calculation of relative percent difference (applicable only to matrix spike duplicates, lab control sample duplicates, and lab replicates or duplicates).
46	RPD_LIMIT	C10	No	Upper limit for RPD (percent) (applicable only to matrix spike duplicates, lab control sample duplicates, and lab replicates or duplicates).
47	UPPER_LIMIT	C10	No	Upper spike recovery control limit (in percent). Applicable to surrogates or spiked samples only.
48	LOWER_LIMIT	C10	No	Lower spike recovery control limit (in percent). Applicable to surrogates or spiked samples only.

Table 1. DuPont EIM EDD format				
Field	Field Name	Length	VVL	Field Contents
49	<i>LAB_ARRIVAL_DATE</i> [LAB_RECEIPT_DATE] - Column Name in EIM	Date	No	Date that the sample arrived at the lab (mm/dd/yyyy). Required for field samples only.
50	<i>LAB_ARRIVAL_TIME</i> [LAB_RECEIPT_TIME] - Column Name in EIM	Time	No	Time that the sample arrived at the lab (HH:MM). Required for field samples only.
51	HARD_COPY_DUE_DATE	Date	No	Hardcopy lab report due date.
52	RUSH_TAT	C1	No	Specify if sample was submitted as "Rush" – valid values for this field are Y and N.
53	EDD_DUE_DATE	Date	No	Date (mm/dd/yyyy) the EDD (electronic data deliverable) is due.
54	SUBCONTRACT [ANALYSIS_SUBCONTRACTED_FLAG] – Column Name in EIM	C1	No	Enter Y (Yes) if analysis was performed by a subcontractor lab. Otherwise, field can be left blank. The only valid values are Y or NULL.
55	SUBCONTRACT_LAB_ID	C10	Yes	Code or identifier for the subcontract lab. Has list of values. Prior approval is required by client to use subcontract lab. Client will provide Subcontract_Lab_ID.
56	LAB_REPORTING_LIMIT_TYPE	C10	Yes	Coded value identifying the type of reporting limit (e.g., practical quantitation limit, method detection limit, etc.). Only valid values are PQL or MDL.
57	BASIS	C3	Yes	Basis for reporting the result. Only valid values are W, D, or N.
<p>Notes:</p> <p>a. Fields in Bold Regular font are required for all records (e.g., LAB_ID).</p> <p>b. Fields in Italic font are required for various subsets of samples and/or analyses.</p> <p>c. Fields In Regular font are optional.</p>				

Appendix G

DuPont DDR Process

In-House DuPont Data Review (DDR) Process

A Description of Electronic Data Deliverable (EDD) and Hardcopy Deliverables Received from the Laboratory

The DuPont Corporate Remediation Group (CRG) uses a pre-selected group of commercial laboratories to provide environmental analytical support services. One of the key capabilities of these laboratories is to have internal operational and data structure capability based on the Resource Conservation and Recovery Act (RCRA) or SW846 quality control batch concept [versus the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program model]. DuPont receives hardcopy and electronic diskette deliverables from the laboratories for each sample group or lot. There may be one or more lots in an “analytical program.” These programs are typically subsets of a remediation project and are based on logical sampling events associated with a particular project.

Key components for a laboratory deliverable set are as follows: samples by project or sampling event, test results by sample, parameters by test (may vary by sample as well), and reporting thresholds by parameter by test.

The deliverables are also characterized by quality control test results reported for each quality control (QC) batch element associated with an appropriate set of sample results. The QC batch elements reported in deliverables include the following: method blank (MB), laboratory control spike (LCS), laboratory control spike duplicate (LCSD), sample matrix spike (MS), sample matrix spike duplicate (MSD), and sample matrix replicate (REP). Measures of accuracy are represented by percent recovery (%R), and measures of precision are represented by relative percent difference (RPD) for spike duplicates or REPs. Sample QC results reported in the deliverables include surrogate standard (SS) recovery.

