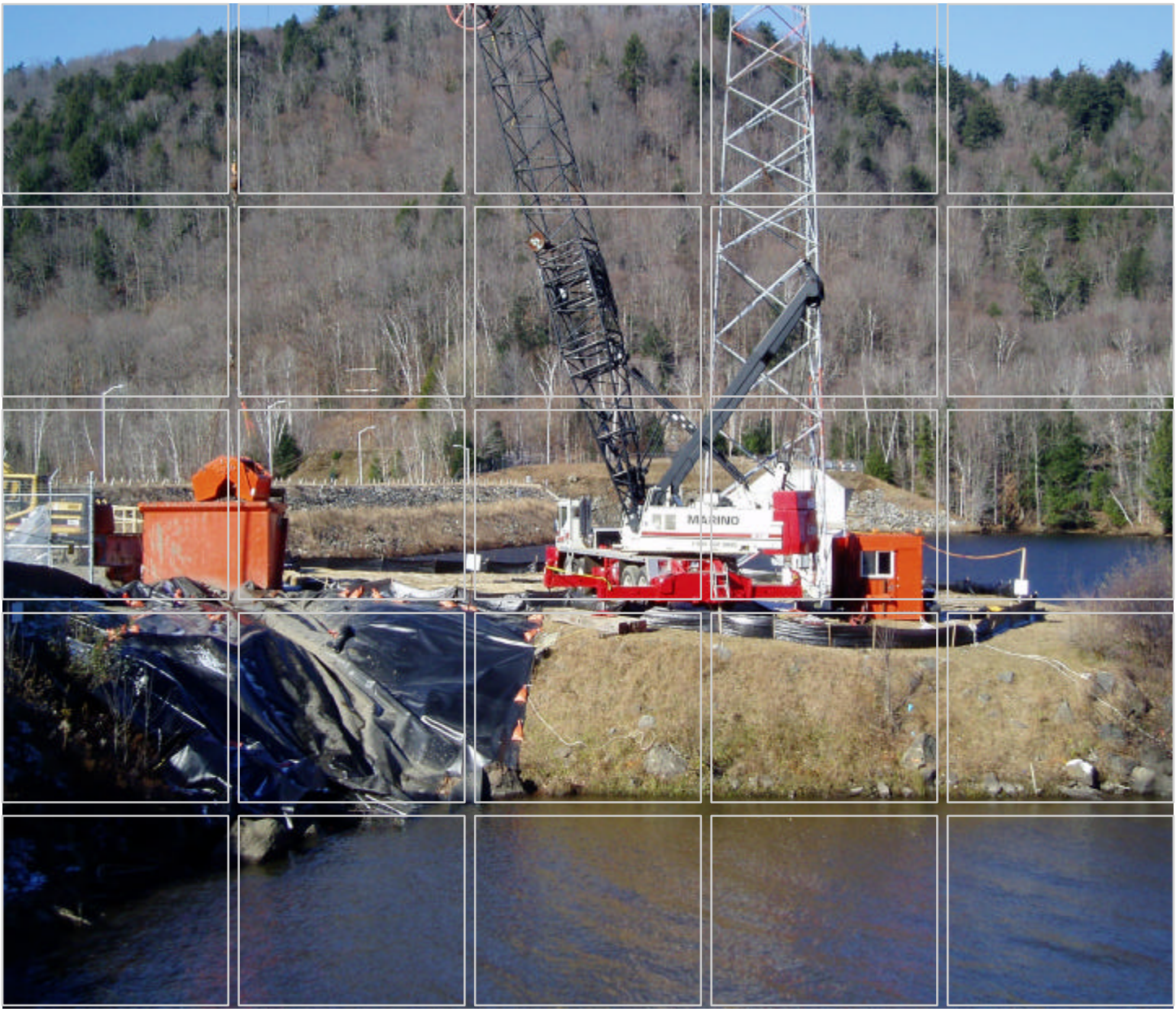

TSCA Sediment Final Report

Yankee Nuclear Power Station
Site Closure Project
Rowe, Massachusetts

24 July 2006

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1.0 INTRODUCTION

Yankee Atomic Electric Company (YAEC) is pleased to submit this Final Report for Risk-Based Sediment Remediation (Report) at the Yankee Nuclear Power Station (YNPS) located in Rowe, Massachusetts (the "Site") (Figure 1). This Report was prepared by YAEC's consultant, Environmental Resources Management (ERM), in fulfillment of Condition 17 of the United States Environmental Protection Agency's (US EPA's) Approval for Risked-Based Remediation (Approval) of sediment containing polychlorinated biphenyls (PCBs) issued 28 September 2004 under 40 Code of Federal Regulations (CFR) 761.61(c), a copy of which is included in Appendix A.

In accordance with Condition 17 of EPA's Approval, this Report includes a short narrative describing the remedial activities completed including the location and size of the areas remediated, the type and volume of PCB-remediation waste generated, the type and volume of PCB-remediation waste treated on-site or disposed off-site, a summary of analytical results verifying compliance with the cleanup goal of less than or equal to one (1) milligram per kilogram (mg/kg) PCBs, disposal manifests, and a summary of site restoration activities.

The cleanup of PCB-containing sediment was conducted in accordance with EPA's Approval and methods outlined in the Risk-Based Disposal Approval (RBDA) Application dated 30 June 2004. The RBDA Application was prepared to satisfy EPA and other applicable local, state and federal regulatory agencies governing the cleanup of PCBs in sediment at the Site.

Prior to cleanup, assessment of the nature and extent of the release of PCBs to the environment (including soil, groundwater, surface water, sediment and fish), characterization of the potential risk posed by the release and evaluation of remedial alternatives was completed under the requirements of the Massachusetts Contingency Plan (MCP), Code of Massachusetts Regulations (CMR) 40.0000. Actions under the MCP resulted in the selection of the remedial alternative for PCBs in sediment, consisting of Excavation and/or Dredging, Off-Site Disposal, On-Site