Phase IV Soil Remediation Report
Former C-E Cast Facility
Muse, Pennsylvania

Prepared For:

Prospect Hill Management Corporation
Norwalk, Connecticut

ABB Environmental Services, Inc.

ABB

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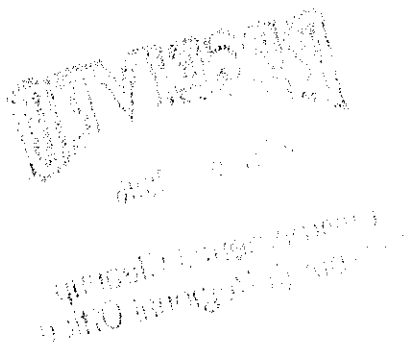
April 1996

Prepared for
Prospect Hill Management Corporation
Norwalk, Connecticut

Submitted by
ABB Environmental Services, Inc.
Portland, Maine



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FORMER C-E CAST FACILITY
MUSE, PENNSYLVANIA

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EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES) successfully completed the Phase IV Soil Remediation Program at the former C-E Castings (C-E Cast) facility, located on Mine Hill Road, in Muse, Cecil Township, Washington County, Pennsylvania. Soil remediation and site restoration activities were implemented in accordance with the provisions and intent of the Pennsylvania Department of Environmental Protection's (PADEP) Land Recycling and Environmental Remediations Standards Act (Act 2) (PADEP, 1995a).

ABB-ES began soil remediation at the C-E Cast facility with the Phase IV Remediation Pilot Test Program in August, 1995. During the pilot test, approximately 700 cubic yards (cy) of impacted soil was formed into a pile (stack) and treated using Thermally Enhanced Vapor Extraction (TEVE) technology. Upon successful completion of the pilot test, ABB-ES began the Phase IV Soil Remediation Program on September 6, 1995; the program was completed in the spring of 1996. During this period approximately 20,000 cy of impacted soils were excavated from the four areas (Area 1-1 through Area 1-3, and Area 3-1) identified during the site remedial investigation and seven additional areas identified during the soil remediation program.

As part of the site restoration activities, ABB-ES constructed a sediment pond for erosion control purposes. During this construction, four areas containing drums (BSA-1 through BSA-4) were unearthed. Impacted soils from these areas were excavated and treated, any drums or drum carcasses were removed and disposed of off-site. As a result of the discovery of buried drums on-site, ABB-ES performed a geophysical survey of approximately 6-acres of the site to determine the presence of additional areas of buried drums. The geophysical survey identified 16 electromagnetic anomalies, where metal objects were potentially buried. As a result of test pitting at these 16 anomalies three additional areas (EMA-3, EMA-4, and

EMA-15) were discovered to contain buried drums and/or impacted soils. Soil from these additional areas were also excavated and treated, and the drums were removed and disposed of off-site.

The impacted soils excavated at the site were formed into a total of 20 stacks. Each stack was treated for a minimum of five days (120 hours). During treatment, constant air monitoring was conducted using the TEVE system's flame ionization detector and photoionization detector. After five days of treatment, a minimum of seven samples of treated soil were collected from each stack to verify that site contaminants of concern were not present at concentrations greater than the PADEP Statewide Health Standards. Confirmatory sampling and analysis was also performed on the walls and floor of each of the 11 areas excavated to verify that all impacted soil had been removed from the excavations.

To complete the remediation program, the site was restored to usable land. Upon completion of the treatment of impacted soils, the clean soil was transported back to the previously excavated areas, placed in the excavations as fill, and compacted. A total of more than 11 acres of disturbed area was graded, covered with 12 inches of vegetative soil, seeded and mulched. Drainage ditches were also constructed, stone dikes installed, and sedimentation traps constructed. Maintenance of any areas that erode will be performed until a substantial growth of grass has developed. Groundwater at the site will continue to be monitored to assess what impact the removal of source areas has on groundwater quality at the site.

1.0 INTRODUCTION

At the request of Prospect Hill Management Corporation (PHMC), a subsidiary of Combustion Engineering Inc., ABB Environmental Services, Inc. (ABB-ES) conducted the remediation of impacted soils at the former C-E Castings Facility (C-E Cast) located on Mine Hill Road, in Muse, Cecil Township, Washington County, Pennsylvania. Site soil remediation and restoration activities were implemented in accordance with the provisions of the Pennsylvania Department of Environmental Protection (PADEP) Land Recycling and Environmental Remediations Standards Act (Act 2) of 1995 (PADEP,1995a).

Prior to soil remediation, ABB-ES had conducted three environmental investigations at the C-E Cast site, including a site closure investigation (Phase I), a Phase II site investigation, and a Phase III site investigation. These were conducted from 1993 through 1994, and comprise the remedial investigation for the site. Based on the results of the remedial investigation, ABB-ES selected Thermally-Enhanced Vapor Extraction (TEVE) technology (also referred to as Low Temperature Thermal Desorption) to treat impacted site soils.

On September 1, 1995, PHMC submitted a Notice of Intent to Remediate (NIR) to PADEP, Washington County, and Cecil Township (ABB-ES, 1995a). The PHMC published the NIR in the local newspaper, the *Washington Observer-Reporter*, and PADEP published the NIR in the Pennsylvania Bulletin (Appendix A).

ABB-ES began soil remediation at the C-E Cast facility with the Phase IV Remediation Pilot Test Program in August 1995. During the pilot test, approximately 700 cubic yards (cy) of impacted soils were successfully treated using TEVE technology. Upon successful completion of the pilot test, ABB-ES began the Phase IV Soil Remediation Program on September 6, 1995; Phase IV was completed in February 1996. During this period, approximately 20,000 cy of impacted soils from

four areas identified during the site investigations (Areas 1-1 through 1-3, and Area 3-1), and seven areas identified during the Phase IV Soil Remediation Program (Barral Storage Area [BSA] BSA-1 through BSA-4, EMA-3, EMA-4, and EMA-15), were excavated and remediated.

This report documents the successful remediation of impacted soils at the C-E Cast facility and the restoration of the site to useable property. Section 2.0 of this report presents the site history, and describes the geology and hydrogeology of the site and the region. Section 3.0, Basis for Remedial Action, discusses the identification of standards, criteria and guidelines, the selection of exposure factors, and the soil remediation pilot study. Section 4.0 summarizes the field changes made to the Draft Remedial Action Plan (RAP) (ABB-ES, 1995b). Section 5.0 discusses the implementation of the RAP, including the excavation and remediation of impacted soils and restoration of the site. Section 6.0 presents the Summary and Conclusions. Figures and tables are presented at the end of Section 6.0. All laboratory analytical data are presented in Volume II - Phase IV Soil Remediation Analytical Data (Volume II).

2.0 SUMMARY OF FINDINGS

This section presents a site history (including a summary of previous investigations), and describes the geology and hydrogeology of the site and the region.

2.1 SITE HISTORY

The C-E Cast facility is located in the Village of Muse, Pennsylvania (Figure 2-1). The H.C. Frick Coal Company (Frick) founded the village to house workers for its National No. 3 coal mine, which underlies the site and part of the village. Frick, and then the United States Steel Co. (now USX), operated the coal mine from 1923 until January 26, 1953, when USX closed the mine. Coal mine-related facilities on-site included a mule barn, a maintenance shop, coal storage sheds, lamp house, hoist house, and a blackwater lagoon (used for disposal of coal wash water). Shaft No. 3, an entrance to the mine, is also located on-site (Figure 2-2).

In 1953, USX sold the real estate, excluding the mine, to Chemical and Solvents, Inc., which managed a chemical recovery and recycling operation at the site. Chemical recovery facilities included a railroad siding where chemicals were unloaded, aboveground chemical storage tanks, and a large distillation or "cracking" tower and other smaller stills where chemicals were recovered (see Figure 2-2). In 1968, Chemical and Solvents, Inc. sold the property to Combustion Engineering, Inc. C-E Cast, a subsidiary of Combustion Engineering, Inc., continued the chemical recovery operations and manufactured and sold chemical additives and equipment to the castings industry. The chemical recovery operation was discontinued in 1970; manufacturing of additives and equipment continued until 1985.

