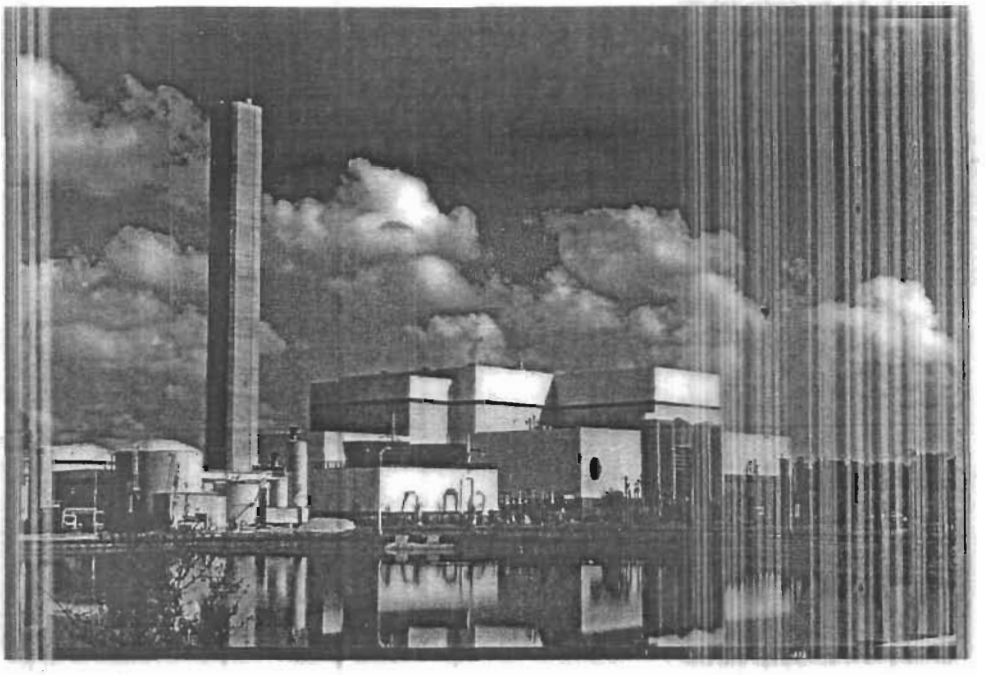
MALCOLM PIRNIE

Environmental Engineers, Scientists & Planners



TITLE V PERMIT APPLICATION PACKAGE

LEE COUNTY RESOURCE RECOVERY FACILITY

FT. MYERS, FLORIDA

1971-015

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

July 3, 1996

Mr. Scott Sheplak
Florida Department of Environmental Protection
Division of Air Resources Management
2600 Blair Stone Road
Mail Station #5500
Tallahassee, Florida 32399-2400

Re: Additional Title V Permit Application Packages
Lee County Resource Recovery Facility, Fort Myers, Florida

Dear Mr. Sheplak:

Please find enclosed, three additional copies of the Title V Permit Application Package for the Lee County Resource Recovery Facility in Fort Myers, Florida. This should complete our Title V submittal requirements. If you should have any questions concerning this submittal please contact me at (704) 547-8550.

Very truly yours,

MALCOLM PIRNIE, INC.

Andy S. Counts
Air Quality Project Engineer

cl
1971-016-400

Enclosures

ASCL73.WPD

8401 UNIVERSITY EXECUTIVE PARK DRIVE SUITE 124 CHARLOTTE, NC 28262-3386 704-547-8550 FAX 704-547-8530

TABLE OF CONTENTS

MALCOLM PIRNIE

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1.0 INTRODUCTION

This application package is submitted in accordance with Title V of the 1990 Clean Air Act Amendments as incorporated in Rule 62-213, F.A.C.

The Lee County Resource Recovery Facility (the Facility) located in Fort Myers, Florida, has the capacity to convert approximately 1,200 tons per day of solid waste into energy. The Facility is self-sufficient and operates on a small portion of the power it generates. The remaining electricity is sold to Florida Power and Light Company to power area homes and businesses.

The Facility consists of two, 600 ton per day waterwall furnaces with Martin reverse-reciprocating grates and ash handling system. The air pollution control equipment consists of dry flue gas scrubbers, fabric filter baghouses and mercury and nitrogen abatement systems.

The emissions from the Facility are currently regulated under permit PSD-FL-151. The Facility has the following significant emission sources: Two (2) mass-burn municipal waste combusters, one (1) ash handling system, and one (1) lime silo. The Facility also has the following insignificant emissions sources: ferrous sulfate tank, caustic soda tank, sulfuric acid tank, boiler chemicals, cooling tower chemicals, solvent degreaser, soda ash silo, carbon silo, and truck traffic. Emission calculations can be found in Section 7 of this package.

MALCOLM PIRNIE

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Professional Engineer Certification

1. Professional Engineer Name : Steven Hunter Ramsey

   Registration Number : 42047

2. Professional Engineer Mailing Address :

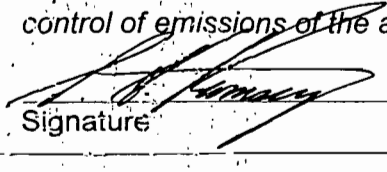
   Organization/Firm : Malcolm Pirnie, Inc.
   Street Address : 445 Hutchinson Ave.
   City : Columbus
   State : OH Zip Code : 43235-5677

3. Professional Engineer Telephone Numbers :

   Telephone : (614)888-4953 Fax : (614)888-6295

4. Professional Engineer Statement :

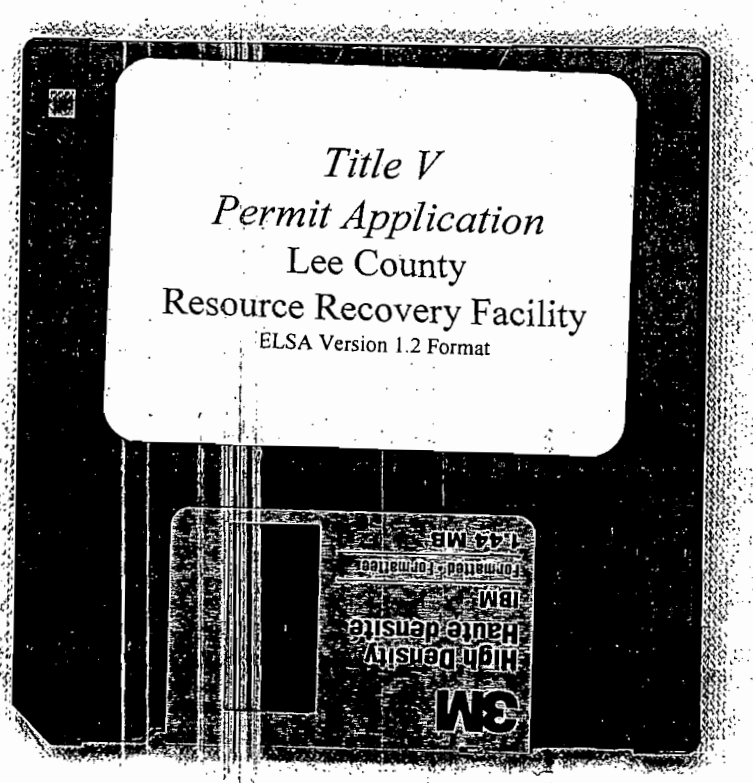
I, the undersigned, hereby certified, except as particularly noted herein, that :*
(1) To the best of my knowledge, there is reasonable assurance (a) that the air pollutant emissions unit(s) and the air pollutant control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions in the Florida Statues and rules of the Department of Environmental Protection; or (b) for any application for a TitleV source air operation permit, that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in the application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application;
(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application; and
(3) For any application for an air construction permit for one or more proposed new or modified emissions units, the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.



Signature

6/24/96
Date

* Attach any exception to certification statement.


Title V
Permit Application
Lee County
Resource Recovery Facility
ELSA Version 1.2 Format
3M
High Density
Haute densite
IBM
1.43 MB

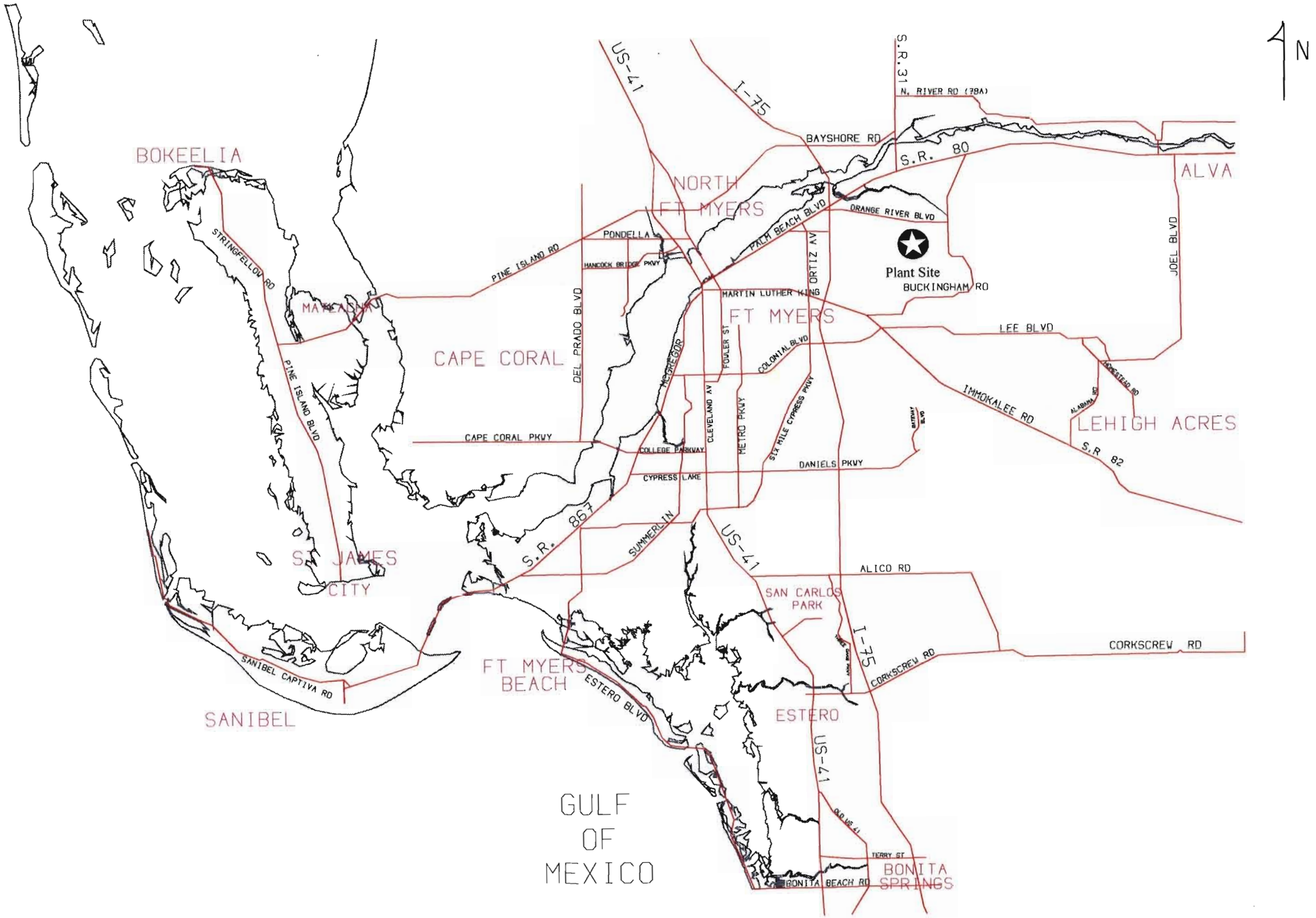
MALCOLM PIRNIE

3

Area Map Showing Facility Location

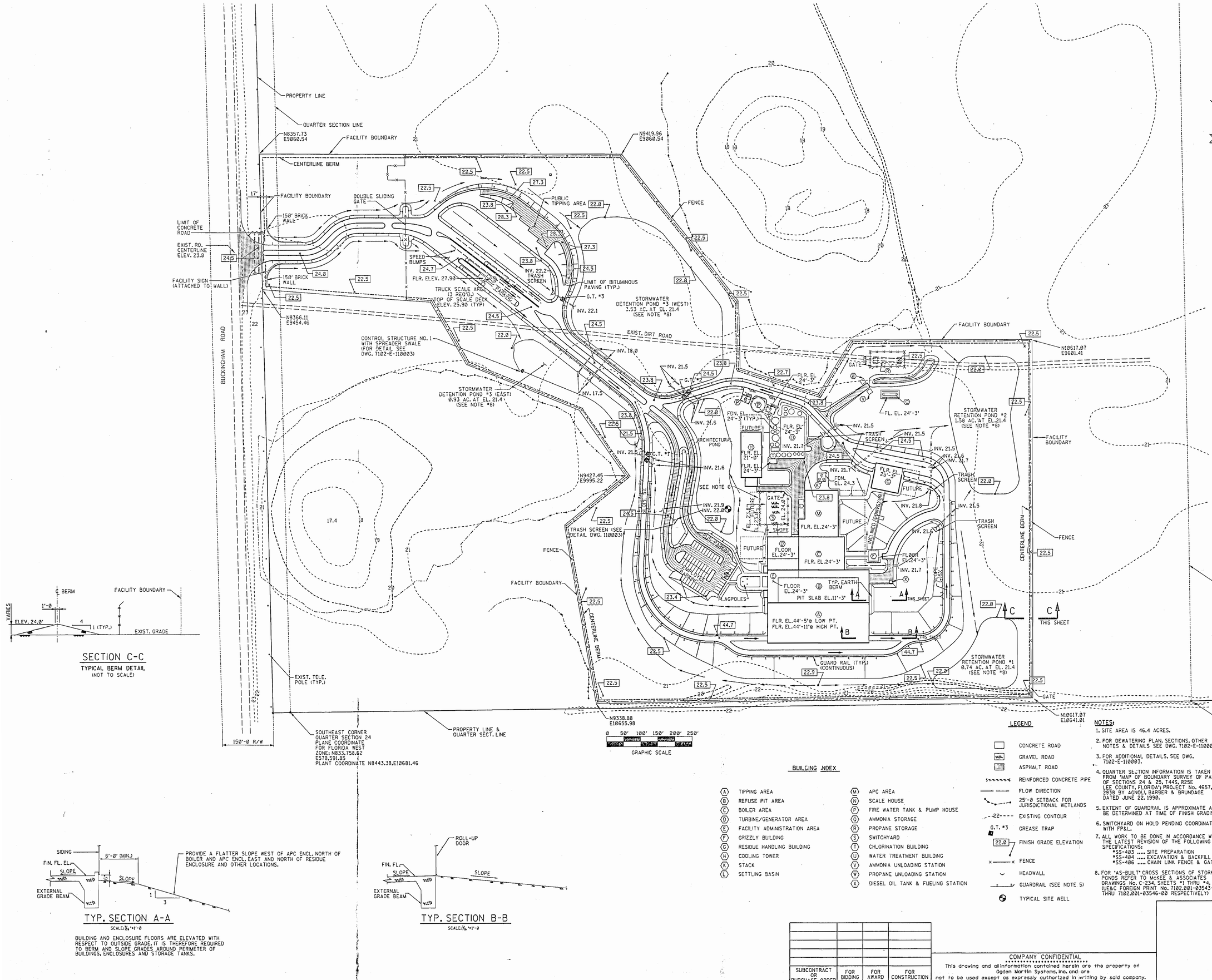
Exhibit

I


N
BOKEELIA
MATLACHA
CAPE CORAL
NORTH FT MYERS
FT MYERS
ALVA
LEHIGH ACRES
SANIBEL
S. JAMES CITY
FT MYERS BEACH
ESTERO
SAN CARLOS PARK
BONITA SPRINGS
GULF OF MEXICO
US-41
I-75
S.R.31
S.R. 80
S.R. 82
S.R. 867
N. RIVER RD (78A)
BAYSHORE RD
ORANGE RIVER BLVD
PALM BEACH BLVD
ORTIZ AV
JOEL BLVD
Plant Site
BUCKINGHAM RD
PONDELLA
HANCOCK BRIDGE PKWY
PINE ISLAND RD
STRINGFELLOW RD
PINE ISLAND BLVD
DEL PRADO BLVD
MARTIN LUTHER KING
FOWLER ST
COLONIAL BLVD
LEE BLVD
IMMOKALEE RD
ALABAMA RD
HOMESTEAD RD
CAPE CORAL PKWY
COLLEGE PARKWAY
CLEVELAND AV
METRO PKWY
SIX MILE CYPRESS PKWY
DANIELS PKWY
CYPRESS LAKE
SUMMERLIN
ALICO RD
CORKSCREW RD
ESTERO BLVD
OLD US 41
TERRY ST
BONITA BEACH RD
SANIBEL CAPTIVA RD

Facility Plot Plan

Exhibit 2



SECTION C-C
TYPICAL BERM DETAIL
(NOT TO SCALE)

PROVIDE A FLATTER SLOPE WEST OF APC ENCL. NORTH OF BOILER & APC ENCL. EAST AND NORTH OF RESIDUE ENCLOSURE AND OTHER LOCATIONS.

TYP. SECTION A-A
SCALE: 1/8"=1'-0

BUILDING AND ENCLOSURE FLOORS ARE ELEVATED WITH RESPECT TO OUTSIDE GRADE. IT IS THEREFORE REQUIRED TO BERM AND SLOPE GRADES AROUND PERIMETER OF BUILDINGS, ENCLOSURES AND STORAGE TANKS.

TYP. SECTION B-B
SCALE: 1/8"=1'-0

BUILDING INDEX

(A)	TIPPING AREA	(M)	APC AREA
(B)	REFUSE PIT AREA	(N)	SCALE HOUSE
(C)	BOILER AREA	(P)	FIRE WATER TANK & PUMP HOUSE
(D)	TURBINE/GENERATOR AREA	(Q)	AMMONIA STORAGE
(E)	FACILITY ADMINISTRATION AREA	(R)	PROPANE STORAGE
(F)	GRIZZLY BUILDING	(S)	SWITCHYARD
(G)	RESIDUE HANDLING BUILDING	(T)	CHLORINATION BUILDING
(H)	COOLING TOWER	(U)	WATER TREATMENT BUILDING
(K)	STACK	(V)	AMMONIA UNLOADING STATION
(L)	SETTLING BASIN	(W)	PROPANE UNLOADING STATION
		(X)	DIESEL OIL TANK & FUELING STATION

LEGEND

- CONCRETE ROAD
- GRAVEL ROAD
- ASPHALT ROAD
- REINFORCED CONCRETE PIPE
- FLOW DIRECTION
- 25'-0 SETBACK FOR JURISDICTIONAL WETLANDS
- -22- EXISTING CONTOUR
- G.T. #3 GREASE TRAP
- 22.0 FINISH GRADE ELEVATION
- FENCE
- HEADWALL
- GUARDRAIL (SEE NOTE 5)
- TYPICAL SITE WELL

NOTES:

1. SITE AREA IS 46.4 ACRES.
2. FOR DEWATERING PLAN, SECTIONS, OTHER NOTES & DETAILS SEE DWG. 7102-E-110001.
3. FOR ADDITIONAL DETAILS, SEE DWG. 7102-E-110003.
4. QUARTER SECTION INFORMATION IS TAKEN FROM "MAP OF BOUNDARY SURVEY OF PART OF SECTIONS 24 & 25, T44S, R25E LEE COUNTY, FLORIDA" PROJECT No. 4657, FILE No. 2838 BY AGNOLI, BARBER & BRUNDAGE DATED JUNE 22, 1990.
5. EXTENT OF GUARDRAIL IS APPROXIMATE AND SHALL BE DETERMINED AT TIME OF FINISH GRADING.
6. SWITCHYARD ON HOLD PENDING COORDINATION WITH FP&L.
7. ALL WORK TO BE DONE IN ACCORDANCE WITH THE LATEST REVISION OF THE FOLLOWING O.M.S.L. SPECIFICATIONS:
   - *SS-403 ..... SITE PREPARATION
   - *SS-404 ..... EXCAVATION & BACKFILL
   - *SS-406 ..... CHAIN LINK FENCE & GATES
8. FOR "AS-BUILT" CROSS SECTIONS OF STORMWATER PONDS REFER TO McKEE & ASSOCIATES DRAWINGS No. C-234, SHEETS *1 THRU *4. (UE&C FOREIGN PRINT No. 7102.001-03543-00 THRU 7102.001-03546-00 RESPECTIVELY)

REVISIONS

A-7/22/92-PRELIMINARY 30% ISSUE FOR INFORMATION ONLY
B-8/7/92-70%-ISSUED FOR OMS REVIEW
0-8/25/92-ISSUED FOR CONSTRUCTION
1-9/11/92-ISSUED FOR PROCUREMENT
2-9/30/92-ISSUED FOR PERMIT
3- 10/14/92 - ISSUED FOR CONSTRUCTION
4- 11/6/92 - REVISED ROAD, BLDG, & INV. ELEVS.
5- 1/15/93- REVISED FACILITY ENTRANCE
6- 3/18/93- REVISED WATER TREATMENT AND SCALE AREAS. ADDED LIMIT OF CONC. ROAD & TRASH SCREEN
7- 4/27/94- REVISED PUBLIC TIPPING AREA & ACCESS ROADWAY WIDTH. REVISED SCALE ELEVS. & ADDED 2nd FIRE WATER PUMPHOUSE. DELETED (2) PARKING SPACES.
8- 6/10/94- REVISED LIMIT OF PAVING @ PUBLIC TIPPING AREA ACCESS ROAD & SHOW FIRE WATER PUMPHOUSES
9 - 8/22/94 - REVISED PER RFI#460 - "RECORD DRAWING"
10 - 2/25/95 - REVISED SIDEWALK @ BUILDING ENTRANCE AND ADDED AS-BUILT DRAINAGE INFO FOR S.F.W.M.D. PERMIT - "RECORD DRAWING"
11 - 4/24/95 - REVISED TO INCORPORATE CLIENT COMMENTS - "RECORD DRAWING"

SUBCONTRACT OR PURCHASE ORDER	FOR BIDDING	FOR AWARD	FOR CONSTRUCTION

United Engineers & Constructors
A Raytheon Company

CIVIL PLOT PLAN

LEE COUNTY SOLID WASTE RESOURCE RECOVERY FACILITY

OGDEN MARTIN SYSTEMS OF LEE, INC.

