777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.:	115
DATE:	January 20, 2017
ENGINEER:	Matt Baldwin
Category/General Equip Description:	Dryer
Equipment Specific Description:	Commercial Laundry Dryer, Natural Gas-Fired
Equipment Size/Rating:	N/A
Previous BACT Det. No.:	70

This BACT determination will update Determination #70 for a natural gas-fired commercial laundry dryer.

BACT ANALYSIS

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

The following control technologies are currently employed as BACT for natural gas-fired commercial laundry dryers by the following agencies and air pollution control districts:

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

<table>
<tr><td colspan="2">For natural gas-fired commercial laundry dryer</td></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>
The following process codes were reviewed:
(A) 19.600 – Misc. Boilers, Furnaces, Heaters
(B) 19.900 – Other Misc. Combustion

<u>RULE REQUIREMENTS:</u>
No applicable requirements</td></tr>
</table>

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT)/Requirements</td></tr>
<tr><td>Air Resources Board (ARB)</td><td>

BACT
Source: ARB BACT Clearinghouse[(A)]

<table>
<tr><td colspan="2">For natural gas-fired commercial laundry dryer</td></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 A

RULE REQUIREMENTS:
No applicable requirements

</td></tr>
<tr><td>SMAQMD</td><td>

BACT
Source: SMAQMD BACT Clearinghouse, BACT Determination Number 70

<table>
<tr><td colspan="2">For natural gas-fired commercial laundry dryer</td></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>

RULE REQUIREMENTS:
None

</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>
<u>BACT</u>
Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 43.[A]

<table>
<tr><td colspan="2">Dryer or oven</td></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>1. Carpet Oven: 80 ppmvd @ 3% O_2
2. Rotary, Spray, and Flash Dryers[A]: Natural gas-fired, low NOx burner
3. Tray, Agitated Pan, and Rotary Vacuum Dryers: Natural gas-fired, low NOx burner
4. Tenter Frame Fabric Dryer: 60 ppmvd @ 3% O_2
5. Other Dryers and Ovens – Direct and Indirect Fired: 30 ppmvd @ 3% O_2</td></tr>
<tr><td>SOx</td><td>Natural gas-fired</td></tr>
<tr><td>PM10</td><td>1. Carpet Oven: Natural gas-fired
2. Rotary, Spray, and Flash Dryers[B]: Natural gas-fired, baghouse
3. Tray, Agitated Pan, and Rotary Vacuum Dryers: Natural gas-fired
4. Tenter Frame Fabric Dryer: Natural gas-fired
Other Dryers and Ovens – Direct and Indirect Fired: Natural gas-fired</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
(A) Note that the BACT guidelines are in process of being updated. The current draft document (5/4/16), maintains the same standards as listed above.
(B) Dryers for foodstuff, pharmaceuticals, aggregate & chemicals.

Source: SCAQMD LAER/BACT Determinations

<table>
<tr><td colspan="2">Dryer or Oven: Dryer, Laundry A/N 391633 (12/6/02)</td></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
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>South Coast AQMD (continued)</td><td>
<u>RULE REQUIREMENTS:</u>
Reg XI, Rule 1147 – NOx Reductions from Miscellaneous Sources
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 <u>require a District permit</u> and are not specifically required to <u>comply with a nitrogen oxide emission limit by other District Regulation XI rules</u>.
<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>Tenter Frame or Fabric or Carpet Dryer</td><td>30 ppm or 0.036 lb/MMBtu</td><td>NA</td><td>NA</td></tr>
<tr><td>Other Unit or Process Temperature</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 2,000,000 Btu/hr or less, from the requirement to obtain a written permit. Therefore in practice, the BACT, LAER and Rule 1147 standards only apply to commercial laundry dryers with a heat input greater than 2,000,000 Btu/hr.
</td></tr>
<tr><td>San Joaquin Valley APCD</td><td>
<u>BACT</u>
Source: SJVUAPCD BACT Guideline 1.19.11
<table>
<tr><th colspan="2">Commercial Laundry Dryer < 5 MMBtu/hr, Natural Gas Fired</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>75% Control (Lint Collector and natural gas fuel, or equal)</td></tr>
<tr><td>PM2.5</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td></tr>
</table>
</td></tr>
</table>

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

This rule does not apply to any dryer, dehydrator, or oven that has a total rated heat input of < 5.0 MMBtu/hr, however, the emissions standards are listed below for reference.

