ACTIVE SMAQMD BACT CLEARINGHOUSE

CATEGORY: **OVEN/KILN**

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

BACT Determination Number: 168	**BACT Determination Date:** 10/31/2017

Equipment Information

Permit Number: 25271
Equipment Description: DRYING OVEN
Unit Size/Rating/Capacity: 14 mmBTU/hr, direct & natural gas-fired
Equipment Location: HUHTAMAKI, INC
8450 GERBER RD
SACRAMENTO, CA

BACT Determination Information

ROCs	**Standard:**	No standard
	Technology Description:	
	Basis:	
NOx	**Standard:**	20 ppm @ 3% O2
	Technology Description:	Ultra-Low NOx Burner
	Basis:	Achieved in Practice
SOx	**Standard:**	Natural gas fueled
	Technology Description:	
	Basis:	Achieved in Practice
PM10	**Standard:**	Natural gas fueled
	Technology Description:	
	Basis:	Achieved in Practice
PM2.5	**Standard:**	Natural gas fueled
	Technology Description:	
	Basis:	Achieved in Practice
CO	**Standard:**	395.6 ppmvd @ 3% O2
	Technology Description:	
	Basis:	Achieved in Practice
LEAD	**Standard:**	N/A
	Technology Description:	
	Basis:	

Comments:

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

DETERMINATION NO.: 168

DATE: June 29, 2017

ENGINEER: Michelle Joe

Category/General Equip Description: Drying Oven

Equipment Specific Description: Direct Fired, Natural Gas-Fired Dryer for Molded Paper Products

Equipment Size/Rating: ≤ 20 mmBTU/hr

Previous BACT Det. No.: N/A

This BACT determination was determined under the project A/C 25271 (Huhtamaki, Inc.) for a 14 mmBTU/hr natural gas-fired drying oven where the products of combustion come into direct contact with the molded paper products (i.e., school lunch trays) to be dried. This source category includes emissions from the decomposition of cellulose as the molded paper products are dried (drying emissions) and from natural gas combustion (combustion emissions).

BACT ANALYSIS

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

The following control technologies are currently employed as BACT/T-BACT for direct fired, natural gas-fired drying ovens rated ≤ 20 mmBTU/hr (not necessarily for drying molded paper products) by the following agencies and air pollution control districts (note: although drying emissions were evaluated as part of this BACT determination, no Achieved in Practice BACT standards were found for drying emissions):

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>US EPA</td><td>
BACT
Source: EPA RACT/BACT/LAER Clearinghouse(A)

<table>
<tr><th colspan="2">For Dryer or Oven, 5.40 mmBTU/hr (NC-0115, 1/6/2007)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>18.0000 ppm, use of low-NOx burner</td></tr>
<tr><td>SOx</td><td>No standard</td></tr>
<tr><td>PM10</td><td>No standard</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
(A) See Attachment A for a summary of the determinations reviewed.
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>US EPA</td><td>

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.

</td></tr>
<tr><td>Air Resources Board (ARB)</td><td>

BACT
Source: ARB BACT Clearinghouse(A)

<table>
<tr><th colspan="2">For Dryer or Oven, Direct or Indirect</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>30 ppmvd @ 3% O_2, Low-NOx burner</td></tr>
<tr><td>SOx</td><td>No standard</td></tr>
<tr><td>PM10</td><td>No standard</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>

(A) See Attachment B for a summary of the determinations reviewed.

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.

</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>SMAQMD</td><td>

BACT
Source: SMAQMD BACT Clearinghouse

<table>
<tr><th colspan="2">For Natural Gas-Fired Drying Oven</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>No standard</td></tr>
<tr><td>SOx</td><td>No standard</td></tr>
<tr><td>PM10</td><td>No standard</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>

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

RULE REQUIREMENTS:
There are currently no category-specific prohibitory series 400 rules that apply to direct fired, natural gas-fired drying ovens.

</td></tr>
<tr><td>South Coast AQMD</td><td>

BACT
Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 43

<table>
<tr><th colspan="2">For Dryer or Oven – Direct and Indirect Fired</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>30 ppmvd @ 3% O_2 (04-10-1998)</td></tr>
<tr><td>SOx</td><td>Natural gas (10-20-2000)</td></tr>
<tr><td>PM10</td><td>Natural gas (10-20-2000)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>

Source: SCAQMD LAER/BACT Determinations(A)

<table>
<tr><th colspan="2">For Dryer or Oven – Others, Direct and Indirect Fired
(1 mmBTU/hr direct hot air dryer and 1 mmBTU/hr tunnel dryer, 6/15/2001)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>20 ppmvd @ 3% O_2, Low-NOx burner</td></tr>
<tr><td>SOx</td><td>No standard</td></tr>
<tr><td>PM10</td><td>No standard</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>

(A) See Attachment C for a summary of the SCAQMD BACT determinations reviewed.

</td></tr>
</table>

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>South Coast AQMD</td><td>

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 ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with nitrogen oxide emissions that require a District permit **and are not** specifically required to comply with a nitrogen oxide emission limit by other District Regulation XI rules.

<table>
<tr><th colspan="4">SCAQMD Rule 1147 Emission Standards
ppmvd @ 3% O_2 or lb/mmBTU heat input
Rule 1147 §(c)(1), Table 1 for NOx</th></tr>
<tr><td>Equipment Category</td><td colspan="3">Process Temperature</td></tr>
<tr><td>Gaseous fuel-fired equipment</td><td>≤ 800° F</td><td>> 800 ° F and < 1200° F</td><td>≥ 1200 ° F</td></tr>
<tr><td>Oven, Dehydrator, Dryer, Heater, Kiln, Crematory, Incinerator, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank</td><td>30 ppm or 0.036 lb/mmBTU</td><td>30 ppm or 0.036 lb/mmBTU</td><td>60 ppm or 0.073 lb/mmBTU</td></tr>
</table>

Note: Rule 219 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 drying ovens with no other emissions other than products of combustion with a heat input greater than 2 mmBTU/hr.

