DRAFT
EXECUTIVE SUMMARY
OF THE WORK MANAGEMENT PLANS

FOR THE REMEDIAL INVESTIGATION AT OU 2:
AOC 3, CENTRAL DRAINAGE DITCH AREA
AND AOC 5, BUILDING J-26
DUPONT CHAMBERS WORKS SITE
DEEPWATER, NEW JERSEY

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Prepared for:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

and

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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1 Introduction

This document is an executive summary of the work management plan components that have been submitted to the U.S. Army Corps of Engineers– Baltimore and Philadelphia Districts (CENAB and CENAP) to conduct a Remedial Investigation (RI) for radioactive-contaminated areas at the DuPont Chambers Works in Deepwater, New Jersey. Specifically, this document is a summary of the following Management Plan components for Operable Unit 2 (OU 2).

- Field Sampling Plan
- Quality Assurance Project Plan
- Site Safety and Health Plan

CENAB and CENAP are providing project management and technical support for this RI. Cabrera Services, Inc. (Cabrera) is the prime contractor for the investigation of OU 2, with engineering support provided by EA Engineering Science and Technology, Inc. (EA).

This RI is being performed under the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP was established in 1974 by the Department of Energy (DOE) to identify the nature and extent *of radiological contamination* and take appropriate cleanup action at sites where work had been performed as part of the nation's early atomic energy program. DuPont held several government contracts to support Manhattan Engineering District (MED) activities known as the Manhattan Project. The results of a March 1977 radiological survey at DuPont indicated that elevated concentrations of uranium were present and resulted in its designation as a FUSRAP site in 1980. The impacted area has been divided into three operable units, each including two of six areas of concern as indicated below. The Operable Units are shown on Figure 1-1.

- *OU 1: AOC 1-Former Building 845 Area and AOC 2-F Parking Corral*
  RI field activities were conducted for OU 1 between May and August 2002. The Draft Report summarizing findings is currently being prepared and potential remedial action alternatives are being evaluated.
- *OU 2: AOC 3-Central Drainage Ditch and AOC 5-Building J-26 Area*
  The present RI field activities are focused on current or former drainage features.
- *OU 3: AOC 4-Historical Lagoon A and AOC 6-East Burial Area*
  The third Operable Unit, OU 3, will be addressed in the next phase.

The same approach and general methodologies for evaluating area OU1 have been applied to the current Remedial Investigation for OU2. These methodologies have been subject to regulatory review and comment during development of the planning documents for OU1. The contaminants of concern, the sampling and analysis strategy, and the analytical screening methods have all remained the same. Lessons learned from the OU1 investigation have been considered in the development of the plans and specific methods to be used for collecting samples at OU2, as described herein. The most significant change to the plan of action for OU2 is reevaluation of the appropriate personal protection with respect to organic lead contamination co-located in the FUSRAP areas of concern. Current plans are to conduct intrusive activities in Level C Personal Protective Equipment.

1.1 Background Information on AOC 3

The following is a synopsis of previously reported information (see Final Technical Project Planning Meeting Brief (URS 2000 and WESTON 2001). AOC 3 includes the section of the

Central Drainage Ditch (CDD) that lies downstream of former Building 845 and the F Parking Corral, extending to Lagoon A (Figure 1-2). The CDD was a component of the Historic Process Water Ditch System (HPWDS). The CDD received process waste from Buildings 708, 101 and 102 and Building 845 (all part of OU1). The wastewater was conveyed to Historical Lagoon but it is unknown whether this wastewater contained uranium. These buildings all housed operations where uranium was handled as part of DuPont's contract with MED. As part of a RCRA corrective action program for the Chambers Works site, portions of the HPWDS have undergone remediation. A segment of the CDD, adjacent to OU 1, was excavated and backfilled in 1997. One aspect of the remedial activities was removing contaminated soil and disposing of the material onsite. DuPont collected soil samples before and after the remediation and provided them to representatives of Oak Ridge National Laboratory to evaluate radiological concerns.

1.2 Background Information on AOC 5

AOC 5 comprises the areas of the surface drains that surrounded former Building J-16 (currently occupied by Building J-26). Building J-26 is located in the southwest quadrant of the Chambers Works site. A map of the J-26 area is provided as Figure 1-3. At present the focus of remedial investigation activities at Building J-26 (AOC 5) is on the former drainage features that surrounded former Building J-16.

At the time of MED contract operations at Chambers Works, this area was occupied by Building J-16 which was part of Jackson Laboratories. These laboratories performed experimental work, including designing and refining chemical and radioactive production processes. Products included green salt (UF_4) and uranium hexafluoride (UF_6). The laboratory served as a unit operations test facility for the uranium oxide to uranium tetrafluoride (brown oxide to green salt) conversions process. An open drainage ditch surrounded Building J-16 and was later replaced by a buried culvert that is capped by a steel grate in some places. The original drainage system was part of the HWPDS.

1.3 Summary of the Site Geosystem

The following brief summary of the local geosystem was developed from data collected during the OU 1 investigation. The stratigraphy of OU1 is thought to be similar to that of both areas of OU2. A more complete description of the geosystem beneath the entire Chambers Works is included in the Draft Field Sampling Plan for OU 2 (May 2003).

1.3.1 Site-Specific Geology

Three soil units were encountered during the OU 1 RI. The upper 5 to 8 feet below ground surface (bgs) of soil is composed of fill material that comprises the A aquifer. The A aquifer is the uppermost water-bearing zone at the Chambers Works and is a perched aquifer in many places. This unit may extend as deep as 17 ft across the site. Locally the unit consists of sands and silty sands.

The middle unit of silt and clay is likely the AB confining unit, based on textural descriptions and elevation. The AB confining unit was probably deposited in a Holocene to Recent marsh depositional environment (Weston 1992) and consists of organic silt, clay, and peat deposits. It occurs at an average depth of 0 feet National Geodetic Vertical Datum (NGVD). The AB confining unit is not continuous throughout the site. In some areas recent streams have eroded away the silts and clays of the confining unit and deposited coarser-grained sediments, resulting in a breach in the low-permeability character of the unit.

The lower unit encountered at OU 1 consisted of sands and gravelly sands that persisted to the completion depths of the borings (approximately 15 feet below ground surface). In places where the middle unit is missing, the lower unit is in direct contact with the upper unit. This lower unit is the B Aquifer.

Table 1-1 Soil Units Encountered at OU 1

Depth [ft bgs]	Avg Top [ft bgs]	Avg Bottom [ft bgs]	Description	USCS Classes	DuPont Unit
0.5 to 8	0	5	Brown to gray, fine to medium sand containing fine to medium gravel and/or silt. Often mottled reddish-brown and often stained black over upper 2 to 3 ft.	SM, SP-SM, SC-SM	A aquifer
0.5 to 11	5	9	Gray to dark gray, soft to very soft silt and clay mixtures. Not present at all locations	MH, ML, CL, CH	AB confining unit
3 to 15	9	At least 15	Strong reddish brown gravelly sand to sand and gravel. Fine to medium gravel is rounded.	SM, SW	B aquifer

* ft bgs – feet below ground surface

1.3.2 Site-Specific Hydrogeology

The A Zone, consisting mainly of fill material, is the uppermost hydrogeologic unit at the Chambers Works complex. The A Zone extends from the ground surface (approximately 10 ft NGVD) to approximately -10 ft NGVD at its greatest depth at the complex. The A Zone ranges from 0 to approximately 17 ft thick across Chamber Works and is fully to partially saturated in some locations, whereas in other areas, a saturated zone is not present.

The AB Confining Unit, composed of organic silt, clay, and peat, is the first clay horizon encountered below ground surface. The AB Confining Unit ranges from 0 to 12 ft thick and is present from approximately -10 to -15 ft NGVD.

Beneath OU 1, the depth to first groundwater was estimated to be two to three feet below grade based on observations made during the soil boring program. This zone of perched water corresponds to the A aquifer. The topographic relief across OU 1 ranges from a maximum of 5.1 feet NGVD to a minimum of zero feet NGVD at the floor of the CDD. These elevations indicate that the floor of the CDD intercepts the water table and that the ditch would therefore be gaining water from the aquifer. The difference in elevation between the bottom of the CDD and the water table also indicates that the direction of perched groundwater flow in the vicinity of the CDD would be toward the ditch.

