



SRSNE Site Group

Remedial Design Work Plan Attachment O

**Groundwater Containment and
Treatment Evaluation and
Optimization Study Work Plan**

Solvents Recovery Service of New England, Inc.
(SRSNE) Superfund Site
Southington, Connecticut

November 2010

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and Treatment Evaluation
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Work Plan**

Solvents Recovery Service of
New England, Inc. (SRSNE)
Superfund Site
Southington, Connecticut

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Executive Summary

This document provides a work plan for a groundwater containment and treatment evaluation and optimization study (GCTEOS) that will be initiated upon completion of the in-situ thermal treatment and capping components of the remedy at the Solvents Recovery Service of New England, Inc. (SRSNE) Site in Southington, Connecticut. The GCTEOS pertains to the operation of the Hydraulic Containment and Treatment System (HCTS) at the SRSNE Site, including the assessment of the groundwater capture zone achieved by the system and evaluation of its effectiveness in containing groundwater impacted by constituents of concern (COCs) related to historical SRSNE Site operations.

The purposes of the GCTEOS will be to:

- demonstrate that the performance standards for the HCTS and the severed plume (i.e., the portion of the plume downgradient of the capture zone) are being met
- if necessary, propose modifications and/or enhancements to the system necessary to achieve compliance
- evaluate the protectiveness of the demonstration of compliance requirements set forth in Attachment B of the SOW

The GCTEOS Work Plan includes a general description of the HCTS, and the data collection, evaluation and modeling activities that will be used to meet the above-listed objectives.

1. Introduction

1.1 Purpose and Scope

This document has been prepared on behalf of the SRSNE Site Group, an unincorporated association of Settling Defendants to a Consent Decree (CD) and Statement of Work (SOW) for the Remedial Design/Remedial Action (RD/RA) at the Solvents Recovery Service of New England, Inc. (SRSNE) Superfund Site in Southington, Connecticut (Site) (Figure O-1). The CD was lodged on October 30, 2008 with the United States District Court for the District of Connecticut in connection with Civil Actions No. 3:08cv1509 (SRU) and No. 3:08cv1504 (WWE). The CD was entered by the Court on March 26, 2009.

Sections V.C.4 and V.C.5 of the SOW require the performance of a groundwater containment and treatment evaluation and optimization study (GCTEOS) upon completion of the in-situ thermal treatment and capping components of the remedy at the Site. The GCTEOS pertains to the operation of the Hydraulic Containment and Treatment System (HCTS) at the SRSNE Site, including the assessment of the groundwater capture zone achieved by the system and evaluation of its effectiveness in containing groundwater impacted by constituents of concern (COCs) related to historic SRSNE Site operations. While the SOW does not specifically require submittal of a work plan associated with the GCTEOS, this plan has been proactively prepared as a component of the *Remedial Design Work Plan* (RDWP) to describe the planned approach for implementing the GCTEOS.

Based on Section V.C.4 of the SOW, the purposes of the GCTEOS are summarized as follows:

- Demonstrate that the Performance Standards for the HCTS and the severed plume (i.e., the portion of the plume downgradient of the capture zone) are being met.
- If the Performance Standards for the HCTS or severed plume are not met, propose modifications and/or enhancements to the system necessary to achieve compliance. An assessment will also be made as to whether additional modifications or enhancements to the containment and

treatment system will increase effectiveness and/or decrease the costs or time of operation while continuing to meet its objectives.

- Evaluate the protectiveness of the demonstration of compliance requirements set forth in Attachment B of the SOW, as modified. If the United States Environmental Protection Agency (USEPA) determines that the demonstration of compliance requirements is no longer protective, the SRSNE Site Group will propose new demonstration of compliance requirements.

1.2 Document Organization

This GCTEOS Work Plan is organized in the following sections:

- **Section 1 – Introduction:** Describes the purpose, scope, and organization of this document.
- **Section 2 – Background:** Describes the HCTS, the severed plume and the Performance Standards associated with each.
- **Section 3 – Process to Demonstrate Attainment of Performance Standards:** Describes the activities that will be performed to demonstrate that the Performance Standards are met, and provides provisions for modifying the HCTS, if necessary.
- **Section 4 – Schedule:** Describes the timing during which the GCTEOS will be conducted.
- **Section 5 – References:** Lists documents cited herein.

