

Workgroup Recommendations and Other Potential Control Measures
Homes and Restaurants Workgroup

HR010 – Restaurant Controls

DESCRIPTION

The number of restaurants in New Jersey is estimated to be around 22,000.¹ Estimated emissions from restaurant operations rank second highest in the New Jersey fine particle matter (PM_{2.5}) inventory.² Restaurant operations include charbroilers, griddles, deep fat fryers, ovens, and other equipment. Under-fired charbroilers are responsible for the majority of emissions from this source category. The table below outlines the contribution of pollution from under-fired charbroilers, chain-driven charbroilers, griddles, and deep-fat fryers. Oven emissions appear to be negligible.

Table 1. Restaurant Operations Emissions by Equipment Type in New Jersey

Equipment Type	Percent (%) of Restaurant Operations Emissions in New Jersey	
	Total PM	Total VOC
Under-fired Charbroiling	84	71
Chain-driven Charbroiling (e.g., Burger King)	10	22
Griddles	5	4
Deep-Fat Fryers	Negligible	2
Ovens	Negligible	Negligible

The SCAQMD committed to developing control measures for emission reductions from restaurant operations. While originally intending on controlling under-fired charbroiling, the largest part of the emissions from restaurant operations, the SCAQMD determined that control of chain-driven charbroilers was the most cost-effective. They, along with other California air quality management districts, did proceed with controlling chain-driven charbroilers. This is a much smaller source of emissions from restaurant operations, and affects mostly Burger King, the only known restaurant chain in New Jersey that uses chain driven charbroilers. In California, Carl's Jr. also uses chain-driven charbroilers.

Currently, the type of restaurant operation emissions regulated by SCAQMD is not regulated in New Jersey. The only state in the country that regulates emissions from restaurants is California.³ There are three air district rules in California that control emissions from restaurant operations: SCAQMD Rule 1138 – Control of Emissions from Restaurant Operations,⁴ Ventura County Air Pollution Control District (VCAPCD) Rule 74.25 – Restaurant Cooking Operations, and San Joaquin Valley Unified Air Pollution Control District (SJUVAPCD) Rule 4692 – Commercial Charbroiling. All three rules have similar requirements for chain-driven charbroilers, which are also referred to as conveyORIZED charbroilers. Chain-driven charbroilers must use a certified emission control device that reduces particulate matter (PM) and volatile organic compounds (VOCs) by at least 83%. The potential control

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measure under review focuses on adopting the SCAQMD rule for restaurant operations specifically controlling “...chain-driven charbroilers used to cook meat”.⁵

IMPLEMENTATION

SCAQMD Rule 1138 requires the use of a catalytic oxidizer device along with test requirements and recordkeeping.⁴ Other control devices may be used if they are as effective or more effective than the catalytic oxidizer and are certified. Other control methods have been identified such as filtration systems and thermal incineration.⁶

Under the rule, the charbroilers are not subject to air permitting or Best Available Control Technology (BACT) requirements⁶ but they are required to follow their nuisance rule and its opacity standards. After the rule was adopted on November 14, 1997, applicable restaurants had approximately 2 years to reduce PM₁₀ and VOC emissions by installing a catalyst.⁶

COST

Much of the existing information on restaurant operation controls refers to the staff report released by the SCAQMD in 1997.⁷ The most current information on costs for controlling restaurant operations using catalytic oxidizers were reported in a staff report released by the VCAPCD in 2004^{3,8} and was provided by Engelhard Corporation in response to this white paper.⁸ It should be noted that permitting is not required under SCAQMD’s rule. The costs to control charbroilers in the VCAPCD area were calculated according cost figures provided by the SCAQMD staff report, which was based upon Prototech Incorporated and Engelhard Corporation catalysts. Engelhard Corporation (now BASF Corporation) has updated cost figures that better reflect the cost savings that the control can provide.⁹ A major source of savings in the decreased usage of natural gas. Both sets of cost figures are shown in Tables 2 and 3.

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Table 2. One-Time Costs

a. Cost Figures from VCAPD’s Final Staff Report⁸

Capital Cost for catalytic oxidizer	\$3,700
Installation Cost	\$1,000
District Permit Processing (after 6/30/04)	\$958
Subtotal	\$5,658
Catalyst Replacement after 5 years	\$4,289
TOTAL	\$9,947

b. 2006 Cost Figures – Engelhard Corporation⁹

Capital Cost for catalytic oxidizer (includes catalyst and transition adapter onto the charbroiler)	\$2,750
Installation cost	\$100
<i>Total One-Time Costs</i>	<i>\$2,850</i>