In 1985, Combustion Engineering, Inc. sold the C-E Cast business and leased the property to CastAmerica. CastAmerica ceased operations in May 1987, selling their

patents and goodwill to Ashland Chemical. With the exception of one building, Building 1, the facility has been idle since 1987. In July 1987, Combustion Engineering, Inc. leased Building 1 to Castec to house an equipment assembly and spare parts operation. Castec vacated the property in December 1993.

Summary of Previous Investigations. Initial investigation activities began in 1980, when a landfill cell was constructed at the site. This cell was constructed to store hazardous waste generated before 1979, as well as the contents of the black water lagoon and the dump areas located along an unnamed creek on the eastern side of the site. Construction of the landfill cell and closure of the black water lagoon and several other lagoons in 1980, were completed under a closure plan prepared by Penn Environmental (now a unit of NUS Corporation).

Beginning in 1992 and continuing until the Phase IV soil remediation, ABB-ES conducted three environmental investigations at the former C-E Cast facility at the request of Combustion Engineering, Inc. These three investigations, a site closure investigation (Phase I), a Phase II site investigation, and a Phase III site investigation, were conducted from 1992 through 1994 and comprise the Remedial Investigation for the C-E Cast site. Detailed results of these investigations can be found in the Site Assessment Report (Phase I) (ABB-ES, 1993), Report of Field Investigation (Phase II) (ABB-ES, 1994a), and Draft Phase III Site Investigation Report (ABB-ES, 1994b).

Based on the results of these investigations, ABB-ES constructed a conceptual model of the site. This site conceptual model is presented in Subsection 2.2.2.

2.2 SITE CHARACTERIZATION

The characteristics of the site geography, geology and hydrogeology, aquifer, and contaminant distribution are presented in the following subsections. These are derived from observations and data collected during the three site investigations.

2.2.1 Physical Characterization

Geographic Setting. The C-E Cast site is located on a hill north of Muse (see Figure 1-2). The 83-acre property contains approximately 17 acres of coal mine tailings. Approximately 10 acres were developed with buildings, tank farms, and parking. The remaining 56 acres were undeveloped (see Figure 2-2).

Frick opened the National No. 3 mine in 1923 to mine the Pittsburgh Coal. National No. 3 is approximately 11,300 acres in extent, and is L-shaped, with the longer leg oriented approximately N25E and the shorter N65W. An entrance to the mine, Shaft No. 3, is located on-site. This shaft was 312 feet deep from a ground surface elevation of approximately 1,200 feet mean sea level. The mine shaft under the site was filled and abandoned in July 1994. Water level measurements obtained from Shaft No. 3 during the RI indicated that up to 200 feet of water may be present in the mine.

Limited data regarding mine operations are available; records from the mine apparently were lost when operations ceased (January 26, 1953). Two other mines, National No. 1 and National No. 2, reportedly are connected to National No. 3 (A. Graziani, 1993). National No. 3 is also reportedly connected to a mine owned by the Henderson Coal Company, located south and east of National No. 3.

Geology and Hydrogeology. The C-E Cast site is located in the Pittsburgh Plateaus Section of the Appalachian Plateaus Province (Socolow, 1962). Approximately

27 acres of the original site topography have been obscured by activities such as the grading and disposal of mine tailings and the construction of the landfill in 1980.

Soil borings drilled during the site investigations indicated the soil beneath the disturbed portions of the site consisted predominantly of fill overlying clayey weathered shale. The overburden ranged from approximately 1.5 feet in thickness to approximately 40 feet. The fill generally increased in thickness toward the southwest and was thickest across the western portions of the site.

The weathered shale underlying the fill and native soil has nearly horizontal bedding planes and shaley partings when dry. When wet, these partings are not visible and the weathered shale resembles massive clay. There is a local high in bedrock surface topography near the center of the site, forming a nearly north-south ridge dipping steeply to the east and west, and less steeply to the south. To the east, the surface topography roughly follows the bedrock surface; to the west, the bedrock flank has been filled with mining tailings.

Groundwater is present at depths ranging from the surface to deeper than 75 feet below ground surface (bgs). Groundwater also occurs in several shallow (less than 5 feet bgs) perched zones at the site. The surface of the first continuous water-bearing zone generally follows the surface topography. Groundwater appears to flow predominantly to the east and southeast.

Aquifer Characteristics. The hydraulic gradient across the site ranges from 0.04 feet/feet to 0.1 feet/feet. Perched water flowing in the area of the former railroad bed was potentially influenced by the coarse gravel (railroad ballast) used during its installation; the bed acted as a zone of higher hydraulic conductivity and a preferred pathway. Analytical data from site investigations also suggested a north-south component of groundwater flow in the area.

The hydraulic conductivity of the weathered clay and bedrock beneath the site ranges from $2x10^{-5}$ to $6x10^{-4}$ centimeters per second (cm/sec), and based on an estimated aquifer thickness of 20 feet, transmissivity ranges from $2x10^{-1}$ to $9x10^{-3}$ cm/sec. Using an estimated effective porosity of 0.25, groundwater velocity across the site ranges from 2.4 feet/year to 243 feet/year. Using the mean of the calculated hydraulic conductivity of $2x10^{-4}$ cm/sec, the average groundwater velocity is approximately 80 feet/year.

Topographic maps of the mine area, dated 1927, show a drainage swale running south from the western side of the site. Groundwater appears to discharge at the base of the relict drainage swale near the southern end of the property.

Surface run-off and shallow groundwater at the site appear to drain east into an unnamed tributary of Brush Run (see Figure 2-2). This tributary begins as an intermittent stream in a marshy area in the northeastern corner of the site and flows south just outside the eastern property boundary. Approximately 1,000 feet south of the marshy area the intermittent stream enters a culvert. Downstream of the culvert the tributary is a perennial stream. The nature of the discharges to the tributary inside this culvert is unknown but may include groundwater.

Brush Run flows south into the Chartiers Creek and then north to the Ohio River. Drainage from north of the site enters the Ohio River via Millers Creek and Chartiers Creek.

2.2.2 Conceptual Model and Contaminant Distribution

The following site conceptual model is based on the results of the site investigations discussed in Subsection 2.1. At that time, analytical results were compared to the former Pennsylvania Department of Environmental Resources (PADER [currently called PADEP]) Level 2 cleanup standards provided in the "Cleanup Standards for Contaminated Soils Guidance Document" (PADER, 1994).

Soils. The nature and distribution of contaminants detected in site soils can be linked to past operation of the solvent recovery facility and the black water lagoon. Significant concentrations of halogenated volatile organic compounds (VOCs) in excess of PADER 2 standards were detected in Area 1, with the highest concentrations occurring in a 0.5- to 2-foot thick layer of oily fill detected within 4 feet of the ground surface, along the former railroad bed. The impacted soils in Area 1 appear to be the source of groundwater contamination migrating off-site to the east. To minimize the potential for migration of site contaminants and remove the potential for direct exposure to contaminated soils, soil remediation was planned for Area 1 soils.

Area 2 encompasses the former black water lagoon. The results of the Phase II and III site investigations indicated that the removal action completed in 1980 removed the sludge and originally impacted soil materials from this area. The residual contamination detected in this area included halogenated VOCs similar to Area 1, and benzene, toluene, ethyl benzene, xylenes, and styrene (BTEXS). Based on the lower levels of site contaminants observed in this area (only one boring yielded samples with concentrations exceeding PADER 2 criteria), this contamination was interpreted as deriving from groundwater migration of contaminants from the former lagoon to the underlying soils. Whereas the original source of groundwater contamination had been removed, ABB-ES proposed to re-seal the concrete cap atop Area 2 and divert drainage around the area to minimize infiltration. These steps would further reduce the potential for contaminant migration via groundwater.

Area 3 is the former storage tank area. One soil sample from this area contained BTEXS in concentrations exceeding PADER 2 criteria.

