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Guaranteed Remediation Certainty
Our Word Is Who We Are

<u>Project Example</u> – Guaranteed Fixed Price Remediation of Trichloroethene using Electrical Resistance Heating at the Pemaco Superfund Site, Maywood, CA

*This project involves a **guaranteed fixed price remediation** of trichloroethene **(TCE)** to **a depth of 95 feet below ground surface.** This is the first EPA Superfund Site in CA that identified ERH as the preferred technology in the Record of Decision.*

Client Reference: Mr. Tim Garvey, project manager, TN & Associates, Ventura, CA 93001, (805) 585-6386.
Engineer: Mr. Greg Beyke, TRS, Vice President of Engineering, Franklin, TN 99353, (615) 791-5772, gbeyke@thermalrs.com.
Project Superintendent: Mr. Tom Powell, TRS, Operations Manager, Vancouver, WA 98665, (360) 693-6301, tpowell@thermalrs.com.
Lithology: Clay and silt in the vadose and saturated zones.
Hydrology: Groundwater depth at 60 ft bgs.
Treatment Area, Depth Interval, and Volume: 13,200 square feet, 35 - 95 ft bgs, approximately 30,000 cubic yards.
Site Constraints: ERH remediation of TCE DNAPL to 95 ft bgs.
Beginning Contaminant Concentrations: 27,000 µg/l of TCE in groundwater.
Cleanup Goal: Federal MCL or 5 µg/l for TCE in groundwater.
Project Status: TRS has prepared an 80% design package for the ERH system and the design package has been reviewed. Installation and operations are planned in late 2006 through early 2007. Estimated project completion in late 2007.
Total TRS Price: $1,979,670.00 or ~$67.00 a cubic yard.
Contract Terms: Guaranteed Fixed Price Remediation (GFPR).

<u>Problems Encountered and Corrective Actions:</u>

TRS design engineers worked with the City of Maywood to revise our ERH remedial design based on design changes made to the Maywood Riverfront Park. The Park was built on the properties surrounding the Pemaco Superfund site. Once the ERH remediation is complete, the Park will be expanded to cover the area remediated by ERH.

TRS was involved with EPA and TN & Associates at numerous presentations to local citizen action groups to explain the ERH technology and process of remediating the Pemaco Superfund site TCE source area, including vapor treatment using thermal oxidation.

In order to ensure sufficient heating of the portion of the Site that abuts the L.A. River Basin, underlying the concrete riverbank, TRS designed electrodes that will be installed

using angled drilling techniques. Final depths for the electrodes, wells and TMPs will be as described in the 100% design specifications.

Prior to drilling with a rig, all boreholes will be hand augered to a depth of four feet bgs to confirm the absence of utilities. Borings for electrodes and wells will then be advanced using a hollow stem auger drill rig.

Background

Thermal Remediation Services, Inc. (TRS) as a subcontractor to TN & Associates, is providing Electrical Resistance Heating (ERH) design, construction, operations, and specialty equipment for remediation of trichloroethene (TCE) DNAPL in soil and groundwater at the Pemaco Superfund site located in Maywood, California (the Site). This is the first Record of Decision in California written by EPA that identifies ERH as the preferred technology for the remediation of the deep TCE DNAPL source area at the Site.

The Pemaco Superfund Site is comprised of 1.4 acres located in a mixed industrial and residential neighborhood in Maywood, Los Angeles County, California. A wide variety of chemicals were used previously onsite including chlorinated and aromatic solvents, flammable liquids, oils and specialty chemicals. These chemicals were stored in drums, aboveground storage tanks (ASTs) and underground storage tanks (USTs). After the owner abandoned the site in 1991, the remaining stored chemicals, drums, ASTs, and USTs were removed by the EPA between 1992 and 1998. Environmental assessments performed between 1990 and 1999 identified soil and groundwater contamination that originated from the blending and storage of chemicals. A soil vapor extraction (SVE) system was installed as an interim measure in 1998 and operated until 1999, when it was shut down due to community concerns with emissions from the thermal oxidation unit used to treat the extracted vapors.

