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September 18, 2015

Ms. Karen Lumino
Office of Site Remediation and Restoration
CT Superfund Section
USEPA Region 1
5 Post Office Square, Suite 100
Mailcode OSRR07-4
Boston, MA 02109

Subject: Solvents Recovery Service of New England Inc. Superfund Site
Southington, Connecticut
Revised In-Situ Thermal Remediation
Construction Completion Report

Dear Ms. Lumino:

Pursuant to paragraph 37 of the Consent Decree (CD) for the Remedial Design/Remedial Action at the Solvents Recovery Service of New England, Inc. Superfund Site entered on March 26, 2009 by the United States District Court for the District of Connecticut in connection with Civil Actions No. 3:08cv1509 (SRU) and No. 3:08cv1504 (WWE), and in accordance with Paragraph VI.H of the Statement of Work (SOW) attached to the CD as Appendix B, enclosed please find the revised Construction Completion Report for the In-Situ Thermal Remediation portion of the Remedial Action.

Responses to Agency comments are attached.

Please contact me if you have any questions.

Sincerely,

Bruce Thompson
Project Coordinator

Enclosures

cc: Shannon Pociu, CTDEEP
SRSNE Executive Committee

Responses to Comments Dated September 10, 2015 on
Draft In-Situ Thermal Remediation Construction Completion Report

Comments

1. Page 8, section 3.3. Include the Root Cause Memorandum regarding the oxidizer shut-down as an attachment and reference it in this section.

Response: The Root Cause Memorandum is now referenced and included as Attachment E to the Report.

2. Page 10, section 3.6. Add anticipated date (month, year) for delivery of compliance report #7.

Response: The anticipated report submission date has been added

3. Page 11, section 4 table.

a) include the heaters being reduced to 10% at the time the oxidizer was shut down, and when the oxidizer was brought back online, the heaters were ramped up from 10% to 100%.

b) 8/26/14 entry should specify that these repairs were made to the oxidizer

c) include dates for disassembly of the well field piping entry

d) delete groundwater monitoring entries that are not related to ISTR operation (e.g., 6/3/13, 7/12/13, 9/17/13)

Response: The requested edits have been made.

4. Page 12, section 5. Please add to this section a summary of the supporting rationale for the system shutdown as was contained in the shutdown memo. the discussion of partial vs full shut down is/could be confusing especially to those unfamiliar with the site.

Response: The requested summary has been added.

5. Page 13, section 5.3. Was the mass removal estimate based on the post-treatment mass estimate or the pre-treatment mass estimate? Please clarify.

Response: The requested clarification has been added.

6. Page 14, bottom two paragraphs. These two paragraphs are written in future tense and do not indicate whether any significant issues were tracked or non-

conformance reports issued during the course of the project, which should be included. Update as appropriate.

Response: The requested edits have been made.

7. Page 17, section 6.2, 3rd paragraph. a) indicate that an air monitoring station was moved to the police station yard and discuss (briefly) the results, and, b) it is our understanding that the source of the odors was narrowed down to the scrubber exhaust and the vapor extraction piping?

Response: The requested edits have been made.

8. Page 18, section 7.2. Update information regarding the revised soil investigation plan.

Response: The requested update has been incorporated.

9. Page 19. Shannon's phone number is 860-424-3546.

Response: The phone number has been corrected.

10. Appendix C is written in future tense but should reflect any changes that were made during operations. Revised as necessary.

Response: The appendix has been revised.

11. Not all the as-builts are in color, nor do they need to be. However, in some case it is integral to the understanding - i.e., the wellfield layout. Include color submittals as appropriate.

Response: Appropriate as-builts have been provided in color.

Responses to Additional EPA Comments Received on September 18, 2015

1. Section 8, contacts. Technically, the section I'm in is the "ME/VT/CT Superfund Section"

Response: This address has been corrected.

2. Last paragraph on page 4 – "PIPP" is not previously defined

Response: **"**PIPP" has been defined.

In-Situ Thermal Remediation
Construction Completion Report

Table of Contents

1. Introduction 1
2. Background 1
   2.1 Description of Site 1
   2.2 Summary of ROD Requirements and Performance Standards 2
   2.3 Remedial Design 3
   2.4 ROD Amendments, Differences, and Technical Impracticability Waivers 4
3. ISTR Construction and Operation Activities 5
   3.1 ISTR System Construction 5
   3.2 ISTR System Operation 7
   3.3 Problems and Deviations 7
   3.4 Off-Site Transport and Disposal 9
   3.5 ARAR Conformance Evaluation 10
   3.6 Cost Breakdown 10
4. Chronology of Events 10
5. Performance Standards and Construction Quality Control 12
   5.1 Sample Collection and Analysis 12
   5.2 Demonstration of Achievement of Performance Standards 12
   5.3 VOC Mass Removed and Mass Extraction Rates 13
   5.4 Construction Quality Assurance/Control 14
   5.5 Performance Data Quality 16
   5.6 USEPA Oversight 16
6. Final Inspection 18
   6.1 Results of pre-final and final RA inspections 18
   6.2 Adherence to H&S and Perimeter Air Monitoring 18
7. Future Activities and Schedule 19
   7.1 Operations and Maintenance Activities 19
   7.2 Post-ISTR Activities and Schedule 19
8. Contact Information 20
9. References 21

Figures

1 Site Location Map

Attachments

A Summary of Wellfield Boring Depths

B As-Built Drawings

C Detailed Description of ISTR Treatment System Components

D TerraTherm's Weekly ISTR Project Summary Reports

E Oxidizer Shutdown Root Cause Analysis Memorandum (9/18/14)

F April 2015 ISTR Demonstration of Attainment of Interim NAPL Cleanup Levels

G Manifest Summary and Copies of the Certificates of Disposal

H Monthly Progress and IQAT Reports for the ISTR Construction Period

I Weekly Meeting Agenda and Minutes for the ISTR Construction Period

1. Introduction

This document has been prepared on behalf of the Solvents Recovery Service of New England, Inc. (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 SRSNE Superfund Site located at 90 Lazy Lane in Southington, Connecticut (Site; Figure 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. The CD and the SOW define the response activities and deliverable obligations that the Group has to perform to implement RD/RA activities at the Site.

This Remedial Action Construction Completion Report summarizes the design, construction, and operation of the in-situ thermal remediation (ISTR) system at the SRSNE site. Consistent with the Record of Decision (ROD: United States Environmental Protection Agency [USEPA] 2005), the ISTR system was installed and operated to treat an area where non-aqueous phase liquid (NAPL) was present in the overburden material as a result of historical operations at the Site.