To remove the source of groundwater contamination, on-site low-temperature thermal desorption was planned for soils from Area 1 and a small portion of Area 3. Soils with contaminant concentrations exceeding PADER criteria (PADER, 1994) for

groundwater protection would be excavated, treated, and returned to the site. Following soil remediation, the site would be graded to promote proper drainage.

Groundwater. Area 1 soils appear to be the source of groundwater contamination migrating east of the site. Site-related chemicals from Area 1 are migrating off-site via groundwater on the eastern side of the property and may be discharging to a small stream running along the eastern site boundary. In the southern and northwestern portions of the site, contaminant migration via groundwater appears to be confined within the site boundaries. The lower concentrations of groundwater contamination detected downgradient of Area 2 indicated that the soils removed in 1980 had likely been the original source of groundwater contamination in this area. The residual contamination in Area 2 is unlikely to be a significant continuing source.

The inconsistent occurrence of site-related contaminants in monitoring wells directly adjacent to potential source areas suggests groundwater flow in some areas may be primarily through bedrock fractures or along bedding planes.

Removal of the groundwater contaminant source areas is expected to lead to an attenuation of contaminant concentrations over time. Long-term monitoring of the perimeter wells for site contaminants is planned.

Surface Water and Sediments. Contaminant concentrations in surface water flowing along the abandoned railway on-site are fully attenuated before leaving the site. The potential exposure to trespassers (hunters and recreational vehicle drivers) could be effectively addressed by the site remediation and closure. Soil remediation in Area 1 would remove the source of contamination, and the final site grading would ensure that site drainage does not contact any areas of contamination.

Migration Pathways. Based on analytical results and the geologic and hydrogeologic data, ABB-ES identified two migration pathways. The major pathway is through groundwater, and the secondary pathway is through surface water receiving groundwater recharge and/or runoff, and preferential pathways such as the former railroad bed.

VOCs are present in groundwater downgradient from Areas 1 and 2. These compounds have moved as a result of groundwater flow. Site contaminants detected in groundwater downgradient of Area 1 indicate that contamination has moved off-site via groundwater east of Area 1. Analyses of groundwater from perimeter monitoring wells to the south and north indicates that contamination has not reached the property boundaries in the north, southeast, south, and southwest. Local residents are served by municipal water supplies; there are no known receptors for the groundwater migration pathway.

Surface water flow was identified in the Phase II investigation as a potential contaminant migration pathway. Surface water and sediment analyses conducted during the Phase III investigation indicate that contaminants reaching the drainage ditch from Area 1 are attenuated before reaching the marsh area in the northern portion of the site, and are therefore unlikely to be moving off-site in the unnamed tributary to Brush Run. Groundwater moving off-site to the east could potentially discharge to this unnamed tributary, bringing with it the low concentrations of site-related contaminants detected in MW-201. As the observed concentrations are low and the source area is being remediated, this pathway is not considered a significant exposure pathway.

An additional potential migration pathway is mine water flow through the flooded mine workings. Because the interconnection of the mine workings with other mines is unknown, no exposure point characterization is possible for this medium.

3.0 BASIS FOR REMEDIAL ACTION

This section discusses the identification of the standards, criteria, and guidelines used by ABB-ES in the remediation of the C-E Cast facility soils. The selection of exposure factors and the results of the pilot test program are also presented in this section.

3.1 IDENTIFICATION OF STANDARDS, CRITERIA, AND GUIDELINES

As stated in the draft Phase IV Remediation Pilot Test Program Work Plan (ABB-ES, 1995d), the pilot test was designed to address the former PADER Level 2 Standards (PADER 2) as soil cleanup criteria. At that time, PADER guidance for soil cleanup was provided in the "Cleanup Standards for Contaminated Soils Guidance Document" (PADER, 1994). PADER 2 standards, applicable to soils impacted from past releases greater than one year old, were selected as the most appropriate for the C-E Cast site because site operations had ceased in 1987.

On May 19, 1995, Act 2 was signed into law, to be effective July 18, 1995. At the same time, PADE*R* became PADE*P*, and the standards in PADEP Act 2 replaced the PADER 2 standards. To eligible for cleanup liability protection under Act 2 one or a combination of three environmental remediation standards must be selected and met: a Background Standard, a Site Specific Standard, or a Statewide Health Standard. At the C-E Cast site, ABB-ES chose to remediate to the statewide Health Standard using the most protective of the Statewide Health Standards for soil; the soil to groundwater pathway standard. These standards can be found in Appendix B2 of the Act 2 guidance manual (PADEP, 1995).

Also as a result of Act 2, ABB-ES revised the original list of site contaminants of concern (COCs). Styrene and cis-1,2-dichloroethene were deleted from the list of

COCs for soil because the maximum detected concentrations of these compounds in soil were below the Act 2 Statewide Health Standards. Similarly, the maximum concentrations of tetrachloroethane (TCA) and vinyl chloride were below the Act 2 Statewide Health Standards; however, tetrachloroethene (TCE) and vinyl chloride were retained as site COCs, because they remain COCs for groundwater. This list of site COCs and their associated Act 2 Statewide Health Standards are shown on Table 3-1.

3.2 SELECTION OF EXPOSURE FACTORS

The former C-E Cast Facility is an inactive site located in a residential/rural area. All on-site structures have been levelled. Therefore, potential receptors for soil contamination are limited to site trespassers. Exposure to site soils could have been limited through control of site access and/or site closure activities that involve filling and grading. However, impacted soils appeared to be a source of groundwater contamination migrating off-site. In order to minimize migration of site contaminants and to remove the potential exposure to impacted soils, ABB-ES chose to remediate impacted soils to achieve the more stringent Act 2 Statewide Health Standards.

Soil remediation and site closure are expected to mitigate the migration of site-related contaminants to groundwater by removing the contaminant source and/or reducing infiltration through contaminated soils.

No confirmed receptors for the groundwater migration pathway are present, because all area residences are served by the city water system. Impacted groundwater moving off-site to the east appears to be discharging to the unnamed tributary to Brush Run that flows along the eastern site boundary. Hunters, recreational vehicle drivers, and others walking in the woods in this area could potentially come in contact with this water. However, assuming dilution and volatilization, it is unlikely

that groundwater discharge to this stream would pose a risk to human health or the environment.

3.3 REMEDIAL ACTION PLAN

In March 1995, ABB-ES prepared and submitted to PADER, a Phase IV Remedial Action Plan (RAP) for the C-E Cast site. The RAP provided PADER with a design for treatment of impacted soils at the facility (ABB-ES, 1995). Prior to starting full remediation, ABB-ES obtained all of the necessary town, county, and state permits, (Appendix A), and conducted a Pilot Test Program to demonstrate that the chosen remedial technology, TEVE, could treat the impacted soils to the required standards.

3.4 PILOT TEST PROGRAM RESULTS

In August 1995, ABB-ES conducted the TEVE pilot test at the former C-E Cast facility. Detailed results of the pilot test can be found in the Phase IV Remediation Pilot Test Program Report (ABB-ES, 1995c). A summary of the pilot test results and recommendations for modifications to the treatment process based on these results, are presented below.

During the pilot test, impacted soil from the C-E Cast facility were excavated, formed into a pile (stack), and treated on-site using TEVE technology, by Gregg, Inc. and its subcontractor, Quality Recycling, Inc. Analytical results from the pilot test showed that TEVE technology successfully treated the COCs in site soils to concentrations below the Act 2 Statewide Health Standards.

Analytical results from 28 soil samples collected and analyzed after four days of treatment, and 28 soil samples collected and analyzed after seven days of treatment showed one exceedance (total xylenes) of the Act 2 Statewide Health Standards, for

12 COCs. This one exceedance out of 672 analyses (56 samples for 12 analytes) represents a treatment effectiveness of more than 99 percent.

Hourly field measurements of VOCs volatilizing from the soil stack into the stack air stream (contaminated air stream) during treatment indicated that the concentration of VOCs decreased sharply after the fourth day of treatment.