</td></tr>
</table>

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>San Joaquin Valley APCD</td><td>

BACT
Source: SJVUAPCD BACT Guideline 1.5.6 B (10/15/2014)

<table>
<tr><td colspan="3">For Metal Heat Treatment Oven – Natural Gas Fired, < 5.0 mmBTU/hr</td></tr>
<tr><td>Pollutant</td><td>Achieved in Practice or in the SIP</td><td>Technologically Feasible</td></tr>
<tr><td>VOC</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>NOx</td><td>30 ppmv @ 3% O_2 (0.061 lb/mmBTU) and use natural gas fuel</td><td>5 ppmv @ 3% O_2 (0.006 lb/mmBTU) with the use of an SCR system where the unit's exhaust temperature is $\geq$ 500 ºF</td></tr>
<tr><td>SOx</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM10</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM2.5</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
</table>

Source: SJVUAPCD BACT Guideline 1.6.16 (8/26/1999)

<table>
<tr><td colspan="3">For Seed Processing Dryer – Natural Gas Fired, 12 mmBTU/hr</td></tr>
<tr><td>Pollutant</td><td>Achieved in Practice or in the SIP</td><td>Technologically Feasible</td></tr>
<tr><td>VOC</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>NOx</td><td>20 ppmv @ 3% O_2 (Low-NOx burner, with LPG as backup fuel)</td><td>9 ppmv @ 3% O_2 (SCR, LTO or equal) (A)</td></tr>
<tr><td>SOx</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM10</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM2.5</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
</table>

(A) SCR and LTO were determined to be not cost effective.

</td></tr>
</table>

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>San Joaquin Valley APCD</td><td>
Source: SJVUAPCD BACT Guideline 1.6.21 (10/31/2002)
<table>
<tr><td colspan="3">For Flake Cereal Dryer – Natural Gas Fired, Conveyor-fed, 8 mmBTU/hr</td></tr>
<tr><td>Pollutant</td><td>Achieved in Practice or in the SIP</td><td>Technologically Feasible</td></tr>
<tr><td>VOC</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>NOx</td><td>20 ppmv @ 3% O_2
(Low-NOx burner or equal)</td><td>9 ppmv @ 3% O_2 (Ultra-Low NOx burner or equal) (A)</td></tr>
<tr><td>SOx</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM10</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM2.5</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
</table>
(A) 9 ppmv Ultra-Low NOx burner was determined to be not cost effective.

Source: SJVUAPCD BACT Guideline 1.9.9 (2/20/1999)
<table>
<tr><td colspan="3">For Molded Paper Products Dryer – Natural Gas Fired, 4.8 mmBTU/hr</td></tr>
<tr><td>Pollutant</td><td>Achieved in Practice or in the SIP</td><td>Technologically Feasible</td></tr>
<tr><td>VOC</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>NOx</td><td>80 ppmv @ 3% O_2
(standard burner)</td><td>1. 9 ppmv @ 3% O_2 (Ultra-Low NOx burner, Selective Catalytic Reduction (SCR), or equal)
2. 20 ppmv @ 3% O_2 (Low-NOx burner)</td></tr>
<tr><td>SOx</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM10</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM2.5</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
</table>
<u>T-BACT:</u>
There are no T-BACT standards published in the clearinghouse for this category.
</td></tr>
</table>

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>San Joaquin Valley APCD</td><td>
<u>RULE REQUIREMENTS:</u>
Rule 4309 – Dryers, Dehydrators, and Ovens

This rule applies to any dryer, dehydrator, or oven that has a total rated heat input of ≥ 5.0 mmBTU/hr.

<table>
<tr><th colspan="3">SJVUAPCD Rule 4309 Emission Standards
ppmvd @ 3% O_2 (B)
Rule 4309 §5.2, Table 1 for Gaseous Fuel Fired</th></tr>
<tr><th>Process Description</th><th>NOx limit (B)</th><th>CO Limit (B)</th></tr>
<tr><td>Other processes (A)</td><td>40.5 ppm</td><td>395.6 ppm</td></tr>
</table>
(A) Excludes asphalt/concrete plants and milk, cheese, and dairy processing.
(B) Rule 4309's limits are in ppmvd @ 19% Oxygen. The values listed in the table have been corrected to 3% O_2 for comparison purposes.
</td></tr>
<tr><td>San Diego County APCD</td><td>
<u>BACT</u>
Source: NSR Requirements for BACT Guidelines (June 2011)

<table>
<tr><th colspan="2">For natural gas-fired drying oven</th></tr>
<tr><td>VOC</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>NOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>SOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM10</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM2.5</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>CO</td><td>N/A – No BACT determinations found</td></tr>
</table>
<u>T-BACT:</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS:</u>
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.
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>Bay Area AQMD</td><td>
<u>BACT</u>
Source: BAAQMD BACT Guideline

<table>
<tr><th colspan="2">For natural gas-fired drying oven</th></tr>
<tr><td>VOC</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>NOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>SOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM10</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM2.5</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>CO</td><td>N/A – No BACT determinations found</td></tr>
</table>
<u>T-BACT:</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS:</u>
Reg 8, Rule 2 – Organic Compounds from Miscellaneous Operations
Organic compound emissions from any operation consisting entirely of natural gas is exempt from this rule.

Reg 9, Rule 3 – Inorganic Gaseous Pollutants; NOx from Heat Transfer Operations §9-3-301
This rule does not apply to any new or modified heat transfer operation designed for a maximum heat input of less than 264 GJ (250 million BTU).
</td></tr>
</table>

Summary of Achieved in Practice Control Technologies

The following control technologies have been identified and are ranked based on stringency:

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	1. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD]
NOx	1. 18 ppmvd @ 3% O_2, Low-NOx burner [EPA] 2. 20 ppmvd @ 3% O_2, Low-NOx burner [SCAQMD, SJVAPCD] 3. 30 ppmvd @ 3% O_2, Low-NOx burner and use natural gas fuel [ARB, SCAQMD, SJVAPCD] 4. 40.5 ppmvd @ 3% O_2 [SJVAPCD] 5. 80 ppmvd @ 3% O_2 [SJVAPCD] 6. Natural gas fired with LPG as a backup fuel [SJVAPCD] 7. No standard [SMAQMD, SJVAPCD, SDCAPCD, BAAQMD]
SOx	1. Natural gas fueled [SCAQMD] 2. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD]
PM10	1. Natural gas fueled [SCAQMD] 2. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD]
PM2.5	1. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD]
CO	1. 395.6 ppmvd @ 3% O_2 [SJVAPCD] 2. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD]

The following control technologies have been identified as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
VOC	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD
NOx	20 ppmvd @ 3% O_2, Low-NOx burner (A)	SCAQMD, SJVAPCD
SOx	Natural gas fueled	SCAQMD
PM10	Natural gas fueled	SCAQMD
PM2.5	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD
CO	395.6 ppmvd @ 3% O_2	SJVAPCD

(A) The 18 ppmvd @ 3% O2, Low-NOx burner determination found in the EPA clearinghouse was discounted as it was determined to not be technologically feasible for this application. For further information, see the discussion under the **Technologically Feasible Alternatives for NOx** section below.

