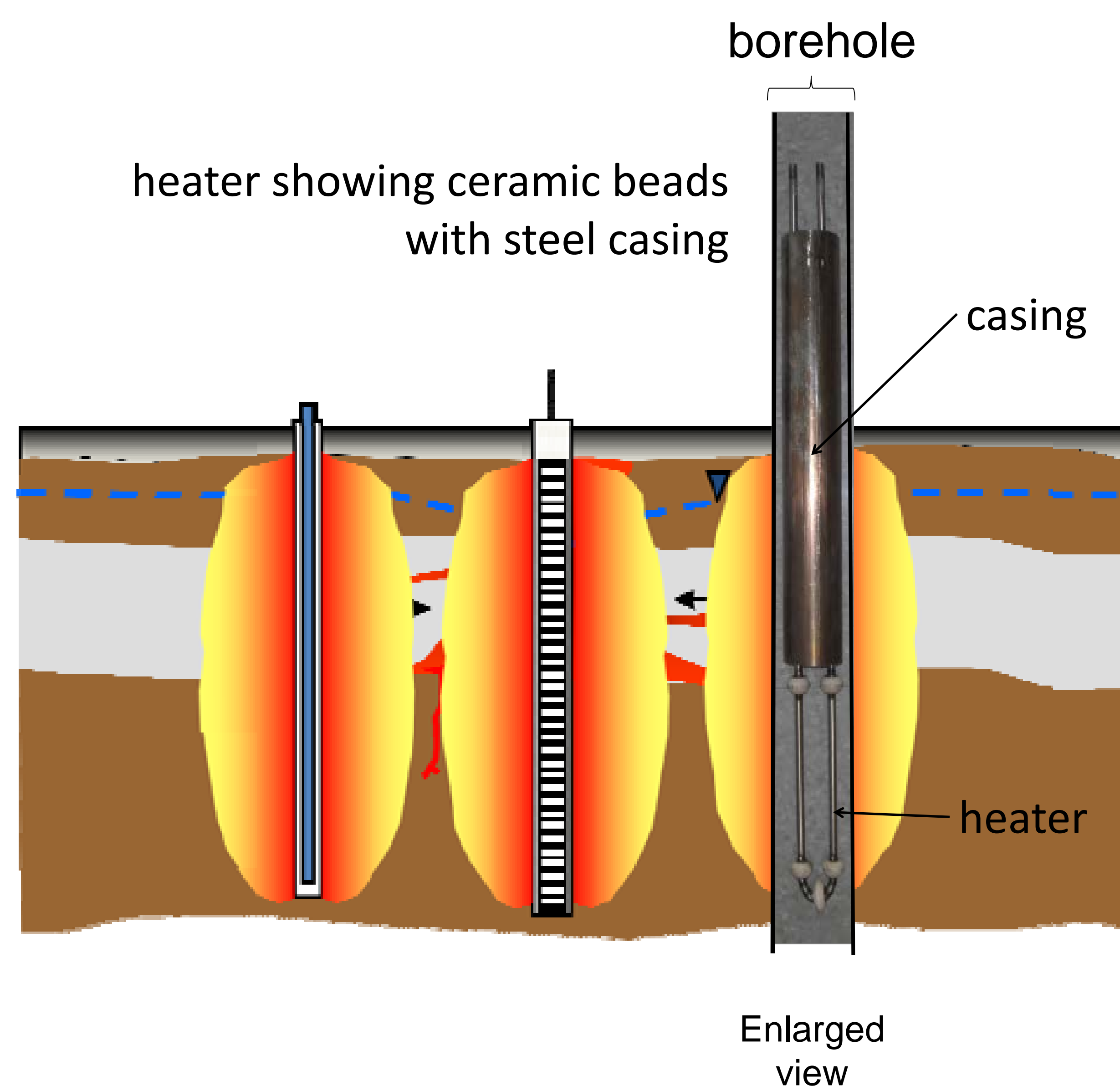


Solvents Recovery Services of New England (SRSNE) Superfund Site

Robin Swift, Kevin Crowder, Jim Galligan, Willey Leung, Gorm Heron

What is In Situ Thermal Remediation?