The concentration of VOCs in the air stream decreased from a maximum of 47 parts per million (ppm) to 10 ppm during the 161-hour treatment time. The maximum concentrations occurred following 37 hours of treatment and decreased most sharply during the third and fourth days of treatment (61 to 93 hours). During the remaining three days of treatment, the concentration of VOCs in the contaminated air stream appeared to be minimal.

Because the pilot test analytical results showed that TEVE technology successfully removed COCs to concentrations below the Statewide Health Standards, ABB-ES proposed to treat the remaining impacted soil using the TEVE technology. In addition, based on the observations and data collected during the Pilot Test Program, ABB-ES made the following determinations concerning treatment of impacted soils:

- The optimum treatment time is four days.
- Applying a factor for safety to the optimum treatment time of four days, each soil stack should be treated for five days or 120 hours.
- During the pilot test, a two-foot section of perforated aluminum heating pipe, located at one end of the stack, deteriorated. Therefore, the remaining soil stacks should be constructed using steel heating pipe.

- Continued performance testing would be appropriate during full site remediation. However, fewer samples are sufficient to confirm effective treatment. The number of samples could be reduced to one sample per 200 cy (treated soil), with additional samples, if necessary, to assure treated soils meet the requirements of the Act 2 standards.

4.0 REMEDIAL ACTION PLAN REVISIONS

The following subsections present the deviations from the RAP made during the course of the Phase IV Soil Remediation Program.

4.1 REVISIONS TO PLANS, DESIGNS, AND SPECIFICATIONS

Following excavation of Areas 1-1 and 3-1 (see Figure 2-2), ABB-ES' subcontractor, Gregg, Inc., began to rough grade the site for the final site closure. While setting grade limits, ABB-ES field engineers discovered that the final grading plan C-104 did not allow enough soil coverage to cover the old building foundations and broken floor slabs. Following telephone conferences between ABB-ES' field engineers and the ABB-ES Design Service Center in Portland, Maine, ABB-ES decided to raise the final grades by two feet. This change required an additional 14,500 cy of cover material to complete the final grading and maintain the drainage that had been planned. The final grading plan is presented on the Final Grading Plan Erosion Control Plan (Appendix B).

4.2 ANALYTICAL PROGRAM REVISIONS

Soil samples collected from the excavations and treated stacks during the first half of the Phase IV Soil Remediation Program were submitted to ABB-ES' on-site mobile laboratory, as stated in the RAP (ABB-ES, 1995b). On September 27, 1995, after the completion of excavating in Areas 1-1 through 1-3, Area 3-1, and the four barrel storage areas (BSA-1 through BSA-4) (see Figure 2-2), the mobile laboratory was moved to the ABB-ES office in Portland, Maine.

Excavation of electrical magnetic area (EMA) EMA-3 unearthed a white and black powdery substance and excavation of EMA-4, unearthed several buried drums that contained unknown substances. The mobile laboratory analytical program had been designed to identify and quantify the site COCs only, and did not have the capability to fully characterize samples collected from these areas. Consequently, ABB-ES submitted confirmation samples to a Pennsylvania-certified laboratory (Quanterra) for analysis. Samples collected from EMA-3 were submitted for VOC analysis. Because buried drums containing unknown substances were unearthened from EMA-4, samples collected from EMA-4 were submitted for both VOC and semivolatile organic compound (SVOC) analysis. Samples collected from the treated stacks containing soil from EMA-3 and EMA-4 was also analyzed for both VOCs and SVOCs. The off-site analyses were conducted for the priority pollutant list of analytes, using U.S. Environmental Protection Agency (USEPA) Method 8240 for VOCs and USEPA Method 8270 for SVOCs. These also included a library search for tentatively identified compounds (TICs), in order to identify the potential for the presence of additional compounds not being tested for by the on-site laboratory. Confirmation samples from EMA-15 and treated soil stacks continued to be analyzed by ABB-ES in the mobile laboratory.

The results of the off-site laboratory testing for samples collected from areas EMA-3 (see Subsection 5.2.3.1) and EMA-4 (Subsection 5.2.3.2) indicated the presence of VOCs and SVOCs that had not been listed as COCs. As a result, ABB-ES revised the list of site COCs to include these additional compounds (Table 4-1). Samples collected from the treated soil stacks that contained soils excavated from these areas, were tested for the additional compounds (Subsection 5.4) by the remediation contractor's (Quality Recycling, Inc.) laboratory, Blue Marsh Laboratory. ABB-ES' split samples collected from these stacks were also submitted to an off-site laboratory (Quanterra) for VOC and SVOC analyses, including a library search for TICs.

4.3 AMENDMENT TO SITE-SPECIFIC HEALTH AND SAFETY PLAN

Because drums containing unknown substances and high concentrations of contaminants were unexpectedly found on-site during the Phase IV Soil Remediation Program, the RAP Heath and Safety Plan (HASP) (ABB-ES, 1995b) was amended by ABB-ES' Corporate Health and Safety Officer. The instructions presented in the amendment were followed by all personnel working in hazardous areas on-site. The revised HASP sections are included in Appendix C. The most significant procedural change was the requirement of Level B Personal Protective Equipment (PPE) during the excavation of EMA-4.

4.4 OFF-SITE WORK

On September 18, 1995, while excavating impacted soils at EMA-4, ABB-ES field personnel discovered drums and impacted soils beyond the C-E Cast property line. ABB-ES stopped excavating and contacted Mr. John J. Kosky, Jr., the owner of the adjacent property, to apprise him of the situation and to request a meeting to discuss removal of the drums and impacted soils from his property. On November 1, 1995, this meeting was held between ABB-ES and Mr. Kosky, at the project site. At that time, verbal permission was given by Mr. Kosky to excavate on his property. ABB-ES prepared a letter of authorization, dated November 6, 1995, giving ABB-ES permission to excavate on Mr. Kosky's property (ABB-ES, 1995c). This letter was signed by Mr. Kosky and his wife, Madeline Kosky on November 13, 1995 (see Appendix A). Excavating at EMA-4 resumed on November 16, 1995.

5.0 IMPLEMENTATION OF REMEDIAL ACTION PLAN

This section discusses the excavation, sampling and analysis, and remediation of impacted soils from the four areas (Area 1-1 through 1-3 and Area 3-1) identified during the site investigations and pilot study. It also describes the seven additional areas (BSA-1 through BSA-4, EMA-3, EMA-4, and EMA-15) identified during the Phase IV Soil Remediation Program. The Final Grading and Erosion Control Plan (see Appendix B) presents all areas where impacted soils were excavated and remediated.

Soil excavation, soil treatment, and site restoration was performed by Gregg, Inc. and Quality Recycling Inc., under the direction of ABB-ES.

5.1 EXCAVATING, CONFIRMATORY SAMPLING AND ANALYSIS OF IMPACTED SOILS

Excavating. The 11 areas identified by ABB-ES as having impacted soils were prepared for excavation by removing trees, brush, and other debris. Impacted soils were then excavated, loaded onto trucks, and transported for staging to the concrete floor slab of former Building 1, where treatment occurred. Miscellaneous debris encountered during excavating (e.g., railroad ties, pipe, concrete chunks, solid waste, etc.) was separated from the impacted soil prior to treatment and staged for decontamination and/or disposal.

ABB-ES used field analytical results and/or PID measurements to direct the removal of impacted soils. All field analytical data are presented in Volume II. Once ABB-ES field personnel assessed that all impacted soil had been removed from the floors and walls of the excavation, confirmatory soil samples were collected and analyzed to verify removal of all impacted soil.

Confirmatory Sampling. Confirmatory sampling was performed on the walls and floor of each excavation in accordance with procedures presented in the Act 2 guidance manual (PADEP, 1995b) for small site (less than 10,890 square feet [ft^2]) or medium site (10,890 to 130,500 ft^2) remediations (PADEP, 1995b). If all safety conditions required by the HASP were met, soil samples were collected directly from the excavation. When these conditions were not met, soil samples were collected from the back-hoe bucket. The soil samples were collected according to the procedures described in the RAP Quality Assurance Project Plan (ABB-ES, 1995b). Excavating proceeded until confirmatory sampling and analysis results indicated that all soil exceeding Act 2 Statewide Health Standards had been removed. Excavations were then backfilled with treated soil.