DuPont generally requires for each deliverable that “each QC batch must include a measure of accuracy and precision for the associated samples in the batch; and these measures preferably should come from the representative sample matrix.” Percent recoveries (%Rs), the measure of accuracy, are measured in the sample matrix from the matrix spike (MS) or the laboratory control spike (LCS). Relative Percent Differences (RPDs), the measure of precision, are measured from the MS and Matrix Spike Duplicate (MSD), laboratory replicates, or LCS and laboratory control spike duplicate (LCSD) pairs. The method blank (MB) must be reported for all parameters in the associated samples and must be less than the practical quantitation limit (PQL) for each parameter. Acceptance criteria for %Rs and RPDs are method dependent and are supplied by the laboratory with each deliverable for review purposes only. The default requirement is that batch QC is performed on a DuPont project-specific basis, which means the batch QC will be performed on samples collected from the project, and that the sample collection effort will have to include additional sample material. Exceptions, based on individual project needs, are DuPont sample QC (same nominal matrix but sources limited to DuPont sites) and generic method QC (same nominal matrix but different client source).

The Locus EIM™ database architecture uses a QC batch identifier derived from laboratory operations (in contrast to an alphanumeric code or other “social security number” type convention). Six fields in the analysis and results records are concatenated to form the unique “batch identifier.” These are pre-prep method (e.g., 1310, 1311, and 1312), prep method, analytical method, batch start date (to accommodate multiple batches on the same day), batch no. (assigned by the laboratory), and instrument identifier (samples and batch QC must be performed on a single instrument).

Field QC elements, such as trip blank (TB), field blank (FB), and equipment rinsate blank (EB), are treated as field samples.

Method QC information, (e.g., calibration information, internal standard recoveries, instrument tunes, etc) is not included in the Locus EIM™ deliverables specification.

Certain field-specific sample types are identified through the sample naming convention. These include field duplicates, field specified samples for composites, duplicates, aqueous samples field filtered for “dissolved metals,” and aqueous samples unpreserved with acid and intended for separate assay for acrolein and acrylonitrile.

Hardcopy and electronic formats include batch QC element results in addition to sample results. The laboratory establishes significant figure conventions for reporting results. Reporting thresholds are normally based on either method detection limit (MDL) or practical quantitation limit (PQL) conventions.

Chemical Abstracts Registry numbers (CAS Nos.) are used to establish a common nomenclature base for synonyms. Arbitrary numeric codes are established by DuPont to fill CAS No. data fields for non-chemical based parameter names (e.g., for pH and alkalinity)

Basic Elements and Flow of the DuPont CRG Analytical Data Review Process

The DuPont CRG has a centralized staff to provide analytical planning and liaison functions. The group, known as the Analytical Data Quality Management Group (ADQM), also performs an in-house quality control review of all data received from laboratories.

The objective of the DuPont data evaluation process is to determine if the project defined data quality objectives (DQOs) for precision, accuracy, representativeness, comparability, completeness, and usability are met. Data qualifiers are assigned, as appropriate; to specifically indicate data points that do not meet stated DQOs. Field parameters, such as pH, specific conductance, redox, dissolved oxygen, and temperature, are not typically evaluated for accuracy, precision, and representativeness. Field parameter tests do not include quality control samples related to the data quality characteristics; however, field system audits can provide a level of quality control assurance for the parameters.

The DuPont Data Review (DDR) is an internal review process used by the ADQM group to assist with the determination of data usability. The electronic data deliverables received from the laboratory are loaded into the Locus EIM™ database and processed through a series of data quality checks, which are a combination of software (Locus EIM™ database Data Validation Module (DVM)) and manual reviewer evaluations.

The review process includes comparing available laboratory data deliverables (hardcopy and EDD) versus the original project specifications, examining the completed chain of custody, thoroughly reviewing the Laboratory Case Narrative and deliverables as appropriate, and using the DVM during the data evaluation. Data qualifiers are applied as described in the following section, and corrective action is initiated as appropriate.