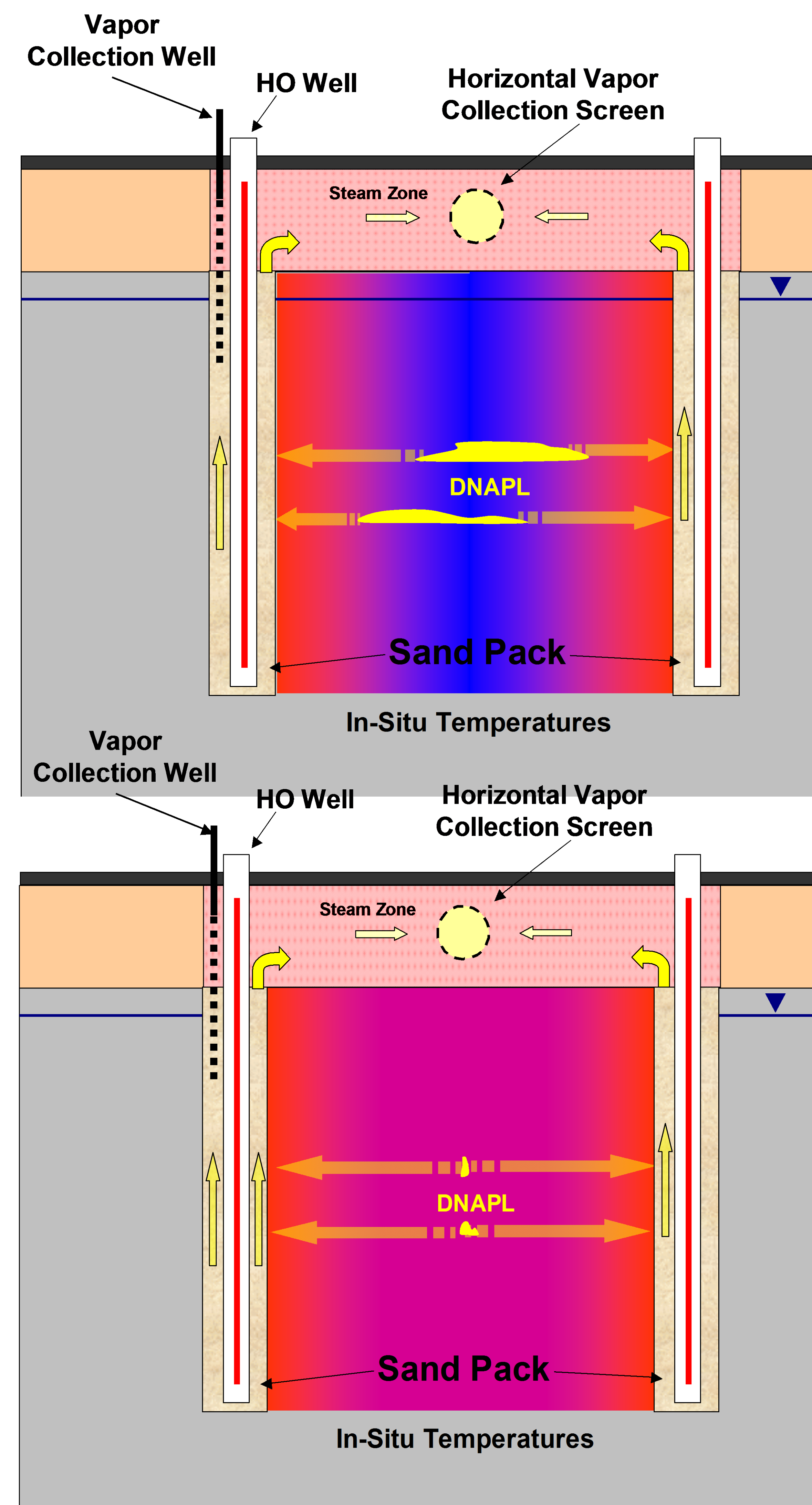
...it's a remediation technique where electric heaters are placed inside steel wells to generate heat, which then heats the soil by thermal conduction. A vacuum is applied to the heated soil to remove vaporized constituents for above ground treatment.



Vertical heaters are used to heat contaminated soil and water to ~212 °F (boiling) and create a temperature gradient.

The heat/energy moves away from the heaters through thermal conduction.

How does it Work?



A vacuum is applied to vapor extraction wells to collect vaporized constituents for aboveground treatment.