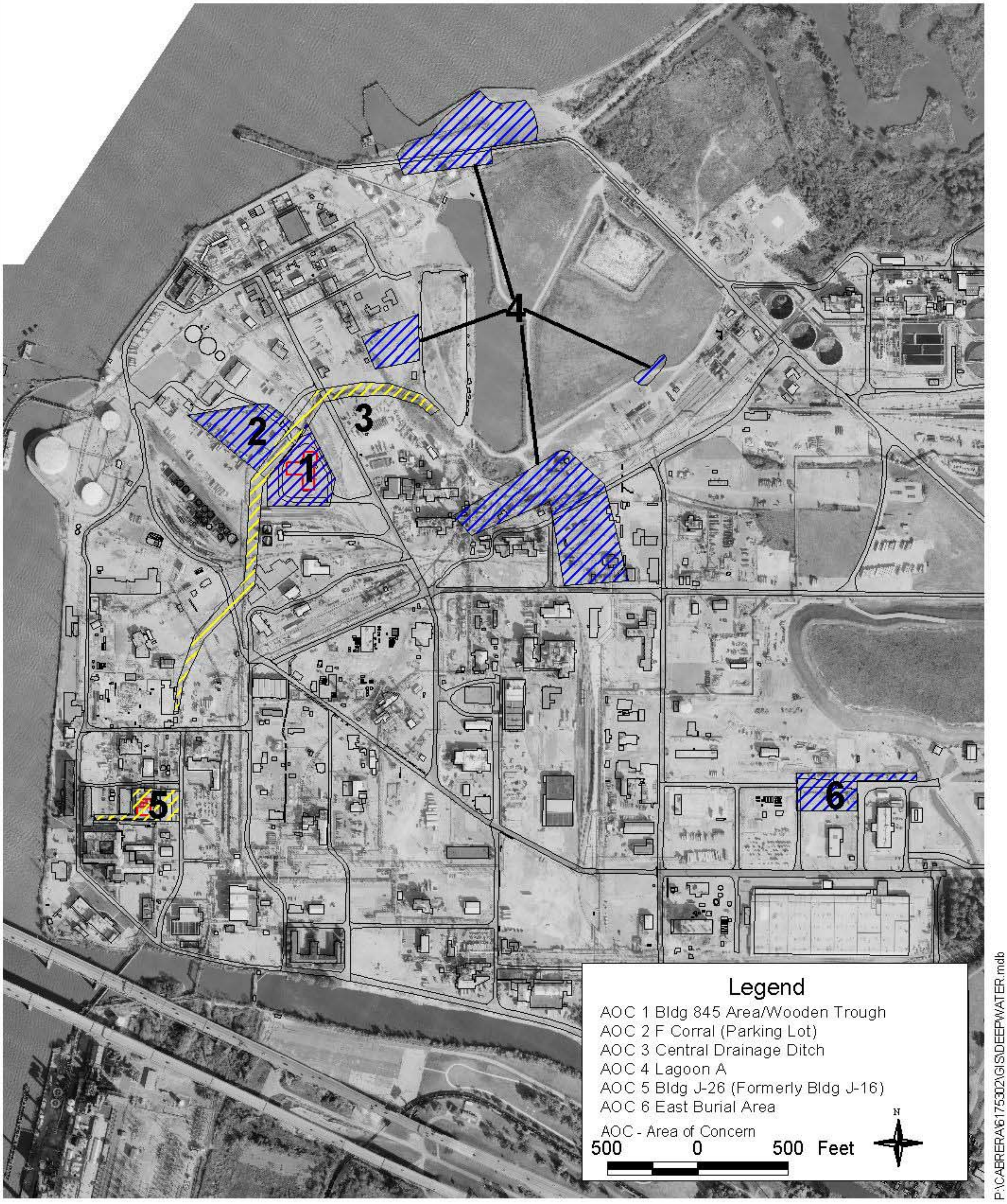

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FIGURE 1-1
AREAS OF CONCERN

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FIGURE 1-2
AOC 3 -
CENTRAL DRAINAGE DITCH

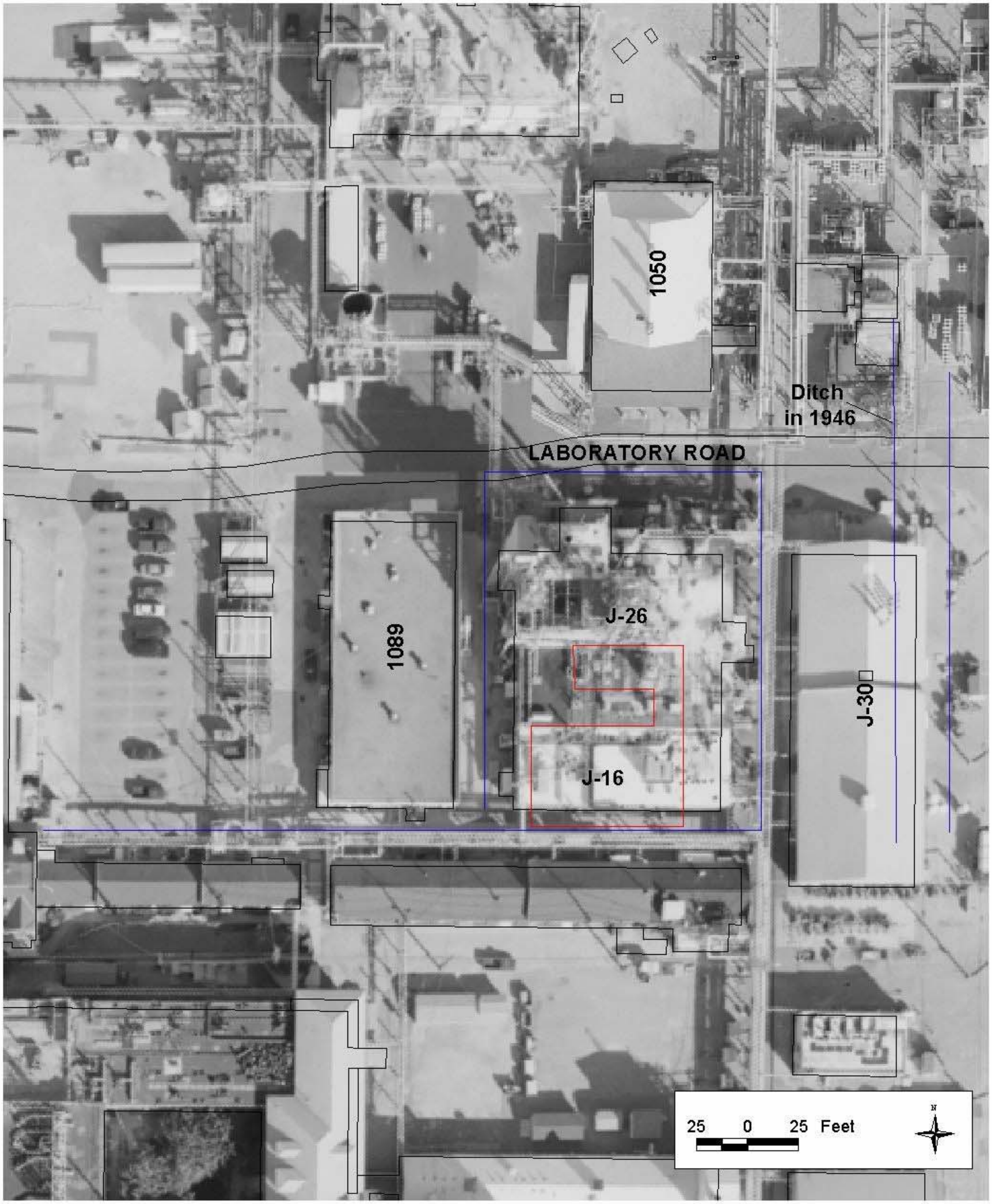

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FIGURE 1-3
AOC 5 -
BUILDING J-26

2 Project Team

The Project Organization Chart is included as Figure 2-1. Tables listing contacts associated with the site are included as Table 2-1 and Table 222-2. Additional information regarding the roles and responsibilities of key individuals is included in Section 2 of the Field Sampling Plan.

