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AP-42 Section Reference 12.2
Report Sect. Reference 4 164

# ERIE COKE CORPORATION

# ERIE, PENNSYLVANIA

## Report on

# MEASUREMENT OF PARTICULATE MATTER EMISSIONS FROM A COKE QUENCH CAR SCRUBBER EXHAUST DUCT COMPLIANCE DEMONSTRATION - AUGUST 7 & 8, 1996

## SEPTEMBER 1996

ATS ADVANCED TECHNOLOGY SYSTEMS, INC.

[redacted]

# Measurement of Particulate Matter Emissions from a Coke Quench Car Scrubber Exhaust Duct - Compliance Demonstration - August 7 & 8, 1996

September 1996

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# 1.0 INTRODUCTION

## 1.1 Summary of Test Program

On August 7 and 8, 1996, a compliance air emissions test program was conducted to measure particulate matter emissions from the pushing emissions control system for the coke batteries operated at the Erie Coke Corporation facility located in Erie, Pennsylvania. The test program was conducted to satisfy Pennsylvania Department of Environmental Protection (PA DEP) requirements.

The coke battery pushing emissions control system includes a suction hood which is stationed above the coke hot car during the push and a scrubber which removes particulate matter from the gas stream prior to discharge to the atmosphere. Air emissions from the scrubber are exhausted through a single rectangular duct. Concentrations and emission rates of particulate matter in the exhaust gas stream were measured for the duration (two minutes) of 12 consecutive pushes on each of the two test days. Testing was performed only during periods of normal maximum plant operation. Advanced Technology Systems, Inc. (ATS) was contracted by Erie Coke Corporation (host site) to conduct this particular air emissions test program.

## 1.2 Key Personnel

The key personnel who coordinated the test program and their telephone numbers are listed below:

| Name | Affiliation and Assignment | Telephone Number |
|---|---|---|
| William J. Wetzel | Erie Coke Corporation<br>Erie, Pennsylvania<br>Plant Manager | 814-454-0177 |
| John P. Shimshock | Advanced Technology Systems, Inc.<br>Monroeville, Pennsylvania<br>Senior Project Scientist | 412-829-2208 |

## 2.0 PROCESS DESCRIPTION AND EXHAUST GAS SAMPLING LOCATION

A schematic of the coke battery pushing emissions control system can be found in Figure 1. During a push, coke battery emissions are controlled with a suction hood which is stationed above the coke hot car during the push. The emissions are routed to a scrubber which removes particulate matter from the gas stream prior to discharge to the atmosphere. Cleaned gas from the scrubber is exhausted through a horizontally-aligned rectangular duct with dimensions of 48 inches (depth) by 23 inches (height). Three vertically-aligned test ports are installed on the duct. The test ports are located 15 feet downstream of the nearest duct disturbance (5.8 duct diameters) and 9 feet from the exhaust point (3.5 duct diameters). A schematic of the duct and traverse points can also be found in Figure 1. For particulate traverses, twelve traverse points (four per test port) were located in accordance with EPA Reference Method 1..

# 3.0 SUMMARY AND DISCUSSION OF TEST RESULTS

## 3.1 Objective

The purpose of this particular emissions testing program was to satisfy PA DEP requirements. The specific objective for the test program was to measure, in duplicate, particulate matter emissions from the coke quench car scrubber exhaust duct.

## 3.2 Field Test Changes and Problems

There were no deviations from standard EPA Reference Methods for emissions testing. The test program was also conducted in accordance with the requirements of the PA DEP Source Testing Manual (Revision No. 2, June 1995) with the following exception:

> At Erie Coke Corporation, normal maximum plant operation includes approximately twelve pushes per eight-hour shift. As such, the PA DEP requirement of sampling 50 cubic feet of exhaust gas per test run was replaced with the requirement of sampling the emissions from twelve pushes per test run. The emissions from each push were sampled for two minutes, resulting in a total sample test duration of 24 minutes per test run.

There were no analytical problems or plant operational problems encountered during the test program.

## 3.3 Presentation of Results

The test results have been summarized in Table 1. Particulate matter concentrations and emission rates are listed in units of grains per dry standard cubic foot (gr/dscf) and pounds per hour (lb/hr), respectively. The average particulate matter concentration and emissions rate was 0.0303 gr/dscf and 0.59 lb/hr, respectively.

As promulgated in Pennsylvania Air Pollution Control Regulations, Section 123.13, the emissions can not exceed 0.02 gr/dscf or the mass emissions rate calculated from the following formula, whichever is greater:

$$A = 0.76\,E^{0.42}$$

where A = Allowable Emissions (lb/hr)

E = Emissions Index = F x W

F = Process Factor (pounds per unit)

W = Production or Charging Rate (units per hour)

For this test effort, the parameter F is equal to 1 lb/ton coke pushed, and the parameter W is equal 12.55 ton coke/push. Substituting the appropriate values into the formula listed above yields an allowable particulate matter emission rate of 2.20 lb/hr. The average particulate matter emissions rate measured in this test program (0.59 lb/hr) is less than PA DEP allowable emission rate (2.20 lb/hr).