<table>
<tr><td colspan="3">SJVUAPCD Rule 4309 Emission Standards
ppmvd @ 3% O_2 (B)
Rule 4309 §5.2, Table 1 for Gaseous Fuel Fired</td></tr>
<tr><td>Process Description</td><td>NOx limit (B)</td><td>CO Limit (B)</td></tr>
<tr><td>Other processes (A)</td><td>40 ppm</td><td>395 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% Oxygen for comparison purposes.
</td></tr>
<tr><td>San Diego County APCD</td><td>
<u>BACT</u>
Source: NSR Requirements for BACT
Pursuant to Rule 11(d)(18)(iv), Laundry dryers, extractors, or tumblers used for fabrics cleaned only with solutions of bleach or detergents containing no volatile organic solvents are not required to obtain a permit and are therefore not subject to New Source Review (BACT).

<u>RULE REQUIREMENTS:</u>
Regulation 4, Rule 68 – Fuel-Burning Equipment – Oxides of Nitrogen
This rule does not apply to fuel burning equipment which has a maximum input rating of < 50 MMBtu/hr.
</td></tr>
<tr><td>Bay Area AQMD</td><td>
<u>BACT</u>
Source: BAAQMD BACT Guideline

<table>
<tr><td colspan="2">For natural gas-fired commercial laundry dryer</td></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>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>

Discussion regarding turndown ratio:

For commercial laundry dryers, the equipment manufacturer must consider the turndown ratio so that the dryer does not scorch and damage the linens being dried. Generally, these dryers ramp up to a high firing rate initially to drive off most of the moisture. As moisture is driven off and the linen temperature increases, the dryer switches to mid- and low-fire to keep the linen temperature high enough to drive off any remaining moisture, but low enough not to damage the fabric. However, oven and dryer burners with turndown ratios greater than 30:1 may not be able to meet achived in practice standards for NOx while still achieving the desired high turndown ratios. Some facilities in milder climates have been able to compensate by reducing the burner's heat input to meet emission limits, but in effect sacrificing the overall turndown ratio. While this may work for most facilities within the District, turndown ratio may need to be reconsidered during subsequent BACT determinations.

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. Natural gas fueled [BAAQMD] 2. No Standard [EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD]
NOx	1. 30 ppmvd @ 3% O_2, Low-NOx burner [ARB, SMAQMD, SCAQMD] 2. No Standard [EPA, ARB, BAAQMD, SDAPCD]
SOx	1. Natural gas fueled [SCAQMD] 2. No Standard [EPA, ARB, SMAQMD, SJUVAPCD, SDAPCD, BAAQMD]
PM10	1. 75% Control (Lint Collector and natural gas fuel, or equal) [SJVUAPCD] 2. No Standard [EPA, ARB, SMAQMD, SCAQMD, SDAPCD, BAAQMD]
PM2.5	1. No Standard [EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD]
CO	1. No Standard [EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, 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	Natural gas fueled	BAAQMD
NOx	30 ppmvd @ 3% O_2, Low-NOx burner	ARB, SMAQMD, SCAQMD
SOx	Natural gas fueled	SCAQMD
PM10	75% Control (Lint Collector and natural gas fuel, or equal)	SJUVAPCD
PM2.5	No standard	EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD
CO	No standard	EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD

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.

VOC	No other technologically feasible option identified
NOx	No other technologically feasible option identified
SOx	No other technologically feasible option identified
PM10	1. 99% Control (Baghouse and natural gas fuel, or equal.) 2. 90% Control (Venturi Scrubber and natural gas fuel, or equal.)
PM2.5	1. Same as above for PM10 (assuming all PM10 falls within the PM2.5 range) 2. Same as achieved in practice for PM10 (assuming all PM10 falls within the PM2.5 range)
CO	No other technologically feasible option identified

Cost Effective Determination:
After identifying the technologically feasible control options, 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

Baghouse
As shown in Attachment B, the cost effectiveness for the add on baghouse to control PM10 was calculated to be $18,139 per ton (see Attachment D – Baghouse Cost Effectiveness Analysis). The following basic parameters were used in the analysis.

PM10 Control Level = 99%

PM10 Baseline Level= 1.82 ton PM10/year (9.9 lb/day x 92 days/quarter x 4 quarters)

Equipment Life = 10 years

Direct Cost = $54,076

Indirect Cost = $0

Direct Annual Cost = $14,814

Indirect Annual Cost = $18,054

Total Annual Cost = $32,868

PM10 Removed = 1.81 tons

Cost of PM10 Removal = $18,139 per ton reduced

Therefore, the add-on baghouse is considered not cost effective and is eliminated.