Small Site Remediations. Ten of the 11 impacted areas excavated were small sites as defined in the Act 2 guidance manual (PADEP, 1995b). At these excavations, ABB-ES measured the area of the walls and floor, and then used Table 1, Excavation Floor Samples, and Table 2, Excavation Sidewall Samples, in chapter 2 of the guidance manual to determine the appropriate number of samples to be collected for confirmatory analysis. The sampling locations were selected using PADEP's biased sampling method also presented in the Act 2 guidance manual. This sampling method stipulates that soil samples are to be collected from excavation floor and wall locations where PID measurements are greater than background, and/or locations with visually stained soils. Where no visible stained soils or elevated PID measurements were present, ABB-ES used best professional judgement in choosing the appropriate sampling locations.

Medium Site Remediations. One excavation (EMA-3) was classified as a medium size site as defined in the Act 2 guidance manual. At this excavation ABB-ES used the statistical random sampling strategy presented in the Act 2 guidance, to collect the appropriate number of samples. This sampling strategy provided a 95% confidence level in determining hot spot soil concentrations within the excavation (PADEP, 1995b).

To perform the statistical random sampling, ABB-ES established a grid system over a map of the walls and floor of the excavation. Once the grid was established, ABB-ES assigned coordinates to all of the grid nodes, and selected 25 percent as sampling locations. Sampled grid nodes were selected from the random numbers table provided in the Act 2 guidance manual (See Appendix E).

Confirmatory Analysis. Confirmatory analysis was conducted at all excavation areas to verify that all impacted soil had been removed from the excavation. All confirmatory samples were analyzed for VOCs; samples from EMA-4 were also analyzed for SVOCs. The table below summarizes the excavation analytical program. ABB-ES used either its mobile laboratory or Quanterra for confirmatory sample analysis.

EXCAVATION ANALYTICAL PROGRAM

EXCAVATION AREA	LABORATORY	ANALYSIS	RATIONALE
Areas 1-1, 1-2, 1-3, 3-1, EMA-15, and Barrel Storage Areas 1, 2, 3, 4	ABB-ES	**VOCs** - 8021M[1]	Verify COC concentrations were below PADEP Act 2 Statewide Health Standards for Soil.
EMA-3	Quanterra	**VOCs** - 8240 + TICs[2]	Verify VOC concentrations were below PADEP Act 2 Statewide Health Standards for Soils, and identify presence of other site-related compounds.
EMA-4	Quanterra	**VOCs** - 8240 + TICs[2] **SVOCs** - 8270 + TICs[2]	Verify VOC and SVOC concentrations were below PADEP Act 2 Statewide Health Standards for Soil, and identify the presence of other site-related compounds.

Notes:
[1] Method 8021M = USEPA Method 8021 modified for selected VOCs (i.e., COCs)
[2] TICs = Library search for tentatively identified compounds (TICs)

In addition, three soil samples, collected from EMA-4, underwent analysis using Method 1311 for TCLP, Method 8240 for VOCs, and ASTM Method 90-92 for ignitability. Area specific excavation, sampling, and analysis procedures are discussed in the following subsections. The confirmatory sampling results, detections only, are presented for each area in the remainder of Section 5.0. Confirmatory samples with COC concentrations exceeding the clean-up standards are not shown on these tables (except for EMA-3 and EMA-4); only the results of the successful resampling and reanalysis performed after additional excavation are shown. Complete laboratory analytical results are presented in Volume II.

5.2 TREATMENT OF IMPACTED SOILS

Thermally Enhanced Vapor Extraction. Twenty stacks of soil were treated by Gregg, Inc./Quality Recycling, Inc. during the Phase IV Soil Remediation Program, using TEVE technology. The TEVE treatment unit was housed in a custom-built 24-foot enclosed trailer. The primary components of the unit are the blower system, the heat chamber, and the catalytic reactor bank. Impacted soil was piled in a stack and covered on the top and sides with a heavy gauge (10 millimeter or greater) plastic sheeting. Each stack was constructed in layers (lifts), with hot air injection tubes placed on the top of the first and second lifts, and vapor extraction tubes on top of the third lift.

Each stack had approximate base dimensions of 39 by 100 feet, top dimensions of 13 by 75 feet, and a height of approximately 9-12 feet. Excluding approximately 910 linear feet of 12-inch diameter perforated aluminum heating pipe, the total volume of soil treated was approximately 986 cy (1,000 tons) per stack. The stacks were constructed in three lifts, with thicknesses of approximately 2, 5, and 2 feet, respectively.

The TEVE system was connected to the soil stack with flexible ducting. Warm air (300 to 375 degrees Fahrenheit) moved through the contaminated soil, increasing the rate of contaminant volatilization. The contaminants were carried by the air stream through the heat chamber. All exhaust gases were passed through the catalytic reactor bank, assuring no contaminants or particulates were exhausted into the atmosphere.

All impacted soil was treated for a minimum of five days (120 hours). Quality Recycling, Inc. performed constant air monitoring during treatment using the TEVE system's cone Flame Ionization Detector and PID. Appendix D presents the stack emissions monitoring results.

Test Stack Sampling and Analysis. To confirm that soil treatment achieved Act 2 Statewide Health Standards, up to seven soil samples were collected from each stack and analyzed for COCs after the soil treatment was complete. ABB-ES used the Act 2 Random Numbers Table (Appendix E) to establish sampling locations. These locations are presented in Appendix F. A minimum of one sample was collected for each 200 cy of soil treated as recommended by Act 2 guidance.

Samples were collected from the top or side of the stack using a slide hammer. The soil samples were collected in a clear plastic liner placed inside the sampling spoon, to ensure that contaminants would not come in contact with the inside of the spoon. The liner was replaced each time the slide hammer went into the hole. The slide hammer was decontaminated between samplings to prevent cross-contamination. Soil samples were collected in accordance with sampling procedures in the RAP Quality Assurance/Quality Control Plan (ABB-ES, 1995b).

All treated soil samples from each stack were analyzed for the COCs by VOC Method 8240 by ABB-ES' subcontractor's contract laboratory (Blue Marsh Laboratory Inc.). In addition, ABB-ES analyzed soil samples from stacks one through 13 for VOCs, by Method 8240. Samples collected from stacks 14 through

20 were also analyzed by Blue Marsh and by Quanterra for SVOCs by USEPA Method 8270. This analysis included a library search for TICs, due to the fact that these stacks contained soil excavated from EMA-4. Concentrations for some samples from stack 17 were found to exceed PADEP Act 2 soil standards; therefore, the stack received additional treatment and was resampled. Resampling included analysis for all sample locations by both laboratories. Confirmatory stack sampling analytical summary tables are presented in Appendix G. Results of the resampling indicated that the treated soils were below the PADEP Act 2 soil standards.

5.3 Excavating and Confirmatory Sampling and Analysis of Area 1

Area 1 represents the former location of solvent reclamation activities conducted on-site. Area 1 consists of the area around the former cracking tower, smaller stills, railroad siding, chemical off-loading area, and chemical storage tanks (see Figure 2-2).

Site investigation data indicated that the vertical extent of contamination requiring treatment varied from approximately 2 to 6 feet below grade across portions of Area 1. Because the lateral extent of soil contamination to the south and west was unclear, for soil estimating purposes ABB-ES assumed the lateral extent of impacted soil to be 27,000 ft^2. ABB-ES estimated an in-place volume of 6,000 cy of soil that exceeded the PADER Level 2 standards within Area 1.

While excavating in Area 1 during the pilot study, ABB-ES used an on-site laboratory to provide real-time soil analyses characterizing the horizontal and vertical extent of impacted soil. Using the field analytical results, ABB-ES determined that Area 1 consisted of three distinct and separate areas of impacted soil. Therefore, for excavation and remediation purposes, ABB-ES divided Area 1 into Area 1-1, Area 1-2, and Area 1-3 (see Appendix B).

