SMAQMD BACT CLEARINGHOUSE

CATEGORY Type: **OVEN/KILN**

BACT Category: Minor Source BACT

BACT Determination Number: 265	**BACT Determination Date:** **8/25/2020**

Equipment Information

Permit Number: 26573

Equipment Description: DRYING OVEN

EXPIRED

Unit Size/Rating/Capacity: 14 MMBtu/hr, direct & natural gas-fired

Equipment Location: HUHTAMAKI, INC
8450 GERBER RD SACRAMENTO, CA

BACT Determination Information

District Contact: Permitting Section Phone No.: (279) 207-1122 email: permitting@airquality.org

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: Updates previous BACT #168 (expired 10/31/19).

777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

DETERMINATION NO.:	265
DATE:	April 14, 2020
ENGINEER:	Michelle Joe

Category/General Equip Description:	Drying Oven
Equipment Specific Description:	Direct Fired, Natural Gas-Fired Dryer for Molded Paper Products, $\leq$ 20 MMBtu/hr
Equipment Size/Rating:	Minor Source BACT
Previous BACT Det. No.:	168

This Best Available Control Technology (BACT) determination will update Determination #168 which was made on October 31, 2017 for a 14 MMBtu/hr natural gas-fired drying oven under P/O 25271 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).

The District reviewed all previously reviewed BACT clearinghouses and rules in BACT #168 and determined that no significant changes have occurred since the previous BACT #168 evaluation.

Therefore, all other considerations made under the previous BACT will remain the same as reviewed below, 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 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):

US EPA

BACT: Source: EPA RACT/BACT/LAER Clearinghouse (A)

RBLC ID: NC-0115 (1/6/2007) for a Dryer or Oven, 5.40 MMBtu/hr	
VOC	No standard
NOx	18.0000 ppm, use of low-NOx burner
SOx	No standard
PM10	No standard
PM2.5	No standard
CO	No standard

(A) See Attachment A for a summary of the EPA BACT Clearinghouse determinations reviewed.

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.

California Air Resources Board (CARB)

BACT: Source: ARB BACT Clearinghouse (A)

For Dryer or Oven, Direct or Indirect	
VOC	N/A – No BACT determinations found
NOx	30 ppmvd corrected to 3% O_2
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

(A) See Attachment B for a summary of the ARB BACT Clearinghouse 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.

Sacramento Metropolitan AQMD

BACT: Source: SMAQMD BACT Clearinghouse

BACT #168 for Drying Oven, 14 MMBtu/hr, Direct & Natural Gas-Fired (10/31/17)	
VOC	No standard
NOx	20 ppmvd corrected to 3% O_2, Ultra Low-NOx burner
SOx	Natural gas fueled
PM10	Natural gas fueled
PM2.5	Natural gas fueled
CO	395.6 ppmvd corrected to 3% O_2

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

RULE REQUIREMENTS:
Rule 419 – NOx from Miscellaneous Combustion Units (amended 10/25/18)
This rule applies to any miscellaneous combustion unit with a total rated heat input capacity of 2

MMBtu per hour or greater located at a major stationary source of NOx ($\geq$ 25 TPY of NOx) or with a total rated heat input capacity of 5 MMBtu per hour or greater located at any area source of NOx (< 25 TPY of NOx). Gaseous fuel-fired ovens are required to meet the following NOx and CO emission limits:

Table 1: Miscellaneous Combustion Units Emission Limits Expressed in ppmv @ 3% O_2			
Equipment Category	**NOx Limit ppmv @ 3% O_2 (lb/MMBtu)**		**CO Limit ppmv @ 3% O_2 (lb/MMBtu)**
Gaseous Fuel-Fired Equipment	**Effective (see Rule 419, Section 401)**		
	Process Temperature		
	< 1200 °F	$\geq$ 1200 °F	
Oven, Dehydrator, Dryer, Heater, or Kiln	30 (0.036)	60 (0.073)	400 (0.30)

