Connecticut Yankee Corrective Action Completion Fact Sheet

July 16, 2014

The Remediation Division of the Connecticut Department of Energy and Environmental Protection (CTDEEP) received a report titled "Corrective Action Completion Report" (the Report) on July 2, 2014. The Report was prepared by Amec Environment and Infrastructure, Inc. on behalf of Connecticut Yankee Atomic Power Company's (CYAPCO). Haddam Neck Plant (HNP) located at 362 Injun Hollow Road in East Hampton, Connecticut (Site) to support site closure.

The Report serves to:

- Document the completion of Resource Conservation and Recovery Act (RCRA) Corrective Action Program (CAP) requirements;
- Demonstrate that the environmental conditions at the HNP are in compliance with the CTDEEP Remediation Standard Regulations (RSRs); and
- Satisfy CYAPCO's remaining Stewardship Permit obligations.

Historically, both chemical and radiological constituents have been detected in soils and groundwater at concentrations above CTDEEP RSRs. The Report details activities that support the conclusion that corrective action measures for site closure, including environmental investigation, remediation activities, and post-remediation groundwater monitoring have been completed in accordance with applicable state and federal requirements.

The Report has been prepared to satisfy the Corrective Action Completion Report submittal requirements pursuant to Section II.B of CYAPCO's Stewardship Permit which was issued by CTDEEP on October 23, 2007. The Report summarizes the investigations, remediation, and groundwater monitoring conducted to fully meet closure requirements for the HNP and support a petition for termination of the Stewardship Permit and the issuance of a Certificate of Completion from the CTDEEP Commissioner for the HNP.

Site Background:

The HNP Site is owned by CYAPCO and is located at 362 Injun Hollow Road in the Town of Haddam, Middlesex County, Connecticut. The HNP consists of approximately 525 acres of mostly wooded land located on Haddam Neck, 21 miles south-southeast of Hartford. The HNP is bordered to the west by the Connecticut River, to the north by residential areas, to the east by rural undeveloped land and the Salmon River, and to the south by Salmon Cove. Only about 25 acres of the property were developed as an industrial area. The main power station area was located on a level, 600-foot wide terrace. The remaining acreage is mostly undeveloped, with the exception of five acres that encompass the Independent Spent Fuel Storage Installation (ISFSI), and a smaller parcel that included half of the Haddam Neck substation, in the northern portion of the property.

On November 18, 1980, CYAPCO first submitted an application to be a permitted generator and storage facility for hazardous waste. CYAPCO was then issued RCRA Part A Treatment, Storage, and Disposal Facility (TSDF) Permit No. CTD042306720. Several revisions were later submitted to modify the permit, with the last revision submitted in March 1989 to comply with regulatory changes concerning mixed waste. The revised application qualified HNP for interim status to treat and store mixed waste at the Site. It was this RCRA permit that brought CYAPCO into the RCRA CAP. The RCRA CAP was conducted under the regulatory authority of the United States Environmental Protection Agency (USEPA) and was in compliance with the CTDEEP RSRs with the final goal to facilitate transfer of the property in

accordance with the Connecticut Property Transfer Act. The RCRA investigations and remediation work were conducted from 2002 through 2007. On July 24, 2006, CYAPCO submitted an Environmental Condition Assessment Form (ECAF) to enter into the Voluntary Remediation Program (CGG Section 22a-133x). The CTDEEP responded by letter dated May 11, 2007 that approved the proposed schedule and stated that the CTDEEP would provide formal review and approval of the remediation (*i.e.* the site will not be delegated to a Licensed Environmental Professional [LEP]). The CTDEEP, in consultation with USEPA, issued a Stewardship Permit in August 2007 to document that all investigation and remediation activities were complete and that the only remaining work required to obtain site closure was the completion of post-remediation groundwater monitoring.

