air pollution control district
SANTA BARBARA COUNTY

GUIDANCE DOCUMENT FOR EMISSIONS VERIFICATION OF CONTAMINATED SOIL/GROUNDWATER CLEANUP (CSC) PROCESSES

I. INTRODUCTION

To ensure compliance, each contaminated soil/groundwater cleanup (CSC) project using soil vapor extraction (SVE) shall follow the procedures outlined in this document. Each system used for CSC projects shall install the process instrumentation outlined in Section II, *Instrumentation*, of this document. Each applicant shall submit, for approval by the District, the information outlined in Section III, *Authority to Construct Application Requirements*, of this document. This information shall be compiled into the Emissions Verification Test (EVT) Plan. Once an ATC is issued, the applicant shall conduct a 3-hour EVT during the first 14 days of the Source Compliance Demonstration Period (SCDP). The EVT will verify that the emission and operational information used in preparing the ATC are accurate. The EVT shall be conducted in accordance with Section IV, *Emissions Verification Test Procedures*, of this document. At the completion of the EVT, the system will be allowed to operate for 10 continuous days while a written report containing the information listed in Section V, *Emissions Verification Report*, is prepared and submitted to the District. The District may require the system to be shut down if the report is not received within 10 calendar days of EVT completion, or if the District cannot determine compliance based on the results of the report.

II. INSTRUMENTATION

The instrumentation listed below shall be permanently installed while the CSC system is in operation.

A. Each system shall have process instrumentation to monitor the process parameters listed in Table 1.

B. The instruments used to monitor the above parameters shall be of the type listed in Table 2. The use of any instrument not listed in this document shall be prohibited unless approved by the District in writing.

C. Each instrument used to monitor the above parameters shall be sized such that the average expected value of the parameter will be 50% of the span value for that instrument.

D. All instruments used to monitor the above parameters shall be calibrated as specified in Table 2, maintained according to manufacturer's recommendations, and permanently installed on the system.

III. AUTHORITY TO CONSTRUCT APPLICATION REQUIREMENTS

The following EVT information shall be submitted with all ATC applications for CSC projects. Failure to submit complete information to the list below may lead to the denial of the application. The information shall be compiled into a document called the Emissions Verification Test Plan.

A. An "as-built" process flow diagram, which shows the sampling locations and the required process instrumentation locations, pipe diameters, and stack size (height and diameter).

B. An instrumentation list showing the parameter to be monitored, the type of instrument, the span of the instrument, the serial number of the instrument, the date of the most recent calibration, and the calibration method used.

C. Calibration data sheets for each instrument that present the results of the most recent calibration.

D. The manufacturer's recommended maintenance procedure for each instrument used to monitor the parameters in Table 1.

E. The sampling methodology for any compounds not listed in Table 3 must be specified in the EVT Plan and approved in writing by the District before the ATC permit is issued. Total petroleum hydrocarbon (TPH) analysis per Table 3 may be used to quantify reactive organic compounds (ROC), if specified in the EVT Plan and approved in writing by the District.

IV. EMISSIONS VERIFICATION TEST PROCEDURES

A. PROCESS START-UP

1) The permittee shall notify the District (in writing) when initial operations of the system are to commence. This establishes the beginning of the SCDP.

2) The system shall be allowed to operate for a maximum of 14 calendar days from the initiation of the SCDP to perform system shakedown, establish the operational parameters of the equipment and complete the EVT.

3) The system shall be tested for three continuous hours during the EVT. This 3-hour test shall be used to verify the emissions under the worst case condition (highest inlet vapor concentration). A District Inspector (or representative) may be present during this test.

4) During the 3-hour EVT, the system parameters listed in Table 1 shall be recorded every half hour and stream sampling shall be conducted as specified in Section IV.B, *Stream Sampling for Laboratory Analysis*, and Section IV.C, *Stream Monitoring for Total Petroleum Hydrocarbons (TPH)*. The results of the EVT shall be recorded in a table similar in format to Table 4A (for carbon canister systems) or Table 4B (for thermal/catalytic oxidizer systems). The laboratory analysis results for all compounds required by the permit shall be presented in a table similar in format to Table 5. The permittee shall also submit the complete

analytical report provided by the State-certified laboratory, which must include the name of the method(s) used to analyze the gas samples.

5) After completion of the emissions verification test, the system will be allowed to operate for 10 continuous days while the permittee prepares and submits a written report documenting the results of the EVT. This report must be received by the District no later than 10 calendar days after completion of the EVT if continued operations (within the limits of the 60-day SCDP) are desired. If the report is not submitted within 10 days of completion of EVT testing or the facility cannot demonstrate compliance with permit conditions, then the system shall be shut down until written approval for continued operations from the District is obtained.