DRAWN	DATE	DESIGNED	DATE	
EJO	2/25/95	EJO	2/25/95	
CHECKED	DATE	PROJECT NO.		SCALE
		C-1033		1"=100'-0
APPROVED	DATE	DRAWING NO.	SHT.	OF REV.
		7102-E-110000	1	1 11

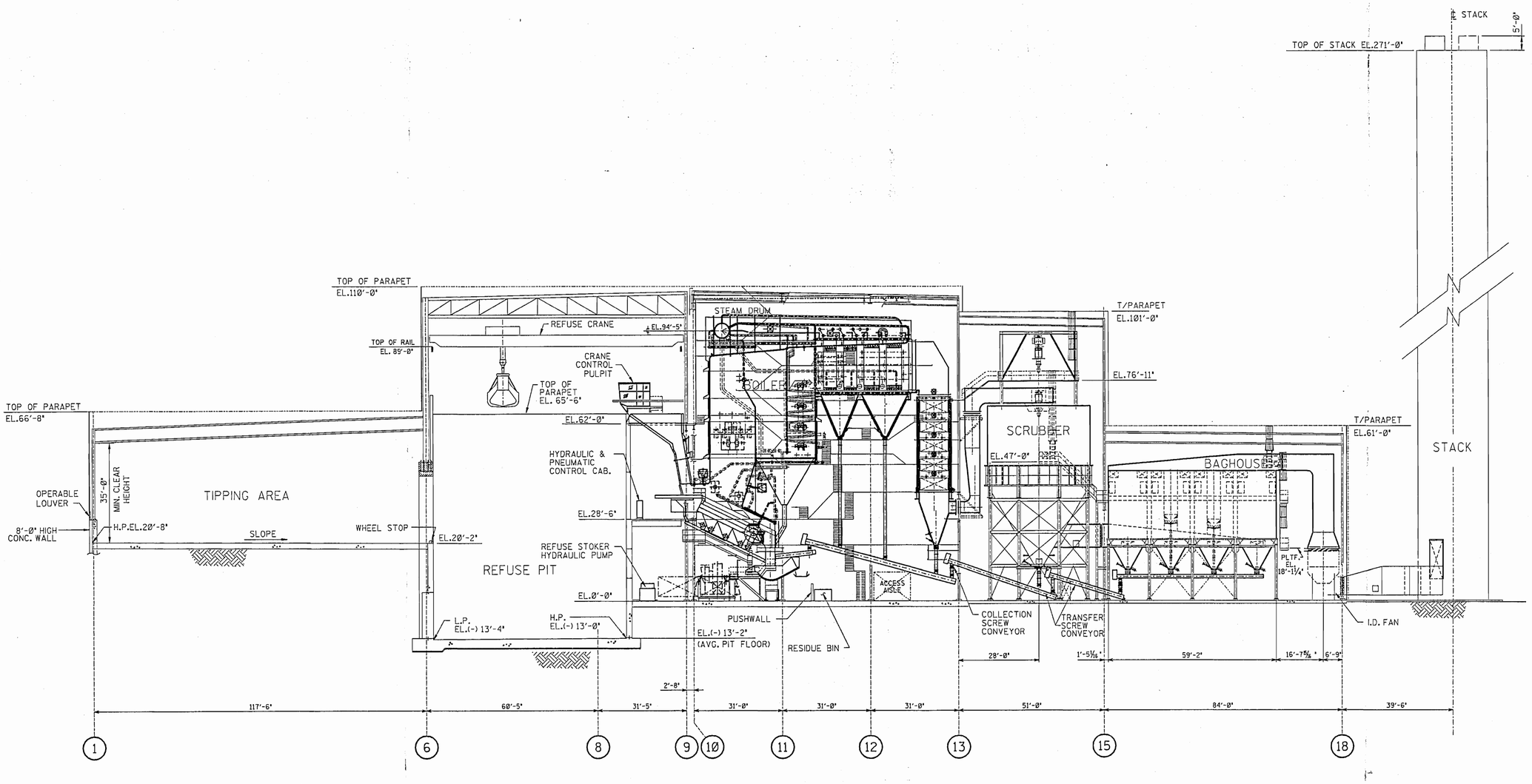
MICROSTATION

Process Flow Diagram

Exhibit 3

REVISIONS
A-09/04/92-PRELIMINARY 30% ISSUE FOR CLIENT REVIEW & COMMENTS.
B-12/04/92-REVISED BOILER AREA, SCRUBBER, BAGHOUSE, I.D. FAN & SCREW CONVEYORS
C-02/08/93-REVISED APC AREA & SCREW CONVEYORS, REFUSE CRANE ELEVATION, 90% ISSUE FOR CLIENT REVIEW & COMMENTS.
0-03/23/93-ISSUE FOR CONSTRUCTION
1-10/20/93-REVISED DIM'S., ACCESS LADDERS TO BAGHOUSE.
2-02/14/95-RECORD DWG.

(2)



SECTION A-A

SUBCONTRACT OR PURCHASE ORDER	FOR BIDDING	FOR AWARD	FOR CONSTRUCTION

United Engineers & Constructors
A Raytheon Company

GENERAL ARRANGEMENT
SECTION A-A
LEE COUNTY SOLID WASTE RESOURCE RECOVERY FACILITY

OGDEN MARTIN SYSTEMS OF LEE, INC.

DRAWN	DATE	DESIGNED	DATE	
D.L.B.	12/04/92			
CHECKED	DATE	PROJECT NO.		SCALE
		C-1033		1/8"=1'-0"
APPROVED	DATE	DRAWING NO.	SHT.	OF REV.
[illegible]	2/14/95	7102-E-210901		2

MICROSTATION

8 7 6 5 4 3 2 1

Precautions to Prevent Emissions of Uncontrolled Particulate Matter

Exhibit 4

PRECAUTIONS TO PREVENT EMISSIONS OF UNCONTROLLED PARTICULATE MATTER

Ogden Martin Systems of Lee (OMSL), Inc. has developed operation and maintenance procedures (see Exhibit 11) for all particulate control devices.

The Facility has installed opacity monitors on each boiler exhaust to monitor compliance with the particulate opacity standard established in PSD-FL-151.

Fugitive Emissions Identification

Exhibit 5

FUGITIVE EMISSIONS IDENTIFICATION

The Facility has no significant sources of fugitive emissions. Fugitive particulate emissions can be caused by truck traffic and the conveying of ash residue. Fugitive particulate emissions from truck traffic are negligible due to paved roads and housekeeping. Fugitive particulate emissions from the conveyance of ash residue are negligible due to the moisture content of the residue.

MALCOLM PIRNIE

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List of Insignificant Activities

Exhibit 6

INSIGNIFICANT ACTIVITIES

The following is a list of proposed insignificant activities and their emission levels. The emissions calculations can be found in Section 7.

Activity	Pollutant	Emissions (tons/yr)
Boiler Chemicals	VOC	1.4
Cooling Tower Chemicals	VOC	0.0
Solvent Degreaser	VOC	0.33
Soda Ash Silo	Particulate	Negligible
Carbon Silo	Particulate	Negligible
Truck Traffic	Particulate	Negligible

These activities are insignificant based on their emission levels.

Enhanced Monitoring Plan

Exhibit 7

ENHANCED MONITORING PLAN

The 40 CFR Part 64 rule as proposed, replaces enhanced monitoring with compliance assurance monitoring (CAM). CAM moves away from the original plans emission monitoring/tracking requirements and focuses on proper maintenance and operation of air pollution control equipment as well as the emission source itself. This rule is yet to be promulgated. However, based on our review of the draft rule, we anticipate no new requirements.

Compliance Report

Exhibit 8

COMPLIANCE REPORT

The Facility underwent annual stack testing October 23, 1995 thru October 30, 1995. The Facility's air emissions were tested for particulate matter, PM-10, opacity, arsenic, beryllium, lead, mercury, sulfuric acid mist, fluorides, nitrogen oxides, hydrogen chloride, dioxin/furans, carbon monoxide, total hydrocarbons, and sulfur dioxide. These results demonstrated that the facility was in compliance with the emissions limits established in Florida permit No. PSD-FL-151. This testing will be conducted on an annual basis.

The Facility also operates and maintains continuous emissions monitors (CEMS) for the following pollutants: carbon monoxide, oxygen, oxides of nitrogen, opacity, and sulfur dioxide. Any exceedances in the permitted limits are reported on a quarterly basis to the FDEP.

Compliance Statement

Exhibit 9

COMPLIANCE STATEMENT

In accordance with specific condition 3-f(v) of PSD-FL-151, quarterly reports of excess emissions will be submitted.

Compliance Certification

I, the undersigned, am the responsible official as defined in Chapter 62-213, F.A.C., of the Title V source for which this report is being submitted. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made and the data contained in this report are true, accurate, and complete.

Name: Larry Johnson
Title: Director, Lee County Department of Solid Waste Management

Signature: _____ Date: _____

MALCOLM PIRNIE

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Process Flow Diagram

Exhibit 10

SEE EXHIBIT 3

Detailed Description of Control Equipment

Exhibit 11

LEE COUNTY RESOURCE RECOVERY FACILITY
DRY SCRUBBER
SYSTEM DESCRIPTION

INDEX

1.0 INTRODUCTION

1.1 PURPOSE

The Dry Scrubber System neutralizes acidic chemical compounds (hydrogen chloride, hydrogen fluoride, sulphur dioxide and mercury vapor) from the exhaust gas of the two refuse-fired boilers. The spray dryer absorber carries out the chemical neutralization. The lime system is used to prepare and supply lime slurry to the spray dryer absorber for use in the chemical neutralization process. The carbon system is used to prepare and supply carbon slurry to the reactor feed tank for mercury abatement.

1.2 SYSTEM OVERVIEW

1.2.1 Lime System

The lime system prepares lime slurry for use in the sulfur dioxide and acid neutralization process in a sufficient quantity and concentration to maintain continuous flue gas treatment in the spray dryer absorber. The system has been designed for batch mixing to provide this service.

Pebble size lime (CaO) is delivered to the plant via self-contained pneumatic truck trailers. The lime is unloaded from the truck trailer to the lime silo, above the lime preparation area. The silo is sized to hold enough lime to maintain several days of system operation of each flue gas cleaning train at the maximum combustion rate of the boilers. Normal operation requires that 9.24 tons of lime per day consumed to maintain air pollution control system operation. The silo can hold 60 tons of lime. Maximum design operation requires 84 tons of lime per week.

The lime silo has one conical discharge. Lime is discharged through a bifurcated chute discharging to a slaking train. Two slaking trains are supplied. Normally, only one slaking train, and therefore, one silo discharge, is operational to supply the system. However, both slaking trains may be operated simultaneously during periods of high slurry demand. Knife gates are installed in the chute beneath the lime silo (feed bin) to select whichever slaking train is operational.

The flow of the material from the silo discharge is aided by a bin vibrator. Variable speed screw feeders are then used to meter lime to the slakers in the proportions required for slaking. During normal operation, up to 770

lbs/hr of lime must be metered through one or both of the slakers to maintain the operation of the spray dryer absorbers.

The pebble sized lime flows by gravity from the screw feeders to detention type slakers where it is slaked to a slurry of hydrated lime and water. The slakers mix and slake the lime, using abrasion resistant rotating paddles, and provide a vessel for the slaking reaction to occur. Approximately four pounds of water are required to slake each pound of quicklime.

5.5 to 29.8 gallons per minute of slaked lime slurry, with a solids contend to approximately twenty five percent (25%), flows by gravity from the detention slakers to the slurry grit screens.

Water is sprayed onto the surface of the grit screens at a rate of approximately 3 1/2 GPM to remove grit and large particles of lime that will not pass the #20-mesh screens. Wet grit is discharged from each screen for disposal. Lime slurry passing the grit screen flows by gravity to the lime slurry tank.

A total of approximately 5.4 lbs of water must be mixed with each pound of lime, at the slakers and grit screens, to obtain the required lime slurry feed concentration at the discharge of the slurry tank. The variable feed adjustments of the screw feeder and the manual water control valves at the grit screens and slakers allow water and lime to be combined at a rate that will maintain a batch mode of mixing.

The water sprayed onto the grit screen is mixed with the lime slurry as it passes through the screen before entering the lime slurry storage tank. The rate that water is added to the lime slurry may be varied so that a desired 20% lime solids concentration can be achieved in the slurry tank. An agitator, in the slurry tank, incorporates and mixes the slaked lime slurry to maintained the suspension of lime solids.

Lime feed slurry is pumped from the lime slurry tank at 15 GPM to the slurry head tank. Where the overflow recirculation back to the slurry tank prevents the separation of the water and lime and sustains a liquid head capable of enhancing the turn down capability of the system. The slurry head tank discharges to the reactor feed tank at a normal rate of 4 GPM.

The slurry pump also discharges to the dilution water treatment tank. There a small amount of slurry is added to the tank to raise the pH of the dilution water which comes from the waste water system. The dilution water is then pumped to the reactor penthouse into the dilution head tank. Dilution water is then added to the reactor feed tank at a constant rate of normally 21 GPM.

The reactor feed tank discharges to the atomizer through regulating valve. There the flow is regulated to maintain both reactor temperature of 285°F and the SO_2 at permit levels. The normal flow rate is 30 GPM.

2.1.2 Spray Dry Absorber (SCRUBBER)

Untreated flue gas and reactor lime/carbon slurry combine in the spray dryer absorber, resulting in the neutralization and removal of the acid and mercury components contained in the gas stream. The two streams, lime/carbon slurry and boiler exhaust gas, combine, and result in a dry product and scrubbed gas exiting the absorber chamber. The absorber and its support equipment are designed to maintain the reaction between lime/carbon slurry and flue gas necessary for SO_2, acid neutralization, carbon abatement and for moisture evaporation. The result of maintaining this balance between slurry and gas is the desired absorber exit flue gas conditions.

Slurry flow to each spray dryer absorber head tank is metered by a flow control valve to obtain the proper feed concentration to the spray dryer absorber atomizer. Automatic adjustment to the flow is made as a function of the output from an SO_2 analyzer monitoring the gas discharge from the scrubber. The quantity of slurry metered to the head tank is proportional to the concentration of SO_2 monitored.

The reactor tank liquid level is held constant by adding dilution water through a automatic make-up float valve. The amount of water required to maintain the tank level varies with the amount of slurry metered to the reactor tank from the slurry head tank and the outlet temperature of the spray dryer absorber. A large quantity of slurry metered to the reactor tank will require less dilution water to maintain the tank level. A smaller amount of slurry requires more dilution water.

Feed slurry from the reactor tank flows by gravity through the atomizer feed pipe. The flow of slurry from the head

tank is metered by a flow control valve. The flow through the control valve is increased or decreased based on the temperature of the flue gas exiting the spray dryer absorber. A feedback signal from the atomizer power transmitter verifies that slurry flow to the atomizer increases or decreases in proportion to the spray dryer absorber outlet temperature. The reactor tank level maintains a constant liquid head to improve the turn down capability of the flow control valve.

The slurry passes through a stationary swirl-type liquid distributor into the atomizer wheel where induced centrifugal force, from the rapidly spinning wheel, discharges the slurry through the wheel nozzles at high velocity. The design of the atomizer wheel, its rate of spin, and the discharge velocity of the slurry creates a cloud of finely divided droplets around the periphery of the atomizer wheel.

Flue gas enters from the top of the spray dryer absorber through a cyclonic roof gas dispenser. The dispenser directs the flue gas into the zone filled by the atomized slurry cloud where violent mixing occurs. Most of the chemical absorption occurs in this zone.

The temperature differential across a spray dryer absorber is termed "spraydown". At a constant gas rate, a large slurry flow rate to the atomizer, will produce a large spraydown. The temperature across each spray dryer absorber in the air pollution control system drops from approximately 425°F at the absorber inlet to 285°F at the absorber outlet. The absorber spraydown would be 140°F under normal operation at the incinerator maximum combustion rate.

The absorption efficiency and the amount of lime used in the absorption process are a function of the flue gas humidity. The closer the outlet temperature is to the adiabatic saturation temperature (dewpoint), the lower the stoichiometry or lime usage. This means that at lower temperatures the humidity will be greater, absorption efficiency will increase, and lime utilization will be optimized. However, low temperature operation presents the risk of condensation, plugging, and deposit formations. An outlet operating temperature of 285°F at the spray dryer absorber outlet insures safe operation and adequate lime utilization. A lower temperature will improve lime consumption but may also present the risks mention previously.

The spray dryer absorber features a two-point product discharge. A portion of the dried spent chemicals and ash settle to the bottom of the chamber. This material discharged at the base of the powder discharge cone, passes through a hopper and is discharged to the ash handling system. The remainder of the spent chemical and ash, entrained in the flue gas, is carried from the module through the gas outlet in the side of the discharge cone.

2.0 COMPONENTS

2.1 LIME SYSTEM

The lime slurry preparation systems includes a lime storage silo fitted with bin vibrators at the discharge of the silo, a vent system on the silo roof, screw type lime feeders, detention type lime slakers, vibratory screens, grit conveyors, and lime slurry storage tank with appropriate controls and instruments. All lime slurry preparation plant equipment is housed in an enclosure below the lime silo.

2.1.1 Lime Storage Bin

The lime storage bin comprises the top 70' of the height of the lime system enclosure. The bin is a mass flow vessel used for the storage of pebble lime.

The lime storage bin storage has a capacity of 120,000 pounds. A conical bifurcated chute discharge is located at the bottom of a 60 degree conical hopper. The storage bin is constructed of carbon steel. The bin is also equipped with a vacuum/pressure relief valve to relieve excess pressure or vacuum that may occur within the bin. The relief valve is part of the roof-mounted manway access cover.

Pebble lime is delivered to the plant via pneumatic self-unloading truck trailers. The lime is conveyed vertically from grade to the top of the lime storage bin through 4 inch diameter piping.

2.1.2 Lime Bin Vent Filter

Manufacturer: Flex-Kleen
Type: 84-BVDS-16

Conveying air, vented from the lime storage bin during

lime unloading, passes through the lime bin vent filter before exhausting to atmosphere. The lime bin vent filter utilizes a fabric media to remove entrained lime from the vented air.

The bin vent filter is activated only when the silo is being refilled with product. When activated, the filter has an automatic cleaning system which prevents the individual filter bags from becoming choked with an accumulation of dust. Cleaning is accomplished with a short impulse of compressed air.

2.1.3 Lime Bin Activator

The lime storage bin incorporates an electrical bin activator to facilitate the discharge of lime to downstream components of the lime system. The activator is equipped with a mechanically adjustable vibrator motor to adjust the intensity of the vibration at the bin bottom. The vibrator is activated by a timer that allows the bin activator to operate only 10 seconds every three minutes. Should the feeder receiving insufficient flow, this time can be adjusted.

2.1.4 Diverter

A two-way flow diverter has been provided at the discharge of the bin activator. This valve allows flow of pebble lime to only one feeder at a time. The operator must select which system is to run either train A or train B.

The following components are included in both trains.

2.1.5 Rotary Feeder

Manufacturer: CHEMCO

The rotary vane feeder provides a complete seal between the storage silo and the slaker. This eliminates the possibility of flooding which exists with the screw and the belt feeder. This feeder has a feed rate of 25 lbs to 1000 lbs of pebbles lime per hour. This is simply achieved by increasing of decreasing the speed of the feeder.

2.1.6 Lime Slaker

Manufacturer: CHEMCO

Pebble sized lime must be reduced in size and hydrated for

use in the absorption process. Sizing and hydration of the lime occurs in the lime slaker.

The slaker is designed such that after the water to lime ration has been set by the operator, any further changes in the feed rate will not affect the feeder to lime ratio since the feeder control will correct the water feed rate to maintain an 4 - 1 ratio. There are four water sources that are introduced into the slaker. They are as follows: Slaking water; Temperature control water; Torque or consistency control water; Dilution water. All of the above courses of water are accurately measured period to entering the slaker by a rotameter panel. The slacking water is continually controlled by the feeder, thus any change in the feed rate will automatically result in changes in slaking water to maintain the 4 - 1 ratio.

The high quality quicklime will generate exothermic heat to a mean temperature of 175°F F in a range of 170°F to 180°F when added to water at a rate of one part lime to four parts water by weight. Agitator breaker bars through the length of the slaker provide an immediate mixing action and full suspension of the mix to facilitate dispersion and breakdown of lumps.

Over 99% of the water introduced in the slacking chamber is introduced with the slaking and temperature control. The slaking water provides approximately 90% of the required in the slaking process to maintain a 4 - 1 water to lime ratio. The temperature control water produces the 10% balance to maintain the proper temperature control of 170°F.

2.1.7 Slurry Grit Screen

Manufacturer: SWECO

Slaked lime slurry flows by gravity from the slakers to a slurry grit screen located beneath each slaker. The grit screens are oscillating, replaceable, stainless steel wire #20-mesh screens. Slurry, deposited on the grit screens, is washed with water to cleanse the slurry of grit particles. Grit free slurry passes through screen and flows by gravity into the lime slurry tank. Collected grit is carried from each screen by a grit screw to a hopper for disposal.

Each grit screen is sized to handle 30 GPM of lime slurry. The size #20 mesh screens are 30 inches in diameter. Oscillation of the screens is maintained by a 1/2 HP

electric motor.

The vibrating grit screens are controlled using "Hand-Off-Auto" switches on the lime system control panel. When the auto position has been selected, the associate grit screen begins to vibrate, and the grit spray starts automatically, when a slurry tank low level indication activates slaking. Continuous operation of the grit screens and sprays occurs when the selector switch is placed in the "HAND" position. Power to the grit screens is removed and grit spray operation is discontinued when the control switch is placed in the OFF position.

Water flow to the grit sprays is controlled automatically by the dilution water spray set at approximately 3 1/2 GPM or manually via a hand valve in series with a solenoid operated cutoff valve.

2.1.8 Grit Screw

Grit removed from the slaked lime slurry by the slurry grit screens is carried from each screen through a 6-inch diameter screw conveyor. The grit screw extends beyond the exterior of the lime system enclosure. Grit is deposited in collection containers for disposal.

The grit screw utilizes a auger type screw, and is powered by an electric motor.

The grit screw is controlled through a Hand-Off-Auto switch on the lime system control panel.

The grit screw operates automatically whenever the control switch is in the "Auto" position and the slurry tank level detector indicates a low slurry level. With the control switch in the "Hand" position, the grit screw will operate continuously. The "OFF" position of the selector switch de-energizes the grit screw.

The grit screw will continue operation, along with the grit screens and grit sprays, from 0 to 10 minutes after the slurry tank level detector indicates a high level and shuts down the slaking system.

2.1.9 Lime Slurry Storage Tank

Slaked lime is mixed, stored, and kept in suspension within the slurry tank, for use when required by the dryer absorber. The 13'-0" diameter slurry tank includes a

sloped bottom to allow complete drainage, and openings for slaked lime feed, recirculation from the slurry head tank, an agitator, a level probe, an overflow, three slurry outlets, internal baffles, 24" man-way and the tank drain. The slurry tank is constructed of high carbon steel with a capacity of approximately 6,500 gallons.

A level detector senses the slurry level in the tank which sends a signal to the DCS and used for local slaking controls. A double impeller agitator for mixing and suspending the slurry solids is also supplied.

2.1.10 Slurry Tank Mixer

Manufacturer: SEW-Eurodrive
Type: FAF70DT100SC4

The slurry tank mixer is mounted on top of the slurry tank. The shaft of the mixer passes through the top of the slurry tank. A 48" diameter impeller agitates the slurry, blending and maintaining the solids suspended in water.

2.1.11 Slurry Feed Pumps

Manufacturer: Goulds
Type: SC 1.5 X 2.11 II
Capacity: 45 GPM

Three slurry pumps, one operating, one on standby, and one for emergency back-up are used to pump lime slurry to the head tanks located within the spray dryer absorber penthouses.

Each slurry pump is a centrifugal type pump with erosion resistant hi-chrome impeller and scroll liner. The pumps are V-belt driven. Each slurry pump is rated for 45 GPM at 140 ft. total dynamic head.

2.1.12 Dilution Tank

Dilution water is neutralized, stored, and kept in dilution tank within the scrubber area, for use when required by the dryer absorber. The 10' diameter by 10' high tank includes a fill off the wastewater system a recirculation line from the dilution water head tank and a small line from the slurry feed pump discharge. The slurry feed is used to neutralize the acidic nature of the supplied waste water. The tank also includes an agitator,

a level probe, an overflow, three dilution pump outlets, and the tank drain. The dilution water tank is constructed of carbon steel with a capacity of 2000 gallons.

2.1.13 Dilution Feed Pumps

Manufacturer: Goulds
Type: 1 X 1.5 - 6

Three dilution pumps, one operating and one standby and one emergency, are used to pump dilution water to the head tanks located within the spray dryer absorber penthouses.

Each dilution pump is a centrifugal type pump with erosion resistant hi-chrome impeller and scroll liner. Each slurry pump is rated for 75 GPM at 130 ft. total dynamic head.