The HNP completed decommissioning in 2007, and in November 2007 the CYAPCO Operating Licensed area was reduced under the regulatory authority of the Nuclear Regulatory Commission (NRC). In addition to NRC license reduction, site closure includes:

- The RCRA CAP under the regulatory authority of the USEPA;
- Oversight of radiological issues defined in Title 22a, Chapters 446 and 446A of the Connecticut General Statutes (CGS) regulated by the CTDEEP Bureau of Air Management and Radiation Division; and
- Oversight of Voluntary Remediation under CGS Section 22a-133x and the CT Property Transfer Act under 22a-134 et seq. conducted by the Bureau of Water Protection and Land Reuse.

Since 2007 CYAPCO has been monitoring groundwater at the HPN and, as documented in the Groundwater Report for Compliance with CTDEEP RSRs Monitoring Plan Closure (AMEC, 2013), has met the monitoring requirements outlined in the Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 3 (AMEC, 2014).

Chemical Characterization and Remediation:

The HNP has been investigated under the RCRA CAP with regulatory oversight from the USEPA. The HNP is also in the CT Voluntary Remediation Program with regulatory oversight from the CTDEEP. Additionally, a Stewardship Permit was issued to CYAPCO in 2007 for postremediation groundwater monitoring. The overall goals of these programs are to achieve site closure under RCRA in accordance with USEPA guidance (USEPA, 1996 and 2003) and to complete site remediation in accordance with the RSRs under the CT Voluntary Remediation Program. The results of RCRA CAP activities are presented in several types of documents that are used to support site closure and demonstrate that the HNP has been investigated and remediated in accordance with applicable standards, guidance, and regulations.

Site characterization activities at the HNP have been conducted in a phased approach. This approach was similar to the phases outline in the CTDEEP Draft Site Characterization Guidance Document (CTDEEP, 2000); however, CYAPCO employed the nomenclature used in the USEPA RCRA guidance documents (USEPA, 1986 and 1989). Instead of Phase I, II, and III investigations, the CYAPCO RCRA CAP was conducted by completing a Historic Records Review (HRR) (Phase I), a Limited Field Investigation (LFI) Program (Phase II), and a RFI Program (Phase III), including a Baseline Ecological Risk Assessment (BERA). The RCRA Corrective Action Program is under the regulatory authority of both CTDEEP and USEPA. However, USEPA has delegated RCRA Authority to CTDEEP with the understanding that the RSRs are protective of human health and the environment and are the appropriate clean up criteria for RCRA sites in Connecticut. The RSR Criteria are human health risk-based values that are based on a target cancer risk of 1.0E-06 and a hazard index of 1.0. During site characterization, the analytical data were evaluated to assess whether site characterization goals of adequately defining the nature and extent of contamination were achieved. Data were also evaluated using ecological screening values as required under the RSRs.

The HRR was conducted to identify areas of the HNP where pollutants may have been released to the environment. Phase I activities included:

- Interviews with current and former Site employees to understand past practices and operations;
- Review of previous investigations;
- Review of aerial photographs;
- Review of files from the CTDEEP;
- Review of files from the USEPA; and
- Review of files from the HNP.

The HRR identified 21 areas of concern (AOCs), including numerous potential contaminant sources (PCSs) where chemicals were potentially released and/or historical practices may have impacted environmental conditions. The HRR findings were presented in the HRR (MACTEC, 2003a). The HRR also provided recommendations for the LFI activities.

The LFI was conducted to provide initial data on environmental conditions at each of the 21 AOCs identified in the HRR. An LFI Work Plan was prepared and submitted to the USEPA and CTDEEP in June 2003 (MACTEC, 2003b). During the LFI, another AOC (AOC 22) was identified and investigated. The LFI field program included completion of geophysical surveys, soil borings, and test pits; installation of monitoring wells; and collection of soil, sediment, surface water, and groundwater samples for various laboratory analyses. LFI field activities were completed in 2003 and documented in the Draft LFI Report and RFI Work Plan (MACTEC, 2004a).

