CATEGORY: **SOIL REMEDIATION**

BACT Size: Small Emitter BACT (PTE < 10 lb/day) **SOIL VAPOR EXTRACTION (SVE)**

BACT Determination Number: 224	**BACT Determination Date:** 6/4/2019

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:

EXPIRED

BACT Determination Information

ROCs	**Standard:**	9.9 lb/day and % control based on influent
	Technology Description:	IC Engines, Thermal Oxidizers, Catalytic Oxidizers, or Carbon Adsorption that achieve the control efficiency requirements stated below.
	Basis:	Achieved in Practice
NOx	**Standard:**	(see additional BACT for technology below)
	Technology Description:	IC Engines, Thermal Oxidizers, or Catalytic Oxidizers that meet the APC-specific requirements in the BACT determination evaluation.
	Basis:	Achieved in Practice
SOx	**Standard:**	(see additional BACT for technology below)
	Technology Description:	IC Engines, Thermal Oxidizers, or Catalytic Oxidizers that meet the APC-specific requirements in the BACT determination evaluation.
	Basis:	Achieved in Practice
PM10	**Standard:**	(see additional BACT for technology below)
	Technology Description:	IC Engines, Thermal Oxidizers, or Catalytic Oxidizers that meet the APC-specific requirements in the BACT determination evaluation.
	Basis:	Achieved in Practice
PM2.5	**Standard:**	(see additional BACT for technology below)
	Technology Description:	IC Engines, Thermal Oxidizers, or Catalytic Oxidizers that meet the APC-specific requirements in the BACT determination evaluation.
	Basis:	Achieved in Practice
CO	**Standard:**	(see additional BACT for technology below)
	Technology Description:	IC Engines, Thermal Oxidizers, or Catalytic Oxidizers that meet the APC-specific requirements in the BACT determination evaluation.
	Basis:	Achieved in Practice
LEAD	**Standard:**	
	Technology Description:	
	Basis:	

Comments: 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

777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

DETERMINATION NO.: 224

DATE: May 2, 2019

ENGINEER: Michelle Joe

Category/General Equipment Description: Soil Remediation System with VOC <10 lb/day

Equipment Specific Description: Soil Vapor Extraction (SVE)

Equipment Size/Rating: Minor Source BACT

Previous BACT Det. No.: 151

This Best Available Control Technology (BACT) determination will update Determination #151 which was made on April 4, 2017 (and later addended on May 3, 2017 to: clarify that the NOx limit only applies to burners used to heat up thermal oxidizer and catalytic oxidizer beds; and to remove reference to BACT No. 143 & 144, which was later found to not be approved at the time this BACT was finalized) for Soil Remediation – Soil Vapor Extraction (SVE). 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.***

The District reviewed all previously reviewed BACT clearinghouses and rules, and found that the only significant changes were:

- the adoption of SMAQMD's Rule 419 – NOx from Miscellaneous Combustion Units (amended 10/25/2018); and
- the amendment to SCAQMD Rule 1147 – NOx Reductions from Miscellaneous Sources (amended 7/7/2017) that changed the NOx emission limit for all gaseous fuel-fired remediation units with process temperatures ≤800 °F from 30 ppm NOx to 60 ppm NOx.

Therefore, all other considerations made under the previous BACT will remain the same, unless otherwise noted.

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, RBLC ID: OH-0210 (7/3/1993)*	
VOC	Good Engineering Practices (GEP)
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	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 (proposed rule 5/13/2016, comment period ended 7/27/2016):
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). According to the original final rule dated 10/8/2003, 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.

As of 5/13/2016, EPA was seeking comments on their proposals to amend the NESHAP to remove the exemptions for site remediation activities performed under CERCLA or RCRA, and to remove the applicability requirement that site remediations be co-located with at least one other stationary source regulated by another NESHAP (which will require standalone site remediations, with the potential to emit 10 TPY of a single HAP or 25 TPY for a combination of HAPs, to comply with the NESHAP).