2.1.14 Instrument and Controls

In addition to local controls the following remote instrumentation/control is provided. Controls are identical for both units where tag numbers (Suffix A denotes control for unit A and B for unit B):

Identification	Function
FY-1916A/B	Lime diverter knife valve air control valve
HS-1916A/B	Lime diverter knife valve control switch
ZSC-1916A/B	Lime diverter knife valve indication closed
ZSO-1916A/B	Lime diverter knife valve indication opened
HS-1930A/B	Rotary feeder on/off/auto switch
LSHH-1917	Lime bin level switch high high
LAHH-1917	Lime bin level alarm high high
LSH-1917	Lime bin level switch high

LAH-1917	Lime bin level alarm high
LSL-1917	Lime bin level switch low
LAL-1917	Lime bin level alarm low
PSL-1919	Lime bin filter pulse air pressure transmitter
PAL-1919	lime bin filter pulse air pressure alarm low
FV-1920	Lime bin filter pulse air control valve
HS-1920	Lime bin filter pulse air control switch
PDISH-1920	Lime bin filter pressure differential indication switch high
PDAH-1920	Lime bin filter pressure differential alarm high
PSL-1929A/B	Slaking water inlet pressure switch low
PAL-1929A/B	Slaking water inlet pressure switch alarm low
FV-1925A/B	Slaking water flow valve
HS-1925A/B	Slaking water flow valve control switch
FIC-1925A/B	Slaking water flow valve control flow indication
FV-1927A/B	Torque water flow valve
HS-1927A/B	Torque water flow valve control switch
FIC-1927A/B	Torque water flow valve control flow indication
FV-1928A/B	Cooling water water flow valve

HS-1928A/B	Cooling water flow valve control switch
FIC-1928A/B	Cooling water flow valve control from indication
FV-1929A/B	Dilution water water flow valve
HS-1929A/B	Dilution water flow valve control flow indication
FIC-1929A/B	Dilution water flow valve control switch
HS-1932A/B	Slaker vent motor switch
HS-1922A/B	Grit screen conveyor switch
HS-1921A/B	Grit screen switch
HS-1925A/B	Slaker heater switch
TE-1931A/B	Slaker temperature element
TIC-1931A/B	Slaker temperature indication
TAH-1931A/B	Slaker temperature alarm high
HS-1939	Lime slurry storage tank agitator
LIT-1938	Lime slurry storage tank level transmitter
LIR-1938	Lime slurry storage tank level indicator rate transmitter
LAL-1938	Lime slurry storage tank level alarm low
LAH-1938	Lime slurry storage tank level alarm high
LAHH-1938	Lime slurry storage tank level alarm high high
FV-1940A/B	Lime slurry pump inlet control air valve
XSC-1940A/B	Lime slurry pump inlet valve switch

	closed
ZSO-1940A/B	Lime slurry pump inlet valve switch opened
ZIC-1940A/B	Lime slurry pump inlet valve indication closed
ZIO-1940A/B	Lime slurry pump inlet valve indication open
FIC-1940	Lime slurry low control valve to pump by-pass manifold
FV-1941A/B	Lime slurry pump outlet control air valve
ZSC-1941A/B	Lime slurry pump inlet valve outlet switch indication closed
ZSO-1941A/B	Lime slurry pump outlet valve switch indication opened
ZIC-1941A/B	Lime slurry pump outlet valve indication closed
ZIO-1941A/B	Lime slurry pump outlet valve indication open
FV-1935	Lime slurry back-up pump inlet control air valve
ZSC-1935	Lime slurry back-up pump inlet valve switch closed
ZSO-1935	Lime slurry back-up pump inlet valve switch open
ZIC-1935	Lime slurry back-up pump inlet valve indication closed
ZIO-1935	Lime slurry back-up pump inlet valve indication open
FIC-1935	Lime slurry flow control valve to pump by-pass manifold
FV-1937A/B	Lime slurry back-up pump outlet control air to reactor #2

ZSC-1937A/B	Lime slurry back-up pump inlet valve outlet switch closed to reactor #2
ZSO-1937A/B	Lime slurry back-up pump outlet valve to reactor #2 switch open
ZIC-1937A/B	Lime slurry back-up pump outlet valve to reactor #2 indication closed
ZIO-1937A/B	Lime slurry back-up pump outlet valve to reactor #2 indication open
FV-1936A/B	Lime slurry back-up pump outlet control air to reactor #1
ZSC-1936A/B	Lime slurry back-up pump inlet valve outlet switch closed to reactor #1
ZSO-1936A/B	Lime slurry back-up pump outlet valve to reactor #1 switch open
ZIC-1936A/B	Lime slurry back-up pump outlet valve to reactor #1 indication closed
ZIO-1936A/B	Lime slurry back-up pump outlet valve to reactor #1 indication open
FV-1950A/B	Dilution water pump inlet control air valve
ZSC-1950A/B	Dilution water pump inlet valve switch closed
ZSO-1950A/B	Dilution water pump inlet valve switch open
ZIC-1950A/B	Dilution water pump inlet valve indication closed
ZIO-1950A/B	Dilution water pump inlet valve indication open
FV-1951A/B	Dilution water pump outlet control air valve
ZSC-1951A/B	Dilution water pump inlet valve outlet switch closed

ZSO-1951A/B	Dilution water pump outlet valve switch open
ZIC-1951A/B	Dilution water pump outlet valve indication closed
ZIO-1951A/B	Dilution water pump outlet valve indication open
FV-1952	Dilution water back-up pump inlet control air valve
ZSC-1952	Dilution water back-up pump inlet valve switch closed
ZSO-1952	Dilution water back-up pump inlet valve switch opened
ZIC-1952	Dilution water back-up pump inlet valve indication closed
ZIO-1952	Dilution water back-up pump inlet valve indication open
FIC-1952	Dilution water flow control valve to pump by-pass manifold
FY-1954	Dilution water back-up pump outlet control air
ZSC-1954	Dilution water back-up pump inlet valve outlet switch closed
ZSO-1954	Dilution water back-up pump outlet valve switch open
ZIC-1954	Dilution water back-up pump outlet valve indication closed
ZIO-1937A/B	Dilution water back-up pump outlet valve indication open

2.2 DRY SCRUBBER

The Dry Scrubber consists of a slurry head tank, dilution head tank, reactor feed tank, reactor feed tank agitator, slurry atomizer, spray dryer absorber.

2.2.1 Slurry Head Tank

The slurry head tank, located in the penthouse above the spray dryer absorber chamber, creates a gravity head pressure sufficient to allow proper operation of the reactor feed tank. This tank also stores lime slurry in case of a slurry feed pump malfunction. The tank hold sufficient material to give approximately 1 1/2 minutes of scrubber operation while the slurry feed pump is down.

The head tank is 7" in diameter by 10' in height. The carbon steel tank is equipped with a 1 1/2" slurry inlet, a 1 1/2" slurry outlet to the reactor feed tank, and a 2" overflow. The slurry flow to the reactor feed tank is controlled by a flow control valve from the SO_2 controller. The slurry used is proportional to the flue gas SO_2.

2.2.2 Dilution Head Tank

The head tank, located in the penthouse above the spray dryer absorber chamber, creates a gravity head pressure sufficient to allow proper operation of the reactor feed tank. This tank also stores dilution water in case of a dilution feed pump malfunction. The tank hold sufficient material to give approximately 1 1/2 minutes of scrubber operation while the dilution feed pump is down.

The head tank is 7" in diameter by 10' in height. The carbon steel tank is equipped with a 1 1/2" dilution inlet, a 1 1/2" dilution outlet to the reactor feed tank, and a 2" inch overflow. The outlet flow is controlled by the level in the reactor feed tank.

2.2.3 Reactor Feed Tank

The reactor feed tank, located in the penthouse above the spray dryer absorber chamber, creates a gravity head pressure sufficient to allow proper operation of the atomizer.

The head tank is 24" in diameter by 44" in height. The carbon steel tank is equipped with a 1 1/2" slurry inlet, a 1 1/2" dilution water inlet, a 3/8" inlet from the carbon feed system, and a 2" overflow and a 2" feed to the atomizer.

An agitator maintains solids in suspension and provides blending of slurry and water as dictated by process

requirements. A removable 40% open perforated stainless steel grit screen, at the head tank outlet to the atomizer feed line, removes particles in the slurry that might adversely affect atomizer operation.

A flow/SO_2 cascaded controller in the spray dryer absorber control panel adjusts the control valve position based on the flow feed back signal from the magnetic flowmeter. The setpoint for the lime slurry flow to the head tank is generated by the SO_2 controller based on the SO_2 emission as measured by the analyzer at the gas discharge of the baghouse. Make-up water is added to the head tank from the dilution water head tank a level control valve to maintain the required liquid level in the reactor feed tank, and to obtain the desired lime slurry concentration.

An overflow connection returns lime slurry that overflows the head tank to the trench.

2.2.3 Reactor Feed Tank Agitator

The feed tank has a direct drive mixer. All wetted parts are fabricated of 316 stainless steel. The mixer includes a 3/4" x 26" long shaft and one 3 1/2" diameter impeller. The mixer is driven by a 1.0 HP electric motor.

2.2.4 Atomizer

Manufacturer: ABB

Three rotary atomizers, two operating and one spare, are used in the spray dryer absorbers. Each atomizer has its own service stand.

The atomizer is driven by a vertical, flange mounted 75 HP electric motor. The motor shaft is connected via flexible coupling to the atomizer gear box.

Power is transferred through the atomizer gear box by a double helical toothed gear to the atomizer spindle. Turning within special high speed ball bearings, the spindle is supported at its lower extremity by a self-lubricating guide bearing made of antimony impregnated carbon.

An atomizer wheel is fitted to the end of the spindle at the bottom of the atomizer. The atomizer wheel is specially designed to resist the high temperatures and high abrasion associated with its operation in the spray dryer absorber. A wear resistant base plate protects the

lower wheel body from abrasion.

The atomizer wheel is designed to optimize lime slurry feed atomization. The wheel is dynamically balanced to resist the centrifugal forces associated with its high speed operation.

The atomizer oil return oil pump takes suction from the lower sump where it discharges to the oil cooler. The cooled oil then collects in the oil reservoir. The supply oil takes suction from the oil reservoir and discharges to the gear box cooling oil supply and the flex shaft oil supply. The atomizer's internal oil supply pump distributes the oil through a filter to the internal bearings and wheel. The internal oil pump also supplies oil to an external oil pressure transducers. These transducers will shut down the atomizers upon low lube oil pressure.

The oil sump is located in the lower part of the atomizer. Also included, in the lower portion of the atomizer, are the spindle, spindle bearing supports, the feed pipe bracket, and the conical skirt.

Atomizer power cable connections are made through a combination plug/receptacle.

2.2.4 Spray Dryer Absorber Module

The spray dryer absorber modules are mixing chambers for the process exhaust gas and the atomized lime slurry. Each module includes an inlet gas dispenser, a mixing chamber for the slurry and flue gas, a penthouse, and a powder discharge cone.

Untreated flue gas enters the spray dryer absorber module through the inlet gas dispenser. The gas dispenser is a cyclonic inlet on the roof of the spray dryer absorber chamber. Gas exits the dispenser and spirals downward through vanes located between the upper segment of the atomizer support cone and the spray dryer absorber chamber roof. As the gas enters the spray dryer absorber chamber, it comes in contact with the atomized slurry sprayed from the atomizer wheel.

The atomizer is supported from an inverted cone-shaped structure, formed by upper and lower dispenser cone segments, extending into the absorber chamber from the spray dryer absorber chamber roof. The atomizer wheel extends into the absorber module through the lowermost

portion of the support cone. The location of the atomizer wheel ensures optimum mixing of the atomized cloud of lime slurry with untreated flue gas entering the chamber from the gas dispenser.

One atomizer support stand is supplied in each spray dryer absorber penthouse. An additional support stand is supplied for the spare atomizer. The support stand is for storage of the atomizer, when it is removed from the spray dryer absorber during atomizer or absorber chamber maintenance. An electric hoist with a monorail trolley to facilitate service and movement of equipment within the penthouse, and to transport equipment and material between the penthouse and grade.

A powder discharge cone is at the bottom of the spray dryer absorber. This inverted cone-shaped hopper directs spent chemicals and ash, that have settled out of the gas stream, to a discharge point at the base of the cone.

A 24-inch manway is located in the lower cylindrical portion of each spray dryer absorber chamber and at the lower extremity of each powder discharge cone to provide access to the spray dryer absorber chamber interior during maintenance and service.

Treated flue gas exits the spray dryer absorber chamber horizontally trough square discharge opening in the powder discharge cone. Flue gas ducting carries the treated flue gas from the chamber's gas discharge point to the respective baghouse of each air pollution control system.

The outlet duct temperature of each spray dryer absorber is monitored by a thermocouple. A temperature signal is transmitted by a temperature transmitter to the spray dryer absorber control panel where it is recorded on a temperature recorder and used by the temperature controller to control slurry feed to the atomizer. Low and high spray dryer absorber outlet temperature alarms, displayed on the spray dryer control panel, are monitored through the temperature controller using the same temperature signal.

2.2.7 Instrument and Controls

In addition to local controls the following remote instrumentation/control are provided (Suffix A denotes control for unit 1 and B for unit 2, double suffixes denotes multiple location):

Identification	Function
TT-1901AA/AB/AC	Reactor inlet flue gas temperature transmitter
TI-1901AA/AB/AC	Reactor inlet flue gas temperature instrument
TADH/L-1901AA/AB/AC	Reactor inlet flue gas differential temperature alarm high/low
PDT-1901A/B	Reactor flue gas pressure differential transducer
PDAH-1901A/B	Reactor flue gas pressure differential alarm high
PIR-1901A/B	Reactor flue gas pressure differential indication rate
LSH-1901A/B	Reactor hopper level switch high
LAH-1901A/B	Reactor hopper level alarm high
TT-1902A/B	Reactor hopper temperature transmitter
TIR-1902A/B	Reactor hopper temperature indicating recorder
TAL-1902A/B	Reactor hopper temperature alarm low
HS-1903A/B	Reactor hopper heater switch on/off/auto
TT-1904AA/AB/AC	Reactor outlet flue gas temperature transmitter
TI-1904AA/AB/AC	Reactor outlet flue gas temperature instrument

TADH/L-1904AA/AB/AC	Reactor outlet flue gas temperature alarm high/low
TIR-1904A/B	Reactor outlet temperature indication recorder
TAHH-1904A/B	Reactor outlet temperature alarm high high
TAH-1904A/B	Reactor outlet temperature alarm high
TAL-1904A/B	Reactor outlet temperature alarm low
TALL-1904A/B	Reactor outlet temperature alarm low low
YI-1913A/B	Atomizer oil cooler fan motor
TI-1913A/B	Atomizer oil cooler reservoir temperature
TSL-1913A/B	Atomizer oil cooler reservoir temperature switch low
PT-1913A/B	Atomizer oil pressure transducers
PIR-1913A/B	Atomizer oil pressure indication rate
PDIR-1913A/B	Atomizer oil pressure differential indication rate
PDAH-1913A/B	Atomizer supply oil pressure differential alarm
PT-1912A/B	Atomizer supply oil pressure transducers
PIR-1912A/B	Atomizer supply oil pressure indication rate
PAL-1912A/B	Atomizer supply oil pressure alarm low
PALL-1912A/B	Atomizer supply oil pressure alarm low low
VT-1909A/B	Atomizer gear box oil pressure transducers

PIR-1909A/B	Atomizer gear box oil pressure indication rate
PAL-1909A/B	Atomizer gear box oil pressure alarm low
PALL-1909A/B	Atomizer gear box oil pressure alarm low low
PDAH-1909A/B	Atomizer gear box oil differential pressure alarm
PDIR-1909A/B	Atomizer gear box oil differential pressure indication rate
PT-1910A/B	Atomizer gear box oil pressure transducers
PIR-1910A/B	Atomizer gear box oil pressure indication rate
TT-1909A/B	Atomizer gear box oil temperature transducers
TIR-1909A/B	Atomizer gear box oil temperature indication rate
TAH-1909A/B	Atomizer gear box oil temperature alarm high
TAHH-1909A/B	Atomizer gear box oil temperature alarm high high
TAL-1909A/B	Atomizer gear box oil temperature alarm low
TT-1910A/B	Atomizer motor top bearing oil temperature transducers
TIR-1910A/B	Atomizer motor top bearing oil temperature indication rate
TAH-1910A/B	Atomizer motor top bearing oil temperature alarm high
TAHH-1910A/B	Atomizer motor top bearing oil temperature alarm high high
TS-1910A/B	Atomizer motor top bearing

	temperature element
TT-1911A/B	Atomizer motor bottom bearing oil temperature transducers
TIR-1911A/B	Atomizer motor bottom bearing oil temperature indication rate
TAH-1911A/B	Atomizer motor bottom bearing oil temperature alarm high
TAHH-1911A/B	Atomizer motor bottom bearing oil temperature alarm high high
TE-1911A/B	Atomizer motor bottom bearing temperature element
VE-1910A/B	Atomizer vibration switch
VT-1910A/B	Atomizer vibration transmission switch
VAH-1910A/B	Atomizer vibration alarm high
VAHH-1910A/B	Atomizer vibration alarm high high
VIR-1910A/B	Atomizer vibration indication rate
LSH-1960A/B	Reactor feed tank level switch high
LAH-1960A/B	Reactor feed tank level alarm high
LSL-1960A/B	Reactor feed tank level switch low
LAH-1960A/B	Reactor feed tank level alarm low
FE-1960A/B	Reactor feed tank slurry flow level
FT-1960A/B	Reactor feed tank slurry flow totalizer
FIR-1960A/B	Reactor feed tank slurry inlet flow indication rate
FV-1960A/B	Reactor feed tank slurry inlet flow valve
FIC-1960A/B	Reactor feed tank slurry inlet flow control valve
YI-1960AA	Feed tank agitator on

YI-1960AB	Feed tank agitator off
LV-1961A/B	Feed tank level control from dilution water head tank valve.

2.3 CARBON INJECTION SYSTEM

2.3.1 Bag Loading

The bag unloading system is designed to lift and transfer individual 800 pound bags (super sacks) of dry powdered activated carbon and dump them on a routine operating into one of two storage bins. Each bin will have a usable storage capacity of 1800 lbs and will required refilling once a day based on an average use of 50 pounds per hour. Each bin is equipped with a high level switch and remote alarm contact to signal overfill and a low level switch and alarm to signal a low material supply.

2.3.2 Slurry Make-up

The slurry make up system cover the material as it moves between the day bin and the slurry tank. One of the two feed lines (day bin and feeder) is selected to operate and the other is for standby. Then manual shut off gate at the bottom of the selected bin is open allowing material to flow to the feeder where is transferred into the slurry tank at a controlled rate.

The feeder is fixed to handled the average usage rate of 50 lbs/hr, the maximum rate of 75 lbs/hr, and the minimum of 25 lbs/hr. the feeder is started and stopped from the main control station (DCS); feeder speed is locally controlled by the operator through a variable frequency drive. A 4-20ma signal proportional to the feeder speed is sent to the DCS. The feeder also has a locally mounted counter to totalize throughput, and contacts for feeder run fault alarm to remote.

The slurry tank has a working volume of 40 gallons. At the fixed pumping rate of 2 GPM, the tank would have a 20 minute retention time. The slurry tank is equipped with level switches to open/closed the water supply solenoid valve and signal low and high alarms to the DCS.

The slurry tank mixer maintains the slurry in suspension and mix incoming dry material and water together. They are started and stopped from the DCS via a soft key and are run continuously.

2.3.3 Slurry Pumping

Three slurry pumps make up the slurry pumping system one normally operating, one standby for additional capacity, if required, and one off-line standby for pump failure. The pumps are started and stopped from the DCS whenever the entire FGD system is required to run. Each pump is set up for a constant flow rate of 2 GPM. Since the water flow rate into the slurry tank is at a fixed rate, the slurry concentration, the amount of actual carbon in the slurry can be varied by adjusting the speed of the feeder. At the average feed rate of 50 lbs/hour, the concentration of the slurry will be approximately 5%. The pumping rate can be adjusted by changing the speed of the pump; however, this will require adjusting the variable pitch sheaves on the pump drive.

2.3.4 Instrument and Controls

In addition to local controls the following remote instrumentation/control is provided (Suffix A denotes control for unit 1 and B for unit 2):

Identification	Function
PDI-1970	Dust collector high differential pressure alarm
HS-1970	Dust collector on/off switch
LAH-1971A/B	Carbon day bin high level alarm
LAH-1971A/B	Carbon day bin low level alarm
HS-1972A/B	Carbon screw feeder status
SC-1972A/B	Carbon screw feeder fault alarm
LSH-1974	Carbon slurry tank high level switch
LAH-1974	Carbon slurry tank high level alarm
LSL-1974	Carbon slurry tank low level switch
LAL-1974	Carbon slurry tank low level alarm
HS-1975A/B	Carbon slurry pump switch on/off/auto

HS-1976 Carbon slurry back-up pump switch on/off/auto

3.0 OPERATION

3.1 START UP

3.1.1 Verify the following:

a. Slurry tank drain valve is closed.

b. Pebble lime silo has adequate level.

c. Instrumentation and service air is available for service.

d. Grit screen is clean.

e. Grit screw collection bin is in place.

f. Adequate slaking water pressure.

g. Slurry feed pump drain and flush valves are closed.

h. Atomizer is in the operating position.

i. Slurry feed hose connected to atomizer.

j. Air seal line is connected to atomizer base plate.

k. Atomizer motor power cable is connected.

l. Vibration monitoring cable is connected.

m. Instrumentation cable is connected.

n. Atomizer oil level is normal (via dipstick).

o. Reactor tank strainer is clean.

p. Reactor tank drain valve is closed.

q. Reactor tank cover is closed.

r. Reactor tank flow control valve to atomizer is closed.

s. Carbon silo has adequate level.

t. Carbon slaking water has adequate pressure.

3.1.2 Open the lime silo knife gate to the train that is to be placed in service.

3.1.3 Select the slurry feed pump switch to the pump that is to be placed in service.

3.1.4 Start the lime slurry tank agitator.

3.1.5 Open the water supply valve to the slaker.

3.1.6 Select the dilution, cooling water, torque water and slaking water control valves switch to "Auto".

3.1.7 Select the screw feeder control switch to "Auto".

3.1.8 Select the lime silo bin vibrator control switch to "Auto".

3.1.9 Select slurry feed pumps control switch to "Off".

3.1.10 Select grit screen control switch to "Auto".

3.1.11 Select grit screw control switch to "Auto".

3.1.12 Select slaker control switch to "Auto".

3.1.13 Select screw feeder control switch to "Auto". Slaker system will now automatically start and produce slurry.

3.1.14 Place the slurry control value (atomizer head tank fill valve) to manual and close it.

3.1.15 Verify that the discharge of the selected slurry pump and open its suction and discharge valves.

3.1.16 When the slurry storage tank has reached approximately midpoint start the slurry feed pump.

3.1.17 Verify return flow from scrubber.

3.1.18 Fill the reactor head tank to 10% of normal operating level (via the slurry control valve and slurry head tank).

3.1.19 While filling the slurry system fill the dilution water treatment tank with waste water. Ensuring the lime slurry tank is supplying adequate slurry to neutralize the waste water.

3.1.20 Line up the dilution water pump and fill the dilution head tank observing an overflow back to the dilution water treatment tank.

3.1.21 Open the dilution water supply valve to the reactor tank. The reactor water supply float valve will automatically establish and maintain normal operating level.

3.1.22 Ensure carbon slaking water pressure.

3.1.23 Select carbon train to be put in service.

3.1.24 Open manual shut off gate at the bottom of the selected bin align material to flow to the feeder.

3.1.25 The feeder is started for the DCS locally set the screw feed to obtain a set rate of 50 lbs of carbon per hour.

3.1.26 Adjust slaking water through flow valve FV-1973 to obtain 2 GPM.

3.1.27 Adjust the carbon slurry pumps to maintain 2 GPM and align system to the reactor feed tank.

3.1.28 Start reactor tank agitator.

3.1.29 Ensure Flyash Handing System is in service.

3.1.30 Place Baghouse in service. (See System Description No. 20)

3.1.31 Start atomizer and verify all its associated alarms clear.

3.1.30 Ensure atomizer flow/temperature controller is in manual with its output at 0%.

3.1.31 Open reactor tank isolation valve to atomizer.

3.1.32 Place the atomizer flow/temperature controller to "Auto" with a setpoint of 285°F.

3.1.33 When the economizer outlet temperature reaches 285°F. set the lime flow controller to 30%.

3.1.34 Verify slurry flow from the head tank to the reactor tank.

3.1.35 Monitor Scrubber outlet temperature and ensure that it stabilizes.

3.1.36 Place the SO_2 controller to "Auto" and adjust the setpoint to the desired stack SO_2 concentration.

3.1.37 Monitor actual SO_2 Emissions.

3.2 NORMAL OPERATION

3.2.1 The lime slaking operates as bach process. The slaking equipment automatically starts up when the slurry tank lowers to a predetermined level and shuts down when the slurry tank is full.