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:

Pollutant	**Technologically Feasible Alternatives**
VOC	No other technologically feasible option identified
NOx	1. 5 ppmvd @ 3% O_2 (0.006 lb/mmBTU), SCR system where the unit’s exhaust temperature is $\geq$ 500 ºF [SJVAPCD] 2. 9 ppmv @ 3% O_2, Ultra-Low NOx burner, Selective Catalytic Reduction (SCR), or equal [SJVAPCD]
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

- **Technologically Feasible Alternatives for VOC:**

  Although no technologically feasible alternatives were identified for VOC, the applicant identified the following controls and discussed their technological feasiblity:

  - Carbon Adsorber – Not technologically feasible due to high exhaust temperatures and VOC composition (majority could be alcohols).
  - Biofilter – Not technologically feasible due to the lack of PM10 control upstream.
  - Catalytic Oxidizer – Not technologically feasible due to the lack of PM10 control upstream.
  - Regenerative Thermal Oxidizer – Technologically feasible.

- **Technologically Feasible Alternatives for NOx:**

  The following technologically feasible alternatives were identified for NOx and discussed below for technological feasibility:

  - Ultra-Low NOx Burner – Although the applicant has proposed a Maxon Ultra-Low NOx burner that has achieved 9 ppm NOx in lab testing, the burner manufacturer is only able to guarantee 20 ppm NOx for this application. For drying molded paper products, a turndown ratio of 4:1 and an operating temperature between 350 to 500 ^{0}F is required to ensure that the drying oven does not unevenly heat or burn the paper product being dried. Additionally, the burner manufacturer has identified the following issues which preclude an emission guarantee below 20 ppm (i.e., therefore excluding 9 ppm NOx and 18 ppm NOx as being technologically feasible):
    - The layout of the drying oven results in the flow of process air being perpendicular to the firing of the burner, which can disrupt the flow pattern and increase NOx generation;
    - Tight air fuel ratio control, back pressure, and recirculation air parameters, as well as space constraints within the drying oven restrict any changes to the proposed configuration and NOx generation; and
    - With the applicant's required 4:1 turndown ratio, 20 ppm NOx is the lowest emission guarantee for the range of 100% to 25% of the maximum firing rate.

    For these reasons, the burner manufacturer has stated that 20 ppm NOx is the lowest technologically feasible control for this application. However, as per CH&SC Section 40723, if, after conducting a review pursuant to Section 40723(b), the District determines that the BACT requirements are not achievable by a source, the District shall revise those requirements to a level achievable by that source.
  - Selective Catalytic Reduction (SCR) – Not technologically feasible due to the exhaust gas temperature (350 to 380 ^{0}F) operating below the optimum temperature range of 480 to 800 ^{0}F.

- **Technologically Feasible Alternatives for PM10:**

  Although no technologically feasible alternatives were identified for PM10, the applicant identified the following controls and discussed their technological feasiblity:

  - Baghouse – Not technologically feasible due to fire risks from uneven heating and burning of the molded paper products and fouling of the filter bags from the potential presence of sticky materials from the heating of the molded paper products.
  - Electrostatic Precipitation (ESP) – Not technologically feasible due to the exhaust gas flow rate (4,500 acfm) being below the range necessary for this technology to work effectively (typically 100,000 to 200,000 acfm).
  - Venturi Scrubber (Wet Scrubber) – Technologically feasible.

After eliminating the technologically infeasible options of carbon adsorber, biofilter, catalytic oxidizer, ultra-low NOx burner meeting 9 ppm or 18 ppm, SCR, baghouse, and ESP above,

regenerative thermal oxidizer and venturi scrubber were identified as technologically feasible alternatives.

Cost Effectiveness Determination:
After identifying the technologically feasible alternatives, a cost analysis is performed to take into consideration economic impacts for all technologically feasible controls identified.

Maximum Cost per Ton of Air Pollutants Controlled

A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below (except coating operations):

Pollutant	Maximum Cost ($/ton)
ROG	17,500
NOx	24,500
PM10	11,400
SOx	18,300
CO	TBD if BACT triggered

A. Regenerative Thermal Oxidizer for VOC:

As shown in Attachment D, the cost effectiveness for the add-on regenerative thermal oxidizer to control VOC was calculated to be $220,593 per ton (see Attachment D – Regenerative Thermal Oxidizer Cost Effectiveness Analysis). The following basic parameters were used in the analysis.

VOC Control Level = 95%

VOC Baseline Level = 0.99 ton VOC/year

Equipment Life = 10 years

Direct Cost = $270,915

Indirect Cost = $67,287

Direct Annual Cost = $137,114

Indirect Annual Cost = $70,243

Total Annual Cost = $207,357

VOC Removed = 0.94 tons

Cost of VOC Removal = $220,593 per ton reduced

Since this exceeds the $17,500 per ton cost effectiveness threshold for VOC, the add-on regenerative thermal oxidizer is considered not cost effective and is eliminated.

B. Venturi Scrubber for PM10:

As shown in Attachment E, the cost effectiveness for the add-on venturi scrubber to control PM10 was calculated to be $16,846 per ton (see Attachment E – Venturi Scrubber Cost Effectiveness Analysis). The following basic parameters were used in the analysis.

PM10 Control Level = 99%

PM10 Baseline Level= 1.61 ton PM10/year

Equipment Life = 10 years

Direct Cost = $63,395

Indirect Cost = $14,223

Direct Annual Cost = $8,623

Indirect Annual Cost = $18,331

Total Annual Cost = $26,954

PM10 Removed = 1.60 tons

Cost of PM10 Removal = $16,846 per ton reduced

Since this exceeds the $11,400 per ton cost effectiveness threshold for PM10, the add-on venturi scrubber is considered not cost effective and is eliminated.

C. SELECTION OF BACT:

Based on the above analysis, no technologically feasible alternatives were found to be cost effective and therefore were not selected. BACT for NOx will be set at the applicant's proposal (as well as what has currently been achieved in practice), BACT for VOC, SOx, PM10, and CO will remain the standards that have been achieved in practice, and BACT for PM2.5 will be set to be the same as for PM10.