5.3.1 Area 1-1

The Area 1-1 excavation is located along the railroad bed in the central portion of the site. This area is the former location of the railroad siding where chemicals were loaded and unloaded from tank cars. Between 570 and 600 cy of soil were excavated from Area 1-1 during the pilot test program in August 1995. The remaining approximately 200 cy of impacted soil was excavated during the Phase IV Soil Remediation Program.

Area 1-1 has an area of approximately 8,400 ft^2, a small site according to the Act 2 guidance. Act 2 guidance recommends seven floor samples and eight wall samples be collected from an excavation of this size. To ensure that all impacted soil had been removed, ABB-ES collected 29 samples for confirmatory analysis, 10 floor samples and 19 wall samples (Figure 5-1). Samples were collected from locations most likely to be contaminated. These include locations with elevated PID measurements, soil staining, as well as areas of preferential pathways.

Analytical results of the 29 confirmatory samples collected from the excavation at Area 1 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmatory sample analyses from Area 1-1 are shown in Table 5-1.

5.3.2 Area 1-2

The Area 1-2 excavation is roughly circular in shape and is located approximately 90 feet east of MW-2 in the central portion of the site. Approximately 400 cy of impacted soil was removed from the excavation.

This excavation has an approximate total area of 2,328 ft^2; a small site according to Act 2 guidance. Act 2 guidance recommends four floor samples and six wall samples be collected for an excavation of this size. ABB-ES collected a total of 16 soil

samples for confirmatory analysis, four floor samples and 12 wall samples (Figure 5-2). Samples were collected using the biased sampling approach.

Analytical results of the 16 confirmatory samples collected from the excavation at Area 1-2 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmatory sample analyses from Area 1-2 are shown in Table 5-2.

5.3.3 Area 1-3

Area 1-3, also located in the central portion of the site, is triangular in shape and is in the former location of the chemical distillation and cracking tower operations. Approximately 12,700 cy of impacted soil was removed from this excavation.

ABB-ES began excavating in Area 1-3 at soil boring SB-N06 and worked outwards (see Figure 2-2). Concrete, wood debris, wire, and piping were encountered during excavation. This debris was separated from the impacted soil and stockpiled for future sampling. Excavating progressed outward from SB-N06 and encountered the concrete pad on which the former cracking tower had been built. ABB-ES collected samples from below the concrete pad; field analysis indicated that the soils beneath the pad had been impacted by site activities. ABB-ES then to broke apart and removed the concrete pad, to access the impacted soils beneath and surrounding the pad.

The broken pieces of concrete were scanned with a PID meter and visually inspected. Pieces greater than 1 cubic foot were also measured and labeled. Concrete with evidence of contamination (staining and/or elevated PID measurements) were sampled and analyzed in the field laboratory.

ABB-ES field personnel used a drill to collect a surface powder sample from one side of each concrete piece. Two additional concrete powder samples were then

collected by drilling one-half inch and then one-inch further into the concrete. If the surface sample and two inner samples were not determined to be impacted by COCs, the concrete was backfilled into the completed excavation. Pieces of concrete with COC concentrations greater than the Act 2 Statewide Health Standards were removed from the excavation and stockpiled adjacent to impacted soil on the former Building 1 foundation for later TEVE treatment in a soil stack. After treatment was completed, the stack was sampled and confirmed to be clean; the treated concrete was then buried in the completed excavation. A total of 34 concrete samples and two duplicates were collected and analyzed. Concrete analytical results are presented in Volume II.

Approximately 100 tons of clean concrete and 45 tons of impacted concrete were removed from the excavation. After all concrete and impacted soil had been removed, Area 1-3 had an average total area of 10,900 ft^2. Area 1-3 is considered to be a small site and the Act 2 guidance manual recommends eight floor samples and 10 wall samples be collected for confirmatory analysis for an excavation of this size. ABB-ES collected a total of 31 soil samples for confirmatory analysis, 10 floor samples and 21 wall samples (Figure 5-3). The confirmatory soil samples were collected using the biased sampling approach.

Analytical results of the 31 confirmatory samples collected from the excavation at Area 3 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmatory sample analyses from Area 1-3 are shown in Table 5-3.

5.4 Excavating and Confirmatory Sampling and Analysis of Area 3-1

Area 3-1 is located in the former above ground chemical storage tank area. The former tank area was originally investigated by ABB-ES for evaluation as a borrow pit. During the Phase II soil investigation, ABB-ES detected BTEXS at 2 feet bgs

in one of the soil borings. Based on this data, ABB-ES estimated the volume of impacted soil in Area 3-1 requiring remediation to be 300 cy.

Approximately 100 cy of soil had been excavated and remediated from Area 3-1 during the pilot test. Concrete piers, previously used to support aboveground storage tanks, were encountered during excavation. Soil was scraped from the concrete piers for treatment, and the piers were left in the excavation.

This excavation had an approximate total area of approximately 980 ft^2. The Act 2 guidance manual recommends two floor samples and five wall samples be collected from an excavation of this size. ABB-ES collected nine soil samples from the excavation, five floor samples and four wall samples (Figure 5-4). These soil samples were collected according to the biased sampling technique described in the Act 2 guidance manual (PADEP, 1995b).

Analytical results of the nine confirmatory samples collected from the excavation at Area 3-1 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmatory sample analyses from Area 3-1 are shown in Table 5-4.

5.5 Excavating and Confirmatory Sampling and Analysis of Barrel Storage Areas

As part of the Phase IV soil remediation activities at the C-E Cast facility, ABB-ES constructed a sediment pond in the northeastern portion of the site. During construction of the sediment pond, Gregg, Inc. unearthed four separate areas (BSA-1 through BSA-4) containing 55-gallon drums, 5-gallon pails, and other debris. All four of these areas are located within the portion of the site that underwent a closure in 1980 under the direction of Penn Environmental (see Appendix B). At the time they

were found by Gregg, Inc., the drums were covered with several feet (oxidized coal mine tailings) of red dog followed by 6-12 inches of clay.

A total of 71 intact to mostly-intact drums were removed from the barrel dump areas and placed into over-pack drums for later off-site disposal (Subsection 5.3).

5.5.1 Barrel Storage Area 1

Barrel Storage Area 1 (BSA-1) was located below the berm separating the sediment pond and the common borrow area. Approximately 760 cy of soil were removed from BSA-1. Several intact drums, drum fragments, and drum carcasses were also removed from the excavation.

BSA-1 had a total wall and floor area of approximately 5,100 ft^2, a small site according to the ACT 2 guidance manual. The guidance manual recommends six floor samples and six wall samples be collected for an excavation of this size. To ensure that all of the impacted soil had been removed, ABB-ES collected 15 samples for confirmatory analysis, eight floor samples and seven wall samples (Figure 5-5). Samples were collected from locations most likely to contain contamination, using the biased sampling approach. These included locations with elevated PID measurements, soil staining, and areas where drums were discovered.

Analytical results of the 15 confirmation samples collected from the excavation indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmation sample analyses from BSA-1 are shown in Table 5-5.

5.5.2 Barrel Storage Area 2

Barrel Storage Area 2 (BSA-2) was located approximately 10 feet west of BSA-1, also below the berm separating the sediment pond and the common borrow area. Approximately 700 cy of soil were excavated from BSA-2.

This excavation had an approximate total area of 6,670 ft^2. The Act 2 guidance manual recommends seven floor samples and eight wall samples be collected from an excavation of this size. ABB-ES collected eight wall and seven floor soil samples from the excavation (Figure 5-6). These soil samples were collected from areas where contamination would be expected to be found according to the biased sampling technique described in the guidance manual.

Analytical results of the 15 confirmation samples collected from the excavation at BSA-2 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmation sample analyses from BSA-2 are shown in Table 5-6.

5.5.3 Barrel Storage Area 3

Barrel Storage Area 3 (BSA-3) was located in the center of the sediment pond (see Appendix B). Approximately 350 cy of impacted soil was removed from this excavation. Drum carcasses, lids, soda cans, coffee cans and other small household debris were removed from this excavation. No intact drums were found.