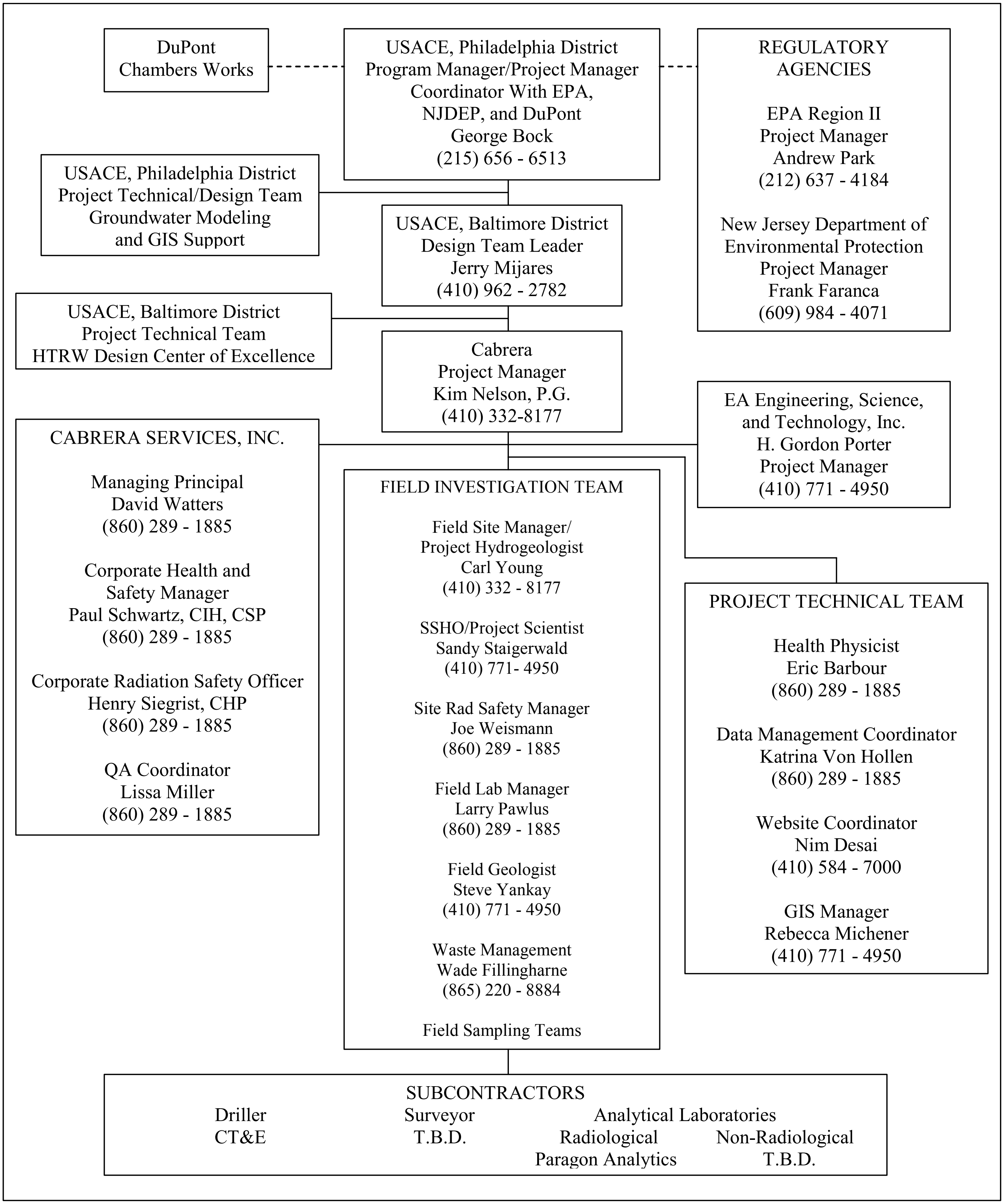


FIGURE 2-1 ORGANIZATION CHART FOR OU2 INVESTIGATION

Table 2-1 DuPont Chambers FUSRAP Project Team

NAME	LOCATION	PHONE	DISCIPLINE
Erika McCormick	USACE-NAP	910-251-4793	Chemist – Quality Assurance
James Bynum	USACE-NAB	410-962-6803	Industrial Hygienist
Beth Adams	USACE-NAP	215-656-6719	GIS
Glen Stevens	USACE-NAP	215-656-6687	Hydrogeologist
Alan Warminski	USACE-NAB	410-962-2179	Chemist
David Watters	Cabrera Services, Inc.	860-289-1885	Health Physicist – Managing Principal
Debra Ford	USACE-NAB	410-962-6736	Design Team Manager
Scott Denzer	LDC, Inc. – Carlsbad, CA	760-634-0437	Chemist – Data QA Consultant
Vernon Griffin	USACE-NAB	410-962-3333	IH Technician – On-site Health and Safety Mgt
Carl Young	Cabrera Services	410-332-8177	Hydrogeologist – Field Site Coordinator
Eric Barbour	Cabrera Services	860-289-1885	Health Physicist
Andrew Rak	USACE-NAB	703-610-2166	Risk Assessor – Tech Review
Raymond Corral	USACE-Baltimore	410-962-2769	Risk Assessor
Chris Hallam	USACE-NAB	410-962-3545	Lead Health Physicist
Bryan Frey	USACE-NAB	410-962-5642	Environmental Engineer
Kim Nelson	Cabrera Services	410-332-8177	Geologist – A/E Project Manager
Nim Desai	EA Engineering Science & Technology	410-329-5176	Website Coordinator
Joe Weismann	Cabrera Services	845-298-7596	Radiological Safety Manager
Sandy Staigerwald	EA Engineering Science & Tech	410-584-7000	Site Health and Safety Officer
Hans Honerlah	USACE-NAB	410-962-9184	Health Physicist – Technical Review

Table 2-2 Contact Information for Other Stakeholders

NAME	RESPONSIBILITY	PHONE	E-MAIL
Eng, Jeanette	USEPA	(212) 637-4007	eng.jeanette@epa.gov
Faranca, Frank	Project Manager NJDEP	(609) 984-4071	ffaranca@dep.state.nj.us
Boettler, Al	DuPont	(302) 892-0647	albert.j.boettler@usa.dupont.com
Dougherty, John	URS	(856) 540-3857	john.j.dougherty@usa.dupont.com
Doyle, David	NJDEP		
Goodman, Jenny	NJDEP		
Norcross, Scott	URS		scott.w.norcross@usa-dupont.com
Park, Andrew	Project Manager USEPA	(212) 637-4184	
Pavelka, Anne	NJDEP	(609) 292-3007	apavelka@dep.state.nj.us
Rogers, Steve	DuPont	(302) 856-3469	stephen.o.rogers-1@dupont.com
Stanley, Nancy	NJDEP	(609) 984-5452	nstanley@dep.state.nj.us
Sugihara, Terry	NJDEP	(609) 633-1356	tsugihara@dep.state.nj.us
Truskowski, Ed	NJDEP-BER	(609) 984-5542	etrusuowski@dep.state.nj.us

3 Field Investigation

The following section provides a summary of planned activities for the field investigation at OU 2. These activities also include collection of supplemental data from OU 1 for the purpose of evaluating contaminant fate and transport. Refer to the Field Sampling Plan for OU 2 for additional detail.

3.1 Objectives

The primary objective of this RI is to define the nature and extent of MED-related radiological contamination present at OU 2, (consisting of AOCs 3 and 5). These areas are identified as wastewater conveyance features associated with buildings where MED operations took place. Previous historical investigations indicate that MED-related radiological contamination is limited to natural uranium isotopes (i.e., U-234, U-235, and U-238) and their short-lived decay progeny. Given the history of MED-related operations at Chambers Works and the methods of wastewater conveyance and disposal in practice across the facility at that time, the potential exists for uranium contamination to have been conveyed in wastewater and deposited in sediments in the CDD. Previous investigations associated with RCRA actions elsewhere at Chambers Works identified elevated uranium concentrations in limited segments of CDD sediments, adjacent to the former MED operations identified as OU1.

For each AOC, the field investigation includes geophysical, radiological, and location surveys; soil boring installation; collection and analysis of subsurface soil samples; and collection and analysis of groundwater samples.

The radiological investigation program for this RI consists of a combination of on-site direct radiation measurements using handheld radiation detectors, on-site laboratory sample analyses, and off-site laboratory sample analyses. On-site radiological measurement techniques have been selected based on radiological characteristics of the uranium contaminant, potentially impacted media, and reasonable implementation of the best available technology.

