

# **DRAFT FINAL MONITORING OPERATIONS AND MAINTENANCE PLAN**

## **For The Pemaco Remedial Action**

**PEMACO SUPERFUND SITE**  
**5050 E. Slauson Avenue**  
**Maywood, California**

### **Prepared for:**

**U.S. Environmental Protection Agency**  
**Region IX**  
**San Francisco, California**



**U.S. Army Corps of Engineers**  
**Omaha District**  
**Omaha, Nebraska**



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**Ventura, California 93001**

**October 2007**

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## PEMACO SUPERFUND SITE MAYWOOD, CALIFORNIA

Prepared for  
U.S. Environmental Protection Agency – Region IX  
San Francisco, California

U.S. Army Corps of Engineers – Omaha District  
Omaha, Nebraska

OCTOBER 2007

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## ACRONYMS AND ABBREVIATIONS

ACFM	Actual Cubic Feet per Minute
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
ARARs	Applicable or Relevant and Appropriate Requirements
AST	above ground storage tanks
bgs	Below ground surface
C°	Degree Centigrade
CD	Compact Disc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
D	Exposition Well
DMP	Data Management Plan
DPE	Dual-phase Extraction
DVD	Digital Video Disc
EDD	Electronic data deliverables
EPA	Environmental Protection Agency
EPP	Environmental Protection Plan
ERH	Electrical Resistive Heating
ERM	Environmental Resources Management, Inc
FE	Flow Element for vapor
FI	Flow Indicator for vapor
FM	Flow Meter for water
FQI	Cumulative meter for water
FT	Feet
FTO	Flameless Thermal Oxidizer
GIS	Geographical Information System
Hg	Mercury
in.	Inches
ISMS	Integrated Safety Management System
JSA	job safety analysis
Kw	Kilowatt
KW/hr	Kilowatt/hour
LEL	Lower Explosive Limit
MOMP	Management and Operation and Maintenance Plan
MSDS	Material Safety Data Sheet
NCP	National Contingency Plan
O&M	Operation and Maintenance
OM	Operation Manager
OSHA	Occupational Safety and Health Agency
P	Perched Well
PCU	Power Control Unit
PI	Pressure Indicator
PID	Photo Ionization Detector
PM	project manager
ppb	parts per billion
PPE	Personal Protective Equipment
QA	quality assurance
QC	quality control

## **ACRONYMS AND ABBREVIATIONS (CONTINUED)**

RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SCFM	Standard Cubic Feet per Minute
SOW	Scope of Work
SQL	Sequel Data Base
SSHP	Site Specific Health and Safety Plan
SSRL	Site Specific Remediation Levels
SVE	Soil Vapor Extraction
TCE	Trichloroethene
TI	Temperature Indicator
TN&A	T N & Associates, Inc.
TRS	Thermal Remediation Services, Inc.
USACE	United States Army Corp of Engineering
UST	underground storage tanks
VI	Vacuum Indicator
VMP	Vapor Monitoring Point
VR	Vapor Recovery Well
WMP	Waste Management Plan

## 1.0 INTRODUCTION

This Monitoring, Operation, and Maintenance Plan (MOMP) has been prepared for the Pemaco Superfund Site (“Pemaco Site” or “Site”) in Maywood, California. The report was prepared by T N & Associates, Inc. (TN&A) in accordance with the following documents:

- *Record of Decision for the Pemaco Superfund Site (ROD)* (USEPA, 2005)
- Statement of Work under PRAC Contract No. DACA 45-06-D-0006.
- Final Remedial Design Report (TN&A, 2006)

This work is being performed under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as “Superfund”) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the CERCLA regulations published in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). TN&A is performing this work under contracts issued by the U.S. Army Corps of Engineers (USACE), Omaha District; for the USEPA, Region IX (USEPA).

This MOMP focuses on operation and maintenance (O&M) of the remedial system being implemented under the ROD consisting of a dual-phase extraction (DPE) and treatment system at the Pemaco Site. This plan covers two phases of the planned remedial action, as described in the Final Design Report (TN&A, 2006), as follows:

- Phase I: commissioning and startup of the DPE system, and
- Phase II: operation and maintenance of the DPE and treatment system during thermal treatment of the source area.

Phase III, which will consist of post-thermal treatment DPE operation, will be addressed through a separate MOMP due to significant differences in treatment strategy.

A comprehensive description of the extraction and treatment system is contained in the *Final Remedial Design Report, Pemaco Superfund Site*, (TN&A, 2006). The Electrical Resistive Heating (ERH) contractor will use the site’s extraction and treatment system for removal and destruction and/or capture of the contaminants of concern. An overview of the ERH implementation and operation is contained in *Work Plan, In Situ Thermal Remediation (Electrical Resistance Heating)* prepared by Thermal Remediation Services, Inc. (TRS), dated September 21, 2006 (TRS, 2006).

This MOMP describes the key elements of system operation, data collection (manual and analytical), data management and distribution, and supervision. By defining these elements, site managers, operators and technicians will understand their roles, and the necessary activities and data needed for ensuring a safe, effective and successful operation of the extraction and treatment system.

## 2.0 BACKGROUND

The Pemaco Site is comprised of 1.4 acres located in a mixed industrial and residential neighborhood in Maywood, Los Angeles County, California. Drawing G-1 is the Title Sheet of the design drawings package and shows the Site location and vicinity maps (TN&A 2006a). The facility formally operated as a custom chemical blender from the 1950s until 1991. A wide variety of chemicals were used and stored on site 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). In 1991 the facility was abandoned by its owner. Remaining stored chemicals in drums and storage tanks (USTs) were removed by the USEPA 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 at the Site. A soil vapor extraction (SVE) system was installed as an interim treatment measure in 1998 and operated until 1999, when it was shut down due to community concerns about emissions from the thermal oxidation unit used to treat the extracted vapors.

The USEPA enlisted the Pemaco Site into the Superfund program in 1999, and TN&A performed a full-scale Remedial Investigation (RI) between January 2001 and November 2001. TN&A conducted treatability tests including aquifer testing in December 2001 and a high vacuum dual phase extraction pilot test in December 2002. Additional "source" area evaluation was performed in September 2003 via membrane interface probe. The Record of Decision (ROD) for the soil vapor and groundwater systems was finalized in January 2005. Groundwater monitoring, "data gap" investigations, and pilot-scale activities for the evaluation of remedial technologies have been in progress for the Pemaco Site since May 2001.

The City of Maywood, in conjunction with the Trust for Public Land, is developing the Site and adjacent properties to build the Maywood Riverfront Park ("the Park"), a public recreational park. The remedial activities at the Site will be integrated with the existence of this park.

The primary remedies to be implemented at the site are Dual-Phase Extraction (DPE), where vapor and liquids are brought to the surface through a network of extraction wells; and thermally-enhanced DPE, where the subsurface is heated to the boiling temperature of water, and vapor and liquids are brought to the surface through a network of extraction wells.

The method for heating the soil at the site is Electrical Resistive Heating (ERH) and is accomplished by installing electrodes into the subsurface in the most contaminated part of the site (approximately 14,000 square feet). Electrical current flows from one electrode to another and the soil, acting as a "resistor," heats up. The reasons for heating the soil are to 1) greatly increase the rate of contaminant removal, and 2) to increase soil permeability in order to facilitate contaminant recovery from fine-grained soils. Because of the effectiveness of the heating, the ERH phase of remediation will be significantly shorter than the DPE phase, although some MPE well will be operated during the thermal phase.

Both DPE and ERH technologies will use the same extraction and treatment equipment. This MOMP addresses the operation, maintenance, data requirement, and response actions for the system operation.



### **3.0 PHASE I – SYSTEM COMMISSIONING AND ESTABLISHMENT OF HYDRAULIC AND PNEUMATIC CONTROL**

#### **3.1 DESCRIPTION**

The first phase of the DPE and thermally-enhanced remediation consists of extraction and treatment system commissioning, and the operation of all the extraction wells outside and within the ERH boundary area. The initial purpose for the 30- to 100-day commissioning phase is to thoroughly test all of the process equipment and determine all the design parameters for the ERH remediation are achieved ([Table 1](#)).

Additional operational parameters of vapor from the Flameless Thermal Oxidizer (FTO) and carbon absorber system treatment system will be evaluated by performance of a source test using South Coast Air Quality Management District (SCAQMD) protocols. A risk-based dispersion model performed by Earth Tech. has determined the vapor discharge limitation for the FTO and carbon system assuming 99.9% and 99.99% efficiency. The dispersion and accompanying discharge limitation is in Appendix A of the Environmental Protection Plan (EPP), [Attachment 1](#) of this report.

Water discharge limits into the sewer are in the Self-Monitoring Form provided in Appendix B of the EPP ([Attachment 1](#)). Effectiveness of the water treatment by the carbon treatment system will be by analytical methods described in the Sampling and Analysis Plan (SAP) in [Attachment 2](#).

The commissioning period will also be a period of shakedown and training for site workers, data recording and management, communication protocols, establishment of hydraulic and pneumatic control, and system capacity. ERM, the contractor of the extraction and treatment system, will prepare a comprehensive Operations and Maintenance Manual which describes components, controls, operation, and maintenance of all equipment. A final draft of the Operations and Maintenance Manual will utilize “lessons learned” during the commissioning period, and be submitted to USACE prior to startup.

The commissioning and startup period will incorporate the 58 ERH electrode-extraction wells only after the source testing of the extraction and treatment system.

Sample location, frequencies, and monitoring parameters are summarized in [Tables 2](#) through [5](#) (provided at the end of the text). Sample collection and analysis details are described in SAP ([Attachment 2](#)).

#### **3.2 STARTING THE TREATMENT SYSTEM**

The directions for initiating operation of the extraction and treatment system follow:

##### **Step 1 – Begin Groundwater Extraction**

Extraction of groundwater from the Exposition Wells may begin prior to vapor extraction/DPE startup. The decision for starting groundwater extraction will depend upon the confidence of the operators to manage the liquid stream of the processing equipment. A list of the 32 Exposition Wells equipped with downhole pumps is on [Table 6](#). These wells are to be operated full time for

the duration of the Phase I and Phase II. The procedure for the initial startup will generally consist of:

1. Turning on compressor for the pneumatic pumps, and checking that the design pressure is achieved in the distribution line.
2. Gauging all monitoring wells for baseline gradient calculation and groundwater elevation.
3. Beginning operation of the pumps at full capacity.
4. As the pumps come on line, measuring the flow rate into the process equipment; the capacity of the compressor; analytical results prior to sewer discharge.
5. When all the groundwater pumps are operating, gauging monitoring wells for calculating the groundwater gradient and elevation change.

### **STEP 2 – Begin Vapor Extraction from Perched Zone and Exposition Wells**

The commissioning of the well field will begin with vapor extraction from the 25 DPE Perched Wells, and 32 Exposition Wells ([Table 6](#)). Data collection for this sub-phase is detailed in the SAP (Attachment 2). The procedure for this initial startup will generally consist of:

1. Gradually opening the flow valves to all DPE Perched wells and Exposition wells until all wells are 100 percent open.
2. Determining total flow into FTO from the all the vapor extraction and DPE wells.
3. If the flow is less the 1000 scfm (the capacity of the FTO), opening dilution air valves until the system operates at approximately 1000 scfm.
4. Measurement of vapor concentrations in and out of the vapor treatment system
5. Measurement of vacuum prior to and after the steam condenser
6. Measurement of vacuum for each of vapor extraction wells
7. Measurement of condensate collected in Moisture Separator and treated by the process equipment.
8. Measurement of vacuum from each of the 30 Vacuum Monitoring Points (VMP) to determine the radius of influence in the ERH well field.
9. Collecting physical and analytical data collection and of all process parameters per the SAP.
10. Performing source testing of FTO and carbon absorption system

### **STEP 3 – Addition of 28 Vapor Recovery (VR) and 58 Electrode Vapor Extraction Wells**

Step 3 is the addition of the vapor recovery (VR) electrode vapor extraction wells, with simultaneous operation of the DPE Perched wells, VR wells, and DPE Exposition wells. It is critically important that the parameters for the ERH extraction wells are met ([Table 1](#)). If the ERH parameters cannot be met with all the DPE Perched and Exposition wells and VR wells operating, the Exposition DPE wells will be shut down in the following sequence: DB, DA, and DAB until the vapor extraction rate of 560 scfm for the ERH well field is met. It is also necessary to ensure that the vapor streams are properly balanced with contaminated and dilution air to meet the goal of 25-30 percent LEL at 1000 scfm into the FTO. Data collection for the vapor extraction wells will follow the SAP. The process of adding the ERH extraction wells will consist of:

1. Collection of vacuum from each Vapor Monitoring Point (VMP) and VR extraction well.
2. Balancing the flow from the Perched wells, VR wells, and electrode vapor extraction wells to meet 560 scfm at the ERH condenser.
3. Measurement of vacuum before and after the condenser unit, at each of the five headers in the ERH well field, and at the wellhead at each extraction well in the well field.
4. Ensuring that there is proper LEL concentration in order to meet an optimum operational goal for the FTO.

5. Measurement of vapor concentrations in the ERH well field, DPE Perched and VR lines.
6. After FTO is at 100 percent capacity, analyzing vapor concentrations in and out of FTO to determine if operational parameters are being met.
7. If additional capacity is available in the vapor extraction system, adding DPE Exposition wells until capacity of 1000 scfm is met.
8. Performance of physical and analytical data collection and of all process parameters per the SAP.
9. Manual measurements of all thermocouples and comparison of manual with web site posting.

### **3.3 CRITERIA FOR COMPLETION OF PHASE I**

The intent of Phase I is to field test the equipment at full capacity of vapor and liquid streams, and use this phase to identify health and safety issues, fix problems with controls, equipment, personnel, data gathering, communication, etc. This phase is also used to establish hydraulic and pneumatic control prior to commencement of ERH.

This phase will be considered complete when the following is completed:

1. Extraction parameters for the ERH wells have met.
2. DPE Perched, VR, and DPE Exposition wells are adjusted to optimize the use of the vapor extraction and treatment system.
3. Pneumatic and hydraulic control has been measured and baseline extraction data has been determined.
4. Source testing of the FLO is completed, and the system operates within the parameters established by the air model.
5. The process equipment meets all performance parameters.
6. Collection and web-posting of electronic and manual data from ERH operations and treatment equipment is considered safe and satisfactory.
7. Initial trouble-shooting and adjustments to the equipment and well field has been completed.
8. All physical and analytical data has been collected per the SAP for Phase I.
9. Manual thermocouple measurements are equivalent with web site posting.