Based on the results of the Phase II characterization activities (i.e., LFI Report), the RFI was conducted to further assess environmental conditions at each AOC. The Draft LFI Report and RFI Work Plan were prepared and submitted to the USEPA and CTDEEP in March 2004 (MACTEC, 2004a). During the initial RFI, two additional AOCs (AOCs 23 and 24) were identified and investigated. A Supplemental RFI Work Plan was also prepared to address data gaps and comments from the CTDEEP. The Supplemental RFI Work Plan was submitted to the USEPA and CTDEEP in November 2004 (MACTEC, 2004b).

The RFI and Supplement RFI included completion of geophysical surveys, soil borings, and test pits; installation of monitoring wells; and collection of soil, sediment, surface water, and groundwater samples for various laboratory analyses. RFI and Supplemental RFI activities were completed in the fall of 2006. The USEPA approved the RFI Report by letter dated December 28, 2006. The RFI Report was revised based on comments from the CTDEEP and the Final RFI Report (MACTEC, 2007a) was submitted to the USEPA and CTDEEP in January 2007. The CTDEEP approved the Final RFI Report by letter dated March 8, 2007.

The RSRs require documentation that releases of site related constituents do not adversely impact ecological receptors. RCRA guidance also requires a BERA to be completed as part of the RFI Program. The BERA was conducted in accordance with applicable USEPA risk assessment guidance documents. The BERA was conducted to identify possible ecological receptors and potential exposure pathways; qualitatively assess the risk of adverse effects to ecological receptors; and provide information that may be used to evaluate if response actions are required to achieve final remedy for the Site. The draft BERA was submitted to the USEPA and CTDEEP in February 2006 (MACTEC, 2006b). USEPA provided comments on the BERA in May 2006 and CYAPCO submitted a final response to comments and a BERA Addendum in October 2006 (MACTEC, 2006d). USEPA approved the BERA in an email dated

December 22, 2006. CTDEEP documented their concurrence with the USEPA approval in an Interdepartmental Memorandum dated January 30, 2007 and approved the BERA as part of the approval of the Final RFI Report by letter dated March 8, 2007.

With the characterization of the HNP complete, remediation of the HNP focused on efforts to achieve site closure under RCRA, as well as to comply with the requirements of the CTDEEP RSRs and the Voluntary Remediation Program. CYAPCO has completed Interim Corrective Measures (ICMs) and prepared a Corrective Measures Study (CMS) and Remedial Action Plan (RAP) to address environmental media at the HNP in support of site closure. A post-remediation groundwater monitoring program has also been completed. Activities associated with the remediation are discussed in the following paragraphs. The groundwater monitoring program is discussed later in this document.

Interim Corrective Measures (ICM) have been completed at numerous AOCs in accordance with the USEPA RCRA Corrective Action Plan Guidance (USEPA, 1994, 1996, and 2003). The ICMs have included removal of soils with contaminant concentrations above applicable CTDEEP RSR Criteria. Work Plans were prepared for each ICM in accordance with USEPA guidance. Each ICM Work Plan provided the scope of work to be completed, including confirmation sampling, analysis, and reporting requirements. As part of the ICMs, confirmation samples were collected to verify that all soil with contaminant concentrations above CTDEEP RSR Criteria was removed. Confirmation samples from sediment remediation were compared to ecological screening values. ICM confirmation samples were collected and analyzed in accordance with the ICM Work Plans.