An investigative screening value (ISV) of 14 pCi/g of total uranium (7 pCi/g U-238) has been established for the RI. The derivation of this ISV is provided in the Draft QAPP for OU 2. Handheld radiation detector measurements will be used to identify surface and subsurface activity on a near real time basis during implementation of the field effort. The measurements, however, do not have adequate sensitivity to measure uranium concentrations at or near the ISV. Recognizing this limitation, these measurements are intended to focus on identifying potential biased discrete sample locations in an efficient manner, without generating unacceptable delays in field implementation. An on-site screening laboratory, with adequate sensitivity to measure uranium concentrations below the ISV, will be used to analyze these samples. Comparison of the on-site laboratory screening results to the screening level will serve as the primary means for field decision-making regarding expansion of the systematic sampling grid and termination depth for collection of soil cores. Off-site laboratory sample analyses will serve as “record results” and will be used to determine the nature and extent of MED-related contamination, as well as in support of risk-based decisions on potential remedial actions.

Mechanisms for uranium to be transported at the Chambers Works facility include suspension of soil into the air, movement in surface run-off, and movement of uranium through the vadose zone into the groundwater and then transport in groundwater as dissolved ions or sorbed to colloids. The suspension of contaminated soil or movement in run-off would require the contamination to be at the surface of the ground and would result in extremely small amounts of contamination transported to other locations on the site or off-site.

Movement with groundwater comprises the only appreciable pathway for uranium to be transported to a receptor. The uranium may be transported as dissolved ions or may be sorbed to mobilized colloids. A study by Argonne National Laboratories determined that uranium moves slowly through Chambers Works soils as dissolved ions. Distribution coefficient (K_d) values for uranium were approximately 10,000 milliliter per gram (mL/g) (DOE, 1997a). This value indicates that uranium is not very mobile under most circumstances at Chambers Works.

3.2 Investigation Methods for OU 2

The following section describes the purpose and methods of the proposed field investigation tasks.

- **Geophysics / Utility Clearance**

CABRERA will use a variety of methods to locate subsurface utilities and other obstructions. The initial step will be to have DuPont review the proposed locations of the soil borings and confirm our understanding of the locations of the utilities. The location of mapped utilities will be marked with spray paint. A magnetic pipe locator will then be used to scan the proposed boring locations for metallic obstructions. Finally, ground-penetrating radar (GPR) will be utilized to further identify subsurface anomalies. In active process areas, a second clearance by DuPont of proposed boring locations will be initiated. No borehole will be advanced until the appropriate permit is in place from DuPont.

- **Gamma Walkover Survey**

A gamma walkover survey will be conducted to identify near-surface areas of radiological impact. The proposed field detection technique for near-surface contaminants does not have adequate sensitivity to measure uranium concentrations at or near the 14 pCi/g (7 pCi/g U-238) ISV. It is designed to provide a relative measure of uranium concentrations and support the selection of bias sampling locations, within the confines of its sensitivity limitations. The surface survey data will also be used as a first level decision-making tool for horizontal expansion of the systematic sampling grid. Biased samples analyzed by the on-site laboratory will have adequate sensitivity to meet the ISV.

In AOC 3 the areas of the CDD that intersect with the wooden trough will be surveyed because elevated readings were encountered along the study area boundaries during the OU1 field investigation. Two areas near the intersection of the wooden tough with the CDD will be surveyed where indicated in Figure 3-1. One area is directly north and the other is adjacent to the railroad tracks, north and east of the wooden trough. Results will be plotted using Z scores and anomalous readings will be proposed for further investigation.

- **Soil Boring / Soil Sampling**

The primary means of determining the radiological impact to soils will be by laboratory analysis of soil samples. The soil samples will be collected using Geoprobe™ direct-push technology, utilizing 2-inch cores. The coring device is double-walled, with an outer casing assembly and an inner, retractable sampling assembly. The planned total depth for borings is 10 feet, which allows for collection of both soil and groundwater samples from below the water table. The borehole depths will be increased if on-site radiological measurements indicate that the soils are impacted at 10 feet. After the borings have been completed, temporary well casings and screens will be placed in the boreholes to allow for water-sample collection and for the advancement of a down-hole gamma detector.

A geologist will log the soil textures and collect samples. A sample volume of approximately one kilogram (1 kg) is required for gamma spectroscopy analysis, which would require approximately 29 cm of 2-inch diameter (5.1 cm) core. Due to the size of the sampling equipment and the necessary sample volumes, samples will likely be composed of a minimum 1-ft core interval. In those cores with low recovery, the sample interval may be composited from greater than 1-ft intervals. Continuous core sampling will be performed in 2-ft sections. One sample will be collected from each two-foot section for radiological analysis. At depth intervals where more soil sample is needed, an additional boring will be made in close proximity to collect more soil from the same depth interval.

Ludlum Model 44-9 pancake GM detectors will be used to perform scans of soil cores following removal or opening of the acetate core sleeve. The estimated detection sensitivity of the GM soil core measurements is approximately 20 pCi/g, which is greater than the 14 pCi/g screening value. However, the GM soil core scan will be used in connection with the down-hole Sodium Iodide detector to select samples for offsite laboratory analysis. The data will be evaluated by borehole and depths where results exceed three standard deviations above the average for the borehole to identify potential samples for offsite analysis. Discrete samples may be collected from soil cores where GM measurements exceed this criterion. In the event that down-hole gamma measurements and GM measurements are not in agreement, results of the GM measurements will be used because they directly measure radiation from the soil core that was removed (i.e., the soil that will become the discrete sample).

- **Down-hole Gamma Monitoring**

Bicron Model G-1, 1-inch by 1-inch cylindrical Sodium Iodide detectors in stainless-steel waterproof housings will be used to perform in situ down-hole gamma measurements. The detectors will be lowered through solid PVC casings that will be placed in the boreholes. The proposed field detection techniques for subsurface contaminants, described below, do not have adequate sensitivity to measure uranium concentrations at or near the 14 pCi/g (7 pCi/g U-238) ISV. They are designed to provide a relative measure of uranium concentrations and support the selection of bias sampling locations in each borehole to appropriate depths, within the confines of their sensitivity limitations. The subsurface survey data will also be used to make rapid real-time field decisions for offsite sample selection and continuation of vertical sampling when readings are greater than three standard deviations over the average within a borehole.

- **On-site Laboratory Screening of Soil Samples**

Discrete soil samples from every two-foot interval of each boring will be screened in the on-site gamma spectroscopy laboratory. On-site laboratory analyses will have adequate sensitivity to meet the ISV and will serve as the primary screening result for field decision-making regarding final selection of samples for offsite analysis, and expanding the borehole transect vertically or horizontally. U-238 decay progeny emit discrete energy gammas that can be used to identify and quantify total uranium activity concentrations in discrete samples. On-site gamma spectroscopy laboratory analyses will be performed using an N-type high purity germanium (HPGe) gamma spectroscopy system and Marinelli beakers. Sample mass will be estimated using a laboratory balance, and samples will be counted without performing physical processing such as drying and grinding. The approximate detection sensitivity of the on-site gamma spectroscopy laboratory is 4 pCi/g of total uranium, well below the investigative screening level of 14 pCi/g. Since the ISV is derived from conservative risk-based criteria and average background concentrations, the level of sensitivity is adequate to make decisions regarding defining the extent of contamination. Therefore, the primary DQOs for the RI are met.

- **Off-site Laboratory Analysis of Soil Samples**

Using the on-site screening results, two soil samples from each borehole will be selected for off-site analysis. Gamma spectroscopy, with and without radium daughter in-growth, (EPA Methods 901.0 and 901.1) will be performed on all soil samples selected for off-site analysis. A summary of soil sampling parameters is included as Table 3-1.

- **Groundwater Sampling**

Groundwater samples will be collected from each of the boring locations. Groundwater sampling will take place after each borehole has been surveyed with the sodium-iodide probe and soil sampling has been completed. Samples will be acquired using a peristaltic pump and dedicated polyethylene tubing. The low-flow sampling protocol (EPA, 1998) will not be utilized because samples will be collected from temporary sampling points and not monitoring wells. However, low flow rates will be maintained during sampling to minimize the suspension of particulates. Each of the borehole locations will be sampled for radiological parameters. Samples will also be collected for geochemical parameters to assist in the feasibility study and for fate and transport analysis. Groundwater analysis parameters are listed in Table 3-2 and Table 333-3. Filtered and unfiltered aliquots will be collected from each location.