## 4.0 PHASE II – ERH AND CONTINUED VAPOR AND GROUNDWATER EXTRACTION

### 4.1 DESCRIPTION OF PHASE II

Phase II of the remediation will commence after all criteria for completion of Phase I has been accepted by the USEPA and the USACE. Phase II is a continuation of the vapor and groundwater extraction, with operational modifications to accommodate the ERH (source area remediation) program. The thermal aspect of Phase II entails the energizing of the 58 electrodes as shown on the site map ([Figure 1](#)). TRS is responsible for the operation, maintenance and performance of the ERH system, which includes:

1. The Power Control Unit (PCU),
2. Subsurface electrodes and associated VR wells,
3. Subsurface thermocouples monitoring, and
4. Steam condenser unit operation.

The TRS Work Plan, previously referenced, describes the ERH technology, system design, installation, and operation and maintenance of the ERH system. Note that contaminants volatilized by the ERH process will be routed to the extraction and treatment system operated by TN&A. This system is described in detail in the Final Engineering Report. Major design and equipment elements for the ERH components of the project are shown as schematics on [Figures 2 and 3](#).

The performance criteria for the ERH are to meet temperature set points within the energy budget calculated by TRS. The temperature specifications are shown on [Table 8](#).

### 4.2 STARTING THE ERH WELL FIELD

The commencement of the ERH operation will occur after the all the criteria for Phase I has been successfully completed. The startup and operation of the ERH system is the responsibility of TRS and is described in Section 8.0 of the TRS Work Plan. TRS has developed internal procedures and trained personnel for the ERH system startup, operation, and data collection. TN&A will monitor the results of the following key elements of ERH system startup:

1. Touch and step potential testing done to ensure proper grounding and insulation of all metal wells and piping in the well field;
2. Temperature response in thermocouples and extraction wells; and
3. Energy use.

All data that is being collected for the ERH operation and the extraction and treatment system is contained in the SAP ([Attachment 2](#)). The SAP defines the type and frequency during Phase II operations. The data has been divided into the three operational elements as shown below.

**1. Process Data:** The process data is used to understand how the equipment is functioning and the types and concentrations of contaminants in the waste streams. The data measurement points and their acronyms are summarized as follows:

FE	Flow Element for vapor
FI	Flow Indicator for vapor
FM	Flow Meter for water
FQI	Cumulative meter for water
VI	Vacuum Indicator
TI	Temperature Indicator
PI	Pressure Indicator
VR	Vapor Recovery Well
D	Exposition Well
P	Perched Well
VMP	Vapor Monitoring Point

The physical data collection points for the process and treatment system are identified on [Figure 2](#). The locations of the sampling ports for chemical data collection are shown on [Figure 3](#). Most process data will be collected daily and generally consist of:

1. Vapor flow rates (FE and flow indicator on FTO),
2. Pressure/vacuum (VI),
3. Temperature (TI),
4. Liquid flow rates (FI),
5. Liquid flow, cumulative (FM),
6. Liquid levels (PLC readings),
7. Chemical data for liquid (200-series),
8. Analytical data for vapor (100-series), and
9. PID measurements for vapor.

**2. Well Field Data:** The well field data is used for optimization of vapor flow for the ERH well field, understanding temperature distribution, amount and effect of water withdrawal, and determining the radius of influence for the vapor extraction system. The well field data include:

1. Well head vacuum (well number),
2. Vapor flow/extraction rates (FE),
3. Liquid flow/extraction rates (FQI),
4. Temperature (TI),
5. Analytical data for liquid (sampling ports 200-series),
6. Analytical data for vapor (sampling ports 100-series),
7. Draeger or similar tube screening for VMPs,
8. PID screening in vapor header system, and
9. Groundwater elevations (10 wells in and around the ERH area).

**3. ERH Data:** ERH data is used to make adjustments to power, water injection, and/or extraction systems for optimization of the process and will include:

1. Total energy use,
2. Subsurface temperature/thermocouple data,
3. Energy per electrode,
4. Condensate in and out of the condenser, and
5. Water injected into the electrodes; total and individual.

#### **4.2.1 Maintaining ERH Extraction Parameters**

It is critical to ensure that the ERH well field has the designed flow rate and vacuum per the TRS Work Plan (Table 3.1 in Section 3.0 of TRS's Work Plan). The ERH well field flow rates and vacuum readings will be taken daily from gauges on the down-stream side of the steam condenser. Adjustments in the number and/or flow from MPE wells outside the ERH well field will be made so that the design rate can be maintained. These adjustments are the responsibility of TN&A.

#### **4.3 ATTAINMENT OF TEMPERATURE GOALS**

Attainment of the temperature goals is expected to occur after 73 days of ERH operation (TRS Work Plan). Ten percent of the thermocouple readings will be validated by TN&A using hand-held instrumentation. If all the temperature goals have been met simultaneously, the 30-day holding period will begin. If temperature goals are not met, heating will continue until the temperature goals are met. If the temperature goal is met prior to the estimate of 73 days, the 30-day holding period will start as soon as the temperature data is validated.

#### **4.4 30-DAY HOLDING PERIOD**

The 30-day holding period will start immediately after validation of the attainment of the temperature goals. During this phase, temperatures cannot drop below the attainment goals. Data gathering and analysis during this phase will help determine if the ERH portion of the remediation will move forward. The decision-making process of additional ERH is described below.

#### **4.5 REMEDIAL ACTION OBJECTIVES**

The Remedial Action Objectives (RAOs) for Pemaco are to protect human health and the environment from threats caused by exposure to contaminated soil, soil vapor, indoor air, and groundwater, and to restore groundwater to potential beneficial use as a drinking water source. All chemicals of concern have been identified at the Site and are listed in Table 8-1 "Site Specific Remediation Levels (SSRLs) in the Pemaco Record of Decision, January 13, 2005 (EPA, 2005). In order to meet the RAO for the primary contaminant at Pemaco, trichloroethene (TCE), it will be necessary to remediate groundwater to 5 µg/l and soil to 60 ppb by the end of the remediation period, which is scheduled for 5 years.

Within the ERH area, there are no contractual obligations with the ERH vendor, TRS, to meet the soil and groundwater standards. TRS' only contractual obligation is to meet temperature set points within the energy budget shown in [Table 6](#). As a remedial strategy to meet the groundwater and soil RAOs in the ERH treatment area, an estimated 206 days of heating and extraction will be provided by TRS. According to TRS, as shown in Table 7, heating to temperature and holding at temperature for 30 days will require approximately 3.4 million (MM) kilo-watt hours (kW/hrs) of electricity. Meeting the RAOs in soil and groundwater using ERH would require an additional 90 days of heating, and therefore would expend an additional 3.0 MM kW/hrs of electricity, as per TRS.

## **4.6 DECISION PROCESS FOR CONTINUED ERH OPERATION**

The decision to continue with ERH heating after the thermal set points have been met for 30 days will be a process that will consider physical and analytical data from the subsurface the process equipment. Key data elements will include:

- Temperature Performance and Distribution;
- Contaminants trends in the vapor and liquid streams;
- Soil vapor concentration from the ERH header sampling points and VMP's;
- Groundwater concentrations from VR, DPE and monitoring wells; and
- Possible soil sampling.

### **4.6.1 Temperature Performance and Distribution**

If the thermal remediation is successful, there should be no “cold” spots within the target volume. The thermocouple wells, which are positioned near the center of triangles formed by the electrodes, are in the areas that are the most difficult to heat. Cold areas can become places where contaminants can condense, and if in the saturated zone, are not subject to the vapor extraction system. Subsurface temperature data will be modeled and visualized in three dimensions, with graphic output taking the form of horizontal and vertical cross sectional views of temperature distribution through the modeled space. The graphic output will be shared with the project team on the project team website (Section 7.0).

The thermocouple strings will be read each day. Data from a single string will show the vertical temperature profile; historic temperature data will show how quickly the soil responds to the energy input. Individual thermocouple data will be used to identify heating efficiency at specific depths.

### **4.6.2 Contaminant Trends in Vapor and Liquid Streams**

Analysis of contaminant concentrations in vapor and groundwater over time will show the effect of mass recovery versus temperature. A third factor, energy input, will also be considered. Ultimately, recovery of mass will become asymptotic, or close to asymptotic. The length of time needed to reach asymptotic conditions depends upon the quantity of mass, permeability of the medium, and the effectiveness/coverage of the extraction system.

### **4.6.3 Soil Vapor Concentrations from Well Heads and VMP**

Trends (concentrations versus time) from the recovery wells and VMP should also be used in conjunction with the data from the process equipment for determining if ERH is to continue. It is possible for the overall mass removal rate measured in the process line to be low or “flattening” while some wells could still have high concentrations. Identification of “clean” areas may allow some electrodes to be turned off, while increasing power and/or extraction to those zones requiring more treatment. The electrodes are setup in zones to facilitate targeted system management ([Figure 1](#)).

### **4.6.4 Groundwater Concentrations from VR, DPE and Monitoring Wells**

Obtaining and analyzing dissolved concentrations from the VR and DPE and monitoring wells can be used for determining contaminant distribution in groundwater. The analytical data used

in conjunction with the vapor and temperature data may give indications if an area of the site has met the RAOs or requires additional heating and/or extraction.

#### **4.6.5 Possible Soil Sampling**

Obtaining soil samples in conjunction with analysis of the groundwater, soil vapor, and process data may help determine if the RAOs have been met, or additional remediation is required. Confirmation soil sampling would be performed after significant mass has been recovered, or if vapor and/or groundwater concentrations from individual wells have fallen below RAOs, indicating significant remedial progress.

#### **4.6.6 Evaluation Process**

Two weeks before the end of the 30-day temperature holding period, all pertinent graphs, and field data will be compiled and distributed or posted on the project team web site (Section 7.1). Note that most, if not all, of this data will be collected in the course of normal operations, in accordance with the SAP (Attachment 2). Note that there will be almost 120 days of non-thermal and thermal operation, during which the type and quantity of data needed to make the decision to move forward with additional ERH will be obtained. This evaluation process will evolve with the project, as strengths and weaknesses of the technology application become evident.

#### **4.6.7 Vapor Treatment Options**

Vapors extracted from the subsurface will be treated through a flameless thermal oxidizer (FTO) with secondary treatment ("polish") by granular activated carbon (GAC). Source testing and additional analytical sampling of the influent and effluent of the FTO may provide sufficient data to reevaluate the vapor treatment train. The system is designed to utilize the FTO as the primary method for vapor destruction, using vapor phase carbon in the event the FTO cannot meet the air quality standards. After several months of thermal operation the majority of the mass may be removed, which may allow treatment by the carbon unit alone. The decision to use only carbon will depend upon vapor concentrations in influent, vapor concentrations measured at the wellheads, and contaminants remaining in the subsurface after ERH temperature goals are met and held for 30 days.



## **5.0 PHASE III – POST-ERH DUAL-PHASE EXTRACTION (DPE)**

Phase III begins after cessation of the thermal heating. The primary technology for Phase III is DPE. The operations, sampling and data collection, and management of the extraction and treatment system will change significantly because the ERH system and FTO will not be in operation. In addition, a better understanding of the subsurface conditions from the system operation and data collection from Phases I and II will aid in optimization of Phase III. Data specific to the operation of the ERH system will not be included in the SAP during Phase III.

Because the duration of this phase is estimated to be 5 years, the frequency of the data collection, and in some cases the types of data required, will be evaluated. Operation of the extraction system and treatment will be modified to allow for reduced man-hours, and a significant change in the project personnel. This will be possible because the ERH and FTO systems will not be operated, and the expected concentrations in the vapor and liquid streams should be substantially lower than during Phase I and Phase II.

The operation of Phase III may also include biological augmentation (TN&A, 2007), which will be reflected in a modified O&M plan and SAP to include the biological parameters.

For the above stated reasons, it is recommended that this MOMP be amended toward the end of Phase II to ensure the document is tailored to Phase II operations and monitoring needs.

## 6.0 COMMUNICATIONS PLAN

This communications plan specifies how project issues will be communicated among the project team and with USEPA/USACE. In general, a number of planned conference calls and summary reports are distributed that facilitate coordination of the project team. The project team website (Section 7.0) supports team communications through a calendar, event announcements, discussion bulletin board, file uploads and an on-line library of project documents. A procedure has also been developed to address unplanned issues and problems.

### 6.1 SCHEDULED COMMUNICATIONS

Scheduled communications consists of those activities that are scheduled on a daily, weekly, or monthly basis to communicate project progress. Communication primarily consists of teleconferences and summary reports. These communications include the following:

- Daily Field Call: The TN&A Site Manager will facilitate a daily field call each weekday with each of the Project Managers (as shown on the Organization Chart, [Figure 4](#)). The purpose of the field call will be to review recent occurrences, review work to be performed during the upcoming day, and review data to be collected. This call will also be used to emphasize items of particular concern or issues warranting close attention. Other team members may also join this call during periods when the field team can benefit from further engineering input, etc.
- Daily Reports: The TN&A Site Manager will prepare a daily report at the end of each week day that summarizes data collection and field activities for the current day. This daily report will be uploaded to the website by 9am on the following weekday (the Friday report will be uploaded by 9am the following Monday).
- Weekly Team Conference Call: A weekly conference call will be held for the extended project team, including all site Operators and Managers. The purpose of this call is to confirm that all aspects of the project are properly communicated among the project team. The agenda of the call will address: 1) Work completed during the previous week, 2) Work planned for the upcoming week and priorities, 3) Staffing issues, 4) Equipment status, and 5) Changes in system operations and/or schedule.
- Weekly Data Summary Report: A PDF summary report will be uploaded to the project team website on Tuesday of each week that provides a quick overview of the previous week's activities, existing problems or issues, and charts and figures that track the progress of the remediation. Figures included in the weekly report will include an energy balance, energy use, temperatures maps and profiles, water balance, water level hydrographs, and mass removal graphs. The report will be prepared by TN&A with input from Earth Tech and TRS. The report will be reviewed by Project Manger or a designated senior engineer before being uploaded to the website.
- Weekly Management Report: A weekly management report will be provided to EPA and USACE on Monday of each week. The primary purpose of this report is to provide a brief overview of the project and highlight any critical items. Items requiring immediate

attention will always be e-mailed as identified, but a reminder of the issue will be included in the weekly management report.