South Coast AQMD

BACT: Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities (amended 2/1/2019), page 45

For Dryer or Oven – Direct and Indirect Fired	
VOC	No standard
NOx	30 ppmvd @ 3% O_2 (04-10-1998)
SOx	Natural gas (10-20-2000)
PM10	Natural gas (10-20-2000)
PM2.5	No standard
CO	No standard

Source: SCAQMD LAER/BACT Determinations(A)

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)	
VOC	No standard
NOx	20 ppmvd @ 3% O_2, Low-NOx burner
SOx	No standard
PM10	No standard
PM2.5	No standard

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)	
CO	No standard

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

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 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.

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

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.

San Diego County APCD

BACT: Source: NSR Requirements for BACT (dated 6/2011)

For natural gas-fired drying oven	
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:
Regulation 4, Rule 68 – Fuel-Burning Equipment – Oxides of Nitrogen (effective 9/20/1994)
This rule does not apply to fuel burning equipment which has a maximum input rating of < 50 MMBtu/hr.

Bay Area AQMD

BACT: Source: BAAQMD BACT Guideline

For natural gas-fired drying oven	
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:
Reg 8, Rule 2 – Organic Compounds from Miscellaneous Operations §8-2-110 (revised 4/24/2018)
This rule for organic compound emissions exempts any operation consisting entirely of natural

gas, and therefore does not apply.

Reg 9, Rule 3 – Inorganic Gaseous Pollutants; NOx from Heat Transfer Operations §9-3-301 (amended 3/17/82)
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 MMBtu).

San Joaquin Valley APCD

BACT: Source: SJVAPCD BACT Clearinghouse (Searchable)

SJVUAPCD BACT Guideline 1.5.6 B (10/15/2014) - Metal Heat Treatment Oven, Natural Gas Fired, < 5.0 MMBtu/hr		
Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	50 ppmv @ 3% O_2 (0.061 lb/MMBtu) and use natural gas fuel	5 ppmv @ 3% O_2 (0.006 lb/MMBtu) with the use of an SCR system where the unit's exhaust temperature is ≥ 500 ºF
SOx	No Standard	No Standard
PM10	No Standard	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

SJVUAPCD BACT Guideline 1.6.16 (8/26/1999) - Seed Processing Dryer, Natural Gas Fired, 12 MMBtu/hr		
Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	20 ppmv @ 3% O_2 (Low-NOx burner, with LPG as backup fuel)	9 ppmv @ 3% O_2 (SCR, LTO or equal) (A)
SOx	No Standard	No Standard
PM10	No Standard	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

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

SJVUAPCD BACT Guideline 1.6.21 (10/31/2002) - Flake Cereal Dryer, Natural Gas Fired, Conveyor-fed, 8 MMBtu/hr		
Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	20 ppmv @ 3% O_2 (Low-NOx burner or equal)	9 ppmv @ 3% O_2 (Ultra-Low NOx burner or equal) (A)
SOx	No Standard	No Standard
PM10	No Standard	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard
CO	No Standard	No Standard

(A) 9 ppmv Ultra-Low NOx burner was determined to be not cost effective.

SJVUAPCD BACT Guideline 1.9.9 (2/20/2001) - Molded Paper Products Dryer, Natural Gas Fired, 4.8 MMBtu/hr		
Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	80 ppmv @ 3% O_2 (standard burner)	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)
SOx	No Standard	No Standard
PM10	No Standard	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

SJVUAPCD BACT Guidelines 1.6.8 A (4/14/1995) and 1.6.8 B (3/13/2015) - Pistachio Nut Dryer, Natural Gas Fired, 6.9 MMBtu/hr		
Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	1. Natural gas, or 2. LPG for operations with no access to a natural gas pipeline	No Standard
NOx	1. Low NOx burner and natural gas @ 0.0832 lb-NOx/MMBtu (68.5 ppmvd @ 3% O_2), or 2. Low NOx burner and LPG @ 0.1248 lb-NOx/MMBtu (102.8 ppmvd @ 3% O_2) for operations with no access to a natural gas fuel source	No Standard
SOx	1. PUC quality natural gas, or 2. LPG for operations with no access to a PUC natural gas pipeline	No Standard
PM10	1. Natural gas, or 2. LPG for operations with no access to a natural gas pipeline	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