At borings where perched water is encountered, a second temporary piezometer may be installed at this depth. Depth-to-water measurements will be recorded (as referenced to ground surface). Groundwater in the perched aquifer will be submitted for the same list of analytes as for samples from the water table aquifer.

3.2.1 Boring Locations at AOC 3

At the CDD, the borings will be placed along the centerline of the channel, to the extent feasible. Twenty boring locations in the CDD are proposed, as shown in Figure 3-1: 14 locations at 100-foot intervals along the CDD; 2 locations assumed to be related to historical CDD pathway; and 4 locations at the historical CDD drainage into Lagoon A. An estimated five additional boring locations will be selected for biased sampling based on radiological field screening, observed sedimentation patterns within the CDD, gamma-logging results, or other field observations. These locations will be proposed by the Field Team and approved by designated USACE project team personnel.

During a site visit in June 2003, the CDD contained water along the entire stretch through AOC 3. At the downstream end of the CDD, the depth of water in the center of the channel appeared to be about two feet, while at the upstream end of AOC-3, the water depth was approximately one foot. Conversations with DuPont personnel indicate that during droughts, many portions of the CDD are dry. The banks of the ditch slope at 20 to 30 degrees.

In order to sample from the centerline of the channel, where water is present field personnel propose to lay down wooden planks – approximate dimensions 3in x 14in x 14 ft - and back a truck-mounted Geoprobe™ out over the water. Several planks will be used so that the Geoprobe™ operator can stand on them. The Geoprobe™ will be advanced using a double-walled system to keep surface water out. In the event that this method proves unsatisfactory, an alternative method, involving setup of the rig from a small barge or raft may be employed.

3.2.2 Boring Locations at AOC 5

At Building J-26, the borings will be placed as close to the historic drain locations as possible. Results of the geophysical survey will be reviewed to determine if the historical drainage can be distinguished by the GPR data. Twenty borings are proposed in the Building J-26 area; 15 borings spaced along 75-foot intervals and 5 at biased sampling locations, depending on field conditions and screening survey results, as shown in Figure 3-2.

At J-26 the drains are believed to have been narrow structures consisting of open wooden troughs. They are thought to have been buried with the top of the culvert in the range of 1 to 2 feet below current ground surface with process piping placed within them. The soil borings will be placed as close to the location of the drain as possible without risking damage to the existing process piping. The borings will be alternated on the left and right sides of the drain, if possible. Due to the presence of extensive process piping (aboveground) as well as extensive buried utilities, it is anticipated that numerous borings will require relocation for clearance.

Table 3-1 Soil Analysis Parameters

Parameters	Methodology[1]	Number of Samples	Types of Samples’[2]
Gamma Spectroscopy (with and without radium daughter in-growth)	EPA 901.0 and 901.1	**AOC 3:** 50 [2 samples per boring, 20 pre-selected boring locations, 5 biased] **AOC 5:** 40 [2 samples per boring, 15 pre-selected boring locations, 5 biased]	Primary
		3 for AOC 3, 2 for AOC 5 [5%]	Field duplicates
		5 for AOC 3, 4 for AOC 5 [10%]	QA splits for 3rd party lab
		Variable [5%]	Field wipe samples

[1] Analytical methods must be capable of meeting NJ Groundwater Quality Criteria, September 1998 (N.J.A.C. 7:9-6, Table 1) and Federal MCLs, October 1996. Alternate analytical methods can be utilized but must first be approved by USACE.

[2] Field wipe samples for radiological analysis will be collected for each type of equipment used each day a decontamination event occurs (aqueous samples) or at a rate of 1 per 20 primary samples (non-aqueous samples).

Table 3-2 Groundwater Analysis Parameters

Parameters	Methodology[3]	Number of Samples	Types of Samples[4, 5]
Gross Alpha & Beta[6]	EPA 900	**AOC 3:** 20 from pre-selected locations, 5 from biased locations **AOC 5:** 15 from pre-selected locations, 5 from biased locations	Primary
		1 for AOC 3, 1 for AOC 5 [5%]	Field duplicates
		1 for AOC 3, 1 for AOC 5 [5%]	Field rinsate blank
Isotopic Uranium[4]	EMLU02	**AOC 3:** 20 from pre-selected locations, 5 from biased locations **AOC 5:** 15 from pre-selected locations, 5 from biased locations	Primary
		1 for AOC –3, 1 for AOC 5 [5%]	Field duplicates
		1 for AOC 3, 1 for AOC 5 [5%]	MS/MSD pairs
		1 for AOC 3, 1 for AOC 5 [5%]	Field rinsate blank
Total Radium[4]	903.0/904.0 modified	**AOC 3:** 20 from pre-selected locations, 5 from biased locations **AOC 5:** 15 from pre-selected locations, 5 from biased locations	Primary
		1 for AOC 3, 1 for AOC 5 [5%]	Field duplicates
		1 for AOC 3, 1 for AOC 5 [5%]	Field rinsate blank

[3] Analytical methods must be capable of meeting NJ Groundwater Quality Criteria, September 1998 (N.J.A.C. 7:9-6, Table 1) and Federal MCLs, October 1996. Alternate analytical methods can be utilized but must first be approved by USACE.

[4] Field duplicates will be collected at the rate of 5% of primary samples.

[5] Field rinsate blanks for chemical analysis will be collected for each type of equipment used each day a decontamination event occurs (aqueous samples) or at a rate of 1 per 20 primary samples (non-aqueous samples).

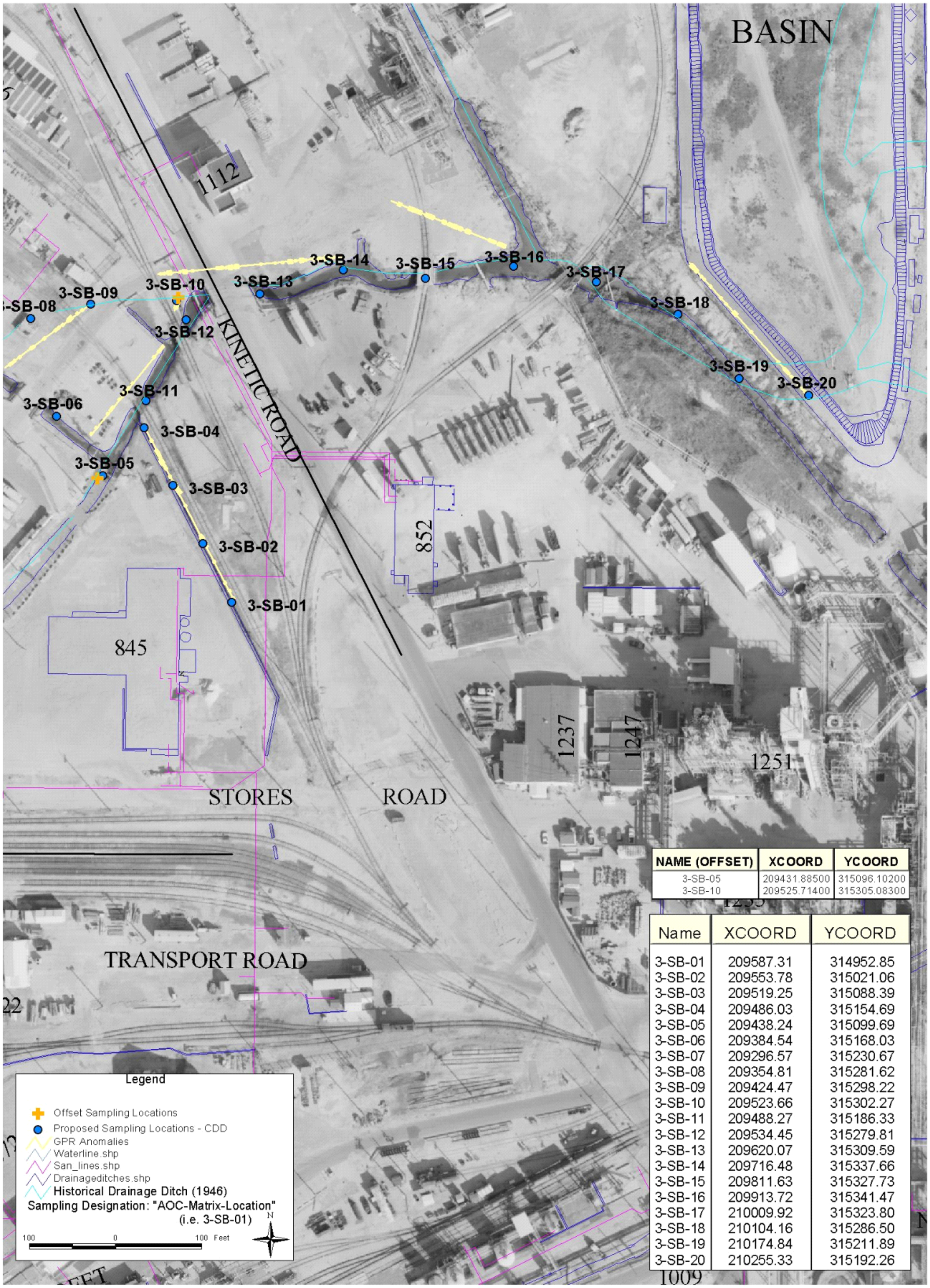
[6] Unfiltered samples plus filtered samples will be collected. Field-filtered samples will be collected using a 0.45-micron disposable filter.