Table 1 also lists other pertinent stack and sampling parameters which include stack gas flow rate in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm), stack gas temperature ($^{o}$F), and moisture content of the stack gas (percent by volume), gas volume sampled for each test in units of dry standard cubic feet (dscf) and the isokinetics value for each test. The isokinetics value is equal to the ratio of the average linear gas velocity sampled through the probe nozzle to the average stack gas velocity. An isokinetics value between 90 percent and 110 percent is considered acceptable. All isokinetics values were within the acceptable range of values. Actual test sampling times have also been included in Table 1.

Copies of the plant operational data for the test program, the field data sheets and equipment calibration data can be found in Appendix A. The gravimetric results and emissions calculations for each stack test can be found in Appendix B.

## 4.0 SAMPLING AND ANALYTICAL PROCEDURES

The execution of the emissions test program required the use of several test procedures approved by U.S. EPA and PA DEP. This section outlines the stack sampling and analytical procedures utilized.

### 4.1 Location of Traverse Points

As outlined in Section 2.0, the scrubber exhaust gas flows through a horizontally-aligned rectangular duct with dimensions of 48 inches (depth) by 23 inches (height). For particulate traverses, twelve traverse points (four per test port) were located in accordance with EPA Reference Method 1.

### 4.2 Gas Stream Velocity and Volumetric Flow Rate

Gas velocities and volumetric flow rates of the exhaust gas stream were measured using a calibrated S type pitot tube in accordance with EPA Reference Method 2. Gas velocity differential pressures were recorded at each traverse point. Static pressure of the exhaust gas stream was measured with the same pitot tube. Exhaust gas temperatures were measured with a type K thermocouple.

### 4.3 Dry Gas Molecular Weight

Dry gas molecular weight of the exhaust gas stream (concentrations of carbon dioxide, oxygen, and nitrogen by difference) were measured with the use of Fyrite apparatus in accordance with EPA Reference Method 3.

### 4.4 Moisture Content

Percent moisture content, by volume, of the exhaust gas stream was measured by the weight gain of the impingers used in an EPA Reference Method 5 sampling train. Moisture content was calculated

from the knowledge of the weight gain of the four sample train impingers and dry gas volume sampled.

### 4.5 Particulate Matter

Particulate matter sampling was performed in accordance with EPA Reference Method 5 and PA DEP Reference Method 5. Exhaust gas samples were withdrawn isokinetically from the stack, with particulate emissions collected in a nozzle, a heated glass-lined probe, and on a heated glass fiber filter. A gas sample volume greater than 15 dry standard cubic feet was collected during each of the 24-miaute test runs.

Clean up of the sampling trains included an acetone rinse of front-half sample train components (nozzle, probe liner and top half of filter holder). The rinse was saved in a separate bottle (identified as Bottle No. 1). The particulate filter was removed from the holder and placed in a petri dish. Following the gravimetric analysis of the impingers for moisture gain, the contents of the first three impingers were collected in a separate bottle (identified as Bottle No. 2). The empty impingers, bottom half of the filter holder and connecting glassware were then rinsed with distilled deionized water; these washes were added to Bottle No. 2.

The contents of Bottle No. 1 (front-half acetone rinse) was evaporated to dryness, desiccated and weighed to a constant weight. The particulate filter was desiccated and weighed to a constant weight. The contents of Bottle No. 2 (back-half water rinse) were filtered under suction through a preweighed 0.22 micrometer membrane filter to measure water-insoluble materials. The filter used to capture the insoluble material was dried, desiccated and weighed to a constant weight. The filtrate was discarded. The total particulate catch was the sum of the front-half sample train acetone rinse residue (corrected for blank), the particulate filter catch plus the back-half sample train water-insoluble materials catch.

# 5.0 INTERNAL QA/QC ACTIVITIES

## 5.1 QA/QC Problems

There were no QA/QC problems associated with either the test equipment calibrations or the analytical laboratory analyses.

## 5.2 QA Audits

No on-site or analytical laboratory audits were conducted.