Supporting figures are also attached and referenced as appropriate.

2. Background

The "Non-Time-Critical Removal Action [NTCRA] 1 and NTCRA 2 Groundwater Extraction and Treatment System" or "NTCRA 1/2 Groundwater System" refers to the on-site combined groundwater extraction and treatment system implemented under Administrative Orders on Consent I-94-1045, effective October 4, 1994, and, 1-97-1000, effective February 18, 1997. With entry of the CD on March 26, 2009, the combined NTCRA 1/2 Groundwater System is now referred to as the HCTS per SOW Section V.A.

The HCTS includes two main groundwater extraction systems, each of which pumps groundwater to a single groundwater treatment system, where it is treated prior to discharge to the Quinnipiac River. The extraction systems and their Performance Standards are described below, followed by a description of the Performance Standards for the severed plume.

2.1 NTCRA 1 and NTCRA 2 Groundwater Extraction Systems

The groundwater extraction components of the HCTS currently consist of the following.

- NTCRA 1 Groundwater Extraction System: consists of a steel sheet pile wall through the overburden to the top of bedrock, and 12 overburden groundwater extraction wells (RW-1 through RW-12) west (upgradient) of the sheet pile wall within the NTCRA 1 Containment Area (Figure O-2). Groundwater is extracted from the wells to maintain hydraulic gradient reversal across the sheet pile wall. Pumping from these wells was initiated in 1995. The NTCRA 1 groundwater extraction system generally pumped between 5 and 20 gallons per minute (gpm) during 2008.
- NTCRA 2 Groundwater Extraction System: consists of two overburden extraction wells (RW-13 and RW-14) and one bedrock extraction well (RW-1R) just north of the Connecticut Light & Power (CL&P) easement (Figure O-2). These wells began operating in 1999, 2007, and 2001, respectively. The NTCRA 2 system generally pumped between 20 and 35 gpm during 2008.

The combined NTCRA 1 and NTCRA 2 groundwater extraction systems generally pumped between 25 and 50 gpm in 2008. Generalized capture zones for the NTCRA systems in the overburden and the bedrock are illustrated on Figures O-3 and O-4, respectively.

2.2 Hydraulic Containment and Treatment System Performance Standards

As specified in SOW Section IV.B.2, the Performance Standards for the HCTS are the NTCRA 1 and NTCRA 2 Groundwater Extraction and Treatment System Demonstration of Compliance Requirements. These requirements are presented in SOW Attachment B and, in brief, include three types of criteria:

- *Confirm that groundwater upgradient of the extraction wells is flowing in the direction of the extraction wells:* This Performance Standard is measured by plotting and contouring hydraulic head data to confirm that the hydraulic gradient is toward the extraction wells.
- *Verify that groundwater flow downgradient of the extraction wells is reversed:* This Performance Standard is measured by comparing hydraulic head data between pairs of piezometers to verify that the hydraulic head at the “inner” piezometer is lower than the hydraulic head of the “outer” piezometer.
- *Treat extracted groundwater to meet ARARs in treated effluent:* This Performance Standard is measured by collection and analysis of treated water to determine if concentrations in effluent meet all applicable or relevant and appropriate requirements (ARARs), including the National Pollutant Discharge Elimination System (NPDES) Program, 40 C.F.R. Part 122, 125.

In accordance with SOW Section IV.B.2, groundwater in the overburden and bedrock aquifers that contains Site-related COCs shall continue to be captured and treated on site using the HCTS, unless and until it is modified pursuant to Sections V.B.6, V.C.4, V.C.6 or VI I.E of the SOW, or as required by USEPA to meet the Performance Standards for the severed plume.