BSA-3 had a total area of approximately 2,700 ft^2, a small site according to the Act 2 guidance manual. Act 2 guidance suggest four floor and four walls samples be collected for confirmatory analysis. ABB-ES collected nine confirmation samples, four wall and five floor samples (Figure 5-7). These samples were collected using the biased sampling approach.

Analytical results from the nine confirmatory samples indicated that COC concentrations were below the Act 2 Statewide Health Standards. Results from analysis of the confirmation samples are shown in Table 5-7.

5.5.4 Barrel Storage Area 4

Barrel Storage Area 4 (BSA-4) is located approximately 25 feet southwest of BSA-2. Approximately 230 cy of impacted soil was removed from this excavation. Seven mostly-intact drums were removed from BSA-4. In addition, several bags of black putty-like material and several bags of sugar were also removed from the excavation. PID measurement of the bags of putty and sugar were 0 ppm. The bags containing putty were placed in over-pack drums, and the bags containing sugar were included with the impacted soil for treatment.

BSA-4 had a total area of 1,700 ft^2 and is considered a small site. The Act 2 guidance manual recommends four floor and five wall samples be collected for confirmatory analysis. ABB-ES collected five wall samples and two floor samples for confirmatory analysis using the biased sampling approach (Figure 5-8). Analytical results indicated that COC concentrations were below the Act 2 Statewide Health Standards.

Results from analysis of the confirmation samples are shown in Table 5-8.

5.6 GEOPHYSICAL SURVEY

From October 4 through 6, 1995, ABB-ES conducted a geophysical survey at the C-E Cast site using electromagnetic (EM) metal detection. The purpose of this survey was to screen for buried metallic objects within an approximately 5- to 6-acre area. Surveying was conducted in response to the unexpected discovery of drums, drum carcasses, and fragments during construction of the sediment pond in the northeastern portion of the site.

Two areas were the subject of the geophysical survey: the larger in the northeastern corner of the site, the smaller located in the central portion of the site, south of the

concrete pad covering the closed sewage lagoon. This smaller area was surveyed at the request of the PADEP.

Instrumentation and Survey Design. ABB-ES used a Geonics EM-61 Time Domain Metal Detector to screen for subsurface metallic debris. A 60- by 60-foot grid was established using a tape and compass prior to geophysical surveying. Pin flags were used to identify grid nodes. The data were collected with a data logger over a 5- by 10-foot grid across the site, downloaded to a computer, and processed using various geophysical software applications.

Sediment Pond Area. A 5- by 10-foot survey grid was used to collect geophysical data in the sediment pond area. Several locations exhibiting elevated values (anomalies) indicative of the presence of metal were identified. Other subtle magnetic anomalies were also detected throughout the survey area. Figure H-1 (Appendix H) presents the location of EM-61 anomalies, with reference to the survey grid and the proposed location of exploratory test pits for the sole purpose of ground truthing the EM-61 survey results. Figures H-2 through H-5 present the results obtained from the EM-61 survey.

Sixteen areas of anomalies were designated for test pitting to determine the presence of drums. Test pitting rationale for each detected anomaly was based on the breadth and magnitude of the anomaly and the presence or absence of metallic debris at each location. Anomalies requiring test pitting were labelled EMA-1 through EMA-16 (see Figure H-1). Test pitting of anomalies EMA-4 and EMA-15 revealed drums. Test pitting at EMA-3 revealed black and white powdery substances. Test pitting at EMA-9 revealed several drum fragments and a large amount of demolition debris, including concrete with rebar, railroad rails, sheet metal, corrugated piping, and metal cables. Test pitting at the other anomalies revealed a variety of metal objects and demolition debris.

Aboveground Tank Area EM-61 data was collected over an approximately 0.5-acre area encompassing a portion of the concrete slab covering the closed lagoon and the area between the area of the former aboveground tanks and the concrete slab. EM-61 data results are presented in Figures H-6 through H-9. The most notable feature detected beneath the survey area was the concrete pad covering the closed lagoon, the footprint of which is easily observed in the northern portion of the survey area. The linear EM anomaly outlined in Figure H-6 is most likely the result of abandoned metallic piping associated with the closed lagoon and the aboveground tank area. Test pitting of this area was deemed unnecessary.

5.7 EXCAVATING AND CONFIRMATORY SAMPLING AND ANALYSIS OF ELECTROMAGNETIC ANOMALY AREAS

Based on the results of the geophysical survey and subsequent test pitting in the anomalous areas identified, ABB-ES identified three additional areas requiring the removal of impacted soil. The following subsections discuss these areas.

5.7.1 Electromagnetic Anomaly Area 3

Electromagnetic Anomaly Area 3 (EMA-3) is located north of the sediment pond. A test pit dug at EMA-3 during the geophysical survey (Subsection 5.2.2) revealed the presence of both black and white powdery substances. To assess whether this material was a site contaminant and if it could be treated with TEVE, ABB-ES collected a sample of each. Analytical results indicated concentrations of several VOCs were above Act 2 Statewide Health Standards, and that the material could successfully be treated using TEVE.

ABB-ES removed approximately 12,000 cy of the powdery material and impacted soil from this excavation (Figure 5-9). After excavating was completed, EMA-3 had a total area of approximately 15,100 ft^2, a medium site according to the Act 2 guidance

manual. For a site of this size, Act 2 guidance recommends statistical random sampling be performed to confirm that all impacted soil has been removed.

ABB-ES established a grid system over a map of the walls and floor of the excavation using a calculated grid interval of 17 feet, and selected 25 percent of the grid nodes for sampling locations (see Subsection 5.1). After these 16 sampling locations were selected using the random numbers table provided in the Act 2 guidance manual (see Appendix E), and plotted on the map, it was apparent that several areas of the excavation had not been included in the sampling locations. To provide better sampling coverage, using best professional judgement, ABB-ES selected five additional grid nodes to sample. ABB-ES collected a total of 21 samples for confirmatory analysis, 16 floor samples and five wall samples (see Figure 5-9).

Analytical results of the confirmatory samples collected from the excavation indicated that COC concentrations were above the Act 2 Statewide Health Standards at three locations (Table 5-9). Based on these results, ABB-ES excavated several hundred cy of additional soil from these three locations (see Figure 5-9).

After the second round of excavating was completed, ABB-ES collected three samples in the newly excavated areas. The second round of analytical results from the confirmatory samples indicated chemical concentrations were below the Act 2 Statewide Health Standards (see Table 5-9).

On December 14, 1995, PADEP requested additional samples from EMA-3 to confirm ABB-ES' analytical results. On January 30, 1996, ABB-ES met a PADEP representative at EMA-3 to collect a split sample from one location in the excavation (see Figure 5-9). Analytical results from this sample are presented in Table 5-9.

5.7.2 Electromagnetic Anomaly Area 4

Electromagnetic Anomaly Area 4 (EMA-4) was located approximately 25 feet east of the sediment pond and extended across the eastern property boundary line. Several tall trees (greater than 40 feet) were removed to allow access to this anomaly area.

ABB-ES began excavating in the center of the anomaly and worked in a northerly and easterly direction. Several rusty drums containing liquid were removed from this side of the excavation. In addition, an approximately 1-foot thick black layer of sludge and an approximately 4-inch thick layer of still bottom-like material were encountered in the eastern wall face. Excavating continued until several rusty drums leaked their contents onto the ground when unearthed. PID measurements at these drums were greater than 900 ppm, and PID measurements in the breathing zone in the work area near these drums were steadily greater than 50 ppm.

Because the PID measurements were so high and the contents of the drums unknown, ABB-ES stopped excavating and collected four samples of soil from beneath the leaky drums, one sample of the sludge, and one of the still-bottom-like material. These samples were analyzed for VOCs and SVOCs. To assess whether EMA-4 soils could be treated by TEVE technology, ABB-ES also collected three composite soil samples for hazardous characteristics analyses (flash and fire points, and TCLP VOCs).