As soil temperatures rise, volatile contaminants in soil and water are vaporized.

DNAPL = dense non aqueous phase liquid

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Brownfield Site in Syracuse, NY. Former manufacturing site contaminated with chlorinated compounds. Now a Lowes home improvement center.



Other Similar TerraTherm Sites

Taunton, MA. Former drum disposal area contaminated with chlorobenzenes, BTEX, and chlorinated compounds.



Teterboro, NJ. Three acre former manufacturing site contaminated with approximately 30,000 lbs. of chlorinated compounds.

2006

2007

2008

2009

2010

2011

2012

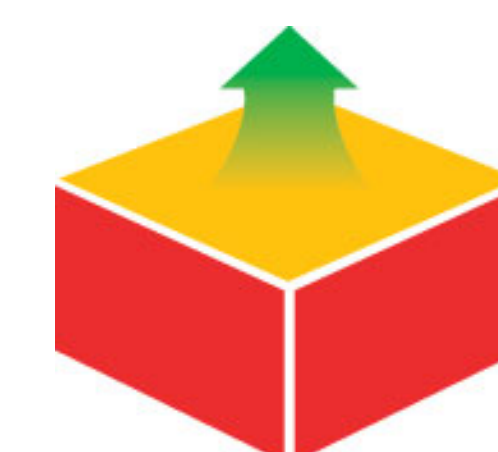
2013



Confidential Site, FL. Successful removal of 4,000 lbs of chlorinated compounds.



Former military storage facility in Memphis, TN contaminated with chlorinated compounds. Successful removal of 12,500 lbs of mass (over 99.99% removal). Recipient of the 2009 Secretary of Defense Environmental Award.



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North Haven, CT – Pilot Study. Successful removal of 25,000 lbs of chlorinated and other organic compounds. Full scale remedy currently in design.



Ground Water
Monitoring & Remediation
Summer 2009

Thermal Treatment of Eight
CVOC Source Zones/ 56

A 14-Year MNA Field Study
of MGP Tar MAHs and PAHs
in Groundwater/ 66

Mitigating Bias from Non-
Dissolved Petroleum in
Groundwater Samples/ 77

MNA Remedy for Arsenic
Mobilized by Anthropogenic
Inputs of Organic Carbon/ 84

Characteristics of Pore Water
Where Ethanol is Spilled onto
Pre-existing NAPL/ 93