Following USEPA's approval of the CMS, a Corrective Measure Implementation (CMI)/Remedial Action Report (CMI/RAR), the last phase of the RCRA Corrective Action Program, was completed and submitted to both agencies (MACTEC, 2007f). For the HNP, all soil, sediment, and groundwater remediation has been completed as ICMs and therefore, with the exception of postremediation groundwater monitoring, no additional remedial actions were required. USEPA approved the CMI/RAR. CTDEEP provided verbal comments and Revision 1 of the CMI/RAR was published in August 2007.
The effectiveness of HNP's remediation activities was assessed by the groundwater monitoring program conducted in compliance with the CTDEEP approved Groundwater Monitoring Plan to Demonstrate Compliance with CTDEEP RSRs, Revision 3 (AMEC, 2014). This plan was designed and completed to assess the remedial activities completed, verify compliance with groundwater remediation criteria, and document long-term effectiveness of the remediation.

Since the submittal of the CMI/RAR in August 2007, CYAPCO has a continued to implement a comprehensive spill reporting program at the HNP. The program is used to identify and report all releases to CTDEEP. The CMI/RAR reviewed CYAPCO and CTDEEP spill reports through July 2007. A review of CYAPCO and CTDEEP spill reports from August 2007 to July 2014 did not reveal any releases. CYAPCO prepared a letter to update the status of the Site to document that no known releases of hazardous waste or hazardous substances have occurred since CMI/RAR for the Site was submitted in August 2007.

In 2007, the CTDEEP in consultation with USEPA terminated HNP's interim status under RCRA and issued a Stewardship Permit. The Stewardship Permit documented that all environmental investigation and remediation activities had been completed and that the only remaining requirement to obtain site closure was the completion of the groundwater monitoring program presented in the Groundwater Monitoring Plan to Demonstrate Compliance with CTDEEP RSRs (MACTEC, 2007c). The final groundwater monitoring plan, Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 3 (AMEC, 2014) was approved by CTDEEP Commissioner on February 25, 2014 (CTDEEP, 2014).

Radionuclide Characterization and Remediation:

Radiological remediation has been completed at the HNP in accordance with the LTP (CYAPCO, 2007a) under the regulatory authority of the NRC and in accordance with the requirements of the CTDEEP Bureau of Air Management, Division of Radiation Protection for radiological issues defined in Title 22a Chapters 446 and 446A of the Connecticut General Statutes. By letter dated November 20, 2002, CTDEEP approved a cleanup criterion for radionuclides of 19 milliRem per year Total Effective Dose Equivalent (TEDE), plus As Low As Reasonably Achievable (ALARA) for all media. This is consistent with the NRC cleanup goal of 25 milliRem per year TEDE, plus ALARA. To achieve these goals, Derived Concentration Guideline Levels (DCGLs) were calculated for each media to provide criteria for each radionuclide by media. By letter dated October 7, 2004, CTDEEP accepted the USEPA Maximum Contaminant Levels (MCLs) as criteria for groundwater. The MCLs also include an evaluation of sum of the fractions, or the unity rule to demonstrate that there is no unacceptable risk from radionuclides in groundwater at the time of site closure.

The characterization and remediation of impacted media was conducted in accordance with the LTP and in parallel with NRC guidance; the radiological characterization followed a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) approach of characterization. Documents prepared under NRC regulations were also used to document radiological conditions. Under this program, soils that exceeded the calculated DCGLs were remediated. Areas were characterized by survey area designated in the LTP.

The radiological groundwater program was also conducted in support of the LTP; however, instead of using DCGLs as the cleanup criteria, the groundwater program compared data to the MCLs for the "Resident Farmer's Well" exposure scenario. As noted above, the MCLs are also the CTDEEP Site-Specific RSR Criteria for Groundwater Protection.

Groundwater Monitoring and Remediation:

Based on data collected during the RFI, groundwater beneath the HNP has been characterized. Historically low-levels of polynulcear aromatic hydrocarbons (PAHs) and inorganics were detected. These detections were generally located within the industrialized portion of the HNP. During D&D activities, and more specifically during the soil and groundwater remediation conducted within the Radiologically Controlled Area (RCA), most of the sources and impacted areas were excavated and replaced with clean fill. Under the RCRA CAP, groundwater did not require remediation, and with the exception of boron, there are no discernable chemical plumes. Boron was used at the HNP as a neutron absorber and was co-located with radiologically impacted water. Boron had been detected in groundwater; however, at concentrations below the applicable RSR Criteria, and did not require remediation.

