

# Proactive Best Available Control Technology (BACT) Determination

## District BACT Guideline 2.1.1

Soil Remediation Operation – Thermal/Catalytic Oxidizer

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**San Joaquin Valley  
Unified Air Pollution Control District**

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

**Emissions Unit:** Soil Remediation Operation – Thermal/Catalytic Oxidizer

**Industry Type:** Remediation

**Last Update:** TBD

<b>Pollutant</b>	<b>Achieved in Practice or contained in SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
VOC	98.5% overall capture and control for VOC inlet concentrations $\geq$ 2000 ppmv  97% overall capture and control for VOC inlet concentrations < 2000 ppmv and $\geq$ 200 ppmv  95% overall capture and control for VOC inlet concentrations < 200 ppmv		

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 - Permit Specific BACT**

2.1.1

## **I. Introduction**

The objective of this project is to proactively update BACT Guideline 2.1.1, which covers soil remediation operations utilizing thermal/catalytic oxidizers. This guideline was last updated on March 17, 1997.

The current update will incorporate any applicable and more stringent emission control standards that have been achieved in practice or determined to be technologically feasible since the last update and also make any necessary corrections and changes needed to ensure consistency with the District's BACT policy.

The discussions in this update will be limited to the following topics:

- Source of emissions
- Current BACT requirements
- Top-down BACT analysis for VOC emissions
- Recommendations

## **II. Source of emissions**

Several different types of vapor extraction systems may be used to remove contaminant vapors (e.g. gasoline, diesel) from contaminated soil or groundwater. The vapor extraction system conveys a mixture of contaminated vapors and air to the thermal/catalytic oxidizer.

In a thermal oxidizer (also often referred to as incinerator or afterburner), the temperature of the process stream is increased from ambient air to  $\geq 1,400$  °F with the assistance of a natural gas-fueled burner. The combustion chamber is maintained at  $\geq 1,400$  °F. The heated gases are turbulently mixed with oxygen and retained for a minimum of 0.5 seconds in the combustion chamber to ensure maximum VOC destruction. Under high temperatures and in the presence of oxygen, VOC and other organic compounds are chemically oxidized into carbon dioxide and water.

The catalytic oxidizer utilizes a catalytic element installed downstream of the combustion chamber burners. The precious metals in the catalytic element will accelerate the oxidation process at a lower temperature than for thermal oxidation, normally  $\geq 600$  °F.

The combustion of supplemental fuel to maintain the required oxidation temperature produces NO<sub>x</sub>, SO<sub>x</sub>, PM<sub>10</sub>, CO, and VOC emissions. However, since the thermal/catalytic oxidizer is an emissions control device (i.e. used to destroy VOCs in the extracted soil vapors), the combustion emissions are incidental to the control method (i.e. collateral pollutants) and are therefore not subject to BACT requirements.

### III. Current BACT Requirements

The current requirements of BACT Guideline 2.1.1 are as summarized in the following table:

<b>Pollutant</b>	<b>Achieved in Practice or contained in SIP</b>	<b>Technologically Feasible</b>	<b>Alternate Basic Equipment</b>
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		

The current BACT guideline is intended to apply to soil remediation operations that need to use a thermal oxidizer (either regenerative thermal or catalytic) in order to destroy the VOC removed from the contaminated soil. Typically, a soil remediation operation will require the use of a thermal oxidizer when the influent VOC emission concentrations are high enough that an activated carbon system is not practical due to carbon breakthrough occurring very rapidly. District BACT guideline 2.1.3 applies to soil remediation operations served by an activated carbon adsorption systems, so this option will be removed from the Alternate Basic Equipment category in this guideline.

The current guideline includes BACT requirements for NOx emissions; however, NOx is not emitted by the soil remediation operation. The source operation is the soil remediation operation, which emits only VOC from the contaminated soil. Therefore, the soil remediation operation can only trigger BACT for VOC emissions. NOx is emitted by the thermal oxidizer control system as part of the VOC destruction process itself, which isn't part of the source operation. Therefore, the revised BACT guideline will be limited to the pollutant emitted by the source operation, which is VOC.

#### IV. Top-Down BACT Analysis

##### **BACT analysis for VOC Emissions**

As explained earlier, a soil remediation operation only emits VOCs prior to add-on control equipment. Therefore, BACT will only be evaluated for VOC emissions.

##### **Step 1 - Identify All Possible Control Technologies**

The following BACT clearinghouse references were reviewed to identify any control technologies that could be considered more stringent than the current District BACT requirements for soil remediation operations utilizing Thermal Oxidizer or Catalytic Oxidizer:

- EPA RACT/BACT/LAER clearinghouse
- CARB BACT clearinghouse
- South Coast AQMD (SCAQMD) BACT clearinghouse
- Bay Area AQMD (BAAQMD) BACT clearinghouse
- Sacramento Metro AQMD (SMAQMD) BACT clearinghouse
- San Diego County APCD (SDCAPCD) BACT clearinghouse

Also, the following Rules and Regulations were reviewed to identify any emission limits that could be considered more stringent than the current District BACT requirements for soil remediation operations utilizing Thermal Oxidizer:

- South Coast AQMD Rule 1166
- Bay Area AQMD Regulation 8, Rule 47
- SJVAPCD Rules 4651

##### **Survey of BACT Guidelines:**

The EPA RACT/BACT/LAER clearinghouse does not include general guidelines, only determinations made by individual agencies. The following determinations were found for soil remediation operations.