3.2.2 The slurry feed pump runs continuously with approximately half of its discharged flow being directed to the two scrubber head tanks. The remainder of its discharge is recirculated back to the slurry storage tank.

3.2.3 The quantity of slurry that is admitted into a individual scrubbers slurry head tank is automatically regulated based on stack SO_2. As SO_2 rises the slurry flow is increased.

3.2.4 As the flow out of the head tank (to the atomizer) is greater than the slurry flow to the head tank (from the slurry feed pumps) dilution water is automatically (via float valve) added to maintain the reactor tank level. In this manner the slurry concentration that is admitted to the spray dry absorber is automatically adjusted as needed.

3.2.5 The quantity of slurry/water that is admitted from the head tank to the atomizer is automatically regulated based on scrubber outlet temperature. As temperature rises the slurry/water flow is increased.

3.2.6 At least once per shift perform the following:

a. Inspect scrubber discharge to ash handling system. Confirm its flow and dryness.

b. Inspect head tank for build-up and clean (via hose) as required.

c. Verify flood valve operation to make sure valve shuts off on high level.

d. Inspect and clean (as required) slurry tank screens.

e. Inspect slurry tank for build-up. Clean as required.

3.2.7 Slurry feed lump switchover is performed as required.

3.2.7.1 Stop operating pump and close its discharge valve.

3.2.7.2 Close slurry head tank feed line valve.

3.2.7.3 Open back-up pump suction and discharge valves

3.3.7.4 Start back-up pump.

3.2.7.5 Open slurry head tank feed line value.

3.2.7.6 Open previously operating pump's flush water valve and backflush slurry line into slurry tank for 2 minutes.

3.2.7.7 Close previously operating pump's suction valve.

3.2.7.8 Connect previously operating pump's discharge to drain.

3.2.7.9 Open previously operating pump discharge valve and flush into drain for 2 minutes.

3.2.7.10 Close previously operating pump discharge valve and flush water valve.

3.3 SHUTDOWN

3.3.1 Coordinate the time to shutdown versus available lime slurry in slurry tank in order to use all the lime slurry inventories.

3.3.2 Close lime bin knife gate.

3.3.3 Select lime screw feeder control switch to "Off".

3.3.4 Select water control valve switch to "Close".

3.3.5 Select bin vibrator control switch to "Off".

3.3.6 Select slaker and slaker water controls switch to "Off".

3.3.7 Select grit screen control switch to "Off".

3.3.8 Select grit screw control switch to "Off".

3.3.9 When slurry tank level drops below the low level place the SO_2 controller in manual and set to 0%.

3.3.10 Close head tank isolation valve.

3.3.11 Open atomizer flush water valve.

3.3.12 As economizer outlet temperature reduces the automatic temperature controller will reduce the feed flow (to atomizer) to 0.

3.3.13 Place temperature controller in manual and set output to 0.

3.3.14 Open head tank outlet isolation and drain valves. Flush water will now clear the tank outlet nozzle and overflow into the head tank and overflow to the slurry tank.

3.3.15 Close head tank outlet isolation valve. All slurry lines within the penthouse and between the penthouse and lime slaking system and the head tank are to be flushed and drained of all liquids and kept empty during shutdown.

3.3.16 Close flush water valve. Atomizer and head tank flushing is now complete.

3.3.17 Momentarily set output of temperature controller to 50%, then reset it to 0%, to drain any residual liquid from the atomizer slurry feed line.

3.3.18 Stop Atomizer.

3.3.19 Verify that the wheel protection water valve closes when temperature drops below 250°F.

3.3.20 Stop slurry feed pump.

3.3.21 Close pump suction valve and open pump flush water valve. Flush discharge piping for 2-5 minutes.

3.3.22 Stroke lime slurry control valve via the SO_2 controller, then reset controller output to 0%.

3.3.23 Close pump discharge valve and open pump suction valve. Flush suction piping for 1-2 minutes.

3.3.24 Close pump suction valve and flush water valve.

3.3.25 Stop heat tank agitator.

3.3.26 Close head tank dilution water valve.

3.3.27 Open head tank drain valve.

3.3.28 Stop slurry tank agitator.

3.3.29 Open lime slurry tank drain valve.

4.0 REFERENCES

4.1 PIPING AND INSTRUMENTATION DRAWINGS

Description	Drawing Number
Flue Gas Cleaning System Cover Sheet	726-PD-01
Flue Gas Cleaning System Reactor	726-PD-02
Flue Gas Cleaning Atomizer Machine	726-PD-04
Flue Gas Cleaning Line Preparation	726-PD-05
Flue Gas Cleaning Rector	726-PD-06
Flue Gas Cleaning Dilution	726-PD-07
Flue Gas Cleaning Reagent	726-PD-08
Flue Gas Cleaning Air System	726-PD-09
Flue Gas Cleaning Carbon	726-PD-10
Flue Gas Cleaning Water Supply	726-PD-11
Flue Gas Cleaning Potable Water	726-PD-12

4.2 VENDOR MANUALS

ABB Flue Gas Cleaning Systems Volume 1-4

LEE COUNTY RESOURCE RECOVERY FACILITY
BAGHOUSE
SYSTEM DESCRIPTION

INDEX

1.0 INTRODUCTION

1.1 PURPOSE

Treated flue gas is directed from the spray dryer absorber to a pulse jet fabric filter (baghouse) for cleaning. Entrained particulate is filtered from the gas stream as the gas passes through cloth filter bags within the baghouse. This particulate forms a "filter cake" of lime and flyash on the bag surfaces. Once formed, the filter cake acts as an additional filter medium. The filter cake also aids in the removal of acids in the flue gas. Filtered gas is delivered to the stack via the induced draft fan for exhaust. Captured particulate is periodically cleaned from the bags and released into the baghouse hoppers for delivery to the ash conveying system by a pneumatically operated pulse air system.

1.2 SYSTEM OVERVIEW

The baghouse is a self-cleaning modular dust collector designed to remove dust particles from the flue gas streams. It consists of 8 standard modules per unit, each containing 320 woven fiberglass bags. The inlet and outlet of each of the 8 modules are connected to common inlet and outlet manifolds. Each module is provided with a manually operated inlet damper (butterfly type) and a pneumatically operated outlet damper (poppet type).

Fabric bags within each baghouse module filter collect dust from the flue gas. The dust laden gas enters the baghouse modules below the filter bags, slows down, changes direction, and passes through the filter bags from the outside to the inside of the bag. The mechanics of turning and slowing the gas results in some of the dust falling directly into the hopper. The remainder is deposited on the outside of the filter bags. Each filter bag is supported from within by a wire cage. The wire cages prevent the collapse of the filter bags during the filtering operation.

To keep system draft pressure drop at an acceptable level, the filter bags are periodically cleaned of some of the collected material. The baghouse cleans the bags using a short pulse of compressed air directed into the clean interior of the bags from their top ends which are open. The compressed air pulse, opposite to the direction of gas flow, expands the bag which causes some of the collected filter cake on the outside of the bag to fall into the hopper below.

A bypass duct and damper is provided around the baghouse. The bypass damper may be opened only during extreme emergencies and only under the direct supervision of the shift supervisor.

2.0 COMPONENTS

The overall baghouse design criteria and performance guarantees are as follows. Individual component descriptions and information are contained in the following sections.

Flue gas flow (design)	149,292 ACFM per train
Gas temperature (inlet)	285° F
Type	Pulse jet
Number of modules	8
Bags per module	320
Filter media area per module	7288 square feet
Air to Cloth Ratios:	
Gross	2.88 ACFM/Ft² of cloth
Net	3.29 ACFM/Ft² of cloth

FILTER BAGS

Material	Woven fiberglass
Finish	Teflon coated acid resistant
Weight	16 ounces/square yard
Maximum temperature	500° F (for 30 minutes)

PERFORMANCE GUARANTEES

Outlet dust load	.0033 Grains/ACF 7% oxygen
Fabric pressure drop	7" WC design
Opacity	10% permit maximum
Bag Life	2 years

2.1 MODULES

The baghouse is comprised of 8 individual modules or compartments. These modules provide the needed sectionalization for off line cleaning and/or maintenance. Each module contains 320 filter bags. A module consists of a hopper, outlet plenum, tube sheet, and compressed air distribution system.

2.1.1 Hopper

The hopper has two main purposes; 1) to serve as the dirty flue gas inlet into each module and 2) to collect dust for removal by the dust removal system. A turning vane and baffle design in each hopper minimizes turbulence and promotes even distribution of gases at the bottom of the bags. An access door is provided for inspecting each hopper interior. Each hopper is installed with a vibrator to dislodge any potential bridging. These are pneumatically operated hammers.

A discharge flange connects the hopper to the flyash system via a knife valve. All compartment hoppers discharge to a common baghouse conveyor. The two baghouse conveyers discharge to a common flyash conveyor via rotary air lock valves. See the Flyash Handling System Description for details.

2.1.2 Compartment Outlet Plenum

Each module serves as the housing for the filter bags and contains an outlet plenum for the clean flue gas. The dirty gas and outlet plenum are separated by a tube sheet, to which the filter bags are mounted. An access door is provided for entry into the outlet plenum. This allows access to the top of the tube sheet for inspection, removal, or installation of the filter bag and cage assemblies. Clean gas exits the outlet plenum of each module through the outlet poppet damper and flows into the outlet manifold.

2.1.3 Tube Sheet

Each tube sheet is fabricated of one quarter inch A-36 steel. The tube sheet supports the filter bags and separates the clean and dirty sides of the baghouse. It also serves as a filter bag inspection platform inside the plenum. The tube sheet filter bag array is arranged in 20 rows, with 16 filter bags in each row. The filter bag is inserted into the tube sheet and at the top of the bag a snap band attaches the bag to the tube sheet. The bag cage

assemblies are inserted into the bag and held in place by the top retainer flange. The cage assembly is in two pieces to allow for retrieval in the limited space of the upper casing.

2.1.4 Pulse Air Distribution System

Included in this system is a 400 gallon receiver located in the APC area, solenoid actuated diaphragm valves, the pulse pipes, and the cleaning cycle timer panel. A single pulse pipe is positioned over each row of filter bags and connected to the air receiver with a solenoid actuated diaphragm valve.

The amount of compressed air delivered to the bags is a function of air pressure inside the air receiver and the length of time the diaphragm valve remains open. A pressure regulator on each air receiver is used to indicate and control air pressure within the air receiver. The operation of the valves is controlled by the cleaning cycle timer panel.

The duration of the pulse of air is very short. The quick response time is achieved by the use of $1^1/_2$ inch double diaphragm valves. Compressed air inside the air receiver pressurizes both sides of the trigger diaphragm and the main diaphragm, holding the valve in the closed position. Upon energization of a solenoid valve, a pressure differential across the trigger diaphragm results. The diaphragm then lifts, allowing air to be vented from one side of the main diaphragm. The induced pressure differential across the main diaphragm causes it to be lifted and admit air to the pulse pipe which directs air into the filter bags.

The air burst passes through a venturi installed at the top of the bag/cage assembly which accelerates the pulse. The air quickly travels down the filter bags. This sudden acceleration of the fabric from the cage followed by deceleration causes most of the accumulated filter cake to separate from the outside of the filter bag. De-energization of the solenoid valve closes the atmospheric vent and allows air pressure to close the diaphragm valve.

2.2 ACCESS DOORS

There are two access doors on each module. One for the outlet plenum and one for the hopper. During operation, it is important that the doors are closed sealed to prevent leakage. In leakage of outside air cools the steel which

is a potential corrosion problem and will cause bag deterioration.

CAUTION: EXTREME CARE MUST BE TAKEN WHEN OPENING ANY OF THE ACCESS DOORS ON THE BAGHOUSE.

WARNING: HOT DUST CAN CAUSE SEVER BURNS AND FATAL INJURIES.

BEFORE OPENING HOPPER DOORS, LOCK IT OUT. BE SURE THE HOPPER IS EMPTY AND RESIDUAL DUST HAS HAD ADEQUATE TIME TO COOL. DO NOT STAND IN FRONT OF THE DOOR WHEN OPENING IT.

2.3 FILTER BAG

Each module contains 320 filter bags. Each bag is 6" in diameter and 14'- 6" in length. The bag material is woven fiberglass with an acid resistant finish. The fabric weight is sixteen ounces per square yard. A two inch wear cuff at the bottom of the bags prevents premature failure caused by bag to bag abrasion. Support for the fabric is provided by wire cages which are inserted into each bag.

Because of the need to minimize excessive flexing of the fiberglass yarns, a tight fit between the filter bag and the cage is provided. In addition to this, the vertical cage wires are spaced less than an inch apart to provide good support for the fabric. To provide adequate rigidity, the cages are constructed of 12 gauge wire with annular rings spaced on six inch centers.

The filter bags are removed and installed from the clean flue gas outlet plenum. There is no need to enter the dirty side of the baghouse to replace bags. Once the pulse pipes are disconnected, each filter bag and cage assembly can be inserted or removed through an opening in the tube sheet.

The method utilized to seal the filter bag against the tube sheet is accomplished by a metal snap ring that is integral to the upper collar of the bag. Once the bags are inserted and positioned in the inlet plenum tube sheet, a snap ring is used to attach it to the tube sheet. Snap ring spring pressure forms a tight seal to the tube sheet around the upper portion of the bag. A rigid flange on the cage assembly maintains the correct bag alignment. The cage is fabricated in two pieces to facilitate removal in the tight space. To reinstall the cage, first insert

bottom portion into bag and angle top portion of the cage into bottom portion while inserting. The filter cage then slides into the bag as one unit.

2.4 INLET AND OUTLET MANIFOLDS

The inlet and outlet manifolds distribute the flue gases into and out of each individual module. The manifolds are centrally located between the two rows of modules. The flue gas passages and manifolds have been designed to optimize the following essential criteria:

a. Minimize the plenum, compartment damper and system pressure drop

b. Balance the flow and dust distribution between compartments and between filter bags within a compartment

c. Minimize the potential for particulate dropout in the inlet manifold.

These objectives have been ensured by these key design features; a stepped inlet manifold, multiple turning vanes in each elbow, low flue gas velocities at critical transitions and a system of turning vanes and baffles in each hopper.

The inlet and outlet dampers are provided with the following remote indications/alarms (equipment listed here are associated with unit A compartment A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
PDI-1804AA	Baghouse compartment differential pressure
PIR-1803A	Baghouse inlet pressure indication rate
PIR-1804A	Baghouse outlet pressure indication rate
PDIR-1804A	Baghouse compartment pressure differential indication rate
PDAL-1804A	Baghouse compartment pressure differential alarm low

PDAH-1804A	Baghouse compartment pressure differential alarm high
PDAHH-1804A	Baghouse compartment pressure differential alarm high high
TT-1804A	Baghouse outlet temperature transmitter
TIR-1804A	Baghouse outlet temperature indication rate

2.5 EXPANSION JOINTS

Expansion joints are located at the flue gas inlet and outlet plenums of each module. This allows relief of thermal stress at the points where the modules are connected to the manifolds. Stresses occur as a result of taking one module off line while the remaining modules are operating at higher gas temperatures. The forces generated by thermal expansion and contraction, if not accommodated, will result in misaligned dampers and structural damage to the modules and manifolds. Non-metallic joints are used because they are corrosion resistant and can handle three dimensional movement and extreme temperature variances without cracking or splitting.

2.6 BAGHOUSE DAMPERS

Isolation dampers are located at the flue gas inlet and outlet plenums to each module. The module inlet dampers are 24 inch by 72 inch butterfly dampers. The outlet dampers are 39 inch poppet type dampers. The baghouse bypass duct damper is a 50 inch poppet type damper.

Each damper has open and shut limit switches that provide position indication to the distributed control system (DCS).

2.6.1 Poppet Dampers

The baghouse is designed to operate under negative pressure, i.e., less than atmospheric pressure. Under these conditions, when a baghouse module is isolated, the damper closest to the induced draft fan is closed. Since this is the only damper that closes during off line compartment cleaning, poppet dampers are used at this location. These dampers are selected for their minimal leakage characteristics.

Poppet dampers consist of a flat circular plate, or blade, connected to a shaft. The shaft is either raised to close or lowered to open the outlet damper (the action is reversed for the bypass damper). In the closed position, the blade is seated against an opening in the duct work. The duct opening is fitted with a raised collar onto which the circular blade seals. The poppet damper actuator provides enough force to cause a deflection of the blade as it seals around the collar, similar to the action of a diaphragm seal. The blade is flexible enough to provide a uniform metal seal without creating permanent deformation.

A guide bar provides alignment of the poppet shaft and prevents rotation of the blade, thereby allowing consistent sealing after repeated use. A machined packing gland is used to seal the poppet shaft at the point where it penetrates the duct.

A double acting air cylinder provides the force necessary to open and close the poppet damper. The position of the damper is indicated by magnetic limit switches. The air cylinder is mounted on a pedestal support with oversized handholes for easy access during maintenance. A pin and lock assembly is used to mechanically lock the poppet damper in the closed position for on line maintenance. The damper must be locked in a closed position before entering the module.

2.6.2 Butterfly Dampers

Butterfly dampers are used at the flue gas inlet of each module. Leakage is not as critical through this damper, because during module isolation, the poppet damper at the module outlet will also be closed. The primary concern is to use a damper that provides minimal pressure drop characteristics and functions well in a dirty flue gas stream. The reason for vaning the manifold turn preceding the damper is to provide uniform gas flow distribution.

Several design features are incorporated into the butterfly inlet dampers to minimize leakage and corrosion. Spring type blade seals fabricated of mild steel are installed around the perimeter of the damper frame. The damper shaft is carbon steel with teflon packing glands. A hand operated, rotary chain wheel actuator provides the necessary torque to open and close the damper. Limit switches are included to indicate damper position. This damper is also mechanically locked in the closed position to ensure safety during maintenance periods. The damper must be locked in a closed position before entering the module.

The baghouse dampers are provided with the following remote indications/alarms (equipment listed here are associated with compartment A in unit A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
HS-1800A	Bypass damper A open switch
FY-1800A	Bypass damper A pneumatic control valve
ZSC-1800A	Bypass damper A switch closed
ZIC-1800A	Bypass damper A indication closed
ZSO-1800A	Bypass damper A switch open
ZIC-1800A	Bypass damper A indication closed
HS-1801A	Bypass damper 1A open switch
FY-1801A	Bypass damper 1A pneumatic control valve
ZSC-1801A	Bypass damper 1A switch closed
ZIC-1801A	Bypass damper 1A indication closed
ZSO-1801A	Bypass damper 1A switch open
ZIC-1801A	Bypass damper 1A indication closed
ZSC-1804AA	Baghouse compartment inlet damper switch closed
ZIC-1804AA	Baghouse compartment inlet damper indication switch closed
ZSO-1804AA	Baghouse compartment inlet damper switch open
ZIO-1804AA	Baghouse compartment inlet damper indication switch open

ZSC-1802AA	Baghouse compartment outlet damper switch closed
ZIC-1802AA	Baghouse compartment outlet damper indication switch closed
ZSO-1802AA	Baghouse compartment outlet damper switch open
ZIO-1802AA	Baghouse compartment outlet damper indication switch open
HS-1802AA	Baghouse compartment outlet damper control switch
FY-1802AA	Baghouse compartment outlet damper control pneumatic control valve

2.7 INSULATION AND LAGGING

Insulation and lagging are applied to all hot surfaces including modules, hoppers, inlet and outlet manifolds. The insulation is fiberglass rigid board material. The lagging is a ribbed aluminum.

The access doors are covered with six inches of fiberglass insulation which is protected with a mild steel cover.

2.8 HOPPER HEATERS

Manufacturer: HotFoil
Type: HB

The hopper heaters are low watt density blanket types. The total heat load is five kilowatts per hopper with a design voltage of 460 VAC, single phase. The junction box is dust and water tight (NEMA 4). The heater is controlled by a temperature sensor mounted on the hopper wall. There are two heaters per hopper, one operating and the other as a spare.

The hopper heaters are designed to maintain the lower one third of the hopper surface area at 270 to 310° F. The temperature controllers automatically maintain this temperature when the selector switch is in the automatic position.

The hopper heaters are provided with the following remote indications/alarms (equipment listed here are associated with compartment A in unit A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
YI-1804AA	Hopper heater switch on
HS-1804AA	Hopper heater switch automatic switch
TC-1804AA	Hopper heater temperature control
TAL-1804AA	Hopper heater temperature alarm low

2.9 HOPPER LEVEL INDICATOR

There is one level indicator per hopper to detect a high ash level. Each hopper level detectors provide a high hopper ash level alarm to the control room DCS when the hopper level is 5' 7" above the outlet flange.

The hoppers are provided with the following remote indications/alarms (equipment listed here are associated with compartment A in unit A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
LSH-1804AA	Baghouse hopper level switch high
LAH-1804AA	Baghouse hopper level alarm high

2.10 HOPPER VIBRATORS

There is one pneumatic hopper vibrator per hopper which produces a pattern of pulsating vibrations to keep the dust particles agitated and in a free flowing condition. The hopper vibrators are interlocked with the flyash system to prevent the hopper vibrators from operating when the associated hopper screw conveyer is secured.

The hoppers vibrators provided with the following remote indications/alarms (equipment listed here are associated with compartment A in unit A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
HS-1804AA	Baghouse hopper vibrator control switch
FV-1804AA	Baghouse hopper vibrator air actuating valve

2.11 COMPRESSED AIR SYSTEM

Compressed air is supplied to the baghouse by the plant air compressors. The air for each baghouse is collected and stored in its own air receiver. Air receivers for the baghouse bypass dampers are also installed at the baghouse.

The compressed air is provided with the following remote indications/alarms (equipment listed here are associated with compartment A in unit A. Equipment for compartments B through H and unit B compartments A through H are similar.):

Identification	Function
HS-1803A	Baghouse cleaning cycle start
FV-1804AA01	Baghouse pulse air cleaning per row 01-20
PCV-1966A	Baghouse pulse air pressure control valve
PSL-1966A	Baghouse pulse air pressure switch low
PAL-1966A	Baghouse pulse air pressure alarm low
FV-1966A	Baghouse pulse air pressure flow valve

2.12 BAGHOUSE CONTROL BY BAILEY INFI 90

A screen on the Bailey INFI 90 (DCS) displays the control system logic. The displays are arranged in a graphic layout which indicates the status of various modes in which the system is operating and monitors the overall pressure drop. It also allows remote control of the following functions:

a. System startup or shut down

b. Manual or automatic cleaning cycle

c. Manual cleaning of an individual compartment

d. On line or off line cleaning or on line simultaneous cleaning.

e. Control of the bypass and outlet dampers

3.0 OPERATION

3.1 STARTUP

3.1.1 Leak Checking Bags

At the time of initial startup and after a bag change has been performed, it is very important to leak check the bags to ensure that all bags are correctly installed and do not have any holes.

3.1.1.1 Start the induced draft fan per the Combustion Air System Description if it is not already in operation.

3.1.1.2 Verify that the baghouse access doors and rod out tubes are closed.

3.1.1.3 Open the outlet damper for the module to be leak checked.

3.1.1.4 Shut the inlet damper for the module to be leak checked.

3.1.1.5 Remove the cap of the rod out tube for the module to be leak checked. Attach a 4" flexible hose to the tube.

3.1.1.6 The negative draft in the baghouse will vacuum the fluorescent dust into the module and distribute the precoating on the bags.

3.1.1.7 Close the outlet damper.

3.1.1.8 Place a work clearance on the module.

3.1.1.9 Enter the outlet plenum and inspect each bag with a black light. If there is a faulty bag. The fluorescent dust will be illuminated. Replace any faulty bags

3.1.1.10 Close the outlet plenum access door. Ensure that there is no air in leakage.

3.1.1.11 Remove the work clearance.

3.1.1.12 Precoat the bags (see section 3.1.2).

3.1.2 PRECOATING BAGS

At the time of initial startup and after a bag change has been performed, it is very important to precoat the bags to prevent bag blinding and subsequent bag failure.