As of the close of the comment period on 7/27/2016, no further updates or final rule were posted on EPA's website. Assuming that these amendments took effect, this subpart does not apply to the majority of soil remediation projects since they would either be exempt as remediation activities at gas stations or standalone site remediations with the potential to emit less than 10 TPY of a single HAP or 25 TPY for a combination of HAPS.

California Air Resources Board (CARB)

BACT:
Source: ARB BACT Clearinghouse

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

Sacramento Metropolitan AQMD

BACT:
Source: SMAQMD BACT Clearinghouse, BACT Determination No. 151

<table>
<tr><td colspan="2">For Soil Vapor Extraction with VOC <10 lb/day (4/4/2017)</td></tr>
<tr><td>VOC</td><td>
1. Catalytic Oxidizers
2. Thermal Oxidizers
3. Carbon Adsorption
4. IC Engines

Each subject to the following VOC control efficiencies and maximum emission limit:
<table>
<tr><th>For VOC Concentration at Influent of Control Device (ppmv):</th><th>For VOC Concentration at Effluent of Control Device (ppmv):</th><th>Required VOC Control Efficiency</th><th>Maximum Effluent VOC Daily Limit</th></tr>
<tr><td>N/A</td><td>≤10 ppmv</td><td>None</td><td rowspan="4">9.9 lb/day (A)</td></tr>
<tr><td>≥2,000 ppmv</td><td>N/A</td><td>≥98.5%</td></tr>
<tr><td>≥200 ppmv to <2,000 ppmv</td><td>N/A</td><td>≥97%</td></tr>
<tr><td><200 ppmv</td><td>N/A</td><td>≥90%</td></tr>
</table>
(A) The 9.9 lb/day VOC emission limit was a carry-over of the pre-2011 amendment to Rule 202 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.
</td></tr>
<tr><td>NOx
SOx
PM10
PM2.5
CO</td><td>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).</td></tr>
</table>

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.

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

Rule 419 – NOx from Miscellaneous Combustion Units (amended 10/25/2018):
This rule applies to any miscellaneous combustion unit with a total rated heat input capacity of 5 million Btu per hour or greater located at any area source of NOx (<25 TPY of NOx). Since the majority of thermal oxidizers used for soil remediation projects are both located at an area source of NOx and are rated below 5 mmBTU/hr and that Section 112 specifically exempts air pollution control devices, this rule does not apply.

South Coast AQMD

BACT:
Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities (Revised February 1, 2019)

For Soil Vapor Extraction – Thermal/Catalytic Oxidation (Natural Gas – burner only) (2-1-2019)	
VOC	N/A – No BACT determinations found
NOx	Compliance with Rule 1147
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	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 7/7/2017):
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.

Rule 219 - Equipment Not Requiring a Written Permit Pursuant to Regulation II (amended 4/6/2018) exempts combustion equipment firing natural gas, for which the maximum heat input is 2 mmBTU/hr or less and for which there are no other emissions other than products of combustion (except for food ovens rated ≤ 2 mmBTU/hr), from the requirement to obtain a written permit. Therefore, in practice, the BACT, LAER and Rule 1147 standards only apply to process heaters or any combustion unit with no other emissions other than products of combustion with a heat input greater than 2 mmBTU/hr.

Requirements from Tables 1 and 2 for remediation units only:

Category	NOx Emission Limit			Unit Shall be in Compliance
	Process Temperature			
	≤800 ºF	>800 ºF and <1200 ºF	≥1200 ºF	
Gaseous Fuel-Fired Equipment (A)(B)(C)				
In-Use remediation unit manufactured & installed prior to March 1, 2012	60 ppm or 0.073 lb/mmBTU	60 ppm or 0.073 lb/mmBTU	60 ppm or 0.073 lb/mmBTU	Upon combustion system modification or replacement, unit replacement, or relocation beginning March 1, 2012
Any **In-Use** unit with emissions ≥1 lb/day & manufactured after 1997				July 1 of the year the unit is 15 years old
New remediation unit with heat rating ≥ 0.325 mmBTU/hr & installed after January 1, 2010				At the time a District permit is required
Liquid Fuel-Fired Equipment				
In-Use remediation unit manufactured & installed prior to March 1, 2012	40 ppm or 0.053 lb/mmBTU	40 ppm or 0.053 lb/mmBTU	60 ppm or 0.080 lb/mmBTU	Upon combustion system modification or replacement, unit replacement, or relocation beginning March 1, 2012
Any **In-Use** unit with emissions ≥1 lb/day & manufactured after 1997				July 1 of the year the unit is 15 years old
New remediation unit with heat rating ≥ 0.325 mmBTU/hr & 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 particulate matter, air toxics, VOCs, landfill gas, digester gas or other combustible vapors are mixed in the unit's burner with combustion air or fuel, including but not limited to natural gas, propane, butane or liquefied petroleum gas, prior to or at 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 regenerative thermal or catalytic oxidizer unit with a burner used to heat up or maintain temperature of the unit or a unit that incinerates particulate matter, 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.

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 Joaquin Valley APCD

BACT:
Source: SJVAPCD BACT Clearinghouse (Searchable)

For BACT Guideline 2.1.1 A: Soil Remediation Operation Utilizing Thermal and Catalytic Oxidizers (12/7/1992)	
VOC	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.
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	N/A – No BACT determinations found

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

For BACT Guideline 2.1.3: Soil Remediation Operation – Carbon Adsorption (9/15/1993)	
VOC	95% control efficiency for uncontrolled emissions over 2 lb/day
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	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)	
VOC	95% control efficiency
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	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)	
VOC	For soil remediation: Activated polymer/carbon canisters with 95% control
NOx	For boiler: 0.036 lb/mmBTU (30 ppmv) when natural gas firing and 0.048 lb/mmBTU (40 ppmv) when firing diesel backup fuel
SOx	For boiler: Natural gas with LPG backup
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	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.

Bay Area AQMD

BACT:
Source: BAAQMD BACT Guideline

BAAQMD BACT Document #151A.1 (6/16/1995) for Soil Vapor Extraction	
VOC	Achieved in Practice: ≤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. Typical Technology: Two or more activated carbon canisters in series or thermal oxidizer or catalytic oxidizer.
NOx	No standard
SOx	No standard
PM10	No standard
PM2.5	No standard
CO	No standard

T-BACT:
The BACT standard above also represents the T-BACT standard for this category.

RULE REQUIREMENTS:
Regulation 8, Rule 47 – Air Stripping and Soil Vapor Extraction Operations (amended June 15, 2005):
This rule limits the VOC emissions from air stripping and soil vapor extracting operations 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 air stripping 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 Diego County APCD

BACT:
Source: NSR Requirements for BACT Guidelines (June 2011)

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

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

Regulation 4, Rule 68 – Fuel-Burning Equipment – Oxides of Nitrogen (9/20/1994):
This rule does not apply to fuel burning equipment which has a maximum input rating of < 50 mmBTU/hr. Since the majority of thermal oxidizers used for soil remediation systems are rated below 5 mmBTU/hr, this rule does not apply.

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 lb/hr VOC = (0.08 lb/hour*387 scf/lb-mol*10^6)/(300 scfm*16 lb/lb-mol*60 min/hour) = 107.5 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 and are ranked based on stringency (according to the required % VOC control efficiency or ppmv concentration) in **bold**:

<table>
<tr><th colspan="3">RANKING OF TECHNOLOGIES ACHIEVED – SOIL VAPOR EXTRACTION (SVE)</th></tr>
<tr><th>Pollutant</th><th>Standard</th><th>Source</th></tr>
<tr><td rowspan="6">VOC (A)</td><td>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:
<table>
<tr><th>For VOC Concentration at Influent of Control Device (ppmv):</th><th>For VOC Concentration at Effluent of Control Device (ppmv):</th><th>Required VOC Control Efficiency:</th><th>Maximum Effluent VOC Daily Limit</th></tr>
<tr><td>N/A</td><td>≤10 ppmv</td><td>None</td><td rowspan="4">9.9 lb/day</td></tr>
<tr><td>≥2,000 ppmv</td><td>N/A</td><td>≥98.5%</td></tr>
<tr><td>≥200 ppmv to <2,000 ppmv</td><td>N/A</td><td>≥97%</td></tr>
<tr><td><200 ppmv</td><td>N/A</td><td>≥90%</td></tr>
</table></td><td>SMAQMD BACT No. 151</td></tr>
<tr><td>≤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.</td><td>BAAQMD BACT #151A.1</td></tr>
<tr><td>95% or greater control efficiency for uncontrolled emissions over 2 lb/day.</td><td>SJVAPCD BACT #2.1.1 A & BACT #2.1.6</td></tr>
<tr><td>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.</td><td>BAAQMD Regulation 8, Rule 47</td></tr>
<tr><td>Good Engineering Practices (GEP)</td><td>EPA OH-0210</td></tr>
<tr><td>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.</td><td>Ventura County APCD Rule 74.29</td></tr>
</table>

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

RANKING OF TECHNOLOGIES ACHIEVED – IC ENGINE CONTROLLING SVE		
Pollutant	**Standard**	**Source**
VOC	***(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
NOx	LPG auxiliary fuel and 3-way catalytic converter	SJVAPCD BACT #2.1.2
	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
SOx	LPG auxiliary fuel	SJVAPCD BACT #2.1.2
	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM10	LPG auxiliary fuel	SJVAPCD BACT #2.1.2
	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM2.5	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
CO	LPG auxiliary fuel and 3-way catalytic converter	SJVAPCD BACT #2.1.2
	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151

RANKING OF TECHNOLOGIES ACHIEVED – THERMAL OXIDIZER CONTROLLING SVE		
Pollutant	**Standard**	**Source**
VOC	***(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
NOx	Burners fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
SOx	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
PM10		
PM2.5		
CO		

[1] 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.

RANKING OF TECHNOLOGIES ACHIEVED – CATALYTIC OXIDIZER CONTROLLING SVE		
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 fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
SOx	No standard	
PM10	No standard	
PM2.5	No standard	
CO	No standard	

[1] 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.

RANKING OF TECHNOLOGIES ACHIEVED – CARBON ADSORPTION CONTROLLING SVE		
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	

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 ^{0}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 ^{0}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 as the most stringent, achieved in practice control technologies:

<table>
<tr><th colspan="3">BEST CONTROL TECHNOLOGIES ACHIEVED – SOIL VAPOR EXTRACTION (SVE)</th></tr>
<tr><th>Pollutant</th><th>Standard</th><th>Source</th></tr>
<tr><td>VOC</td><td>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:
<table>
<tr><th>For VOC Concentration at Influent of Control Device (ppmv):</th><th>For VOC Concentration at Effluent of Control Device (ppmv):</th><th>Required VOC Control Efficiency</th><th>Maximum Effluent VOC Daily Limit</th></tr>
<tr><td>N/A</td><td>≤10 ppmv</td><td>None</td><td rowspan="4">9.9 lb/day</td></tr>
<tr><td>≥2,000 ppmv</td><td>N/A</td><td>≥98.5%</td></tr>
<tr><td>≥200 ppmv to <2,000 ppmv</td><td>N/A</td><td>≥97%</td></tr>
<tr><td><200 ppmv</td><td>N/A</td><td>≥90%</td></tr>
</table></td><td>SMAQMD BACT No. 151</td></tr>
</table>

Then, based on the specific control device used, the following 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 - LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
NOx	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
SOx	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM10	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM2.5	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
CO	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151

BEST CONTROL TECHNOLOGIES ACHIEVED – THERMAL OXIDIZER CONTROLLING SVE		
Pollutant	**Standard**	**Source**
VOC	***(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
NOx	Burners fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
SOx	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
PM10		
PM2.5		
CO		

[1] 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.

BEST CONTROL TECHNOLOGIES ACHIEVED – FOR CATALYTIC OXIDIZER CONTROLLING SVE		
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 fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
SOx	No standard	
PM10	No standard	
PM2.5	No standard	
CO	No standard	

[1] 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.