Proactive BACT for Soil Remediation Operation – Thermal Oxidizer  
Project N-1230343

<b>RBLC ID</b>	<b>VOC Control Efficiency</b>	<b>Permit Year</b>	<b>Compliance Verified?</b>
OH-0194 <sup>1</sup>	99%	1991	No
CA-0435 <sup>2</sup>	97%	1991	No
CA-0394	95%	1990	No

No determinations for soil remediation operations were found in the CARB BACT clearinghouse, nor in the San Diego County APCD BACT Clearinghouse.

The SCAQMD BACT clearinghouse search yielded an analysis, 573110, performed in 2019; however, that analysis did not address VOC controls nor destruction efficiency.

BAAQMD's BACT Guideline 151A.1 (1995) established the following POC<sup>3</sup> control standards as Achieved in Practice requirements for soil vapor extraction operations served by thermal/catalytic oxidizers or carbon adsorption:

- ≤ 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

SMAQMD's BACT determination #89 (2014, currently expired) established the following ROC<sup>4</sup> control efficiencies as Achieved in Practice requirements for small emitter and minor source (< 10 lb-VOC/day) soil remediation operations utilizing catalytic oxidizers, thermal oxidizers, carbon adsorption, or I.C. engines:

- ≥ 98.5% for influent concentrations ≥ 2,000 ppmv
- ≥ 97% for influent concentrations ≥ 200 ppmv to < 2,000 ppmv
- ≥ 90% for influent concentrations < 200 ppmv

<sup>1</sup> RBLC ID OH-0194 references a permit with a controlled emission rate of 8.3 lb-VOC/hr (199.2 lb-VOC/day at 24 hr/day). This operation is more than a magnitude larger than the operations typically permitted within the District and therefore the control efficiency achieved by this operation is not reflective of the control that may be achieved by operations at the District that are operating at much lower VOC inlet concentrations/emission rates.

<sup>2</sup> RBLC ID CA-0435 references a permit achieving a control efficiency of 97%. Based on the 350 CFM rating of the equipment a controlled emission rate of 1 lb-VOC/day, and assuming gasoline or similar compounds are being remediated, the VOC inlet concentration for this operation is between 200 ppmv and 2000 ppmv. The 97% control efficiency requirement for this permit is identical to the level of control required by SMAQMD and BAAQMD BACT Guidelines for inlet VOC Concentrations in this range.

<sup>3</sup> Precursor Organic Compounds - assumed to be equivalent to VOC for the purposes of this BACT determination.

<sup>4</sup> Reactive Organic Compounds - assumed to be equivalent to VOC for the purposes of this BACT determination.

Survey of Applicable Rules and Regulations:

None of the rules surveyed contained any requirements that are more stringent than the District's current BACT requirement of 95% control for all influent concentrations.

List of Control Options Identified

- Option #1: 99% VOC control (US EPA RACT/BACT/LAER Clearinghouse ID OH-0194)
- Option #2: For VOC inlet concentrations  $\geq 2000$  ppmv:  $\geq 98.5$  overall capture and control efficiency;  
For VOC inlet concentrations  $\geq 200$  ppmv: 97% overall capture and control efficiency;  
For VOC inlet concentrations  $< 200$  ppmv: 90% overall capture and control efficiency  
(SMAQMD and BAAQMD BACT Guidelines)
- Option #3: For all concentrations, 95% overall capture and control efficiency (SJVAPCD Existing Guideline)

**Step 2 - Eliminate Technologically Infeasible Options**

While one soil extraction operation was found in the EPA RACT/BACT/LAER Clearinghouse with a permitted limit of 99% destruction of VOCs by weight, that operation was determined to be much larger than the operations typically permitted within the District. The level of control that can be achieved is highly dependent on the inlet concentration/inlet emission rate, the combustion characteristics of the VOC compound that is being remediated, and other site-specific factors. Therefore, a 99% capture and control efficiency is likely not achievable for the life of the types of soil remediation projects typically permitted in the District due to rapidly decreasing inlet VOC concentrations. Since the operation found with a 99% control efficiency is far outside the scope of the soil remediation operations typically permitted within the District, Option #1 will be eliminated as a technologically feasible option.

**Step 3 - Rank Remaining Control Technologies by Control effectiveness**

Options #2 and #3 remain and will be combined into a single option using the highest level of control achieved for each inlet concentration range as follows:

- For inlet concentrations  $\geq 2000$  ppmv: Achieve at least 98.5% overall capture and control efficiency
- For inlet concentrations  $\geq 200$  ppmv to  $< 2000$  ppmv: Achieve 97% overall capture and control efficiency

- For inlet concentrations < 200 ppmv: Achieve 95% overall capture and control efficiency.

These levels of control have been listed as Achieved in Practice in BACT Guidelines applicable throughout several jurisdictions within California. The District did not identify any other emission control technologies that can achieve higher levels of VOC control.

#### **Step 4 - Cost Effectiveness Analysis**

Since this is a proactive BACT determination that is not part of a specific permitting action, cost effectiveness analysis is not required. Furthermore, no technologically feasible nor alternate basic equipment options were identified that could offer higher levels of VOC control.

#### **Step 5 - Select BACT**

Since this is a proactive BACT determination that is not part of a specific permitting action, selecting BACT is not applicable. Recommendations for updates and corrections/changes to the current BACT requirements are discussed in the following section and summarized in the draft updated BACT guideline attached in Appendix A.

### **IV. Recommendations**

Based on the preceding analyses, the current BACT guideline should be updated as follows:

- Remove NO<sub>x</sub> since it is a collateral pollutant emitted only by the control device and not the soil remediation operation itself.
- Establish VOC BACT as described in Appendix A.

#### **Appendices**

A: Draft Updated BACT Guideline 2.1.1

B: Current BACT Guideline 2.1.1

Appendix A  
Draft Updated BACT Guideline 2.1.1

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Appendix B  
Current BACT Guideline 2.1.1

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**

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