ADQM analytical project QC review is assigned to a technically qualified chemist or scientist, with the assistance from administrative support staff and database management staff, as needed.

The initial step following receipt of deliverables from the laboratory is to complete a preliminary administrative inventory. EDDs are loaded by the laboratory into the Locus EIM™ database and the analytical laboratory report is loaded to an electronic drop box. The deliverables are inspected to ensure that the assigned program name and work location are correctly assigned to the deliverables. When a set of project data is complete, the review process continues.

The EDD data are listed and compared in content to the hardcopy version supplied by the laboratory. Inconsistencies are communicated to the laboratory and corrected. This step is referred to as the accuracy check. Accuracy checks are normally performed on all deliverables from laboratories new to the DuPont program; on any laboratories that have recently implemented a new data management system; and on a percentage of routine deliverables submitted by veteran laboratories.

A completeness check involves a review to determine if all samples submitted were processed at the laboratory for desired test parameters. In the present form, this is a manual software assisted process. Again, inconsistencies are communicated to the sampling team and/or laboratory for resolution.

Appropriateness of deliverables is reviewed with assistance of a series of diagnostic software queries called the “Backstop.” The electronic deliverables are reviewed to ensure that correct dates and times of sample collection have been entered, that QC batch integrity requirements are met for sample tests, that no duplicate records are present, that QC acceptance criteria exceptions are adequately documented, that tentatively identified compound listings are consistent, and that reported results have been properly entered.

The DDR phase of the review process is performed by the chemist using software (see the following section) in combination with the interpretation of appropriate elements of the hardcopy material. In general, all chemistry data submitted by the laboratories are reviewed and evaluated using this process. In addition, third-party data validation, if required for the program, is applied to the project data. The extent of third-party validation varies with the individual program design and is typically detailed in the project Quality Assurance Project Plan (QAPP) if a QAPP was developed for the project.

Project-level review is performed to ensure consistent application of descriptor information relating to sample type and sample location naming conventions. Tasks include review of sample tables for sample source identification, sample type descriptor, matrix descriptor, field duplicate descriptors, designation of samples for total or dissolved metals, and proper entry of sample depths and time of collection. Data sets are checked to ensure that field data have been loaded; if they have not been loaded, field data are

entered by hand into a spreadsheet template, and the template data are then uploaded to the database. Data sets are checked to ensure that the source name, date, and time of collection for each sample are consistent between sample table and field table. Data sets are checked to ensure proper formatting.

Overview of the DDR

DuPont is utilizing a database system, the Locus EIM™ database, which is designed to perform a supervised automated review on a project data set. The DDR essentially performs a summary level validation. Consistent with EPA guidance for nomenclature on external party data verification, the DDR performs a Stage 2A verification and validation compliance check¹. The DDR compares the documented sample receipt conditions and analytical QC results in the analytical data package to the acceptance criteria, requirements or guidelines present in national or regional data validation documents, analytical method(s) or contract. The QC chemist specifies the quality control acceptance limit criteria (e.g., lab supplied QC acceptance criteria or a set as specified by project requirements). The software then performs a review, using a pre-defined series of decision trees, and completes a summary report for the chemist, describing data points with qualifiers applied due to quality control criteria exceedances. The chemist then reviews other supporting documentation, including the laboratory hardcopy deliverables, case narrative, and chain of custody, as appropriate. This overall review may result in modification of the qualifiers or application of additional data qualifiers. A data evaluation summary report is then developed by the chemist to accompany the analytical data for project team and agency review.

The attached table entitled “DuPont In-House Review Process (Labstats Version)” outlines the basic design characteristics of the DDR process. Each analytical batch will contain a measure of precision and accuracy, per SW 846 guidelines. Data review will be conducted using available quality control parameters contained in each analytical batch. Hold time, method blank (MB), trip blank (TB), field blank (FB), equipment blank (EB), MS/MSD, LCS/LCSD, replicate, and surrogate results are included in this portion of the review process. The table explains how specific review criteria are to be applied for each review parameter; it includes a glossary of data qualifiers and a hierarchy for applying those qualifiers; it details appropriate application of data qualifiers; and it contains additional comments to clarify the review processes.