- Monthly Summary: This is a brief report recapping the critical elements of the project: energy use, temperature profiles, projected subsurface conditions, mass recovery curves, projected length of operation, and any issue not resolved in a timely fashion.

## **6.2 NON-SCHEDULED COMMUNICATIONS**

Time-critical issues and items will be communicated to USACE as they are identified, typically by e-mail since this allows the project team to be copied on important communications. These items will include health and safety issues, updates on equipment repair and/or replacement, early notices on potential problems, and status updates of urgent items in progress.

As-needed teleconferences will be conducted to address specific scope items to confirm that the project team understands the issue. As issues are identified that require modification to equipment or processes in the field, an additional form will be completed to communicate the required modifications. The time-critical issues will be summarized in the weekly management report as a reminder of the status of each item.

## 7.0 DATA MANAGEMENT PLAN

The remedial system will be managed via a password controlled website accessible to the full project team. The full data management cycle ([Figure 5](#)) provides data generated as either electronic data deliverables (EDDs) or as manually entered readings, imported to the secure archive database, and then mirrored to a web database from where it can be dynamically accessed via specialized interfaces.

### 7.1 PROJECT WEBSITE

The Pemaco project website will serve as a work environment where internal and external participants come together as a cohesive team. All data generated through system monitoring as well as environmental data (e.g. groundwater chemical data, vapor data) will be accessible to the project team via the website. The website will function as a secure virtual office space with all of the tools and facilities necessary for the project team members to stay up to date on developments and to interact with one another:

*Team Coordination Tools:*

- Document Upload
- Contact List
- Bulletin Board
- Calendar
- Events & Announcements

*Project Materials:*

- Online Library of Relevant Historical Materials
- Operational Materials

*Static:*

- Reports
- Graphics
- Animations

*Dynamic:*

- Interactive Maps
- Interactive Schematics
- Database Query Interfaces
- Graphing Interfaces

### 7.2 DATA COLLECTION AND MANAGEMENT

All field and analytical data collected at the site will be stored permanently in TN&A's Environmental Data Management System (EDMS), a comprehensive SQL Server database hosted on the company intranet behind a secure firewall. Stored data can be exported out of the EDMS in a variety of formats, including Microsoft Access databases, Microsoft Excel spreadsheets, delimited text files, dBASE files, and others. The format and structure of these files can be customized to meet the export requirements for nomenclature, data structure, and file size. Exported files can be transferred via e-mail, FTP protocol, written to CD or DVD, or other means depending upon the final size of the file(s).

Integrity of the data stored in EDMS is maintained through software access permissions. Access permissions are set in the SQL Server application by the database or domain administrators. The ability to alter and add data to EDMS is limited to a few trained individuals in the company. Approved individuals are limited to read-only access. All non-approved persons (internal and external) are denied any access to EDMS

For the purposes related to the database, the collected data will be classified as either manually recorded or electronically recorded. Each classification of data has a standard procedure for entering the data into the database, as described in the following sections.

### **7.2.1 Manually Recorded Data**

Manually recorded data includes any measurement that is written down or typed into an electronic file by field personnel. Typically these data will include, but not limited to, water level measurements, pressure/vacuum readings, and flow volumes.

Manually recorded data will be recorded on pre-printed forms (field sheets) in the field and/or directly entered into a formatted electronic spreadsheet. Data recorded on field sheets will then be hand entered into a pre-formatted electronic spreadsheet. The electronic spreadsheet will be imported into the database using a standard query.

### **7.2.2 Electronically Recorded Data**

Electronically recorded data is any data that is automatically recorded by sensors or laboratory equipment or output by another database and stored electronically. These data are then saved and transferred as an electronic file or EDD. Sources of EDDs can include, but are not limited to sub-contractors, such as analytical laboratories, or data loggers.

Any entity that will be providing electronic data will be provided specifications for the format of the EDD. These specifications will include definitions for the data columns, data format, valid values, and file format of the EDD. The EDDs will be required to be provided in the specified format. EDDs will be imported into the database using a query specifically constructed for each entity.

The format of the EDD provided by data loggers is predetermined by the factory programming. Data will be downloaded from a data logger and exported to a generic electronic file type using factory supplied software. This generic electronic file will be imported into the database using a query specifically constructed for each device.

## **7.3 DYNAMIC WEB ACCESS TO PROJECT DATA**

For security purposes, data stored in the EDMS is only directly accessible to internal (TN&A) project personnel. The project website will access data from a server-hosted database that mirrors the EDMS via a process of automatic synchronization, in which new or updated records in the EDMS are copied over on an hourly basis. Data access will be provided through four customized interfaces ([Figure 5](#)):

- Interactive map interface: A web-GIS powered interface for displaying queryable map features (wells, sample locations, etc).
- Interactive schematic interface: A web-GIS powered interface for displaying queryable schematic diagrams (P&ID layouts, etc).

- Database Query Interface: A web-form interface for making direct database queries, resulting in a tabular output.
- Graph-generation Interface: A web-form interface for making direct database queries, resulting in a simple x/y graph output.

### **7.3.1 Temperature Monitoring Data**

Temperature data for the 450 thermocouples deployed at the project site will be provided on a daily basis as an EDD by the subcontractor ([Table 5](#)). The EDD will be imported into the EDMS for permanent storage as described in Section 7.2, and the data will be made available on the project website on a same-day basis via automatic synchronization as described in Section 7.3. From the project website, temperature data may be directly accessed via interactive maps, database query, and dynamically-generated graphs.

### **7.3.2 Process Data**

Process chemical data will be taken from 27 sampling ports ([Table 2](#)), both as field recordings and as lab samples. Process physical data will be taken from 90 locations ([Table 3](#)) as field recordings. All process data will ultimately be imported into the EDMS and made available via the project website as described in Sections 7.2 and 7.3, where it will be accessible via interactive schematics, database query, and dynamically-generated graphs.

### **7.3.3 Well Field Data**

Well field physical data will be recorded for 218 wells as field recordings ([Table 5](#)). Well field chemical data will be taken for 297 measurements as both field recordings and lab samples ([Table 4](#)). All well field data will ultimately be imported into the EDMS and made available via the project website as described in Sections 7.2 and 7.3, where it will be accessible via interactive maps, database query, and dynamically-generated graphs.

## 8.0 ROLES AND RESPONSIBILITIES

The organization chart describing the project team for operation of the thermal treatment system is shown in Figure 4. A detailed explanation of the roles and responsibilities of each of the team members directly connected to the operation is provided below. A contact list for key team members is provided in [Table 9](#).

### 8.1 PROJECT DIRECTOR, PROJECT MANAGER AND SENIOR ENGINEER

Project Director – Tim Garvey, TN&A. The Project Director will ensure there are sufficient corporate resources for successful operation and completion of the project. In addition, because of Mr. Garvey's substantial understanding of the project, he will be a technical resource for many of the activities, manage the bioremediation pilot test, and be available on an as-needed basis and for any meetings and/or presentations.

Project Manager – Dacre Bush, TN&A. The Project Manager (PM) of the thermal treatment phase of the project is responsible for overall management of all project activities, administration of funds, assignment and coordination of project resources, and compliance with environmental, health and safety, and QA. The Project Manager reports to USEPA Contract Manager on project progress, expenditures, develop spending projections, and reviews and reports cost and schedule variances. The Project Manager has the ultimate responsibility for the successful execution of the thermal remediation, and is supported by corporate and local support in performance of this role.

Responsibilities of the thermal remediation Project Manager include:

- Providing technical direction to TN&A and prime subcontractors during performance of the remediation through the Project and Site Managers identified on the organization chart.
- Work closely with the USACE contract administrator in administration of the contract.
- Communicate daily with the Project and Site managers on progress of the remediation activities.
- Ensure the appropriate resources are assigned to support the project.
- Assembling the information necessary to track and report on project performance.
- Reviewing and approving all submittals and all proposed changes to design documents.
- Providing the USACE with cost and schedule performance, variances and recovery plans, and accruals.
- Overall responsibility for the technical direction TN&A and subcontractors, and the achievement of the technical goals of the remediation.
- Chairing Technical Oversight meetings and conference calls.

Senior Engineer – John Wingate, TN&A. The Senior Engineer will be responsible for oversight of the extraction and treatment system. The Senior Engineer will perform site inspections, review all physical and chemical data of the process equipment, participate in the daily operations call, ensure proper staffing is on site for system operation, and assist the Project Manager with weekly and monthly reports.

## **8.2 PROJECT CHEMIST**

The Project Chemist is responsible for quality assurance/quality control (QA/QC) of analytical data and the management of hard copy and electronic data generated during project activities in accordance with SW-846, CLP (contract laboratory program), and other requirements as specified by USEPA. In addition, the Project Chemist provides oversight and guidance for the subcontract laboratories through various QA/QC activities, including data review/validation and systems and performance auditing. The duties and responsibilities include the following:

- Determination of project sampling and analytical requirements and preparation of SAP;
- Preparation of the field sampling analytical programs;
- Setting up and maintaining the sample management system. Tracking the progress of environmental samples throughout the process of acquisition, transportation, receipt, analysis, data validation and data reporting;
- Oversight of sampling program implementation and coordinating with the Field Team Leader on field sampling matters;
- Resolving all QA/QC problems with the subcontracted laboratories and reporting them to the Project Manager;
- Reviewing all chemical analytical data and laboratory QA/QC reports for compliance with QC requirements and technical accuracy;
- Ensuring all the analytical data packages are validated against the National Functional Guidelines and according to the project-specific requirements on level of review and frequency of samples to be validated;
- Coordinating with data management personnel on all electronic data issues including electronic deliverables from the field and the laboratories;
- Ensuring that field logs, field variance forms and other deviations from approved plans are maintained within the project files; and
- Overseeing the data entry into the database including data entry QA and verification of all data.

## **8.3 SITE OPERATIONS MANAGER**

The Site Operations Manager will be responsible for ensuring all aspects of the operation and maintenance of the extraction and treatment system, and reports to the TN&A Senior Engineer. The Site Operations Manager is responsible for ensuring that the extraction and treatment system is staffed with qualified personal, and that they have the proper support for health and safety, equipment, additional staff, and resolution of problems. The Site Operations Manager will ensure proper operational parameters for the system as determined by the Senior Engineer and technical oversight team. Maintaining proper staffing levels, health and safety of the operators, and compliance with all permits and applicable or relevant and appropriate regulations (ARARs) are key areas of responsibility.

The Site Operations Manager will have the responsibility of recording daily activities of his team members, tracking project progress, coordinating the sampling of all effluent streams with TN&A, and communicating with the Senior Engineer and technical oversight team. The Site Operations Manager will be required to perform inspections of the process equipment and piping/equipment in the well field. In addition, the Site Operations Manager will share responsibilities for granting access for all site visitors and conducting daily health and safety “tailgate” meetings with the site workers and performing the health and safety overview with site visitors.



Elements of Site Operations Manager at a minimum include:

- Daily health and safety “tailgate” meetings;
- Providing management and oversight of technicians and subcontractors;
- Review automated data on a daily basis to confirm that data are being properly recorded, data are of appropriate quality, and that the data makes sense;
- Assisting with identifying problems and implement solutions regarding data collection;
- Communicating urgent issues to the Senior Engineer;
- Facilitate and assist with field efforts or repairs as needed;
- Maintenance of Material Safety Data Sheets (MSDS’s), Health and Safety logs, visitor logs, storm water inspections, etc;
- Daily communication with TN&A field team leader (for chemical monitoring sampling) regarding daily activities;
- Routine maintenance and repair of all mechanical equipment;
- Overseeing/supervising specialty contractors when needed;
- Recording pertinent data from extraction and treatment equipment;
- Identify problems and recommend solutions before equipment failure;
- Preparing maintenance and repair logs for each piece of equipment;
- Ensuring proper operation of the extraction and treatment system;
- Minimizing any down-time due to repairs and/or equipment maintenance;
- Assisting with system data that is recorded and transmitted to the Senior Engineer;
- Recording the daily activities of the O&M workers and subcontractors;
- Maintaining an “Action Item Tracking Sheet”;
- Preparing weekly management summary report for the Senior Engineer; and
- Weekly status report of equipment and repairs.

#### **8.4 SITE SAMPLING MANAGER**

The TN&A Site Sampling Manager will have the responsibility of recording daily activities, coordinating all required sampling, and communicating activities to the Project Manager. The Site Sampling Manager will be required to perform inspections of the process equipment and piping/equipment in the well field. In addition, the Site Sampling Manager will be responsible for granting access for site visitors and conducting daily health and safety “tailgate” meetings with the site workers and performing the health and safety overview with site visitors.

The primary responsibilities will include:

- Daily health and safety “tailgate” meetings and activity call;
- Downloading and/or faxing to Ventura the sampling and data collection summary from the Data Management System for daily activities;
- Performing sampling and monitoring activities;
- Supervising well field sampling activities;
- Data entry at the end of each day;
- Schedule lab pick-ups;
- Keep inventory of the sample containers;
- Daily or as needed communication on the sampling schedule and issues with Project Chemist; and
- Preparing a brief weekly summary report for the Project Manager, as needed.

## **8.5 ERH MANAGEMENT ROLES AND RESPONSIBILITIES**

### **8.5.1 ERH Project Manager**

The ERH Project Manager (ERH PM), provided by TRS, is responsible for ensuring safe and effective operation of the ERH system (electrode well field, vapor recovery conveyance system, and condenser system). The ERH PM's major objective is the coordination of the ERH system with the vapor recovery and treatment system in order to optimize the thermal treatment and contaminant removal. The ERH PM will ensure that the proper resources, staff and equipment, are maintained at all times. Data recording and transmittal of all ERH components to the TN&A PM is the responsibility of the ERH PM. The ERH PM will also provide weekly progress reports on the ERH system which include key operational parameters (energy input, temperature data, estimated vapor extraction rates, condensation removal rates, etc), along with recommendations and/or comments for optimization and/or data requirements needed for optimization. All unforeseen changes in site conditions and/or scope will be immediately documented to transmit to the TN&A PM.

Tasks of the ERH PM at a minimum include:

- Safe and effective operation of all ERH remediation components;
- Coordination of ERH system with the extraction and treatment system to ensure meeting temperature and remediation goals;
- Proper staffing of the ERH system;
- Overseeing data collection and transmittal of data per the SAP;
- Weekly progress reports documenting energy use, thermocouple data, extraction rates of vapor and water, mass removal rates, and recommendations for future operations;
- Documentation of all unforeseen site conditions that may impact the SOW, budget and/or timeline;
- Participation in weekly progress conference calls; and
- Monthly progress reports and invoicing.