BEST CONTROL TECHNOLOGIES ACHIEVED – CARBON ADSORPTION CONTROLLING SVE		
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	

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:

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

[1] "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 ≤ 10 ppmv VOC at Outlet of Control Device or ≥ 98.5% Capture/Destruction Efficiency:
The ≤ 10 ppmv VOC limit at the outlet of a control device or ≥ 98.5% capture/destruction efficiency using two or more activated carbon canisters in series or thermal oxidizer or catalytic oxidizer [BAAQMD] and the 95% control of VOCs for emissions over 2 lb/day uncontrolled using thermal or catalytic oxidizers [SJVAPCD] is already required as part of the achieved in practice BACT for VOC.

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 soil vapor extraction 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.

<table>
<tr><th colspan="3">BACT FOR SOIL VAPOR EXTRACTION (SVE)
FOR PROJECTS EMITTING <10 LB/DAY VOC</th></tr>
<tr><th>Pollutant</th><th>Standard</th><th>Source</th></tr>
<tr><td>VOC</td><td>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:
<table>
<tr><th>For VOC Concentration at Influent of Control Device (ppmv):</th><th>For VOC Concentration at Effluent of Control Device (ppmv):</th><th>Required VOC Control Efficiency</th><th>Maximum Effluent VOC Daily Limit</th></tr>
<tr><td>N/A</td><td>≤10 ppmv</td><td>None</td><td rowspan="4">9.9 lb/day</td></tr>
<tr><td>≥2,000 ppmv</td><td>N/A</td><td>≥98.5%</td></tr>
<tr><td>≥200 ppmv to <2,000 ppmv</td><td>N/A</td><td>≥97%</td></tr>
<tr><td><200 ppmv</td><td>N/A</td><td>≥90%</td></tr>
</table></td><td>SMAQMD BACT No. 151</td></tr>
</table>

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

BACT FOR IC ENGINE CONTROLLING SOIL VAPOR EXTRACTION (SVE) FOR PROJECTS EMITTING <10 LB/DAY VOC		
Pollutant	**Standard**	**Source**
VOC	***(see VOC standard under Soil Vapor Extraction BACT above)*** - and - LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
NOx	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
SOx	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM10	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
PM2.5	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151
CO	LPG as an auxiliary fuel and a 3-way catalytic converter	SMAQMD BACT No. 151

BACT FOR THERMAL OXIDIZER CONTROLLING SOIL VAPOR EXTRACTION (SVE) FOR PROJECTS EMITTING <10 LB/DAY VOC		
Pollutant	**Standard**	**Source**
VOC	***(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
NOx	Burners fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
SOx	Either natural gas or propane and good combustion practices	SMAQMD BACT No. 151
PM10	Either natural gas or propane and good combustion practices	
PM2.5	Either natural gas or propane and good combustion practices	
CO	Either natural gas or propane and good combustion practices	

[1] 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 CATALYTIC OXIDIZER CONTROLLING SOIL VAPOR EXTRACTION (SVE) FOR PROJECTS EMITTING <10 LB/DAY VOC		
Pollutant	**Standard**	**Source**
VOC	***(see VOC standard under Soil Vapor Extraction BACT above)***	
NOx	Burners fired on mixture of process gas and supplemental fuel: No standard	SCAQMD Regulation XI, Rule 1147
	Burners fired on 100% natural gas or propane[1]: 1. 1. 60 ppm NOx at 3% O_2 for process temperatures ≤ 800 °F. 2. 2. 60 ppm NOx @ 3% O_2 for process temperatures > 800 °F.	
	Burners fired on liquid fuel: 1. 1. 40 ppm NOx at 3% O_2 for process temperatures < 1200 °F. 2. 2. 60 ppm NOx @ 3% O_2 for process temperatures ≥ 1200 °F.	
SOx	No standard	
PM10	No standard	
PM2.5	No standard	
CO	No standard	