In addition, this BACT standard will include the drying emissions as proposed by the applicant

BACT FOR DRYING OVEN, DIRECT FIRED, NATURAL GAS FIRED, ≤ 20 MMBTU/HR, FOR DRYING MOLDED PAPER PRODUCTS		
Pollutant	**Standard**	**Source**
VOC	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, SDCAPCD, BAAQMD
NOx	20 ppmvd @ 3% O_2, Ultra-Low NOx burner	SCAQMD, SJVAPCD
SOx	Natural gas fueled	SCAQMD
PM10	Natural gas fueled	SCAQMD
PM2.5	Natural gas fueled	SCAQMD
CO	395.6 ppmvd @ 3% O_2	SJVAPCD

D. SELECTION OF T-BACT:

There are no Federal NSPS's, NESHAP's nor State ATCM's for this source category. None of the sources surveyed have any toxic T-BACT determinations published. Therefore, T-BACT standards will be considered as meeting the BACT standards identified above.

REVIEWED BY: Brian F Vmk **DATE:** 9-15-17

APPROVED BY: [signature] **DATE:** 9/15/17

Attachment A

Review of BACT Determinations Published by EPA

List of applicable[A] BACT determinations published in EPA's RBLC Clearinghouse for **Process Code 19.600 (Misc. Boilers, Furnaces, Heaters), Process Code 19.900 (Other Misc. Combustion), and keywords "dryer" and "oven"**:

Process Code 19.600 – Misc. Boilers, Furnaces, Heaters								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Ammonia Converter Start-Up Heater Stack, 20 mmBTU/hr	LA-0306	12/20/2016	BACT-PSD	N/A	N/A	N/A	For PM2.5 only: 7.6 lb/mmcf (0.0076 lb/mmBTU), use of pipeline quality natural gas and good combustion practices	84 lb/mmcf (0.084 lb/mmBTU), use of pipeline quality natural gas and good combustion practices
Limestone/Dolomite Additive System Air Heater, 23 mmBTU/hr (B)	IN-0185	04/24/2014	BACT-PSD	N/A	0.0120 lb/mmBTU (9.9 ppm), use of low-NOx burners, natural gas only, and good combustion practices	0.0005 lb/mmBTU, use of natural gas and good combustion practices	N/A	N/A
Graphite Electrode Pitch Impregnation Preheater, 12.00 mmBTU/hr	SC-0142	06/08/2012	BACT-PSD	0.0110 lb/mmBTU, use of low-NOx burners, annual tune-up, and good combustion practices	0.1000 lb/mmBTU (82.35 ppm), use of low-NOx burners, annual tune-up, and good combustion practices	N/A	0.023 lb/mmBTU, use of low-NOx burners, annual tune-up, and good combustion practices	0.0830 lb/mmBTU, use of low-NOx burners, annual tune-up, and good combustion practices

Process Code 19.900 – Other Misc. Combustion								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Automotive Coating Drying Oven, 6.47 mmBTU/hr	TN-0160	10/10/2008	BACT-PSD	N/A	0.0500 lb/mmBTU (41.2 ppm), use of low-NOx burners or equivalent control	N/A	N/A	N/A
Process Heater, 10 mmBTU/hr	FL-0286	01/10/2007	BACT-PSD	2.0000 grains/100 scf gas	0.0950 lb/mmBTU (78.2 ppm)	2.0000 grains/100 scf gas	2.0000 grains/100 scf gas	0.0800 lb/mmBTU
Keyword search "dryer" and "oven"								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Alloy Plant Strip Dryer, 1.37 mmBTU/hr	AL-0307	10/09/2015	BACT-PSD	0.0060 lb/mmBTU, use of good combustion practices	0.0700 lb/mmBTU (57.68 ppm), use of low-NOx burner	N/A	N/A	0.0300 lb/mmBTU, use of good combustion practices
Steel Manufacturing Small heaters and dryers	AR-0140	09/18/2013	BACT-PSD	0.0054 lb/mmBTU, use of natural gas and good combustion practices	0.0800 lb/mmBTU (66 ppm), use of low-NOx burner and good combustion practices	0.000588 lb/mmBTU, use of natural gas and good combustion practices	0.000588 lb/mmBTU, use of natural gas and good combustion practices	0.0824 lb/mmBTU, use of natural gas and good combustion practices
Inlet Air Heater, 16.10 mmBTU/hr	WY-0070	08/28/2012	BACT-PSD	N/A	0.0120 lb/mmBTU (9.9 ppm), use of ultra low NOx	N/A	N/A	0.0800 lb/mmBTU, use of good combustion practices

					burner			
Wood Veneer Dryer No, 1-4 Heated Zones Controlled by Regerative Catalytic/Thermal Oxidizer	LA-0259	01/31/2012	BACT-PSD	5.5 lb/mmcf (0.0055 lb/mmBTU)	50 lb/mmcf (41.5 ppm), use of low-NOx burners	N/A	N/A	84 lb/mmcf (0.084 lb/mmBTU)
Slag Mill Dryer, 75.4 TPH	LA-0239	05/24/2010	BACT-PSD	0.0073 lb/mmBTU, use of good combustion practices	0.0490 lb/mmBTU (40.39 ppm), use of low-NOx fuel combustion	2000 grains/mmcf natural gas	0.0100 lb/mmBTU, use of good combustion practices	0.1120 lb/mmBTU, use of good combustion practices
Steel Mill Line 1 Post-Dryer, 7.70 mmBTU/hr	AL-0287	03/25/2010	BACT-PSD	0.0055 lb/mmBTU	0.0600 lb/mmBTU (49.5 ppm)	0.0006 lb/mmBTU	0.0076 lb/mmBTU	0.0600 lb/mmBTU
Steel Mill Ladle Dryer, 5.00 mmBTU/hr	IA-0087	05/29/2007	BACT-PSD	N/A	100 lb/mmcf (82.4 ppm), use of good combustion practices	N/A	N/A	84 lb/mmcf (0.084 lb/mmBTU)
Dryer or Oven, 5.40 mmBTU/hr	NC-0115	01/06/2007	BACT-PSD	N/A	18.0000 ppmvd@ 3% O_2, use of low-NOx burner	N/A	N/A	N/A

(A) "Applicable" criteria included: dryer or heater, rated ≤ 20 mmBTU/hr, direct fired, natural gas-fired, application for drying product.
(B) Listed in the EPA RBLC as 19 mmBTU/hr maximum heat input capacity, but later corrected to 23 mmBTU/hr in the PSD/Significant Source Modification Permit and therefore excluded from the scope of this determination.