Venturi Scrubber

As shown in Attachment C, the cost effectiveness for the add on venturi scrubber to control PM10 was calculated to be $40,225 per ton (see Attachment E – Venturi Scrubber Cost Effectiveness Analysis). The following basic parameters were used in the analysis.

PM10 Control Level = 90%

PM10 Baseline Level= 1.82 ton PM10/year (9.9 lb/day x 92 days/quarter x 4 quarters)

Equipment Life = 10 years

Direct Cost = $105,351

Indirect Cost = $23,636

Direct Annual Cost = $29,627

Indirect Annual Cost = $39,640

Total Annual Cost = $69,267

PM10 Removed = 1.64 tons

Cost of PM10 Removal = $40,225 per ton reduced

Therefore, the add on venturi scrubber is considered not cost effective and is eliminated.

<u>Using the PM10 BACT standard for PM2.5</u>
Lint traps and natural gas fuel is already required as achieved in practice BACT for PM10 [SJVUAPCD]. Since both PM10 and PM2.5 trigger BACT at >0 lb/day and PM2.5 is a subset of PM10 for both natural gas combustion and lint generation, BACT for PM2.5 will be triggered whenever BACT is triggered for PM10. Therefore there is no additional cost associated with requiring lint traps and natural gas as BACT for PM2.5 for new emission units.

C. SELECTION OF BACT:

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

BACT FOR COMMERICAL LAUNDRY DRYER		
Pollutant	**Standard**	**Source**
VOC	Natural gas fueled	BAAQMD
NOx	30 ppmvd @ 3% O_2, Low-NOx burner	ARB, SMAQMD, SCAQMD
SOx	Natural gas fueled	SCAQMD
PM10	75% Control (Lint Collector and natural gas fuel, or equal)	SJUVAPCD
PM2.5	75% Control (Lint Collector and natural gas fuel, or equal)	SJUVAPCD
CO	No standard	EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD

REVIEWED BY: ______________________ **DATE:** ______________________

APPROVED BY: ______________________ **DATE:** ______________________

Attachment A

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 @ 15% O_2	NA	2000 ppmvd @ 15% O_2	0.1 grains/scf
6 MMBtu/hr [(B)]	SCAQMD	05/01/2000	60 ppmvd @ 15% O_2	NA	NA	NA
3.5 MMBtu/hr, Average load equals 1.5 MMBtu/hr [(C)]	SCAQMD	10/27/2001	30 ppmvd @ 15% O_2	NA	NA	NA
5 MMBtu/hr, 400-600F operating temperature [(D)]	SCAQMD	02/06/2002	30 ppmvd @ 15% O_2	780 lb/month (facilitywide)	NA	NA
5.4 MMBtu/hr [(E)]	SCAQMD	12/07/2001	18 ppmvd @ 15% O_2	NA	NA	NA
1.9 MMBtu/hr [(F)]	SCAQMD	05/27/2003	30 ppmvd @ 15% O_2	NA	NA	5 ppmvd
96 MMBtu/hr [(G)]	SCAQMD	01/02/1997	6 ppmvd @ 15% O_2	NA	NA	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.
(E) Polyethylene resin melting and curing.
(F) Direct-fired makeup air heater to control booth temperature.
(G) Conveyorized three-zone, 8-layer (no other notes given in description).

= Dryer/oven not used for commercial laundry and therefore not part of the scope of this determination.

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

Attachment B

BACT Determinations published by SCAQMD

Section I: AQMD BACT Determinations

Application No.: 391633

Equipment Category – Dryer or Oven

1. GENERAL INFORMATION		DATE: 9/6/2002
A. MANUFACTURER: American Laundry		
B. TYPE: Tumbler	C. MODEL: 438	
D. STYLE:		
E. APPLICABLE AQMD RULES: None		
F. COST: $ (NA)	SOURCE OF COST DATA:	
G. OPERATING SCHEDULE: 14 HRS/DAY	5 DAYS/WK	52 WKS/YR

2. EQUIPMENT INFORMATION		APP. NO.: 391633
A. FUNCTION: Clothes dryer		
B. MAXIMUM HEAT INPUT: 3.5 MMBtu/hr	C. MAXIMUM THROUGHPUT: Two 800 lb loads/hr	
D. BURNER INFORMATION: NO.: 1	TYPE: Low-NOx	
E. PRIMARY FUEL: Natural Gas	F. OTHER FUEL: LPG	
G. OPERATING CONDITIONS: Average load = 30%. Average heat input = 1.5 MMBtu/hr		