   After approval for continued operations is granted, routine sampling (monthly or quarterly, as specified in the permit) shall be performed for TPH and process parameters in Tables 4A and 4B, as applicable, in accordance with the methods identified in Tables 2 and 3.

B. STREAM SAMPLING FOR LABORATORY ANALYSIS

1) During the EVT, samples of the control device inlet and outlet vapor streams shall be taken once an hour for laboratory analysis. The inlet and outlet samples for any given hour shall be taken within fifteen minutes of each other. The laboratory analysis will quantify reactive organic compounds (ROCs), TPH, and toxic compounds such as perchloroethylene and benzene as applicable. TPH analysis per Table 3 may be used to quantify ROC, if specified in the EVT Plan and approved in writing by the District. All toxic compounds as required by the permit shall also be quantified. Toxic compounds are those compounds identified by either the US EPA, the Office of Environmental Health Hazard Assessment (OEHHA), or the Santa Barbara County APCD. For soils contaminated by dry cleaning chemicals, the District usually requires perchloroethylene (PCE) and trichloroethylene (TCE) to be quantified. For soils contaminated by leaking underground gasoline storage tanks, the District usually requires benzene, toluene, ethyl benzene, xylenes (BTEX), and methyl tert-butyl ether (MTBE) to be quantified.

2) The inlet and outlet samples may be taken by the District observer using the methodology specified in this document.

3) The applicant shall supply all the materials necessary to do the sampling. Sample line shall be constructed of stainless steel, Teflon, or glass.

4) All samples shall be analyzed by a State-certified laboratory using the methods specified in Table 3. If sampling is required for a compound or group of compounds not listed in Table 3, the sampling methodology must be specified in the EVT Plan and approved in writing by the District before the ATC permit is issued.

C. STREAM MONITORING FOR TOTAL PETROLEUM HYDROCARBONS (TPH)

1) The control device inlet and outlet vapor streams shall be monitored once an hour for TPH. The inlet and outlet vapor stream monitoring for any given hour shall be done within fifteen minutes of each other.

2) The TPH monitoring shall be done using an Organic Vapor Analyzer (OVA) calibrated using an isobutylene standard, unless another standard is specified in the permit.

3) If it is not physically possible to put the OVA probe in the stream to be analyzed, the following procedure must be followed:

a) Obtain a sample of the stream in a Tedlar bag using an appropriate procedure as described in Table 3.

b) Use the OVA to analyze the contents of the Tedlar bag for TPH.

4) The inlet and outlet TPH monitoring may be done by the District observer using the methodology specified in Table 3.

5) The applicant must provide all the materials necessary to do the TPH monitoring including the Tedlar bag, the OVA, and the OVA calibration gas. Sample line shall be constructed of stainless steel, Teflon, or glass.

6) The OVA must be calibrated against an isobutylene calibration gas (unless another standard is specified in the permit) on a daily basis, following manufacturer's recommended procedures.

V. EMISSIONS VERIFICATION REPORT

A. An Emissions Verification Report (Report) shall be prepared and submitted to the District. The Report must be received by the District within 10 calendar days of completion of the EVT if continued system operations (within the 60-day SCDP) are desired.

B. The Report shall include an "as-built" process flow diagram that includes all sampling locations.

C. The Report shall contain the results summarized in a format similar to that in Table 4A (for carbon canister systems) or Table 4B (for thermal/catalytic oxidizer systems) and Tables 5 and 6, which includes the following information:

1) A compilation of the half-hour system parameters stipulated in Table 1 and all field data.

2) The time that each gas sample was taken and the time each TPH monitoring analysis was performed.

3) Laboratory analysis results of the inlet and outlet samples for concentration of TPH and all toxic compounds required by the permit, presented in units of parts per million by volume (PPMV).

4) Field monitoring results for TPH in units of PPMV.

5) Calculations of the emission rates (in units of pounds per hour), inlet feed rates (in units of pounds per hour), and control device efficiencies for ROC and all toxic compounds required by the permit. If any constants are used in the calculations, they shall be defined with proper units. Pollutant mass flow rate and control efficiency equations are shown beneath Table 6.

D. The report shall include one complete example calculation, each for control device inlet and outlet flows (scfm) and emissions (lb/hr) for any one lab sample point.