2.3 Severed Plume

The severed plume is the portion of the plume that is beyond the combined capture zone of the HCTS. Specifically, the severed plume is the portion of the SRSNE plume in the overburden and bedrock south of the NTCRA 2 capture zone (Figures O-3 and O-4, respectively).

2.4 Severed Plume Performance Standards

The Performance Standards for the severed plume are the federal and state drinking water standards, as specified in SOW Section IV.B.3. Federal drinking water standards are the Federal Maximum Contaminant Levels (MCLs). State drinking water standards are the Connecticut Class GA Groundwater Protection Criteria.

Also, the quality of the groundwater in the severed plume, which has shown a trend of decreasing contamination levels since the construction of the former NTCRA 1/2 system, must not be adversely impacted by changes in Site conditions, decline in equipment performance and/or moving the HCTS.

In the event that the Southington Water District activates production wells in the Curtiss Street Well Field, the risks in the severed plume beyond the supplemental containment system must be within USEPA's risk management standard for carcinogens and noncarcinogens, as shown by a human-health risk assessment. The human health risk assessment approach will be described in detail in the Supplemental Containment Action Plan, which will be submitted under separate cover.

3. Processes to Demonstrate Attainment of Performance Standards

3.1 Hydraulic Containment and Treatment System

3.1.1 NTCRA 1 and NTCRA 2 Demonstration of Compliance Requirements

The Performance Standards for the hydraulic containment and treatment system as described in SOW Section IV.B.2, are presented in SOW Attachment B. These Performance Standards are equal to the Demonstration of Compliance Requirements for the NTCRA 1 and NTCRA 2 systems, which are described above.

Under the compliance monitoring programs for the NTCRA 1 and NTCRA 2 groundwater containment systems, hydraulic head data will be collected and evaluated to verify that the Demonstration of Compliance Requirements for the NTCRA 1 and NTCRA 2 systems are maintained, meeting the Performance Standards for the HCTS. Compliance with these Performance Standards will be demonstrated by continued water-level monitoring at NTCRA 1 and NTCRA 2 compliance piezometers, and these data will continue to be reported annually within the Annual State of Compliance Report.

During and following the In-Situ Thermal Remediation (ISTR), both NTCRA 1 and 2 groundwater containment systems shall continue operations to maintain hydraulic containment standards. The ISTR work is not anticipated to impact the operations of the NTCRA 2 groundwater containment system; however modifications are anticipated for the NTCRA 1 groundwater containment system to maintain satisfactory operations and system performance. The *Pre-ISTR Preparation Plan* (PIPP; Attachment M to the RDWP) identifies the steps necessary to evaluate and implement the required NTCRA 1 system modifications to maintain satisfactory system performance.

Because some existing NTCRA 1 recovery well(s) and piezometers will require abandonment, an updated NTCRA 1 Demonstration of Compliance Plan (DCP) will be prepared to address necessary changes to the DCP to incorporate these system modifications. The updated DCP will be a separate deliverable but prepared in consort with the proposed NTCRA 1 modifications discussed within the PIPP.

3.1.2 Additional Tasks

Beyond the requirements for the HCTS specified in the SOW, additional tasks will be required to confirm that the capture zone of the HCTS contains groundwater with COC concentrations that exceed federal drinking water standards and risk-based levels, as required by the Record of Decision (ROD p. 96 of 115) (USEPA 2005). Multiple lines of analysis will be used to meet this objective, similar to capture zone evaluation procedures suggested in USEPA technical documents (2002 and 2008). The additional proposed tasks listed below are aligned with the general procedures described in those documents.