3. COMPANY INFORMATION		APP. NO.: 391633
A. NAME: Aramark Uniform Services		B. SIC CODE: 7218
C. ADDRESS: 4422 E. Dunham Street CITY: Los Angeles	STATE: CA	ZIP: 90023
D. CONTACT PERSON: Yevgenu (Gene) Sherman	E. PHONE NO.: 323-266-0555	

4. PERMIT INFORMATION		APP. NO.: 391633
A. AGENCY: SCAQMD	B. APPLICATION TYPE: new construction	
C. AGENCY CONTACT PERSON: Amir Dejbakhsh	D. PHONE NO.: 909-396-2618	
E. PERMIT TO CONSTRUCT/OPERATE INFORMATION: ☒ CHECK IF NO P/C	P/C NO.: P/O NO.: F45790	ISSUANCE DATE: ISSUANCE DATE: 10/27/2001
F. START-UP DATE: Late in 2000		

5. EMISSION INFORMATION	APP. NO.: 391633
A. PERMIT	
A1. PERMIT LIMIT: NOx not to exceed 30 PPM at 3% O2	
A2. BACT/LAER DETERMINATION: NOx not to exceed 30 PPM at 3% O2	
A3. BASIS OF THE BACT/LAER DETERMINATION: Part D of BACT Guidelines	
B. CONTROL TECHNOLOGY	
B1. MANUFACTURER/SUPPLIER: Maxon	

Combustion equipment form date 7/17/2002

5. EMISSION INFORMATION

APP. NO.: 391633

B2. TYPE: Cyclomax

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: 30 PPM NOx, corrected to 3% O2

B7. PRIMARY POLLUTANTS: NOx, CO, SOx, PM10

B8. SECONDARY POLLUTANTS: None

B9. SPACE REQUIREMENT:

B10. LIMITATIONS:

B11. UNUSED

B12. OPERATING HISTORY: This unit has been operating for nearly two years, with no significant operational problems.

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: Victor Yip DATE: 4/9/2002

D2. COMPLIANCE DEMONSTRATION: No problems with tumbler operation noted.

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

D4. VIOLATION: NO. OF VIOLATIONS: 1 DATES: 4/9/2002
CAUSES: Late with Rule 1146 testing of water heater

D5. MAINTENANCE REQUIREMENTS:

D6. UNUSED

D7. SOURCE TEST/PERFORMANCE DATA RESULTS AND ANALYSIS:
DATE OF SOURCE TEST: Not required CAPTURE EFFICIENCY:
DESTRUCTION EFFICIENCY: OVERALL EFFICIENCY:
SOURCE TEST/PERFORMANCE DATA:
OPERATING CONDITIONS:
TEST METHODS:

6. COMMENTS

APP. NO.: 391633

Attachment C
Baghouse Cost Effectiveness Analysis

BAGHOUSE COST EFFECTIVENESS CALCULATION

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

Section 6 - Particulate Matter Controls, Chapter 1 - Baghouses and Filters

Capital Costs

Direct Costs		Factor	Cost
Purchased equipment costs			
Fabric filter (Bid from Air Dynamics, requested by G&K)			$ 35,029
Bags and cages			$ -
Auxillary equipment			$ -
Total = A			$ 35,029
Instrumentation		0.10 A	$ 3,503
California Sales taxes		0.085 A	$ 2,977
Freight		0.05 A	$ 1,751
Purchased equipment costs, PEC	B=	1.24 A	$ 43,261
Direct installation costs		0.25 B	$ 10,815
Section 1.4.3 of the Cost Control Manual estimates that for prepackaged units, the installation costs would be 20-25% of the purchased equipment cost (B).			
Site Preparation		As required, SP	$ -
Buildings		As required, Bldg.	$ -
Total Direct Cost, DC		**1.74 B + SP + Bldg.**	**$ 54,076**
Indirect Costs (installation) - included with direct installation costs			
Engineering		0.00 B	$ -
Construction and field expense		0.00 B	$ -
Contractor fees		0.00 B	$ -
Start-up		0.00 B	$ -
Performance test		0.00 B	$ -
Contingencies		0.00 B	$ -
Total Indirect Cost, IC		**0.00 B**	**$ -**
Total Capital Investment (rounded) = DC + IC		**2.19 B + SP + Bldg.**	**$ 54,076**