= Excluded from the scope of this determination according to the following criteria: NOx > 20 ppm, burner rated > 20 mmBTU/hr, indirect heaters, boilers, thermal oxidizers, coke ovens, coating oven VOC emissions, curing oven VOC emissions, baked goods oven VOC emissions, dehydrators, dryer/coolers, germ dryers, paint sludge dryers, space heaters, air heaters, air supply make up units, hot oil heaters, fuel gas heaters, spray dryers, case-by-case basis other than BACT

= Selected as the most stringent BACT determination achieved in practice. However after further analysis was found to not be technologically feasible for this application.

Attachment B

Review of BACT Determinations Published by ARB

List of BACT determinations published in ARB's BACT Clearinghouse for **Dryer or Oven, Direct or Indirect**:

Capacity	Source	Date	NOx	VOC	CO	PM10
4.0 mmBTU/hr (A)	SCAQMD	12/01/1999	30 ppmvd @ 3% O_2	N/A	2000 ppmvd @ 15% O_2	0.1 grains/scf
6 mmBTU/hr (B)	SCAQMD	05/01/2000	60 ppmvd @ 3% O_2	N/A	N/A	N/A
3.5 mmBTU/hr, Average load equals 1.5 mmBTU/hr (C)	SCAQMD	10/27/2001	30 ppmvd @ 3% O_2	N/A	N/A	N/A
5 mmBTU/hr (D)	SCAQMD	02/06/2002	30 ppmvd @ 3% O_2	For powder coating operation only: 780 lb/month (facilitywide)	N/A	N/A
5.4 mmBTU/hr (E)	SCAQMD	12/07/2001	18 ppmvd @ 3% O_2	N/A	N/A	N/A
1.9 mmBTU/hr (F)	SCAQMD	05/27/2003	30 ppmvd @ 3% O_2	N/A	N/A	5 ppmvd
96 mmBTU/hr (G)	SCAQMD	01/02/1997	6 ppmvd @ 15% O_2	N/A	N/A	2000 ppmvd @ 15% O_2

(A) Dryer used to soften polystyrene sheet.
(B) Tenter frame fabric dryer used to dry cotton and cotton blended fabrics.
(C) Tumbler dryer used for drying clothes (commercial laundry)
(D) Conveyorized powder coating curing oven with a maximum turn-down requirement of 5:1 and 400-600 ºF operating temperature.
(E) Polyethylene resin melting and curing; NOx limit requested as RECLAIM concentration limit.
(F) Direct-fired makeup air heater to control booth temperature; 70-130 ºF operating temperature.
(G) Conveyorized three-zone, 8-layer (no other notes given in description).

= Dryer/oven not similar in size or application to direct-fired drying of molded paper products and therefore not part of the scope of this determination.

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

Attachment C

BACT Determinations Published by SCAQMD

Section III: Other Technologies

Application No.: 376463

Equipment Category – Dryer or Oven--Others, Direct and Indirect Fired

1. GENERAL INFORMATION

DATE: 6/15/2001

A. MANUFACTURER:

B. TYPE: Direct hot air dryers and tunnel dryer

C. MODEL:

D. STYLE:

E. APPLICABLE AQMD REGULATION XI RULES:

F. COST: $ (2000) SOURCE OF COST DATA:

G. OPERATING SCHEDULE: 24 HRS/DAY 5 DAYS/WK 52 WKS/YR

2. EQUIPMENT INFORMATION

APP. NO.: 376463

A. FUNCTION: Drying plastic packaging materials during and after flexographic printing process. Direct hot air streams used to dry materials between color stations and tunnel dryer used for final drying.

B. SIZE/DIMENSION/CAPACITY: Hot air production: 1 MMBtu/hr; Tunnel dryer: 1 MMBtu/hr

C. BLOWERS: 1.5 hp blower for each burner plus 20 hp exhaust blower

D. TOTAL FLOW RATE: scfm

E. MATERIAL STORED/PROCESSED/HANDLED:

F. THROUGHPUT/PROCESS RATE/USAGE RATE:

3. COMPANY INFORMATION

APP. NO.: 376463

A. NAME: Lawson Mardon Packaging

B. SIC CODE: 2759

C. ADDRESS: 1120 E. Sandhill Ave.
CITY: Carson STATE: CA ZIP: 90746

D. CONTACT PERSON: Dan Garvey

E. PHONE NO.: 310-631-6170

4. PERMIT INFORMATION

APP. NO.: 376463

A. AGENCY: SCAQMD

B. APPLICATION TYPE: new construction

C. AGENCY CONTACT PERSON: Bijan Ataian

D. PHONE NO.: 909-396-2454

E. PERMIT TO CONSTRUCT/OPERATE INFORMATION: P/C NO.: F36519 ISSUANCE DATE: 1/19/2001
☐ CHECK IF NO P/C P/O NO.: F36519 ISSUANCE DATE: 1/19/2001

F. START-UP DATE:

5. EMISSION INFORMATION

APP. NO.: 376463

A. PERMIT

A1. PERMIT LIMIT: None relating to dryers.

5. EMISSION INFORMATION

APP. NO.: 376463

A2. BACT/LAER DETERMINATION: Use of low-NOx burners guaranteed to produce less than 20 ppmvd NOx (corrected to 3% O2). Use of natural gas.

A3. BASIS OF THE BACT DETERMINATION: Control of NOx to 30 ppmvd, corrected to 3% O2, and use of natural gas were pre-existing BACT. The 20-ppm burner was suggested by the applicant.

B. CONTROL TECHNOLOGY

B1. MANUFACTURER/SUPPLIER: Eclipse

B2. TYPE: WINNOX

B3. DESCRIPTION: low-NOx burner

B4. CONTROL EQUIPMENT PERMIT APPLICATION DATA: P/C NO.: ISSUANCE DATE: P/O NO.: ISSUANCE DATE:

B5. WASTE AIR FLOW TO CONTROL EQUIPMENT: FLOW RATE: ACTUAL CONTAMINANT LOADING: BLOWER HP:

B6. WARRANTY: 20 ppmvd NOx, corrected to 3% O2.

B7. PRIMARY POLLUTANTS: NOx, CO, PM

B8. SECONDARY POLLUTANTS:

B9. SPACE REQUIREMENT:

B10. LIMITATIONS:

B11. UNUSED

B12. OPERATING HISTORY: This printing line is just starting up.