Table 3-3 Geotechnical and Geochemical Analyses

Parameters	Methodology	Number of Samples (1)	Lab	*Minimum* Sample Volume
Soil (Geotechnical) Samples				
Grain size	ASTM D422	AOC3: 5; AOC5: 4	Paragon [3]	600 g
Soil moisture content	ASTM D2216	AOC3: 5; AOC5: 4	Paragon [3]	
Specific gravity	ASTM D854	AOC3: 5; AOC5: 4	Paragon [3]	
Liquid and plastic limits	ASTM D4318	AOC3: 5; AOC5: 4	Paragon [3]	
pH	SW 9054C	AOC3: 5; AOC5: 4	Paragon [3]	
Cation exchange capacity	EPA 9081	AOC3: 4; AOC5: 4	WES	200 g
Total organic carbon	SW 9060	AOC3: 4; AOC5: 4	WES	10 g
K_d		OU1: 4; OU2: 2	WES	300 g
SEM/XRD		AOC3: 2, AOC5: 2	WES	20 g
U availability	Sequential extraction	OU1: 4; AOC3: 1; AOC5: 1	WES	10 g
Groundwater (Geochemical) Samples				
Sulfide	Colorimetric HACH 8131	AOC3: 25; AOC5: 20	onsite	50 mL
Nitrite	Colorimetric HACH 8507	AOC3: 25; AOC5: 20	onsite	20 mL
Chloride	EPA 300	AOC3: 25; AOC5: 20	Paragon	105 mL
Nitrate	EPA 300	AOC3: 25; AOC5: 20	Paragon	
Phosphate	EPA 300	AOC3: 25; AOC5: 20	Paragon	
Alkalinity as CO_2	EPA 310	AOC3: 25; AOC5: 20	Paragon	
Ferrous iron (2)	Hach method 8146	AOC3: 25; AOC5: 20	onsite	50 mL
TAL Metals	SW 6010B	AOC3: 25; AOC5: 20	Paragon	100 mL
Sulfate	Turbidimetric HACH 8051	AOC3: 25; AOC5: 20	onsite	50 mL

[1] Sampling frequency is 10% of primary sampling rate for geotechnical samples and 100% for geochemical samples.
[2] Ferric iron will be derived from total iron minus ferrous iron

[3] Paragon uses a subcontractor for geotechnical analyses



NAME (OFFSET)	XCOORD	YCOORD
3-SB-05	209431.88500	315096.10200
3-SB-10	209525.71400	315305.08300

Name	XCOORD	YCOORD
3-SB-01	209587.31	314952.85
3-SB-02	209553.78	315021.06
3-SB-03	209519.25	315088.39
3-SB-04	209486.03	315154.69
3-SB-05	209438.24	315099.69
3-SB-06	209384.54	315168.03
3-SB-07	209296.57	315230.67
3-SB-08	209354.81	315281.62
3-SB-09	209424.47	315298.22
3-SB-10	209523.66	315302.27
3-SB-11	209488.27	315186.33
3-SB-12	209534.45	315279.81
3-SB-13	209620.07	315309.59
3-SB-14	209716.48	315337.66
3-SB-15	209811.63	315327.73
3-SB-16	209913.72	315341.47
3-SB-17	210009.92	315323.80
3-SB-18	210104.16	315286.50
3-SB-19	210174.84	315211.89
3-SB-20	210255.33	315192.26

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JULY 2003

DUPONT CHAMBERS WORKS
FUSRAP SITE

Deepwater, New Jersey

FIGURE 3-1
PROPOSED SOIL BORING LOCATIONS IN AOC 3

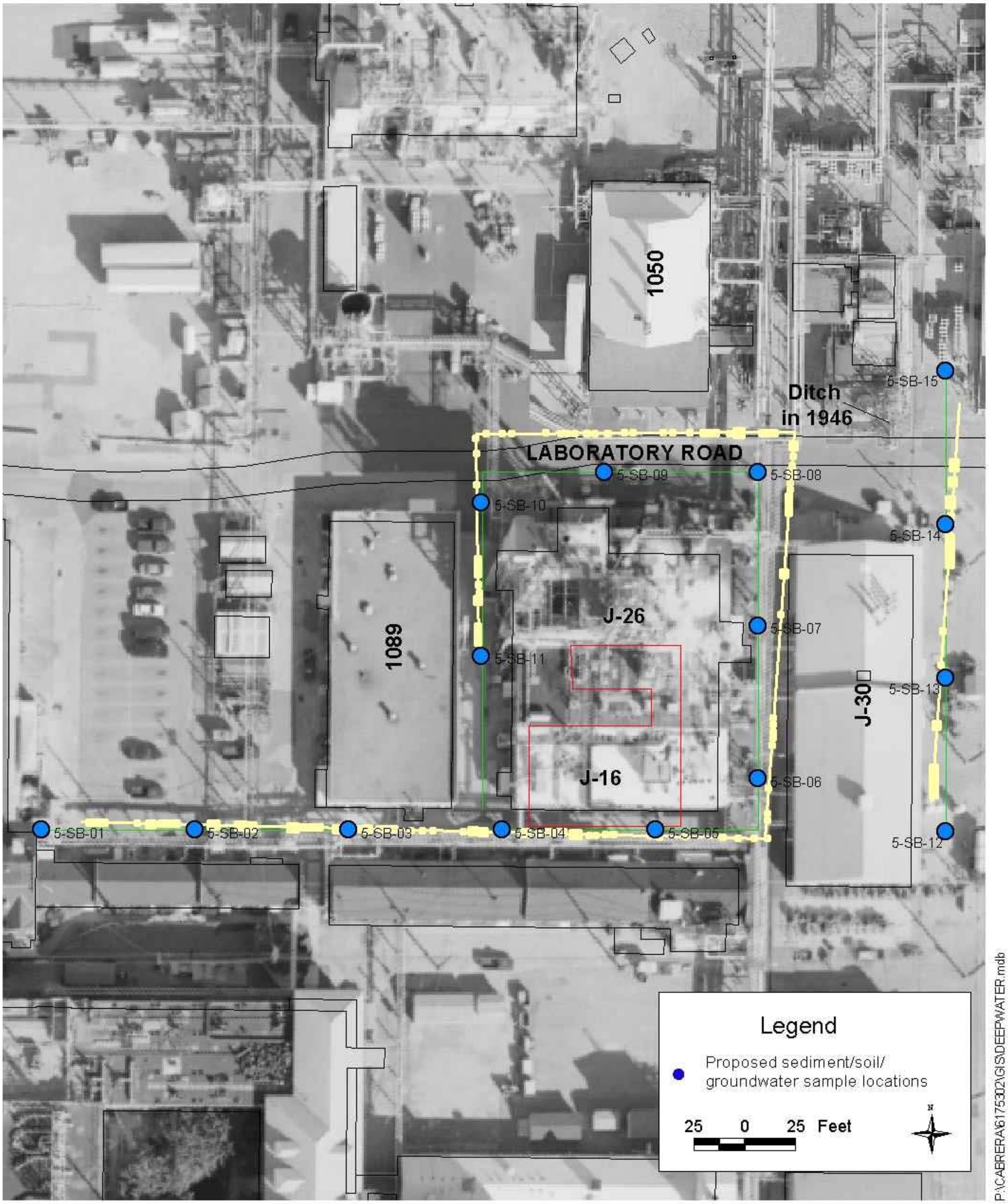

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FIGURE 3-2
PROPOSED SOIL
BORING LOCATIONS IN
AOC 5

4 Health & Safety

4.1 Chemical Hazards

The primary chemical hazard is tetraethyl lead, which is expected to be present in soil vapor. Chemical hazards are discussed in detail in the Site-Specific Safety and Health Plan. A table of potential chemical hazards is included below as Table 444-1.