BAGHOUSE COST EFFECTIVENESS CALCULATION (continued)				
Annual Costs				
Direct Annual Costs, DAC	Factor			Cost
Operating Labor				
Operator labor cost, O ($13.25/hr, 1 hr/8 hr shift, 2 shifts/day 260 days/yr)			$	6,890
*Hourly Rate provided by G&K Services				
Supervisor labor cost	15%	of O	$	1,034
Operating Labor Total, OL			$	7,924
Maintenance Labor				
Labor, L ($13.25/hr, 0.5 hr/8 hr shift, 2 shifts/day 260 days/yr)			$	3,445
Material	100%	of L	$	3,445
Utilities				
Electricity (system is passive due to high flow rate from dryer)			$	-
Replacement Parts			$	-
Total DAC			**$**	**14,814**
Indirect Annual Costs, IAC				
Overhead	60%	OL+ML	$	8,888.10
Administrative charges	2%	DC+IC	$	1,081.52
Property Tax	1%	DC+IC	$	541
Insurance	1%	DC+IC	$	540.76
Captial recovery (10-year equipment life, 5% interest)	0.129505	DC+IC	$	7,003.09
Total IAC			**$**	**18,054**
Total Annual Cost		**DAC + IAC**	**$**	**32,868**

Emission Control Cost Calculation - Baghouse				
	Annual	**Control Efficiency**	**Reduction**	**Control Cost**
Pollutant	**PM tons/year [1]**	**%**	**tons PM/year**	**$/Ton Rem**
Particulate Matter (PM)	1.82	99%	1.81	$ 18,139
[1] Proposed permit limit of 9.9 lb PM/day. EF has assumes that PM = PM10.				

Attachment D

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 = 9,000 acfm)		4.5 Qsat + 19,000	$	59,500
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			$	59,500
Instrumentation (assumed to be include per Section 6, Chapter 2, Table 2.5)		0.00 A	$	-
California Sales taxes		0.085 A	$	5,058
Freight		0.05 A	$	2,975
Purchased equipment costs, PEC	B=	1.14 A	$	67,533
Direct installation costs				
Foundations & supports		0.06 B	$	4,052
Handling & erection		0.40 B	$	27,013
Electrical		0.01 B	$	675
Piping		0.05 B	$	3,377
Insulation for ductwork		0.03 B	$	2,026
Painting		0.01 B	$	675
Direct installation costs		0.56 B	$	37,818
Site Preparation		As required, SP	$	-
Buildings		As required, Bldg.	$	-
Total Direct Cost, DC		**1.56 B + SP + Bldg.**	**$**	**105,351**
Indirect Costs (installation)				
Engineering		0.10 B	$	6,753
Construction and field expense		0.10 B	$	6,753
Contractor fees		0.10 B	$	6,753
Start-up		0.01 B	$	675
Performance test		0.01 B	$	675
Contingencies		0.03 B	$	2,026
Total Indirect Cost, IC		**0.35 B**	**$**	**23,636**
Total Capital Investment (rounded) = DC + IC		**2.19 B + SP + Bldg.**	**$**	**129,000**

VENTURI SCRUBBER COST EFFECTIVENESS CALCULATION (continued)				
Annual Costs				
Direct Annual Costs, DAC	Factor			Cost
Operating Labor				
Operator labor cost, O ($13.25/hr, 2 hr/8 hr shift, 2 shifts/day 260 days/yr)			$	13,780
Supervisor labor cost	15%	of O	$	2,067
Operating Labor Total, OL			$	15,847
Maintenance Labor				
Labor, L ($13.25/hr, 1 hr/8 hr shift, 2 shifts/day 260 days/yr)			$	6,890
Material	100%	of L	$	6,890
Total DAC			**$**	**29,627**
Indirect Annual Costs, IAC				
Overhead	60%	OL+ML	$	17,776.20
Administrative charges	2%	DC+IC	$	2,580
Property Tax	1%	DC+IC	$	1,290
Insurance	1%	DC+IC	$	1,289.87
Captial recovery (10-year equipment life, 5% interest)	0.129505	DC+IC	$	16,704.42
Total IAC			**$**	**39,640**
Total Annual Cost		**DAC + IAC**	**$**	**69,267**

Emission Control Cost Calculation - Venturi Scrubber

Pollutant	Annual PM tons/year [1]	Control Efficiency %	Reduction tons PM/year	Control Cost $/Ton Rem
Particulate Matter (PM)	1.8	90%	1.7	$ 40,225

[1] Proposed permit limit of 9.9 lb PM/day. G&K has assumed that PM = PM10.