Section III: Other Technologies

Basic Equipment or Process: Boiler
Application No. 259724

1. Basic Equipment	
1a. Manufacturer: Cleaver Brooks	1b. Type: Fire Tube Type
1c. Model: CB700	1d. Style: Unknown
1e. Function This boiler is one of three-packaged boilers located at Alta Dena Dairy facility in California, and is used to produce steam.	1f. Applicable AQMD Regulation XI Rules Rule 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generations, and Process Heaters
1g. Cost Unknown Source of Cost Data:	
2. Basic Equipment Rating/Size – Combustion Equipment	
2a. Design Rated Capacity 16.70	2b. Maximum Rated Capacity 16.70
2c. Burner Information Number: 1 Type: Low NOX with FGR	2d. Fuel Type Natural Gas
2e. Supplemental Fuel: None	2f. Operating Condition
3. Company Information	
3a. Name: Alta Dena Dairy	3b. Address: 17637 E. Valley Blvd. City of Industry, CA 91747
3c. Contact Person: Ed Goren	3d. Phone No.: (626) 854-4202
4. Permit Information	
4a. Agency South Coast AQMD	4b. Agency Contact Person Arturo Arreola
4c. Phone No: (909) 396-2534	4d. Permit to Construct Information P/C No.: 259724 Issuance Date: 2/5/92
4e. Start-Up Date: 12/1996	4f. Permit to Operate Information

	P/O No.: Pending Issuance Date:

5. Emission Information

5a. Permit Limit	**5a2.** BACT/LAER Determination
5a1. Permit Limit NOX: 40 ppmvd @ 3% O2 CO: 400 ppmvd @ 3% O2	The BACT/LAER for NOx and CO emissions from this boiler are shown in Item (5a1).

5b. Control Technology

5b1. Manufacturer/Supplier

Cannon Technology, Inc.
PO Box 1
New Kensington, PA 15068
(724) 335-8541

5b2. Description: Name of Control(s): Low Temperature Oxidation System (LTO)

The LTO system utilizes ozone to oxidize and control various pollutants, including NOx. The LTO system process includes (1) the recovery of waste heat from the flue gas, (2) the oxidation of NOx and CO, (3) the absorption of higher nitrogen and sulfur oxides formed in a scrubber solution, and (4) removal of ozone slip.

NOx in the flue gas is oxidized by ozone to form nitrogen pentoxide (Eq. 1, 2, and 3). The nitrogen pentoxide forms nitric acid vapor as it contacts the water vapor in the flue gas (Eq. 4). Then the nitric acid vapor is absorbed as dilute nitric acid and is neutralized by the sodium hydroxide in the scrubbing solution forming sodium nitrate (Eq. 5). Ozone slip is removed by scrubbing with sodium sulfite (Eq. 6).

$NO + O_3 \Rightarrow NO_2 + O_2$ (Eq. 1)
$NO_2 + O_3 \Rightarrow NO_3 + O_2$ (Eq. 2)
$NO_3 + NO_2 \Rightarrow N_2O_5$ (Eq. 3)
$N_2O_5 + H_2O \Rightarrow 2HNO_3$ (Eq. 4)
$HNO_3 + NaOH \Rightarrow NaNO_3 + H_2O$ (Eq. 5)
$NaSO_3 + O_3 \Rightarrow NaSO_4 + O_2$ (Eq. 6)

5b3. Control Equipment Permit Application Data	**5b4.** Waste Air Flow to Control Equipment
P/C No .: Not Applicable P/C Issuance Date: P/O No.: Not Applicable P/O Issuance Date: **5b5.** Warranty Cannon Technology guarantees that NOX and CO concentrations from the exhaust of the LTO	Flow Rate: Unknown Inlet Blower: Unknown **5b6.** Primary Pollutant The LTO is used to reduce NOX emissions from the boiler.

system will not exceed 4 ppmv and 50 ppmv, respectively. The LTO system is also guaranteed for 2 years. Cannon Technology supplied this information.

5b7. Secondary Pollutant

Since LTO uses ozone injection, it has a potential for ozone slip. Testing indicates insignificant ozone slip when the controlled NOx concentration is between 4 and 5 ppmvd at 3% O2.

5b9. Limitations

Due to the unstable equilibrium of ozone, the self-decomposition of ozone in the system would be accelerated by high flue gas temperature. The following operating conditions are required for effective oxidation:

1) frequent calibration of analytical instruments, as required,
2) flue gas temperature of 300ºF or below at ozone injection,
3) minimum retention time of 1.5 seconds after ozone injection, and
4) the readiness of ozone generator prior to boiler start-up.

5b11. Operating History

Operating since 1997

5b13. Source Test Conditions/Performance Data

The performance test results shown in Item (5b12) were measured at three steady state loads: 4.1 MMBtu/hr, 8.8 MMBtu/hr, and 13 MMBtu/hr. These data represent the highest 15-minute average NOX and CO concentrations among the three loads tested. The 15-minute averages were obtained from 1-minute samples of testing over a total period of 1-hour.

5b8. Space Requirement

80 sq. ft Platform & 100 sq. ft platform for oxygen tank

5b10. Location of Prior Demonstration & Agency
Facility: Not Applicable Contact Person: Not Applicable Phone Number: Not Applicable Agency: Not Applicable

Address: Not Applicable Permit Number: Not Applicable Contact Person: Not Applicable

5b12. Source Test/Performance Data Analysis

2/13/98

NOx <1.0 ppmv dry,3% O2
CO <5.7 ppmv dry @3% O2

10/22/97

NOx <3.3 ppmv dry @3% O2
CO <3.3 ppmv dry @3% O2

4/4/97

NOx <3.2 ppmv dry @3% O2
CO <8.1 ppmv dry @3% O2

5c. Cost

5c1. Control Equipment Cost

Capital: Unknown

5c2. Annual Operational/Maintenance Cost

Unknown

Source of Cost Data:

Installation: Unkown Capital + Installation: $360,000 - $400,000. Source of Cost Data:	
5d. Demonstration of Compliance **5d1.** Date of Field Evaluation 2/13/98 **5d3.** Compliance Demonstration NOx < 1 ppmvd @3% O2 CO < 5.7 ppmvd @3% O2 **5d5.** No. of Violations None	**5d2.** AQMD Staff Performing Field Evaluation Engineer's Name: Glenn Kasai , Hoshik Yoo Inspector's Name: **5d4.** Variance No. of Variances: 0 Causes: **5d6.** Frequency of Maintenance Unknown

6. Comment
The Cannon Technology LTO System is a promising NOx reduction technology for many types of NOx-emitting sources. Although the system operated automatically for over 4 1/2 months at the user's operating capacity, the data available on the equipment has not yet met the achieved-in-practice criteria of 6 months of continuous operation at a minimum of 50% of operating capacity.