Memo

To: Carol Krause
From: Paul Wade, Class One Technical Services
Date: January 17, 2014
Subject: Analysis of Ambient Air Quality Impacts from Odacrem Coffee Roaster

The memo discusses the impacts from the proposed coffee roaster on ambient air quality and health effects. The proposed roaster will process 5 pounds of coffee beans per batch and 2.5 batches per hour or 12.5 pounds per hour. The proposed total production would be 18 tons of coffee per year.

The coffee roaster will combust natural gas at a maximum rated capacity of 16,000 BTU per hour. As a comparison, a typical residential natural gas air heater will have a rated capacity of 100,000 BTU per hour or a 50 gallon hot water heater will have a rated capacity of 36,000 BTU per hour.

Air emissions from the coffee roaster include particulate emissions from the handling and roasting of the coffee beans and combustion emissions from burning natural gas (NG). These emissions are vented to a stack exhausting to the outside air at a rate of 205 cubic feet per minute. To calculate pollutant emission rates from the coffee roaster, emission factors were obtained from EPA documented emission factors for combustion of natural gas and coffee roasting, the Sacramento Metropolitan Air Quality Management District "Permitting Procedures Manual Coffee Bean Roasting Process" revised April 05, 2011, and Puget Sound Clean Air Agency Source Testing September 2003. Emission rate calculations are found in Attachment A of this Memo. The following table summarizes the calculated emission rates.

Estimated Maximum Emission Rates

Pollutant	PPH	TPY
NOx, Nitrogen Dioxide, NG Combustion	1.68E-03	1.21E-03
CO, Carbon Monoxide, NG Combustion	3.44E-03	4.95E-03
SO2, Sulfur Dioxide, NG Combustion	1.01E-05	7.28E-06
VOC, Volatile Organic Carbon, NG Combustion	5.38E-03	7.74E-03
PM, Particulate, Coffee Roasting	1.50E-02	2.16E-02
CO2e, Greenhouse Gases, NG Combustion	1.13E+00	1.62E+00
Lead, NG Combustion	8.42E-09	6.06E-09
Formaldehyde, HAPs, NG Combustion	6.74E-07	4.85E-07
Acrolein, HAPs, NG Combustion	1.13E-04	1.62E-04
Acetaldehyde, HAPs, NG Combustion	2.25E-04	3.24E-04

The estimated criteria pollutant emission rates do not exceed any emission rate requiring an air quality "Authority to Construct" permit at 10 pounds per hour (PPH) or 25 tons per year (TPY). Looking at particulate emissions as the highest emission rate at 0.015 pph, the facility would have to increase production by 666 times to require a permit. Since the facility is a commercial operation and emits "any" quantity of hazardous air pollutants (HAPs), the coffee roaster will need a source registration from the Albuquerque/Bernalillo County Air Quality Program.

To determine health affects due to emission of HAPs, health screening levels were obtained from documentation prepared by the Texas Commission on Environmental Quality Toxicology Division. Effects Screening Levels (ESLs) currently used by the TCEQ Toxicology Division for air permitting were used to compare with the results of the screening analysis. For this screening analysis, I looked at the maximum emission rate for each HAPs as it leaves the stack to determine the highest 1 hour and annual impact concentrations that could affect the public in the ambient air. The concentration impacts were determined using EPA's Regulatory Dispersion Model - American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee Dispersion Model (AERMOD), *Version 12345* and one year of Albuquerque Airport meteorology (1993). This model is recommended by USEPA for determining Class II impacts within 50 km. Input to the model included stack exhaust parameters and estimated maximum emission rates. The following are the stack parameters input into the model.

Model Stack Parameters	
Stack Height (ft)	15 ft
Stack Exit Flowrate (ACFM)	205 ACFM
Stack Temperature (ºF)	100ºF
Stack Exit Diameter (ft)	0.5 ft

Results show impacts from HAPs emissions well below the ESLs for each of the HAPs pollutant modeled, see table below. Short-term ESL is a 1 hour concentration and Long-term ESL is an annual concentration. Further discussion is found in Attachment B of this Memo.

