

CATEGORY:

**SOIL REMEDIATION**

BACT Size: Small Emitter BACT (PTE &lt; 10 lb/day)

SOIL VAPOR EXTRACTION (SVE)

<b>BACT Determination Number:</b> 151		<b>BACT Determination Date:</b> 4/4/2017	
<b>Equipment Information</b>			
<b>Permit Number:</b> N/A -- Generic BACT Determination			
<b>Equipment Description:</b> SOIL VAPOR EXTRACTION (SVE)			
<b>Unit Size/Rating/Capacity:</b> Soil Vapor Extraction with VOC <10 lb/day			
<b>Equipment Location:</b>			
<b>BACT Determination Information</b>			
<b>ROCs</b>	<b>Standard:</b>	9.9 lb/day & % control based on Influent VOC	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers, or Carbon Adsorption	
	<b>Basis:</b>	Achieved in Practice	
<b>NOx</b>	<b>Standard:</b>	(see additional BACT for technology below)	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers	
	<b>Basis:</b>	Achieved in Practice	
<b>SOx</b>	<b>Standard:</b>	(see additional BACT for technology below)	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers	
	<b>Basis:</b>	Achieved in Practice	
<b>PM10</b>	<b>Standard:</b>	(see additional BACT for technology below)	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers	
	<b>Basis:</b>	Achieved in Practice	
<b>PM2.5</b>	<b>Standard:</b>	(see additional BACT for technology below)	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers	
	<b>Basis:</b>	Achieved in Practice	
<b>CO</b>	<b>Standard:</b>	(see additional BACT for technology below)	
	<b>Technology Description:</b>	IC Engines, Thermal Oxidizers, Catalytic Oxidizers	
	<b>Basis:</b>	Achieved in Practice	
<b>LEAD</b>	<b>Standard:</b>		
	<b>Technology Description:</b>		
	<b>Basis:</b>		
<b>Comments:</b> SVE that achieve the control efficiency requirements stated below: For Effluent VOC Concentrations <= 10 ppmv, no required % control efficiency. For Influent VOC Concentrations >= 2,000 ppmv, at least 98.5% control efficiency required. For Influent VOC Concentrations >= 200 ppmv and < 2,000 ppmv, at least 97% control efficiency required. For Influent VOC Concentrations < 200 ppmv at least 90% control efficiency required.			
<b>District Contact:</b> Michelle Joe Phone No.: (916) 874 - 4853 email: mjoe@airquality.org			

**SMAQMD BACT CLEARINGHOUSE**

CATEGORY:

**SVE - IC ENGINE**

BACT Size: Small Emitter BACT (PTE < 10 lb/day)

**SOIL VAPOR EXTRACTION (SVE)**

<b>BACT Determination Number:</b> 151	<b>BACT Determination Date:</b> 4/4/2017
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**Equipment Information**

**Permit Number:** N/A -- Generic BACT Determination  
**Equipment Description:** SOIL VAPOR EXTRACTION (SVE)  
**Unit Size/Rating/Capacity:** Soil Vapor Extraction with VOC <10 lb/day  
**Equipment Location:**

**BACT Determination Information**

<b>ROCs</b>	<b>Standard:</b>	9.9 lb/day & % control based on influent VOC
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>NOx</b>	<b>Standard:</b>	(see additional BACT for technology below)
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>SOx</b>	<b>Standard:</b>	(see additional BACT for technology below)
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>PM10</b>	<b>Standard:</b>	(see additional BACT for technology below)
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>PM2.5</b>	<b>Standard:</b>	(see additional BACT for technology below)
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>CO</b>	<b>Standard:</b>	(see additional BACT for technology below)
	<b>Technology Description:</b>	LPG as an auxiliary fuel and 3-way catalytic converter
	<b>Basis:</b>	Achieved in Practice
<b>LEAD</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	

**Comments:**

**District Contact:** Michelle Joe Phone No.: (916) 874 - 4853 email: mjoe@airquality.org

CATEGORY:

**SVE - THERMAL OXIDIZER**

BACT Size: Small Emitter BACT (PTE &lt; 10 lb/day)

SOIL VAPOR EXTRACTION (SVE)

<b>BACT Determination Number:</b> 151	<b>BACT Determination Date:</b> 4/4/2017
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**Equipment Information**

**Permit Number:** N/A -- Generic BACT Determination  
**Equipment Description:** SOIL VAPOR EXTRACTION (SVE)  
**Unit Size/Rating/Capacity:** Soil Vapor Extraction with VOC <10 lb/day  
**Equipment Location:**

**BACT Determination Information**

<b>ROCs</b>	<b>Standard:</b>	9.9 lb/day & % control based on influent VOC
	<b>Technology Description:</b>	1400 °F and 0.5 second retention time.
	<b>Basis:</b>	Achieved in Practice
<b>NOx</b>	<b>Standard:</b>	NG or LPG and good combustion practices
	<b>Technology Description:</b>	(also see comments below for burners that heat up the thermal oxidizer bed)
	<b>Basis:</b>	Achieved in Practice
<b>SOx</b>	<b>Standard:</b>	NG or LPG and good combustion practices
	<b>Technology Description:</b>	
	<b>Basis:</b>	Achieved in Practice
<b>PM10</b>	<b>Standard:</b>	NG or LPG and good combustion practices
	<b>Technology Description:</b>	
	<b>Basis:</b>	Achieved in Practice
<b>PM2.5</b>	<b>Standard:</b>	NG or LPG and good combustion practices
	<b>Technology Description:</b>	
	<b>Basis:</b>	Achieved in Practice
<b>CO</b>	<b>Standard:</b>	NG or LPG and good combustion practices
	<b>Technology Description:</b>	
	<b>Basis:</b>	Achieved in Practice
<b>LEAD</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	

**Comments:** Burners fired on process gas & supplemental fuel, or with propane, butane or LPG where NG is not available: No standard.  
 Burners fired on 100% natural gas or propane: 30 ppm NOx at 3% O2 for process temp ≤800 °F, 60 ppm NOx @ 3% O2 for process temp >800 °F.  
 Burners fired on liquid fuel: 40 ppm NOx at 3% O2 for process temp <1200 °F, 60 ppm NOx @ 3% O2 for process temp ≥1200 °F.

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**ACTIVE**

**SMAQMD BACT CLEARINGHOUSE**

CATEGORY:

**SVE - CATALYTIC OXIDIZER**

BACT Size: Small Emitter BACT (PTE < 10 lb/day)

**SOIL VAPOR EXTRACTION (SVE)**

<b>BACT Determination Number:</b> 151	<b>BACT Determination Date:</b> 4/4/2017
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**Equipment Information**

**Permit Number:** N/A -- Generic BACT Determination  
**Equipment Description:** SOIL VAPOR EXTRACTION (SVE)  
**Unit Size/Rating/Capacity:** Soil Vapor Extraction with VOC <10 lb/day  
**Equipment Location:**

**BACT Determination Information**

<b>ROCs</b>	<b>Standard:</b>	9.9 lb/day & % control based on influent VOC
	<b>Technology Description:</b>	600 °F and 0.5 second retention time.
	<b>Basis:</b>	Achieved in Practice
<b>NOx</b>	<b>Standard:</b>	see comments below
	<b>Technology Description:</b>	(for burners that heat up the catalyst bed)
	<b>Basis:</b>	Achieved in Practice
<b>SOx</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>PM10</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>PM2.5</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>CO</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>LEAD</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	

**Comments:** Burners fired on process gas & supplemental fuel, or with propane, butane or LPG where NG is not available: No standard. Burners fired on 100% natural gas or propane: 30 ppm NOx at 3% O2 for process temp ≤800 °F, 60 ppm NOx @ 3% O2 for process temp >800 °F. Burners fired on liquid fuel: 40 ppm NOx at 3% O2 for process temp <1200 °F, 60 ppm NOx @ 3% O2 for process temp ≥1200 °F.