The remedial approach established for the site in the ROD included multiple components. The Remedial Design Work Plan (RDWP; ARCADIS 2010a) indicated that the design, implementation, and documentation of the various key components would each be addressed separately. As indicated above, this report is being submitted to the USEPA to document completion of the ISTR implementation component of the remedy. The content is intended to address the Completion Report requirements of Section VI.H of the Statement of Work (SOW), as well as applicable provisions of USEPA's May 2011 guidance titled "Closeout Procedures for National Priority List Sites."

2. Background

2.1 Description of Site

The SRSNE Site is located in the Town of Southington, Connecticut, in Hartford County, approximately 15 miles southwest of the City of Hartford. It is located on Lazy Lane, just off Route 10 (Queen Street), and adjacent to the Quinnipiac River. The SRSNE Site consists of the SRSNE Operations Area (4 acres), the Cianci property (10 acres), a railroad easement (the Railroad Right-of-Way), and those areas where groundwater contamination has come to be located, including Southington's Curtiss Street Well Field (the Town Well Field). The Town Well Field is a 28-acre parcel of undeveloped land containing two municipal drinking water wells that were closed in 1979 when they were found to be contaminated with volatile organic compounds (VOCs).

SRSNE performed spent solvent recycling operations at the Site from 1955 to 1976. After 1976, operations at SRSNE focused on blending the sludge and still bottoms with flammable liquid wastes for use as a waste-fuel product for rotary kilns. In 1988, the batch stills used in the distillation process were removed, and fuel blending became the primary enterprise of the facility until it closed in 1991.

The solvents and chemicals handled, stored and processed at the facility in the Operations Area included chlorinated solvents, ketones, alcohols, aromatic compounds and waste oils.

2.2 Summary of ROD Requirements and Performance Standards

The ROD for the SRSNE Site was issued by the USEPA on September 30, 2005. It identified several remedial components, including:

1. Removal of a culvert that drained from the SRSNE property to the Quinnipiac River and relocation/replacement of that culvert through a new impermeable pipe
2. In-situ thermal remediation of the overburden NAPL area
3. Excavation of specific areas of impacted soil and wetland soil from the Cianci property and consolidation of those materials in the former SRSNE Operations Area
4. Construction of a Resource Conservation and Recovery Act (RCRA) Subtitle C cap over contaminated soils in the SRSNE Operations Area and Railroad Right-of-Way
5. Construction and operation of a Hydraulic Containment and Treatment System (HCTS) to contain, extract, and treat affected groundwater
6. Monitored natural attenuation (MNA) of groundwater in the “severed plume” area
7. Implementation of institutional controls

Of these components, Item 1 was completed as part of the pre-ISTR site preparation activities, which were documented in the *Pre-ISTR Site Preparation Completion Report* (ARCADIS, 2013a). Item 2 was recently completed and is the subject of this completion report. Items 3 and 4 are planned future activities to be designed and implemented now that ISTR activities have been completed. Item 5 is ongoing as part of the continued operation of extraction wells and the existing groundwater treatment system. Item 6 is currently ongoing as part of the approved MNA program. Item 7 is being addressed via the Institutional Control Plan currently being developed among the SRSNE Site Group, USEPA, and CT DEEP.

Specific to the ISTR component of the remedy, the remedial action objective (RAO) established in the ROD for human health was to “reduce or stabilize contaminants in the NAPL area that would otherwise result in groundwater concentrations that pose a carcinogenic risk in excess of 10^{-4} to 10^{-6}, non-carcinogenic Hazard Index greater than 1, or that exceed ARARs [Applicable or Relevant and Appropriate

Requirements].” For protection of the environment, the RAO was to “reduce contaminants in the NAPL area to achieve one or more of the following:

- Shorten the time frame that groundwater standards are exceeded;
- Shrink the size of the groundwater contaminant plume;
- Reduce groundwater contaminant concentrations; and
- Prevent the migration of NAPL.”

In consideration of these RAOs, the Performance Standards established for the Overburden NAPL Area (i.e., the area to be treated using ISTR) were described in Section IV.A.4 of the SOW. That section states that “VOC contamination in the treatment zone will be reduced to levels that are not indicative of the presence of pooled or residual NAPL.” Further, it established Interim NAPL Cleanup Levels (INCLs), which are soil-based concentrations of selected constituents at or below which are no longer indicative of the presence of NAPL. The INCLs were established as follows:

Compound	Interim NAPL Cleanup Level mg/kg (parts per million)
Trichloroethylene (TCE)	222
Tetrachloroethylene (PCE)	46
1,1,1-Trichloroethane	221
Ethylbenzene	59
Toluene	48
p/m-Xylene	70
o-Xylene	42

Once sampling indicated that the INCLs were attained, Section IV.A.4 of the SOW included further provisions for USEPA to “evaluate whether to continue to operate the in-situ thermal treatment system in areas within the Overburden NAPL Area where [US]EPA determines that appreciable amounts of NAPL continue to be recovered. For this purpose, [US]EPA will only require continued operation of the of the in-situ thermal treatment where ‘appreciable recovery of NAPL contamination’ continues to occur.” It also capped the extent of continued operation at the maximum number of days required to achieve the INCLs (i.e., if it takes 180 days of heating to achieve the INCLs, the maximum amount of time that USEPA could require continued operation of any or all wells would be 180 days).

2.3 Remedial Design

The remedial design for the ISTR system was prepared by TerraTherm, Inc. the vendor selected by the SRSNE Site Group to implement the thermal component of the remedy. The conceptual design was submitted in April 2010. Comments on the

conceptual design were received in e-mails dated March 22, September 20, October 6 and October 8, 2010. Responses to those comments were provided on December 3, 2010. Further draft comments were received on February 18, 2011, discussed on a conference call on March 1, 2011, and finalized on March 2, 2011. Responses to these additional comments were provided on April 6, 2011. The draft 100% ISTR Design Report and Remedial Action Work Plan (100% Design) was submitted on July 10, 2013. Comments on the draft 100% Design were received on September 3, 30, and October 1, 2013. Responses to these comments were provided on October 25, 2013. A revised 100% Design was submitted on December 26, 2013. The USEPA approved the final design on April 18, 2014 and the final 100% Design was submitted by TerraTherm in May 2014.

The 100% Design (TerraTherm 2014) provided ISTR-related design and implementation details such as a description of the thermal technology, identification of the target treatment zone, basis of design information, the system monitoring program, detailed design drawings and specifications, a description of the operations approach, emergency response plan, and performance evaluation methods.