The default quality control acceptance limits by matrix to be applied for matrix spike percent recovery, matrix spike duplicate relative percent difference, laboratory control spike percent recovery, and laboratory control spike duplicate relative percent difference are provided by the laboratory on the electronic deliverable. In addition, the DDR has standard default criteria for qualifying data as quantitatively estimated, and limit criteria for rejection of data. The default values are based on Region III data validation guidelines and on National Functional Guidelines for Data Validation. They represent norm values commonly employed in third-party data validation, as opposed to acceptance limits specified in SW 846 methods. The SW 846 approach is generally used for laboratory

¹ Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA (EPA 540-R-08-005, 13 January 2009)

operations control purposes and are typically much more liberal; the DDR default criteria reflect values appropriate for data usability decision making. Actual acceptance criteria limit values may vary from these default values, as dictated by individual project needs. Tables of specific project acceptance limits will be included as an essential part of each QAPP, if a QAPP is developed for the sampling event, for review and approval.

The DDR program also permits the chemist to set up alternative evaluation criteria in accordance with the data evaluation requirements of a particular EPA Region or state agency, providing the variability and versatility needed to meet varying project needs. In addition to the standard data acceptance windows, it can also be set to include hold times, specific citations to inorganic tests, and common organic contaminants with associated contamination decision limits. The software set-up entries can be modified by adding or deleting test elements, changing pre-selected acceptance limit criteria, and by adding site/project-specific organic contaminants for blank qualification.

Documentation

All data qualifiers applied, as a result of the DDR will be stored in the Locus EIM™ database. Reports of analytical results will include the in-house qualifiers as a result modifier. The QC chemist will compile an overview of data usability for the project in a data review narrative. This will be included with the data evaluation summary report to the project team and the agency. Result qualifiers applied during this process will be summarized and explained. Corrective action taken will be documented. Any associated data validation report done by a third party will be appended to this report, and conclusions will be incorporated into the data evaluation summary report.

The Locus EIM™ database has modules that query data from the database by Site. Most tables and/or reports generated using Locus EIM™ can provide one text field that combines the results and qualifier. This text field is normally used for cross-tab tables, map postings, etc. Many reports also provide the laboratory qualifier, the in-house (i.e., DDR) qualifier or the third-party review qualifier (if validation was performed), but it is advantageous to provide the end-user with one text field that has the most appropriate qualifier applied. Note that if third party validation is performed, the third party qualifier will replace the DDR qualifier in the database. Therefore, for data collected prior to implementation of the Locus EIM™ database (April-2013), Locus EIM™ will store the third-party review qualifier if one exists or the laboratory qualifier (if a third-party review qualifier does not exist). For the majority of data, laboratory qualifiers will not be provided in the Result Report field. In a few cases, there are qualifiers supplied by the laboratory that may affect data usability that are not evaluated by the DDR (e.g., E qualifier for percent difference greater than 10% for serial dilution analysis and P for pesticides). In these cases, the project chemist will evaluate the impact of the laboratory qualifier on the usability of the data and will manually apply the qualifier based on professional judgement. The use of professional judgement will be documented on the Data review Narrative, which will accompany the data.

DuPont In-House Review Process (Labstats Version)		
Review Parameter	Review Criteria	Comments
Results	Flag hits J where value > MDL but < PQL	Laboratory will also apply qualifier on the result.
Hold time	Flag J (hits) or UJ (non-detects) if pre-prep, prep or analysis/reanalysis hold time exceeded Flag J (hits) or R (non-detects) if pre-prep, prep or analysis/reanalysis hold time exceeded by >= 2X	Hold times specified in Federal Register.
MB	If MB >= RL, If result < RL, no flag If result <= 5X MB, flag hits B If result <= 10X MB, flag hits B for acetone, 2-butanone, methylene chloride, phthalate esters only	RL defined as MDL or PQL per location/jobname.
TB, EB, FB	As above for MB	As above for MB.