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ACTIVE

SMAQMD BACT CLEARINGHOUSE

CATEGORY:

SVE - Carbon Adsorption

BACT Size: Small Emitter BACT (PTE < 10 lb/day)

SOIL VAPOR EXTRACTION (SVE)

<b>BACT Determination Number:</b> 151	<b>BACT Determination Date:</b> 4/4/2017
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Equipment Information

**Permit Number:** N/A -- Generic BACT Determination  
**Equipment Description:** SOIL VAPOR EXTRACTION (SVE)  
**Unit Size/Rating/Capacity:** Soil Vapor Extraction with VOC <10 lb/day  
**Equipment Location:**

BACT Determination Information

<b>ROCs</b>	<b>Standard:</b>	9.9 lb/day & % control based on influent VOC
	<b>Technology Description:</b>	Carbon Adsorption
	<b>Basis:</b>	Achieved In Practice
<b>NOx</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>SOx</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>PM10</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>PM2.5</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>CO</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	
<b>LEAD</b>	<b>Standard:</b>	
	<b>Technology Description:</b>	
	<b>Basis:</b>	

**Comments:** SVE that achieve the control efficiency requirements stated below:  
 For Effluent VOC Concentrations <= 10 ppmv, no required % control efficiency.  
 For Influent VOC Concentrations >= 2,000 ppmv, at least 98.5% control efficiency required.  
 For Influent VOC Concentrations >= 200 ppmv and < 2,000 ppmv, at least 97% control efficiency required.  
 For Influent VOC Concentrations < 200 ppmv at least 90% control efficiency required.

**District Contact:** Michelle Joe Phone No.: (916) 874 - 4853 email: mjoe@airquality.org



## ADDENDUM TO BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.: 151

DATE: May 3, 2017

ENGINEER: Michelle Joe

**Category/General Equipment**

Description: Soil Remediation

Equipment Specific Description: Soil Vapor Extraction (SVE)

Equipment Size/Rating: Small Emitter (<10 lb/day) and Minor Source BACT

Previous BACT Det. No.: 89

This addendum to Best Available Control Technology (BACT) determination will update Determination #89 which was made on November 17, 2014 for Soil Remediation – Soil Vapor Extraction (SVE) and Determination #151 which was public noticed on March 3, 2017.

Based on public comments received for SVE controlled by thermal oxidizers and catalytic oxidizers, this addendum will include a clarification that the NO<sub>x</sub> limit only applies to burners used to heat up thermal oxidizer beds and catalytic oxidizer beds.

Based on internal comments received for SVE controlled by IC engines, this addendum will remove the reference to SMAQMD BACT No. 143 & 144 – IC Engine Spark – Prime, Gaseous-Fueled (Excluding Biogas), which was later discovered to not be an approved BACT determination.

This source category involves the in-situ (“in place”) remediation of VOCs in the vadose zone (the portion of the subsurface above the water table) using vacuum blowers and extraction wells to induce gas flow through the subsurface, collecting the contaminated soil vapor, and then treating the vapors aboveground. *Note: Thermal desorption units and soil remediation kilns were not reviewed as part of this soil vapor extraction BACT category.*

Additionally, this determination is being updated to include T-BACT for the Toxic Air Contaminants (TAC) – typically benzene, MtBE, perchloroethylene (PCE), and/or trichloroethylene (TCE) – associated with soil remediation.

### **BACT/T-BACT ANALYSIS**

#### **A. ACHIEVED IN PRACTICE (Rule 202, §205.1a):**

The following control technologies are currently employed as BACT/T-BACT for Soil Remediation – Soil Vapor Extraction (SVE) for projects emitting <10 lb/day VOC by the following air pollution control districts (see Attachment A for copies of listed BACT determinations):

US EPA

**BACT:**

Source: EPA RACT/BACT/LAER Clearinghouse

For Process Type 29.100 – Contaminated Soil Treatment\*  
RBLIC ID: AZ-0031 (6/3/1996) for soil remediation unit controlled by thermal oxidizer, 20 ton/hour soil throughput capacity

<b>VOC</b>	90% control efficiency; 55 tons/year emission limit
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

\* This BACT determination was found to be the most stringent Achieved in Practice BACT determination published in the EPA RACT/BACT/LAER clearinghouse. See Attachment B for more information.

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

40 CFR Part 60 – New Source Performance Standards (NSPS):

There are currently no 40 CFR, Part 60 NSPS sections that apply to this source category.

40 CFR Part 61 – National Emission Standards for Hazardous Air Pollutants (NESHAPS):

There are currently no 40 CFR, Part 61 NESHAPs that apply to this source category.

40 CFR Part 63 – NESHAPS for Source Categories (MACT Standards):

There are currently no 40 CFR, Part 63 NESHAPs that apply to this source category.

The following rule was reviewed and is discussed below to verify inapplicability:

40 CFR Part 63, Subpart GGGGG – National Emission Standards for Hazardous Air Pollutants: Site Remediation (amended 10/8/2003)

This subpart applies to remediation activities co-located at major stationary sources that emit hazardous air pollutants (HAP) and meet the affected source definition specified for a source category that is regulated by another subpart under 40 CFR Part 63 (another MACT standard). Remediation activities at gas stations and remediation activities performed under the authority of CERCLA or RCRA are exempt from this subpart. For projects not co-located at a major stationary source, this subpart is not applicable.

ARB

**BACT:**

Source: ARB BACT Clearinghouse

For Solid Vapor Extraction	
<b>VOC</b>	N/A – No BACT determinations found
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

ARB Airborne Toxic Control Measures (ATCM):

There are currently no ATCMs that apply to this source category.



**SMAQMD**

**BACT:**

Source: SMAQMD BACT Clearinghouse, BACT Determination No. 89

**For Soil Vapor Extraction with VOC <10 lb/day (11/17/2014)**

**VOC**

1. Catalytic Oxidizers
2. Thermal Oxidizers
3. Carbon Adsorption
4. IC Engines

Each subject to the following VOC control efficiencies and maximum emission limit:

For VOC Concentration at Influent of Control Device (ppmv):	For VOC Concentration at Effluent of Control Device (ppmv):	Required VOC Control Efficiency	Maximum Effluent VOC Daily Limit
N/A	<10 ppmv	None	9.9 lb/day (A)
≥2,000 ppmv	N/A	≥98.5%	
≥200 ppmv to <2,000 ppmv	N/A	≥97%	
<200 ppmv	N/A	≥90%	

- (A) The 9.9 lb/day VOC emission limit was a carry-over of the pre-2011 amendment to Rule 201 New Source Review (NSR) emission limit (which kept emissions below the 10 lb/day BACT trigger). After the 2011 NSR amendment, the following reasonable daily VOC limits were considered:
- For SCAQMD, site-specific daily VOC limits were established using initial test data and applying the applicant-provided APC control efficiency.
  - For BAAQMD, a daily VOC limit was not established and instead relied on their BACT (tiered VOC control efficiency based on influent concentrations, unless effluent concentrations are ≤10 ppmv).
  - For SMAQMD, at a maximum, an applicant could propose a daily limit below the facility wide offset trigger (<4,999 lb/day).
  - For SMAQMD, at a minimum, an applicant could propose an arbitrary daily limit that may reflect the maximum concentrations during the initial test, which may then be exceeded if/when concentrations fluctuate during the course of site remediation. An applicant-proposed daily limit was also discussed as being unfair and non-standardized.
  - For SMAQMD, based on Field Operations' past experience, exceedances of the 9.9 lb/day limit occurred when equipment malfunctioned (rather than due to "hot spots" of VOC contamination).
- Ultimately, it was decided that the previous 9.9 lb/day VOC emission limit was the most reasonable limit at the time and should continue to be used as the daily limit.

**NOx**

**SOx**

**PM10**

**PM2.5**

**CO**

For thermal oxidizers: either natural gas or propane and good combustion practices (as achieved in practice).

For IC engines: LPG as an auxiliary fuel and a 3-way catalytic converter (as achieved in practice).

SMAQMD (continued)

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category. From past permitting policy (refer to SMAQMD Soil and Water Remediation Manual (12/18/2013)), T-BACT was considered similar to BACT since the TACs of concern (typically benzene, MtBE, and/or trichloroethylene (TCE)) are VOCs. Therefore, control of VOCs through meeting the BACT standard will also control the TACs that are VOCs, and will be considered equivalent to meeting T-BACT requirements.

**RULE REQUIREMENTS:**

There are currently no category-specific prohibitory series 400 rules that apply to soil remediation.