Additional implementation details were also described in the following documents that were developed and submitted over the course of the work:

- *Thermal Wellfield Implementation Support Plan* (TWISP; ARCADIS 2013b). This document provided additional details regarding the process to be used for thermal wellfield installation, the various project team roles and responsibilities, the anticipated waste management approach, and the perimeter air monitoring program to be used during installation of the thermal wellfield.

- ISTR Confirmatory Soil Sampling Plan – Revised (ARCADIS November 2014). This document provided additional details regarding the confirmatory soil sampling approach. It was based on the sampling approach described in Section 13.10.2 of the 100% Design, but provided additional details regarding the specific sample locations, depths, and collection methods used for the confirmatory soil sampling to demonstrate when the INCLs were achieved.

2.4 ROD Amendments, Differences, and Technical Impracticability Waivers

No amendments, differences or Technical Impracticability Waivers were requested or implemented during pre-ISTR site preparation construction work or during operation of the thermal in-situ remediation system.

3. ISTR Construction and Operation Activities

Development and construction of the remedial action was completed in several stages following entry of the CD in March 2009. Pre-ISTR site preparation activities were implemented between 2010 and 2012 and were summarized in the *Pre-ISTR Site Preparation Completion Report* (ARCADIS 2013). As described in that document, these activities were conducted to prepare the site for TerraTherm to construct and operate the ISTR system. The following subsections summarize the key elements associated with the construction and operation of the ISTR system. They also summarize key deviations from the initial system design expectations and provide reference to off-site disposal, compliance with Applicable or Relevant and Appropriate Requirements (ARARs), and cost-related details. A further chronology of the associated events is provided in Section 4, and Section 5 summarizes the monitoring activities that supported determination of the system shutdown.

3.1 ISTR System Construction

ISTR well field installation commenced on April 23, 2013 and was completed on September 24, 2013. The activities during this phase of work included installing the various heater wells, vapor extraction wells, monitoring wells, and subsurface monitoring points as necessary to implement the heating phase consistent with the 100% Design. As a result of sheen, staining, and/or NAPL observed at a few drilling locations outside the initially targeted thermal treatment zone, additional soil borings were performed to delineate the extent of overburden NAPL in those discrete areas. As a result of that investigation, eight additional heater wells were added southwest of the Thermal Treatment Zone (TTZ) and six additional heater wells were added along the eastern boundary of the TTZ.

During well field installation, it was noted that the depth to competent bedrock averaged approximately 3 feet deeper than expected. The expected depth to rock was based on historic knowledge, which included the prior NAPL delineation study and a limited number of monitoring wells in the Operations Area. The method used to determine “top of rock” was also different. During the NAPL delineation study conducted as part of the Feasibility Study, Geoprobe direct push drilling rigs were utilized, which met refusal at the interpreted top of weathered rock. The ISTR heaters were installed with rotasonic drilling, which does not easily differentiate weathered rock from the overlying till, so the drilling proceeded into the “competent rock” and the depths to top of weathered and competent rock are visually interpreted from the recovered core material. The approach used to assess the top of rock was described in the TWISP, and the interpreted top of rock was recorded for each of the heater well borings. Attachment A includes tables summarizing the various boring depths and interpreted depths to top-of-bedrock in the TTZ for the heater wells, groundwater monitoring wells, vapor extraction wells, and temperature/pressure monitoring points.

The greater-than anticipated depths to bedrock also triggered design revisions for the heater well network. Specifically, the lengths of certain heater wells were modified to account for the increased depth, and then the heater circuits were modified to balance the load associated with each circuit. The final well depths are recorded in the As-Built Drawings (Attachment B).

The following table summarizes the type and number of wells installed in the thermal wellfield:

Subsurface Item	Number Installed
Heater Wells	607
Vapor Extraction Wells (Vertical)	551
Vapor Extraction Wells (Horizontal)	290 lineal feet
Temperature Monitoring Points	99
Vacuum Monitoring Points	64
Groundwater Monitoring Wells	7

Once the well network was installed, a lightweight concrete cover was installed that encompassed the well network. The concrete mixture had high air entrainment to maximize its thermal insulating properties, and provided sufficient compressive strength to support the work to be performed atop the cover (e.g., operation of the drill rig to be used for confirmatory soil sampling). The cover was approximately 12 inches thick with a minimum R value of 0.12 W/m°K, and was constructed in a series of pours to mimic, to the extent practical, the surface grade of the TTZ. Installation of the ISTR cap commenced on September 30, 2013 and was completed on October 30, 2013.

Construction of the above ground portion of the ISTR system occurred after completion of the cap. Within the treatment zone, this included the vapor extraction well piping, manifolds, circuits, wiring and controls. Consistent with the 100% Design, the components of the treatment process were constructed on an equipment staging pad located east of the treatment area (Sheet C104 in Attachment B). These included the following major components:

- Heat exchanger
- Cooling tower(s)
- Moisture separator
- Vacuum blower
- Heat exchanger

- Chiller
- Moisture separator
- Duct heater
- Combustion blower
- Thermal oxidizer
- Scrubber

A summary description of each major component is presented in Attachment C. The various components are also shown on the as-built drawings provided in Attachment B. Shake down testing of the ISTR system components was completed in May 2014.

3.2 ISTR System Operation

Consistent with the 100% Design, heating of the TTZ was divided into two phases. The purpose of the phased heating was to reduce the peak VOC generation rate. Based on design-related modeling, the heating phases were separated by approximately 60 days, and the expected treatment duration was approximately 135 days per area (i.e., 195 days from the start of Phase I to the end of Phase II). Phase 1 heating commenced on May 15, 2014 and Phase 2 heating commenced on July 16, 2014. Heating of both phases was suspended on August 13, 2014 as a result of failure of part of the oxidizer used to treat VOC vapors. While heating was suspended, the heaters were reduced to "idle" (approximately 10% of capacity, necessary to protect them from rapid cooling). The oxidizer was repaired, and additional process monitoring implemented to help prevent a re-occurrence. Heating of Phase 1 at full power resumed on September 12, 2014, Phase 2 heating resumed on September 30, 2014.

System monitoring was performed in general accordance with the monitoring program described in the 100% Design, with additional monitoring as needed for diagnostic purposes or based on consultation with USEPA over the course of the work. Details regarding the operational status of the system were reported in weekly summary reports that were provided to the project team. Copies of those reports are provided in Attachment D.

Confirmation soil sampling and completion of treatment in Phases 1 and 2 is discussed in Section 5.2 of this report.