Treatment and Re-use and Restoration. The remedial alternative design, construction and implementation plans are outlined in the Phase IV-Remedy Implementation Plan (RIP; ERM, 2004) and amendments thereto (ERM, 2005). On 23 June 2005, YAEC received US EPA approval to implement on-site thermal desorption to treat PCB-impacted materials (Appendix A).

2.0 NARRATIVE OF REMEDIAL ACTIVITIES

2.1 BACKGROUND

In Spring 2000, YAEC discovered the presence of polychlorinated biphenyls (PCBs) in paint on the exterior surfaces of plant structures and some buildings. Sampling and analysis of paint chips confirmed the presence of PCBs, Aroclor 1254, at concentrations up to 90,000 mg/kg. PCBs were detected in paint chips from other buildings at the site at concentrations up to 720 mg/kg. The paint was observed to be flaking off the Vapor Container (VC), falling to the ground and mixing with road sand that was applied to the pavement for traction during the winter.

Subsequent investigation and sampling determined that PCBs originating from the paint had impacted Site soil and entered the storm water drainage system (Figure 2). The drainage system discharged to the Sherman Reservoir near the East Storm Drain (ESD) Outfall and to the West Storm Drain Ditch (WSDD), which discharges into the Deerfield River. The release was reported to the Massachusetts Department of Environmental Protection (MA DEP) and US EPA on 26 April 2000.

Investigations conducted in accordance with the requirements of the MCP indicated that PCBs in sediment requiring cleanup were limited to two areas near the ESD and WSD outfalls (see Figures 3 and 4). These areas are described below:

- ESD - This is an area in Sherman Reservoir within approximately 100 feet of the East Storm Drain Outfall. PCB-impacted sediment was covered by water up to a depth of approximately 10 feet. PCBs had been detected in sediment in this area at concentrations up to 20 mg/kg. PCBs were identified in sediment at concentrations in excess of 1 mg/kg over an area of 14,000 sq. ft. to a depth of 1 foot.
- WSDD - The area targeted for remediation in the WSSD was estimated at 500 linear feet located between the outfall and the culvert to the access road. PCBs had been detected in sediment in the WSDD at concentrations up to 9.2 mg/kg.