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

RULE REQUIREMENTS:
Rule 4309 – Dryers, Dehydrators, and Ovens (adopted 12/15/2005)
This rule applies to any dryer, dehydrator, or oven that has a total rated heat input of ≥ 5.0 MMBtu/hr.

SJVUAPCD Rule 4309 Emission Standards ppmvd @ 3% O_2 (B) Rule 4309 §5.2, Table 1 for Gaseous Fuel Fired		
Process Description	NOx limit (B)	CO Limit (B)
Other processes (A)	40.5 ppm	395.6 ppm

(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.

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, SDCAPCD, BAAQMD, SJVAPCD]
NOx	1. 18 ppmvd @ 3% O_2, Low-NOx burner [EPA] (A) 2. 20 ppmvd @ 3% O_2, Low-NOx burner [SMAQMD, SCAQMD, SJVAPCD] 3. 30 ppmvd @ 3% O_2, Low-NOx burner and use natural gas fuel [ARB, SCAQMD] 4. 40.5 ppmvd @ 3% O_2 [SJVAPCD] 5. 50 ppmvd @ 3% O_2 [SJVAPCD] 6. 68.5 ppmvd @ 3% O_2 [SJVAPCD] 7. 80 ppmvd @ 3% O_2 [SJVAPCD] 8. Natural gas fired with LPG as a backup fuel [SJVAPCD] 9. No standard [SDCAPCD, BAAQMD, SJVAPCD]
SOx	1. Natural gas fueled [SMAQMD, SCAQMD] 2. No standard [EPA, ARB, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD]
PM10	1. Natural gas fueled [SMAQMD, SCAQMD] 2. No standard [EPA, ARB, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD]
PM2.5	1. Natural gas fueled [SMAQMD] 2. No standard [EPA, ARB, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD]
CO	1. 395.6 ppmvd @ 3% O_2 [SMAQMD, SJVAPCD] 2. No standard [EPA, ARB, SCAQMD, SDCAPCD, BAAQMD, 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.

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	SMAQMD, SCAQMD, SJVAPCD
SOx	Natural gas fueled	SMAQMD, SCAQMD
PM10	Natural gas fueled	SMAQMD, SCAQMD
PM2.5	Natural gas fueled	SMAQMD
CO	395.6 ppmvd @ 3% O_2	SMAQMD, SJVAPCD

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 ≥ 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 feasibility:
  - 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 ºF 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 ºF) operating below the optimum temperature range of 480 to 800 ºF.

■ **Technologically Feasible Alternatives for PM10:**

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

- 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

Regenerative Thermal Oxidizer Cost Effectiveness Analysis

As shown in Attachment D, the cost effectiveness for the add-on regenerative thermal oxidizer to control VOC was calculated to be $163,497 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 = 1.35 tons VOC/year

Equipment Life = 20 years

Direct Cost = $505,661

Indirect Cost = $108,912

Direct Annual Cost = $115,317

Indirect Annual Cost = $97,230

Total Annual Cost = $212,547

VOC Removed = 1.30 tons

Cost of VOC Removal = $163,497 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.

Venturi Scrubber Cost Effectiveness Analysis

As shown in Attachment E, the cost effectiveness for the add-on venturi scrubber to control PM10 was calculated to be $11,794 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= 2.20 tons PM10/year

Equipment Life = 12 years

Direct Cost = $63,395

Indirect Cost = $14,223

Direct Annual Cost = $9,034

Indirect Annual Cost = $16,795

Total Annual Cost = $25,829

PM10 Removed = 2.19 tons

Cost of PM10 Removal = $11,794 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, BACT for VOC, NOx, SOx, PM10, PM2.5, and CO will remain at what is currently achieved in practice.