South Coast AQMD

**BACT:**

Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities (Revised December 2, 2016)

*Note: SCAQMD does not have a published BACT for non-major polluting facilities which complies with Rule 1147.*

For Soil Remediation	
<b>VOC</b>	N/A – No BACT determinations found
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

**Regulation XI, Rule 1147 - NOx Reductions from Miscellaneous Sources (amended 9/9/2011)**

This rule applies to vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units, and other combustion equipment with NOx emissions (except internal combustion engines subject to District Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Engines) that require a District permit and are not specifically required to comply with a NOx emission limit by other District Regulation XI rules.

South Coast AQMD (continued)

Requirements from Tables 1 and 2 for remediation units only:

Category	NOx Emission Limit			Unit Shall be in Compliance
	Process Temperature			
	≤800 °F	>800 °F and <1200 °F	≥1200 °F	
<b>Gaseous Fuel-Fired Equipment (A)(B)(C)</b>				
<b>In-Use</b> remediation unit manufactured prior to 1998	30 ppm or 0.036 lb/mmBTU	60 ppm or 0.072 lb/mmBTU	60 ppm or 0.072 lb/mmBTU	Upon combustion modification or change of location beginning March 1, 2012
Any <b>In-Use</b> unit manufactured after 1997				July 1 of the year the unit is 15 years old
<b>New</b> remediation unit installed after January 1, 2010				At the time a District permit is required
<b>Liquid Fuel-Fired Equipment</b>				
<b>In-Use</b> remediation unit manufactured prior to 1998	40 ppm or 0.053 lb/mmBTU	40 ppm or 0.053 lb/mmBTU	60 ppm or 0.080 lb/mmBTU	Upon combustion modification or change of location beginning March 1, 2012
Any <b>In-Use</b> unit manufactured after 1997				July 1 of the year the unit is 15 years old
<b>New</b> remediation unit installed after January 1, 2010				At the time a District permit is required

- (A) Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. **The emission limit applies solely when burning 100% fuel** and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas.
- (B) Exemption for Mixing Fuel with Air Toxics, VOCs, or Other Vapors Prior to Incineration: As per Section (g)(3)(E), a remediation unit in which a fuel, including but not limited to natural gas, propane, butane or liquefied petroleum gas (LPG), is mixed with air toxics, VOCs, landfill gas, digester gas or other combustible vapors prior to incineration in the unit, in order to maintain vapor concentration above the upper explosion limit or above a manufacturer specified limit in order to maintain combustion or temperature in the unit is not subject to the provisions of this rule. **This exemption does not apply to a burner with a separate fuel line used to heat up or maintain temperature of a unit or incinerate air toxics, VOCs or other combustible vapors in a gas stream moving past the burner flame.**
- (C) Exemption for Propane, Butane or Liquefied Petroleum Gas Where Natural Gas is Not Available: As per Section (g)(7), **remediation units are exempt from the applicable emission limit in Table 1 while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available.** Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

South Coast AQMD (continued)

**Regulation XI, Rule 1166 - Volatile Organic Compound Emissions from Decontamination of Soil (amended 5/11/2001)**

This rule limits the VOC emissions from excavating, grading, handling, and treating VOC-contaminated soil as a result of leakage from storage or transfer operations, accidental spillage, or other deposition. Since this rule applies to the ex-situ ("out of place") remediation of soil which has been excavated from the contamination site, this rule does not apply to this source category of in-situ remediation.

San Diego County APCD

**BACT:**

Source: NSR Requirements for BACT Guidelines (June 2011)

For Soil Remediation	
<b>VOC</b>	N/A – No BACT determinations found
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

There are currently no category-specific Regulation IV rules that apply to soil remediation.

Bay Area AQMD

**BACT:**

Source: BAAQMD BACT Guideline

For Soil Vapor Extraction <u>BACT #151A.1 (6/16/1995)</u>	
<b>VOC</b>	<p><u>Achieved in Practice:</u>  <math>\leq 10</math> ppmv at outlet of control device; or <math>\geq 98.5\%</math> capture/destruction efficiency if inlet VOC <math>\geq 2000</math> ppmv; or <math>\geq 97\%</math> capture/destruction efficiency if inlet VOC <math>\geq 200</math> to <math>&lt; 2000</math> ppmv; or <math>\geq 90\%</math> capture/destruction efficiency if inlet VOC <math>&lt; 200</math> ppmv.</p> <p><u>Typical Technology:</u>            Two or more activated carbon canisters in series or thermal oxidizer or catalytic oxidizer.</p>
<b>NOx</b>	No standard
<b>SOx</b>	No standard
<b>PM10</b>	No standard
<b>PM2.5</b>	No standard
<b>CO</b>	No standard

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

Bay Area AQMD (continued)

**RULE REQUIREMENTS:**

**Regulation 8, Rule 47 – Air Stripping and Soil Vapor Extraction Operations (amended June 15, 2005)**

This rule limits the VOC emissions from soil vapor extraction systems which either:

1. Emit more than one of the following compounds in excess of: 0.05 lb/day of benzene, 0.2 lb/day of vinyl chloride, 0.5 lb/day of trichloroethylene, 0.5 lb/day of perchloroethylene, or 0.5 lb/day of methylene chloride, or
2. Emit a total of greater than or equal to 1 lb/day of benzene, vinyl chloride, perchloroethylene, methylene chloride, and/or trichloroethylene.

For systems subject as described above, Section 8-47-301 requires any soil vapor extraction operations which emit benzene, vinyl chloride, perchloroethylene, methylene chloride, and/or trichloroethylene to be vented to a control device which reduces emissions to the atmosphere by at least 90% by weight.

For systems with total organic compound emissions greater than 15 lb/day, Section 8-47-302 requires operations to be vented to a control device which reduces total organic compound emissions by at least 90% by weight.

San Joaquin Valley APCD

**BACT:**

Source: [SJVAPCD BACT Clearinghouse \(Searchable\)](#)

<u>For BACT Guideline 2.1.1 A: Soil Remediation Operation Utilizing Thermal and Catalytic Oxidizers (12/7/1992)</u>	
<b>VOC</b>	95% or greater control efficiency for emissions over 2 lb/day, thermal oxidizer @ 1400 °F and 0.5 sec OR catalytic oxidizer @ 600 °F and 0.5 sec.
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

<u>For BACT Guideline 2.1.2: Soil Remediation Operation – I.C. Engine (6/18/1992)</u>	
<b>VOC</b>	LPG auxiliary fuel and 3-way catalytic converter at 95% control
<b>NOx</b>	LPG auxiliary fuel and 3-way catalytic converter
<b>SOx</b>	LPG auxiliary fuel
<b>PM10</b>	LPG auxiliary fuel
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	LPG auxiliary fuel and 3-way catalytic converter

San Joaquin Valley APCD (continued)

For BACT Guideline 2.1.3: Soil Remediation Operation – Carbon Adsorption (9/15/1993)

<b>VOC</b>	95% control efficiency for uncontrolled emissions over 2 lb/day
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

For BACT Guideline 2.1.4: Extracted Soil Remediation Using Steam Stripping/Flushing and 4-Stage Carbon Adsorption, > or = 40 tons/hour (11/21/1995)

<b>VOC</b>	95% control efficiency
<b>NOx</b>	N/A – No BACT determinations found
<b>SOx</b>	N/A – No BACT determinations found
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

For BACT Guideline 2.1.6: Soil Remediation Operation – Using a Boiler = or <4.2 mmBTU/hr to Inject Steam into the Soil to Drive Off Air Contaminants and Controlled by Activated Polymer/Carbon Canisters (10/20/1995)

<b>VOC</b>	For soil remediation: Activated polymer/carbon canisters with 95% control
<b>NOx</b>	For boiler: 0.036 lb/mmBTU (30 ppmv) when natural gas firing and 0.048 lb/mmBTU (40 ppmv) when firing diesel backup fuel
<b>SOx</b>	For boiler: Natural gas with LPG backup
<b>PM10</b>	N/A – No BACT determinations found
<b>PM2.5</b>	N/A – No BACT determinations found
<b>CO</b>	N/A – No BACT determinations found

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

**Rule 4651 – Soil Decontamination Operations (amended 9/20/2007)**

This rule limits VOC emissions from soil that has been contaminated with a VOC-containing liquid and applies to operations involved in the excavation, transportation, handling, decontamination, and disposal of contaminated soil. Since this rule applies to the ex-situ (“out of place”) remediation of soil which has been excavated from the contamination site, this rule does not apply to this source category of in-situ remediation.