3.3 Problems and Deviations

As discussed in Section 3.1, modifications to the heater well lengths were made relative to the lengths indicated in the 100% Design. These modifications were made because, during wellfield installation, depths to bedrock were generally greater than had been anticipated based on data available at the time of the initial design. The final heater well depths, as well as the additional wells installed to the southwest and east of the originally targeted treatment zone (Section 3.1), are indicated on Sheet C-104 of the As-Built Drawings provided in Attachment B.

As indicated in the preceding section, an unexpected shutdown of the thermal oxidizer occurred in August 2014. Following a period of investigation, repairs, and system modification, the oxidizer was brought back on line in September 2014. A detailed memorandum summarizing the root cause of the oxidizer failure, as well as the subsequent system modifications and corrective actions, was submitted to the USEPA on September 18, 2014. A copy of that memorandum is included as Attachment E.

The As-Built Drawings represent the aboveground thermal treatment train as it was built and operated for approximately three months (May – August 2014), prior to the August 13, 2014 oxidizer shutdown. During the period that the oxidizer was being repaired, power to the heaters was minimized and vapors collected from the treatment zone were treated using granular activated carbon. Additional safety features and pre-treatment equipment was also installed during this period. The following are the major modifications that occurred:

- One additional flammability analyzer was installed at the influent to the heat exchanger upstream of the dilution blower;
- One additional thermocouple was installed at the influent to the oxidizer chamber;
- One organoclay vessel at the outlet of the oil-water separator to capture any free phase or emulsified organic material that may carry over (a third vessel was onsite but not installed);
- One liquid granular activated carbon vessel was installed at the end of the liquid process stream (just prior to discharge to the sewer) to facilitate changeouts to better manage higher loading rates; and
- During the cool down period, the oxidizer/scrubber were taken offline to mitigate potential odor concerns from the community and the backup vapor granular activated carbon vessels were brought online.

Other minor operational modifications from the 100% ISTR Design Document were made during the demonstration of compliance for Phase 2. These included adding insulation in one area of the site, and raising the elevation of the heaters in wells within that area. These changes are further discussed in the April 2015 ISTR Demonstration of Attainment of Interim NAPL Cleanup Levels document, a copy of which is provided in Attachment F.

3.4 Off-Site Transport and Disposal

Various wastes were generated in the course of the ISTR implementation and subject to off-site transport and disposal. Specific waste types, disposal method/facility, quantity, and shipping date ranges are summarized in the following table.

Waste Type	General Description	Disposal Facility	Disposal Method	Cumulative Amount Disposed	Unit	Shipping Start Date	Last Shipping Date
NAPL	Drummed NAPL recovered from ISTR system operations, including oil-water separator	Clean Harbors - Deer Park, TX	Incineration	105	55-gal drums	9/30/14	5/12/15
LGAC	Liquid phase granular activated carbon from the water treatment system	Clean Harbors - Deer Park, TX	Incineration	52	55-gal drums	1/13/15	6/25/15
Filter Clay	Spent organoclay used to filter effluent from the oil-water separator	Clean Harbors - El Dorado, AR	Incineration	50	55-gal drums	1/13/15	5/29/15
VGAC	Vapor phase granular activated carbon from the vapor treatment system	VEOLIA - Port Arthur, TX	Incineration	104,698	pounds	12/15/14	6/23/15
Original Hose and Piping	Original hose connections from the vapor extraction wells and spent fiberglass and steel pipe from the vapor collection system	USE Michigan	Micro-encapsulation	175	CY	4/29/15	7/13/15
Replacement Hose	Spent replacement hose from the vapor extraction wells (different manufacturer and characteristics than original hose)	VEOLIA - Port Arthur, TX	Incineration	4	CY box	6/23/15	7/13/15
Diesel Solvent	Spent solvent from ISTR equipment cleaning during demobilization	Clean Harbors - Deer Park, TX	Incineration	62	55-gal drums	6/25/15	6/25/15
Soil Cuttings	Miscellaneous soil cuttings generated in the course of the work	MDI, Michigan	stabilization and landfill	6	55-gal drums	6/23/15	6/23/15

Copies of the associated manifest details and certificates of disposal received thus far are included in Attachment G.

3.5 ARAR Conformance Evaluation

The ISTR activities were conducted in compliance with the ARARs identified in the ROD. As discussed in the 100% Design (TerraTherm 2014), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) exempts the need to obtain permits or implement administrative requirements under federal law (e.g., dredge and fill permits), state law (e.g., water discharge permits), and local law (e.g., building construction permits relative to fire prevention, electrical, and other code requirements). Notwithstanding the permit exemption, remedial action under CERCLA must comply with the substantive requirements of federal, state and local laws and regulations if they are identified as ARARs. Compliance with the substantive requirements of federal, state and local laws is also referred to as "permit equivalency." The requirements and manner of compliance for the applicable or relevant rules and regulations for ISTR were summarized in a table provided in Section 10.4 of the 100% Design.

3.6 Cost Breakdown

Section VI.H of the SOW and USEPA's 2011 "Closeout Procedures for National Priority List Sites" indicate completion reports are to include final, detailed cost breakdowns associated with the work. Detailed cost breakdowns are not included herein, but associated costs will be separately presented in the forthcoming *Annual State of Compliance Report #7* (anticipated submittal in March 2016).

4. Chronology of Events

Consistent with Exhibit 2-5 from USEPA's 2011 "Closeout Procedures for National Priority List Sites," this section summarizes the chronology of events related to the ISTR component of the Site remedy. More detailed descriptions of key components were presented in Section 3 above.

Activities Associated with Installation and Operation of the In-Situ Thermal Remediation System	Start Date	Completion Date
Regulatory and Design Submissions		
Record of Decision	9/30/2005	
Consent Decree lodged	10/30/2008	
Consent Decree entered by the court	3/26/2009	
Remedial Design Work Plan (RDWP) submitted	4/20/2009	
Pre-ISTR Preparation Plan (PIPP) approved	8/11/2009	
Conceptual Design/Remedial Action Work Plan submitted	4/10/2010	
Final Design/Remedial Action Work Plan submitted	7/10/2013	
Final Design/Remedial Action Work Plan approved	4/18/2014	
Pre-ISTR Site preparation activities	**9/20/2010**	**11/16/2012**