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, SDCAPCD, BAAQMD, SJVAPCD
NOx	20 ppmvd @ 3% O_2, Ultra-Low NOx burner	SMAQMD, SCAQMD, SJVAPCD
SOx	Natural gas fueled	SMAQMD, SCAQMD
PM10	Natural gas fueled	SMAQMD, SCAQMD
PM2.5	Natural gas fueled	SMAQMD
CO	395.6 ppmvd @ 3% O_2	SMAQMD, 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.

APPROVED BY: Brian F Krebs **DATE:** **08/27/2020**

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", "heater", and "oven"** (note: determinations reviewed under the previous BACT #168 are included in this table for reference in *italics*):

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**
Dew Point Heater (Fuel Gas Heater), 16.0 MMBtu/hr, 140 MMcf/year	VA-0328	04/26/2018	BACT-PSD	0 tons/year	0.8000 tons/year (9 ppm), use of ultra low NOx burners	0 tons/year	0.5000 tons/year	2.6000 tons/year
Natural Gas Fired Fuel Gas Heaters, 15.90 MMBtu/hr	TX-0824	06/13/2017	BACT-PSD	N/A	N/A	N/A	N/A	2,818.7400 tons/year
Ammonia Converter Start-Up Heater Stack, 20 MMBtu/hr	*LA-0306*	*12/20/2016*	*BACT-PSD*	*N/A*	*N/A*	*N/A*	*PM2.5 only: 7.6 lb/mmcf (0.0076 lb/MMBtu), use of pipeline quality natural gas, & good combustion practices*	*84 lb/mmcf (0.084 lb/MMBtu), use of pipeline quality natural gas, & 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, & good combustion practices*	*0.0005 lb/MMBtu, use of natural gas & 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, & good combustion practices*	*0.1000 lb/MMBtu (82.35 ppm), use of low-NOx burners, annual tune-up, & good combustion practices*	*N/A*	*0.023 lb/MMBtu, use of low-NOx burners, annual tune-up, & good combustion practices*	*0.0830 lb/MMBtu, use of low-NOx burners, annual tune-up, & 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**
Pulp Dryer and Pulper, 1,320 tons/day	WI-0268	02/19/2019	BACT-PSD	1.0000 lb/ADTFP and 7.1000 ton/month (12-month average), use of low VOC-containing materials	N/A	N/A	N/A	N/A
Yankee Dryer (for crepe paper drying directly on heated cylinder/roller), natural gas-fired	AL-0326	05/30/2018	BACT-PSD	N/A	N/A	N/A	0.2100 lb/MDTFP, 7.8000 tons/year	N/A
Clearcoat Drying Oven, 6.82 MMBtu/hr	TN-0161	12/03/2012	BACT-PSD	N/A	3.1000 lb/hr (371 ppm), use of low-NOx burners	N/A	N/A	N/A
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**
Steel Mill Curing Ovens, natural gas fired	TX-0882	01/17/2020	BACT-PSD	0 lb/MMBtu	0.1000 lb/MMBtu (82.4 ppm), use of good combustion practices & clean fuel	0.0006 lb/MMBtu, use of good combustion practices & clean fuel	0.0075 lb/MMBtu, use of good combustion practices & clean fuel	0.0820 lb/MMBtu, use of good combustion practices & clean fuel
Finish Mill Air Heaters, 16.70 MMBTU/HR	IN-0312	06/27/2019	BACT-PSD	0.0054 lb/MMBtu	50.0000 lb/MMcf (41.2 ppm)	N/A	N/A	8,657.0000 tons/year
Space Heaters, 20.00 MMBtu/hr	WI-0292	04/01/2019	BACT-PSD	0.0055 lb/MMBtu	N/A	N/A	N/A	0
Ladle Preheaters, 15.00 MMBtu/hr	OH-0379	02/06/2019	BACT-PSD	N/A	2.1200 lb/hr (114.5 ppm)	N/A	0.1120 lb/hr	1,764.0000 lb/hr
Natural Gas Fired Line Heater, 1.50 MMBtu/hr	WI-0291	01/28/2019	BACT-PSD	N/A	0.1000 lb/MMBtu (82.4 ppm)	N/A	N/A	N/A
Combined Collection/Curing Operations for Mineral Wool Manufacturing: Gutter Exhaust, Spinning Chamber, Curing Oven & Hoods, and Cooling Section (oven size claimed to be confidential), 18,950 scfm (30,000 Nm^3/hr)	WV-0030	04/30/2018	BACT-PSD	78.0200 lb/hr, use of afterburner, good combustion practices, & 40 CFR 63 Subpart DDD compliance	14.5500 lb/hr (either: 600 ppm, assuming max applicable rated heat input of 20 MMBtu/hr; or 30 ppm, assuming low NOx burner standard and 400 MMBtu/hr max rated heat input), use of low NOx burner & good combustion practices	0.0100 lb/hr, use of natural gas	21.2100 lb/hr, use of wet electrostatic precipitator	35,644.0000 tons/year (CO_2e), use of natural gas & good combustion practices