DuPont In-House Review Process (Labstats Version)		
Review Parameter	Review Criteria	Comments
MS/MSD	<p>If MS/MSD %R outside criteria and unspiked sample result $\leq 4X$ spike conc, flag associated results (see comments) as follows:</p> <p>%R above criteria and sample result $< RL$, no flag %R above criteria and sample result $\geq RL$, flag hits only J %R below criteria but above 'reject' limit, flag hits J and non-detects UJ %R below 'reject' limit, flag hits J and non-detects R</p> <p>If MS/MSD RPD above criteria, flag associated results J</p>	<p>RL defined as MDL or PQL per location/jobname.</p> <p>Criteria for %R and RPD applied to soil and water samples for organic and inorganic parameters per laboratory generated statistical windows.</p> <p>Qualify 'parent' (background) sample only for organic %R or RPD outside criteria. All samples in batch will be qualified for inorganic %R or RPD outside criteria.</p> <p>Evaluate and qualify only compounds spiked and outside criteria.</p>
LCS/LCSD	<p>If LCS/LCSD %R outside criteria (except Sb and Ag), flag all associated results as follows:</p> <p>%R above criteria and sample result $< RL$, no flag %R above criteria and sample result $\geq RL$, flag hits only J %R below criteria but above 'reject' limit, flag hits J and non-detects UJ %R below 'reject' limit, flag hits J and non-detects R</p> <p>If LCS/LCSD RPD above criteria, flag associated results J</p>	<p>RL defined as MDL or PQL per location/jobname.</p> <p>Criteria for %R and RPD applied to soil and water samples for organic and inorganic parameters per laboratory generated statistical windows.</p> <p>All samples in batch will be qualified for %R or RPD outside criteria.</p> <p>Evaluate and qualify only compounds spiked and outside criteria.</p>
REP (lab dup)	<p>If REP RPD outside criteria, flag all associated results J</p> <p>Criteria are per laboratory generated statistical windows when both results are $>5X$ PQL</p> <p>If one or both samples are $< 5X$ PQL, criteria are \pm PQL for waters, $2X$ PQL for soils</p>	<p>Criteria for RPD applied to soil and water samples for organic and inorganic parameters per Review Criteria.</p> <p>Qualify 'parent' (background) sample only for organic RPD outside criteria. All samples in batch will be qualified for inorganic RPD outside criteria.</p> <p>Qualify only compounds outside criteria.</p>

DuPont In-House Review Process (Labstats Version)		
Review Parameter	Review Criteria	Comments
Surrogates (organics only)	<p>Qualify associated results only as follows when DF <= 4X:</p> <p>If one surrogate %R is high or low (for VOCs only), or two or more surrogates with some high, some low, flag hits J and non-detects UJ</p> <p>If two or more surrogates have %R all high, flag hits only J</p> <p>If two or more surrogates have %R all low, flag hits J and non-detects UJ</p> <p>If one or more surrogates have %R < 10%, flag hits J and non-detects R</p>	<p>Criteria for %R are lab generated statistical limits (as per SW-846).</p> <p>Qualify volatile aromatics only if volatile aromatic surrogate(s) outside criteria; similarly qualify only volatile halogenated, semi-volatile base neutral, or semi-volatile acid compounds if specified surrogate(s) outside criteria.</p> <p>Qualify associated pest/PCB compounds only if both surrogates outside criteria, or at least one surrogate %R < 10%.</p>
Tentatively Identified Compounds (TICs)	Flag TICs with a J.	

Laboratory Stats qualifiers – hierarchy is R, B, J, UJ	
Qualifier	Definition
U	Not detected at the associated reporting limit.
B	Not detected substantially above the level reported in laboratory or field blanks.
J	Analyte present. Reported value may not be accurate or precise.
UJ	Not detected. Reporting limit may not be accurate or precise.
R	Unusable result. Analyte may or may not be present in the sample.