Table 4-1 Potential Chemical Hazards

Chemical of Concern	Permissible Exposure Limits [PELs]	Maximum Concentrations
Radioactive Materials (U-nat)[8]	100 millirem/year (USACE EM385-1-1 limit for the public). 0.05 mg/m^3 (OSHA TWA for Ur)	Unknown[9]
Lead	0.05 mg/m^3 (NIOSH/OSHA TWA)	Unknown
Tetraethyl Lead (TEL)	0.075 mg/m^3 (NIOSH/OSHA TWA)	0.09 mg/m^3 [10]
Ethylene dibromide	20 ppm (OSHA TWA), 30 ppm ceiling 0.045 ppm (NIOSH TWA), 0.13 ppm (1 mg/m^3) (NIOSH STEL)	Unknown
Ethylene dichloride	50 ppm (OSHA TWA), 100 ppm ceiling 1 ppm (4 mg/m^3) (NIOSH TWA), 2 ppm (8 mg/m^3) (NIOSH STEL)	Unknown
Phosgene	0.1 ppm (OSHA TWA), 0.40 mg/m^3 0.1 ppm, 0.40 mg/m^3 (NIOSH TWA), 0.2 ppm STEL	Unknown
Antimony	0.5 mg/m^3 (ACGIH, OSHA, and NIOSH TWA)	Unknown
Fluoride	2.5 mg/m^3 (ACGIH, OSHA, and NIOSH TWA)	Unknown
Iodine	0.1 ppm (1 mg/m^3) (ACGIH, OSHA, and NIOSH TWA)	Unknown
Dinitrobenzene, nitrobenzene, benzene, chlorobenzene and dichlorobenzene, toluene, xylene, dinitrophenol, dinitrotoluene, nitrotoluene, tetrachloroethylene, Freon 113,	1 ppm (OSHA TWA) for benzene[11] 0.1 ppm (0.32 mg/m^3)(NIOSH TWA) for benzene	Unknown

[8] U-nat-denotes natural uranium which contains radioactive isotopes U^{234}, U^{235}, and U^{238}.

[9] Radiological data available from Bechtel and Oak Ridge National Laboratory (ORNL) characterizations indicated the following:

- The 1983 Bechtel investigation indicated exposure rate measurements along the CDD ranged up to 15 microrem per hour (μR/hr), which is approximately 3.5 times background radiation levels. Similar data were not available for the Building J-26 Area.
- Sediment sample results from an ORNL 1977 investigation ranged up to 12,600 pCi/g of Ur-238. Sediment collected during the 1983 Bechtel investigation ranged up to 4 pCi/g Ur-238. The portion of the CDD where these sample were collected was remediated in 1977 by DuPont for TEL.
- Water sample results collected adjacent to the CDD during the ORNL investigation yielded 0.67 pCi/L for U-238.

[10] Measured by Weston at OU 1 in one background air sample during field activities. The other 43 air samples did not detect organic lead.

[11] The PELs for these compounds are higher than the PEL for benzene. The PEL for benzene is listed as the most conservative value.

4.2 Action Levels

Action levels for intrusive activities will be determined based on results of daily perimeter air sample results and real time monitoring to be conducted on personnel within the exclusion zones during all intrusive activities at OU 2. Action levels based on air monitoring results are summarized in Table 4-2. Air will be monitored for volatile organics and organic lead, specifically.

Table 4-2 Task Specific Action Levels for Direct-Reading Instruments

Task/Hazard	Instrument	Action Level*
Drilling/Explosive atmosphere.	CGI as required.	1% – 10% LEL: Continue work. Determine source of meter response (i.e. 5% LEL may indicate potential health or instrument drift.) > 10% LEL (ambient air): Stop work; investigate the source. > 10% LEL (confined space): Stop work and evacuate confined space until levels < 10% are measured.
Drilling, Confined Space/Oxygen content.	O_2 meter (included with CGI instrument) as required.	< 19.5%: Stop work and evacuate site until levels >19.5% and < 23.5% (ambient air) or > 19.5% and < 23.5% (confined space) are measured. > 19.5% to <23.5% (ambient air) or 19.5% to 23.5% (confined space): Acceptable levels for O_2. > 23.5% (ambient air or confined space): Fire hazard potential; stop work and consult CIH. OSHA defines oxygen enriched as 23.5%.
Drilling, vibracoring or augering, sample collection/Organic vapors.	PID/FID.	0 to 1 ppm: Continue monitoring breathing zone in work areas. Intrusive work will begin in Level C. Downgrade from Level C is not expected, but will be considered based on air sampling at the breathing zone for specific contaminants as discussed in Section 7. Primary chemical hazards are tetraethyl lead and benzene, which require specific air sampling and analysis. . > 0.5 ppm: Notify Program Safety Manager to re-evaluate conditions. Begin contaminant-specific monitoring for benzene using a Draeger Tube.
Drilling, vibracoring, augering/Particulates.	Mini-Ram.	> 0.5 mg/m^3: At a minimum, Level C PPE is required or dust control measures should be implemented. This is based on the OSHA TWA for lead and uranium and an assumed 5% (50,000 mg/kg inorganic lead or Ur) soil contamination level.
Drilling, vibracoring, augering/External Gamma Radiation.	Micro-R-meter or equivalent.	> 2.0 millirem/hr.: Post area as radiation area. Control access to the area, and ensure that all personnel in area have dosimetry.
Drilling, vibracoring, augering/Radioactive Contamination.	Ludlum 2221 with 43-89 (alpha-beta detector), or equivalent.	> 1,000 dpm/100 cm^2: Post area as a Radiological Contamination Area, contain contamination to control the spread, and ensure all personnel in the area have the proper PPE.
Drilling, vibracoring, augering/Airborne Radioactive Contamination.	Personal (Breathing Zone) and area air samplers.	> 10 % of a Derived Air Concentration (DAC) from 10CFR20 Appendix B, Table 1, Column 3: Post area as Airborne Radioactivity Area, stop work, and ensure all personnel have the appropriate respiratory protection (Level C PPE).

*Readings in the Breathing Zone shall be used to determine respiratory PPE.

4.3 Emergency Contacts

Service	Telephone Number
Plant Medical	Ext. 2222
Ambulance Service	Ext. 2222
Police – Security	(856) 540-2400
Fire	(856) 540-3512
Hospital: Salem County Memorial 310 Woodstown Road Salem, NJ 08079	(856) 935-1000
Environmental Release Contact	Ext. 2222
CABRERA CIH/Paul Schwartz	860.653.4159 home 860.463.8595 cell

5 Management of Investigation Derived Material

Cabrera is committed to timely management of investigation derived material (IDM). While work is occurring at an AOC, IDM will be temporarily stored at the work site. When work is completed at each AOC, IDM will be transported to the 90-day storage area specified by DuPont. Waste liquids will be temporarily stored in a large capacity polypropylene tank, or alternatively, 55-gallon DOT-approved drums, analyzed, and if results are acceptable to the DuPont Wastewater Treatment Plant, discharged to the Treatment Plant. Composite samples of the solid IDM (less PPE) will be used for characterization. Solid IDM will remain on-site in the 90-day storage area until the analytical laboratory results are available to determine the disposal requirements.

All containers will be clearly marked with the source location (OU number and AOC number), type of material (soil, groundwater, concrete coring, PPE, etc.), the corresponding location number (well number of boring number), and start date of container. In addition, a label that identifies the name and number of the on-site USACE representative will be placed on the containers.