Two Natural Gas Heaters (Dew Point Heaters), 9.90 MMBtu/hr each	FL-0364	03/21/2018	BACT-PSD	0.0050 lb/MMBtu	N/A	N/A	N/A	N/A
Fiberglass Curing Oven, 25.2 MMBtu/hr, natural gas-fired	WV-0027	09/15/2017	BACT-PSD	N/A	0.5900 lb/ton glass pulled (3-hour average), use of low NOx burner and FGR	N/A	N/A	N/A
Coating Ovens, < 10 MMBtu/hr, natural gas-fired	IN-0278	02/01/2017	BACT-PSD	0.0050 lb/MMBtu, use of natural gas only & good combustion practices	N/A	N/A	N/A	N/A
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 burner*	*N/A*	*N/A*	*0.0800 lb/MMBtu, use of good combustion practices*
Wood Veneer Dryer, 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.

[light orange] = *Excluded from the scope of this determination according to the following criteria: NOx > 20 ppm, burner rated > 20 MMBtu/hr,* paper/pulp process rate > 50 tons/day, *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,* grain dryers, *paint sludge dryers, space heaters, air heaters, air supply make up units, hot oil heaters, fuel gas heaters, spray dryers,* ladle and tundish dryers (for metal casting), Yankee dryers, *determinations made on a case-by-case basis other than BACT*

[yellow] = *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** (note: determinations reviewed under the previous BACT #168 are included in this table for reference in *italics*):

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: ☐ CHECK IF NO P/C	P/C NO.: F48686 ISSUANCE DATE: 2/6/2002	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

RTO Cost Estimate

Direct Costs			
Total Purchased equipment costs (in 2020 dollars)			
Incinerator + auxiliary equipment[a] (A) =			
Equipment Costs (EC) for Regenerative Oxidizer	=[2.664 x 100,000 + (13.98 x Qtot)] x (2020 CEPI/2016 CEPCI) =	$329,635	in 2020 dollars
Instrumentation[b] =	0.10 × A =	$32,964	
Sales taxes =	0.03 × A =	$9,889	
Freight =	0.05 × A =	$16,482	
	Total Purchased equipment costs (B) =	$388,970	in 2020 dollars

Footnotes

a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.

b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2020 dollars)			
Foundations and Supports =	0.08 × B =	$31,118	
Handlong and Errection =	0.14 × B =	$54,456	
Electrical =	0.04 × B =	$15,559	
Piping =	0.02 × B =	$7,779	
Insulation for Ductwork =	0.01 × B =	$3,890	
Painting =	0.01 × B =	$3,890	
Site Preparation (SP) =		$0	
Buildings (Bldg) =		$0	
	Total Direct Installaton Costs =	$116,691	
Total Direct Costs (DC) =	Total Purchase Equipment Costs (B) + Total Direct Installation Costs =	$505,661	in 2020 dollars