Actions under the MCP resulted in the selection of the remedial alternative for PCBs in sediment, consisting of Excavation and/or Dredging, Off-Site Disposal, On-Site Treatment and Re-use and Restoration, including:

- obtaining necessary permits and approvals;

- excavating PCB-impacted sediment at greater than 1 mg/kg;
- collecting and analyzing sediment samples following removal actions in each area to verify compliance the 1 mg/kg remedial goal;
- backfilling the WSDD with clean soil and restoring the wetland area;
- managing and disposing of water, excavated sediment, and remedial waste; and
- demobilizing equipment and project work areas.

2.2 SAMPLING PROGRAM

Sediment sampling focused on satisfying TSCA clean-up requirements in accordance with 40 CFR 761 Subpart O for PCBs. Soil samples were analyzed for PCBs by EPA Method 8082. Ultrasonic extraction (Method 3550B) was used for the initial delineation samples. Based on consultation with EPA, the extraction method was changed to soxhlet extraction (Method 3540C) for samples collected after 25 October 2004. Northeast Laboratory Services, located in Waterville, Maine and Spectrum Analytical in Agawam, Massachusetts conducted the PCB analyses.

Samples from Sherman Reservoir were collected in accordance with YNPS Procedure DP-8124 Collection of Pond Sediment Samples for Site Characterization. A boat-mounted Vibracore System was used to direct push or vibrate the core sampler into the sediment.

Samples from the WSDD were collected in accordance with YNPS Procedure DP-8120 Collection of Site Characterization and Site Release Samples. Samples were collected manually using a hand shovel or trowel. All samples were collected from 0 to 3 inches (7.5 cm) below the base of the dredged or excavated area. Dedicated sampling equipment was used where feasible. Reused sampling equipment was decontaminated prior to, and following, sample collection in accordance with the Quality Assurance Project Plan, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts (29 September 2003 YNPS QAPP).

In addition, samples associated with remedial activities were collected and managed in accordance the October 2004 Delineation and Verification Field Sampling Plan (FSP). The FSP was prepared as a supplement to the QAPP (YNPS, September 2003). The FSP outlines the approach and methods for characterizing sediment quality at the site as part of PCBs remediation efforts to satisfy Toxic Substances Control Act (TSCA) requirements in accordance with 40 CFR 761 subpart D.

2.3 DESCRIPTION OF SEDIMENT REMOVAL – EAST STORM DRAIN

2.3.1 Delineation of PCBs for Placement of Silt Curtain

Prior to the initiation of remedial activities in the Sherman Reservoir, sediment sampling was completed in Sherman Reservoir to confirm the outer boundary of the dredge area and ensure placement of the silt curtain to contain the entire work area. On 30 September and 1 October 2004 sediment samples were collected every 10 feet along the proposed location of the silt curtain (see Figure 5). Twenty-seven sediment samples, including three duplicates, were collected and analyzed to delineate the boundary of the silt curtain and work area (SD-502 to ESD-025). Seven additional samples, including one duplicate, were collected to delineate impacts along the shoreline (SD-538 to SD-542 and SD-544). Laboratory results are summarized in Table 1 and included in Appendix B.

Two samples had a PCB concentration above the remedial objective of 1 mg/kg. SD-525 had a concentration of 1.1 mg/kg, but a duplicate sample at that location had 0.240 mg/kg. Therefore, the average concentration at that location was 0.67 mg/kg, which was below the remedial objective. The other sample above the remedial goal was collected along the western shoreline (ESD-544 – 3.10 mg/kg), and therefore, removal actions were conducted in that area. None of the other delineation samples contained PCB concentrations in excess of 1 mg/kg.

The silt curtain's location was determined by a Global Positioning Survey (GPS) survey and a map indicating the placement of the curtain was provided to MA DEP and the Rowe Conservation Commission prior to dredging. The Rowe Conservation Commission visited the site and indicated approval of placement of the silt curtain. Figure 5 indicates the final location of the silt curtain.