Amador County APCD

**BACT:**

Source: ARB BACT Clearinghouse

There are no BACT standards published in the clearinghouse for this category.

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

**Rule 903 – Contaminated Soil Remediation (amended 6/28/1994)**

This rule limits the VOC emissions from organic chemical- or petroleum chemical-contaminated soil when: excavated; aerated without a control device; aerated with a control device; bioremediated (by soil washing, thermal incineration, or other remediation proposals); or stored in piles. Since this rule applies to the ex-situ ("out of place") remediation of soil which has been excavated from the contamination site, this rule does not apply to this source category of in-situ remediation.

Butte County AQMD

**BACT:**

Source: ARB BACT Clearinghouse

There are no BACT standards published in the clearinghouse for this category.

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

**Rule 237 – Soil Decontamination (amended 8/22/2002)**

This rule limits the VOC emissions from soil excavation and remediation, or treatment of soil contaminated by VOCs, and applies to the excavation, aeration, or treatment of soils contaminated by VOCs.

Section 5.3 requires the treatment of contaminated soil (as defined in Section 4.4 to include gasoline, diesel fuel, jet fuel, or other hydrocarbon that may be harmful to the public, as determined by the APCO) to be accomplished by:

1. Installation and operation of a VOC collection and control system for in-situ treatment of contaminated soil;
2. Installation and operation of a VOC collection and control system for on-site treatment of contaminated soil; or
3. Installation of any alternative VOC control technology, which provides an equivalent or greater level of control and as approved by the APCO on a case-by-case basis.

Ventura County APCD

**BACT:**

Source: ARB BACT Clearinghouse

There are no BACT standards published in the clearinghouse for this category.

**T-BACT:**

There are no T-BACT standards published in the clearinghouse for this category.

**RULE REQUIREMENTS:**

**Rule 74.29 – Soil Decontamination Operations (effective 7/1/2008)**

As per Section B.3, this rule applies to soils that contain gasoline, diesel fuel, or jet fuel, and limits the VOC emissions from soil vapor extraction, bioremediation, or bioventing operations to:

1. 100 ppmv VOC (measured as methane, tested according to an organic vapor analyzer certified according to the requirements of EPA Method 21, and sampled by inserting the probe inlet of the analyzer on the centerline of the exhaust or vent, upstream of the point where the exhaust gases meet the atmosphere), and
2. Require a health risk assessment if the total system flow rate is greater than 300 scfm and the system would emit VOC at a rate greater than 0.08 lb/hour.

*Assuming a maximum rated flow rate of 300 scfm and using the equation in Section F.2.:  
 $0.08 \text{ lb/hr VOC} = (0.08 \text{ lb/hour} * 387 \text{ scf/lb-mol} * 10^6) / (300 \text{ scfm} * 16 \text{ lb/lb-mol} * 60 \text{ min/hour}) = 107.5 \text{ ppm VOC}$*

As per Section D, for any soil decontamination project, recordkeeping shall be required for at least two years after initial entry and shall include:

- All dates that soil was disturbed and the quantity of soil disturbed on each date
- Reasons for excavation or grading
- Cause of VOC soil contamination and history of the site
- Description of tanks or piping associated with the soil decontamination
- Description of mitigation measures employed for dust, odors and VOC emissions
- Details of treatment and/or disposal of VOC contaminated soil, including the ultimate receptor
- Description of monitoring equipment and techniques
- All VOC emission measurements shall be recorded on a continuous permanent strip-chart or in a format approved by the Air Pollution Control Officer
- A map showing the facility layout, property line, and surrounding area up to 2500 feet away, and including any schools, residential areas or other sensitive receptors such as hospitals or locations where children or elderly people live or work.

The following control technologies have been identified for soil vapor extraction systems and are ranked based on stringency (according to the required % VOC control efficiency or ppmv concentration) in **bold**:



RANKING OF TECHNOLOGIES ACHIEVED – SOIL VAPOR EXTRACTION (SVE)				
Pollutant	Standard			Source
VOC	For SVE systems with VOC <10 lb/day and controlled by: 1. Catalytic Oxidizers 2. Thermal Oxidizers 3. Carbon Adsorption 4. IC Engines  Each subject to the following VOC control efficiencies and maximum emission limit:			SMAQMD BACT No. 89
	For VOC Concentration at Influent of Control Device (ppmv):	For VOC Concentration at Effluent of Control Device (ppmv):	Required VOC Control Efficiency	Maximum Effluent VOC Daily Limit
	N/A	≤10 ppmv	None	9.9 lb/day
	≥2,000 ppmv	N/A	≥98.5%	
	>200 ppmv to <2,000 ppmv	N/A	≥97%	
	<200 ppmv	N/A	≥90%	
	≤10 ppmv at outlet of control device; or ≥98.5% capture/destruction efficiency if inlet VOC ≥2000 ppmv; or ≥97% capture/destruction efficiency if inlet VOC ≥200 to <2000 ppmv; or ≥90% capture/destruction efficiency if inlet VOC <200 ppmv.			BAAQMD BACT #151A.1
	95% or greater control efficiency for uncontrolled emissions over 2 lb/day.			SJVAPCD BACT #2.1.1 A & BACT #2.1.6
	For systems that emit ≥ 0.05 lb/day of benzene, 0.2 lb/day of vinyl chloride, 0.5 lb/day of trichloroethylene (TCE), 0.5 lb/day of perchloroethylene (PCE), 0.5 lb/day of methylene chloride, or a total of 1 lb/day of benzene, vinyl chloride, PCE, methylene chloride, and/or TCE: vented to a control device which reduces emissions to the atmosphere by at least 90% by weight.  For systems with total organic compound emissions greater than 15 lb/day: vented to a control device which reduces total organic compound emissions by at least 90% by weight.			BAAQMD Regulation 8, Rule 47
	90% control efficiency; 55 tons/year emission limit			EPA AZ-0031
100 ppmv VOC (as methane) and require a health risk assessment if the total system flow rate is greater than 300 scfm and the system would emit greater than 0.08 lb/hour VOC.			Ventura County APCD Rule 74.29	

Then, based on the specific control device used, the following **additional** control technologies have been identified and are ranked based on stringency:

<b>RANKING OF TECHNOLOGIES ACHIEVED – IC ENGINE CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	(see VOC standard under Soil Vapor Extraction BACT above) - and - LPG auxiliary fuel and 3-way catalytic converter at 95% control	SJVAPCD BACT #2.1.2
<b>NOx</b>	LPG auxiliary fuel and 3-way catalytic converter	SJVAPCD BACT #2.1.2
<b>SOx</b>	LPG auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 89 and SJVAPCD BACT #2.1.2
<b>PM10</b>	LPG auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 89 and SJVAPCD BACT #2.1.2
<b>PM2.5</b>	LPG auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 89
<b>CO</b>	LPG auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 89 and SJVAPCD BACT #2.1.2

<b>RANKING OF TECHNOLOGIES ACHIEVED – THERMAL OXIDIZER CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	(see VOC standard under Soil Vapor Extraction BACT above) - and - Thermal oxidizer @ 1400 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1
<b>NOx</b>	Burners <sup>1</sup> fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners <sup>1</sup> fired on 100% natural gas or propane <sup>2</sup> : 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	Burners <sup>1</sup> fired on liquid fuel: 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	
<b>SOx</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>PM10</b>		SMAQMD BACT No. 89
<b>PM2.5</b>		
<b>CO</b>		

<sup>1</sup> NOx limit only applicable to burners that heat up the thermal oxidizer bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

<b>RANKING OF TECHNOLOGIES ACHIEVED – CATALYTIC OXIDIZER CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	<i>(see VOC standard under Soil Vapor Extraction BACT above)</i> - and - Catalytic oxidizer @ 600 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1 A
<b>NOx</b>	<u>Burners<sup>1</sup> fired on mixture of process gas and supplemental fuel:</u> No standard	SCAQMD Regulation XI, Rule 1147
	<u>Burners<sup>1</sup> fired on 100% natural gas or propane<sup>2</sup>:</u> 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	<u>Burners<sup>1</sup> fired on liquid fuel:</u> 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
<b>SOx</b>	No standard	
<b>PM10</b>	No standard	
<b>PM2.5</b>	No standard	
<b>CO</b>	No standard	

<sup>1</sup> NOx limit only applicable to burners that heat up the catalyst bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

<b>RANKING OF TECHNOLOGIES ACHIEVED – CARBON ADSORPTION CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	<i>(see VOC standard under Soil Vapor Extraction BACT above)</i>	
<b>NOx</b>	No standard	
<b>SOx</b>	No standard	
<b>PM10</b>	No standard	
<b>PM2.5</b>	No standard	
<b>CO</b>	No standard	

**Discussion on Achieved in Practice Control Technologies:**

Although all control technologies are equally effective at controlling VOCs, the site-specific conditions and physical properties of the contaminants of concern directly influence the selection of the treatment technology and the overall treatment strategy. Based on the above review, SMAQMD has identified BACT as the use of IC engines, thermal oxidizers, catalytic oxidizers, or carbon adsorption systems to attain set VOC destruction efficiencies corresponding to set influent VOC concentration values.