	Emission lbs/hr	**1-Hour Conc. (ug/m3)**	**Annual Conc. (ug/m3)**	**Short-term ESL ug/m3 [1]**	**Long-term ESL ug/m3 [1]**
Formaldehyde	6.74E-07	0.00022	0.000030	15	3.3
Acrolein	1.13E-04	0.037	0.0042	3.2	0.15
Acetaldehyde	2.25E-04	0.074	0.0084	90	45

ug/m3 = micrograms per cubic meter

Acrolein modeled concentrations for the Long-term ESL is 2.8% of the ESL and is the highest concentration approaching an ESL. To reach the ESL the facility could combust 35 times more natural gas or 560,000 BTUs per hour.

Conclusion, the facility as proposed would not cause health issues due to ambient air impacts from coffee roasting. Additionally, if the facility would increase production from 12.5 pounds per hour to 437.5 pounds per hour or increase natural gas consumption from 16,000 BTUs to 560,000 BTUs, the impacts to ambient air would still show no significant impacts to the public health.

REFERENCES

1. Sacramento Metropolitan Air Quality Management District "Permitting Procedures Manual Coffee Bean Roasting Process", (Revised April 05, 2011).

2. USEPA, AP-42 Emission Factors, Section 1.4 "Natural Gas Combustion", 07/98

3. USEPA, AP-42 Emission Factors, Section 9.13.2 "Coffee Roasting", 1995

4. TECQ, Texas Commission on Environmental Quality, Toxicology Division - March 2012 Effects Screening Levels

Attachment A: Emission Calculations
Attachment B: Ambient Air Analysis
Attachment C: Resume – Paul Wade

Attachment A
Odacrem Coffee
Emission Calculation

EPA AP-42 Section 1.4 "Natural Gas Combustion", Small Boiler Uncontrolled — **NOx, SO2, Lead**
EPA AP-42 Section 9.13 "Coffee Roasting" — **PM, VOC, CO2e**
Emission Factors from Puget Sound Clean Air Agency Testing September 2003 — **Formaldehyde, Acrolein, Acetaldehyde**

Coffee Throughput 12.5 lbs/hr
18 tons/yr

Burner Maximum Rated Capacity
0.016 mmBTU/Hr

Hours of Operation Based On Throughput
1440 hr/yr

Natural Gas LHV
950 Btu/standard cubic feet

Maximum Natural Gas Usage
1.68E+01 cubic feet/hr
1.68E-05 million scf/hr
2.43E-02 million scf/yr

Exhaust Flowrate
205 ACFM

NOx	100	lbs/MMSCF	AP-42 Section 1.4 (1998)
CO	0.55	lbs/ton	AP-42 Section 9.13 (1995)
SO2	0.6	lbs/MMSCF	AP-42 Section 1.4 (1998)
VOC	0.86	lbs/ton	AP-42 Section 9.13 (1995)
PM	2.4	lbs/ton	AP-42 Section 9.13 (1995) no abatement
CO2e	180	lbs/ton	AP-42 Section 9.13 (1995)
Lead	0.0005	lbs/MMSCF	AP-42 Section 1.4 (1998)
Formaldehyde	0.04	lbs/ton	Puget Sound Clean Air
Acrolein	0.018	lbs/ton	Puget Sound Clean Air
Acetaldehyde	0.036	lbs/ton	Puget Sound Clean Air