2.3.2 Fish Clearing

Electrofishing was performed on 23 October 2004, following placement of the silt curtain and prior to remediation, to clear the work area of fish, particularly the longnose sucker, a designated Species of Special Concern by the Massachusetts Natural Heritage and Endangered Species Program. The type of fish collected and released included yellow perch, golden shiners, and fallfish. No longnose suckers were captured. A photograph of the fish clearing operation is included in Appendix C.

2.3.3 Sediment Dredging

Remediation activities were conducted in November 2004 to remove PCB-impacted sediments from the work area in Sherman Reservoir. Prior to initiating remediation activities, silt fencing was installed around the work area on the peninsula and a silt curtain was deployed in Sherman Reservoir to enclose the work area.

Sediments were removed by dredging using an environmental bucket. The environmental bucket was suspended from a crane that was based on the peninsula. A land-based crane was used instead of the planned barge-based crane due to the relatively small area encompassed by the silt curtain in which to maneuver.

The dredging activities were conducted within 125 feet of the East Storm Drain Outfall. Dredging proceeded from the silt curtain, inwards toward the peninsula. In this way, if any material dripped from the bucket as it was brought to shore, the subsequent dredging would remove the material from the reservoir.

During dredging operations, many subsurface obstacles were encountered; tree stumps, boulders, and logs. Multiple dredge attempts were made at locations where obstacles were encountered. Three attempts were made at each location to remove sediment from the reservoir bottom. After the third attempt, the bucket was moved to the next location. To track dredging progress, a GPS unit was installed on the crane and pressure transducers on the environmental bucket. The GPS unit monitored and recorded the dredge depths and locations of each bucket of material removed from the reservoir (Figure 6). This information was then used to prepare pre- and post-dredging cross-sections and maps of the dredged area (see Figure 7).

The dredged sediments were deposited by the environmental bucket into a container located on the peninsula. The sediments were allowed to settle out of the water column within the container and the excess water was decanted and pumped into a storage tank on the peninsula for later treatment and discharge. The sediments were then transported by a water-tight dump truck to the sediment handling area. The bank of the peninsula was covered with poly-liner. The liner prevented impacts to the peninsula from drips from the bucket as it was brought from the water to the temporary storage containers. This methodology differs from the original plan of using sediment scows due to the relatively small area encompassed by the silt curtain in which to maneuver.

A total of approximately 305 cubic yards of sediment was removed from Sherman Reservoir. This is less than the estimated remedial volume of 520 cubic yards. The difference in volume was due primarily to results from pre-dredging characterization along the shoreline, reducing the area requiring remediation, and the presence of many subsurface obstacles, preventing sediment removal in some locations. Photographs are included in Appendix C.

Turbidity monitoring was performed outside of the silt curtain three times per day during the dredging operations. The turbidity levels remained below the action level of 50 NTUs throughout the duration of the project.

Concurrent with the dredging activities, manual excavation activities were utilized to remove PCB-impacted soils between the outfall pipes (which were located approximately 8 feet above high water line) and the reservoir. The excavation and management of those soils will be addressed under the TSCA self-implementing cleanup for site soil in the industrial area.

2.3.4 Verification Sampling

After the completion of dredging, verification sediment sampling was performed between 20 and 23 November 2004 to determine if the remedial objectives had been achieved. Forty-seven sediment samples, including three duplicates, were collected from the area bounded by the silt curtain. Sample locations are shown in Figure 8. Laboratory results are summarized in Table 2 and included in Appendix D. With the exception of SD-626 and SD-631, PCBs were not detected at concentrations exceeding the 1 mg/kg remedial objective.