Activities Associated with Installation and Operation of the In-Situ Thermal Remediation System	Start Date	Completion Date
ISTR Construction		
TerraTherm mobilization and survey	4/15/2013	4/20/2013
Installation of heater wells, vapor extraction wells, temperature monitoring points, pressure monitoring points and groundwater monitoring wells.	4/23/2013	9/24/2013
Perimeter air monitoring	4/23/2013	4/1/2015
Investigation of seep and discovery/demolition of abandoned septic system	6/21/2013	6/26/2013
investigation of potential presence of NAPL on periphery of thermal treatment zone and installation of 2 additional heaters east of HO-530 and 4 east of HO-551	7/9/2013	7/11/2013
investigation of potential presence of NAPL on periphery of thermal treatment zone and installation of 8 additional heaters west of HO-47 through HO-50	7/31/2013	9/8/2013
Mobilization of Elastizell for installation of insulating cover	9/30/2013	10/30/2013
Initiate construction of ISTR treatment system	10/31/2013	
ISTR System Operation	5/15/2014	4/1/2015
ISTR system startup	5/15/2014	
Final commissioning of oxidizer	5/29/2014	
Install turbulators to increase efficiency of heat exchange for process air to oxidizer	6/6/2014	
Shut dilution air valve	6/20/2014	
Set Phase II heaters to idle	7/9/2014	
Open vapor valves for Phase II	7/16/2014	
Phase I progress sampling	7/28/2014	7/30/2014
Oxidizer damaged and shut down; reduce heaters to idle (10%)	8/13/2014	
Clay filtration unit put online between the oil water separator and the scrubber	8/25/2014	
Replacement of daisy wheel and damaged refractory in oxidizer	8/26/2014	
Oxidizer online, block valve open, & heaters set to 10% and ramped up over 2-week period (full power on 9/12/14)	8/29/2014	
Phase I confirmatory sampling	11/11/2014	11/19/2014
Phase I heaters shutdown	12/8/2014	
Phase II progress sampling	12/1/2014	12/8/2014
Phase II confirmatory sampling	1/5/2015	1/14/2015
Oxidizer taken offline and vapor routed to carbon	1/10/2015	
Select Phase II heaters raised and insulation added to select area	1/21/2015	
Phase II ISTR soil re-sampling	2/3/2015	
Re-sampling CSL-32	2/17/2015	
Approval to shut down remaining heaters	3/1/2015	
Remaining heaters ramped down	3/2/2015	3/6/2015
Vapor recovery shut down	4/1/2015	
Disassembly of the wellfield piping	4/2/2015	5/7/2015
Final Demobilization by TerraTherm		6/5/2015
Final Inspection of the ISTR work	7/13/2015	

5. Performance Standards and Construction Quality Control

5.1 Sample Collection and Analysis

Various ISTR operational parameters were monitored to assess operational performance and treatment progress. This included soil temperature, sub-surface vacuum levels, VOC mass extracted and extraction rate, vapor stream flammability, energy usage, and caustic usage. The associated data were summarized in weekly reports, copies of which are provided in Attachment D.

In addition to monitoring the ISTR operational performance, soil and groundwater sampling were also performed to assess the treatment progress. Groundwater samples were collected from seven monitoring wells (ISTR-1 through -7) located within the thermal treatment area. Samples were collected before heating commenced, and monthly during ISTR. Sampling included “progress” soil sampling performed by TerraTherm to confirm treatment progress and help assess when each treatment Phase was ready for the final confirmation sampling. The confirmation sampling in each area was performed in general accordance with the approach described in Section 13.10.2 of the 100% ISTR Design Document and the ISTR Confirmatory Soil Sampling Plan – Revised. In total, 60 confirmation soil samples were collected from 28 locations within the Phase I area, and 83 confirmation soil samples were collected from 32 locations within the Phase II area (including supplemental samples collected by TerraTherm after initial samples from certain areas did not achieve INCLs). As further discussed in the following section, these data were used to support shutdown in the Phase I and Phase II areas, and the associated data are included in the ISTR Demonstration of Attainment of Interim NAPL Cleanup Levels included as Attachment F.

5.2 Demonstration of Achievement of Performance Standards

Confirmation soil sampling was performed in each phase if the ISTR area once operational parameters and TerraTherm’s progress soil sampling events indicated that the Performance Standards were likely achieved in a given area. Confirmation soil sampling was performed in the Phase I area between November 11 and 19, 2014, and all of the associated samples indicated concentrations below INCLs. Those results and other relevant data were summarized in a report submitted to USEPA on December 1, 2014 titled “In-Situ Thermal Remediation - Phase 1 Confirmation Sampling Results and Recommended Operating Modifications.” On December 3, 2014, USEPA approved a partial shutdown of Phase 1 heaters as proposed in the report.

Confirmation soil sampling was initially performed in the Phase II area between January 5 and 14, 2015. Because certain samples from this area exceeded the INCLs, certain modifications were made (including extending certain heater lengths and adding surface insulation in certain areas for added heat retention) and additional heating was performed. The target area was resampled in February 2015, and samples collected on February 17, 2015 indicated that the INCLs had been achieved at all locations.

Having achieved INCLs at all final confirmation sampling locations, *de maximis* submitted a request for shutdown of the ISTR system on February 27, 2015. The request summarized not only the "progress" soil sampling results, confirmation soil sampling data, and groundwater analytical data, but other operational aspects of the ISTR system and groundwater monitoring data that provided supporting rationale. Pending discussion and comment, USEPA provided approval to shut down the ISTR system on March 1, 2015; shutdown of the heating system commenced on March 2, 2015. Based on comments received, *de maximis* provided a revised, final version of the shutdown request on April 6, 2015. In summary, the request for shutdown was premised on the following considerations:

- INCLs required by SOW Section IV.A.4 were met in all final confirmatory soil samples. On average, soil samples results were two orders of magnitude below INCLs.
- Calculations of mass removed suggest that ISTR resulted in 99.7% removal from soil, exceeding the ROD expectation of 95 to 99% removal.
- Soil temperatures within the ISTR treatment area met design goals, and exceeded the temperature where the target VOCs can exist as NAPL.
- Groundwater data from the thermal treatment zone indicated that VOC concentrations were below levels that are indicative of the presence of NAPL.
- The plot of Phase 2 VOC mass removal versus time had indicated that the rate of mass removal leveled off as of January 16, 2015, indicating the system operation had passed a point of diminishing returns.
- Mass removal rates had declined from a peak of ~10,000 pounds of VOCs per day to less than 26 pounds of VOCs per day.
- Given the dates at which final confirmation soil samples were collected relative to the date of system shutdown, the ISTR system had operated for a minimum of two weeks beyond the time at which INCLs had been achieved.

A copy of the shutdown request, which includes additional details regarding the associated monitoring data and rationale, is included in Attachment F.