The City of Maywood currently owns the Pemaco property. The City has rezoned the property from industrial to recreational use. The City plans to build a 7.3-acre public recreational park, termed the Maywood Riverfront Park (MRP), on six properties surrounding and including the Pemaco Superfund site. The MRP is part of a larger Los Angeles River Greenway program and the Los Angeles River Master Plan. Construction on the park began in 2003 and stopped until the City was able to acquire the last property to be incorporated into the MRP. Construction on the park will resume again in 2006.

Site Conditions

The Site is comprised of the following lithologic units:

- Near surface soil consisting of non-native silty and clayey sand.
- The upper vadose zone consists of clay and silt lenses typically located between 2 to 30 feet bgs. A laterally continuous clay interval that ranges from 1 to 10 feet thick is found between 30 to 40 feet bgs. The perching clay, where it is thick, has local

saturated silty sand intervals within it. The bottom of the upper vadose zone is at the base of this "perching clay."

- The lower vadose zone consists of interbedded clayey silts, silty clays, silty sands and sands from 35 to 65 feet bgs. An unsaturated sand interval is encountered between 40 and 50 feet bgs. The lower vadose zone sand varies from 1 to 14 feet thick and is predominantly fine to medium-grained sands and gravelly sands. The sand appears to be continuous throughout. The interval between 50 and 65 feet bgs is generally fine-grained (slits/clays) with thin local silty sand lenses.
- A perched zone occurs in lenses of poorly graded sand, silty sand, and sandy silt, which lie on top of the perching clay and are locally overlain by finer-grained units. These saturated lenses are located at different depths ranging from 20 and 40 feet bgs and range from 5 inches to 5 feet thick. Measurements of depths to groundwater in the perched zone range from 18.48 to 39.31 feet bgs. Groundwater fluctuations of greater than 5 ft have been observed since groundwater monitoring began.
- The 'A' groundwater zone is found between 65 and 75 feet bgs and is comprised of fine silty sand and poorly graded sands locally interbedded with well-graded sands.
- The 'B' zone is typically found between 80 and 90 feet bgs and is comprised of fine silty sands, poorly graded sands and poorly graded sands with silt ranging from 1.5 to 10 feet thick.

The target ERH remediation area consists of 13,200 square feet as shown on the attached plot plan (Figure 1) with a remediation depth interval from 35 to 95 ft bgs. The remediation volume is approximately 30,000 cubic yards.

The contaminants of concern and their respective boiling temperatures are presented in Table 1.

Table 1. Boiling Temperatures of VOC/Water Mixtures

VOC	Boiling Temperature in Air	Boiling Temperature in Water at 60 ft bgs	Boiling Temperature in Water at 70 ft bgs
pure water	100°C	100°C	107°C
hexane	69°C	62°C	69°C
TCE	87°C	73°C	81°C
cis 1,2-DCE	59°C	54°C	61°C
vinyl chloride	-14°C	-14°C	-8°C
MW-17-70 mixture*	70°C	63°C	70°C

* A mixture of VOCs will boil at an intermediate temperature as described by Raoult's Law. The MW-17-70 mixture properties are based on a groundwater sample collected on 04/02/02 in which the following molar VOC fractions were reported: 87% TCE, 11% cis 1,2-DCE, 2% hexane and 1% vinyl chloride.

Construction and Operations

The ERH system will include 53 electrodes installed on 17-foot centers that extend to a depth of 35 to 95-feet bgs. Each electrode is co-located with a vapor recovery well to capture steam and vapors generated during the ERH application.

The TRS ERH specialty equipment that will be used for this remediation includes one custom-manufactured 2,000-kW Power Control Unit (PCU) for continuous power delivery to the treatment volume, one 40-horsepower blower, and one condenser. A flameless thermal oxidizer will be used for vapor treatment.

ERH operations are scheduled to begin in late 2006. We estimate that 90 – 120 days of operations will be required to reach the remedial goals.

Remedial Goals

TCE in groundwater is the primary, controlling contaminant. The beginning maximum concentration of TCE in groundwater is 27,000 µg/l. The remedial goal for TCE in groundwater is 5 µg/l or a 99.98% reduction. Previous experience indicates that ERH should provide a similar percentage reduction in soil as in groundwater concentrations.