Based on discussions with US EPA, a five-point composite sample (SD-750) and duplicate (SD-750D) were collected (15 December 2004) from the area representative of SD-626 and SD-631. Analytical results indicated that the PCB concentration in the samples was consistent with the remedial objective based on the 95% Upper Confidence Limit of Mean (UCLM). The calculated 95% UCLM (Table 3) is 0.5 mg/kg, with a maximum of 3.4 mg/kg and a mean of 0.36 mg/kg. YAEC received verbal agreement from US EPA on 4 January 2005 that additional removal of sediment from Sherman Reservoir would not be required to meet the cleanup objective based on the supplemental results.

2.4 DESCRIPTION OF SEDIMENT REMOVAL – WEST STORM DRAIN

2.4.1 2004 Sediment Removal

Remediation activities were conducted during October and November 2004 to remove PCB-impacted sediments from the WSDD. Prior to initiating excavation activities, shrubs, trees, and herbaceous vegetation were removed from the work area to facilitate excavation of PCB-impacted sediments. Storm water entering the WSDD was diverted around the work area to allow sediments to dry and to facilitate sediment removal and handling. Temporary check dams constructed with hay bales and stone were also placed within the ditch as measures to avoid erosion and sedimentation. The number and location of the check dams within the ditch varied depending upon the status of the remediation activities being performed at that time. Additional erosion and siltation controls, including a line of hay bales placed perpendicular to the stream channel, were placed on the downstream end of the work area.

Sediments were removed using an excavator along the 500 feet of the ditch between the outfall pipes and a culvert below the access road to the Sherman Station Powerhouse. Sediments from the upper portion of the ditch (upstream portion of WSDD) were dry enough to be loaded directly into intermodal containers for off-site transportation and disposal. The remaining sediments were transported to the sediment handling and dewatering pad.

2.4.2 2004 Verification Sampling and Sediment Removal

After the completion of excavation activities, 28 verification samples, including two duplicates, were collected in October and November 2004 from the West Storm Drain. Two samples, SD-703 and SD-704, exceeded the remedial objective and required additional excavation and sampling. final verification samples (SD-703R and SD-704R) for both locations were below the remedial objective (Table 4 and Figure 9).

A total of approximately 360 cubic yards of PCB-impacted sediment was excavated from the WSDD in 2004. This volume is larger than that originally estimated (110 cubic yards). The volume increased due to results from site characterization and post-excavation sampling.

A survey of the post-excavation grades was performed following the completion of the excavation of the sediment. A cross-section of the pre- and post-excavation survey of the WSDD is provided in Figure 10.

2.4.3 Winter Stabilization

On 6 December 2004, analytical results were received from the laboratory to confirm that the remedial activities in the WSDD were complete. Since the remedial activities extended beyond the planting season, all restoration/replication work, including earthwork and plantings, was delayed until 2005. The proposed approach of delaying regrading and placement of soil was intended to avoid the potential for erosion for the soils and subsequent deposition into the Deerfield River.

During the winter months, the best management practices were utilized, as detailed in the Winter Erosion Control Plan (Appendix E), to stabilize and monitor the condition of the WSDD and to ensure the protection of water quality.

2.4.4 2005 Pre-Restoration Sampling and Sediment Removal

During the 2005 construction season leading up to the planting and restoration of the west storm ditch, storm water was routinely discharged through the west storm drain system. As a precautionary measure to document whether PCB deposition might have occurred, sampling was conducted on 29 September 2005 by collecting six samples (SE-WSD001 through SE-WSD006) from behind check dams that had been left for area stabilization in the storm ditch channel. Sample -001 was most downstream at the western end of the ditch and sample -006 was most upstream just below the outfall of the twin pipes emerging from the embankment below the gatehouse.

Laboratory testing showed PCBs as less than 1 mg/kg in all samples with the exception of SE-WSD005 and -006 (the two most upstream samples, 1.179 and 1.398 mg/kg, respectively). Based on these results, Yankee manually excavated additional material from the upper half of the storm ditch in October 2005 (approximately 260 linear feet). Following this, Yankee collected 13 grab samples every 20 feet from the based of the ditch (samples SD-727 through -739, 6 October 2005).