- Delineation of Plume that Exceeds Federal Drinking Water Standards and Risk-Based Levels
 - This objective will be met by evaluating the latest available groundwater monitoring results upon completion of the in-situ thermal treatment and capping components of the remedy. These data will be obtained from the groundwater sampling events described in the *Monitoring Well Network Evaluation and Groundwater Monitoring Program* (Attachment N to the RDWP) and the *Field Sampling Plan* (Attachments B and C to the Remedial Design Project Operations Plan [RD POP]). The data will be compared to federal MCLs and risk-based levels, and the area where groundwater exceeds either or both of these standards will be delineated.
- Groundwater Elevation Contouring And Hydraulic Gradient Evaluation
 - Groundwater elevation data will be obtained as described in the *Monitoring Well Network Evaluation and Groundwater Monitoring Program* and the *Field Sampling Plan*.
 - Groundwater elevation data will be plotted and contoured to evaluate hydraulic gradients and generalized groundwater flow directions in each of the five monitored groundwater zones, which include:
 - *Shallow, middle and deep overburden*, which represent the upper, middle, and lower thirds of the saturated overburden deposits, respectively

- *Shallow and deep bedrock*, which represent approximately the upper 30 feet of bedrock and the portion of the bedrock that is more than 30 feet below the top of rock, respectively
- The groundwater elevation data will also be plotted on cross sections to depict hydraulic gradients and generalized groundwater flow directions in vertical sections along the axis of the plume (north-south) and perpendicular to it (east-west).
- Surface water elevation measurements will also be collected at the Quinnipiac River, and these data will be use to provide additional resolution of the shallow overburden potentiometric surface.
- Groundwater Flow Modeling
 - As an additional tool in assessing the relationship between the capture zone and areas with groundwater quality impacts, the existing NTCRA 2 regional MODFLOW model (BBL August 1996, September 1997, November 1998, November 1999; BBL and USEPA 2005) will be used to perform particle tracking simulations. Forward particle tracking will be performed with particles starting at the screens of the wells where groundwater samples are above federal drinking water standards and risk based levels.
 - If forward particle tracking from any of these wells predicts that the groundwater migrates from these locations to points beyond the mapped capture zone of the groundwater containment and treatment system, then it will be concluded that those wells are outside of the capture zone of the system. In this case, changes will be recommended to improve the capture zone achieved by the system to prevent “plume bypass”.
 - Reverse particle tracking may also be used, as discussed below.
- Review COC Concentration Trends At Wells Downgradient Of Interpreted Capture Zone Boundary
 - An additional line of evidence to confirm the interpreted capture zone boundary (delineated based on hydraulic head data and modeling

results) will be trends of COC concentrations versus time in the area downgradient of the groundwater containment system.

- Historical COC data will be plotted versus time for the wells within the SRSNE-related plume in southern portion of the Town Well Field Property. These data will be used to illustrate whether concentrations are increasing, decreasing, or remaining the same.
- Any well that is in the southern portion of the CL&P easement and shows an increasing trend in COC concentrations will be interpreted as indicating plume "bypass" in the area upgradient of that well. Reverse particle tracking will be performed for any wells that meet this description to assist in identifying the area where the COC plume is bypassing the groundwater containment and treatment system. Modifications will be proposed for the hydraulic containment system to mitigate such plume bypass, if any.

3.1.3 Hydraulic Influence of Quinnipiac River

In considering the capture zone of the groundwater containment and treatment system and the locations of wells with COC concentrations above federal drinking water standards and risk-based levels, it is important to note the significant role that the Quinnipiac River plays in terms of regional groundwater hydraulics. The Quinnipiac River is a major regional groundwater discharge location. In the absence of groundwater extraction, all of the groundwater within the monitored study area would discharge to the river, or its nearby tributaries. This interpretation was documented during the Remedial Investigation (RI) (BBL 1998), and is supported by hydraulic head data measured at up to 227 wells, piezometers and surface water locations during two comprehensive measurement rounds in winter and summer seasons. This interpretation is also supported by regional groundwater flow model simulations using the calibrated NTCRA 2 MODFLOW model (BBL 2005).

Although a portion of the SRSNE-related COC plume flows toward the Quinnipiac River, the surface water and sediment sampling results obtained along the river during the RI indicated no site-related impact attributed to groundwater discharge (HNUS 1994; BBL 1998). Fourteen subsequent rounds of surface water sampling from November 1998 to April 2005 confirmed previous surface water sampling results, indicating essentially no impact to

surface water quality in the Quinnipiac River east of the former SRSNE Operations Area (BBL 2005). The ROD remedy does not require any remedial action related to the river, except for the excavation of floodplain sediment/soil in an isolated area adjacent to the Quinnipiac River; the affected area is localized around the outfall of the culvert that crosses beneath the former Cianci Property, however, and is not related to groundwater discharge.