3.1.2.1 Start the induced draft fan per the Combustion Air System Description if it is not already in operation.

3.1.2.2 Verify that the baghouse access doors and rod out tubes are closed.

3.1.2.3 Open the outlet damper for the module to be precoated.

3.1.2.4 Shut the inlet damper for the module to be precoated.

3.1.2.5 Remove the cap of the rod out tube for the module to be precoated. Attach a 4" flexible hose to the tube.

3.1.2.6 The negative draft in the baghouse will vacuum the precoating into the module and distribute it on the bags:

3.1.2.7 Open the inlet damper.

3.1.2.8 Remove the flexible hose and replace the cap on the rod out tube.

NOTE: Once a module has been precoated, it must stay on line. If the module has lost the precoating, the procedure must be repeated.

3.1.3 Putting Baghouse In Service

The baghouse will always be in service whenever the induced draft fan is in service.

3.1.3.1 Verify that all doors and access hatches into the flue gas path are closed and sealed.

3.1.3.2 Ensure that the hopper heaters are energized at least twenty four hours before startup and the hopper temperature "low" alarms are not activated.

3.1.3.3 Inspect instrument tubing and fittings for leaks.

3.1.3.4 Ensure that all of the local cleaning cycle timer control panels are in the off position

3.1.3.5 Ensure that the baghouse control panel is energized.

3.1.3.6 Start the flyash handling system and verify complete operation.

3.1.3.7 Verify that all of the module inlet and two of the outlet dampers are open and that the bypass damper is closed.

3.1.3.8 Start the ID and FD fans and purge the furnace. After purging is complete shut down the FD fan and place the auxiliary gas burner in service. See the Combustion Air and Flue Gas System Description for details.

3.1.3.9 Verify that the pulse air is lined up to all eight compartments and that the pulse air regulator is set at 50 PSIG.

3.1.3.10 When the baghouse outlet gas temperature reaches 285° F, open two module outlet dampers via their control switches. The baghouse outlet temperature will drop until these compartments are warmed up.

3.1.3.11 When the baghouse outlet gas temperature again reaches 285° F and stabilizes, open the four remaining module outlet dampers via their control switches.

3.1.3.12 Place all of the local cleaning cycle timer control panels to the on position.

3.1.3.13 Set the cleaning control switch to "off line". This is preferred for initial cleaning and will be the normal operating mode.

3.2 NORMAL OPERATION

With the baghouse in the normal filtering mode of operation all the modules are on line, filtering flue gas. Fabric filter bag cleaning is accomplished by cleaning the modules one at a time in sequence until all modules have been cleaned or the baghouse differential is less than 7" WC. Each module is taken off line, in sequence, for cleaning and returned to service before the cleaning cycle continues for the next module. Only one module is off line for cleaning at a time. All operations associated with fabric filter cleaning are controlled automatically or manually through the DCS.

Under most operating conditions modules are taken off line for cleaning to eliminate the force of the gas pressure drop across the bag which holds the filter cake against the bag. Elimination of the gas pressure force makes dislodging of the filter cake much easier. Stopping the flue gas flow through the module also eliminates partial entrainment and attachment of the removed dust. The dust is dislodged from the bags and falls directly into the hopper. In contrast, if the flue gas continues to flow into the compartment during cleaning, the bags may not be cleaned well enough. As the filter cake is dislodged and falls toward the hopper it becomes partially entrained in the flue gas. Some of the dust may then reattach to the bags resulting in a higher pressure drop.

In applications where the dust is easy to dislodge from the bags and pressure drop is low, it may be possible to clean the modules on line while filtering of flue gas continues. The baghouse control provides the option for on line cleaning. On line cleaning may be necessary when one module has been taken out of service for maintenance or repairs. In this condition, taking a second module off line for cleaning will result in an excessive baghouse differential pressure.

Bag cleaning within a module is accomplished using short duration, low pressure (50-70 PSIG) compressed air pulses blown down into the venturi of each bag from blow pipes mounted just above the tube sheet in the module outlet plenum. The air pulses travel down the bags in the direction opposite to the direction of the flue gas flow with the module on line. The filter cake on the bags is dislodged by a combination of the dynamic pressure of the air pulses as they travel down the bags, and by the shock waves generated by the air exhausting from the blow pipe orifices near the speed of sound.

The baghouse differential pressure will serve, in general, as the best indicator of overall baghouse performance. In particular, the differential pressure across the individual modules will be the best indicator of the condition of the filter bags. A sudden increase or decrease in pressure drop can mean blinded bags, leaks from holes in the fabric, an inoperative damper, cleaning system malfunction or full hoppers. Immediate action is required to isolate and solve the problem and prevent bag failures. To protect the bags, the maximum pressure drop across any module should not exceed 8.5" WC.

3.2.1 Filter Bag Cleaning

3.2.1.1 The automatic cleaning mode is initiated at a differential pressure of 7" WC across the baghouse and stops when all modules have been cleaned.

If the differential pressure has not exceeded the setpoint within six hours in the automatic mode, a timed cleaning cycle will be initiated automatically. The bags are cleaned, one row at a time, with a momentary high pressure burst of air from the compressed air system. Each module is supplied with its own compressed air cleaning system. This system is comprised of one common receiver and a number of diaphragm valves, each provided with a blow pipe which is aligned over a row of bags. The compressed air flows from the receiver, through the diaphragm valve and into the blow pipe. The compressed air is directed downward through a venturi at the mouth of the blowpipe.

3.2.1.2 The operation of the diaphragm valve is controlled by a solenoid valve, while the duration and frequency of energization (on and off times) of the solenoid valve are controlled by the cleaning cycle timer. Cleaning can also be initiated manually.

3.2.2 System Cleaning Cycle

3.2.2.1 The differential pressure across the bags will prevent some of the dust from falling off the bags during cleaning unless the module is isolated from the gas flow. The baghouse allows the module being cleaned to be isolated from the gas flow. This is known as off line cleaning. The baghouse also has the capability to clean the modules on line. Under normal conditions, off line cleaning is recommended to promote longer bag life.

3.2.2.2 The Bailey DCS sequentially controls the operation of all module outlet poppet dampers and timers. The

cleaning operation begins with the outlet poppet damper of the module closing, preventing further filtering of dust laden gases in that module. A signal is sent from the DCS to the module cleaning cycle timer, which sequentially pulses each row of bags. After all rows are pulsed, a null period allows the dust which has been cleaned from the filter bags to settle into the hopper from where it is removed. The outlet damper is then reopened, returning this module to service.

3.2.2.3 Each module will be out of service approximately four minutes for cleaning.

The times allotted for damper closing, the null period or settling period, are programmed into and controlled by the DCS. The duration of the pulse cleaning cycle is adjustable at the cleaning cycle timer for each specific module.

3.2.3 Cleaning Controls

3.2.3.1 A system cleaning cycle can be initiated automatically by either an adjustable time cycle or a system differential pressure signal. Cleaning can also be initiated manually. The controls allow manual initiation of both a system or individual module cleaning cycle.

3.2.3.2 On an average, the baghouse will undergo cleaning every one to four hours if the system is operating in the demand or automatic cleaning mode. The frequency will vary with cleaning air pressure, age of the filter bags, and whether the baghouse is operating at full or partial load.

3.2.3.3 The individual cleaning cycle timer of each module will be operated in a sequential manner. The first module timer will send a signal back to the main controller until all the bags in that module have been cleaned. The timer will then send a signal back to the main controller which will de-energize the first module timer. The main controller will then energize the timer of the second module, repeating the process until all eight modules have been cleaned. The dwell time (delay) between module cleaning cycles is adjustable from 0 to 30 minutes.

3.2.3.4 The cleaning cycle timer, when energized, sequences one solenoid valve at a time. The sequence starts at the

middle row of the module and alternates to the next closest row, continuing this cyclic process until all rows in the module are cleaned.

3.2.3.5 The operating pressure drop can be reduced by one of the following methods. They are listed in order of preference for effectiveness. Each has the effect of either increasing cleaning energy or decreasing cycle time.

(1) Increase the cleaning air pressure at pressure regulator. Cleaning air pressure should be regulated between 50 and 70 PSIG. For maximum bag life, keep air pressure as low as possible.

(2) Decrease timer off time at each individual module timer. Decreasing timer off time (interval between pulses) will shorten the time it takes to clean a module, and therefore, could reduce the overall system pressure drop by using more system cycles per day. Reducing the interval between pulses too much could result in insufficient pressure in the air receiver thereby limiting the volume of air to pulse clean the bags. The interval between pulses should be set such that no solenoid valve is energized more than once every one and a half minutes, otherwise the coil may overheat and fail.

(3) Increase timer on time at each individual module timer. Increasing the timer on time (pulse duration) will result in an increase in the volume of air to pulse clean the bags. A setting of under one tenth of a second will likely result in insufficient cleaning air volume whereas a setting greater than three tenths of a second may cause unnecessary consumption of compressed air.

3.3 SHUT DOWN

Shut down of the baghouse should be accomplished in such a manner so as to prevent fabric filter damage due to lowering gas temperature, as there is potential for moisture or acid condensation on the bags.

Pulse jet cleaning should be manually initiated prior to shut down to remove any excess dust from the filter bags. Initiating a cleaning cycle prior to shut down reduces the likelihood of blinding the filter bags with hard caked dust resulting from moisture condensing on the bags as the unit cools. In addition, falling dust hazards are reduced should module entry be required.

3.3.1 Baghouse Shut Down

Shut down of the entire baghouse can be accomplished once the incinerator grates are completely clear of garbage and the spray dryer atomizer has been shut down.

3.3.1.1 Stop feeding refuse and close the feed chute damper when refuse level drops below the acceptable level.

3.3.1.2 Place the auxiliary gas burner in service and burn off the remaining refuse. See the Martin Stoker System Description and the Combustion Air and Flue Gas System Description for details.

3.3.1.3 Monitor the spray dryer inlet SO_2 level. After the level has dropped and remains below 30 PPM, secure the spray dryer atomizer. See the Spray Dryer Absorber System Description for details.

3.3.1.4 After all the refuse is burned out, secure the auxiliary burner.

3.3.1.5 Close the module outlet dampers via their associated "open/close" selector switches as flue gas flow allows.

3.3.1.6 Place all of the local cleaning cycle timer control panels to the off position.

3.3.1.7 Isolate the modules by closing the module inlet dampers via their associated manual chain operators.

3.3.1.8 Run the flyash handling system for at least 30 minutes after the baghouse is off line.

3.3.1.9 In order to preclude any condensation on bags, the hopper heaters should be left in service whenever possible.

3.3.2 Individual Module Shutdown

A single module should be taken off line only if absolutely necessary, and returned on line as soon as possible. An increase in gas flow velocity through remaining modules when one is out of service will necessitate an increase in the frequency of cleaning cycles during the time the module is off line.

3.3.2.1 An individual module is isolated by closing the open/close selector switch for the appropriate module and by manually closing the inlet butterfly damper for the appropriate module.

3.3.2.2 Place the local cleaning cycle timer control panel in the off position.

3.3.2.3 If the module is to be entered, the inlet and outlet dampers and pulse air header should be properly isolated and tagged out.

3.3.2.4 If entry into the outlet plenum is necessary, open the door and allow the module to ventilate by induced draft until all flue gas has been purged. Take great care not to close the door after entry and become trapped by pressure acting on the door.

3.3.2.5 If entry into the hopper assembly is necessary, the filter bags should be manually cleaned for at least two cycles. Be sure the hopper is empty before opening the hopper access door. Carefully open the access door while staying to the hinge side of the door. Allow the module to ventilate by induced draft until all the flue gas has been purged. Ensure that the hopper flyash screw conveyor has been tagged out.

NOTE: When entering the Baghouse, follow the Ogden Martin Systems Confined Entry Safety Procedure.

4.0 REFERENCES

4.1 PIPING AND INSTRUMENTATION DRAWINGS

Description	Drawing Number
Flyash Handling System	7102-E-2200113
Flue Gas	7102-E-2200103
Flue Gas Cleaning System ABB	726-PD-03

4.2 VENDOR MANUALS

Vendor	Equipment	Equipment Manual
ABB	Flue Gas Cleaning	Volume I-IV

LEE COUNTY RESOURCE RECOVERY FACILITY

THERMAL DENOX
SYSTEM DESCRIPTION

INDEX

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the Thermal Denox System is to control the nitric oxide (NO_x) content of the flue gas. The system uses ammonia as the controlling agent to keep nitric oxide emissions within air permit limits.

1.2 SYSTEM OVERVIEW

The Continuous Emissions Monitoring System (CEMS) samples and keeps track of several important emission parameters. Nitric oxide (NO_x) is one such parameter. Measurement of NO_x at the economizer outlet is sent to the Thermal Denox System control loop for operating the various components of the system. Ammonia is used as the control reagent for NO_x removal.

Liquid ammonia stored in a cylindrical tank flows to a vaporizer located adjacent to the tank. Gaseous ammonia from the vaporizer is returned to the vapor space at the top of the tank. A mixture of ammonia drawn from the top of the storage tank and carrier air is injected into the boiler at one of two injection zones. Typically, only one injection zone will be necessary to achieve the required NO_x reduction. The carrier is needed to ensure that the ammonia is adequately distributed in the flue gases. As the mixture leaves the injection nozzles, it expands as a free jet inside the boiler. This action entrains the flue gas, mixing it with the ammonia, and promotes the Thermal Denox reaction.

The ammonia is stored in a 6840 cubic feet storage tank. The tank has three Denox Ammonia vaporizers which heat the ammonia to a temperature where the vaporization pressure of the liquid is high enough to keep the tank pressure at 50 psig. Based on the system demand, as more ammonia is used and the tank's pressure drops, more vaporizers are energized to maintain the tank at a pressure of 50 psig.

Each injection zone is a common pipe header mounted on the external front wall of the boiler first pass over the grates. One header is mounted low and the other is mounted high in the pass. Piped from the headers and through the boiler front wall are injection nozzles.

Typically, only one injection zone will be necessary to

achieve the required NO_x reduction. As the mixture leaves the injection nozzles, it expands as a free gas inside the boiler. This action entrains the ammonia in the flue gas, mixing it, and promoting the thermal denox reaction.

The first injection zone (Zone 1) consists of twenty-two nozzles installed in the front wall of the boiler just below the auxiliary burners. The second injection zone (Zone 2) consists of twenty nozzles installed in the front wall of the boiler above the auxiliary burner. Zone 1 will normally be used when flue gas temperatures are normal. Zone 2 will be used when flue gas temperatures are high.

The Thermal Denox System is designed to reduce uncontrolled NO_x emissions from each boiler by 60%. In addition to NO_x reduction requirements, residual ammonia (NH_3) emissions at the stack must be minimized to avoid plume formation. Design conditions for residual ammonia breakthrough (slip) is less than 35 PPM. The permit limit for ammonia emission is 50 PPMV. The permit limits for NO_x emission are 180 PPMDV @ 7% O_2 in a 24 hour daily block average.

The Thermal Denox System has two denox air blowers. Each blower discharges carrier air to the denox system. The mixing of ammonia vapor and carrier air is accomplished in the nozzle header. The ammonia vapor is injected directly into the header and is controlled by the ammonia flow control valve which takes its control signal via the NO_x CEM. In addition, the carrier air supplies the injection zone that is not in service with air for cooling and purging of the nozzles that are exposed to the hot combustion gases.

When the boilers are ready to be placed in service, the denox air blowers are started and the system charged up to rated pressure. A continuous flow of air is supplied to the denox nozzles to ensure that, when ammonia is injected, there is proper penetration of the ammonia vapor into the boiler firing chamber.

The injection of ammonia is controlled by a cascade control system. As the NO_x concentration of the flue gas varies up or down, a correction signal is sent to the ammonia flow controller to decrease or increase the flow of aqueous ammonia gas as necessary. If, for any reason, the air flow to the denox nozzles drops too low, the flow of ammonia becomes too high, or the boiler forced draft fan trips, the denox control valve that supplies ammonia will automatically close until the problem is corrected.

Ammonia shut down and/or flow can also be manually controlled by the operator if it should become necessary.

2.0 COMPONENTS

2.1 DENOX AIR BLOWERS (AM-BL-001A, AM-BL-001B)

Manufacturer: Dresser/Roots
Model: 1009 JV
Capacity 1632 CFM @ 18 PSIG

The denox air blowers are rotary screw type blowers which supply large volume of air at low pressures. The blowers are a self contained unit including an internal lubrication system and sound enclosures.

One blower will run at 100% capacity supplying both boilers with the other blower on stand by.

The compressors are driven by 200 HP, 4160 V, 3 Ph, 1780 RPM motors.

The following instrumentation is provided for the carrier air blower (suffix A and B correspond to the appropriate unit):

Identification	Control
HS-0705A,B	Carrier air blower on/off/auto switch
TSH-0706A,B	Carrier air blower temperature switch high
TAH-0706A,B	Carrier air blower temperature alarm high
PT-0707A,B	Carrier air blower pressure transducer
PAH-0707A,B	Carrier air blower pressure alarm high
PAL-0707A,B	Carrier air blower pressure alarm low
PIR-007A,B	Carrier air blower pressure indication rated

2.2 DENOX AMMONIA STORAGE TANK (AM-TK-001)

The denox ammonia storage tank is an 6840 cubic feet storage tank. The tank is constructed of carbon steel with a design pressure of 317 PSIG and temperature of 150° F. The ammonia tank is supplied with two safety relief valves set at 250 PSIG each, and a float type level indicator.

The tank inventory is replenished via tanker truck deliveries. A fill line and a vent recirculation line are provided for ammonia deliveries. When a delivery is made, the truck connects to both the fill and vent lines. The vapors forced out of the storage tank by the ammonia liquid are recovered by the truck, eliminating a possible hazard caused by released ammonia vapors. In addition, a drain recovery tank is provided to drain fill and vent lines after a delivery is completed.

A containment dike is installed around the storage tank and its associated equipment. The dike is sized to hold 110% of the tank and piping capacity. Local safety codes require the dike in the event of a spill.

The following instrumentation is provided for the ammonia storage tank:

Identification	Control
LSH-1704	Ammonia tank high level switch
LAH-1704	Ammonia tank high level alarm
PI-1703	Ammonia tank pressure indication
LI-1702	Ammonia tank level indication
TI-1701	Ammonia tank temperature indication

2.3 DENOX HEAT EXCHANGER VAPORIZER (AM-VP-001A, B, C)

Manufacturer: Sam Dick
Model: 180 AA
Capacity: 180 lbs/hr

Three Denox Vaporizers are provided, each is rated at 30 kw. They are set up to monitor the ammonia tank's pressure. If the tank's pressure drops below 50 psig, the vaporizers will be turned on to heat the tank liquid and thus maintain the tank's pressure.

Since heating electrical demand is proportional to ammonia supplied, normal operating parameters will be determined during acceptance trials. Ammonia vaporizers are sized for only two vaporizers at a time. The third is provided as a standby.

The monitoring equipment is as follows (each unit is similar with instrument tags suffix noting A, B, or C unit):

Identification	Control
HS-1711A,B,C	Vaporizer on/off switch
PSHH-1716A,B,C	Vaporizer inlet pressure switch high high
TSH-1714A,B,C	Vaporizer temperature switch high
LSH-1722A,B,C	Vaporizer level switch high
QL-0712A,B,C	Vaporizer On indication light
PSL-1718	Ammonia vapor return to tank pressure switch low
PAL-1718	Ammonia vapor return to tank pressure alarm low
PSH-1718	Ammonia vapor return to tank pressure switch high
PAH-1718	Ammonia vapor return to tank pressure alarm high
PRV-1708	Ammonia vapor pressure control
PSLL-1709	Ammonia vapor pressure to ammonia control valve switch low low

PALL-1709	Ammonia vapor pressure to ammonia control valve switch low low
PSHH-1710	Ammonia vapor pressure to ammonia control valve switch high high
PAHH-1710	Ammonia vapor pressure to ammonia control valve alarm high high

2.4 FLOW CONTROL VALVES

Flow control valves are provided to regulate the amount of ammonia and carrier air mixed prior to being injected into the boilers at the injection zones. The control loop that controls the ammonia flow valve receives the control signal from the CEMS which draws the signal from AAH-649 located in the flue gas path between the economizer and the spray dryer scrubber. A totalizer receives a NO_x signal from AIC-649 and an ammonia flow signal from Flow Controller FIC-1720. The totalizer, after interpolating these signals, generates a corrected signal back to the flow controller which throttles flow valve FV-1720 open or closed.

Carrier air flow is uncontrolled but monitored by FE-1721 to signal the NO_x FIC-1720 This control sequence is designed to maintain a constant flow of carrier air and vary the amount of ammonia supplied by FV-1720 which mixes with the air downstream of the flow measurement subsequently piped to the injection zones.

The following is a list of valves, controls and instrumentation provided to operate and monitor the air and ammonia flow valves:

Identification	Control/Device
FE-1720A,B	Ammonia flow element
FT-1720A,B	Ammonia flow transmitter
FIR-1720A,B	Ammonia flow indication rate
FIC-1720A,B	Ammonia flow controller
FAH-1720A,B	Ammonia flow alarm
FY-1720A,B	Ammonia flow relay
FXV-1720A,B	Ammonia flow pneumatic control

	valve
FV-1720A,B	Ammonia flow control valve
ZSC-1720A,B	Ammonia flow control valve switch closed
ZLC-1720A,B	Ammonia flow control valve indication closed
ZSO-1720A,B	Ammonia flow control valve switch opened
ZLO-1720A,B	Ammonia flow control valve indication opened
HS-1720A,B	Ammonia control on/off/automatic switch
FT-1721A,B	Air flow transmitter
FE-1721A,B	Air flow element
FIR-1721A,B	Air flow indication rate
FALL-1721A,B	Air flow alarm low low
FAL-1721A,B	Air flow alarm low

3.0 OPERATION

3.1 STARTUP

The following start-up valve identifications apply to boiler #1. For boiler #2, replace the Suffix A with B.

3.1.1 Air Injection System

3.1.1.1 Ensure that all instruments are valved in and working properly.

3.1.1.2 Start up the Denox Air Compressor(s) as required. The following steps should be followed when starting the compressor(s):

1. Open the block valve in the discharge line (DLA-V-007B, BLA-V-001A, BLA-V004A) to zone 1.
2. Select the lead compressor and start locally.
3. Check to see that the oil is above the minimum

starting temperature of 65° F.

4. Adjust the discharge pressure set point to the desired setting.

5. Observe the vibration levels. If excessive vibration levels exist shut the unit down to determine the cause.

6. Observe oil temperature to the compressor casing. The oil temperature control valve should automatically regulate the oil temperature

3.1.1.3 Once a boiler air/gas flow has been established (see the Combustion Air and Flue Gas System Description for details), establish a carrier air flow as follows

1. Ensure that all the injection nozzles are open.

2. Select the injection zone to be used by positioning the purge air and ammonia valves correctly (For Zone 1 - BLV-V-004A open, block valve BLA-V-003A closed: For Zone 2 BLA-V-006A opened block valve BLA-V-005A closed).

3.1.2 Ammonia Injection System

3.1.2.1 Ensure that the ammonia tank is full.

3.1.2.2 Ensure that all instruments are valved in and working properly. Make sure that the air injection system is working properly and that the boiler has been started. Refer to the Combustion Air and Flue Gas System Description for details. Make sure all required valves in the ammonia supply line are lined up and ready to go.

3.1.2.3 Ensure that the heat exchanger vaporizers are ready for service. Verify the valve positioning and that the electric power is available.

3.1.2.4 Start the ammonia vaporizers. Verify proper operation.

3.1.2.5 Prior to firing refuse, line up the ammonia injection system by placing Flow Controller FIC-1720 in manual. Open the flow control valve (FV-1720) until the NO_x level drops to within 10 PPM of the desired setpoint. Place FIC-1720 in automatic to control the NO_x content of the flue gas.