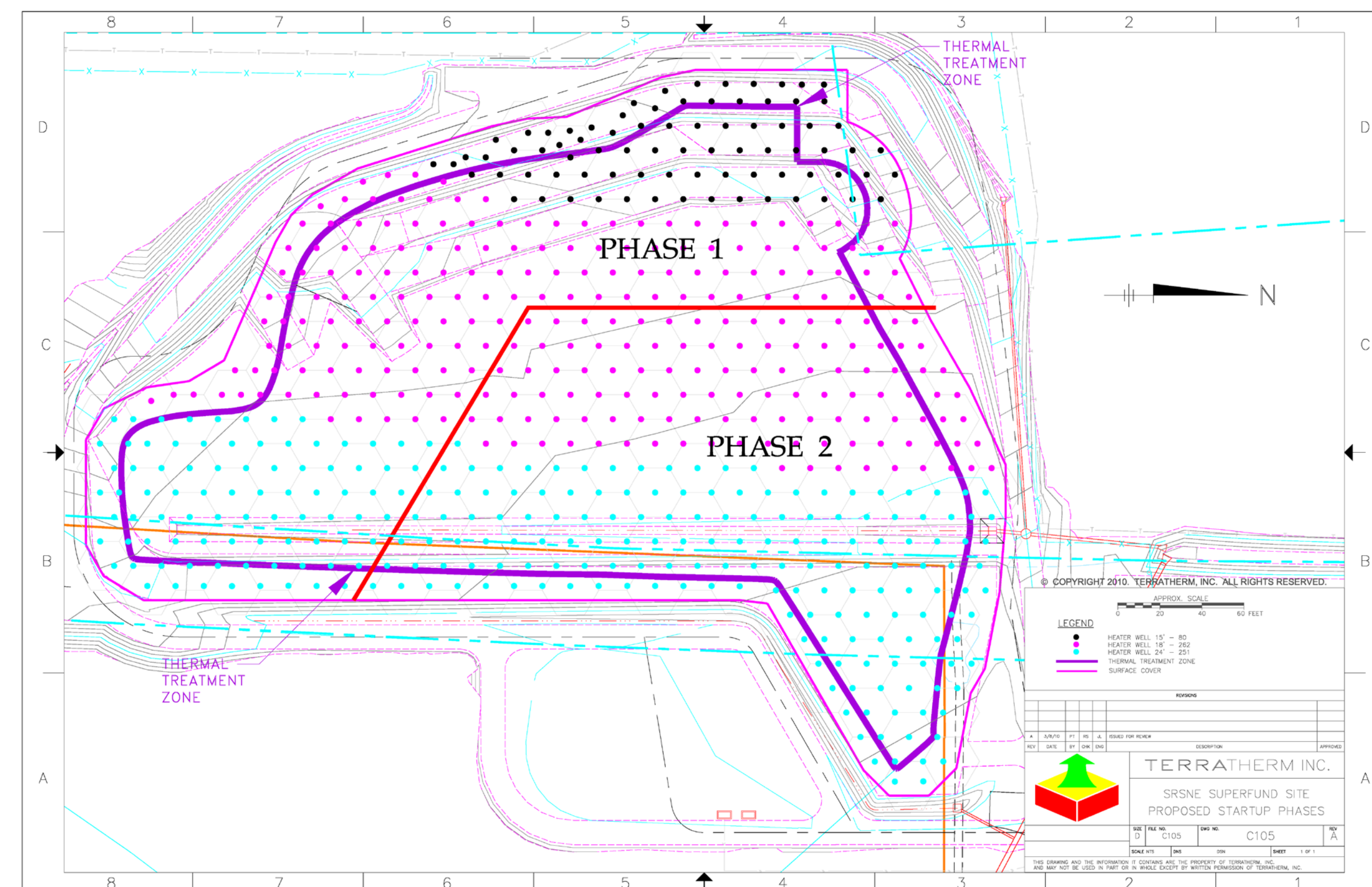
Multiple Transport
Hypotheses in a
Heterogeneous Glacial
Aquifer System/ 105



Solvents Recovery Services of New England (SRSNE) Superfund Site

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What is planned for SRSNE?