Although the extensive history of Site investigations indicates essentially no impact of the SRSNE-related COC plume on the river, it is clear that some COC-impacted groundwater is migrating toward the river. In the immediate proximity of the river, some of the overburden groundwater that contains COC concentrations above federal drinking water standards and risk-based levels migrates toward and ultimately discharges to the river without impacting surface water or sediment quality. Thus, it is likely that a subset of wells with COC concentrations above federal drinking water standards and risk-based levels is not within the capture zone of the HCTS in the literal sense, because it is within the regional hydraulic influence of the Quinnipiac River. Preventing such groundwater discharge to the river (1) would require a significant increase in groundwater extraction adjacent to the river; (2) was not mandated by the ROD; and (3) is not necessary to protect surface water or sediment quality in the river, because these are not impacted by site-related groundwater.

Thus, it is interpreted that such discharge of groundwater (above federal drinking water standards and risk-based levels) to the river in the general area north of the CL&P easement, rather than the extraction wells, would not be considered a material excursion of the Performance Standards for the HCTS.

3.1.4 Supplemental Containment Action Plan

As required by SOW Section V.B.5, a *Supplemental Containment Action Plan* (SCAP) will be developed to describe specific actions that will be undertaken to contain the SRSNE-related COC plume above drinking water standards and risk-based levels in groundwater in the event that the Town of Southington provides written notification that it plans to resume water production at the Town Well Field Property. The SCAP will describe the processes to modify the design of the groundwater containment system, monitoring program, and treatment system to continue to contain the SRSNE-related COC-plume above water standards and risk-based levels.

The SCAP will be submitted within 30 days of USEPA approval of the Memorandum of Agreement (MOA) required by SOW Section V.B.3. The MOA is required to be submitted within 180 days after entry of the RD/RD Consent Decree. Based on the anticipated schedule for entry of the CD, the resultant timing will be such that the SCAP will be prepared prior to implementing the GCTEOS. Accordingly, any systems or processes, or modifications contemplated in the SCAP will be considered as part of the GCTEOS.

3.2 Severed Plume

The following procedures will be conducted to demonstrate compliance with the Performance Standards for the severed plume:

- Compare analytical results for groundwater samples collected from wells within the severed plume to the federal and state drinking water standards (MCLs and Class GA Groundwater Protection Criteria)
 - Compliance will be considered achieved when all of the monitored wells within the Site-related severed plume meet drinking water standards.
- Demonstrate that groundwater quality in the severed plume has not been adversely impacted by changes in Site conditions, decline in equipment performance, and/or moving the hydraulic containment system
 - Compliance will be considered achieved by the repeated confirmation that all of the monitored wells within the severed plume continue to meet drinking water standards in each 5-Year Review, regardless of any changes that may have occurred with respect to Site conditions, equipment performance, and/or modifications to the hydraulic containment system.
- In the event that the Town of Southington elects to re-initiate water-supply production from the Town Well Field Property, confirm that the risks in the severed plume beyond the supplemental containment system are within USEPA's risk management standard for carcinogens and non-carcinogens
 - If the town elects to re-initiate water-supply production at the Town Well Field Property, a Human Health Risk Assessment will to be conducted

to confirm that this Performance Standard is met. As required by the SOW, the risk assessment methodology will be described in the SCAP.

3.3 System Modifications

Two types of system modifications are contemplated. The first would be triggered if the Performance Standards for the HCTS or severed plume are not met, in which case modifications and/or enhancements to the HCTS will be proposed in future work plans, as necessary, to achieve compliance. Modifications or enhancements to the HCTS which increase effectiveness and/or decrease the costs or time of operation, while still achieving performance objectives, will be implemented as part of normal operation and maintenance activities. All system modifications will be discussed in Annual State of Compliance Reports or 5-Year Reviews required by Sections VIII.B and VIII.D of the SOW.