Of the chemicals identified from VOC and SVOC analyses, percent levels of xylene, bis(2-ethylhexyl)phthalate, isophorone, naphthalene, and 4-methylphenol were identified (Table 5-10). These and other chemicals identified, were evaluated by ABB-ES' Corporate Health and Safety Officer to determine the safety level at which work should continue at this excavation. It was determined that Level B PPE was required (see Subsection 3.2). Results of the hazardous waste characteristics analyses indicated that the EMA-4 soils could be treated on-site by TEVE technology

(Table 5-11). After the proper health and safety equipment was obtained, excavating resumed in all directions.

After excavating was completed, EMA-4 had an approximate total area of 9,200 ft^2. The Act 2 guidance manual recommends eight floor and eight wall confirmatory samples be collected from an excavation of this size. ABB-ES collected 16 soil samples, nine wall and seven floor samples, to confirm the removal of contaminated soils exceeding Act 2 Statewide Health Standards (Figure 5-10). These soil samples were collected according to the biased sampling technique described in the Act 2 guidance manual.

Analytical results of the confirmation samples collected from EMA-4 indicated that COC concentrations were above the Act 2 Statewide Health Standards at eight locations (Tables 5-12A and 5-12B). Based on the confirmatory sampling analytical results, ABB-ES excavated an additional soil from those areas where samples exceeded criteria (see Figure 5-10). Once excavation was completed, eight additional soil samples were collected from the newly excavated portions of EMA-4.

The second round of analytical results from the confirmation samples indicated that COC concentrations were below the Act 2 Statewide Health Standards (see Table 5-10).

On December 14, 1995, PADEP requested additional samples from EMA-3 and EMA-4 to confirm ABB-ES' analytical results. On January 30, 1996, ABB-ES met a PADEP representative at the site and collected a split sample from one location in each excavation (See Figure 5-10). Analytical results from this sample are presented in Tables 5-12A and 12B.

5.7.3 Electromagnetic Anomaly Area 15

Electromagnetic Anomaly Area 15 (EMA-15) is located on the eastern side of the common borrow area. A total of approximately 112 cy of impacted soil mixed with general household waste (primarily old bottles and glassware) was removed from this excavation. Five partially-intact drums containing an unknown solid substance and several drum carcasses were excavated from EMA-15.

EMA-15 had an approximate wall and floor area of 1,046 ft^2 (Figure 5-11). Act 2 guidance recommends three floor samples and five wall samples be collected from an excavation of this size. ABB-ES collected eight samples for confirmatory analysis, three floor and five wall samples. Analytical results of the confirmation samples collected from EMA-15 indicated that COC concentrations were below the Act 2 Statewide Health Standards. The results of the confirmation sample analyses from EMA-15 are shown in Table 5-13.

5.8 SLUDGE AREA

The Sludge Area is approximately 1,625 ft^2 in area and is located in the central portion of the site within a small wetland (see Appendix B). Black soil with an oily appearance as identified in this area during site restoration activities, so ABB-ES collected two samples of the black soil. The samples were collected from between 6 inches and 1 foot bgs and were analyzed for VOCs and SVOCs. Analytical results indicated that concentrations were below the Act 2 Statewide Health Standards (Table 5-14). Based on these results, no soil was removed from this area.

5.9 DRUM SAMPLING AND DISPOSAL

A total of 96 intact and partially-intact drums were removed from BSA-1 through BSA-4, EMA-3, EMA-4, and EMA-15. The overpack drums were staged on-site for later sampling and disposal.

Weavertown Environmental Group performed sampling on the contents of a representative number of drums. The drum samples were analyzed by Microbac Laboratories, Inc. for VOCs (USEPA Method 8240) and SVOCs (USEPA Method 8270). Based on the analytical results, the drums were disposed of by Advanced Engineering Technical Services (AETS). Drum sampling analytical results are presented in Appendix I and drum disposal manifests are presented in Appendix J.

The empty, crushed and/or broken drums and drum fragments removed from the excavations were placed on a shaker to remove impacted soil. The drums were then crushed and stored in two 10- by 25-foot roll-off dumpsters pending removal and off-site disposal by AETS. The impacted soil was brought to the treatment pad for TEVE treatment.

5.10 RESTORATION OF IMPACTED AREAS

Upon completion of the treatment and testing of impacted soils, the clean material was transported back to the excavated areas, placed in the excavations, and compacted. The total plant area was graded to a final grading plan that had been previously approved by the Washington County Conservation District.

The total of more than 11 acres of disturbed area was covered with 12 inches of vegetative soil, seeded and mulched. Drainage ditches were graded, stone dikes installed, and sedimentation traps constructed.

Maintenance of any areas that become eroded will be performed until a substantial growth of grass has developed.

6.0 SUMMARY AND CONCLUSIONS

ABB-ES successfully completed the Phase IV Soil Remediation Program at the C-E Cast facility. The soil remediation activities were conducted in accordance with the provisions and intent of PADEP's Land Recycling and Environmental Remediations Standards Act (PADEP, 1995a). Soil remediation consisted of excavating and treating approximately 19,100 cy of impacted soils using TEVE technology (Appendix K).

ABB-ES identified 11 areas at the facility requiring soil remediation. Four of these areas (Area 1-1 through 1-3, and Area 3-1) were identified during previous site investigations. Four barrel storage areas (BSA-1 through BSA-4) were identified during construction of the sediment pond during the remediation program, and three areas (EMA-3, EMA-4, and EMA-15) were identified from a comprehensive geophysical survey performed by ABB-ES throughout the former active portion of the facility.

Approximately 20,000 cy of impacted soil was treated in 20 stacks for an average of five days. Up to seven confirmation samples were collected from each treated stack to verify that COCs were not present at concentrations greater than the Act 2 Statewide Health Standards. Confirmatory soil samples were also collected from the walls and floor of each excavation in accordance with recommendations in the Act 2 guidance manual (PADEP, 1996). In addition to impacted soil, a total of 96 intact to partially-intact 55-gallon drums were removed from the barrel storage areas (BSA-1 through BSA-4), from EMA-4, and from EMA-15. These were placed in overpack drums and staged on-site until removal and proper disposal by AETS.

On completion of soil remediation, the site was graded to the final grading plan (see Appendix B) and restored to useable land. The more than 11 acres of disturbed area was covered with vegetative soil, seeded, and mulched. Drainage ditches were

constructed, stone dikes, installed, and sedimentation traps constructed. Maintenance of areas that erode will continue to be conducted until a substantial growth of grass has developed. Groundwater at the site will be monitored to assess the impact the removal of source areas has on site groundwater.

ABB-ES	ABB Environmental Services, Inc.
Act 2	Land Recycling and Environmental Remediations Standards Act
AETS	Advanced Engineering Technical Services
bgs	below ground surface
BSA	Barrel Storage Area
BTEXS	benzene, toluene, ethylbenzene, m,p-xylene, and o-xylene/styrene
C-E Cast	C-E Castings
cm/sec	centimeters per second
COCs	contaminants of concern
cy	cubic yards
1,1-DCA	1,1-dichloroethane
DCE	dichloroethene
DOT	U.S. Department of Transportation
EM	electromagnetic
EMA	Electromagnetic Anomaly
ft^2	square feet
GC	gas chromatography
HASP	Health and Safety Plan
MCL	Maximum Contaminant Level
NIR	Notice to Remediate
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PADER2	PADER Level 2 Standards
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
PHMC	Prospect Hill Management Corporation
PID	photoionization detector
PPE	personal protective equipment

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ppm	parts per million
RAP	Remedial Action Plan
SVOC	semivolatile organic compound
SQL	Sample Quantification Limit
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TEVE	Thermally Enhanced Vapor Extraction
TICs	Tentatively Identified Compounds
µg/L	micrograms per liter
µg/kg	micrograms per kilograms
USEPA	U.S. Environmental Protection Agency
USX	United States Steel Co.
VOC	volatile organic compound
Volume II	Volume II - Phase IV Soil Remediation Analytical Data

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