### **8.5.2 ERH Site Manager**

The ERH Site Manager, provided by TRS, reports to the ERH PM. The ERH Site Manager has the responsibility of keeping the ERH system and components operating by performing maintenance, repairs, and inspections of the PCU, well field and condenser unit. The ERH Site Manager is also responsible for recording all field and operational data of ERH components per the SAP. Specialty contractors needed for maintenance and/or repair of ERH equipment will be supervised by the ERH Site Manager.

Tasks of the ERH Site Manager at a minimum include:

- Safe and optimal operation of all ERH equipment;
- Performing or overseeing operation and maintenance of all ERH equipment;
- Recording all field, ERH, and condenser data per the SAP;
- Coordinating field and maintenance activities with other site workers so that there is minimal impact to the project;
- Prepare Job Safety Analysis (JSA) for any work that is not included in the Site Safety Plan;
- Preparation of maintenance and repair logs for ERH equipment;
- Daily work reports to be kept in a logbook and submitted to the ERH PM;

- Identification of any equipment or problems that effect operation, and submit proactive recommendations for solving operational or equipment problems;
- Submit MSDSs, health and safety logs, AHAs, and other operational forms and logs to the Site Operations Manager;
- Supervision of the ERH Technician and specialty subcontractors; and
- Ensuring there are sufficient and appropriate tools, spares, manuals, etc. for performance of the job.

### **8.5.3 ERH Technician**

The role of the ERH Technician is to assist the ERH Site Manager in performance of all operation and maintenance activities needed for safe and effective operation of the ERH equipment. The ERH Technician reports to the ERH Site Manager, and is assigned work orders from the ERH Site Manager.

Tasks of the ERH Technician are similar to the ERH Site Manager, and at a minimum will include:

- Safe and optimal operation of all ERH equipment;
- Performing or overseeing operation and maintenance of all ERH equipment;
- Recording all field, ERH, and condenser data as per the SAP;
- Coordinating field and maintenance activities with other site workers so that there is minimal impact to the project;
- Prepare Job Safety Analysis (JSA) for any work that is not included in the Site Safety Plan;
- Preparation of maintenance and repair logs for ERH equipment;
- Daily work reports to be kept in a logbook and submitted to the ERH PM;
- Identification of any equipment or problems that effect operation, and submit proactive recommendations for solving operational or equipment problems;
- Submit MSDSs, health and safety logs, AHAs, and other operational forms and logs to the TN&A Site Manager; and
- Ensuring there are sufficient and appropriate tools, spares, manuals, etc. for performance of the job.

## **9.0 WASTE MANAGEMENT**

The operation of the extraction and treatment system will generate contaminated groundwater, hazardous wastes, and industrial wastes. The Waste Management Plan (WMP) (Attachment 3) describes the waste management activities and procedures that will be used to handle waste disposal.

During operation, TN&A and its subcontractors are responsible for managing California, CERLA and RCRA-regulated wastes in accordance with procedures outlined in the WMP. TN&A is responsible for oversight of the waste management activities to ensure compliance with all requirements for regulated wastes. TN&A will conduct a waste management assessment to document that waste activities are in compliance with site procedures and California, CERCLA, and RCRA regulations (refer to Waste Management Plan, Attachment 3)

USEPA will pre-approve the facility, which will be receiving the hazardous waste streams. Waste disposal will be a joint effort between TN&A and its subcontractors. TN&A will approve the waste disposal contractor acquisition, costs or waste disposal, and determine the type of analytical testing needed for disposal of the waste. EPA is responsible for receiving ownership of regulated wastes and signing for EPA applicable paperwork and analytical results to facilitate compliance with off-site shipping and disposal.

### **9.1 EXAMPLES OF WASTE STREAMS**

The following types of waste are anticipated from the operation and maintenance of the treatment system:

- Spent carbon from vapor and water treatment;
- Bag filters from the liquid process line;
- Contaminated PPE;
- Absorbent pads used for cleaning up small leaks and spills;
- Cleaning rags;
- Partially-filled and empty containers of oil used for maintenance;
- Paint cans and aerosol spray cans;
- Disposable sampling equipment; and
- Trash and rubbish generated by site housekeeping.

Waste will be segregated into regulated and non-regulated streams to minimize generation and disposal of hazardous waste and material.

### **9.2 TRANSPORTATION AND DISPOSAL**

Transportation of waste will be in compliance with the regulatory requirement of the U.S. Department of Transportation according to 49 CFR 170-180. Disposal of regulated wastes from the remediation activities requires compliance with all applicable regulations, including those pursuant to containers, labeling, storage, notifications, manifests, transport, placarding, and the requirements of the receiving disposal facility.

## **10.0 SECURITY AND SITE ACCESS CONTROL**

The roles and responsibilities of TN&A and its prime contractors, TRS and Earth Tech, regarding site access, site control and oversight during operation are described below. Additional information regarding site security during non-working hours is still being formulated, but will be in place prior to system start, and added as an addendum to this MOMP.

Access to the Pemaco site will be restricted and controlled to mitigate health and safety, and environmental hazards to the public, workers, and environment; limit access to authorized and/or trained personnel and escorted visitors; and to control the physical assets of EPA, TN&A and their subcontractors.

Media representatives, regulators, and other members of the public seeking entry are to be referred to the EPA Project Manager or designated representative without granting site entry. Explosives, minors, domestic animals, firearms, alcohol, or illegal drugs will not be brought on site under any circumstances.

### **10.1 SITE ACCESS CONTROL**

TN&A is responsible for site controls associated with the exclusion and contaminant reduction zones and TN&A field office, project work areas, and associated structures. All persons entering the Pemaco work area must sign the TN&A Sign-In-Log and receive a safety briefing commensurate with the areas they access and the work activities.

Security and site access controls will be documented through TN&A's Site Safety and Health Plan (SSHP). TN&A will provide oversight, inspection and access-controlled fencing and gates to control the boundaries of the area under remediation. Within the remediation area will be a control zone, which will require specific training and/or personnel protective equipment (PPE) prior to access. Access control and Occupational Safety and Health Administration (OSHA) required warnings and informational signs would designate limited access areas. Hazard communication, safety briefings, training, and access sign-in and sign-out logs will be documented and reviewed for compliance. The TN&A Sample Manager will document any security/access deviations for the TN&A Project Manager, who will then follow up with a determination of cause and make recommendations to mitigate future access violations.

### **10.2 SUBCONTRACTOR RESPONSIBILITY**

Subcontractors on site will be responsible for ensuring all their workers, visitors, suppliers, vendors and subcontractors will only access the site through the proper entry and cannot work until they have signed the Sign-In-Log and received an appropriate safety briefing. TN&A must be notified 24 hours in advance of non-TN&A corporate employees, technical consultants or other visitors, not directly working on the project, who plan to visit the site. TN&A will seek approval from the USEPA Project Manager (or designed individual) for access permission for these visitors.

## **11.0 HEALTH AND SAFETY MANAGEMENT**

All work performed within the scope of this plan must be accomplished in a manner that protects the health and safety of the workers and environment, and complies with all applicable federal, state, local, and employer requirements. This section provides an overview of the management system for implementing safety requirement and ensuring a safe work environment. Detail related to specific health and safety requirements and procedures are not included in this plan, but are defined in the TN&A's Accident Prevention Plan/Site Specific Safety Plan (APP/SSHP), and Accident Hazards Analysis (AHAs) provided by TRS and ERM, the builder of the extraction and treatment system.

### **11.1 TN&A'S ROLE**

TN&A is ultimately responsible for ensuring that all work performed for USACE and EPA at the site is performed safely and in accordance with federal, state, and local requirements. As part of this responsibility, TN&A will communicate applicable health and safety requirements to TRS and Earth Tech, and provide oversight and inspections of site activities to ensure compliance with such requirements. TN&A will provide direction to all site personnel to correct unsafe or noncompliance acts or conditions.

TN&A is responsible for establishing methods by which work will be performed to ensure a safe work environment that complies with all applicable requirements. TN&A will:

- Inspect and/or provide all required personal protective equipment, exposure monitoring equipment and instruments, area posting and control signs and barriers, and other associated health and safety supplies.
- Plan and perform all work using an Integrated Safety Management System (ISMS) process equivalent to the model applied throughout USACE sites.

#### **ISMS Safety Management Functions**

1. Define the scope of work,
2. Analyze hazards,
3. Develop and implement hazard controls,
4. Perform work within controls, and
5. Provide feedback and continuous improvement.

#### **ISMS Guiding Principles**

1. Line management responsibility for safety,
  2. Clear roles and responsibilities,
  3. Competence commensurate with responsibilities,
  4. Balanced priorities,
  5. Identification of safety standards and requirements,
  6. Hazard controls tailored to work being performed, and
  7. Operations authorization.
- Assign a designated and qualified safety professional to the project during the operation phase of the project. The safety professional will work with the operations team in performing activity hazard analysis, determining appropriate safety controls, prescribing personal protective monitoring equipment, performing and documenting personnel

exposure monitoring, and assisting with any required investigation and analysis of work related accidents, injuries, or near misses. During routine operation of the remediation process system, an individual with health and safety experience commensurate with the process hazards will be designated as the health and safety competent person.

- Maintain and communicate a policy whereby every individual on site has the authority to stop work if imminently unsafe conditions exist.
- Develop a Site-specific Health and Safety Plan (SSHP)
- Develop an Activity Hazard Analysis (AHA) for major activities associated with the anticipated scope of work.
- Notify the Project Manager immediately of any work-related accident resulting in personnel injury or illness, environmental spill or release of regulated material, near miss occurrence, or other event that would require report in accordance with USACE requirements.
- Ensure that any emergency response actions related to their activities or involving their personnel are conducted in accordance with applicable site-specific SSHPs and procedures.

## **11.2 HAZARD ANALYSIS – ACCIDENT PREVENTION PLAN**

TN&A, working with TRS and Earth Tech, will evaluate all work activities and perform a hazard analysis for the operation of the ERH and treatment system. The format for the documented analyses will follow the EM 385-1-1, 3 Nov 2003 AHA format and will include at a minimum the specific hazards associated with each task, the controls or procedures associated with performance of the task, personal protective equipment required, exposure monitoring requirements, and any work limitations or restriction for each task. Site workers will be an integral part of the hazard analysis process.

## **11.3 HEALTH AND SAFETY DOCUMENTS**

TN&A maintains a corporate Health and Safety Manual as the primary document that describes TN&A's commitment to worker protection and defines specific policies related to worker health and safety. This manual is structured to provide standards for routine hazards and associated controls related to general industry and construction hazards.

To implement the health and safety standards for the Pemaco site, a site-specific Accident Prevention Plan/Site Specific Health and Safety Plan (APP/SSHP) was written to provide the framework for day-to-day implementation of the health and safety program.

TRS also has SSHPs that address the hazards and controls associated with their work performed at Pemaco. These SSHPs at a minimum meet the requirements of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response". The subcontractors' SSHPs are subordinate to and will not conflict with the TN&A SSHP for activities at Pemaco.

## **11.4 EMERGENCY RESPONSE ACTIONS**

Emergencies within the scope of this document may include accidents or releases of chemicals, fires, or natural events such as a flood, earthquake, or other natural disaster. The site-specific

APP/SSHPS and Emergency Response Plan ([Attachment 4](#)) contain personnel responsibilities and actions required by TN&A and subcontractors in the event of such emergency.

## **11.5 DOCUMENTATION AND RECORD KEEPING**

Health and safety activities will be formally documented. Among the types of records included are:

- Record of tailgate safety meeting,
- Activity Hazard Analyses (AHAs),
- Access control logs,
- Training records,
- Medical records,
- Exposure monitoring data,
- Instrument calibration data,
- Various safety work permits,
- Routine inspection reports,
- Safety inspections, and
- SSHPS and procedures.



## 12.0 COMPLIANCE AND ENVIRONMENTAL PROTECTION

Following environmental regulations, compliance sampling and recordkeeping is necessary for a safe and hazard-free operation. The objectives of this MOMP and associated plans contained in the appendices have been written for this goal. The EPP ([Attachment 1](#)) and the WMP ([Attachment 3](#)) provide the framework for addressing potential environmental releases as a result of the operation of the treatment system.

The effectiveness of the vapor extraction system will be initially determined by source testing and then by frequent analysis of the vapor stream. Any excursions from the proscribed emissions as determined by the dispersion model ([Attachment 1](#)) will be immediately reported to EPA and mitigation measures will be quickly enacted. The SAP ([Attachment 2](#)) describes the frequency and method for sampling both the air and water streams.