Table 3. Reoccurring Annual Costs

a. Cost Figures from VCAPD’s Final Staff Report⁸

O&M for catalyst	\$500
Exhaust Stack Cleaning (savings)	(-\$750)
District Permit Renewal	\$358
TOTAL	\$108

b. 2006 Cost Figures – Engelhard Corporation⁹

O&M for catalyst	\$25
Exhaust Stack Cleaning (savings)	(\$750)
Lower natural gas cost (savings)	(\$2,000)
<i>Total reoccurring cost (savings)</i>	<i>(\$2,725)</i>

EMISSION REDUCTIONS

Emissions from New Jersey’s 2002 inventory for chain-driven charbroilers were estimated to be 0.61 tons per day (tpd) of PM_{2.5} and 0.20 tpd of VOC. The SCAQMD estimates emission reductions of approximately 0.5 tpd of PM₁₀ and 0.2 tpd of VOC from its rule for chain-driven charbroilers with most of the PM₁₀ emission reductions being PM_{2.5}.⁶ This results in approximately 0.29 tpd of PM₁₀ and 0.1 tpd of VOC estimated emission reductions for New Jersey, if the rule is implemented.

Emissions from New Jersey’s 2002 inventory for total restaurant operations were estimated to be 2,226 tons per year (tpy) or 6.12 tpd of PM_{2.5} and 333 tpy or 0.91 tpd of VOC.² As discussed above, the majority of these emissions (approximately 84 percent) are estimated to be from under-fired charbroilers. Also, it is possible that the PM_{2.5} emissions from charbroilers are underestimated as testing in the South Coast Air Basin has demonstrated that most of the PM₁₀ emissions are equal to or less than 2.5 microns.^{3,6}

COST-EFFECTIVENESS

Chain-Driven Charbroiling

Of all the types of restaurant cooking operations reviewed, SCAQMD staff determined that chain-driven charbroiling operations merited the addition of cost-effective air pollution controls.¹ Cost-effectiveness

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figures for chain-driven charbroiling were estimated at \$1,680 per ton of PM and VOC reduced, but restaurants reported amounts ranging from \$1,000 - \$7,000 per ton of pollutants reduced.⁸

Cost-effectiveness reported by the VCAPCD after replacing the catalyst oxidizer after 5 years was \$14,924 per ton of VOC reduced or \$3,148 per ton of VOC and PM reduced.⁸ If a replacement device was purchased at time of original purchase, then the cost-effectiveness increases to \$11,070 per ton of VOC, or \$2,335 per ton of VOC and PM reduced.

Control methods for under-fired charbroilers were estimated at a cost-effectiveness of \$14,500 per ton.⁶

REFERENCES AND NOTES

1. *A Collaborative Report Presenting Recommended Air Quality Strategies for Further Consideration by the State of New Jersey*. (2005). The Homes and Restaurants Workgroup. Submitted to the New Jersey Department of Environmental Protection. Available at: http://www.nj.gov/dep/airworkgroups/docs/final_hr_workgroup_report.pdf. Accessed March 14, 2006.
2. *Proposed State Implementation Plan (SIP) Revisions for the Attainment and Maintenance of the 8-Hour Carbon Monoxide National Ambient Air Quality Standard, 1-Hour Ozone National Ambient Air Quality Standard, and Fine Particulate Matter National Ambient Air Quality Standard; and the 2002 Periodic Emission Inventory*. (2006). Division of Air Quality Management. New Jersey Department of Environmental Protection. Available at: http://www.state.nj.us/dep/baqp/sip/Prop05_SIPRev.htm. Accessed March 14, 2006.
3. Kennard, A., Anderson, C., Williams, K. J., Mohamad, A., and Tholen, G. (2005). *Final Staff Report SB656 Assessment and Control Measure Evaluation*. Sacramento Metropolitan Air Quality Management District. <http://www.airquality.org/notices/SB656/HearingStaffReport20050728.pdf>. Accessed March 21, 2006.
4. *Rule 1138 – Control of Emissions from Restaurant Operations*. (1997). South Coast Air Quality Management District. <http://www.arb.ca.gov/drdb/sc/curhtml/r1138.htm>. Accessed March 22, 2006.
5. *ibid.*, 1138(a)
6. *Final 2003 Air Quality Management Plan, Appendix IV-A: District's Stationary and Mobile Source Control Measures*. South Coast Air Quality Management District. <http://www.arb.ca.gov/planning/sip/scsip03/scsip03.htm>. Accessed February 8, 2005.

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7. *Staff Report for Proposed Rule 1138 – Control of Emissions from Restaurant Operations*, SCAQMD, October 10, 1997.
8. *Final Staff Report: Proposed New Rule 74.25, Restaurant Cooking Operations Proposed Revisions to Rule 23, Exemptions from Permit*. (2004). Ventura County Air Pollution Control District. http://www.vcapcd.org/pubs/Rules/Rule7425/R7425_SR0831.pdf. Accessed July 18, 2005.
9. Data submitted by Engelhard Corporation in comments to the NJDEP, S. Mack, personal communication, July 6, 2006.