5.3 VOC Mass Removed and Mass Extraction Rates

An evaluation of the performance data from the ISTR treatment period indicates that a total of 496,400 lbs of VOCs were removed from the TTZ, which totals 56,770 cubic yards. Mass removal estimates were determined using three different components and then summing those components together. The three components were as follows:

- Data recorded from the flammability analyzer (converted from percent to a mass using laboratory calculated BTU content – ASTM method);

- USEPA TO-15 analytical laboratory data for chlorinated compounds that are assumed not to be detected by the flammability analyzer; and

- Accumulated LNAPL (assuming a density of toluene).

The ROD anticipated that ISTR would remove 95% to 99% of the NAPL. The pre-ISTR soil VOC concentration was calculated by distributing the VOC mass removed over the mass of soil in the treated volume, resulting in an average pre-treatment concentration of 2,795 mg/kg. The post-ISTR VOC concentrations remaining in the thermal treatment area was based on the average concentrations detected in confirmatory soil samples of 7.445 mg/kg. Comparing these concentrations, we concluded that 99.73% of the VOCs present in the subsurface were removed from the TTZ during operation of the ISTR system. This exceeds the expectations outlined in the ROD.

5.4 Construction Quality Assurance/Control

In accordance with the SOW, *de maximis* functions as the Independent Quality Assurance Team (IQAT) contractor for the RD/RA work at the site. As stipulated in the SOW, the functions and responsibilities of the IQAT, with respect to design and construction include:

1. Review design criteria, plans, and specifications for clarity and completeness;
2. Train Construction Quality Assurance (CQA) inspection personnel on project QA requirements and procedures;
3. Schedule and coordinate CQA inspections;
4. Verify that the Quality Control (QC) plan for construction and remediation activities are implemented in accordance with the site-specific QA plans;
5. Perform independent on-site inspections of the Work as needed to assess compliance with the approved design criteria, plans and specifications; and
6. Report the results of all inspections, including findings that the Work is not acceptable quality or fails to meet the specified design requirements to the SRSNE Site Group, USEPA and CT DEEP.

The site work was performed in accordance with requirements of the site-specific approved CD/SOW deliverables (Deliverables). Prior to beginning site work the draft deliverables were reviewed in detail by the IQAT to identify any potential conflicts among the documents.

The IQAT participated in Technical Information Meeting(s), Pre-Construction Conference(s), Construction Progress Meeting(s) and Final Construction Inspection(s) during the course of work including the construction of the remediation action and report on observations and progress. The IQAT was on-site during pre-design studies, such as soil sampling, monitoring well installation and monitoring well sampling.

Clayton Smith of *de maximis* served as IQAT Manager as the primary contact for all IQAT functions during work at the Site and the primary IQAT contact with the Agencies, Project Coordinator, Remedial Design Contractors and Remedial Action Contractors.

During the construction and remedial action periods, the IQAT prepared a Monthly IQAT Report detailing IQAT observations of the prior month's site activities and providing forecasts of QA/QC activities expected for the next month. A copy of each Monthly IQAT Report was delivered to the Project Coordinator by the 5th of each month in order to be included in the Monthly Progress Report due to the Agencies by the 10th of each month. Copies of the Monthly Progress and IQAT Reports are included as Attachment H.

As written in the SOW, the role of IQAT includes providing written notification to the Project Coordinator and the RA Contractors' CQC Manager(s) of work found to be inconsistent with relevant work plan. Upon encountering work inconsistency, the IQAT would complete a Significant Issue Tracking Sheet and submit a copy to the Project Coordinator and the CQC Manager. The tracking sheets identify the significant issue of work which merits review; document the status of the corrective action and who has been notified. The purpose of the Significant Issue Tracking Sheet is to alert project stakeholders of a potential problem that may be corrected without involving changes to the approved project plans and to prevent the issue from reoccurring. Any corrective action requiring changes to the approved project requirements would be documented as a non-conformance.

Immediately upon identifying any material or workmanship that does not meet project requirements, and determined that any corrective action would involve changes to the approved project plans, the IQAT would prepare a Non-conformance Report. All Non-conformance Reports were to be submitted as soon as possible to the Project Coordinator for distribution to the SRSNE Site Group, Agencies, entity responsible for the non-conformance, Design Engineer and at a minimum the non-conformance would be discussed during the next Weekly Project Meeting. No corrective action activities would be initiated that require changes to the approved project plans without prior communication and approval of the non-conformance corrective action from the USEPA.

While the above-described procedures were in place for identifying inconsistencies and non-conformances over the course of the ISTR implementation, no such issues arose over the course of the project.

The IQAT completed a field Report for each day on-Site. The IQAT Field Reports included the name of the IQAT inspector, date, general weather conditions, summary of the days Health & Safety program, list of Contractors on-Site, brief summary of work performed by each Contractor and meetings attended by the IQAT. The IQAT Daily Field Report also included a Health & Safety summary for each day on-Site summarizing meetings conducted, air quality monitoring conducted and if there were any health and safety incidents reported.

As identified in the Site Specific Health & Safety Plan, every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer. One health and safety incident occurred during the

ISTR implementation activities. On December 8, the drilling helper for Aquifer Drilling and Testing was mounting the core barrel on the rig to push out the samples for collection during the Phase 2 confirmatory soil sampling event. Simultaneously the operator was moving the rig to have the mast footing cover the sample hole. The footing came down on the top of the helper's foot. This incident was caused by a miscommunication of set-up practice which was established the previous drilling day with a different helper. Following the incident, the preventative measure adopted was ensuring that the area is clear before moving/lowering the rig.

5.5 Performance Data Quality

A Quality Assurance Project Plan (QAPP) was developed during the design of the treatment system and was included as Attachment C of the RD POP (ARCADIS 2010b). The QAPP was designed to address the requirements of Section V.C.2.c of the SOW and as intended to address the sampling and analytical methods to be employed during remedial design, construction, and system operation. Aspects of the CT DEEP Reasonable Confidence Protocol (RCP) were incorporated into the QAPP including reporting limit and data quality indicator control limits.

The data quality objectives (DQOs) are identified and discussed in Worksheet #10 of the QAPP. Worksheet #10, presents the individual goals for each aspect of the remediation program and discusses the analytic approach. According to the worksheet, the usability of the data is based upon the results of the validation. The data is considered suitable for use in making decisions if 90% of the data points are not rejected or deemed unsuitable. Performance and acceptance criteria are specified in the SOW along with sampling procedures for chain of custody, laboratory analytical and sampling protocols.