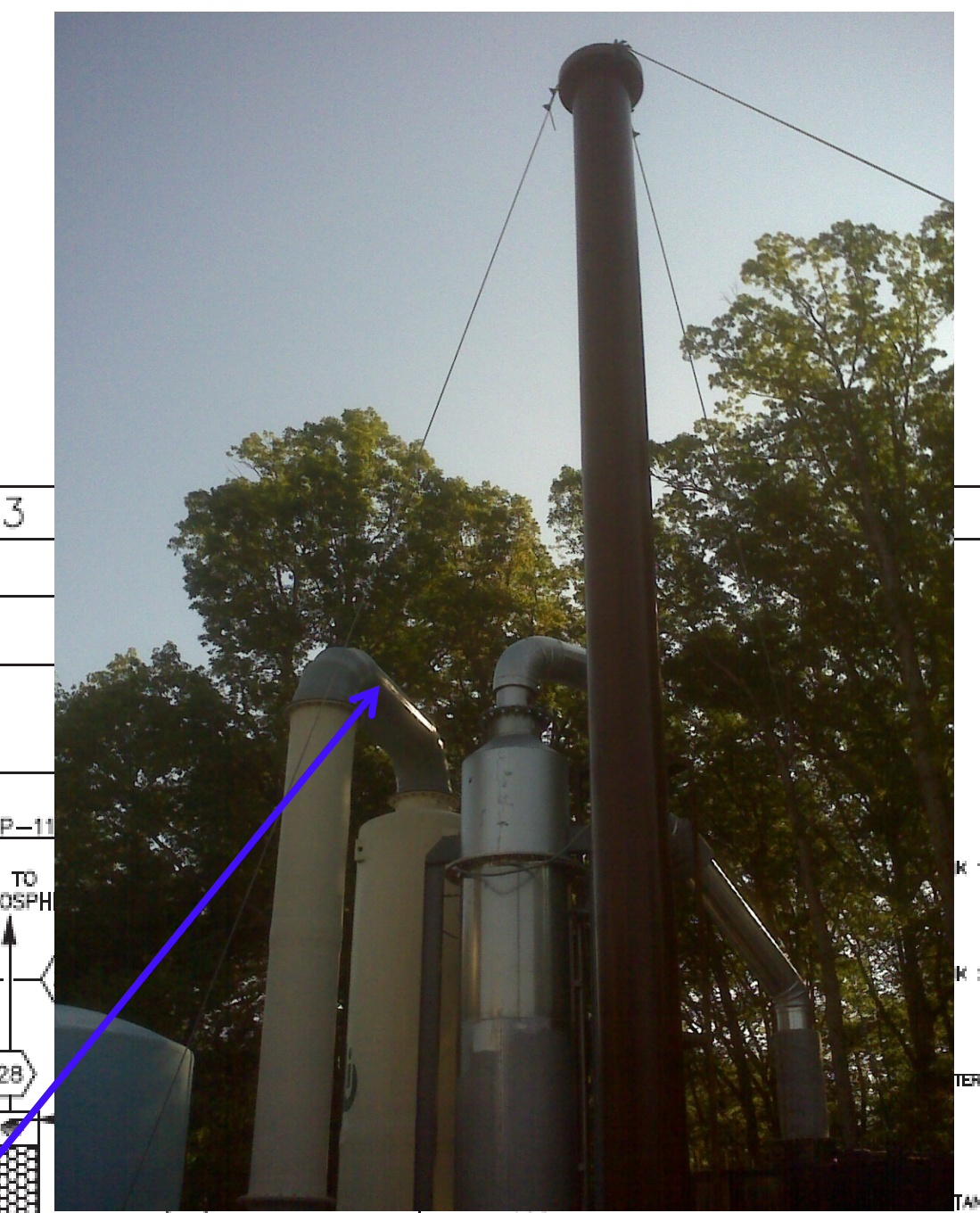
- The thermal treatment area is approximately 58,000 cubic yards
- Treatment depths range between 12 ft bgs (west) to 29 ft bgs (east)
- Operate in two overlapping phases
- Each phase is not expected to exceed 135 days
- Total duration is estimated to be 195 days, but may operate longer at EPA's discretion, provided NAPL continues to be removed
- Approximately 600 heater wells; 500 vertical vapor extraction wells; 260 linear feet of horizontal vapor wells; 98 temperature monitor wells; and 64 pressure temperature monitor wells; 7 groundwater wells
- Target thermal temperature is 212 °F
- Approx. 13.8 million kWh of power
- Vapor flowrate: up to 4,000 scfm