[1] 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 CARBON ADSORPTION CONTROLLING SOIL VAPOR EXTRACTION (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: _____ **DATE:** 6-10-19

APPROVED BY: _____ **DATE:** 6/11/19

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
		Document #:	151A.1
Class:	All	Date:	06/16/95

etermination

POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
POC	1. ≤10 ppmv at outlet of control device; or ≥98.5% capture/destruction efficiency[a,T] 2. ≤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[a,T]	1. Two or More Activated Carbon Canister in Series or Thermal Oxidizer[a,T] 2. Two or More Activated Carbon Canisters in Series or Thermal Oxidizer or Catalytic Oxidizer[a,T]
NOx	1. n/a 2. n/a	1. n/a 2. n/a
SO_2	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
PM_{10}	1. n/a 2. n/a	1. n/a 2. n/a
NPOC	1. ≤10 ppmv at outlet of control device[a,T] 2. ≤10 ppmv at outlet of control device; or ≥95% capture/recovery efficiency[a,T]	1. Two or More Activated Carbon Canisters in Series [a,T] 2. Two or More Activated Carbon Canisters in Series [a,T]

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 s 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	

Process Information - Details

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

RBLC Home | New Search | Search Results | Facility Information | Process List | Process Information

Help

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
Volatile Organic Compounds (VOC)	55.0000 T/YR	BACT-PSD	NO

Process Notes:

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.

RBLC Home | New Search | Search Results | Facility Information | Process List | Process Information | Pollutant Information

Help

FINAL

RBLC 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/OAR 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
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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 s 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

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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
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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 s 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

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Best Available Control Technology (BACT) Guideline 2.1.6 A

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

Pollutant	BACT
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
Aman Environmental Construction, Inc. On-site contaminated soil remediation with two trailor-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 (Detailed Information)	12/26/95 (A/C no. S-2837-1-0) A430-711-96 District Contact: George Heinen San Joaquin Valley Unified APCD (559) 230-5909	**NOx** (Detailed Control Information) York-Shipley low-NOx burner 0.036 lbm/MMBtu on natural gas 0.048 lbm/MMBtu on diesel --- **SOx** (Detailed Control Information) Low-sulfur diesel fuel oil at 0.05% S content by wt. No limit (Equivalent to 0.005 lbm/MMBtu for diesel) --- **VOC/HC** (Detailed Control Information) Activated polymer/carbon cannister 95% control ---

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:

RBLC#	Permit Date	Process Code [A][B]	Rating	Pollutant	Standard	Case-By-Case Basis
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-0496 (BAAQMD) (C)	4/1/1992	29.100	Soil vapor extraction controlled by oxidation catalyst, 1267 scfm capacity	VOC	97% control efficiency; 1.7 lbm/day	BACT-PSD
CA-0471 (SCAQMD) (D)	8/9/1991	29.100	Soil vapor extraction system controlled by regenerative thermal oxidizer, 600 cfm capacity	VOC	98% control efficiency	BACT-PSD
CA-0477 (SCAQMD) (D)	8/9/1991	29.100	Soil vapor extraction system controlled by regenerative thermal oxidizer, 312 cfm capacity	VOC	99% control efficiency	BACT-PSD
CA-0478 (SCAQMD) (D)	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 (SCAQMD) (D)	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 (SCAQMD) (D)	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

RBLC#	Permit Date	Process Code (A)(B)	Rating	Pollutant	Standard	Case-By-Case Basis
CA-0480 (SCAQMD) (D)	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 (SCAQMD) (D)	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 (SCAQMD) (D)	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 (SCAQMD) (D)	12/4/1990	29.100	Soil vapor extraction controlled by thermal oxidizer, 400 scfm capacity	VOC	95% control efficiency; 5 lbm/day	BACT-PSD
CA-0474, CA-0475 (SCAQMD) (D)	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 4/1/1992 BAAQMD BACT determination was superceded by BAAQMD BACT No. 151A.1 (6/16/1995).
(D) 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 superceded by the BAAQMD BACT.

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