The second type of system modification relates to the areas being contained. The NTCRA 1 system, installed pursuant to the Administrative Order on Consent I-94-1045, was based on the need to prevent the migration of overburden groundwater from the highly impacted source-area soils in the Operations Area. The NTCRA 1 SOW contemplated operation of the NTCRA 1 system until achievement of ARARs, or until three months after the completion of construction of the final remedial action for groundwater at the Site, whichever comes first.

Accordingly, following the completion of post-ISTR stabilization of groundwater temperatures, an evaluation of the NTCRA 1 groundwater extraction system will be performed to determine when the operation of the NTCRA 1 groundwater extraction system can be discontinued and the NTCRA 1 extraction system decommissioned. This evaluation will consider the effects on the downgradient containment provided by RW-13, RW-14 and RW-1R, as well as necessary changes to the existing infrastructure (i.e., sheet-pile wall, etc.) if NTCRA 1 pumping were to be discontinued.

3.4 Completion of Groundwater Containment and Treatment

In accordance with Section VIII.E of the SOW, the SRSNE Site Group will submit a Demonstration of Hydraulic Containment and Treatment Completion Report demonstrating that there are no exceedances of federal

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and state drinking water standards and other risk-based levels including an evaluation of the impacts, if any, of discontinuing hydraulic containment on the Monitored Natural Attenuation Plan and quality of the surface water in the Quinnipiac River. The activities that will be taken to decommission the hydraulic containment and treatment system must also be addressed by this report.

4. Schedule

The GCTEOS will be performed (1) following stabilization of groundwater subsequent to ISTR, and (2) prior to the completion of the RD of the long-term groundwater containment, extraction and treatment system. It is expected that the GCTEOS will be completed and submitted for agency approval within a period of approximately 270 days following written notification that the in-situ thermal treatment and capping components of the remedy are complete.

5. References

- BBL. 1994. Non-Time-Critical Removal Action, 100% Ground-Water Containment and Treatment System Design Report. December 1994.
- BBL. 1995. Non-Time-Critical Removal Action No. 1: Demonstration of Compliance Plan. June 1995.
- BBL. 1996. Design and Study Work Plan: Non-Time-Critical Removal Action No. 2, Solvents Recovery Service of New England, Inc., Superfund Site, Southington, Connecticut. August 1996.
- BBL. 1997. NTCRA 2 Interim Technical Memorandum submitted to Ms. Sheila Eckman, United States Environmental Protection Agency. September 25, 1997.
- BBL. 1998. Remedial Investigation Report, Solvents Recovery Service of New England, Inc., Superfund Site, Southington, Connecticut. June 1998.
- BBL. 1998. NTCRA 2 Technical Memorandum, Solvents Recovery Service of New England, Inc., Superfund Site, Southington, Connecticut. November 1998.
- BBL. 1999. Final NTCRA 2 100% Design Report. November 1999.
- BBL and USEPA. 2005. Draft Feasibility Study, Solvents Recovery Service of New England, Inc., Southington, Connecticut. May 2005.
- BBL. 2005. SRSNE Site – Southington, Connecticut. Interim Monitoring and Sampling Report No. 14. June 27, 2005.
- Halliburton NUS (HNUS) Environmental Corporation. 1994. Final Remedial Investigation Report: Remedial Investigation/Feasibility Study. SRSNE Site, Southington, Connecticut. May 1994.
- USEPA. 2002. Elements of Effective Management of Operating P&T Systems. EPA 542-R-02-009.

USEPA. 2005. EPA Superfund Record of Decision: Solvents Recovery Service Of New England, Southington, CT. EPA/ROD/R01-05/008, EPA ID: CTD009717604. September 2005.

USEPA. 2008. A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems EPA 600/R-08/003. January 2008.

WESTON. 2007. RW-14 Completion Report, NTCRA 2 Supplemental Groundwater Recovery Well (RW-14). November 2007.