Radionuclides were released from several sources within the Industrial Area, resulting in several plumes of groundwater impacted with tritium, strontium, and cesium. After characterizing the nature and extent of radionuclides (and boron) in groundwater, the source areas were remediated by dewatering and excavating overburden soil and bedrock below the water table (including blasting of bedrock). The excavation and off-site disposal of these materials, followed by backfilling the excavations with clean fill from off-site borrow sources, eventually resulted in reduced concentrations of radionuclides to below MCLs.

CYAPCO initiated and completed groundwater monitoring as outlined in its LTP. The required LTP groundwater monitoring was completed in 2007, and in November 2007 the CYAPCO NRC Operating

License was reduced to a small area of the Site under the regulatory authority of the NRC. Under the RCRA CAP, groundwater monitoring is conducted to: (1) assess remedial activities, (2) document compliance with remediation criteria (e.g., RSRs), and (3) document the effectiveness of the remediation (i.e., post-remediation monitoring). Additionally, Section 22a-133k-3(g) of the CTDEEP RSRs provide specific requirements for groundwater compliance monitoring to be conducted following remediation of a release area or contaminated groundwater plume

Release areas were remediated for both chemical and radionuclides. Groundwater monitoring activities are detailed in the Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 3 (AMEC, 2014). The Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 1 (MACTEC, 2007e), was submitted to CTDEEP and USEPA on May 21, 2007. CTDEEP approved the plan on May 24, 2007. The Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 2 (MACTEC, 2007e), was submitted to CTDEEP and USEPA on September 12, 2007. CTDEEP approved Revision 2 of the plan on September 20, 2007. The Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 3 (AMEC, 2014), was submitted to CTDEEP and USEPA on January 10, 2014. CTDEEP approved Revision 3 of the plan on February 25, 2014.

By letter dated January 28, 2014, CYPCO formally requested termination of the post-remediation groundwater monitoring program and concurrence from CTDEEP to proceed with decommissioning the remaining groundwater monitoring and support wells associated with the Site. In a letter dated March 7, 2014, CTDEEP approved CYAPCO's plan to terminate the postremediation groundwater monitoring program and decommission the remaining wells. In March/April 2014 the remaining groundwater monitoring wells at the Site were decommissioned. The decommissioning activities were documented in a letter submitted to CTDEEP dated May 9, 2014.

The Report presents a summary of the chemical and radiological programs completed to date and fully demonstrates that the characterization and remediation of impacted media and release areas has been completed in accordance with CTDEEP and USEPA regulations. Twenty four AOCs have been characterized for chemical constituents. All RCRA CSAs and USTs have been closed. Thirty seven ICMs were completed to remediate chemicals released at 18 AOCs. Similarly the entire property has been characterized for radionuclides in accordance with MARSSIM and the LTP. Based on the radiological program, eight areas were remediated and meet the CTDEEP RSR of 19 milliRem per year TEDE plus ALARA and the USEPA MCLs for groundwater.

All investigation and subsequent remediation has been documented and approved by the NRC, CTDEEP, and USEPA (where applicable).

As presented in the Groundwater Report for Compliance with CTDEEP RSRs Monitoring Plan Closure (AMEC, 2013), the groundwater monitoring program conducted at the HNP meets the monitoring requirements outlined in the Groundwater Monitoring Plan for Compliance with the CTDEEP RSRs, Revision 3 (AMEC, 2014) and meets the requirements of the CTDEEP RSRs and other CTDEEP approved numerical criteria. With the completion of the groundwater monitoring program, submittal of the Report fulfills the requirements of CYAPCO's Stewardship Permit.

CYAPCO has requested termination of the Stewardship Permit in a letter to DEEP dated July 9, 2014.

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