5.1 Management of Soil Cuttings

Soil cuttings will be collected and managed so as to minimize the settling-out of liquids in the soil drums. While work is on-going in each AOC, IDM drums will be temporarily stored at the work-site on pallets. The drums will be clearly labeled. Following the completion of activities at each AOC, waste drums will be transferred to the DuPont 90-day storage area.

5.2 Management of Liquid Wastes

The liquid wastes will include some water from decontamination of sampling equipment, and boring or well purge water. These liquid wastes will be stored in new, DOT-approved 55-gallon drums or a trailer-mounted tank that will be maintained at the work-site. Near the completion of field work, the fluids in the tank will be sampled for determination of final disposition. USACE will coordinate with DuPont for the disposal of the aqueous IDM at the on-site wastewater treatment plant (WWTP) once the analytical results are available (assuming the water-quality meets discharge criteria). Liquid wastes will be analyzed for the parameters listed in Table 555555-1.

5.3 Management of Used Personal Protective Equipment

Personal protective equipment (PPE) will be stored much like solid IDM. It will be stored in drums at each AOC during work on the AOC. At completion of work at the AOC, the drums will be moved to DuPont's 90-day storage area.

5.4 Management of Lab Waste

All soil samples that arrive to the onsite lab will be contained in sample jars (Marinelli beakers). After completion of analysis, the sample will be temporarily stored in a trailer onsite for the possibility of future reference. At the completion of the field project, the samples (in their containers) will be added to the soil waste drums for disposal.

A small amount of liquid waste will be generated in the onsite lab; principally from the Hach testing system. These wastes will be contained in a sealed and clearly marked container in the lab and periodically transferred to the IDW storage area for addition to the liquid IDM storage container.

5.5 Final Disposition of Solid IDM

The on-site USACE representative will sign all waste manifests prior to transport to the disposal facility. The USACE will be the generator and will use the USACE generator number for IDM. A Cabrera certified hazardous materials broker will review and approve waste transportation and disposal plans. The solid IDM (soil cuttings, PPE, disposable sampling equipment) will be disposed of at a permitted off-site facility, as identified by USACE. It is anticipated that all liquid IDM will be acceptable for disposal at the DuPont Treatment Plant. If the liquids do not meet the facility's waste acceptance criteria, alternate, off-site disposal plans will be made.

The analytical parameters for waste characterization are listed in Table 555555-1. Solid IDM will be sampled for waste-characterization parameters using a combination of grab and composite samples, as indicated in the table.

Table 5-1 Analysis Parameters for Investigation Derived Waste

Solids			
Parameters	**Methodology**	**Number of Samples**	**Types of Samples**
TCLP VOAs	SW 1311/8260B	1 per AOC, plus one trip-sample per AOC	Grab
TCLP semiVOAs	SW 1311/8270C	1 per AOC	Grab
TCLP metals	SW 1311/6010/7470	1 per AOC	Composite
TCL Pesticides	SW 8081A	1 per AOC	Composite
TCL PCBs	SW 8082	1 per AOC	Composite
RCRA characteristics (ignitability, corrosivity, reactivity	SW 846	1 per AOC	Composite
Paint filter test	SW 9095A	1 per AOC	Composite
Liquids			
TCL VOA	SW 8260B	1 per AOC	Grab
TCL semivolatiles	SW 8270C	1 per AOC	Grab
TCL Pesticides	SW 8081A	1 per AOC	Grab
TCL PCBs	SW 8082	1 per AOC	Grab
TAL Metals	SW 6010B/7000	1 per AOC	Grab
TOC	SW 9060/EPA 415.1	1 per AOC	Grab
RCRA characteristics (flammability, corrosivity, reactivity	SW 846	1 per AOC	grab

6 Data Management & Quality Assurance

Field personnel will utilize field instruments data-recording and GIS capabilities whenever possible to avoid the transcription errors inherent to paper-based systems.

6.1 Data Management System

Field data will be centrally located and managed in a single database that will be accessed through the project website. The database software, named EDMS, interfaces with sample management software called ADR, which was developed for USACE. The EDMS database tracks samples from field to laboratory and tracks sample results from laboratory to delivery. The ADR software performs checks for the completeness and precision of the sample analyses and flags problematic data for review. The system minimizes transcription errors because data entry is performed only once by field personnel and this data is thereafter associated with the proper sample in the database.

The sample collection data is entered in the field using a USEPA program named Forms II Lite, which creates chains-of-custody and electronic files for submission to the laboratory.

6.2 Sample Numbering System

The environmental and associated QC samples collected during this RI will be labeled with a sample identification (ID) number. The sample ID will be composed of six components:

[_ _]	[_ _]	[_ _]	[_ _]	[_ _]	[_ _]
1	2	3	4	5	6

Component 1 – Defines the Area of Concern (AOC)

1	=	AOC 1: Former Building 845 Area
2	=	AOC 2: F Parking Corral
3	=	AOC 3: CDD
4	=	AOC 4: Historical Lagoon A
5	=	AOC 5: Building J-26
6	=	AOC 6: East Burial Area

Component 2 – Defines the Location Type

CC	=	Concrete Coring
SB	=	Soil Boring
MW	=	Monitor Well
TP	=	Test Pit
SS	=	Surface Soil
SW	=	Surface Water
SD	=	Sediment/Drainageway Soil

Component 3 – Identifies the individual sample location (01 through 99).

Component 4 – Defines the sample matrix using letters:

B	=	Subsurface Soil Sample
R	=	Surface Soil Sample
D	=	Sediment/Drainageway Soil Sample
G	=	Groundwater Sample
W	=	Water Sample (not groundwater)
S	=	Surface Water Sample

Component 5 – Defines QC sample collected:

0	=	Used for environmental and matrix spike/matrix spike duplicate samples
1	=	Duplicate Sample
2	=	Equipment Rinsate Blank
3	=	Trip Blank
4	=	Field Blank

Component 6 – Identifies the sample number. Soil samples collected in a boring at 2 and 10 ft bgs would be numbered consecutively (01 and 02, respectively).
To maintain a unique sample number, a database will be maintained that will track the latest sample number used for a site location. Field personnel will be required to check this database before assigning a sample number. If new sampling scenarios arise that are not adequately addressed by this sample ID system, there is enough flexibility in the system to accommodate new scenarios without compromising the existing sampling scenarios.

6.3 Sample Labels and/or Tags

Sample labels will include the following items:

- Client name
- Project name
- Sample location (x and y)
- Date/time
- Sample collector
- Sample identification
- Preservation
- Analyses requested

The sample labels and chain-of-custody will be generated using an electronic database management system to more accurately and precisely manage the sample identification numbers, labeling, and chain-of-custody.

7 Project Schedule

Figure 7-1 Project Schedule

WBS	TASK	Duration	Start	Finish	Pre-decessor
1.0	SCOPING,BACKGROUND/PROJECT PLANNING	129 days?	2/28/03	8/27/03	
2.0	COMMUNITY RELATIONS	106 days?	6/6/03	11/3/03	
3.0	SITE CHARACTERIZATION	302 days?	7/22/03	9/15/04	
3.0.1	Executive Summary Review	1 day	7/22/03	7/22/03	
3.1	Implement & Doc Field Support Activities	42 days	7/23/03	9/18/03	36
3.1.1	Mobilization	3 days	7/23/03	7/25/03	36
3.1.2	Demobilization	5 days	9/12/03	9/18/03	50
3.2	Ecological Survey	2 days	9/1/03	9/2/03	48
3.3	Sample Loc/Gamma/Geophysical Surveys	6 days	7/29/03	8/5/03	38
3.3.1	Geophysical Surveys	2 days	7/29/03	7/30/03	
3.3.1	Gamma Walkover	2 days	8/4/03	8/5/03	
3.3.3	Mark Boring Locations	2 days	7/29/03	7/30/03	
3.3.4	Interpret Surveys	3.5 days	7/31/03	8/5/03	
3.4	Intrusive Investigation	22 days	8/5/03	9/15/03	
3.4.1	AOC 3 Soil / GW Sampling	8 days	8/5/03	8/14/03	
3.4.2	AOC 5 Soil / GW Sampling	5 days	8/15/03	8/21/03	47
3.4.3	Location Survey	1 day	9/3/03	9/3/03	48
3.5	IDM Management	5 days	9/5/03	9/11/03	48
3.6	Sample Analysis & Management	30 days	10/31/03	12/11/03	47