The ROD describes the remedial action objectives for the site. Based on physical characteristics of the target VOCs (boiling point and water solubility) and their present concentrations, TCE is the rate-limiting VOC. All other VOCs will reach their established goals before TCE. The desired TCE reduction in Lower Vadose Zone Soil (35-65 ft bgs) is 97%.

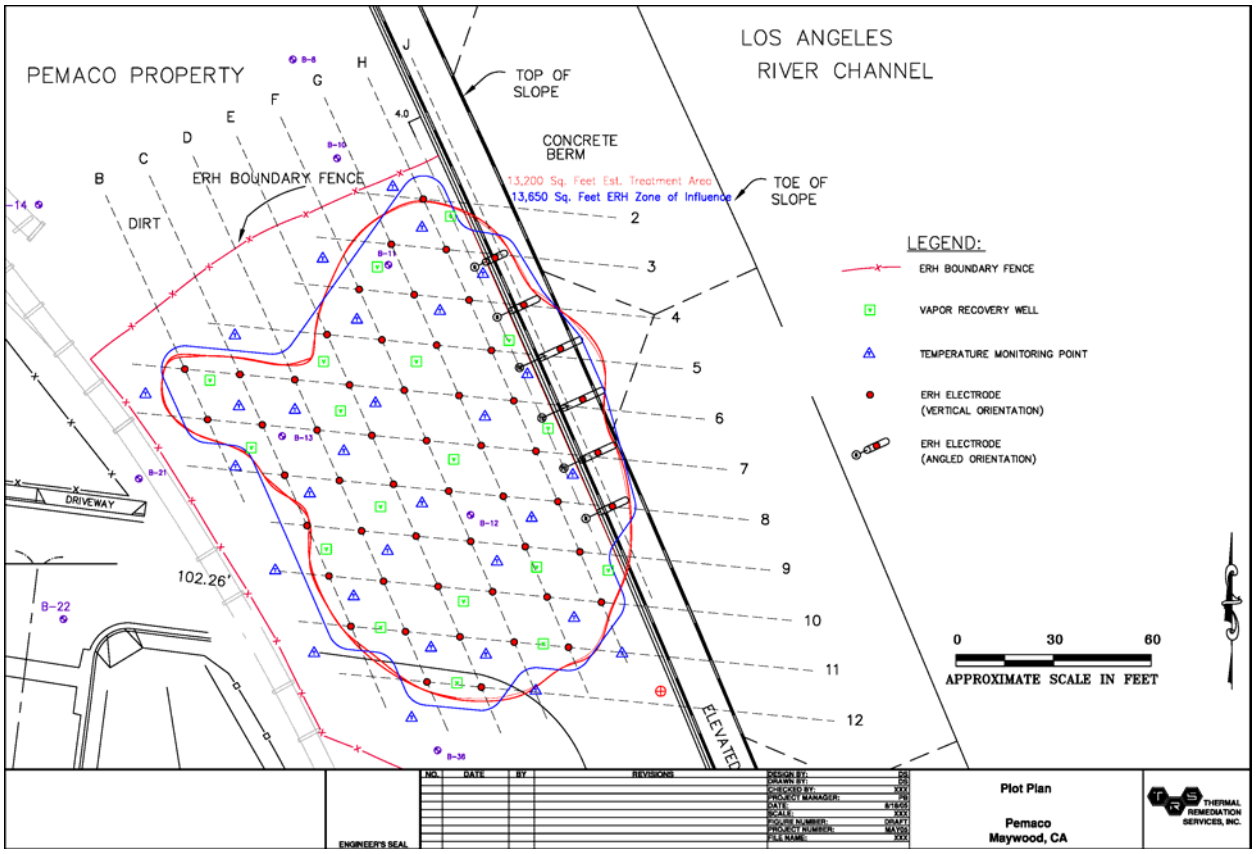

Figure 4. Site Plot Plan Showing Electrode and TMP Locations