B13. UNUSED

B14. UNUSED

C. CONTROL EQUIPMENT COSTS

C1. CAPITAL COST: ☐ CHECK IF INSTALLATION COST IS INCLUDED IN CAPITAL COST

EQUIPMENT: $ INSTALLATION: $ (2000) SOURCE OF COST DATA:

C2. ANNUAL OPERATING COST: $ (2000) SOURCE OF COST DATA:

D. DEMONSTRATION OF COMPLIANCE

D1. STAFF PERMFORMING FIELD EVALUATION:

ENGINEER'S NAME: INSPECTOR'S NAME: DATE:

D2. COMPLIANCE DEMONSTRATION:

D3. VARIANCE: NO. OF VARIANCES: DATES:

CAUSES:

D4. VIOLATION: NO. OF VIOLATIONS: DATES:

CAUSES:

D5. MAINTENANCE REQUIREMENTS:

D6. UNUSED

D7. SOURCE TEST/PERFORMANCE DATA RESULTS AND ANALYSIS:

DATE OF SOURCE TEST: No source test required. CAPTURE EFFICIENCY:

DESTRUCTION EFFICIENCY: OVERALL EFFICEINCY:

SOURCE TEST/PERFORMANCE DATA:

OPERATING CONDITIONS:

TEST METHODS:

6. COMMENTS

APP. NO.: 376463

The low-NOx burner supplier, Eclipse, indicates that this burner can be generally used in most flexographic presses, and the 20 ppm guarantee applies in most cases. The guaranteed NOx level will, however, be higher for an oven that operates at positive pressure or above 1000 deg F. Potential retrofit issues include turndown (the burner is capable of a turndown ratio of from 5 to 10 and thus would not be suitable where a higher turndown ratio is required) and physical fit. Physical fit problems often can be overcome since the burner is externally mounted, and the flame is fully contained in the housing.

Although in this case the dryers are being used in conjunction with a printing press, the principle of transferability makes this technology potentially applicable to other direct and indirect-fired dryers and ovens.

Application No.: 360365

Equipment Category –

Dryer or Oven - Others, Direct and Indirect Fired

1. GENERAL INFORMATION

DATE: 10/11/1999

A. MANUFACTURER: n/a

B. TYPE: conveyorized powder coating curing oven with one 3,700,000 BTU per hour natural gas fired low-NOx burner

C. MODEL: Oven: n/a

BURNER: Maxon, Model Cyclomax

D. STYLE:

E. APPLICABLE AQMD REGULATION XI RULES:

Rule 1107: Coating Of Metal Parts and Products

Rule 1171: Solvent Cleaning Operations

F. COST: $ ( ) SOURCE OF COST DATA:

G. OPERATING SCHEDULE: 16 HRS/DAY 7 DAYS/WK 52 WKS/YR

2. EQUIPMENT INFORMATION

APP. NO.: 360365

A. FUNCTION: The oven is used to cure powder coatings.

B. MAXIMUM HEAT INPUT: 3,700,000 BTU/HR

C. MAXIMUM THROUGHPUT:

D. BURNER INFORMATION: NO.: one TYPE: Maxon Cyclomax (low-NOx burner)

E. PRIMARY FUEL: Natural Gas Fired

F. OTHER FUEL:

G. OPERATING CONDITIONS: Relatively steady-state operation at around 70% capacity. The typical oven temperature is around 400 degrees Fahrenheit.

3. COMPANY INFORMATION

APP. NO.: 360365

A. NAME: Rainbow Coating, Inc.

B. ADDRESS: 21029 Osborne Street

CITY: Canoga Park STATE: CA ZIP: 91304

C. CONTACT PERSON: Mr. Chris Kontos

D. PHONE NO.: (818) 727-9828

4. PERMIT INFORMATION

APP. NO.: 360365

A. AGENCY: SCAQMD

B. AGENCY CONTACT PERSON: Asha G. Rawal

C. PHONE NO.: (909) 396-2506

D. PERMIT TO CONSTRUCT INFORMATION: P/C NO.: 360365 ISSUANCE DATE:

E. START-UP DATE: n/a

F. PERMIT TO OPERATE INFORMATION: P/O NO.: F22510 ISSUANCE DATE: 10/13/1999

5. EMISSION INFORMATION

APP. NO.: 360365

A. PERMIT

A1. PERMIT LIMIT: Facility VOC emissions not to exceed 667 lbs/month

A2. BACT/LAER DETERMINATION:

NOx: =< 30 ppm at 3% oxygen

VOC: use of Regulation XI compliant materials

B. CONTROL TECHNOLOGY

B1. MANUFACTURER/SUPPLIER: Maxon

B2. TYPE: Cyclomax low-NOx burner

B3. DESCRIPTION:

B4. CONTROL EQUIPMENT PERMIT APPLICATION DATA: P/C NO.: same as oven ISSUANCE DATE:
P/O NO.: same as oven ISSUANCE DATE:

B5. WASTE AIR FLOW TO CONTROL EQUIPMENT: FLOW RATE:
ACTUAL CONTAMINANT LOADING: BLOWER HP: HP

B6. WARRANTY:

B7. PRIMARY POLLUTANTS: NOx, CO, VOC, and PM10

B8. SECONDARY POLLUTANTS: none

B9. SPACE REQUIREMENT: n/a

B10. LIMITATIONS: The following limitations apply to the Cyclomax burner:

(1) Oven temperature < 800 degrees Fahrenheit

(2) Maximum turndown ratio = 15/1

B11. LOCATION OF PRIOR DEMONSTRATION & AGENCY:
FACILITY:
CONTACT PERSON: PHONE NO.:
AGENCY:
ADDRESS:
CONTACT PERSON: PHONE NO.:

B12. OPERATING HISTORY:

B13. SOURCE TEST/PERFORMANCE DATA ANALYSIS:
DATE OF SOURCE TEST: CAPTURE EFFICIENCY:
DESTRUCTION EFFICIENCY: OVERALL EFFICEINCY:
PERFORMANCE DATA:

B14. SOURCE TEST CONDITIONS/PERFORMANCE DATA: A source test is not required.

C. COST

C1. CONTROL EQUIPMENT COST: ☐ CHECK IF INSTALLATION COST IS INCLUDED IN CAPITAL COST
CAPITAL: $2,000 INSTALLATION: $ ( ) SOURCE OF COST DATA: Manufacturer

C2. ANNUAL OPERATIONAL/MAINTENANCE COST: $ ( ) SOURCE OF COST DATA:

D. DEMONSTRATION OF COMPLIANCE

D1. STAFF PERMFORMING FIELD EVALUATION:
ENGINEER'S NAME: INSPECTOR'S NAME: DATE:

5. EMISSION INFORMATION

APP. NO.: 360365

D2. COMPLIANCE DEMONSTRATION:

D3. VARIANCE: NO. OF VARIANCES: DATES:
CAUSES:

D4. VIOLATION: NO. OF VIOLATIONS: DATES:
CAUSES:

D5. FREQUENCY OF MAINTENANCE:

6. COMMENTS

APP. NO.: 360365

The $2,000 cost included in section 5C1 is the differential cost for a low-NOx burner for this application. The equipment cost for the Cyclomax burner was approximately $4,000.