cooling tower



thermal oxidizer



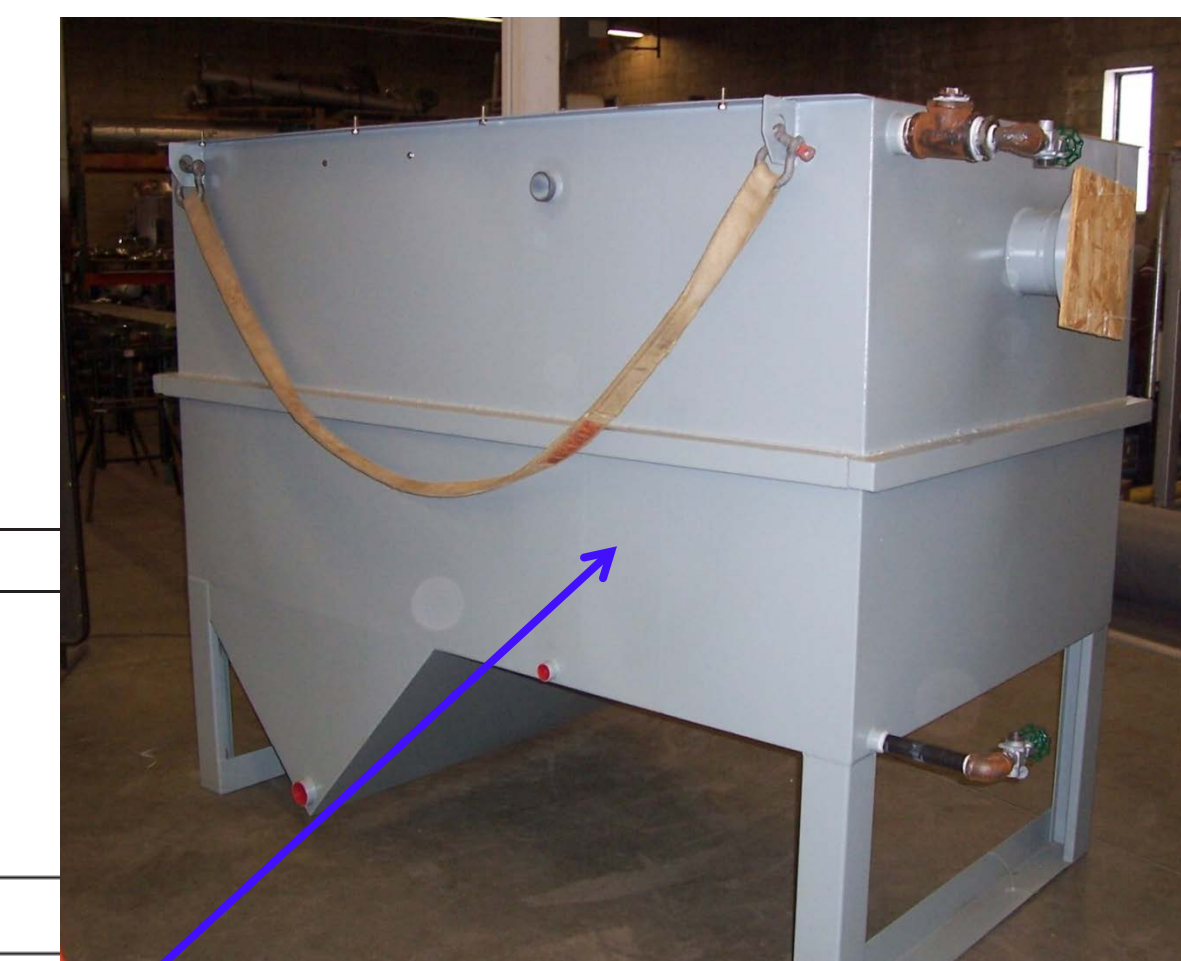
carbon vessels



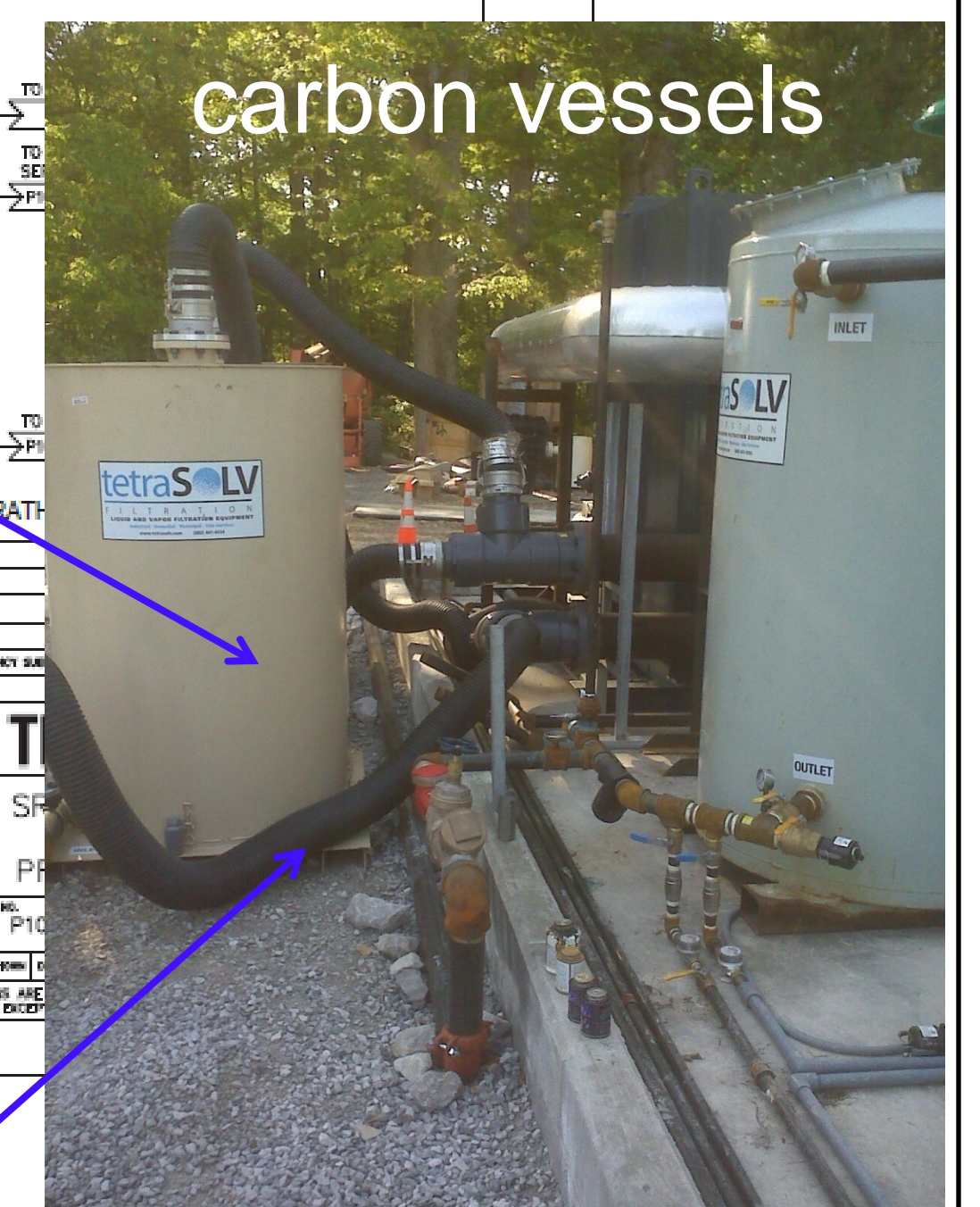
heat exchanger



moisture separator



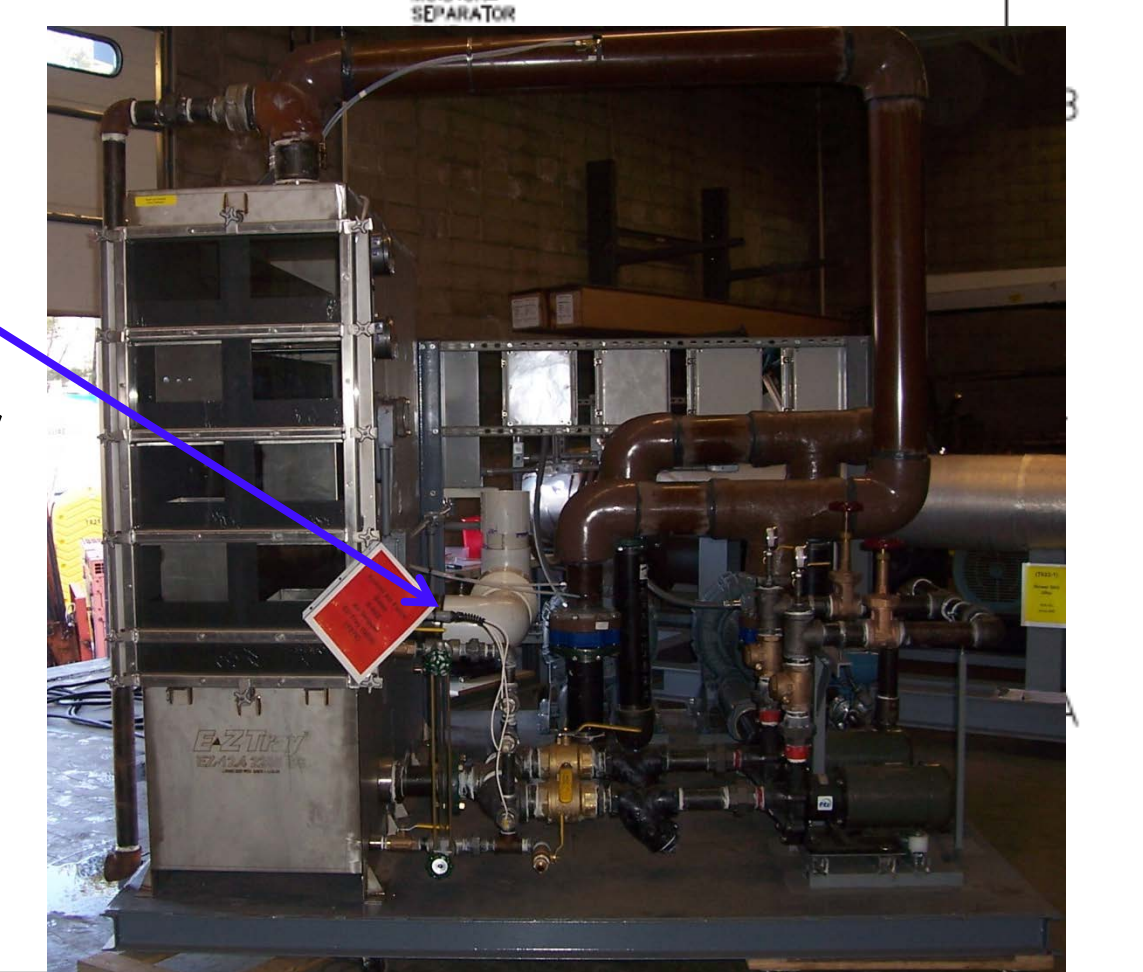
oil/water separator



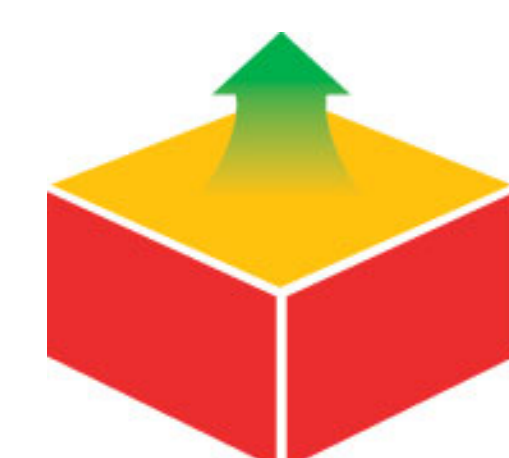
bag filter



air stripper



Equipment not specific to SRS



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Think Thermal

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Think Thermal...Think Safety

TerraTherm has maintained an active program promoting Health & Safety, with:

- EMR below industry average
- Logged an unprecedented 12 out of our total 13 years in business without a lost time injury



Typical personal protective equipment



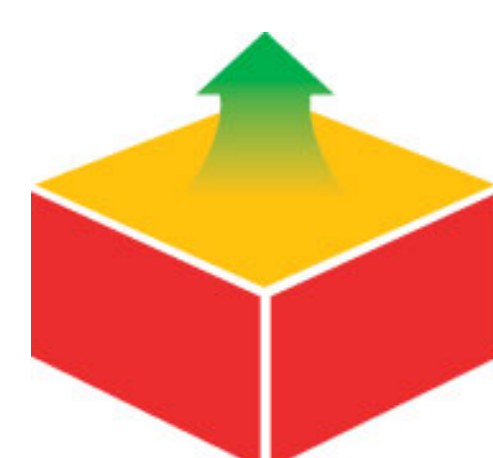
Typical signage and security fence

Our systems include the following safety features:

- Electrical equipment is bonded and grounded; touching equipment does not result in electrical shock.
- Heated pipes and surfaces are insulated and protected; touching them does not result in burns.
- Sites are fenced, with caution signs to alert passers-by not to enter. Operators are on-site daily and on-call at night and on weekends (within 30 minute commute); alarms will automatically notify the operator in the event of a condition that requires attention. Operators will mobilize to the site to correct it immediately.
- Redundant back-up systems are provided, including an emergency generator that turns on automatically in the event of a loss of grid power, so that the off-gas treatment equipment can continue to operate continuously.

The system at SRSNE will include the above, plus:

- Ambient air monitoring at the fence line for immediate notification of increased volatile organic compound concentrations. (TerraTherm has not had an exceedance of ambient air monitoring criteria at any of its sites.)
- Monitoring of the air emissions from the off-gas treatment system.
- Monitoring of the process parameters of the ISTR equipment.
- The off-gas treatment system will be subject to the CTDEP air permitting process which includes monitoring and reporting schedules. (TerraTherm has successfully complied with all air permitting requirements at all of its sites.)
- Display of daily monitoring data on a website accessible to regulators and the community.



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Why the visible vapor plume?

Think boiling tea kettle



The visible vapor plume is condensing water vapor (steam).

The steam is most visible on cool mornings or evenings or during the day in the winter.