3.2 NORMAL OPERATION

The air injection rate is constant and will be determined during acceptance trials. The ammonia flow is controlled by FV-1720 and based on the NO_x level. Flow valve (FV-161) will modulate to keep the NO_x emissions within limits.

Only one Denox Compressor will be placed in service for two boiler operation. The second will be used for stand-by.

Only one propane vaporizer will be required for each boiler in service. The third vaporizer serves as a standby unit.

3.3 SHUT DOWN

3.3.1 After refuse is burned out, secure the ammonia flow by placing FIC-1720 in manual with output set at 0%. Select HS-1720 to close.

3.3.2 Close the ammonia flow control valve isolation valves. Ensure that the bypass around FV-1720 is also closed.

3.3.3 If the entire plant is being secured, secure the vaporizers by selecting the individual control switches to off. Close the vaporizer inlet and outlet isolation valves.

3.3.4 Secure the carrier air flow by closing the appropriate carrier air control isolation valves.

3.3.5 As required, secure one or all of the denox air blowers.

3.4 AMMONIA DELIVERIES

In order to maintain an ammonia inventory on site the storage tank has to be periodically refilled. This is accomplished via tanker truck deliveries. The following procedure is to be followed regarding ammonia deliveries.

3.4.1 Verify the delivery truck has been weighed and record the starting weight.

3.4.2 Inspect the bill of lading. Confirm that the shipment is **Anhydrous Ammonia**. Inspect the invoice and assure that the quantity is correct.

3.4.3 Take a level reading and calculate the storage tank starting gallons. Assure that the shipment will fit into the tank.

3.4.4 Test the local emergency safety shower and eyewash station for proper operation.

3.4.5 Verify that a wash down hose is charged and available for use. Assure adequate access to chemical sorbet pillows.

3.4.6 Inspect the transfer area lighting for proper operation. Inspect all transfer valves, flanges, connections and equipment for potential leak problems.

3.4.7 Assure that the unloading area is free of hazards and that adequate truck space is available.

3.4.8 Once the truck is properly positioned for transfer, verify that the driver has disengaged the transmission and set the parking brake and blocked the wheels.

3.4.9 Don a complete set of chemical resistant personal protection gear.

3.4.10 Verify that the driver is wearing adequate personal protection gear.

3.4.11 Instruct the driver to make his transfer hose-to-truck hookup. Verify that the hose coupling is properly seated and secure.

3.4.12 Position the following isolation valves as indicated:

a) Storage tank isolation valve (AM-V-007) - **CLOSED**

b) Fill line isolation valve (AM-V-003) - **CLOSED**

c) Tank fill vent valve (AM-V-006) - **CLOSED**

d) Fill line drain valve (AM-V-004) - **CLOSED**

e) Vent line drain valve (AM-V-008) - **CLOSED**

3.4.13 Instruct the driver to connect the outlet of his transfer hose to the fill line hookup.

3.4.14 Instruct the driver to open his tank discharge valve. Inspect all couplings and the fill line area for leaks.

3.4.15 Open the tank vent valve AM-V-006.

3.4.16 Open the fill line isolation valve (AM-V-003).

3.4.17 Notify the driver that our system is ready to receive the <u>Anhydrous Ammonia</u>. The driver should now close his tank

vent and pressurize his tank to begin chemical transfer.

3.4.18 After the transfer is complete, ensure that all system pressure has been bled off through the storage tank vent. Verify that the driver has opened his tank vent.

3.4.19 Close and lock the fill line isolation valve (AM-V-003)

3.4.20 Verify that the driver has closed his tank discharge valve.

3.4.21 Open the storage tank isolation valve (AM-V-007)

3.4.22 Close the storage tank vent valve (AM-V-006).

3.4.23 Instruct the driver to disconnect the outlet of his transfer hose from the fill line hookup.

3.4.24 Position a clean five gallon bucket under the transfer hose-to-truck connection to catch any remaining chemical. Instruct the driver to disconnect his transfer hose from the truck.

3.4.25 Take a level reading and calculate the final gallons contained in the storage tank.

3.4.26 Verify the unloaded truck is reweighed. Record truck weight. Review, sign and obtain a copy of the completed invoice.

3.5 EMERGENCY OPERATIONS

3.5.1 Emergency Conditions Requiring Shut Down

The following require immediate shut down of either the thermal denox system operations or ammonia loading operation:

a. Tank rupture;
b. Piping rupture;
c. Fire in the storage area;
d. Emergency boiler shut down;
e. Loss of carrier air;
d. Truck movement during loading;
f. Truck hose rupture;
h. Relief valve opens;
g. Tank pressure exceed relief valve setting.

If any of the above occur the operators must immediately secure the Thermal Denox system to prevent further chemical spill.

3.5.2 Emergency Shut Down

3.5.2.1 Operators Assignments

Upon notification of an emergency situation the shift supervisor will assume the position of the scene leader. If the situation cannot be arrested immediately or further damage will occur the chief engineer and then the facility manager will be notified. The auxiliary engineers will assist the shift supervisors as directed. The control room operator will remain in the control room and direct communications and remote equipment operations.

3.5.4 Shut Down Procedures

3.5.4.1 If there is a uncontrollable release downstream of the vaporizers the ammonia tank should be secured immediately by closing valve AM-V-007. If the leak occurs in the boiler enclosure secure the flow control valve FV-1720 for the applicable boiler from the DCS. After the tank is secured the vaporizers should turned off and the blowers allow to run until the ammonia vapors have dissipated. The system should be isolated and the leak repaired.

3.5.4.2 If there is an uncontrollable leak in the tank and vaporizer area secure the vaporizers immediately from the DCS. Pressurize the fire system and don emergency gear which includes a self contained breathing apparatus. Follow a fog spray of water to the tank shut off valve and secured AM-V-007 tank shut off valve. Secure the blowers and flow control valve FV-1720. Upon securing the tank set up portable blowers to dissipate the ammonia.

3.5.4.3 Upon tank rupture or fire in the tank area: Secure all Denox equipment and notify local authorities. Pressurize the fire system and don emergency gear which includes a self contained breathing apparatus; Direct a steam and or fog of water on the tank. Set up emergency blowers to dissipate the gas.

3.5.5 Start Up Following an Emergency Shut Down

Ensure integrity of the system by applying carrier air at maximum pressure inspecting for leaks.

If tank exceed its MAWP by 1 and 1/2 times call local supplier to assist in draining tank. Inspect tank using an approved non-destructive testing methods by trained

inspectors.

Upon recertification of tank and system integrity ensured, start the system at low load using ammonia. Walk down the system with protective gear and self contained breathing apparatus with a gas detection meter. After this inspection the system can be brought up to full pressure and flow.

3.6 OPERATING LIMITS

3.6.1 Operating Limits

Tank Maximum Allowable Working Pressure (MAWP): PSIG
Area concentrations of Ammonia Gas: Trace smell
Maximum allowable level: 3%
Piping MAWP: 250
Maximum Ammonia Flow: to be determined during acceptance
Maximum Vaporizer Temperature: 150°F

3.6.2 Consequences of Deviations

3.6.2.1 Allowing the tank MAWP to rise above 300 PSIG will cause the tank relief valve to lift releasing gaseous ammonia to the atmosphere. If the relief valve were to stay close possible catastrophic tank failure could occur.

3.6.2.2 Allowing the concentrations of ammonia gas to the trace smell level means that there is a leak in the area which needs to be corrected immediately. Not correcting could lead to eventually emptying the tank with possible personal exposures above the maximum OSHA limits.

3.6.2.3 Allowing the maximum allowable level of ammonia above 3% will cause personnel exposures above the short term limits.

3.6.2.3 Allowing the piping to run above the MAWP may cause the piping and subsequential the tank's pressure relief valve to lift dumping gaseous ammonia to the atmosphere. Continuing to run in this mode will cause a catastrophic piping failure.

3.6.2.4 Allowing the system to run above the maximum ammonia flow will release excessive amounts into the atmosphere. These amounts may be in violation of the air permit.

3.6.2.5 Allowing the vaporizers to exceed their temperature will cause the tank to overpressurized leading to gas release and possible tank rupture.

3.6.3 Steps to Correct or Avoid Deviations

3.6.3.1 Ensure tank relief valve is working properly, vaporizers are not exceeding their maximum settings and that the tank is not overfilled.

3.6.3.2 Fix all leaks immediately. Do not exceed system pressure allowing the relief valves to lift.

3.6.3.3 Fix all leaks immediately if a large leak occurs ensure set up temporary ventilation to keep the ammonia gas level as low as possible. If a large leak is noted and can not be isolated, spray with a fog fire hose nozzles to reduce the concentration.

3.6.3.4 Monitor system temperatures and pressures and if any deviations occur investigate and correct immediately.

3.6.3.5 Monitor system flows rates and if any deviations occur investigate and correct immediately.

3.6.3.6 Monitor vaporizers temperatures and if any deviations occur investigate and correct immediately.

3.7 SAFETY AND HEALTH CONSIDERATIONS

3.7.1 Ammonia Properties

The term "anhydrous ammonia" refers to a compound of the formula NH_3 formed by the chemical combination of nitrogen and hydrogen. The household common chemical referred to as ammonia is actually a mixture of water and ammonia or "aqueous ammonia" and normally with only a concentration of 2% to 4%. These should never be confused with "anhydrous ammonia" which has a much greater hazard potential. (Anhydrous means free from water).

At room temperature and atmospheric pressure, ammonia is a pungent, colorless gas approximately 49% lighter than air. Compressed and cooled, ammonia gas condenses to a colorless liquid about 68% as heavy a water. At atmospheric pressure, the liquid boils at -28°F.

Ammonia is most frequently shipped by highway and rail and stored in pressure containers as a liquefied compressed gas at ambient temperatures.

In a container, ammonia in the liquid normally coexisting with its vapor. Temperature affects both the vapor pressure and volume of liquid ammonia. As the temperature of the liquid rises, the vapor above the liquid phase

exerts increased pressure. For example, in an ammonia cylinder at 65°F loaded to its maximum allowable limit, the vapor phase occupies about 12% of the total cylinder volume. This vapor space would be completely filled with liquid ammonia if its temperature rise were permitted to reach 145°F. Upon further rise the cylinder will bulge and could rupture due to the internal hydrostatic pressure caused by the expanding liquid.

3.7.2 Exposure Prevention Methods

3.7.2.1 Ammonia acts as an irritant to human tissue in varying degrees depending upon the concentration and exposures. The pungent and distinctive odor of the vapor even at low concentrations, provides adequate warning so that no person will voluntary remain in concentrations which are hazardous.

3.7.2.2 Ammonia in the presence of water is highly alkaline. Contact of the skin or mucosa with liquid ammonia of a high concentration of vapor can result in a caustic burn. Also since liquid ammonia boils at -28°F contact with the skin can cause frostbite.

3.7.2.3 OSHA regulations require that a employees short term exposure limit for ammonia not to exceed a time weighted average of 35 ppm ammonia in air by volume in any 15 minute period.

3.7.2.4 Operators or maintenance staff working around a contained ammonia must don the following: Flexible fitting hooded ventilation goggles; rubber or plastic gauntlet gloves impervious to ammonia.

3.7.2.4 Operators and maintenance staff working around a known minor leak (less than 3%) shall don the above mention gear with a full face gas mask with an ammonia (green) or a universal (red) industrial size canister approved by MSHA/NIOSH. These canisters are limited to brief periods of not to exceed 15 minutes with concentrations of ammonia not to exceed 3%. When wearing the mask if any odor of ammonia is detected leave the area immediately.

3.7.2.5 For protection where ammonia concentrations are unknown or known to exceed 3% or in oxygen deficient atmospheres, a Self-Contained Air Breathing Apparatus of an approved pressure demand types must be used.

3.7.3 Measures to be taken if Exposed;

3.7.3.1 Skin/Eye/Mucosa Contact

Ammonia is one of the most water soluble of all gases. Accordingly, the best means of providing first aid caused by ammonia contact with skin/eyes/mucosa is to flush immediately the injury area with large quantities of clean water. Promptness in initiating treatment, using adequate quantities of water and continuing its application for at least fifteen minutes or longer if necessary.

3.7.3.2 Inhalation

A person overcome by ammonia must be carried to a location free of ammonia and the emergency medical assistant summoned immediately. If the person is not breathing the airway should be cleared and artificial respiration started immediately.

3.7.4 Quality Control of Chemicals

All standards or specifications for anhydrous ammonia call some minimum assay or content of ammonia and some maximum content of moisture an oil. The assay measurements should be check at each shipments for acceptable levels.

4.0 REFERENCES

4.1 PIPING AND INSTRUMENTATION DRAWINGS

Description	Drawing Number
SNCR	7102-E-220128
Combustion Air and Flue Gas	7102-E-220103

4.2 LOGIC DIAGRAMS

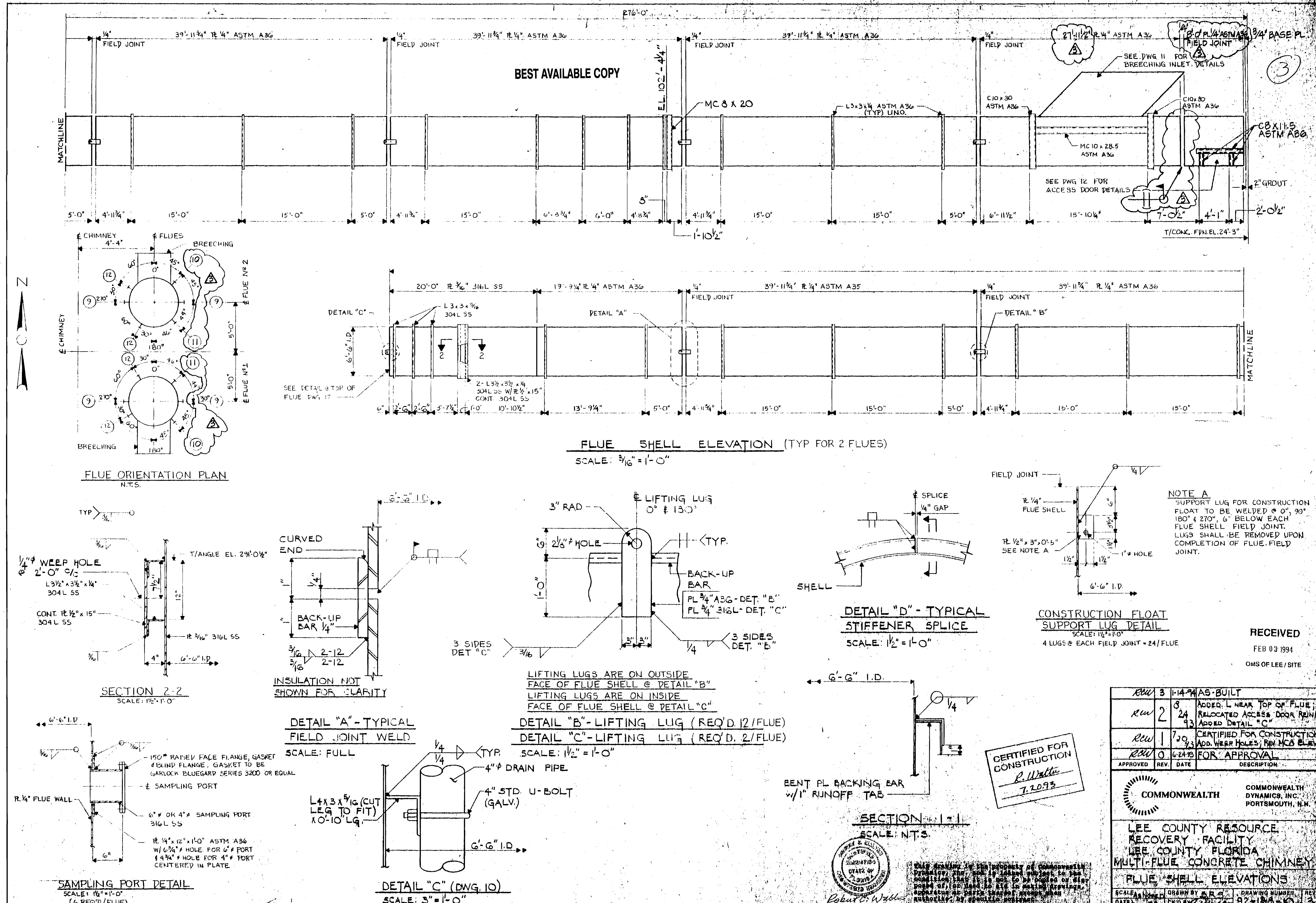
Description	Drawing Number
SNCR	510018

4.3 VENDOR MANUALS

Vendor	Equipment	Equipment Manual
Dresser/Roots	Blower	O&M Manual
Sam Dick	Vaporizers	O&M Manual

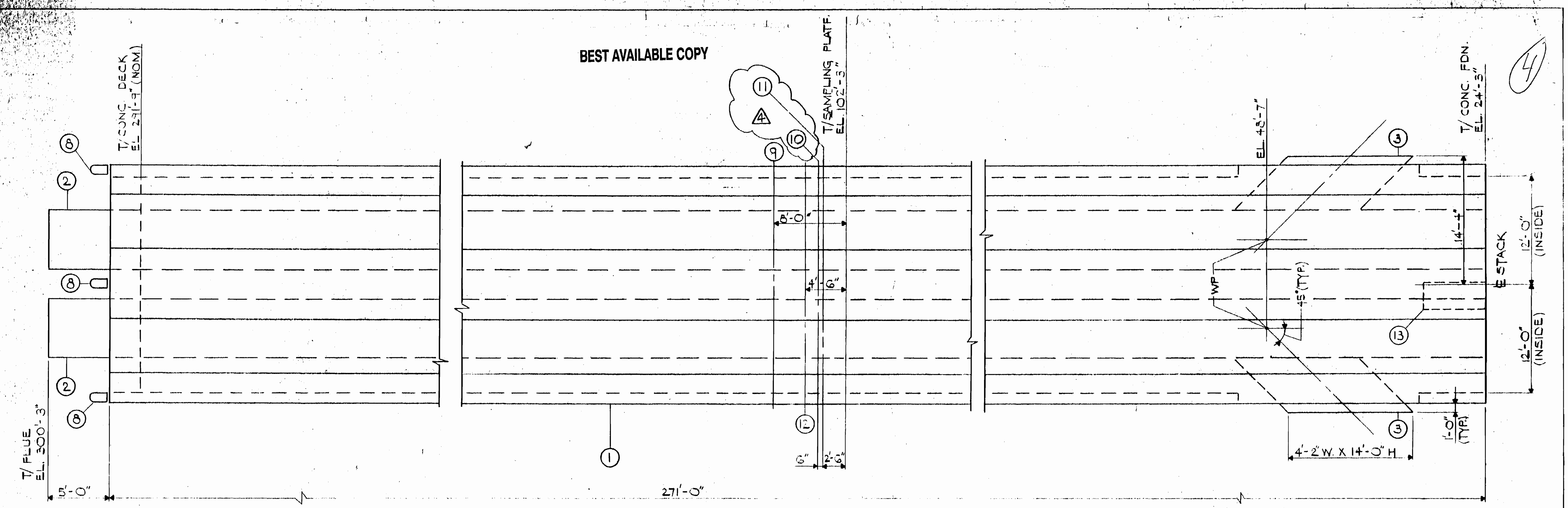
Description of Stack Sampling Facilities

Exhibit 12



BEST AVAILABLE COPY
276'-0"
39'-11¾" PL ¼" ASTM A36
¼" FIELD JOINT
EL. 102'-4¼"
MC 8 X 20
L3x3x¼ ASTM A36 (TYP) U.N.O.
C10x30 ASTM A36
SEE DWG 11 FOR BREECHING INLET DETAILS
MC 10 x 28.5 ASTM A36
C8X11.5 ASTM A36
SEE DWG 12 FOR ACCESS DOOR DETAILS
¾" BASE PL.
2" GROUT
T/CONC. FDN.EL.24'-3"
MATCHLINE
FLUE ORIENTATION PLAN
N.T.S.
℄ CHIMNEY
℄ FLUES
BREECHING
℄ FLUE Nº 2
℄ FLUE Nº 1
FLUE SHELL ELEVATION (TYP FOR 2 FLUES)
SCALE: 3/16" = 1'-0"
20'-0" PL 3/16" 316L SS
19'-9¼" PL ¼" ASTM A36
39'-11¾" PL ¼" ASTM A35
39'-11¾" PL ¼" ASTM A36
DETAIL "C"
DETAIL "A"
DETAIL "B"
L 3x3x5/16 304L SS
2-L3½x3½x¼ 304L SS W/ PL ½"x15" CONT. 304L SS
SEE DETAIL @ TOP OF FLUE DWG 17
6'-6" I.D.
SECTION 2-2
SCALE: 1½"=1'-0"
¼"Ø WEEP HOLE @ 2'-0" C/C
L3½"x3½"x¼" 304L SS
CONT. PL ½"x15" 304L SS
T/ANGLE EL. 291'-0½"
PL 3/16" 316L SS
CURVED END
BACK-UP BAR ¼"
INSULATION NOT SHOWN FOR CLARITY
DETAIL "A" - TYPICAL FIELD JOINT WELD
SCALE: FULL
℄ LIFTING LUG 0° & 180°
3" RAD
2⅛"Ø HOLE
BACK-UP BAR
PL ¾" A36 - DET. "B"
PL ¾" 316L - DET. "C"
3 SIDES DET "C"
3 SIDES DET. "B"
LIFTING LUGS ARE ON OUTSIDE FACE OF FLUE SHELL @ DETAIL "B"
LIFTING LUGS ARE ON INSIDE FACE OF FLUE SHELL @ DETAIL "C"
DETAIL "B" - LIFTING LUG (REQ'D. 12/FLUE)
DETAIL "C" - LIFTING LUG (REQ'D. 2/FLUE)
SCALE: 1½" = 1'-0"
℄ SPLICE
¼" GAP
SHELL
DETAIL "D" - TYPICAL STIFFENER SPLICE
SCALE: 1½" = 1'-0"
FIELD JOINT
PL ¼" FLUE SHELL
PL ½" x 3" x 0'-5" SEE NOTE A
1"Ø HOLE
CONSTRUCTION FLOAT SUPPORT LUG DETAIL
SCALE: 1½"=1'-0"
4 LUGS @ EACH FIELD JOINT = 24/FLUE
NOTE A
SUPPORT LUG FOR CONSTRUCTION FLOAT TO BE WELDED @ 0°, 90°, 180° & 270°, 6" BELOW EACH FLUE SHELL FIELD JOINT. LUGS SHALL BE REMOVED UPON COMPLETION OF FLUE FIELD JOINT.
RECEIVED
FEB 03 1994
OMS OF LEE / SITE
150# RAISED FACE FLANGE, GASKET & BLIND FLANGE. GASKET TO BE GARLOCK BLUEGARD SERIES 3200 OR EQUAL
℄ SAMPLING PORT
PL ¼" FLUE WALL
6"Ø OR 4"Ø SAMPLING PORT 316L SS
PL ¼" x 12" x 1'-0" ASTM A36 W/ 6¾"Ø HOLE FOR 6"Ø PORT & 4¾"Ø HOLE FOR 4"Ø PORT CENTERED IN PLATE
SAMPLING PORT DETAIL
SCALE: 1½"=1'-0"
(6 REQ'D/FLUE)
4"Ø DRAIN PIPE
4" STD. U-BOLT (GALV.)
L4x3x5/16 (CUT LEG TO FIT) x 0'-10" LG.
6'-6" I.D.
DETAIL "C" (DWG. 10)
SCALE: 3"=1'-0"
BENT PL BACKING BAR w/ 1" RUNOFF TAB
SECTION 1-1
SCALE: N.T.S.
CERTIFIED FOR CONSTRUCTION
7.20.93
REV 3 1-14-94 AS-BUILT
REV 2 8-24-93 ADDED L NEAR TOP OF FLUE; RELOCATED ACCESS DOOR REINF.; ADDED DETAIL "C"
REV 1 7-20-93 CERTIFIED FOR CONSTRUCTION; ADD. WEEP HOLES; REV. MC8 ELEV.
REV 0 6-24-93 FOR APPROVAL
APPROVED REV. DATE DESCRIPTION
COMMONWEALTH
COMMONWEALTH DYNAMICS, INC. PORTSMOUTH, N.H.
LEE COUNTY RESOURCE RECOVERY FACILITY LEE COUNTY, FLORIDA
MULTI-FLUE CONCRETE CHIMNEY
FLUE SHELL ELEVATIONS