During the course of preparation and implementation of the remediation at the Site, analytical data was handled with the intent of meeting the DQOs. *de maximis* Data Management Solutions, Inc. (ddms) was contracted to manage, verify, and validate laboratory data in order to ensure that the data was suitable to meet the DQO's. ddms imported laboratory data from the laboratory contractors. As part of the data import process, ddms verified data formatting and valid values remained consistent and electronic data matched hard copy analytical reports. ddms then added the soil sample locations to the site database/GIS. ddms performed 3rd party validation on analytical data from the confirmatory soil sampling events that were completed prior to shutdown of each Phase of the ISTR system.

5.6 USEPA Oversight

USEPA and CT DEEP were provided with all draft documents associated with the planning, operation, and demobilization of the ISTR system for review and comment. Comments received from regulators were addressed and incorporated into these documents as necessary. Following revision, USEPA and CT DEEP were provided with updated copies of the documents for approval or further comment if necessary. Final

approved documents were incorporated into the record and used as standards for that stage of the process as well as for guidance for IQAT oversight. Final shutdown of the ISTR system was also approved by USEPA upon satisfactory achievement of the target soil data identified in the SOW.

In addition to submission of all documentation to regulatory agencies, weekly progress meetings were held during construction and operation of the ISTR remedy. The weekly meetings occurred via teleconference and included representatives of USEPA, CT DEEP, *de maximis*, ARCADIS, and TerraTherm. The weekly calls were intended to provide a weekly update of the progress of the remediation to USEPA as required in the ROD. During the calls, USEPA was provided the current status of the remedy and were able to provide guidance or request additional information when needed. The meetings were held weekly until final shutdown of the ISTR system, then monthly during demobilization until the final inspection. Copies of the agenda and minutes from the weekly meetings are provided in Attachment I.

In addition to weekly progress calls, TerraTherm generated weekly reports summarizing the operational and monitoring information associated with the ISTR system. These reports were provided for review and comment by the USEPA and CT DEEP. Copies of the weekly ISTR summary reports are provided in Attachment D.

6. Final Inspection

6.1 Results of pre-final and final RA inspections

The final USEPA inspection for the ISTR phase of work was held on-site on July 13, 2015. Representatives of USEPA, CT DEEP, and *de maximis* attended the meeting. USEPA inspected the condition of the TTZ and general Site condition in order to insure that no environmental concerns remained following demobilization. The Site was concluded to be in acceptable condition and no follow-up punch list items were noted.

6.2 Adherence to H&S and Perimeter Air Monitoring

Prior to commencement of the on-site activities, a health and safety plan (HASP) was completed for each stage of the project (PIPP construction, ISTR system construction, system operation). These HASPs were provided to USEPA for review and approval as part of the PIPP Plan, Project Operations Plan, and Remedial Action Work Plan. Each HASP provided a detailed description of the expected hazards present on the Site, appropriate personal protective equipment and tools, and procedures to follow to avoid incidents. Each HASP also provided a sequence of events to be followed in the event of an incident to minimize the injury. All staff and contractors were required to review the HASPs and sign the acknowledgement page to ensure that they understood the contents of the HASP and agreed to follow the plan.

The HASPs were strictly adhered to by all on-site personnel and daily health and safety meetings were held prior to initiation of work on every field day. IQAT personnel provided general oversight to ensure that all on-site personnel were performing their duties within the scope of the HASP.

Perimeter air monitoring was performed in accordance with the monitoring plan described in the TWISP. No exceedances of action levels occurred through the course of construction and operation that could not be clearly attributed to equipment exhaust or other innocuous sources. Complaints of objectionable odors were made by the Southington Police Department (SPD) starting in December 2014. The SPD headquarters is located approximately 700 feet north of the ISTR treatment area. Beginning in December 2014, one of the perimeter air monitoring locations was moved onto the police station property in an effort to further investigate the potential for site-related air quality impacts in that area. This monitoring station did not detect VOCs at the new location, nor were VOCs detected in a TO-15 air sample collected from the thermal oxidizer discharge on January 5, 2015. In addition, the CT DEEP deployed an inspector from the Air Bureau on January 12, 2015 to investigate the complaints. The inspector did not note any unusual or unexpected odors that would trigger the need for further action by the Bureau. The source of the odors was not conclusively determined. In reaction to the complaints, the thermal oxidizer was taken offline on January 10, 2015. After January 10, 2015, extracted vapors were treated using vapor-phase granular activated carbon.

7. Future Activities and Schedule

7.1 Operations and Maintenance Activities

Section VI.H of the SOW requires that Construction Completion Reports summarize the O&M activities associated with the subject component of the remedy. Specific to the ISTR component of the remedy discussed herein, the system components have been shut off and demobilized from the site such that there are no continuing ISTR-related operation or maintenance activities. Notwithstanding the completion of work, the following short-term maintenance activities are anticipated within the ISTR-treatment area until such time that the next phase of the remedial approach (i.e., excavation of Cianci Property soil areas and construction of the RCRA cap) is initiated:

- Periodic inspections of the re-vegetated areas (e.g., material staging and support areas) until such time that sufficient growth is established.
- Periodic inspections of re-vegetated areas and site drainage pathways to ensure that excessive erosion and/or sedimentation are not occurring.
- Maintenance of erosion and sedimentation controls until vegetative growth is sufficiently established.
- Placement of additional controls as needed to prevent erosion of site soils in areas such as drip lines adjacent to the ISTR surface cover, perimeter drainage swales, access roads, etc.

7.2 Post-ISTR Activities and Schedule

Having completed the ISTR component of the remedy, the SRSNE Site Group will continue implementing ongoing and remaining components of the approved remedial approach. Specific to the ISTR area, this includes implementing the additional investigation and delineation sampling proposed in the Soil Investigation Plan (Attachment I to the RDWP) and as modified in a memorandum dated August 24, 2015 (with CT DEEP concurrence provided that same date). It also includes conducting the Vapor Control System Evaluation (Attachment J to the RDWP). These items will support the subsequent design and implementation of the remedial activities associated with remediation of the Cianci property soil areas and construction of the RCRA C cap in the former SRSNE Operations Area. It is anticipated that the design activities will be performed in the winter of 2015-16, and that construction activities will be performed during the 2016 field season.

8. Contact Information

Project contact information, consistent with Exhibit 2-5 of USEPA's 2011 "Close Out Procedures for National Priorities List Sites," is summarized below.