E. The Report shall describe any modifications to the system design, adjustments of the preliminary operating parameters (ex. temperature, flow rate, etc.), and any revisions to the extent and degree of contamination.

Table 1 — Recorded System Parameters

a)	Control device inlet temperature in ^{o}F
b)	Stack outlet temperature in ^{o}F
c)	Control device inlet gas flow in scfm or velocity in fpm or pressure difference in inches of H_2O (post dilution, if present)
d)	Stack outlet gas flow in scfm or velocity in fpm or pressure difference in inches of H_2O*
e)	Control device inlet pressure in psig
f)	Control device outlet pressure in psig*
g)	Oxidizer bed temperature in ^{o}F for catalytic oxidizer systems
h)	Combustion temperature in ^{o}F for thermal oxidizer systems
i)	Coefficients (constants) when an orifice plate is used for flow measurement
j)	Amount of supplemental fuel combusted in gallons or scf**

* Required only for thermal oxidizer and catalytic control devices.

** Required only for systems that use fossil fuel (e.g., diesel oil, natural gas, propane) for any device within the system (e.g., thermal oxidizer, pump driven by an internal combustion engine).

Table 2 — Parameters and Preferred Test Equipment

	Parameters	Type Of Equipment	Calibration*
1.	Temperature	Thermometer Thermocouple	Calibrated against a known NBS traceable standard. Calibrated within six months prior to the test.
2.	Pressure	Magnehelics Std. Pressure Gauges Aneroid-barometers	Calibrated against a Standard Pressure barometer or pressure device that is NBS certified. Calibrated within six months prior to the test.
3.	Gas flow	Averaging Pitot Tube Orifice Meter Turbine Flow meter Hot wire Anemometer	Must be calibrated as per manufacturer's recommendations. Proof of calibration must be reviewed and approved by the District.
4.	Fluid Flow	Rotameter or other equivalent devices	Must be calibrated as per manufacturer's recommendations. Proof of calibration must be submitted and approved by the District.

* Instrumentation must be calibrated in increments no greater than ten (10) percent of the span value of the instrument. Manufacturer calibration of instrumentation is acceptable if date of certification, accuracy and length of certification are certified by the manufacturer.

Table 3 — Sampling and Analytical Methods

Analyses	Sampling Methods[1,2,3]	Preferred Analytical Methods[1,3]	Alternate Analytical Methods[1,3]
Benzene MTBE BTEX	CARB 410A/B (Tedlar Bag) or EPA TO-14A (SUMMA Canister) or EPA 18 (Tedlar Bag)	EPA 8020A (GC, MS) or EPA 8260B (GC, MS)	CARB 410A Mod. (GC, PID/FID) or EPA TO-14A (GC, MS)
PCE TCE	CARB 410A/B (Tedlar Bag) or EPA TO-14A (SUMMA Canister) or EPA 18 (Tedlar Bag)	EPA 8260B (GC, MS) or EPA TO-15 (GC, MS)	EPA TO-14A (GC, MS)
TPH ROC[4]	CARB 410A/B (Tedlar Bag) or EPA TO-14A (SUMMA Canister) or EPA 18 (Tedlar Bag)	EPA 8015M (GC, MS)	EPA TO-3 (GC, MS) or EPA TO-14A (GC, MS)
TPH (Monitoring)	Field Survey Instrument	OVA (FID, calibrated using an isobutylene standard)	
Other organics	Contact the Source Test Section of the District for details.		

1 QA/AC procedures within each method must be followed.

2 Gases sampled for collection should be no higher than 300º F, due to the physical properties of the collection vessels. Samples from exhaust streams of catalytic or thermal oxidizers must be cooled prior to collection. The cooling method must be of a non-contacting nature. For example, the cooling method could be a set of empty impingers in an ice bath.

3 If the applicant would like to use a sampling or analytical method not shown in this table, it must be specified in the EVT Plan and approved in writing by the District before the ATC permit is issued.

4 This is an alternative to TPH. The analysis should report the concentrations of C3, C4, C5, C6+ in units of PPMV (corrected to hexane), and the total ROC concentration can be determined by summing all species.