BEST AVAILABLE COPY

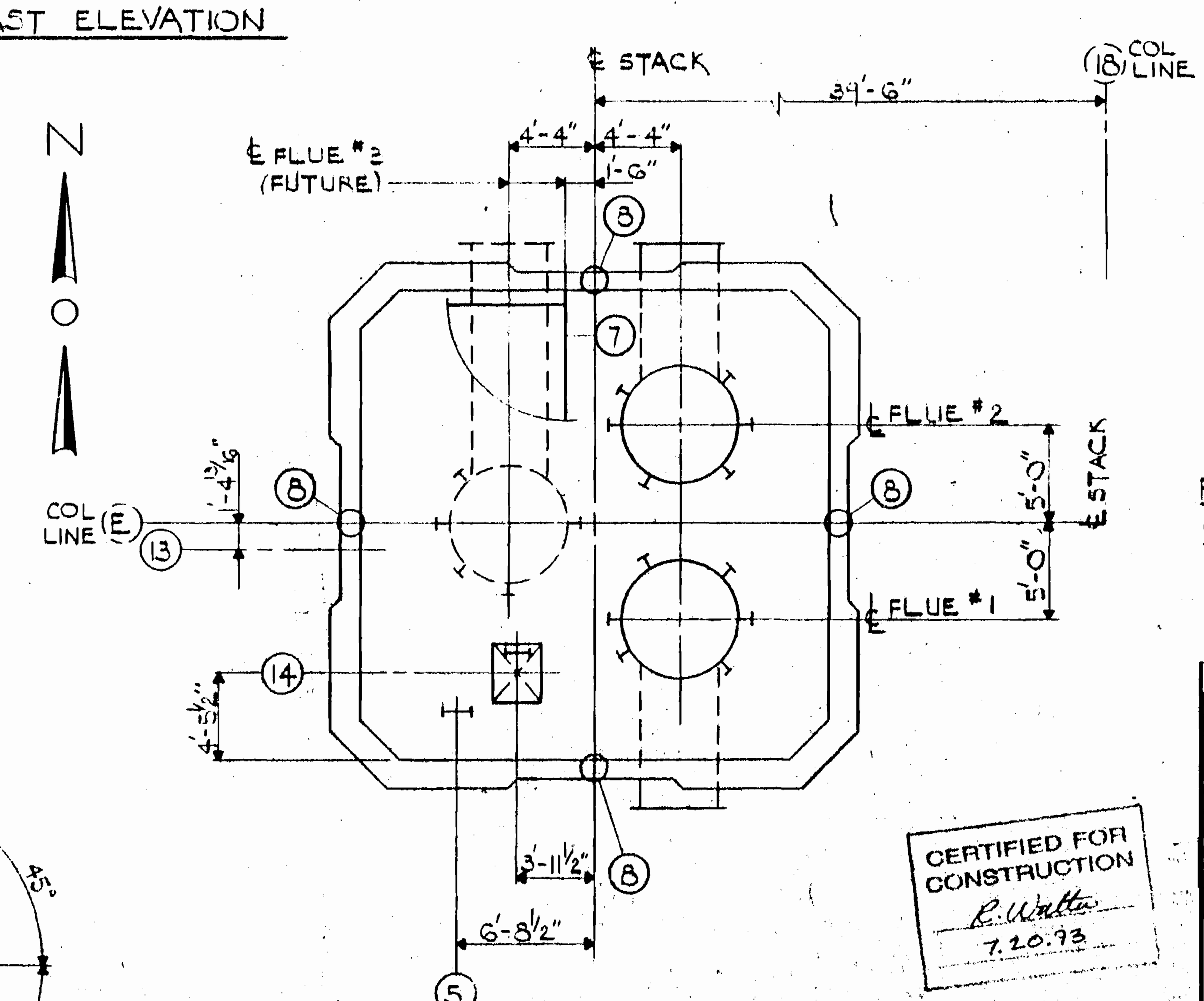


STACK EAST ELEVATION

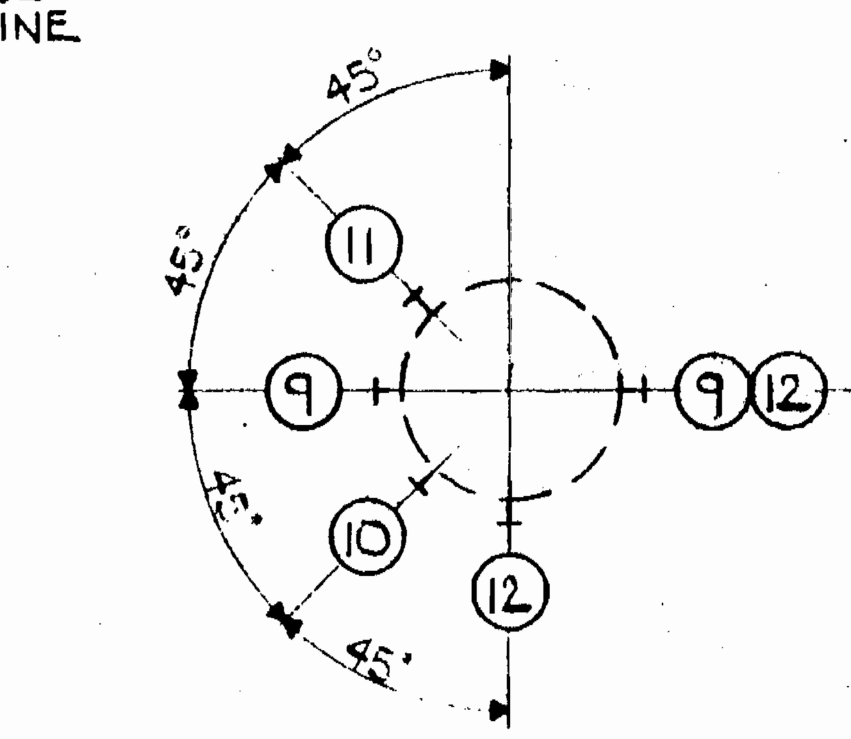
DRAWING NO.	TITLE
92-188-1	GENERAL ARRANGEMENT
92-188-2	FOUNDATION DOWEL ARRANGEMENT
92-188-3	SHELL CONSTRUCTION LAYOUT
92-188-4	START OF VERT. REINF. & DETAILS
92-188-5	REINFORCING DETAILS
92-188-6	BAR LIST & REG. REINF. PLACEMENT SCH.
92-188-7	ROOF FRAMING STEEL
92-188-8	SAMPLING PLATFORM
92-188-9	SAFETY CLIMB LADDER
92-188-10	FLUE SHELL ELEVATIONS
92-188-11	FLUE BASE & BREECHES PLAN SECTIONS & DETAILS
92-188-12	ACCESS DOORS
92-188-13	SAMPLING PLATF. SECTS. & DETS.
92-188-14	SAMPLING PLATF. SECTS. & DETS.
92-188-15	MISC. FRAMING SECTIONS & DETAILS
92-188-16	CONCRETE ROOF PLAN
92-188-17	INSULATION & SIDING DETAILS
92-188-18	PERSONNEL PROTECTION DETAILS
92-188-19	ROOF DRAIN
92-188-20	MASONRY CLOSURE DETAILS
92-188-21	ELEV., PLAN VIEWS & BILL OF MATERIAL
92-188-22	RISER AND WIRING DIAGRAMS
92-188-23	LIGHTNING PROTECTION SYSTEM

ITEM LIST

ITEM	Nº REQD	DESCRIPTION	DWG Nº
1	1	CONCRETE STACK	2-6
2	2	FLUE (6'-6" I.D.)	10 & 12
3	2	BREECHING INLET	11
4	2	ACCESS DOOR (FLUE)	12
5	1	SAFETY CLIMB LADDER	9
6	1	SAMPLING PLATFORM	8,13,14 & 15
7	1	HOISTING DAVIT (500# CAP.)	18
8	4	AVIATION LIGHTS	21,22 & 23
9	2	OPACITY PORTS (4"φ)	10
10	1	C.E.M. PORT (4"φ)	10
11	1	C.E.M. TEST PORT (4"φ)	10
12	2	SAMPLING PORTS (6"φ)	10
13	1	MAN DOOR (3'W. x 7'H.)	20
14	1	ROOF HATCH	7 & 16

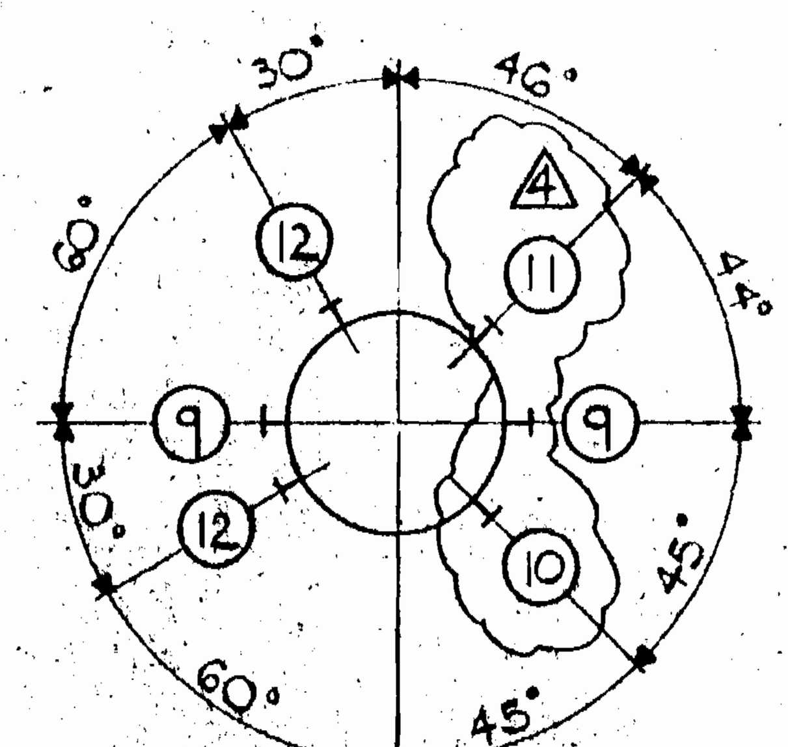


STACK ORIENTATION PLAN

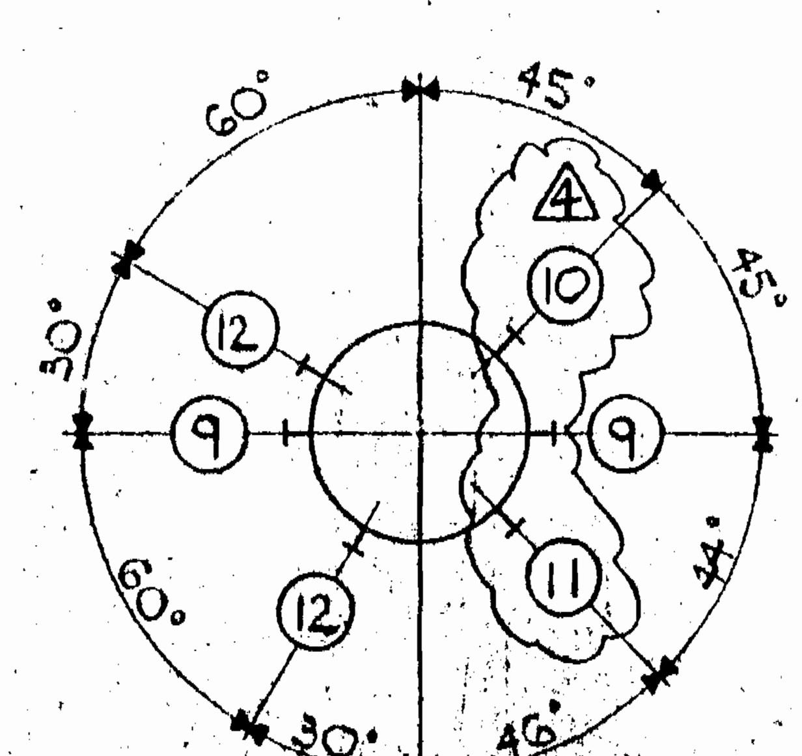


FLUE #3 (FUTURE) ORIENTATION OF PORTS

RECEIVED
FEB 03 1994
CMS OF LEE / SITE



FLUE #1 ORIENTATION OF PORTS



FLUE #2 ORIENTATION OF PORT

CERTIFIED FOR CONSTRUCTION
R. Walter
7.20.93

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Robert Walter 1.7.94

APPROVED	REV.	DATE	DESCRIPTION
RCW	4	1-14-94	AS-BUILT
RCW	3	7.20.93	CERTIFIED FOR CONSTRUCTION
RCW	2	6-21-93	REV. ELEVS., DWG. TITLES & DUCT WITH ADD. DWGS. & ROOF HATCH; RELOCATED DOOR
RW	1	5-10-93	REV. DUCT WITH ADD. DWG. TITLES 3-6, REV. PORT SIZE & LOCATION, RAISED PLATF.
RCW	0	4-6-93	FOR APPROVAL

COMMONWEALTH
COMMONWEALTH DYNAMICS, INC. PORTSMOUTH, N.H.

LEE COUNTY RESOURCE RECOVERY FACILITY
LEE COUNTY FLORIDA
MULTI-FLUE CONCRETE CHIMNEY
GENERAL ARRANGEMENT

SCALE: As noted | DRAWN BY: GRS | DATE: APR. 93 | CKD BY: R. Walter | DRAWING NUMBER: 92-188-1 | REV: 4

Compliance Test Report

Exhibit 13

RESULTS

Table 2-1
Unit 1 Stack - Particulate and Visible Emissions

Run No.		1	2	3	Average
Date (1994)		October 17	October 17	October 17	
Start Time (approx.)		09:38	12:41	17:10	
Stop Time (approx.)		12:03	16:26	21:04	
Gas Conditions					
T_s	Temperature (°F)	286	291	292	**289**
B_{wo}	Moisture (volume %)	16.96	15.50	15.91	**16.12**
O_2	Oxygen (dry volume %)	11.1	10.8	10.8	**10.9**
CO_2	Carbon dioxide (dry volume %)	8.7	8.4	8.5	**8.5**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	141,500	142,100	151,700	**145,100**
Q_{std}	Standard conditions (dscfm)	83,690	84,940	90,110	**86,250**
Particulate					
C	Concentration (gr/dscf)	0.0004	0.0005	0.0003	**0.0004**
C	Corrected to 7% O_2 (gr/dscf)	0.0006	0.0006	0.0005	**0.0006**
C	Corrected to 12% CO_2 (gr/dscf)	0.0006	0.0007	0.0005	**0.0006**
E	Emission rate (lb/hr)	0.304	0.333	0.253	**0.297**
E	Emission rate (lb/10^6Btu)[1]	1.26E-03	1.32E-03	9.49E-04	**1.18E-03**
E	Emission rate (ton/yr)[2]	1.41	1.52	1.09	**1.34**
Visible Emissions					
Start Time (approx.)		09:45	12:45	17:10	
Stop Time (approx.)		10:45	13:45	18:10	
	Average opacity	0	0	0	**0**
	Maximum reading	0	0	0	**0**

[1] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-2
Unit 1 and 2 Stacks - Particulate (Soot Blow)

Run No.		Unit 1 Stack Soot Blow	Unit 2 Stack Soot Blow
Date (1994)		October 19	October 25
Start Time (approx.)		08:33	08:29
Stop Time (approx.)		10:39	10:44
Gas Conditions			
T_s	Temperature (°F)	290	295
B_{wo}	Moisture (volume %)	14.95	18.24
O_2	Oxygen (dry volume %)	10.9	10.9
CO_2	Carbon dioxide (dry volume %)	8.9	9.0
Volumetric Flow Rate			
Q_a	Actual conditions (acfm)	155,400	165,600
Q_{std}	Standard conditions (dscfm)	93,540	94,970
Particulate			
C	Concentration (gr/dscf)	0.0006	0.0004
C	Corrected to 7% O_2 (gr/dscf)	0.0009	0.0006
C	Corrected to 12% CO_2 (gr/dscf)	0.0008	0.0006
E	Emission rate (lb/hr)	0.50	0.35
E	Emission rate (lb/10^6Btu)[1]	1.80E-03	1.27E-03
E	Emission rate (ton/yr)[2]	2.05	1.47
Visible Emissions			
Start Time (approx.)		09:00	08:35
Stop Time (approx.)		10:00	09:35
	Average opacity	0	0
	Maximum reading	0	0

[1] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm for Unit 1 and 90,110 dscfm for Unit 2) assuming 100% availability of the unit.

RESULTS

Table 2-3
Unit 1 Stack - Sulfuric Acid Mist

Run No.[1]		1	4	5	Average
Date (1994)		October 25	October 26	October 26	
Start Time (approx.)		16:43	13:54	14:56	
Stop Time (approx.)		18:42	14:56	16:16	
Gas Conditions					
T_s	Temperature (°F)	317	293	284	294
B_{wo}	Moisture (volume %)	17.03	17.03	17.30	17.07
O_2	Oxygen (dry volume %)	11.4	10.7	10.0	10.5
CO_2	Carbon dioxide (dry volume %)	8.6	8.9	8.8	8.9
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	155,500	149,900	147,900	146,600
Q_{std}	Standard conditions (dscfm)	87,910	87,490	87,090	85,400
Sulfuric Acid Mist					
C	Concentration as SO_2 (ppmdv)	3.0	2.4	1.7	2.4
C	Concentration corrected to 7% O_2 (ppm)	4.4	3.3	2.0	3.3
C	Concentration corrected to 12% CO_2 (ppm)	4.2	3.3	2.3	3.3
E	Emission rate (lb/hr)	4.1	3.3	2.3	3.2
E	Emission rate (lb/10^6Btu)[2]	0.016	0.012	0.0080	0.012
E	Emission rate (ton/yr)[3]	18	14	10	14

[1] The sample obtained during Run 2 was contaminated with $KMnO_4/H_2SO_4$. Run 3 was aborted due to a contaminated probe.

[2] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

[3] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-4
Unit 1 Stack - Lead

Run No.		1	2	3	Average
Date (1994)		October 19	October 20	October 20	
Start Time (approx.)		19:22	08:45	12:58	
Stop Time (approx.)		21:28	12:00	15:34	
Gas Conditions					
T_s	Temperature (°F)	285	291	291	**289**
B_{wo}	Moisture (volume %)	16.99	17.02	16.96	**16.99**
O_2	Oxygen (dry volume %)	10.9	11.0	11.0	**11.0**
CO_2	Carbon dioxide (dry volume %)	9.0	8.8	9.2	**9.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	144,300	152,700	155,200	**150,700**
Q_{std}	Standard conditions (dscfm)	85,270	89,570	91,180	**88,670**
Lead (Pb)[1]					
C	Concentration (µg/dscm)	<2.6	<2.4	<2.4	**<2.5**
C	Concentration @ 7% O_2 (µg/dscm)	<3.7	<3.4	<3.4	**<3.5**
C	Concentration @ 12% CO_2 (µg/dscm)	<3.5	<3.3	<3.2	**<3.3**
C	Concentration (gr/dscf)	<1.2E-06	<1.1E-06	<1.1E-06	**<1.1E-06**
C	Concentration @ 7% O_2 (gr/dscf)	<1.6E-06	<1.5E-06	<1.5E-06	**<1.5E-06**
C	Concentration @ 12% CO_2 (gr/dscf)	<1.5E-06	<1.5E-06	<1.4E-06	**<1.5E-06**
E	Emission rate (lb/hr)	<8.4E-04	<8.2E-04	<8.3E-04	**<8.3E-04**
E	Emission rate (tons/yr)[2]	<3.8E-03	<3.5E-03	<3.5E-03	**<3.6E-03**
E	Emission rate (lb/10^6Btu)[3]	<3.3E-06	<3.1E-06	<3.0E-06	**<3.1E-06**

[1] See Project Overview for discussion of laboratory results.
[2] Calculated using an F_d factor of 9,570 dscf/10^6Btu.
[3] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-5
Unit 1 Stack - Fluoride

Run No.		1	2	3	Average
Date (1994)		October 19	October 19	October 19	
Start Time (approx.)		12:21	13:44	15:15	
Stop Time (approx.)		13:21	14:54	16:23	
Gas Conditions					
T_s	Temperature (°F)	291	291	289	290
B_{wo}	Moisture (volume %)	16.48	17.67	16.08	16.74
O_2	Oxygen (dry volume %)	10.9	11.3	10.9	11.0
CO_2	Carbon dioxide (dry volume %)	8.7	8.4	8.3	8.5
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	148,400	146,100	144,000	146,200
Q_{std}	Standard conditions (dscfm)	87,630	84,980	85,600	86,070
Fluoride					
C	Concentration (ppmdv)	<0.033	<0.030	<0.032	<0.031
C	Concentration @ 7% O_2 (ppm)	<0.045	<0.043	<0.045	<0.044
C	Concentration @ 12% CO_2 (ppm)	<0.045	<0.043	<0.046	<0.045
E	Emission rate (lb/hr)	<8.9E-03	<7.9E-03	<8.6E-03	<8.5E-03
E	Emission rate (lb/10^6Btu)[1]	<3.4E-05	<3.2E-05	<3.3E-05	<3.3E-05
E	Emission rate (ton/yr)[2]	<0.039	<0.036	<0.039	<0.038

[1] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
< Indicates sample was below detectable limit.

RESULTS

Table 2-6
Unit 1 Stack - Volatile Organic Compounds and Total Hydrocarbons

Run No.	1	2	3	Average
Date (1994)	October 25	October 25	October 25	
Start Time (approx.)	10:53	13:16	15:37	
Stop Time (approx.)	12:53	15:16	17:37	
Gas Conditions[1]				
B_{wo} Moisture in sample (% by volume)	16.43	17.03	16.20	16.55
O_2 Oxygen (dry volume %)	10.8	10.8	10.9	10.8
CO_2 Carbon dioxide (dry volume%)	8.8	8.8	8.9	8.8
Flow Conditions[1]				
Q_a *Volumetric flow rate, actual (acfm)*	*156,400*	*160,200*	*152,300*	156,300
Q_{std} Volumetric flow rate, standard (dscfm)	92,730	93,790	90,650	92,390
Volatile Organic Compounds				
Benzene				
C Concentration (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 7% O_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<7E-06	<7E-06	<7E-06	<7E-06
E Emission rate (lb/10^6Btu)[3]	<6E-09	<6E-09	<6E-09	<6E-09
Toluene				
C Concentration (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 7% O_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<1E-05	<1E-05	<1E-05	<1E-05
E Emission rate (lb/10^6Btu)[3]	<8E-09	<8E-09	<9E-09	<8E-09
Ethylene Benzene				
C Concentration (ppmdv)	<1E-06	<1E-06	<1E-06	<1E-06
C Concentration corrected to 7% O_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppm)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<7E-06	<7E-06	<7E-06	<7E-06
E Emission rate (lb/10^6Btu)[3]	<6E-09	<6E-09	<6E-09	<6E-09
Xylene				
C Concentration (ppmdv)	<5.6E-06	<5.6E-06	<5.6E-06	<5.6E-06
C Concentration corrected to 7% O_2 (ppm)	<7.7E-06	<7.8E-06	<7.8E-06	<7.8E-06
C Concentration corrected to 12% CO_2 (ppm)	<7.6E-06	<7.7E-06	<7.6E-06	<7.6E-06
E Emission rate (lb/hr)	<8.6E-06	<8.7E-08	<8.4E-06	<8.6E-06
E Emission rate (ton/yr)[2]	<3.6E-05	<3.6E-05	<3.6E-05	<3.6E-05
E Emission rate (lb/10^6Btu)[3]	<3.1E-08	<3.1E-08	<3.1E-08	<3.1E-08
Total Hydrocarbons (as propane)				
C Concentration (ppmdv)	<1	<1	<1	<1
C Concentration corrected to 7% O_2 (ppm)	<2	<2	<2	<2
C Concentration corrected to 12% CO_2 (ppm)	<2	<2	<2	<2
E Emission rate (lb/hr)	<0.8	<0.8	<0.7	<0.8
E Emission rate (ton/yr)[2]	<3.3	<3.4	<3.3	<3.3
E Emission rate (lb/10^6Btu)[3]	<2.7E-03	<2.7E-03	<2.7E-03	<2.7E-03

< Denotes that the analyte was below the detectable limit.