Section I: AQMD BACT Determinations

Application No.: 385818

Equipment Category – Dryer or Oven

1. GENERAL INFORMATION

DATE: 5/13/2003

A. MANUFACTURER: Industrial Process Equipment

B. TYPE: Conveyorized

C. MODEL:

D. STYLE:

E. APPLICABLE AQMD RULES:

F. COST: $ (NA) SOURCE OF COST DATA:

G. OPERATING SCHEDULE: 8 HRS/DAY 5 DAYS/WK 52 WKS/YR

2. EQUIPMENT INFORMATION

APP. NO.: 385818

A. FUNCTION: Powder coat curing oven, 400-600F operating temperature.

B. MAXIMUM HEAT INPUT: 5 MMBtu/hr

C. MAXIMUM THROUGHPUT:

D. BURNER INFORMATION: NO.: 1 TYPE: Low-NOx

E. PRIMARY FUEL: Natural Gas

F. OTHER FUEL: None

G. OPERATING CONDITIONS: Eight hours per day.

3. COMPANY INFORMATION

APP. NO.: 385818

A. NAME: Fletcher Coating

B. SIC CODE: 3479

C. ADDRESS: 426 Fletcher Ave.
CITY: Orange STATE: CA ZIP: 92865

D. CONTACT PERSON: Kurtis Breeding

E. PHONE NO.: 714-637-4763

4. PERMIT INFORMATION

APP. NO.: 385818

A. AGENCY: SCAQMD

B. APPLICATION TYPE: new construction

C. AGENCY CONTACT PERSON: Fred Del Rosario

D. PHONE NO.: 909-396-2663

E. PERMIT TO CONSTRUCT/OPERATE INFORMATION: P/C NO.: F48686 ISSUANCE DATE: 2/6/2002
☐ CHECK IF NO P/C P/O NO.: F48686 ISSUANCE DATE: 2/6/2002

F. START-UP DATE: December 2002

5. EMISSION INFORMATION

APP. NO.: 385818

A. PERMIT

A1. PERMIT LIMIT: 30 ppmvd NOx, corrected to 3% O2, 30-minute average. Facility-wide VOC limit of 780 lb per calendar month.

A2. BACT/LAER DETERMINATION: Low-NOx Burner

A3. BASIS OF THE BACT/LAER DETERMINATION:

5. EMISSION INFORMATION

APP. NO.: 385818

B. CONTROL TECHNOLOGY

B1. MANUFACTURER/SUPPLIER: Eclipse

B2. TYPE: Low-NOx

B3. DESCRIPTION: WINNOX Model WX-500

B4. CONTROL EQUIPMENT PERMIT APPLICATION DATA: P/C NO.: ISSUANCE DATE:
P/O NO.: ISSUANCE DATE:

B5. WASTE AIR FLOW TO CONTROL EQUIPMENT: FLOW RATE:
ACTUAL CONTAMINANT LOADING: BLOWER HP:

B6. WARRANTY: Burner manufacturer literature shows NOx <30 and CO <250 (both ppmvd@3%O2) down to 10% of rated input.

B7. PRIMARY POLLUTANTS: NOx, CO, VOC PM

B8. SECONDARY POLLUTANTS:

B9. SPACE REQUIREMENT:

B10. LIMITATIONS: B11. UNUSED

B12. OPERATING HISTORY: Oven started operation in December 2002 and has been in service without problems since that time. The oven has been used only about one 8-hr shift per week due to poor market conditions.

B13. UNUSED B14. UNUSED

C. CONTROL EQUIPMENT COSTS

C1. CAPITAL COST: ☐ CHECK IF INSTALLATION COST IS INCLUDED IN EQUIPMENT COST
EQUIPMENT: $ INSTALLATION: $ (NA) SOURCE OF COST DATA:

C2. ANNUAL OPERATING COST: $ (NA) SOURCE OF COST DATA:

D. DEMONSTRATION OF COMPLIANCE

D1. STAFF PERMFORMING FIELD EVALUATION:
ENGINEER'S NAME: INSPECTOR'S NAME: DATE:

D2. COMPLIANCE DEMONSTRATION:

D3. VARIANCE: NO. OF VARIANCES: None DATES:
CAUSES:

D4. VIOLATION: NO. OF VIOLATIONS: None related to oven DATES:
CAUSES:

D5. MAINTENANCE REQUIREMENTS: D6. UNUSED

5. EMISSION INFORMATION

APP. NO.: 385818

D7. SOURCE TEST/PERFORMANCE DATA RESULTS AND ANALYSIS:

DATE OF SOURCE TEST: 12-30-2002

CAPTURE EFFICIENCY:

DESTRUCTION EFFICIENCY:

OVERALL EFFICIENCY:

SOURCE TEST/PERFORMANCE DATA:

NOx, ppmvd@3%O2	16
CO, ppmvd@3%O2	14
O2, % (dry)	19.05
Exhaust Flow, dscfm	1560

OPERATING CONDITIONS: Indicated fuel input rate and measured flue gas flow rate indicated that the oven was operating at approximately 20% rated input. Oven temperature was 585F.

TEST METHODS: Source test was accepted by AQMD Monitoring & Source Test Engineering group. However, it was noted that the NOx measurement was less than 20% of analyzer range so NOx was only proven to be <20 ppmvd@3%O2.

6. COMMENTS

APP. NO.: 385818

The manufacturer literature indicates that this burner maintains acceptable emissions performance down to approximately 10% of its rated input (10:1 turn-down). This oven requires a maximum turn-down of approximately 5:1. Some ovens require turn-down ratios greater than 10:1, and this burner would not be suitable for those ovens.