Table 4A – Field Sheet for Emissions Verification Test

Contaminated Soil Cleanup (Carbon Canister)

Equipment Owner: _____ Permit Type: ATC

Equipment Operator: _____ Permit No.: _____

Equipment/Facility Location: _____ Report Type: EVT

Stationary Source Identification No.: _____ Report Date: _____

Control Device Parameters Monitoring Results

Hours from Start of EVT	Date/Time	Control Device Inlet Temperature (°F)	Stack Outlet Temperature (°F)	Stack Outlet Flow Rate (scfm)	Control Device Inlet Pressure (psig)
0:00					
0:30					
1:00					
1:30					
2:00					
2:30					
3:00					

Table 4A Continued

TPH Monitoring Results

Hours from Start of EVT	Date/Time	TPH Concentration at Inlet (PPMV as Isobutylene)	TPH Concentration at Outlet (PPMV as Isobutylene)
1:00			
2:00			
3:00			

Table 4B – Field Sheet for Emissions Verification Test

Contaminated Soil Cleanup (Thermal/Catalytic Oxidizer)

Equipment Owner: _____ Permit Type: ATC

Equipment Operator: _____ Permit No.: _____

Equipment/Facility Location: _____ Report Type: EVT

Stationary Source Identification No.: _____ Report Date: _____

Control Device Parameters Monitoring Results

Hours from Start of EVT	Date/Time	Control Device Inlet Temperature (°F)	Stack Outlet Temperature (°F)	Control Device Inlet Flow Rate (scfm)	Stack Outlet Flow Rate (scfm)	Control Device Inlet Pressure (psig)	Control Device Outlet Pressure (psig)	Oxidizer Bed/ Combustion Temperature (°F)
0:00								
0:30								
1:00								
1:30								
2:00								
2:30								
3:00								

Table 4B Continued

TPH Monitoring Results

Hours from Start of EVT	Date/Time	TPH Concentration at Inlet (PPMV as Isobutylene)	TPH Concentration at Outlet (PPMV as Isobutylene)
1:00			
2:00			
3:00			

Table 5 – Lab Results Summary Sheet

Sample Information			Inlet Concentration (PPMV)			Outlet Concentration (PPMV)		
Hours from Start of EVT	Date/Time	Sample ID	Benzene	Toluene	TPH	Benzene	Toluene	TPH
1:00								
2:00								
3:00								

Table 6 – Calculated Compound Mass Flow Rates and Control Efficiencies

Sample Information		Benzene Results			Toluene Results			TPH Results		
Date/ Time	Sample ID	Mass Flow Rate Inlet (lb/hr)	Mass Flow Rate Outlet (lb/hr)	Control Efficiency (%)	Mass Flow Rate Inlet (lb/hr)	Mass Flow Rate Outlet (lb/hr)	Control Efficiency (%)	Mass Flow Rate Inlet (lb/hr)	Mass Flow Rate Oulet (lb/hr)	Control Efficiency (%)

Pollutant Mass Flow Rate and Control Efficiency Equations

1. Contaminant Inlet Mass Flowrate (lb/hr)

$$Q_{mi,c} = (C_{i,c}/F1)\ (V)\ (1/F3)\ (MW_c)\ (F4)$$

2. Contaminant Outlet Mass Flowrate (lb/hr)

$$Q_{mo,c} = (C_{o,c}/F1)\ (V)\ (1/F3)\ (MW_c)\ (F4)$$

3. Stack Exit Velocity

$$v_o = (V/F5)\ (1/[\{F6\}\ \{D_s^2\}])\ ([T_o+460]/[T_s+460])$$

4. Control Efficiency of Device

$$EFF_c = ([Q_{mi,c} - Q_{mo,c}]/Q_{mi,c})\ (100)$$

where:

$C_{i,c}$ = Inlet concentration of contaminant *c*, ppm
$C_{o,c}$ = Outlet concentration of contaminant *c*, ppm
D_s = Diameter of exit stack, ft
$F1$ = Conversion factor for ppm = 1×10^6
$F3$ = Ideal gas volume to mass conversion = 379 scf/lb-mole
$F5$ = minute to second conversion factor = 60 sec/min
T_o = Stack outlet temperature, ºF
V = Vapor volume flowrate, scfm
MW_c = Molecular weight of contaminant *c* = 86.00 lb/lb-mole for TPH
= 78.11 lb/lb-mole for benzene
= 92.14 lb/lb-mole for toluene

$Q_{mi,c}$ = Inlet mass flowrate of contaminant *c*, lb/hr
$Q_{mo,c}$ = Outlet mass flow rate of contaminant *c*, lb/hr
EFF_c = Efficiency of control device for contaminant *c*, %
$F2$ = Pound to ton conversion = 2,000 lb/ton
$F4$ = Hour to minute conversion factor = 60 min/hr
$F6$ = pi/4 = 0.7854
T_s = Standard temperature = 60 ºF
v_o = Stack exit velocity, ft/sec