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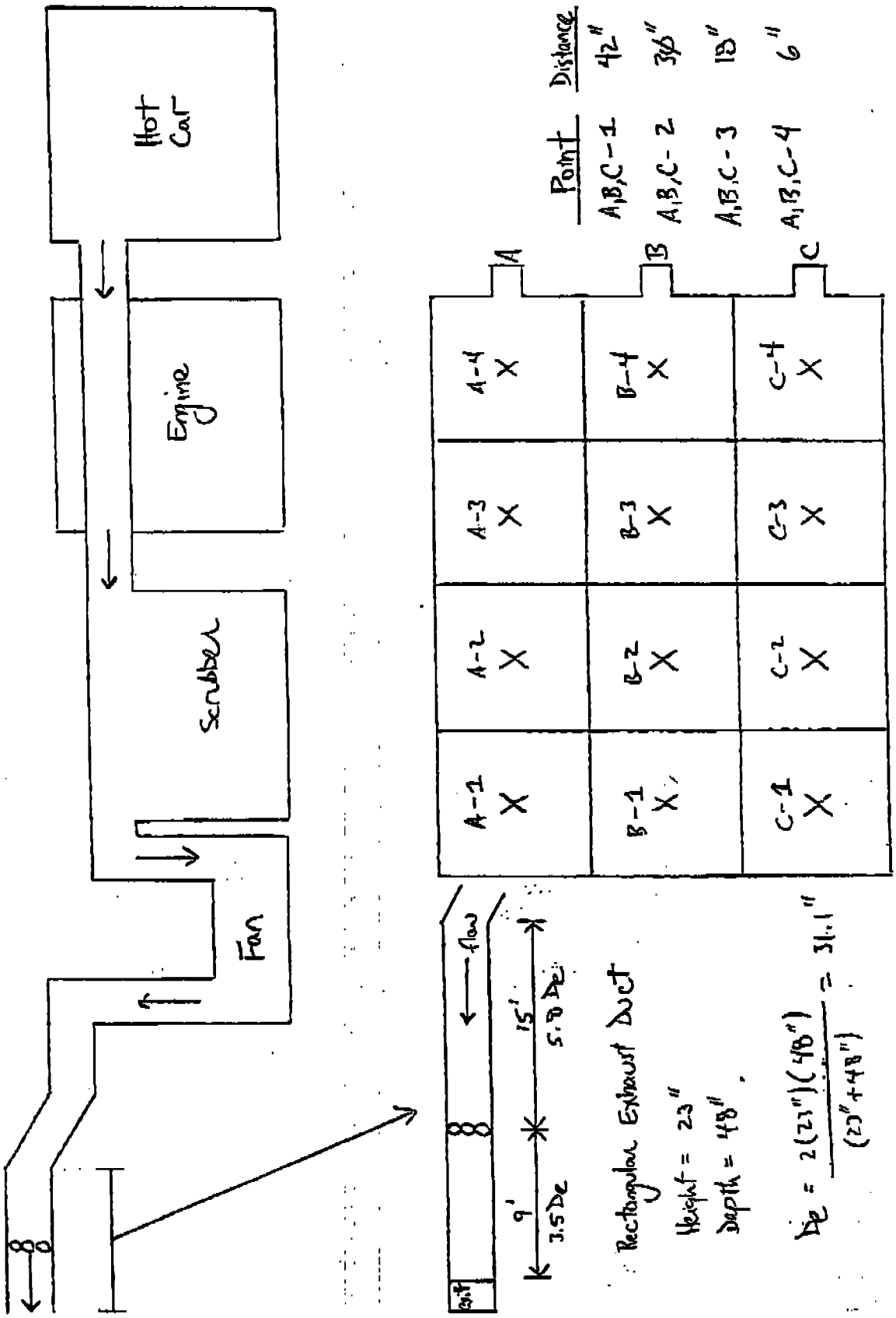
# ERIE COKE CORPORATION - ERIE, PENNSYLVANIA
## FIGURE 1
## SCHEMATIC OF THE COKE BATTERY PUSHING EMISSIONS CONTROL SYSTEM



# ERIE COKE CORPORATION
# ERIE, PENNSYLVANIA

## TABLE 1

## COKE QUENCH CAR - SCRUBBER EXHAUST DUCT
## PARTICULATE MATTER EMISSIONS DATA

| | | Run 1 | | Average |
|---|---|---|---|---|
| Test Number | | EC-QC-1 | EC-QC-2 | |
| Test Date | | 08-07-96 | 08-08-96 | |
| Coke Production Rate | (# ovens/hr) | 2.52 | 2.27 | |
| | (ton coke/oven) | 12.55 | 12.55 | |
| | | 38.3 tons/hr. | 34.5 tons coal/hr. | |
| | | 31.63 tons coke/hr | | |
| Mass Emissions Rate and Concentration | | | | |
| Particulate Matter | (lb/hr) | 0.71 | 0.48 | 0.59 |
| | (gr/dscf) | 0.0356 | 0.0250 | 0.0303 |
| | lb/ton coal | 0.0185 | 0.0139 | 0.0162 |
| Stack Conditions | | | | |
| Flow Rate | (acfm) | 31400 | 33200 | 32300 |
| | (scfm) | 29200 | 31000 | 30100 |
| | (dscfm) | 27800 | 29300 | 28600 |
| Temperature | (°F) | 106 | 103 | 105 |
| Moisture Content | (%) | 5.1 | 5.4 | 5.3 |
| Sampling Conditions | | | | |
| Test times | (EDT) | 1020 to 1506 | 0926 to 1443 | |
| Sampling Time | (minutes) | 24 | 24 | |
| Sample Volume | (dscf) | 15.491 | 16.375 | |
| Isokinetics | (%) | 97.6 | 95.6 | |

(12.55)(2.52)(1.211) = 38.3 tons coal/hr

15.2 tons/oven coal

AP-42 Part.

0.072