Below is a brief description of the various types of SVE control technologies identified (as described in USEPA Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice, March 2006):

1. IC Engines – involves mixing extracted contaminated (typically gasoline) vapors in the carburetor of the engine with air and, if necessary, auxiliary fuel (such as LPG or natural gas), and then combusted normally in the engine. This thermal treatment technology is most effective at controlling high-concentration VOC vapors and is primarily used in the initial stages of an SVE project and for tank degassing operations. Chlorinated VOC compounds are not normally treated in engines unless they are comingled with petroleum VOCs.
2. Thermal Oxidizers – using one or more LPG- or natural gas-fired burners, destroys contaminants at a sufficiently high temperature (1200 to 2000 °F) to promote oxidation (or combustion) of contaminants to carbon dioxide and water. The VOCs in the extracted vapors fuel the oxidation reaction, unless concentrations are too low (in which auxiliary fuel such as LPG or natural gas must be added) or too high (in which dilution air must be added). This thermal treatment technology is able to treat a broad range of contaminants at a wide range of concentrations (including non-halogenated VOCs, semivolatile organic compounds, fuel hydrocarbons, alcohols, aliphatics, aromatics, esters, and ketones). However, treatment of halogenated or chlorinated compounds (including perchloroethylene (PCE) or trichloroethylene (TCE)) may generate dioxins and furans or hydrochloric acid, which may require further treatment (such as carbon adsorption or acid scrubbers).
3. Catalytic Oxidizers – using an electric-powered or a LPG- or natural gas-fired burner alongside a catalyst (typically platinum, palladium, or rubidium deposited on an aluminum oxide-coated ceramic or stainless steel substrate), creates an exothermic combustion reaction to oxidize contaminants. The addition of the catalyst accelerates the rate of oxidation and allows it to occur at lower temperatures (500 to 900 °F) than required by thermal oxidizers. As with thermal oxidizers, treatment of halogenated or chlorinated compounds (including perchloroethylene (PCE) or trichloroethylene (TCE)) may generate dioxins and furans or hydrochloric acid, which may require further treatment (such as carbon adsorption or acid scrubbers).
4. Carbon Adsorption – captures and removes contaminants through physical adsorption using a medium or matrix (including granular activated carbon, zeolite, and synthetic polymers). Using a blower or vacuum pumps, extracted vapors are either pushed or sucked through the matrix and contaminants are collected on the surface of the adsorbent medium until the medium is saturated. Most adsorption systems consist of one or more canisters connected in series or parallel to prevent breakthrough.

Therefore, the following control technologies have been identified for soil vapor extraction systems as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED – SOIL VAPOR EXTRACTION (SVE)				
Pollutant	Standard			Source
VOC	For soil vapor extraction systems with VOC <10 lb/day and controlled by: 1. Catalytic Oxidizers 2. Thermal Oxidizers 3. Carbon Adsorption 4. IC Engines  Each subject to the following VOC control efficiencies and maximum emission limit:			
	For VOC Concentration at Influent of Control Device (ppmv):	For VOC Concentration at Effluent of Control Device (ppmv):	Required VOC Control Efficiency	Maximum Effluent VOC Daily Limit
	N/A	≤10 ppmv	None	9.9 lb/day
	≥2,000 ppmv	N/A	≥98.5%	
	≥200 ppmv to <2,000 ppmv	N/A	≥97%	
<200 ppmv	N/A	≥90%		

Then, based on the specific control device used, the following **additional** control technologies have been identified as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED – IC ENGINE CONTROLLING SVE		
Pollutant	Standard	Source
VOC	(see VOC standard under Soil Vapor Extraction BACT above) - and - To be determined under separate engine-specific BACT upon application.	
NOx	To be determined under separate engine-specific BACT upon application.	
SOx		
PM10		
PM2.5		
CO		

<b>BEST CONTROL TECHNOLOGIES ACHIEVED – THERMAL OXIDIZER CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	(see VOC standard under Soil Vapor Extraction BACT above) - and - Thermal oxidizer @ 1400 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1
<b>NOx</b>	<u>Burners<sup>1</sup> fired on mixture of process gas and supplemental fuel:</u> No standard	SCAQMD Regulation XI, Rule 1147
	<u>Burners<sup>1</sup> fired on 100% natural gas or propane<sup>2</sup>:</u> 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	<u>Burners<sup>1</sup> fired on liquid fuel:</u> 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>SOx</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>PM10</b>		
<b>PM2.5</b>		
<b>CO</b>		

<sup>1</sup> NOx limit only applicable to burners that heat up the thermal oxidizer bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

<b>BEST CONTROL TECHNOLOGIES ACHIEVED – FOR CATALYTIC OXIDIZER CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	(see VOC standard under Soil Vapor Extraction BACT above) - and - Catalytic oxidizer @ 600 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1 A
<b>NOx</b>	<u>Burners<sup>1</sup> fired on mixture of process gas and supplemental fuel:</u> No standard	SCAQMD Regulation XI, Rule 1147
	<u>Burners<sup>1</sup> fired on 100% natural gas or propane<sup>2</sup>:</u> 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	<u>Burners<sup>1</sup> fired on liquid fuel:</u> 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
<b>SOx</b>	No standard	
<b>PM10</b>	No standard	
<b>PM2.5</b>	No standard	
<b>CO</b>	No standard	

<sup>1</sup> NOx limit only applicable to burners that heat up the catalyst bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

<b>BEST CONTROL TECHNOLOGIES ACHIEVED – CARBON ADSORPTION CONTROLLING SVE</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	<i>(see VOC standard under Soil Vapor Extraction BACT above)</i>	
<b>NOx</b>	No standard	
<b>SOx</b>	No standard	
<b>PM10</b>	No standard	
<b>PM2.5</b>	No standard	
<b>CO</b>	No standard	

**B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.b.):**

**Technologically Feasible Alternatives:**

Any alternative basic equipment, fuel, process, emission control device or technique, singly or in combination, determined to be technologically feasible by the Air Pollution Control Officer.

The table below shows the technologically feasible alternatives identified as capable of reducing emissions beyond the levels determined to be "Achieved in Practice" as per Rule 202, §205.1.a:

<b>TECHNOLOGICALLY FEASIBLE ALTERNATIVES</b>		
<b>Pollutant</b>	<b>Technologically Feasible Alternatives</b>	<b>Source</b>
<b>VOC</b>	<p><u>For soil vapor extraction:</u>  <math>\leq 10</math> ppmv at outlet of control device; or <math>\geq 98.5\%</math> capture/destruction efficiency.</p> <p><u>Typical Technology:</u>            Two or more activated carbon canisters in series or thermal oxidizer or catalytic oxidizer.</p>	<p><u>BAAQMD</u>  <u>BACT #151A.1</u></p>
<b>NOx</b>	<p><u>For soil vapor extraction controlled by thermal oxidizer:</u>            1. Natural gas with low NOx burner            2. Water injection (valid only for vapor generation units)</p> <p><u>Alternate Basic Equipment:</u>            Carbon adsorption – as an alternative for VOC control (not valid for vapor generation units<sup>1</sup>)</p>	<p><u>SJVAPCD</u>  <u>BACT #2.1.1</u></p>
<b>SOx</b>	No other technologically feasible option identified	
<b>PM10</b>	No other technologically feasible option identified	
<b>PM2.5</b>	No other technologically feasible option identified	
<b>CO</b>	No other technologically feasible option identified	

<sup>1</sup> "Vapor generation units" are assumed to include ozone injection or air sparging systems, which historically have not been subject to SMAQMD permitting since it is usually operated in conjunction with a soil vapor extraction system and is vented to and controlled by the same air pollution control device.

