Incremental Cost-Effectiveness Analysis Oxidizer #2

This cost effectiveness study was performed on a catalytic oxidizer rated at 1.35 mmBtu/hr. The oxidizer is utilized to control smoke and odor from a commercial coffee roaster. After initial startup, the oxidizer runs for only 2-3 minutes during each roast. The average operation is 40 roasts a day.

Health and Safety Code 40440.11 requires an incremental cost-effectiveness study if a more stringent emission limit is proposed over an existing lowest achievable limit. The existing NOx BACT limit of 60 ppm is from Rule 1147. The proposed new BACT limit is 30 pm NOx at 3% O_2. Both limits apply to the burner only. Only new or replacement costs are analyzed as retrofit costs are considered part of a BARCT analysis and not a BACT requirement.

Average cost-effectiveness per SCAQMD BACT Guidelines Part C analyzes the cost of applying BACT to an uncontrolled case. This BACT update is only targeting the secondary emissions from a control device, therefore average cost effectiveness does not apply.

A Low NOx burner equipped oxidizer was implemented in this application to meet the 30 ppm NOx limit. The incremental equipment cost is the cost differential between the 30 ppm NOx unit and one that can only achieve 60 ppm NOx. Installation costs do not differ as the units are identical except for the burner.

Incremental operating cost consists of two components. Additional fuel use is needed from the less efficient Low NOx equipment. Also, incremental electricity cost was examined for the fan to bring extra combustion air for the Low NOx burner. Both were calculated and included as part of the annual operating cost.

The incremental cost/ton of NOx reduction from this case is below the NOx incremental threshold value from 2st quarter of 2017, the time the equipment was being installed.

Groundworks Catalytic Oxidizer Cost Effectiveness Calculations

Use R1147 limit of 60 ppm NOx @ 3% O2 as baseline, and reduction is to 30 ppm

Oxidizer Info

Manufacturer: Western Combustion Engineering
Model: CA70-NG-2083P-60
Rating: 1.35 MM Btu/hr
Operation Schedule: 1.4 hr/day 300 days/yr
Life 20 years
Interest rate: 4 %

Capital Cost - Incremental

Equipment (cost of 30 ppm oxidizer - cost of 60 ppm oxidizer)	$9,000
Direct & Indirect Installation	$0
Total Capital	$9,000

Annual Operating Cost - Incremental

Additional fuel use	$156	*(from incremental gas use sheet)*
Additional electricity use	$17	*(from incremental electricity use sheet)*
Total Annual Operating Cost (Incremental)	$173	

PVF	13.590
Present Value of Capital Costs	$9,000
Present Value of Annual Costs (20 years @ 4%)	$2,352
Total 20-Year Capital Cost	$11,352
Emissions reduction (lbs/day)	0.07
Emissions reduction (tons/Life)	0.21
Cost per ton of NOx reduction	$54,110
MSBACT maximum cost effectiveness NOx ($/ton)	**$82,665**

INCREMENTAL 2nd Qtr 2017

NOx Reduction Calculation

	Emission Factor lb NOx/mmBtu	Daily heat input(mmbtu/hr) 1.4 hr @ 100% Load	NOx lb day
For 60 ppm@3%O2	0.073	1.890	0.14
For 30 ppm@3%O2	0.036	1.890	0.07
		lb/day Reduction:	0.07

Notes:

- Calculations were based on equipment cost info provided by the facility and by the manufacturer
- Annual operating costs calculated using information from the faciity and the enginnering permit file
- Maximum allowed cost effectiveness was based on 2nd quarter 2017 Marshall & Swift index when the equipment was installed
- Incremental cost effectiveness uses the difference in cost and emissions between the proposed MSBACT and current BACT
- In accordance with H&SC 40440(c) the proposed MSBACT must be less than the District's established Incremental cost-effectiveness value

Incremental Gas use and cost analysis for Groundworks Coffee Catalytic Oxidizer
Assumptions: Ambient temp = 70 degrees F and the burner needs to reach a temp. of 1400 F (per permit condition)

		60 ppm burner	30 ppm Low NOx burner	
1.35 mmbtu/hr burner at 100% load	amount of air for stochiometry	20% excess air for 60 ppm burner	50% excess air for 30 ppm Low Nox burner (MAXON Ovenpak LE)	
DIVIDE heat input rate by 1000 scf/btu and by 1hr/60 min to get cfm of nat gas	Multiply by 9.6 to get cfm of air	air needed for 60 ppm burner (cfm)	air needed for low nox burner (cfm)	
22.50	216.00	259.20	324.00	
	0	43.20	108.00	Actual excess air (cfm)
		20.00%	50.00%	Excess air Percent

Extra Energy Needed for Lo NOx burner

energy needed to heat above amount of air flow	energy needed to heat above amount of air flow	energy needed to heat above amount of air flow
cfm x 1.08 x delta T	cfm x 1.08 x delta T	cfm x 1.08 x delta T
0	62052	155131
btu/hr needed	btu/hr needed	btu/hr needed

Subtract 60 ppm unit energy from 30 ppm unit

93079 btu/hr more energy needed
Divide by 1000 to convert to scf/hr
93.08 scf/hr more gas needed

Combusiton efficiency	100.00%	99.38%	98.45%

catox burner operates 1.4 hr/day, 300 days/yr
39093.06 scf more nat gas a year
convert to therms
390.93 more therms per year

at cost of 40cents/therm
$156.37 more gas cost per year

Incremental Cost Analysis - Catalytic Oxidizer - Groundworks Coffee Inc.

Additional Electrical cost from using Lox NOx oxidizer

Power Consumption by fan (bhp) = Q (cfm) x Pressure (inch WC) / (6356 (constant for unit conversions) x Fan efficiency Coeff)
- use 0.8 as fan efficiency coefficient
- Pressure values (in Water Column) are taken from burner specification sheets

cfm figures based on incremental gas use analysis worksheet results

Bhp needed for 60 ppm equipment = 260 cfm x 5 in WC / 6356 x 0.8
Bhp needed for 60 ppm equipment = 0.26 bhp

Bhp needed for 30 ppm equipment = 324 cfm x 7.6 in WC / 6356 x 0.8
Bhp needed for 30 ppm equipment = 0.48 bhp

Difference of 0.48 and 0.26 = 0.229 bhp
Multiply bhp by .7457 = 0.17 Kw
Divide by 0.9 motor efficiency 0.189 kw

usage is 1.4 hours a day and 300 days a year 79.55228 kwh per year incremental electricity cost

Use 20 cents/kWh - 1504.95 kWh* 20 cents/kWh **$15.91** incremental electricity cost of fan use