Firm/Agency	Role	Name	Position/Title	Address/Telephone
USEPA	Federal Regulatory Agency	Karen Lumino	Remedial Project Manager	USEPA Region 1 ME/VT/CT Superfund Section 5 Post Office Square Suite 100 Mail Code OSRR07-4 Boston, MA 02109 617-918-1348
CT DEEP	State Regulatory Agency	Shannon Pociu	Project Manager	CT DEEP Bureau of Water Protection and Land Reuse 79 Elm Street Hartford, CT 06106 860-424-3546
SRSNE Group	PRP	Robert Kirsch, Esq.	Co-Chair of Executive Committee	Wilmer Hale 60 State Street Boston, MA 02109 617-526-6779
de maximis, inc.	Supervising Contractor	Bruce Thompson	Project Coordinator	200 Day Hill Road Suite 200 Windsor, CT 06095 860-298-0541
TerraTherm, Inc.	In-Situ Remediation Contractor	Robin Swift	Project Manager	151 Suffolk Lane Gardner, MA 01440 978-730-1200
ARCADIS	Remedial Design Contractor	Jeff Holden	Project Manager	160 Chapel Road Suite 201 Manchester, CT 06042 860-645-1084

9. References

ARCADIS. 2010a. Remedial Design Work Plan (RDWP).

ARCADIS. 2010b. Quality Assurance Project Plan (QAPP) (Attachment C to the Remedial Design Project Operations Plan).

ARCADIS. 2013a. Pre-ISTR Site Preparation Completion Report.

ARCADIS. 2013b. Thermal Wellfield Implementation Support Plan (TWISP).

ARCADIS. 2014. ISTR Confirmatory Soil Sampling Plan – Revised. November 7, 2014.

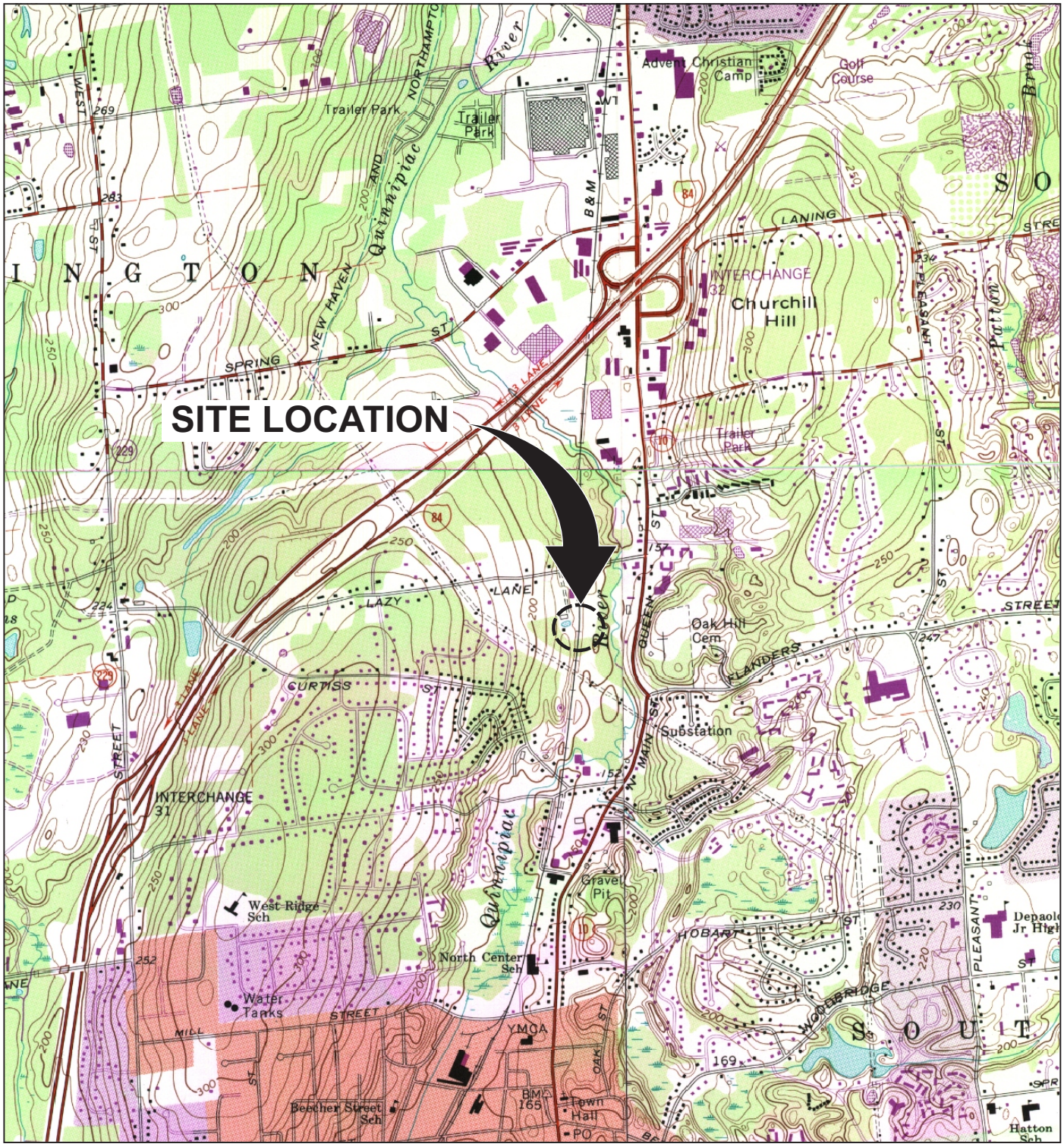
de maximis, inc., 2015. ISTR Demonstration of Attainment of Interim NAPL Cleanup Levels, April 6, 2015

TerraTherm. 2014. In-Situ Thermal Remediation Remedial Action Work Plan and Project Operations Plan (100% Design).

United States Environmental Protection Agency (USEPA). 2005. Record of Decision (ROD).

USEPA. May 2011. Closeout Procedures for National Priority List Sites.

FIGURES



REFERENCE: SOUTHINGTON, CONN. USGS QUAD. 1968 PR 1992, MERIDEN, CONN. USGS QUAD. 1966 PR 1984, NEW BRITAIN, CONN. USGS QUAD. 1966 PR 1984, & BRISTOL, CONN. USGS QUAD 1967 PR 1984.

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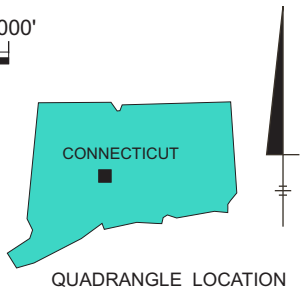

QUADRANGLE LOCATION

SRSNE SUPERFUND SITE
SOUTHINGTON, CONNECTICUT
ISTR COMPLETION REPORT

SITE LOCATION MAP

ARCADIS

FIGURE
1

01/21/2013 SYRACUSE, NY-ENV/CAD DJHOWES
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