Pollutant	PPH	TPY
NOx, Nitrogen Dioxide, NG Combustion	1.68E-03	1.21E-03
CO, Carbon Monoxide, NG Combustion	3.44E-03	4.95E-03
SO2, Sulfur Dioxide, NG Combustion	1.01E-05	7.28E-06
VOC, Volatile Organic Carbon, NG Combustion	5.38E-03	7.74E-03
PM, Particulate, Coffee Roasting	1.50E-02	2.16E-02
CO2e, Greenhouse Gases, NG Combustion	1.13E+00	1.62E+00
Lead, NG Combustion	8.42E-09	6.06E-09
Formaldehyde, HAPs, NG Combustion	6.74E-07	4.85E-07
Acrolein, HAPs, NG Combustion	1.13E-04	1.62E-04
Acetaldehyde, HAPs, NG Combustion	2.25E-04	3.24E-04

Attachment B
Odacrem Coffee
HAPs Concentration Calculations

	lbs/hr	1-Hour Conc. (ug/m3)	Annual Conc. (ug/m3)	Short-term ESL ug/m3 [1]	Long-term ESL ug/m3 [1]	% Short-term ESL	% Long-term ESL	Short-term ESL Basis	Long-term ESL Basis
Formaldehyde	6.74E-07	0.00022	0.000030	15	3.3	0.00147%	0.00091%	Health	Health
Acrolein	1.13E-04	0.037	0.0042	3.2	0.15	1.16%	2.80%	Health	Health
Acetaldehyde	2.25E-04	0.074	0.0084	90	45	0.08%	0.02%	Odor	Health

ug/m3 = micrograms per cubic meter

(1) The latest update of the list of Effects Screening Levels (ESLs) currently used by the Texas Commission on Environmental Quality Toxicology Division for air permiting. This update replaces the list released on July 29, 2011. ESLs, expressed in terms of micrograms per cubic meter (ug/m3) in air, are used to evaluate potential for effects to occur as a result of exposure to concentrations of constituents in the air. ESLs are based on data concerning health effects, odor/nuisance potential, and effects on vegetation. They are not ambient air standards. If predicted or measured airborne levels of a constituent do not exceed the screening level, adverse health or welfare would not be expected to result. If ambient levels of constituents in air exceed the screening level, it does not necessarily indicate a problem, but a more in-depth review is conducted.

Attachment C

Paul D. Wade

Education:

B.S. Mechanical Engineering, University of New Mexico, Albuquerque, NM, December 1992.

B.S. Industrial Arts Education, Northern Arizona University, Flagstaff, AZ, May 1983.

A.A. Automotive Technology, Pima Community College, Tucson, AZ, May 1976.

Registrations and Certifications:

E.I.T, State of New Mexico, 1992
Method 9 Visible Emissions Evaluator Certification, October 31, 2013
MSHA Part 42 Certification, Current

Professional Affiliations:

Air and Waste Management Association

Employment History:

Project Engineer, Class One Technical Services, Inc., Albuquerque, NM 1994 – present

Responsibilities include providing consultation for support of new NRS and Title V permits, modification of existing NSR permits, relocation support, compliance assessment, and facility site selection.

Other duties include preparing emission inventories and permit applications for surface coal mining operations, mineral processing facilities, coal and gas fired electrical generation stations, electronic manufacturing facilities, and other industries.

Experience and Expertise:

I have over 20 years experience in air quality technical, regulatory and compliance issues. I have been responsible for numerous air quality permitting projects and air dispersion modeling analyses for facilities ranging from small sand and gravel operations to large coal-fired power plant complexes. These permitting activities include preparing applications for local and state air

quality construction permits, preparing applications for Title V Operating Permits, and major NSR (PSD) permit applications.

Permit applications and dispersion modeling studies I prepared have been submitted to and accepted by various state, local and federal agencies. I have developed complete permit applications for at least 50 industrial facilities. I have performed at least 75 air dispersion modeling analyses using regulatory approved models such as SCREEN, CTDM, ISCST3, PRIME, and AERMOD.

I have participated in several joint New Mexico Environment Department and industry workgroups on regulatory issues and compliance solutions. I have preformed at least 20 initial compliance tests using EPA's Method 9 "Visual Determination of Opacity".