The referenced plans include:

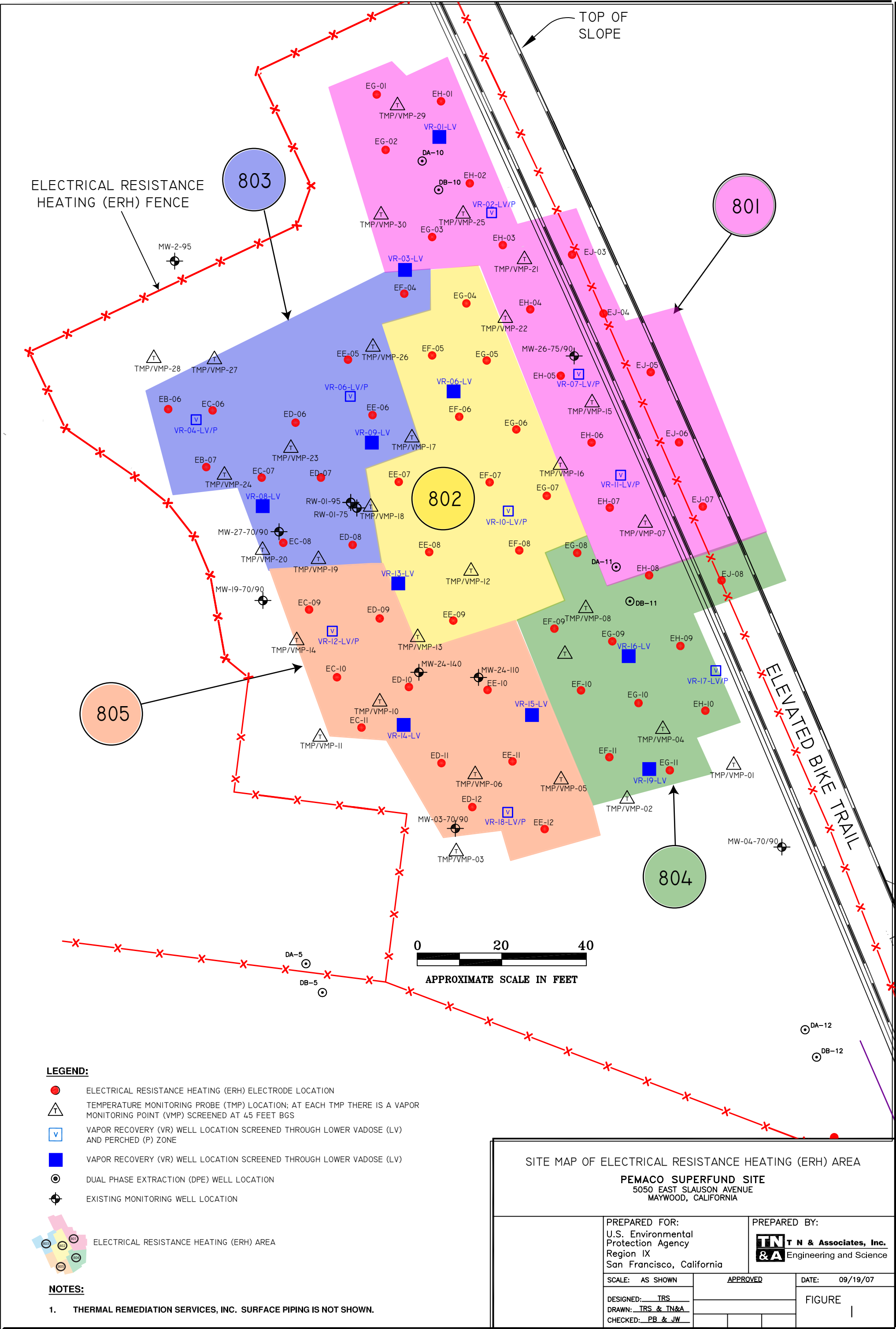
Attachment 1	Environmental Protection Plan,
Attachment 2	Sampling and Analysis Plan,
Attachment 3	Waste Management Plan, and
Attachment 4	Emergency Response Plan

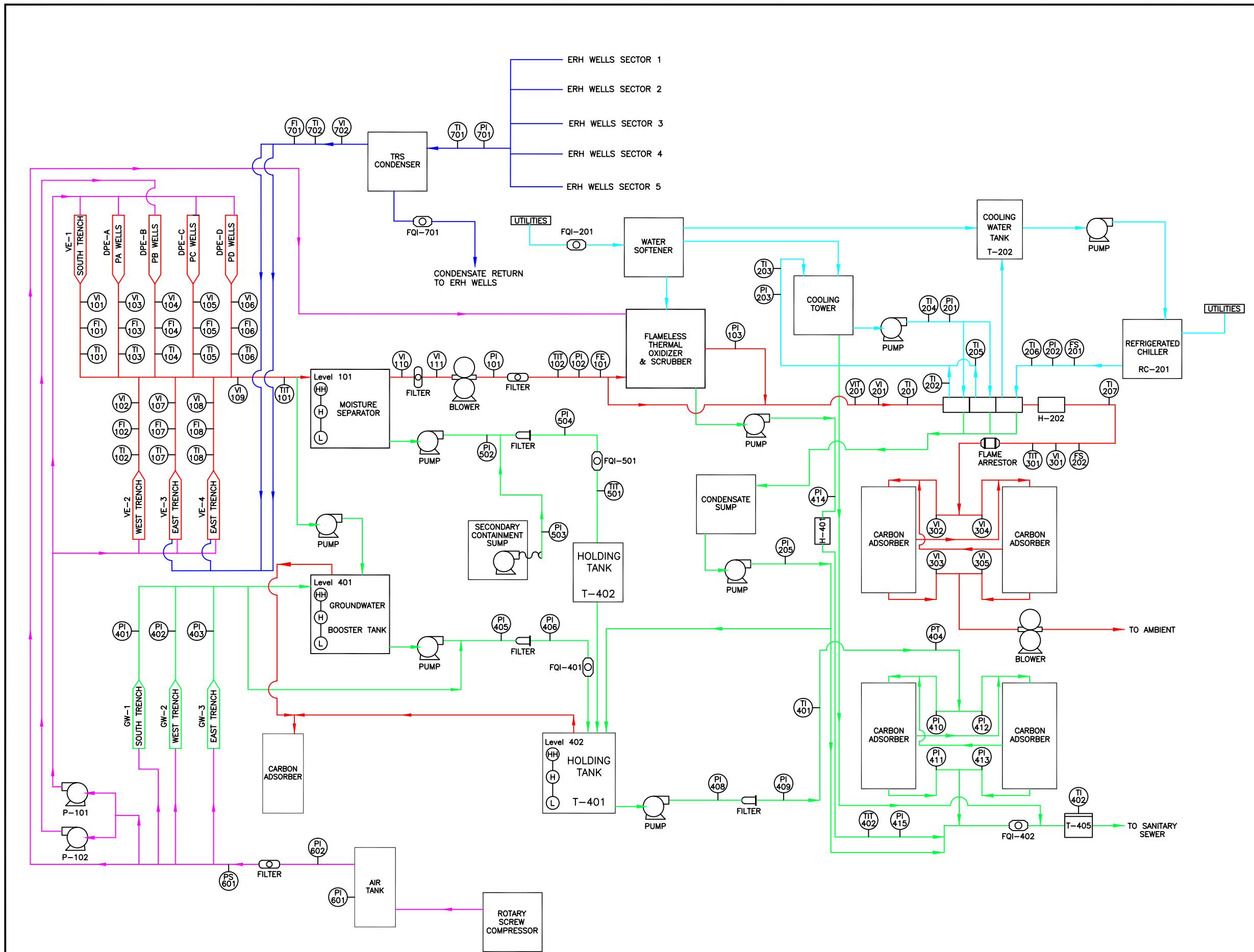
These plans are all part of an integrated approach for the management, operation and maintenance of the Pemaco remedial action. In addition, the ability to easily access operation and sampling data via the project team web site will facilitate treatment system optimization, and enable the project managers and operators to immediately respond to permit excursions.

## 13.0 REFERENCES

- T N & Associates, Inc. (TN&A). 2006. *Final Remedial Design Report*, Pemaco Superfund Site, Maywood, California, August.
- TN&A, 2007. *Enhanced In Situ Bioremediation Pilot Study*, Pemaco Superfund Site, Maywood, California, February.
- Thermal Remediation Services, Inc. (TRS). 2006. *Final Work Plan for In Situ Thermal Remediation (Electrical Resistance Heating)*, Pemaco Superfund Site, Maywood, California 90270. 21 September.
- United States Environmental Protection Agency (USEPA). 2005. Record of Decision for Pemaco Maywood Superfund Site, Maywood, California. EPA ID: CAD980737092. 13 January.
- TN&A, 2006. *Final Remedial Design Report*, Pemaco Superfund Site, TN&A, Pemaco Superfund Site, Maywood, California, September.

## FIGURES





**LEGEND:**

- SOIL VAPOR LINES  
100 Series = Before FTO  
300 Series = After FTO
  - NON-CONTACT CLEAN WATER LINES  
200 Series
  - GROUNDWATER LINES  
400 Series = Exposition Water Treated by GAC  
500 Series = Condensate from Extraction Wells
  - COMPRESSED AIR LINES  
600 Series = Pressurized Air Supply Line
  - TRS CONDENSER VAPOR AND WATER LINES  
700 Series = TRS Vapor and Water Streams  
800 Series = TRS Vapor and Water Streams
- FE 101 FLOW ELEMENT  
PI 101 PRESSURE INDICATORS  
PT 101 PRESSURE TRANSMITTERS  
TI 101 TEMPERATURE INDICATORS  
TIT 101 TEMPERATURE INDICATOR TRANSMITTERS  
VI 101 VACUUM INDICATORS  
FQI-401 FLOW TOTALIZERS

**PEMACO COMPOUND  
PHYSICAL MONITORING LOCATIONS**

PEMACO SUPERFUND SITE  
5050 EAST SLAUSON AVENUE  
MAYWOOD, CALIFORNIA

PREPARED FOR:  
U.S. Environmental  
Protection Agency  
Region IX  
San Francisco, California

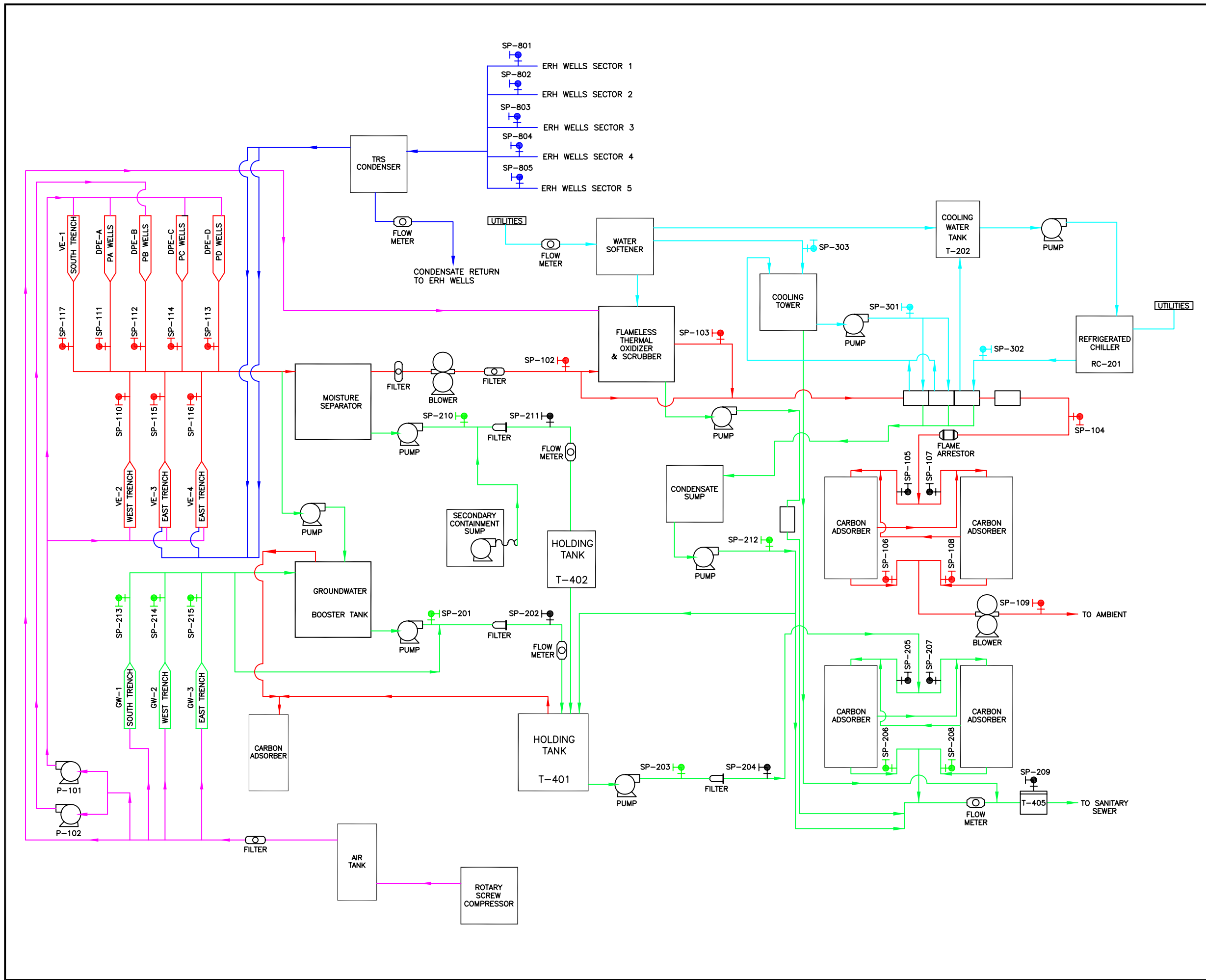
PREPARED BY:  
**TN** T N & Associates, Inc.  
& A Engineering and Science

SCALE: AS SHOWN  
DESIGNED: JW & GN  
DRAWN: DC  
CHECKED: JW

APPROVED  
DRAFT-FINAL

DATE: 9/10/07

FIGURE  
2



**LEGEND:**

- NON-CONTACT CLEAN WATER LINES
- SOIL VAPOR LINES
- GROUNDWATER LINES
- COMPRESSED AIR LINES
- TRS CONDENSER VAPOR AND WATER LINES

**SAMPLE PORTS:**

- SP-101 SP-1## Indicate Vapor Location
- SP-201 SP-2## Indicate Water Location
- SP-301 SP-3## Indicate Cooling Water Location
- SP-801 SP-8## Indicate Sector Sampling Location
- SP-### Additional Port Available for Sampling