### **Discussion on Technologically Feasible Alternatives:**

#### **SVE $\leq$ 10 ppmv VOC at Outlet of Control Device or $\geq$ 98.5% Capture/Destruction Efficiency:**

The  $\leq$  10 ppmv VOC limit at the outlet of a control device or  $\geq$  98.5% capture/destruction efficiency using two or more activated carbon canisters in series or thermal oxidizer or catalytic oxidizer is already required as part of the achieved in practice BACT for VOC [BAAQMD].

However, the achieved in practice BACT is defined as attainment of set VOC destruction efficiencies corresponding to set influent VOC concentration values. This allows for a tiered approach rather than a single VOC concentration limit or control efficiency, and which takes into account the physical and chemical difficulties of:

- achieving higher capture/destruction efficiencies as inlet VOC concentrations decrease (i.e., requiring smaller and smaller effluent concentrations (which may fall under a laboratory's detection limit) to achieve the required destruction efficiency)
- the fact that SVEs "do not have consistent influent VOC concentrations over time" (as described on page 2-5, USEPA Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice, March 2006)
- the variability of influent VOC concentrations in order to maintain a safe lower explosive level (LEL) range to prevent explosive SVE air streams; generally, influent concentrations are limited 10 to 25% of the LEL (defined as the minimum concentration of a chemical vapor in atmospheric air that is sufficient to support combustion), and the desired LEL concentration can be obtained by diluting the SVE influent with ambient air ("dilution air") (as described on pages 2-7 and 3-9, USEPA Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice, March 2006)
- the "likelihood that influent VOC concentrations to the thermal treatment system will decrease over time, thereby affecting both cost to operate and achievable DREs (destruction and removal efficiencies), is an important consideration for SVE off-gas application selection. This consideration must be accounted for in the engineering and economic analysis" (as described on page 3-10, USEPA Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice, March 2006).

Therefore, this BACT limitation is not considered technologically feasible without the tiered approach to the VOC capture/destruction efficiency and will not be considered as a technologically feasible BACT.

#### **SVE Controlled by Thermal Oxidizer Using Natural Gas with Low NOx Burner:**

Thermal oxidizers using natural gas with low NOx burners have already been deemed as achieved in practice BACT for NOx [SCAQMD Regulation XI, Rule 1147]. Furthermore, SJVAPCD BACT Guideline 2.1.1: Soil Remediation Operation – Thermal Oxidizer (3/17/1997) did not indicate a specific NOx concentration as a technologically feasible standard for a low NOx burner.

#### **Cost Effective Determination:**

Since the technologically feasible alternative to use a thermal oxidizer using natural gas with a low NOx burner has already been found to be achieved in practice by SCAQMD, a cost effectiveness analysis is not required.

#### **C. SELECTION OF BACT:**

BACT for the control of VOC emissions from Soil Remediation – Soil Vapor Extraction is the use of IC engines, thermal oxidizers, catalytic oxidizers, or carbon adsorption systems to attain set VOC destruction efficiencies corresponding to set influent VOC concentration values.



Based on the above analysis, BACT for VOC, NOx, SOx, PM10, and CO will remain at what is currently achieved in practice and BACT for PM2.5 will be set to be the same as for PM10.

<b>BACT FOR SOIL REMEDIATION – SOIL VAPOR EXTRACTION (SVE) FOR PROJECTS EMITTING &lt;10 LB/DAY VOC</b>				
<b>Pollutant</b>	<b>Standard</b>			<b>Source</b>
<b>VOC</b>	For soil vapor extraction systems with VOC <10 lb/day and controlled by: <ol style="list-style-type: none"> <li>1. Catalytic Oxidizers</li> <li>2. Thermal Oxidizers</li> <li>3. Carbon Adsorption</li> <li>4. IC Engines</li> </ol> Each subject to the following VOC control efficiencies and maximum emission limit:			
	For VOC Concentration at Influent of Control Device (ppmv):	For VOC Concentration at Effluent of Control Device (ppmv):	Required VOC Control Efficiency	Maximum Effluent VOC Daily Limit
	N/A	≤10 ppmv	None	9.9 lb/day
	≥2,000 ppmv	N/A	≥98.5%	
	≥200 ppmv to <2,000 ppmv	N/A	≥97%	
<200 ppmv	N/A	≥90%		

Then, based on the specific control device used, the following control technologies have been identified as BACT:

<b>BACT FOR SOIL REMEDIATION – IC ENGINE CONTROLLING SVE FOR PROJECTS EMITTING &lt;10 LB/DAY</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	(see VOC standard under Soil Vapor Extraction BACT above) - and - To be determined under separate engine-specific BACT upon application.	
<b>NOx</b>	To be determined under separate engine-specific BACT upon application.	
<b>SOx</b>		
<b>PM10</b>		
<b>PM2.5</b>		
<b>CO</b>		

<b>BACT FOR SOIL REMDIATION – THERMAL OXIDIZER CONTROLLING SVE FOR PROJECTS EMITTING &lt;10 LB/DAY VOC</b>		
<b>Pollutant</b>	<b>Standard</b>	<b>Source</b>
<b>VOC</b>	<i>(see VOC standard under Soil Vapor Extraction BACT above)</i> - and - Thermal oxidizer @ 1400 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1
<b>NOx</b>	<u>Burners<sup>1</sup> fired on mixture of process gas and supplemental fuel:</u> No standard	SCAQMD Regulation XI, Rule 1147
	<u>Burners<sup>1</sup> fired on 100% natural gas or propane<sup>2</sup>:</u> 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	<u>Burners<sup>1</sup> fired on liquid fuel:</u> 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>SOx</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>PM10</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>PM2.5</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89
<b>CO</b>	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 89

<sup>1</sup> NOx limit only applicable to burners that heat up the thermal oxidizer bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

BACT FOR SOIL REMDIATION – CATALYTIC OXIDIZER CONTROLLING SVE FOR PROJECTS EMITTING <10 LB/DAY VOC		
Pollutant	Standard	Source
VOC	(see VOC standard under Soil Vapor Extraction BACT above) - and - Catalytic oxidizer @ 600 °F and 0.5 second retention time	SJVAPCD BACT #2.1.1 A
NOx	Burners <sup>1</sup> fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners <sup>1</sup> fired on 100% natural gas or propane <sup>2</sup> : 1. 30 ppm NOx at 3% O <sub>2</sub> for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of > 800 °F.	
	Burners <sup>1</sup> fired on liquid fuel: 1. 40 ppm NOx at 3% O <sub>2</sub> for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O <sub>2</sub> for process temperatures of ≥ 1200 °F.	
SOx	No standard	
PM10	No standard	
PM2.5	No standard	
CO	No standard	

<sup>1</sup> NOx limit only applicable to burners that heat up the catalyst bed.

<sup>2</sup> Remediation units are exempt from this emission limit while fueled with propane, butane or liquefied petroleum gas in a location where natural gas is not available. Remediation units must comply with the emission limit when natural gas is available and while fueled with natural gas.

BACT FOR SOIL REMDIATION – CARBON ADSORPTION CONTROLLING SVE FOR PROJECTS EMITTING <10 LB/DAY VOC		
Pollutant	Standard	Source
VOC	(see VOC standard under Soil Vapor Extraction BACT above)	
NOx	No standard	
SOx	No standard	
PM10	No standard	
PM2.5	No standard	
CO	No standard	

**D. SELECTION OF T-BACT:**

The toxics at issue with this technology are VOCs. The control of VOCs through meeting the BACT standard will also control toxics found in the VOCs. Therefore, the BACT VOC controls are also the T-BACT controls.

**For Chlorinated Compounds (T-BACT):**

Based on the concerns identified above about generating dioxins and furans or hydrochloric acid from the thermal treatment (i.e., IC engines, thermal oxidizers, or catalytic oxidizers) of chlorinated compounds (including perchloroethylene (PCE) or trichloroethylene (TCE)), further treatment (such as carbon adsorption or acid scrubbers) will be required as T-BACT.