Total Indirect Installation Costs (in 2020 dollars)			
Engineering =	0.10 × B =	$38,897	
Construction and field expenses =	0.05 × B =	$19,448	
Contractor fees =	0.10 × B =	$38,897	
Start-up =	0.02 × B =	$7,779	
Performance test =	0.01 × B =	$3,890	
	Total Indirect Costs (IC) =	$108,912	
Continency Cost (C) =	CF(IC+DC)=	$61,457	

Total Capital Investment =	**DC + IC +C =**	**$676,029**	**in 2020 dollars**

Direct Annual Costs		
Annual Electricity Cost	= Fan Power Consumption × Operating Hours/year × Electricity Price =	$17,781
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$63,461
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$10,617
	Supervisor = 15% of Operator	$1,593
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$10,933
	Materials = 100% of maintenance labor	$10,933

Direct Annual Costs (DC) =	**$115,317**	**in 2020 dollars**

Indirect Annual Costs		
Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$20,445
Administrative Charges	= 2% of TCI	$13,521
Property Taxes	= 1% of TCI	$6,760
Insurance	= 1% of TCI	$6,760
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$49,743

Indirect Annual Costs (IC) =		**$97,230**	**in 2020 dollars**
Total Annual Cost =	**DC + IC =**	**$212,547**	**in 2020 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$212,547	per year in 2020 dollars
VOC/HAP Pollutants Destroyed =	1.30	tons/year
Cost Effectiveness =	$163,497	per ton of pollutants removed in 2020 dollars

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 1 - Introduction, Chapter 2 - Cost Estimation: Concepts and Methodology (November 2017)

Section 6 - Particulate Matter Controls, Chapter 2 - Wet Scrubbers for Particulate Matter (July 2002)

Capital Costs

		Factor		Cost
Direct Costs				
Purchased equipment costs				
Venturi Packaged Unit (Qsat = 3,090 acfm)		4.5 Qsat + 19,000	$	32,905
Auxiliary Costs (assumed to be included per Section 6, Chapter 2, Table 2.5)			$	-
Equipment Costs (assumed to be included per Section 6, Chapter 2, Table 2.5)			$	-
	Total = A		$	32,905
Instrumentation (replacement parts)		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**	**$**	**14,223**
Total Capital Investment (rounded) = DC + IC		**2.19 B + SP + Bldg.**	**$**	**78,000**

(continued on next page)

Annual Costs

Direct Annual Costs, DAC

			Factor			Cost
Operating Labor						
Operator labor cost, O ($20/hr, 0.125 hr/8 hr shift,	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/8 hr shift,	8760	hr/yr)			$	2,738
Supervisor labor cost			15%	of O	$	411
Material			100%	of L	$	2,738
Total DAC					**$**	**9,034**
Indirect Annual Costs, IAC						
Overhead			60%	OL+ML	$	5,420.25
Administrative charges			2%	DC+IC	$	1,552
Property Tax			1%	DC+IC	$	776
Insurance			1%	DC+IC	$	776.18
Capital recovery **Equipment Life (years):**	12	Interest: 4%	0.106552	DC+IC	$	8,270.36
Total IAC					**$**	**16,795**
Total Annual Cost				**DAC + IAC**	**$**	**25,829**

Emission Control Cost Calculation - Venturi Scrubber

Pollutant	Annual PM (tons/year) (A)	Control Efficiency % (B)	Reduction in PM (tons/year)	Control Cost (C) ($/Ton Removed)
Particulate Matter (PM)	2.20	99.0%	2.19	**$ 11,794**

(A) Based on applicant's annual operation limit of 24 hours/day and 266 days/year.

(B) Based on Yorke Engineering's assumption in the original application for this drying oven, P/O 25271.