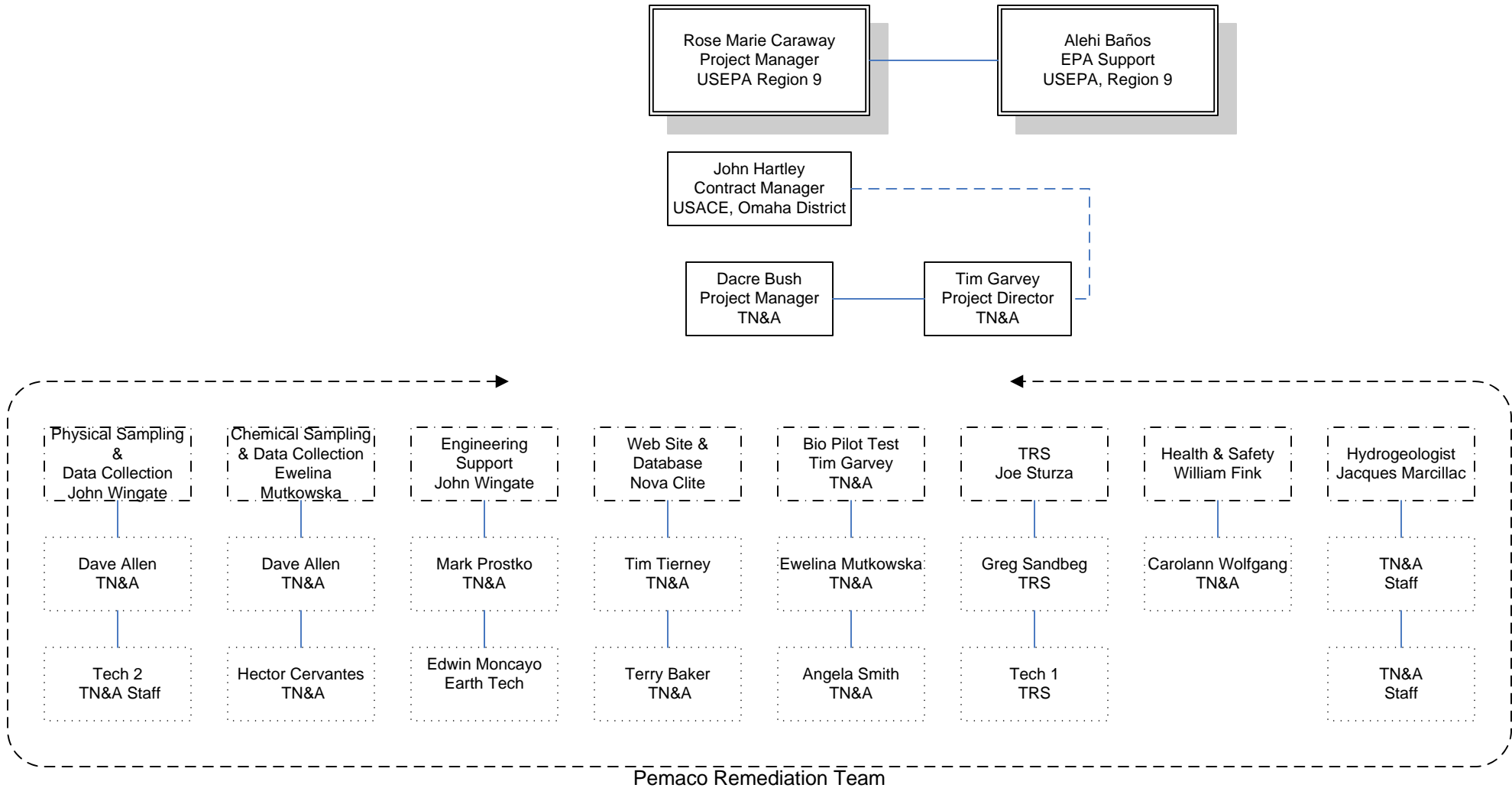
**NOTES:**

Vapor and water samples will be collected at select sampling ports in accordance with sampling program presented in Table 10 of the SAP (TN&A, 2007).

**PEMACO COMPOUND  
SAMPLE PORTS FOR CHEMICAL MONITORING**  
PEMACO SUPERFUND SITE  
5050 EAST SLAUSON AVENUE  
MAYWOOD, CALIFORNIA

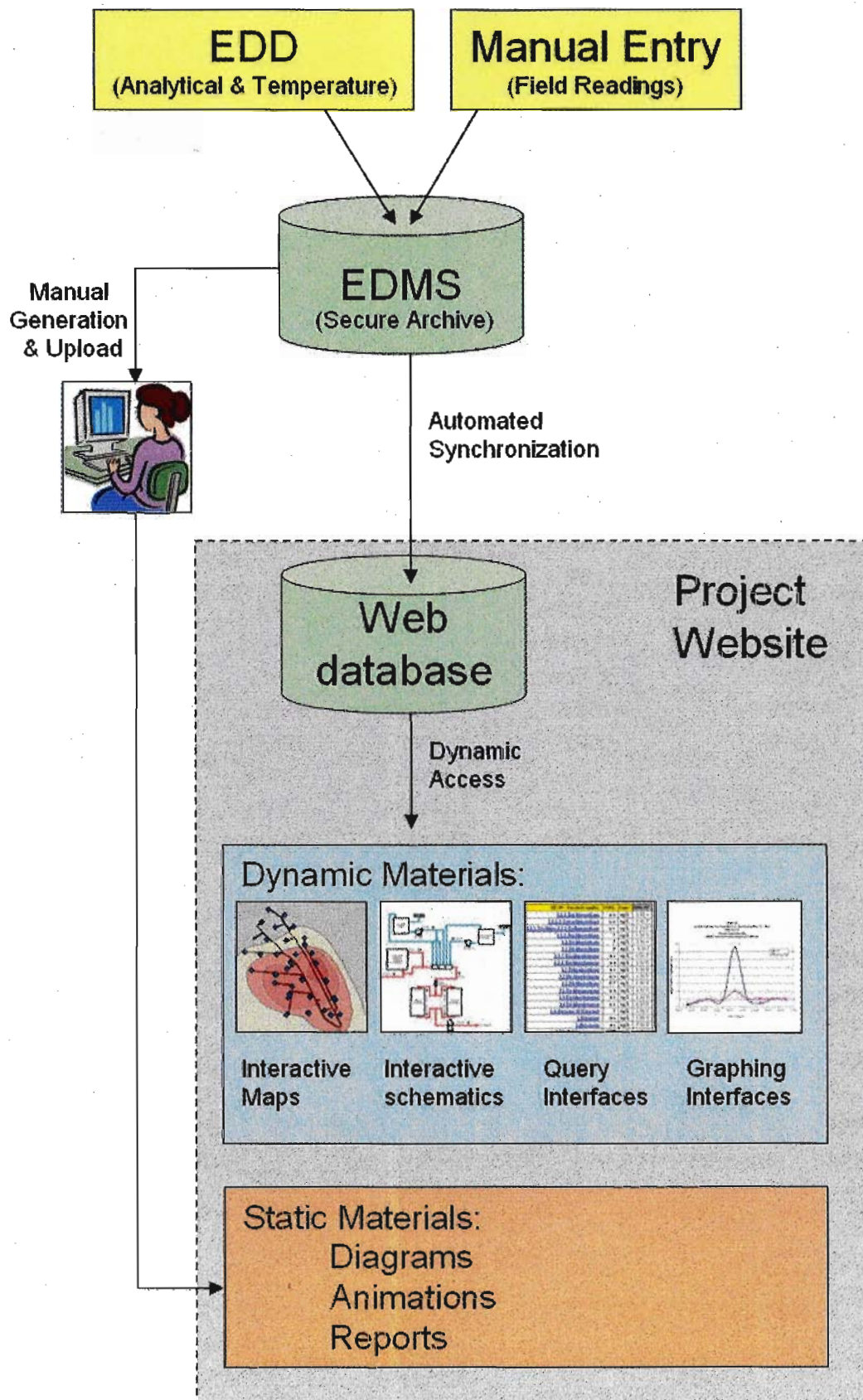
PREPARED FOR: U.S. Environmental Protection Agency Region IX San Francisco, California		PREPARED BY: <b>TN &amp; Associates, Inc.</b> & A Engineering and Science	
SCALE: AS SHOWN	APPROVED DRAFT-FINAL	DATE: 9/10/07	FIGURE 3
DESIGNED: JW & GN			
DRAWN: DC			
CHECKED: JW			

**Figure 4**  
**Organizational Chart**  
 Management and Operation & Maintenance Plan (MOMP)  
 for the Multi-Phase Extraction and Treatment System  
 Pemaco Superfund Site  
 Maywood, California





**FIGURE 5**  
**Data Management Flow Diagram**  
**Pemaco Superfund Site, Maywood, California**





## TABLES

**Table 1**  
**ERH Design Parameters for the Extraction and Treatment System**  
**Pemaco Superfund Site, Maywood, CA**

<b>Process Stream</b>	<b>Maximum Flow or Vacuum</b>
Total Vapor Flow into TRS Condenser	560 scfm
Vacuum into Condenser Unit	12 in. Hg
Vacuum at well heads in ERH area	8 in. Hg.(est.)

**Table 2. Process Vapor and Water Monitoring for Chemical Parameters  
Pemaco Superfund Site, Maywood, CA**

Sample Port ID	Location Description	Sample Collection Device & Method	Analysis & Method	Frequency	Lab	TAT (days)
<b>Vapor</b>						
SP-102	Pre-FTO	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	5 days / week	Reg 9	3
		PID	Volatiles	5 days / week	Reg 9	Real time
SP-103 (or SP-104 if not available for sampling)	Post FTO, pre-GAC; Post-Chiller	6 L Summa (grab)	VOCs; TO-15 SIM	2x per month	Air Toxics	5
		Glass fiber filter	Dioxin/Furans; EPA-23 (stack)	2x first month, then TBD	Specialty Lab	15
SP-105	Pre-Primary GAC Vessel	PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-106	Pre-Secondary GAC Vessel	PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-107	Post-Primary GAC Vessel	PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-108	Post-Secondary GAC Vessel	PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-105 or SP-106 (only if SP-104 is not sampled)	Pre-Primary GAC Vessel (V-104/V-105)	400 ml Summa (grab)	VOCs; TO-15	TBD	Reg 9	3
SP-107 or SP-108 (depending on routed flow)	Post- Primary GAC Vessel; Pre-Secondary GAC Vessel	6 L Summa (grab)	VOCs; TO-15SIM	Weekly	Air Toxics	3
		6 L Summa (grab)	1,4-dioxane by GC/MS	2x first month, then TBD	Local Lab	Normal
SP-109 Source Testing	FTO Inlet, Outlet of Scrubber, Outlet of Vapor Conditioning Package, Outlet of Carbon	Various per SCAQD	Various per SCAQD; Refer to <a href="#">Table X</a>	Baseline and @ 100 deg C	Specialty Lab	Normal
SP-110	West Trench Wells DAB-8, DA/DB-1 to DA/DB-7 (15 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	Weekly	Field Measurement	Real time
SP-111	Wells PA-1 to PA-5 (5 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	Weekly	Field Measurement	Real time
SP-112	Wells PB-1 to PB-7 (7 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	Weekly	Field Measurement	Real time
SP-113	Wells PD-1, PD-4 to PD-9 (7 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	Weekly	Field Measurement	Real time
SP-114	Wells PC-1, PC-4 to PC-6 (4 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	Weekly	Field Measurement	Real time
SP-115	ERH East Trench Wells; DA/DB-7 to DA/DB-10 (6 wells); 58 electrodes & 19 VRs	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-116	ERH East Trench Wells; DA/DB-11 to DA/DB-12 (4 wells); 58 electrodes & 19 VRs	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5
		PID	Volatiles	5 days/ week	Field Measurement	Real time
SP-117	South trench wells DAB-1 to DAB-7 (7 wells)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Weekly	Reg 9	5

**Table 2. Process Vapor and Water Monitoring for Chemical Parameters  
Pemaco Superfund Site, Maywood, CA**

Sample Port ID	Location Description	Sample Collection Device & Method	Analysis & Method	Frequency	Lab	TAT (days)
<b>Water</b>						
SP-201 or SP-202	Post-GW Booster Tank (V-110) or By-pass; pre-Bag Filter (F-107/F-108)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	2/ month	Local Lab	7
SP-203	From wells, condensate to Holding Tank (V-106), Pre-Bag Filter (F-109/F-110)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	Weekly	Local Lab	7
SP-207 or SP-208	Post-Primary GAC Vessel (V-107) (depending on routed flow)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	Weekly	Local Lab	7
		Sample port (grab)	Temperature, pH, flow rate	Weekly	Field Measurement	Real time
		Sample port (grab)	Turbidity	Baseline	Field Measurement	Real time
		Sample port (24-hr composite) various containers	COD, SS, and Lead	Baseline	Local Lab	7
		Sample port (grab) various containers	pH * , Dissolved Sulfide, Oil & Grease, & SVOCs		Local Lab	7
		Sample port (24-hr composite) various containers	COD, SS, and Lead	1 sample/ 3 months	Local Lab	7
		Sample port (grab) various containers	pH * , Dissolved Sulfide, Oil & Grease, & SVOCs	1 sample/ 3 months	Local Lab	7
SP-210	From Moisture Separator (V-101); Pre-Bag Filter (F-105/F-106)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	Weekly	Local Lab	7
SP-212	From FTO vapor conditioning (H-101); pre-Holding Tank (V-106) or bypass to discharge	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	Weekly	Local Lab	7
SP-213	From Exposition Wells South Trench DAB-1 to DAB-7 (7 wells)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	2/ month	Local Lab	7
SP-214	From Exposition Wells West Trench DAB-8, DA/DB-1 to DA/DB-7 (15 wells)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	2/ month	Local Lab	7
SP-215	From Exposition Wells East Trench DA/DB-8 to DA/DB-12 & MW24-140 (11 wells)	Sample port (grab) 3 vials unpreserved	VOCs; EPA 8260B	2/ month	Local Lab	7
SP-301	Cooling water supply to cooling tower	Sample port (grab)	TDS, pH; HACH meter	Weekly	Field Measurement	Real time
SP-302	Cooling water supply to chiller	Sample port (grab)	TDS, pH; HACH meter	Weekly	Field Measurement	Real time

**Notes:**

\* Laboratory analysis for pH is required per Sanitation District of Los Angeles County Permit No. 16961