REVIEWED BY: Ben F. Kirk DATE: 5-8-17

APPROVED BY: George R. Guyan DATE: 5/25/17

# **Attachment A**

**Review of BACT Determinations published by Other  
Agencies**

**BAY AREA AIR QUALITY MANAGEMENT DISTRICT**  
**Best Available Control Technology (BACT) Guideline**

*Source Category*

Source:	Soil Vapor Extraction	Revision:	3
Class:	All	Document #:	151A.1
		Date:	06/16/95

*Termination*

POLLUTANT	BACT	TYPICAL TECHNOLOGY
	1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	
POC	1. $\leq 10$ ppmv at outlet of control device, or $\geq 98.5\%$ capture/destruction efficiency <sup>a,T</sup> 2. $\leq 10$ ppmv at outlet of control device, or $\geq 98.5\%$ capture/destruction efficiency if inlet VOC $\geq 2000$ ppmv, or $\geq 97\%$ capture/destruction efficiency if inlet VOC $\geq 200$ to $< 2000$ ppmv, or $\geq 90\%$ capture/destruction efficiency if inlet VOC $< 200$ ppmv <sup>a,T</sup>	1. Two or More Activated Carbon Canister in Series or Thermal Oxidizer <sup>a,T</sup> 2. Two or More Activated Carbon Canisters in Series or Thermal Oxidizer or Catalytic Oxidizer <sup>a,T</sup>
NOx	1. n/a 2. n/a	1. n/a 2. n/a
SO2	1. n/a 2. n/a	1. n/a 2. n/a
CO	1. n/a 2. n/a	1. n/a 2. n/a
PM10	1. n/a 2. n/a	1. n/a 2. n/a
NPOC	1. $\leq 10$ ppmv at outlet of control device <sup>a,T</sup> 2. $\leq 10$ ppmv at outlet of control device, or $\geq 95\%$ capture/recovery efficiency <sup>a,T</sup>	1. Two or More Activated Carbon Canisters in Series <sup>a,T</sup> 2. Two or More Activated Carbon Canisters in Series <sup>a,T</sup>

*References*

a. BAAQMD  
 T. TBACT

San Joaquin Valley  
Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline 2.1.1\*

Last Update 3/17/1997

Soil Remediation Operation - Thermal Oxidizer

Pollutant	Achieved in Practice or contained in the SIP	Technologically Feasible	Alternate Basic Equipment
NOx		1. Natural gas with low NOx burner 2. Water injection (valid only for vapor generation units)	Carbon adsorption - as an alternative for VOC control (not valid for vapor generation units)
VOC	Thermal Oxidizer @ 1400 F and 0.5 sec  OR  Catalytic Oxidizer @ 600 F and 0.5 sec both at 95% or greater control efficiency		

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

\*This is a Summary Page for this Class of Source



**Best Available Control Technology (BACT) Guideline 2.1.1 B**

**Emissions Unit:** Soil Remediation Utilizing Thermal Oxidizers      **Equipment Rating:** 2.0 MMBtu/hr  
**Facility:** Applied Vapor Technology Inc      **References:** PTO #: S-2986-2-0 Project #: 961120  
**Location:** Various Locations - SJVUAPCD      **Date of Determination:** 3/17/1997

**Pollutant**      **BACT**

CO      BACT NOT TRIGGERED

NOx      No Achieved in Practice controls found

PM10      BACT NOT TRIGGERED

SOx      BACT NOT TRIGGERED

VOC      BACT NOT TRIGGERED

**BACT Status**

**Comment**

Small Emitter

**Best Available Control Technology (BACT) Guideline 2.1.1 A**

**Emissions Unit:** Soil Remediation Utilizing Thermal and Catalytic Oxidizers      **Equipment Rating:** N/A  
**Facility:** ARCO Products Company      **References:** PTO #: N-1676-1-1  
**Location:** Turlock      **Date of Determination:** 12/7/1992

**Pollutant**      **BACT**

CO      BACT NOT TRIGGERED

NOx      BACT NOT TRIGGERED

PM10      BACT NOT TRIGGERED

SOx      BACT NOT TRIGGERED

VOC      95% or greater control efficiency for emissions over 2 lb/day, Thermal Oxidizer @ 1400oF and 0.5 sec retention time and Catalytic Oxidizer @ 600oF and 0.5 sec retention time

**BACT Status**

**Comment**

Achieved in Practice



# Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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## Process Information - Details

For information about the pollutants related to this process, click on the specific pollutant in the list below.

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FINAL

**RBLC ID:** AZ-0031

**Corporate/Company:** THERMAL EARTH SOLUTION

**Facility Name:** THERMAL EARTH SOLUTION

**Process:** SOIL REMEDIATION UNIT

**Primary Fuel:**

**Throughput:** 20.00 TON/HR

**Process Code:** 29.100

### Pollutant Information - List of Pollutants

[Help](#)

Pollutant	Primary Emission Limit	Basis	Verified
<a href="#">Volatile Organic Compounds (VOC)</a>	55.0000 T/YR	BACT-PSD	NO

**Process Notes:**

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Last updated on 11/3/2016



# Pollutant Information

Click on the Process Information button to see more information about the process associated with this pollutant.

Or click on the Process List button to return to the list of processes.

[RBLG Home](#)[New Search](#)[Search Results](#)[Facility Information](#)[Process List](#)[Process Information](#)[Pollutant Information](#)[Help](#)**FINAL**

**RBLG ID:** AZ-0031

**Corporate/Company:** THERMAL EARTH SOLUTION

**Facility Name:** THERMAL EARTH SOLUTION

**Process:** SOIL REMEDIATION UNIT

**Pollutant:** Volatile Organic Compounds  
(VOC)

**CAS Number:** VOC

**Pollutant Group(s):** Volatile Organic Compounds  
(VOC),

**Substance Registry System:** Volatile Organic Com

**Pollution Prevention/Add-on Control Equipment/Both/No Controls Feasible:** A

**P2/Add-on Description:** THERMAL OXIDIZER

**Test Method:** Unspecified

[EPA/QAR Methods](#)[All Other Methods](#)

**Percent Efficiency:** 90.000

**Compliance Verified:**

**EMISSION LIMITS:**

**Case-by-Case Basis:** BACT-PSD

**Other Applicable Requirements:**

**Other Factors Influence Decision:**

**Emission Limit 1:** 55.0000 T/YR

**Emission Limit 2:** 0

**Standard Emission Limit:** 0

**COST DATA:**

**Cost Verified?** No

**Dollar Year Used in Cost Estimates:**

**Cost Effectiveness:** 0 \$/ton

**Incremental Cost Effectiveness:** 0 \$/ton

**Pollutant Notes:**

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 2.1.2\***

Last Update 6/18/1992

**Soil Remediation Operation - I.C. Engine**

Pollutant	Achieved in Practice or contained in the SIP	Technologically Feasible	Alternate Basic Equipment
CO	LPG auxiliary fuel and 3 - way catalytic converter	Natural gas or LPG auxiliary fuel and 3 - way catalytic converter	
NOx	LPG auxiliary fuel and 3 - way catalytic converter	Natural gas or LPG auxiliary fuel and 3 - way catalytic converter	
PM10	LPG auxiliary fuel	Natural gas or LPG auxiliary fuel	
SOx	LPG auxiliary fuel	Natural gas or LPG auxiliary fuel	
VOC	LPG auxiliary fuel and 3 - way catalytic converter @ 95% control	Natural gas or LPG auxiliary fuel and 3 - way catalytic converter @ 95% control	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

\*This is a Summary Page for this Class of Source

Back

**Best Available Control Technology (BACT) Guideline 2.1.2 A**

**Emissions Unit:** Soil Remediation Utilizing I.C. Engine      **Equipment Rating:** 63 hp  
**Facility:** County of Kings      **References:** PTO #: C-380-1-0 Project #: 9233  
**Location:** Hanford      **Date of Determination:** 6/18/1992

**Pollutant**      **BACT**

CO      LPG auxiliary fuel and 3 - way catalytic converter

NOx      LPG auxiliary fuel and 3 - way catalytic converter

PM10      LPG auxiliary fuel

SOx      LPG auxiliary fuel

VOC      95% Control Efficiency, LPG auxiliary fuel and 3 - way catalytic converter