Attachment D

Regenerative Thermal Oxidizer Cost Effectiveness Analysis

REGENERATIVE THERMAL OXIDIZER COST EFFECTIVENESS CALCULATION

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual
EPA publication no. 450/3-90-006

	ASSUMPTIONS	
VOC Parameters		
	Uncontrolled drying & combustion VOC emissions (TPY	0.99
Gas Parameters		
	Total gas flow rate (scfm - inlet)	4500
	Total gas pressure (psi - inlet)	14.7
	Inlet gas temperature (deg F)	350
Equipment Parameters		
	Level of energy recovery (0%, 35%, 50% or 70%)	0%
	Control efficiency (%)	95%
	Equipment life (years)	10
Operating Parameters		
	Hours per day	8
	Days per week	7
	Weeks per year	52
	Shifts per day	1
Electricity Usage		
	Price of electricity ($/kWh)	$ 0.11
	System fan (kWh/yr)	108,711.60
	Total Power Used (kWh/yr)	108,711.60
Gas Usage		
	Price of gas ($/1000 m^3)	$ 352.88
	Auxiliary fuel required (m^3/year)	329,494
	CAPITAL COST	
	Incinerator	$191,239
	Auxiliary equipment (if not included above)	$0
	Equipment Cost (A)	**$191,239**
	Instrumentation (0.1A if not included above)	$0
	Sales taxes (0.085A)	$16,255
	Freight (0.05A)	$9,562
	Total Equipment Cost (B)	**$217,056**
Direct Installation Costs:		
	Foundation & Supports (0.08B)	$17,365
	Handling & erection (0.14B)	$19,130
	Electrical (0.04B)	$8,682
	Piping (0.02B)	$4,341
	Insulation for duct work (0.01B)	$2,171
	Painting (0.01B)	$2,171
	Direct Installation Cost	**$53,859**
	Site preparation	$0
	Facilities & buildings	$0
	Total Direct Costs	**$270,915**

Indirect Costs (installation):			
	Engineering (0.10B)		$21,706
	Construction & field expenses (0.05B)		$10,853
	Contractor fees (0.10B)		$21,706
	Start-up (0.02B)		$4,341
	Performance test (0.01B)		$2,171
	Contingencies (0.03B)		$6,512
	Total Indirect Costs		**$67,287**
	TOTAL CAPITAL INVESTMENT		**$338,203**
	ANNUAL COST		
	Operating Cost		
	Operator ($20/hr, 0.125 hr/8 hr shift, 8760 hr/yr)	$	2,737.50
	Supervisor (15% of operator)	$	410.63
	Operating materials	$	-
	Maintenance		
	Labor ($20/hr, 0.125 hr/8 hr shift, 8760 hr/yr)	$	2,737.50
	Material (same as labor)	$	2,737.50
	Utilities		
	Price of electricity ($/kWh)	$	0.11
	Price of gas ($/1000 m^3)	$	352.88
	Electricity ($/yr)	$	12,219.18
	Natural Gas ($/yr)	$	116,271.84
	Total Direct Annual Costs	**$**	**137,114.15**
	Overhead	$	5,173.88
	Administrative charges	$	6,764.05
	Property taxes	$	3,382.03
	Insurance	$	3,382.03
	Interest rate (%)		5%
	Equipment life (years)		10
	CRF		0.1295
	Capital recovery		$43,798.80
	Capital Recovery Inflation Adjustment		$51,541.04
	Total Indirect Annual Costs	**$**	**70,243.02**
	TOTAL ANNUAL COST	**$**	**207,357.17**
	Annual Cost ($/yr)	$	207,357.17
	Annual Emissions Reductions (tons/yr)		0.94
	(annual emissions based on BACT determination limit for add-on controls)		
	COST PER TON OF VOCs REDUCED ($/ton)	**$**	**220,592.73**

Attachment E

Venturi Scrubber Cost Effectiveness Analysis

VENTURI SCRUBBER COST EFFECTIVENESS CALCULATION

EPA AIR POLLUTION CONTROL COST MANUAL, Sixth Edition, EPA/452/B-02-001, January 2002

Section 6 - Particulate Matter Controls, Chapter 2 - Wet Scrubbers for Particulate Matter

Capital Costs			
Direct Costs	Factor		Cost
Purchased equipment costs			
Venturi Packaged Unit (Qsat = 3,090 acfm)	4.5 Qsat + 19,000	$	32,905
Auxiliary Costs (assumed to be include per Section 6, Chapter 2, Table 2.5)		$	-
Equipment Costs (assumed to be include per Section 6, Chapter 2, Table 2.5)		$	-
Total = A		$	32,905
Instrumentation (as per Section 6, 2.6.1.1)	0.10 A	$	3,291
California Sales taxes	0.085 A	$	2,797
Freight	0.05 A	$	1,645
Purchased equipment costs, PEC	B= 1.24 A	$	40,638
Direct installation costs			
Foundations & supports	0.06 B	$	2,438
Handling & erection	0.40 B	$	16,255
Electrical	0.01 B	$	406
Piping	0.05 B	$	2,032
Insulation for ductwork	0.03 B	$	1,219
Painting	0.01 B	$	406
Direct installation costs	0.56 B	$	22,757
Site Preparation	As required, SP	$	-
Buildings	As required, Bldg.	$	-
Total Direct Cost, DC	**1.56 B + SP + Bldg.**	**$**	**63,395**
Indirect Costs (installation)			
Engineering	0.10 B	$	4,064
Construction and field expense	0.10 B	$	4,064
Contractor fees	0.10 B	$	4,064
Start-up	0.01 B	$	406
Performance test	0.01 B	$	406
Contingencies	0.03 B	$	1,219
Total Indirect Cost, IC	**0.35 B**	**$**	**14,223**
Total Capital Investment = DC + IC	**2.19 B + SP + Bldg.**	**$**	**77,618**
Annual Costs			
Direct Annual Costs, DAC	Factor		Cost
Operating Labor			
Operator labor cost, O ($20/hr, 0.125 hr/shift, 1 shift/8 hr, 8760 hr/yr)		$	2,738
Supervisor labor cost	15% of O	$	411
Operating Labor Total, OL		$	3,148
Maintenance Labor			
Labor, L ($20/hr, 0.125 hr/shift, 1 shift/8 hr, 8760 hr/year)		$	2,738
Material	100% of L	$	2,738
Total DAC		**$**	**8,623**

Indirect Annual Costs, IAC				
Overhead	60%	OL+ML	$	5,173.88
Administrative charges	2%	DC+IC	$	1,552
Property Tax	1%	DC+IC	$	776
Insurance	1%	DC+IC	$	776.18
Captial recovery	0.12951	DC+IC	$	10,051.91
Total IAC			**$**	**18,331**
Total Annual Cost		**DAC + IAC**	**$**	**26,954**

Emission Control Cost Calculation - Venturi Scrubber

Pollutant	**Annual PM (tons/year)**	**Control Efficiency**	**PM Reduction (tons/year)**	**Control Cost ($/Ton Removed)**
Particulate Matter (PM)	1.61	99%	1.60	$16,846