Of these samples, only SD-730 was reported as greater than 1 mg/kg for PCBs (1.384 mg/kg). Yankee then excavated additional sediment from the portion of the ditch represented by this sample and re-sampled (SD-730R, 12 October 2005). The result of this re-testing was below detection limits.

A total of approximately five cubic yards of sediment were excavated from the WSDD in October 2005.

2.4.5 Wetland Restoration

Restoration of the WSDD was completed in October 2005, following removal of PCB-impacted sediment and verification sampling. The remedial areas were generally restored to pre-existing hydrology, vegetation cover, and topography while minimizing site disturbance. Restoration was completed in accordance with the Wetland Restoration and Replication Plan (August 2004). The following construction clarification memos were prepared in support of restoration activities.

- "West Storm Drain Ditch – Winter Erosion Control and Monitoring Plan," December 2004
- "Wetland Restoration and Replication Plan Addendum," February 2005
- "West Storm Drainage Ditch Restoration and Supplemental PCB Removal," 5 October 2005
- "West Storm Drainage Ditch Restoration Species Substitution," 15 October 2005
- "West Storm Drain Clarification of Drainage Controls," 21 October 2005

Photographs of the October 2005 restoration activities are included in Appendix C.

2.5 DATA VALIDATION

Samples collected in 2004 from Sherman Reservoir and the WSDD were validated by ERM in 2005. Samples collected from the WSDD in 2005 were validated in the Spring of 2006. The data qualifiers are noted on Tables 1, 2, 4 and 5. Only one sample was rejected through the validation process. Sample SD-512, which was reported as non-detect, was rejected due to low percent solids (18 percent in sample vs. minimum of 30 percent).

3.0 ESTIMATE OF THE TOTAL SIZE OF THE REMEDIATED AREAS

Sediment remediation activities were conducted in October and November 2004 and October 2005. The remediated area and cross-sections of the East Storm Drain (Sherman Reservoir) is shown in Figures 6 and 7. Cross-sections of the WSDD are shown in Figure 10.

The approximate square footage of each remediated area was as follows:

- WSDD = approximately 2,000 square feet (application – 3,500 ft2)
- East Storm Drain = approximately 12,500 (application – 14,000 ft2)

The total volume of sediment removed from the WSDD was approximately 365 cubic yards and from the East Storm Drain was approximately 305 cubic yards.

4.0 WASTE MANAGEMENT AND CHARACTERIZATION

4.1 WASTE MANAGEMENT

Two staging areas were constructed at the site to manage and dewater sediment generated during remedial activities. A large dewatering pad was constructed in "lower staging area," located north of the WSDD and a small truck loading pad was constructed on the peninsula.

The sediment dewatering pad was constructed by placing HDPE plastic on the ground, covering it with geotextile fabric, and then placing approximately six inches of stone on top. An earthen and hay bale berm was installed around the pad and silt fence was installed on the downhill side of the work area. A sump to collect water was installed in the corner of the pad. Photographs of the pad are included in Appendix C.

Sediments from the WSDD and Sherman Reservoir were transported to the dewatering pad and placed into stockpiles. The stockpiles were covered with polyethylene sheeting when not being actively managed. After the sediment passed the paint filter test, lime was mixed with the sediments, when necessary, to make them suitable for off-site transport, as needed. The majority of the sediments were loaded into intermodal containers and transport bags and shipped off-site. However, due to the onset of freezing conditions, approximately 100 cubic yards of material (primarily the dewatering pad gravel and plastic) could not be loaded into containers at the close of 2004 activities. The stockpile that remained was secured for the winter by covering it with a tarpaulin and anchoring it in place. This material was treated on-site with thermal desorption and reused on-site as fill in the Industrial Area. This material was placed in areas that were remediated of PCBs under the TSCA permit issued for soil. The sediments generated in October 2005 were placed into intermodal containers and shipped off-site.