**BACT Status**

**Comment**

Achieved in Practice

San Joaquin Valley  
Unified Air Pollution Control District

**Best Available Control Technology (BACT) Guideline 2.1.6\***

Last Update 10/20/1995

**Soil Remediation Operation - Boiler, = or < 4.2 MMBtu/hr**

Pollutant	Achieved in Practice or contained in the SIP	Technologically Feasible	Alternate Basic Equipment
NOx	0.036 lb/MMBtu (30 ppmv) when gas firing and 0.048 lb/MMBtu (40 ppmv) when firing diesel backup fuel	1. SCR - 9 ppmvd @ 3% O2 2. 30 ppmvd @ 3% O2 low NOx burner flue gas recirculation 3. Exclusive natural gas firing	
SOx	Natural gas with LPG backup		

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

\*This is a Summary Page for this Class of Source

Back

**Best Available Control Technology (BACT) Guideline 2.1.6 A**

<b>Emissions Unit:</b>	Soil Remediation operation using a Transportable Natural gas, LPG and Oil Fired Boiler	<b>Equipment Rating:</b>	4.2 MMBtu/hr
<b>Facility:</b>	Aman Environmental Construction, Inc	<b>References:</b>	ATC #: S-2837-1-0 Project #: 950326
<b>Location:</b>	Various Locations, SJVUAPCD	<b>Date of Determination:</b>	10/20/1995

<b>Pollutant</b>	<b>BACT</b>
------------------	-------------

CO	BACT NOT TRIGGERED
----	--------------------

NOx	0.036 lb/MMBtu (30 ppmv) when gas firing 0.048 lb/MMBtu (40 ppmv) when standby oil firing
-----	---

PM10	BACT NOT TRIGGERED
------	--------------------

SOx	Natural gas with LPG or low-sulfur (= 0.05% S by weight) diesel fuel backup
-----	---

VOC	BACT NOT TRIGGERED
-----	--------------------

**BACT Status**

**Comment**

Small Emitter

Achieved in Practice

SOx

Contained in EPA approved SIP

NOx

## BACT Clearinghouse Database Lookup Results

34 Match(s) for Code 2

### Air Stripper - Ground Water Treatment

Project Name & Description	A/C Issue Date & ARB File No.	Pollutant
<p><u>Aman Environmental Construction, Inc.</u></p> <p>On-site contaminated soil remediation with two trailer-mounted 4.2 MMBtu/hr Donlee Technologies model YSH-100 Turbo Fire II dual-fired marine boilers fired primarily on natural gas with LPG and diesel backup</p> <p>(Detailed Information)</p>	<p>12/26/95</p> <p>(A/C no. S-2837-1-0)</p> <p><u>A430-711-96</u></p> <p>District Contact: George Heinen <u>San Joaquin Valley Unified</u> <u>APCD</u> (559) 230-5909</p>	<p><b>NO<sub>x</sub></b> (Detailed Control Information) York-Shipley low-NO<sub>x</sub> burner</p> <p>0.036 lbm/MMBtu on natural gas 0.048 lbm/MMBtu on diesel</p> <hr/> <p><b>SO<sub>x</sub></b> (Detailed Control Information) Low-sulfur diesel fuel oil at 0.05% S content by wt.</p> <p>No limit (Equivalent to 0.005 lbm/MMBtu for diesel)</p> <hr/> <p><b>VOC/HC</b> (Detailed Control Information) Activated polymer/carbon canister</p> <p>95% control</p>

# **Attachment B**

**Review of BACT Determinations Published by EPA**

**List of BACT determinations published in EPA's RACT/BACT/LAER Clearinghouse for Contaminated Soil Treatment:**

RBL#	Permit Date	Process Code (A)(B)	Rating	Pollutant	Standard	Case-By-Case Basis
AZ-0031	6/3/1996	29.100	Soil remediation unit controlled by thermal oxidizer, 20 TPH capacity	VOC	90% control efficiency; 55 TPY emission limit	BACT-PSD
OH-0210	7/3/1993	29.100	Soil vapor extraction using Good Engineering Practices (GEP)	VOC	0.0104 lb/hr; 0.25 lb/day; 0.0460 TPY	BACT-PSD
CA-0446, CA-0517 (SJVAPC D) (C)	4/27/1992	29.100	Contaminated soil treatment controlled by VOC incinerator, 50 TPH capacity	VOC	99.599% control efficiency; 1.11 lbm/day; 0.02 lbm/ton, by VOC incinerator	BACT-PSD
CA-0496 (BAAQMD ) (D)	4/1/1992	29.100	Soil vapor extraction controlled by oxidation catalyst, 1267 scfm capacity	NOx	1.32 lb/hr, by low-NOx burners	BACT-PSD
CA-0471 (SCAQM D) (E)	8/9/1991	29.100	Soil vapor extraction system controlled by regenerative thermal oxidizer, 600 cfm capacity	PM10	1 lb/hr, 99.98% control efficiency, by baghouse	BACT-PSD
CA-0477 (SCAQM D) (E)	8/9/1991	29.100	Soil vapor extraction system controlled by regenerative thermal oxidizer, 312 cfm capacity	VOC	97% control efficiency; 1.7 lbm/day	BACT-PSD
				VOC	98% control efficiency	BACT-PSD
				VOC	99% control efficiency	BACT-PSD



RBLC#	Permit Date	Process Code (A)(B)	Rating	Pollutant	Standard	Case-By-Case Basis
CA-0478 (SCAQM D) (E)	8/9/1991	29.100	Soil vapor extraction system controlled by regenerative thermal oxidizer, 600 cfm capacity	VOC	99.2% control efficiency	BACT-PSD
CA-0479 (SCAQM D) (E)	8/9/1991	29.100	Soil vapor extraction system controlled by internal combustion engine	VOC	99.7% control efficiency	BACT-PSD
CA-0482, CA-0483 (SCAQM D) (E)	7/29/1991	29.100	Soil vapor extraction system (vent test) controlled by internal combustion engine, 250 cfm capacity	VOC	99.8% control efficiency; 0.21 lbm/day	BACT-PSD
CA-0480 (SCAQM D) (E)	6/7/1991	29.100	In-situ soil vapor extraction operation controlled by thermal oxidizer, 200 cfm capacity	VOC	98% control efficiency; 2 lbm/day	BACT-PSD
CA-0429 (SCAQM D) (E)	12/13/1990	29.100	Soil vapor extraction controlled by thermal oxidizer, 150 scfm capacity	VOC	99% control efficiency; 1 lbm/day	BACT-PSD
CA-0481 (SCAQM D) (E)	12/13/1990	29.100	Soil vapor extraction controlled by thermal oxidizer, 500 scfm capacity	VOC	97% control efficiency; 5 lbm/day	BACT-PSD
CA-0476 (SCAQM D) (E)	12/4/1990	29.100	Soil vapor extraction controlled by thermal oxidizer, 400 scfm capacity	VOC	95% control efficiency; 5 lbm/day	BACT-PSD

RBL#	Permit Date	Process Code (A)(B)	Rating	Pollutant	Standard	Case-By-Case Basis
CA-0474, CA-0475 (SCAQMD) D) (E)	11/15/1990	29.100	Soil vapor extraction controlled by thermal oxidizer, 350 scfm capacity	VOC	97% control efficiency	BACT-PSD

(A) Process Code 29.100 includes contaminated soil treatment.

(B) Thermal desorption units and soil remediation kilns were not reviewed as part of this soil vapor extraction BACT category.

(C) This 4/27/1992 SJVAPCD BACT determination was superseded by SJVAPCD BACT Nos. 2.1.1A (12/7/1992), 2.1.2 (6/18/1992), 2.1.3 (9/15/1993), 2.1.4 (11/21/1995), and 2.1.6 (10/20/1995).

(D) This 4/1/1992 BAAQMD BACT determination was superseded by BAAQMD BACT No. 151A.1 (6/16/1995).

(E) These 1990 to 1991 SCAQMD BACT determinations were not published in the SCAQMD BACT Clearinghouse for either Major or Non-Major sources. Based on an inquiry to SCAQMD on February 28, 2017, it was confirmed that these BACT determinations are not listed in their BACT clearinghouse; instead, SCAQMD has been referring to BAAQMD's BACT for SVE (which was also reviewed as part of this BACT determination). Therefore, it was assumed that these SCAQMD BACT determinations are no longer applicable since they have been superseded by the BAAQMD BACT.

☐ = Selected as the most stringent BACT determination achieved in practice.