**Acronyms:**

COD - Chemical Oxygen Demand

SCAQMD - South Coast Air Quality Management District

SS - Suspended Solids

TDS - total dissolved solids

**Table 3. Monitoring Program for Process Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

Item Description	P&ID #	Measurement Method	Units	Frequency
Differential Pressure Indicating Transmitter	dPIT-101	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
Flow Element on FTO	FE-101	SCADA read-out to PLC; manual entry to database	scfm	7 days/ week
Vapor Flow Indicators	FI-101	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-102	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-103	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-104	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-105	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-106	Pitot tube; manual	acfm (recorded) scfm (converted)	1/ week
	FI-107	Pitot tube; manual	acfm (recorded) scfm (converted)	5 days/ week
	FI-108	Pitot tube; manual	acfm (recorded) scfm (converted)	5 days/ week
Flow Totalizers (liquids)	FQI-201	Meter; manual	gallons (recorded) gal/min (converted)	5 days/ week
	FQI-401	Meter; manual	gallons (recorded) gal/min (converted)	5 days/ week
	FQI-402	Meter; manual	gallons (recorded) gal/min (converted)	5 days/ week
	FQI-501	Meter; manual	gallons (recorded) gal/min (converted)	5 days/ week
Pressure Indicators	PI-101	Manual gauges	psi or in. H2O	5 days/ week
	PI-102	Manual gauges	psi or in. H2O	5 days/ week
	PI-103	Manual gauges	psi or in. H2O	5 days/ week
	PI-201	Manual gauges	psi or in. H2O	5 days/ week
	PI-202	Manual gauges	psi or in. H2O	5 days/ week
	PI-203	Manual gauges	psi or in. H2O	5 days/ week
	PI-401	Manual gauges	psi or in. H2O	5 days/ week
	PI-402	Manual gauges	psi or in. H2O	5 days/ week
	PI-403	Manual gauges	psi or in. H2O	5 days/ week
	PI-404	Manual gauges	psi or in. H2O	5 days/ week
	PI-405	Manual gauges	psi or in. H2O	5 days/ week
	PI-406	Manual gauges	psi or in. H2O	5 days/ week
	PI-407	Manual gauges	psi or in. H2O	5 days/ week
	PI-408	Manual gauges	psi or in. H2O	5 days/ week
	PI-409	Manual gauges	psi or in. H2O	5 days/ week
	PI-410	Manual gauges	psi or in. H2O	5 days/ week
	PI-411	Manual gauges	psi or in. H2O	5 days/ week
	PI-412	Manual gauges	psi or in. H2O	5 days/ week
	PI-413	Manual gauges	psi or in. H2O	5 days/ week
	PI-414	Manual gauges	psi or in. H2O	5 days/ week
	PI-415	Manual gauges	psi or in. H2O	5 days/ week
	PI-501	Manual gauges	psi or in. H2O	5 days/ week
	PI-502	Manual gauges	psi or in. H2O	5 days/ week
	PI-503	Manual gauges	psi or in. H2O	5 days/ week
	PI-504	Manual gauges	psi or in. H2O	5 days/ week
	PI-601	Manual gauges	psi or in. H2O	5 days/ week
	PI-602	Manual gauges	psi or in. H2O	5 days/ week

**Table 3. Monitoring Program for Process Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

Item Description	P&ID #	Measurement Method	Units	Frequency
Pressure Transmitters	PT-101	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	PT-401	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	PT-402	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	PT-403	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	PT-404	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
Temperature Elements	PT-501	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	TE-201	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TE-202	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
Temperature Indicators	TI-101	Manual gauges	deg C/ F	5 days/week
	TI-102	Manual gauges	deg C/ F	5 days/week
	TI-103	Manual gauges	deg C/ F	5 days/week
	TI-104	Manual gauges	deg C/ F	5 days/week
	TI-105	Manual gauges	deg C/ F	5 days/week
	TI-106	Manual gauges	deg C/ F	5 days/week
	TI-107	Manual gauges	deg C/ F	5 days/week
	TI-108	Manual gauges	deg C/ F	5 days/week
	TI-201	Manual gauges	deg C/ F	5 days/week
	TI-202	Manual gauges	deg C/ F	5 days/week
	TI-203	Manual gauges	deg C/ F	5 days/week
	TI-204	Manual gauges	deg C/ F	5 days/week
	TI-205	Manual gauges	deg C/ F	5 days/week
	TI-206	Manual gauges	deg C/ F	5 days/week
	TI-207	Manual gauges	deg C/ F	5 days/week
Temperature Indicator Transmitters	TIT-101	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-102	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-201	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-202	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-301	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-401	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-402	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
	TIT-501	SCADA read-out to PLC; manual entry to database	deg C/ F	7 days/ week
Vacuum Indicators	VI-101	Manual gauges	psi or in. H2O	5 days/week
	VI-102	Manual gauges	psi or in. H2O	5 days/week
	VI-103	Manual gauges	psi or in. H2O	5 days/week
	VI-104	Manual gauges	psi or in. H2O	5 days/week
	VI-105	Manual gauges	psi or in. H2O	5 days/week
	VI-106	Manual gauges	psi or in. H2O	5 days/week
	VI-107	Manual gauges	psi or in. H2O	5 days/week
	VI-108	Manual gauges	psi or in. H2O	5 days/week
	VI-109	Manual gauges	psi or in. H2O	5 days/week
	VI-110	Manual gauges	psi or in. H2O	5 days/week
	VI-111	Manual gauges	psi or in. H2O	5 days/week
	VI-201	Manual gauges	psi or in. H2O	5 days/week
	VI-301	Manual gauges	psi or in. H2O	5 days/week
	VI-302	Manual gauges	psi or in. H2O	5 days/week
	VI-303	Manual gauges	psi or in. H2O	5 days/week
	VI-304	Manual gauges	psi or in. H2O	5 days/week
	VI-305	Manual gauges	psi or in. H2O	5 days/week
	VI-306	Manual gauges	psi or in. H2O	5 days/week
Vacuum Transmitters	VT-101	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week
	VT-201	SCADA read-out to PLC; manual entry to database	psi or in. H2O	7 days/ week

**Table 4. Monitoring Program for Well Field Chemical Parameters  
Pemaco Superfund Site, Maywood, CA**

Monitoring Location ID	Monitoring Location	Sample Collection Device & Method	Analysis & Method	Frequency	Lab	TAT (days)
<b>Groundwater</b>						
ERH Interior: DA/B-10; DA/B-11, MW-26-75/90; RW-01-75/95; MW-24-110/140; ERH Exterior: MW-03-70/90; MW-04-75/90; DA/B-4	10 monitoring wells with special hot sampling wellhead; 6 monitoring wells outside the ERH treatment area	Installed dedicated pumps	TCL VOCs; SOM01.1	Baseline	EPA CLP	7
		Multiparameter probe, flow-through cell	Field analyses (temperature, pH, conductivity, ORP, turbidity, DO);		Field measurement	na
ERH Interior: DA/B-10; DA/B-11, MW-26-75/90; RW-01-75/95; MW-24-110/140; ERH Exterior: MW-03-70/90; MW-04-75/90; DA/B-4	Hot Sampling during ERH for 10 interior; 6 exterior wells to ERH treatment area	Installed dedicated pumps	TCL VOCs; SOM01.1	Every 2 weeks or more frequently as needed during ERH operation	EPA CLP	7
		Multiparameter probe, flow-through cell	Field analyses (temperature, pH, conductivity, ORP, turbidity, DO);		Field measurement	0
DPE Expositions Wells DA-, DB-, DAB-	All Exposition Zone DPE wells (32)	Installed dedicated pumps; calibrated multi-parameter probe (at surface)	TCL VOCs; SOM01.1	Baseline	EPA CLP	Standard
DPE Expositions Wells DA-, DB-, DAB-	All Exposition Zone DPE wells (32)	Installed dedicated pumps; calibrated multi-parameter probe (at surface)	TCL VOCs; SOM01.1	Quarterly	EPA CLP	Standard
<b>Vapor</b>						
Five (5) sectors of VR wells (19)	Sampling locations tbd (5)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	once/week	EPA Reg. 9	3
		PID	Volatiles		Field measurement	Real time
VR-02P, VR-04P, VR-05P, VR-07P, VR-10P, VR-11P, VR-12P, VR-17P, VR-18P	TRS/TN&A Co-located VR Wells (9) Perched Zone	400 ml Summa or Tedlar; Grab sample	2 - 6 highest VOCs; TO-15 or GC or GC/MS	Baseline	EPA Reg. 9	Standard
		Draeger tube or PID	TCE or Volatiles		Field measurement	Real time
VR-02UV, VR-04UV, VR-05UV, VR-07UV, VR-10UV, VR-11UV, VR-12UV, VR-17UV, VR-18UV	TRS/TN&A Co-located VR Wells (9) Upper Vadose	Draeger tube or PID	TCE or Volatiles		Field measurement	Real time
VR-01P, VR-03P, VR-06P, VR-08P, VR-09P, VR-13P, VR-14P, VR-15P, VR-16P, VR-19P	TRS VR Wells (10) Perched Zone	Draeger tube or PID	TCE or Volatiles		Field measurement	Real time

**Table 4. Monitoring Program for Well Field Chemical Parameters  
Pemaco Superfund Site, Maywood, CA**

Monitoring Location ID	Monitoring Location	Sample Collection Device & Method	Analysis & Method	Frequency	Lab	TAT (days)
VR-02P, VR-04P, VR-05P, VR-07P, VR-10P, VR-11P, VR-12P, VR-17P, VR-18P	TRS/TN&A Co-located VR Wells (9) Perched Zone	400 ml Summa or Tedlar; Grab sample	2 - 6 highest VOCs; TO-15 or GC or GC/MS	Based on evaluation of vapor sector sampling	EPA Reg. 9	5
		Draeger tube or PID	TCE or Volatiles	Monthly; Weekly during ERH	Field measurement	Real time
VR-02UV, VR-04UV, VR-05UV, VR-07UV, VR-10UV, VR-11UV, VR-12UV, VR-17UV, VR-18UV	TRS/TN&A Co-located VR Wells (9) Upper Vadose	Draeger tube or PID	TCE or Volatiles	Monthly; Weekly during ERH	Field measurement	Real time
VR-01P, VR-03P, VR-06P, VR-08P, VR-09P, VR-13P, VR-14P, VR-15P, VR-16P, VR-19P	TRS VR Wells (10) Perched Zone	Draeger tube or PID	TCE or Volatiles	Monthly; Weekly during ERH	Field measurement	Real time
VMP-01 through VMP-30	VMPs inside TMPs; 21 within ERH & 9 outside ERH area	Tedlars (grab)	2 - 6 highest VOCs; GC or GC/MS	At thermal setpoints, and 1/ month afterwards	Local lab	2
		Dreager	Volatiles	At thermal setpoints, and 1/ month afterwards	Field measurement	Real time
DPE Wells PA-, PB-, PC-, PD-, DA-, DB-, and DAB-	All DPE Wells (55)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	Baseline	EPA Reg. 9	Standard
		PID	Volatiles		Field measurement	Real time
DPE Wells PA-, PB-, PC-, PD-, DA-, DB-, and DAB-	All DPE Wells (55)	400 ml Summa (grab)	2 - 6 highest VOCs; TO-15	TBD	EPA Reg. 9	5
		PID	Volatiles	Weekly	Field measurement	Real time

**Acronyms:**

CLP - Contract Laboratory Program  
DPE - dual-phase extraction  
ERH - electrical resistant heating  
PID - photoionization detector  
TBD - to be determined

**Acronyms (Continued):**

TCE - trichloroethene  
TCL - target analyte list  
TMP - Temperature monitoring probe  
VMP - vapor monitoring probe  
VOC - volatile organic compounds  
VR - vapor recovery



**Table 5. Monitoring Program for Well Field Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

No.	Well ID	Associated Hydrogeologic Unit	Well Type	Remedial Area <sup>(1)</sup>	Measurement	Frequency
1	MW-01-80	A and B Zones	Monitoring	outside ERH	--	--
2	MW-02-95	B Zone	Monitoring	outside ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
3	MW-03-70	A Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
4	MW-03-90	B Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
5	MW-04-75	A Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
6	MW-04-90	B Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
7	MW-05-105	C Zone	Monitoring	outside ERH	--	--
8	MW-05-135	D Zone	Monitoring	outside ERH	--	--
9	MW-05-85	A and B Zones	Monitoring	outside ERH	--	--
10	MW-06-85	B Zone	Monitoring	outside ERH	--	--
11	MW-07-130	D Zone	Monitoring	outside ERH	--	--
12	MW-07-75	A Zone	Monitoring	outside ERH	--	--
13	MW-08-70	A Zone	Monitoring	outside ERH	--	--
14	MW-08-85	B Zone	Monitoring	outside ERH	--	--
15	MW-09-70	A Zone	Monitoring	outside ERH	--	--
16	MW-09-85	B Zone	Monitoring	outside ERH	--	--
19	MW-10-75	A Zone	Monitoring	outside ERH	--	--
20	MW-10-90	B Zone	Monitoring	outside ERH	--	--
17	MW-10-110	C Zone	Monitoring	outside ERH	--	--
18	MW-10-170	E Zone	Monitoring	outside ERH	--	--
21	MW-11-100	C Zone	Monitoring	outside ERH	--	--
22	MW-12-150	D Zone	Monitoring	outside ERH	--	--
23	MW-12-70	A Zone	Monitoring	outside ERH	--	--
24	MW-12-90	B Zone	Monitoring	outside ERH	--	--
25	MW-13-85	B Zone	Monitoring	outside ERH	--	--
26	MW-14-80	A Zone	Monitoring	outside ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
27	MW-14-90	B Zone	Monitoring	outside ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
28	MW-19-70	A Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
29	MW-19-90	B Zone	Monitoring	perimeter ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
30	MW-20-70	A Zone	Monitoring	outside ERH	--	--
31	MW-20-85	B Zone	Monitoring	outside ERH	--	--
32	MW-21-80	A Zone	Monitoring	outside ERH	--	--
33	MW-21-90	B Zone	Monitoring	outside ERH	--	--
34	MW-22-75	A Zone	Monitoring	outside ERH	--	--
35	MW-22-90	B Zone	Monitoring	outside ERH	--	--
36	MW-23-110	C Zone	Monitoring	outside ERH	--	--
37	MW-23-145	D Zone	Monitoring	outside ERH	--	--
38	MW-24-110	C Zone	Monitoring	within ERH	--	--
39	MW-24-140	D Zone	Monitoring	within ERH	--	--
40	MW-25-110	C Zone	Monitoring	outside ERH	--	--
41	MW-25-130	D Zone	Monitoring	outside ERH	--	--
42	MW-26-75	A Zone	Monitoring	within ERH	Water level; bubbler	Baseline, end of start-up, and monthly through ERH operation
43	MW-26-90	B Zone	Monitoring	within ERH	Water level; bubbler	Baseline, end of start-up, and monthly through ERH operation
44	MW-27-70	A Zone	Monitoring	within ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
45	MW-27-90	B Zone	Monitoring	within ERH	Water level	Baseline, end of start-up, and monthly through ERH operation
46	RW-01-70	A Zone	Monitoring	within ERH	Water level; bubbler	Baseline, end of start-up, and monthly through ERH operation
47	RW-01-95	B Zone	Monitoring	within ERH	Water level; bubbler	Baseline, end of start-up, and monthly through ERH operation
48	PA-01	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
49	PA-02	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
50	PA-03	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
51	PA-04	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
52	PA-05	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
53	PB-01	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
54	PB-02	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly

**Table 5. Monitoring Program for Well Field Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

No.	Well ID	Associated Hydrogeologic Unit	Well Type	Remedial Area <sup>(1)</sup>	Measurement	Frequency
55	PB-03	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
56	PB-04	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
57	PB-05	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
58	PB-06	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
59	PB-07	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
60	PC-01	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
61	PC-02	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
62	PC-05	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
63	PC-06	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
64	PD-01	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
65	PD-04	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
66	PD-05	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
67	PD-06	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
68	PD-07	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
69	PD-08	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
70	PD-09	Perched	Extraction	outside ERH	PID, temperature, vacuum	Weekly
71	DA-01	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
72	DB-01	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
73	DA-02	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
74	DB-02	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
75	DA-03	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
76	DB-03	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
77	DA-04	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
78	DB-04	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
79	DA-05	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
80	DB-05	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
81	DA-06	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
82	DB-06	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
83	DA-07	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
84	DB-07	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
85	DA-08	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
86	DB-08	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
87	DA-09	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
88	DB-09	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
89	DA-10	A Zone	Extraction	within ERH	PID, temperature, vacuum, water cumulative flow	Weekly
90	DB-10	B Zone	Extraction	within ERH	PID, temperature, vacuum, water cumulative flow	Weekly
91	DA-11	A Zone	Extraction	within ERH	PID, temperature, vacuum, water cumulative flow	Weekly
92	DB-11	B Zone	Extraction	within ERH	PID, temperature, vacuum, water cumulative flow	Weekly
93	DA-12	A Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
94	DB-12	B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
95	DAB-01	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
96	DAB-02	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
97	DAB-03	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
98	DAB-04	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
99	DAB-05	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
100	DAB-06	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
101	DAB-07	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
102	DAB-08	A & B Zone	Extraction	outside ERH	PID, temperature, vacuum, water cumulative flow	Weekly
103	VR-01P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
104	VR-02P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
105	VR-02UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
106	VR-03P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
107	VR-04P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
108	VR-04UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
109	VR-05P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
110	VR-05UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
111	VR-06P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
112	VR-07P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
113	VR-07UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
114	VR-08P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
115	VR-09P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
116	VR-10P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
117	VR-10UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
118	VR-11P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
119	VR-11UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
120	VR-12P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
121	VR-12UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
122	VR-13P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
123	VR-14P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
124	VR-15P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
125	VR-16P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
126	VR-17P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
127	VR-17UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
128	VR-18P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
129	VR-18UV	Upper Vadose	Extraction	within ERH	PID, temperature, vacuum	Weekly
130	VR-19P	Perched	Extraction	within ERH	PID, temperature, vacuum	Weekly
131	EB-06	Upper Vadose	Electrode	within ERH	TBD	TBD
132	EB-07	Upper Vadose	Electrode	within ERH	TBD	TBD
133	EC-06	Upper Vadose	Electrode	within ERH	TBD	TBD
134	EC-07	Upper Vadose	Electrode	within ERH	TBD	TBD
135	EC-08	Upper Vadose	Electrode	within ERH	TBD	TBD
136	EC-09	Upper Vadose	Electrode	within ERH	TBD	TBD

**Table 5. Monitoring Program for Well Field Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

No.	Well ID	Associated Hydrogeologic Unit	Well Type	Remedial Area <sup>(1)</sup>	Measurement	Frequency
137	EC-10	Upper Vadose	Electrode	within ERH	TBD	TBD
138	EC-11	Upper Vadose	Electrode	within ERH	TBD	TBD
139	ED-06	Upper Vadose	Electrode	within ERH	TBD	TBD
140	ED-07	Upper Vadose	Electrode	within ERH	TBD	TBD
141	ED-08	Upper Vadose	Electrode	within ERH	TBD	TBD
142	ED-09	Upper Vadose	Electrode	within ERH	TBD	TBD
143	ED-10	Upper Vadose	Electrode	within ERH	TBD	TBD
144	ED-11	Upper Vadose	Electrode	within ERH	TBD	TBD
145	ED-12	Upper Vadose	Electrode	within ERH	TBD	TBD
146	EE-05	Upper Vadose	Electrode	within ERH	TBD	TBD
147	EE-06	Upper Vadose	Electrode	within ERH	TBD	TBD
148	EE-07	Upper Vadose	Electrode	within ERH	TBD	TBD
149	EE-08	Upper Vadose	Electrode	within ERH	TBD	TBD
150	EE-09	Upper Vadose	Electrode	within ERH	TBD	TBD
151	EE-10	Upper Vadose	Electrode	within ERH	TBD	TBD
152	EE-11	Upper Vadose	Electrode	within ERH	TBD	TBD
153	EE-12	Upper Vadose	Electrode	within ERH	TBD	TBD
154	EF-04	Upper Vadose	Electrode	within ERH	TBD	TBD
155	EF-05	Upper Vadose	Electrode	within ERH	TBD	TBD
156	EF-06	Upper Vadose	Electrode	within ERH	TBD	TBD
157	EF-07	Upper Vadose	Electrode	within ERH	TBD	TBD
158	EF-08	Upper Vadose	Electrode	within ERH	TBD	TBD
159	EF-09	Upper Vadose	Electrode	within ERH	TBD	TBD
160	EF-10	Upper Vadose	Electrode	within ERH	TBD	TBD
161	EF-11	Upper Vadose	Electrode	within ERH	TBD	TBD
162	EG-01	Upper Vadose	Electrode	within ERH	TBD	TBD
163	EG-02	Upper Vadose	Electrode	within ERH	TBD	TBD
164	EG-03	Upper Vadose	Electrode	within ERH	TBD	TBD
165	EG-04	Upper Vadose	Electrode	within ERH	TBD	TBD
166	EG-05	Upper Vadose	Electrode	within ERH	TBD	TBD
167	EG-06	Upper Vadose	Electrode	within ERH	TBD	TBD
168	EG-07	Upper Vadose	Electrode	within ERH	TBD	TBD
169	EG-08	Upper Vadose	Electrode	within ERH	TBD	TBD
170	EG-09	Upper Vadose	Electrode	within ERH	TBD	TBD
171	EG-10	Upper Vadose	Electrode	within ERH	TBD	TBD
172	EG-11	Upper Vadose	Electrode	within ERH	TBD	TBD
173	EH-01	Upper Vadose	Electrode	within ERH	TBD	TBD
174	EH-02	Upper Vadose	Electrode	within ERH	TBD	TBD
175	EH-03	Upper Vadose	Electrode	within ERH	TBD	TBD
176	EH-04	Upper Vadose	Electrode	within ERH	TBD	TBD
177	EH-05	Upper Vadose	Electrode	within ERH	TBD	TBD
178	EH-06	Upper Vadose	Electrode	within ERH	TBD	TBD
179	EH-07	Upper Vadose	Electrode	within ERH	TBD	TBD
180	EH-08	Upper Vadose	Electrode	within ERH	TBD	TBD
181	EH-09	Upper Vadose	Electrode	within ERH	TBD	TBD
182	EH-10	Upper Vadose	Electrode	within ERH	TBD	TBD
183	EJ-03	Upper Vadose	Electrode	within ERH	TBD	TBD
184	EJ-04	Upper Vadose	Electrode	within ERH	TBD	TBD
185	EJ-05	Upper Vadose	Electrode	within ERH	TBD	TBD
186	EJ-06	Upper Vadose	Electrode	within ERH	TBD	TBD
187	EJ-07	Upper Vadose	Electrode	within ERH	TBD	TBD
188	EJ-08	Upper Vadose	Electrode	within ERH	TBD	TBD
189	VMP-01-45	Upper Vadose	Vapor Monitoring Probe (VMP)	within ERH	Vacuum & Draeger	Baseline and as needed
190	VMP-02-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
191	VMP-03-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
192	VMP-04-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
193	VMP-05-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
194	VMP-06-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
195	VMP-07-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
196	VMP-08-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
197	VMP-09-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
198	VMP-10-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
199	VMP-11-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
200	VMP-12-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
201	VMP-13-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
202	VMP-14-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
203	VMP-15-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
204	VMP-16-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
205	VMP-17-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
206	VMP-18-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
207	VMP-19-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
208	VMP-20-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
209	VMP-21-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
210	VMP-22-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
211	VMP-23-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
212	VMP-24-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
213	VMP-25-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
214	VMP-26-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed

**Table 5. Monitoring Program for Well Field Physical Parameters  
Pemaco Superfund Site, Maywood, CA**

No.	Well ID	Associated Hydrogeologic Unit	Well Type	Remedial Area <sup>(1)</sup>	Measurement	Frequency
215	VMP-27-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
216	VMP-28-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
217	VMP-29-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
218	VMP-30-45	Upper Vadose	VMP	within ERH	Vacuum & Draeger	Baseline and as needed
219	TMP-01-25 through TMP-01-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
220	TMP-02-25 through TMP-02-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
221	TMP-03-25 through TMP-03-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
222	TMP-04-25 through TMP-04-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
223	TMP-05-25 through TMP-05-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
224	TMP-06-25 through TMP-06-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
225	TMP-07-25 through TMP-07-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
226	TMP-08-25 through TMP-08-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
227	TMP-09-25 through TMP-09-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
228	TMP-10-25 through TMP-10-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
229	TMP-11-25 through TMP-11-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
230	TMP-12-25 through TMP-12-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
231	TMP-13-25 through TMP-13-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
232	TMP-14-25 through TMP-14-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
233	TMP-15-25 through TMP-15-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
234	TMP-16-25 through TMP-16-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
235	TMP-17-25 through TMP-17-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
236	TMP-18-25 through TMP-18-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
237	TMP-19-25 through TMP-19-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
238	TMP-20-25 through TMP-20-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
239	TMP-21-25 through TMP-21-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
240	TMP-22-25 through TMP-22-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
241	TMP-23-25 through TMP-23-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
242	TMP-24-25 through TMP-24-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
243	TMP-25-25 through TMP-25-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
244	TMP-26-25 through TMP-26-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
245	TMP-27-25 through TMP-27-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
246	TMP-28-25 through TMP-28-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily
247	TMP-29-25 through TMP-29-100	Perched, Exposition A & B*	thermocouple	within ERH	Temperature (automated); 10% manual validation **	Daily Weekly
248	TMP-30-25 through TMP-30-100	Perched, Exposition A & B*	thermocouple	outside ERH	Temperature (automated)	Daily

**Notes:**

\* At each TMP, the thermocouple are located at 25 and every 5 feet between 35 and 100 feet below ground surface; Total of 15 thermocouples per TMP.

\*\* For 10% manual data validation, measurements will be taken at randomly selected 45 thermocouples within ERH area.

**Acronyms:**

ERH electrical resistance heating

DPE Dual phase extraction system, includes perched zone DPE and Exposition Zone vacuum-assisted groundwater extraction systems

**Table 6**  
**Summary of Vapor (P and VR) and Water Extraction (D) Wells\***  
**Pemaco Superfund Site, Maywood, CA**

#	Perched Wells ("P")	Vapor Recovery Wells ("VR")	Exposition Wells ("D")
1	PA – 1	VR – 1	DA – 1
2	PA – 2	VR – 2	DA – 2
3	PA – 3	VR – 3	DA – 3
4	PA – 4	VR – 4	DA – 4
5	PA – 5	VR – 5	DA – 5
6	PB – 1	VR – 6	DA – 6
7	PB – 2	VR – 7	DA – 7
8	PB – 3	VR – 8	DA – 8
9	PB – 4	VR – 9	DA – 9
10	PB – 5	VR – 10	DA – 10
11	PB – 6	VR – 11	DA – 11
12	PB – 7	VR – 12	DA – 12
13	PC – 1	VR – 13	DB – 1
14	PC – 2	VR – 14	DB – 2
15	PC – 5	VR – 15	DB – 3
16	PC – 6	VR – 16	DB – 4
17	PD – 1	VR – 17	DB – 5
18	PD – 2	VR – 18	DB – 6
19	PD – 3	VR – 19	DB – 7
20	PD – 4		DB – 8
21	PD – 5		DB – 9
22	PD – 6		DB – 10
23	PD – 7		DB – 11
24	PD – 8		DB – 12
25	PD – 9		DAB – 1
26			DAB – 2
27			DAB – 3
28			DAB – 4
29			DAB – 5
30			DAB – 6
31			DAB – 7
32			DAB – 8

\* List does not include the 58 ERH vapor extraction wells

**Table 7**  
**ERH Design Parameters for Heat-up and 30-day Holding Period\***

<b>Criteria</b>	<b>Design Application</b>
ERH Treatment Area	14,400 square feet
Shallow extent of ERH	35 feet bgs
Deep extent of ERH	95 feet bgs
Approximate ERH treatment volume	32,000 cubic yards
Average depth to groundwater	60 feet bgs
Number of electrodes	58
Distance between electrodes	17 feet (except slant electrodes)
Total depth of electrodes	100 feet bgs
Depth to top of electrodes	37 feet bgs
Number of temperature monitoring points	30
Total of subsurface thermocouples	450
Number of vapor recovery wells	77 (58 electrode, 19 deep, 9 shallow)
Vapor recovery rate for ERH well field	560 scfm
Maximum expected temperature	110 C°
Estimated electrical power input	1400 kilowatts (kW)
Days to heat-up treatment volume	Est. 77
Energy needed for heat-up	2,442,000 kilowatt-hours (kW/hrs)
Energy needed to hold temperature for 30 days after heat-up period	1,000,000 kW/hrs
Energy for additional 90 days	3,000,000 kW/hrs**

\*Criteria and Design Applications based on TRS Work Plan, (TRS, 2006)

\*\* TRS estimated 6,442,000 kW/hrs to meet groundwater cleanup standards

**Table 8**  
**Temperature Requirements for Phase II ERH Heating**  
**and 30-Day Holding Period**

**Pemaco Superfund Site, Maywood, CA**

<b>Soil Interval</b>	<b>Temperature Specification*</b>	<b>Depth and thickness**</b>
A-B Clay	#1 – 100 C°	80ft – 65 ft bgs
Exposition B	# 2 – 110 C°	95ft – 80 ft bgs
Vadose zone	#3 - 87 C°	60ft – 35 ft bgs

\*Eighty-five percent (85%) of the thermocouples must meet or exceed their goals to fulfill the requirement for completion of the heating and 30-day holding period.

\*\*These are general depths and thicknesses for the units. Final depth and thickness of the soil intervals will use data from the TMP boring data.

**Table 9**  
**Contact List**  
**Pemaco Superfund Site, Maywood, CA**

<b>Name</b>	<b>Role</b>	<b>Agency</b>	<b>Phone Number</b>	<b>E-mail</b>
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