Water generated by dewatering activities was treated on-site (in accordance with NPDES Exclusion #MA 04I-096) by passing the water through a sand filter, bag filter and two carbon vessels. Approximately 18,000 gallons of water from the dewatering pad were treated and discharged to the Deerfield River. The treatment system was temporarily relocated to the peninsula and was used to treat 14,000 gallons of water stored on the peninsula. The discharges occurred in December 2004. Testing was performed to confirm that the PCB concentrations were below the discharge limits established by the National Pollution Discharge

Elimination System (NPDES) Exclusion (#MA-04I-096). The system operated within the limits of the exclusion permit. A Notice of Termination for the exclusion permit was sent by YAEC to US EPA on 20 October 2005.

4.2 CHARACTERIZATION OF WASTE MANAGEMENT AREAS

Closure samples were collected from beneath the two sediment staging areas ("peninsula staging area" and "lower staging area"). Sampling was performed in accordance with the applicable YNPS procedures including:

- DP-8120 Collection of Site Characterization and Site Release Samples
- DP-8123 Sample Security and Chain of Custody
- DP-8124 Collection of Pond Sediment Samples for Site Characterization

A sample grid was developed for each area using a 20-foot center. Grab samples were collected from the center of each grid cell from a depth of 0 to 3 inches below ground surface (bgs). Figures 11 and 12 show the sample locations in the peninsula and lower staging area.

Thirty-one soil samples, including two duplicates, were collected from the peninsula staging area on 14 May 2005. The analytical results for the soil closure samples are presented in Table 5 and the sampling locations are shown in Figure 11. None of the samples, with the exception of SB 717, contained concentrations of PCBs in excess of the remedial objective for PCBs. Approximately 1 cubic yard of soil was removed and resampling was conducted at SB 717 on 28 September 2005. The resample result for SB 717R (suffix "R" indicating a resample) was 1.1 mg/kg for total PCBs and approved as consistent with the remedial goal per a conversation between Ken Dow of YAEC and the EPA Region I TSCA Coordinator (Kim Tisa) during a site inspection.

Sixteen soil samples, including one duplicate, were collected from the lower staging area on 19 May 2005. Sampling could not be completed at that time because some of the sediment stockpile was still present along the southwestern portion of the staging area. Eleven additional samples were collected on 27 July 2005, after the remaining stockpile had been removed. The analytical results for the soil closure samples are presented in Table 5 and the sampling locations are shown in Figure 12. None of the soil samples collected in the lower staging area contained concentrations of PCBs in excess of the remedial objective.

Laboratory analytical results for the soil closure sampling and the accompanying chains of custody are included in Appendix F. Each laboratory report contains the laboratory's quality control / quality assurance checks.

4.3 WASTE CHARACTERIZATION, TREATMENT AND DISPOSAL

4.3.1 Waste Characterization

Waste profiles were developed utilizing the pre-remedial characterization data, as required by the receiving facilities.

4.3.2 Waste Treatment

Approximately 100 yards of PCB-impacted materials were treated on-site by the Maxymillian thermal desorption unit on 20 and 21 July 2005. The feed material and treated material were sampled for PCBs and results indicated that the treated material was below the remedial goal for PCBs. A summary of the analytical results are provided in the following table and the laboratory reports are provided in Appendix G.

	Pre-Treatment Result (*Sample ID)*	Post-Treatment Result (*Sample ID)*
Sample 1	9,970 ppb PCB 1254 2,180 ppb PCB 1260 (MT0720F023SED)	18.4 ppb PCB 1254 <9.7 ppb PCB 1260 (MT0720T023SED)
Sample 2	12,000 ppb PCB 1254 1,660 ppb PCB 1260 (MT0721F024SED)	<10.0 ppb PCB 1254 <10.0 ppb PCB 1260 (MT0721T024SED)

4.3.3 Waste Disposal

The following table provides a summary of how the wastes generated during the sediment removal project were handled:

Facility	**Dates Shipped**	**Quantity**
Pine Tree Landfill, Hampden, Maine	3 to 10 June 2005	349 tons
Race, Memphis, Tennessee	7 March 2005	3 tons
EnviroCare, Clive, UT	18 May 2005 and 2 December 2005	26 tons

The waste disposal manifests are provided in Appendix H.