[1] Gas and flow conditions are obtained from simultaneous Method 101A and 108 testing.

[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

[3] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-7
Unit 1 Stack - PCDDs (by individual cogener), Total TEF

Run No.		1	2	3	Average
Date (1994)		October 17	October 17	October 18	
Start Time (approx.)		08:43	14:39	09:00	
Stop Time (approx.)		13:42	18:49	13:10	
Gas Conditions					
T_s	Temperature (°F)	286	290	287	288
B_{wo}	Moisture (volume %)	17.00	16.20	17.01	16.74
O_2	Oxygen (dry volume %)	11.3	11.3	10.8	11.1
CO_2	Carbon dioxide (dry volume %)	8.5	8.6	8.9	8.7
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	159,100	158,000	152,500	156,500
Q_{std}	Standard conditions (dscfm)	94,190	93,760	90,010	92,650
PCDDs (Total TEF)					
2,3,7,8-TCDD					
C	Concentration @ 7% O_2 (ng/dscm)	ND	ND	ND	ND
E	Emission rate (lb/hr)	ND	ND	ND	ND
Other TCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.38E-01	1.06E-01	8.26E-02	1.09E-01
E	Emission rate (lb/hr)	3.37E-08	2.58E-08	2.12E-08	2.69E-08
1,2,3,7,8-PeCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.38E-02	1.39E-02	7.74E-03	1.18E-02
E	Emission rate (lb/hr)	3.37E-09	3.40E-09	1.98E-09	2.92E-09
Other PeCDD					
C	Concentration @ 7% O_2 (ng/dscm)	4.29E-01	3.49E-01	1.01E-01	2.93E-01
E	Emission rate (lb/hr)	1.04E-07	8.49E-08	2.58E-08	7.17E-08
1,2,3,4,7,8-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.94E-02	2.23E-02	1.55E-02	1.90E-02
E	Emission rate (lb/hr)	4.72E-09	5.44E-09	3.97E-09	4.71E-09
1,2,3,6,7,8-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	5.25E-02	4.46E-02	3.35E-02	4.36E-02
E	Emission rate (lb/hr)	1.28E-08	1.09E-08	8.60E-09	1.08E-08
1,2,3,7,8,9-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	7.19E-02	7.53E-02	5.16E-02	6.63E-02
E	Emission rate (lb/hr)	1.75E-08	1.83E-08	1.32E-08	1.64E-08
Other HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	5.20E-01	5.27E-01	3.64E-01	4.70E-01
E	Emission rate (lb/hr)	1.27E-07	1.28E-07	9.33E-08	1.16E-07
1,2,3,4,6,7,8-HpCDD					
C	Concentration @ 7% O_2 (ng/dscm)	3.04E-01	2.73E-01	2.22E-01	2.66E-01
E	Emission rate (lb/hr)	7.41E-08	6.66E-08	5.69E-08	6.59E-08
Other HpCDD					
C	Concentration @ 7% O_2 (ng/dscm)	3.32E-01	2.84E-01	2.17E-01	2.78E-01
E	Emission rate (lb/hr)	8.09E-08	6.93E-08	5.56E-08	6.86E-08
1,2,3,4,6,7,8,9-OCDD					
C	Concentration @ 7% O_2 (ng/dscm)	7.47E-01	4.74E-01	4.64E-01	5.62E-01
E	Emission rate (lb/hr)	1.82E-07	1.16E-07	1.19E-07	1.39E-07
Total PCDDs					
C	Concentration @ 7% O_2 (ng/dscm)	2.63	2.17	1.56	2.12E+00
E	Emission rate (lb/hr)	6.40E-07	5.29E-07	4.00E-07	5.23E-07

ND = Non-detected value.

RESULTS

Table 2-8
Unit 1 Stack - PCDFs (by individual cogener), Total TEF

Run No.	1	2	3	Average
Date (1994)	October 17	October 17	October 18	
Start Time (approx.)	08:43	14:39	09:00	
Stop Time (approx.)	13:42	18:49	13:10	
Gas Conditions				
T_s Temperature (°F)	286	290	287	288
B_{ws} Moisture (volume %)	17.00	18.20	17.01	16.74
O_2 Oxygen (dry volume %)	11.3	11.3	10.8	11.1
CO_2 Carbon dioxide (dry volume %)	8.5	8.6	8.9	8.7
Volumetric Flow Rate				
Q_s Actual conditions (acfm)	159,100	158,000	152,500	156,500
Q_{std} Standard conditions (dscfm)	94,190	93,760	90,010	92,650
PCDFs (Total TEF)				
2,3,7,8-TCDF				
C Concentration @ 7% O_2 (ng/dscm)	1.94E-02	1.95E-02	1.29E-02	1.73E-02
E Emission rate (lb/hr)	4.72E-09	4.76E-09	3.31E-09	4.26E-09
Other TCDF				
C Concentration @ 7% O_2 (ng/dscm)	7.82E-01	5.94E-01	4.77E-01	6.18E-01
E Emission rate (lb/hr)	1.91E-07	1.45E-07	1.22E-07	1.53E-07
1,2,3,7,8-PeCDF				
C Concentration @ 7% O_2 (ng/dscm)	4.42E-02	3.62E-02	2.06E-02	3.37E-02
E Emission rate (lb/hr)	1.08E-08	8.83E-09	5.29E-09	8.30E-09
2,3,4,7,8-PeCDF				
C Concentration @ 7% O_2 (ng/dscm)	8.29E-02	7.53E-02	4.64E-02	6.82E-02
E Emission rate (lb/hr)	2.02E-08	1.83E-08	1.19E-08	1.68E-08
Other PeCDF				
C Concentration @ 7% O_2 (ng/dscm)	8.96E-01	7.81E-01	4.49E-01	7.09E-01
E Emission rate (lb/hr)	2.18E-07	1.90E-07	1.15E-07	1.75E-07
1,2,3,4,7,8-HxCDF				
C Concentration @ 7% O_2 (ng/dscm)	2.16E-01	2.01E-01	1.44E-01	1.87E-01
E Emission rate (lb/hr)	5.26E-08	4.89E-08	3.70E-08	4.62E-08
1,2,3,6,7,8-HxCDF				
C Concentration @ 7% O_2 (ng/dscm)	5.81E-02	5.30E-02	3.87E-02	4.99E-02
E Emission rate (lb/hr)	1.41E-08	1.29E-08	9.92E-09	1.23E-08
2,3,4,6,7,8-HxCDF				
C Concentration @ 7% O_2 (ng/dscm)	1.08E-01	1.03E-01	8.00E-02	9.70E-02
E Emission rate (lb/hr)	2.63E-08	2.51E-08	2.05E-08	2.40E-08
1,2,3,7,8,9-HxCDF				
C Concentration @ 7% O_2 (ng/dscm)	2.76E-03	2.79E-03	ND	1.85E-03
E Emission rate (lb/hr)	6.74E-10	6.79E-10	ND	4.51E-10
Other HxCDF				
C Concentration @ 7% O_2 (ng/dscm)	3.90E-01	3.37E-01	2.27E-01	3.18E-01
E Emission rate (lb/hr)	9.50E-08	8.22E-08	5.82E-08	7.85E-08
1,2,3,4,6,7,8-HpCDF				
C Concentration @ 7% O_2 (ng/dscm)	5.61E-01	4.74E-01	4.13E-01	4.89E-01
E Emission rate (lb/hr)	1.41E-07	1.16E-07	1.06E-07	1.21E-07
1,2,3,4,7,8,9-HpCDF				
C Concentration @ 7% O_2 (ng/dscm)	ND	1.67E-02	1.29E-02	9.88E-03
E Emission rate (lb/hr)	ND	4.08E-09	3.31E-09	2.46E-09
Other HpCDF				
C Concentration @ 7% O_2 (ng/dscm)	1.11E-01	8.89E-02	9.03E-02	8.93E-02
E Emission rate (lb/hr)	2.70E-08	1.63E-08	2.32E-08	2.21E-08
OCDF				
C Concentration @ 7% O_2 (ng/dscm)	1.74E-01	1.14E-01	1.11E-01	1.33E-01
E Emission rate (lb/hr)	4.24E-08	2.79E-08	2.84E-08	3.29E-08
Total PCDFs				
C Concentration @ 7% O_2 (ng/dscm)	3.48	2.87	2.12	2.82
E Emission rate (lb/hr)	8.44E-07	7.01E-07	5.44E-07	6.96E-07

ND = Non-detected value.

RESULTS

Table 2-9
Unit 1 Stack - PCDDs and PCDFs, Total TEF

Run No.		1	2	3	Average
Date (1994)		October 17	October 17	October 18	
Start Time (approx.)		08:43	14:39	09:00	
Stop Time (approx.)		13:42	18:49	13:10	
Gas Conditions					
T_s	Temperature (°F)	286	290	287	288
B_{wo}	Moisture (volume %)	17.00	16.20	17.01	16.74
O_2	Oxygen (dry volume %)	11.3	11.3	10.8	11.1
CO_2	Carbon dioxide (dry volume %)	8.5	8.6	8.9	8.7
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	159,100	158,000	152,500	156,500
Q_{std}	Standard conditions (dscfm)	94,190	93,760	90,010	92,650
Total PCDDs and PCDFs (Total TEF)					
C	Concentration (ng/dscm)	4.21	3.48	2.68	3.46
C	Concentration @ 7% O_2 (ng/dscm)	6.09	5.04	3.68	4.94
C	Concentration @ 12% CO_2 (ng/dscm)	5.94	4.86	3.61	4.80
E	Emission rate (lb/hr)	1.48E-06	1.23E-06	9.44E-07	1.22E-06
E	Emission rate (ton/yr)[1]	6.12E-06	5.09E-06	4.07E-06	5.09E-06
E	Emission rate (lb/10^6Btu)[2]	5.47E-09	4.53E-09	3.31E-09	4.44E-09

[1] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
[2] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-10
Unit 1 SDA Inlet and Stack - Sulfur Dioxide (by EPA M6C) and Hydrogen Chloride

Run No.		1	2	3	Average
Date (1994)		October 24	October 24	October 24	
Start Time (approx.)		10:18	12:03	13:35	
Stop Time (approx.)		11:18	13:03	15:02	
Outlet Gas Conditions					
T_s	Temperature (°F)	283	283	281	**282**
B_{wo}	Moisture (volume %)	17.35	16.45	16.35	**16.72**
O_2	Oxygen (dry volume %)	11.2	10.9	11.0	**11.0**
CO_2	Carbon dioxide (dry volume %)	8.9	9.1	9.0	**9.0**
Q_{std}	Volumetric flow rate (dscfm)[1]	99,150	96,170	96,170	**97,160**
Sulfur Dioxide					
Unit 1 SDA Inlet					
C	Concentration (ppmdv)	56	85	115	**85.3**
C	Concentration @ 7% O_2 (ppm)	74	108	146	**109**
C	Concentration@ 12% CO_2 (ppm)	75	113	148	**112**
Unit 1 Stack					
C	Concentration (ppmdv)	1	8	8	**5.9**
C	Concentration @ 7% O_2 (ppm)	2	11	11	**7.9**
C	Concentration@ 12% CO_2 (ppm)	2	11	10	**7.8**
E	Emission rate (lb/hr)	1.4	8.0	7.5	**5.65**
E	Emission (ton/yr)[2]	5.7	32.2	30.4	**22.7**
E	Emission rate (lb/10^6Btu)[3]	0.0048	0.0269	0.0253	**0.0190**
RE	Removal Efficiency (%)[4]	97.3	89.6	92.8	**93.2**
Hydrogen Chloride					
Unit 1 SDA Inlet					
C	Concentration (ppmdv)	486	615	623	**575**
C	Concentration @ 7% O_2 (ppm)	690	846	875	**804**
C	Concentration@ 12% CO_2 (ppm)	656	829	831	**772**
Unit 1 Stack					
C	Concentration (ppmdv)	6.60	12.5	14.0	**11.0**
C	Concentration @ 7% O_2 (ppm)	9.46	17.4	19.6	**15.5**
C	Concentration@ 12% CO_2 (ppm)	8.90	16.5	18.6	**14.7**
E	Emission rate (lb/hr)	3.72	6.83	7.63	**6.1**
E	Emission (ton/yr)[2]	14.5	27.6	30.8	**24.3**
E	Emission rate (lb/10^6Btu)[3]	0.0129	0.0237	0.0267	**0.0211**
RE	Removal Efficiency (%)[4]	98.6	97.9	97.8	**98.1**

[1] Volumetric flow rate obtained from simultaneous Method 201A Testing.
[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
[3] Calculated using an F_d factor of 9,570 dscf/10^6Btu.
[4] Removal efficiency was based on ppm @ 7% O_2.

RESULTS

Table 2-11
Unit 1 Stack - Ammonia

Run No.		1	2	3	Average
Date (1994)		October 18	October 18	October 18	
Start Time (approx.)		09:10	13:46	15:13	
Stop Time (approx.)		10:10	14:46	16:13	
Gas Conditions					
T_s	Temperature (°F)	286	289	292	**289**
B_{wo}	Moisture (volume %)	16.60	16.17	15.03	**15.93**
O_2	Oxygen (dry volume %)	10.6	11.2	11.2	**11.0**
CO_2	Carbon dioxide (dry volume %)	9.1	8.8	8.7	**8.9**
Ammonia					
C	Concentration (ppmdv)	0.90	1.05	0.76	**0.91**
C	Concentration @ 7% O_2 (ppm)	1.21	1.51	1.09	**1.27**
C	Concentration@ 12% CO_2 (ppm)	1.19	1.44	1.05	**1.22**

RESULTS

Table 2-12
Unit 1 SDA Inlet and Stack - Mercury

Run No.[1]		1	2	4	Average
Date (1994)		October 25	October 25	October 26	
Start Time (approx.)		08:23	11:49	08:28	
Stop Time (approx.)		11:13	14:37	11:08	
Unit 1 SDA Inlet					
Gas Conditions					
T_s	Temperature (°F)	402	408	407	405
B_{wo}	Moisture (volume %)	13.16	13.65	14.37	13.73
O_2	Oxygen (dry volume %)	10.7	10.8	10.6	10.7
CO_2	Carbon dioxide (dry volume %)	9.1	9.0	9.0	9.0
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	170,800	179,100	176,000	175,300
Q_{std}	Standard conditions (dscfm)	90,970	94,260	91,800	92,340
Mercury					
C	Concentration (µg/dscm)	152	132	217	167
C	Concentration @ 7% O_2 (µg/dscm)	208	181	293	227
C	Concentration @ 12% CO_2 (µg/dscm)	201	175	289	222
C	Concentration (gr/dscf)	6.66E-05	5.75E-05	9.49E-05	7.30E-05
C	Concentration @ 7% O_2 (gr/dscf)	9.07E-05	7.91E-05	1.28E-04	9.93E-05
C	Concentration @ 12% CO_2 (gr/dscf)	8.78E-05	7.67E-05	1.26E-04	9.70E-05
E	Emission rate (lb/hr)	0.0519	0.0465	0.0746	0.0577
E	Emission rate (tons/yr)[2]	0.221	0.191	0.316	0.243
E	Emission rate (lb/10^{6}Btu)[3]	1.86E-04	1.63E-04	2.63E-04	2.04E-04
Unit 1 Stack					
Gas Conditions					
T_s	Temperature (°F)	284	287	286	286
B_{wo}	Moisture (volume %)	16.61	16.43	16.20	16.41
O_2	Oxygen (dry volume %)	10.9	10.8	10.2	10.6
CO_2	Carbon dioxide (dry volume %)	8.8	8.8	9.1	8.9
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	154,600	156,400	138,100	149,700
Q_{std}	Standard conditions (dscfm)	91,630	92,730	81,220	88,530
Mercury					
C	Concentration (µg/dscm)	9.84	10.3	13.1	11.1
C	Concentration @ 7% O_2 (µg/dscm)	13.7	14.2	17.0	15.0
C	Concentration @ 12% CO_2 (µg/dscm)	13.4	14.1	17.3	14.9
C	Concentration (gr/dscf)	4.30E-06	4.51E-06	5.73E-06	4.85E-06
C	Concentration @ 7% O_2 (gr/dscf)	5.98E-06	6.21E-06	7.44E-06	6.54E-06
C	Concentration @ 12% CO_2 (gr/dscf)	5.86E-06	6.16E-06	7.55E-06	6.52E-06
E	Emission rate (lb/hr)	3.38E-03	3.59E-03	3.99E-03	3.65E-03
E	Emission rate (tons/yr)[2]	0.0143	0.0150	0.0191	0.0161
E	Emission rate (lb/10^{6}Btu)[3]	1.23E-05	1.28E-05	1.53E-05	1.35E-05
RE	Removal Efficiency (% by weight)	93.5	92.3	94.7	93.5

[1] Run 3 at the SDA inlet did not pass a post-test leak check. Run 3 of both the inlet and Stack was discarded.
[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-13
Unit 1 Stack - Beryllium

Run No.		1	2	3	Average
Date (1994)		October 24	October 26	October 26	
Start Time (approx.)		15:53	08:28	11:18	
Stop Time (approx.)		18:00	10:52	13:22	
Gas Conditions					
T_s	Temperature (°F)	291	298	292	**294**
B_{wo}	Moisture (volume %)	16.84	17.54	17.14	**17.17**
O_2	Oxygen (dry volume %)	11.0	10.3	10.2	**10.5**
CO_2	Carbon dioxide (dry volume %)	8.8	8.9	9.0	**8.9**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	155,600	156,200	150,300	**154,000**
Q_{std}	Standard conditions (dscfm)	91,290	89,880	87,510	**89,560**
Beryllium (Be)					
C	Concentration (µg/dscm)	<0.013	<0.013	<0.013	**<0.013**
C	Concentration @ 7% O_2 (µg/dscm)	<0.018	<0.016	<0.017	**<0.017**
C	Concentration @ 12% CO_2 (µg/dscm)	<0.017	<0.017	<0.017	**<0.017**
C	Concentration (gr/dscf)	<5.6E-09	<5.5E-09	<5.7E-09	**<5.6E-09**
C	Concentration @ 7% O_2 (gr/dscf)	<7.8E-09	<7.2E-09	<7.3E-09	**<7.5E-09**
C	Concentration @ 12% CO_2 (gr/dscf)	<7.6E-09	<7.4E-09	<7.5E-09	**<7.5E-09**
E	Emission rate (lb/hr)	<4.4E-06	<4.2E-06	<4.2E-06	**<4.3E-06**
E	Emission rate (tons/yr)[1]	<1.9E-05	<1.8E-05	<1.9E-05	**<1.9E-05**
E	Emission rate (lb/10^6Btu)[2]	<1.6E-08	<1.5E-08	<1.5E-08	**<1.5E-08**

< Denotes that the analyte was below the detectable limit.
[1] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
[2] Calculated using an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-14
Unit 1 Stack - Arsenic

Run No.[1]		2	3	4	Average
Date (1994)		October 24	October 25	October 25	
Start Time (approx.)		15:53	08:37	13:35	
Stop Time (approx.)		18:25	11:20	16:11	
Gas Conditions					
T_s	Temperature (°F)	296	291	290	**292**
B_{wo}	Moisture (volume %)	16.91	16.94	17.03	**16.96**
O_2	Oxygen (dry volume %)	11.0	10.8	10.8	**10.9**
CO_2	Carbon dioxide (dry volume %)	8.6	9.0	8.8	**8.8**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	152,400	157,800	160,200	**156,800**
Q_{std}	Standard conditions (dscfm)	88,730	92,410	93,790	**91,640**
Arsenic (As)					
C	Concentration (µg/dscm)	<0.130	<0.125	<0.125	**<0.127**
C	Concentration @ 7% O_2 (µg/dscm)	<0.183	<0.172	<0.172	**<0.176**
C	Concentration @ 12% CO_2 (µg/dscm)	<0.182	<0.167	<0.171	**<0.173**
C	Concentration (gr/dscf)	<5.70E-08	<5.46E-08	<5.47E-08	**<5.54E-08**
C	Concentration @ 7% O_2 (gr/dscf)	<8.00E-08	<7.52E-08	<7.52E-08	**<7.68E-08**
C	Concentration @ 12% CO_2 (gr/dscf)	<7.95E-08	<7.29E-08	<7.45E-08	**<7.56E-08**
E	Emission rate (lb/hr)	<4.33E-05	<4.33E-05	<4.39E-05	**<4.35E-05**
E	Emission rate (tons/yr)[2]	<1.90E-04	<1.82E-04	<1.82E-04	**<1.84E-04**
E	Emission rate (lb/10^6Btu)[3]	<1.65E-07	<1.55E-07	<1.55E-07	**<1.58E-07**

< Denotes that the analyte was below the detectable limit.
[1] Run 1 was aborted due to plant process malfunctions.
[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
[3] Calculated using an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-15
Unit 1 Stack - PM_{10}

Run No.[1]		2	3	4	Average
Date (1994)		October 21	October 24	October 24	
Start Time (approx.)		16:18	09:03	12:33	
Stop Time (approx.)		18:37	11:33	14:53	
Gas Conditions					
T_s	Temperature (°F)	295	291	287	291
B_{ws}	Moisture (volume %)[1]	16.80	16.56	16.58	16.65
O_2	Oxygen (dry volume %)	10.8	10.8	10.8	10.8
CO_2	Carbon dioxide (dry volume %)	8.9	8.9	8.9	8.9
Volumetric Flow Rate					
Q_a	Stack, actual conditions (acfm)	165,200	168,500	162,400	165,400
Q_{std}	Stack, standard conditions (dscfm)	96,540	99,150	96,170	97,290
Q_{ca}	Cyclone, actual conditions (acfm)	0.660	0.655	0.652	0.656
Q_{cstd}	Cyclone, standard conditions (dscfm)	0.386	0.386	0.386	0.386
Total Particulate					
m_n	Matter collected (g)	0.0018	0.0016	0.0027	0.0020
C	Concentration (gr/dscf)	0.0006	0.0005	0.0009	0.0007
C	Concentration corrected to 7% O_2 (gr/dscf)	0.0008	0.0007	0.0013	0.0009
C	Concentration corrected to 12% CO_2 (gr/dscf)	0.0008	0.0007	0.0013	0.0009
E	Total particulate emission rate (lb/hr)	0.483	0.463	0.7737	0.573
E	Total particulate emission rate (ton/yr)	2.12	2.03	3.39	2.51
PM_{10}					
m_n	Matter collected in front half acetone (g)	0.0012	0.0009	0.0012	0.0011
m_n	Matter collected in front half filter (g)	-0.0004	-0.0003	0.0002	-0.0002
m_n	Total matter collected (g)	0.0008	0.0006	0.0014	0.0009
C	Concentration (gr/dscf)	0.0003	0.0002	0.0005	0.0003
C	Concentration corrected to 7% O_2 (gr/dscf)	0.0004	0.0003	0.0007	0.0004
C	Concentration corrected to 12% CO_2 (gr/dscf)	0.0003	0.0003	0.0006	0.0004
E	PM_{10} emission rate (lb/hr)	0.212	0.174	0.395	0.260
E	PM_{10} emission rate (ton/yr)[2]	0.852	0.680	1.60	1.04
Acceptance Criteria (M201A): For a run, 9.0 $\mu m \leq D_{50} \leq 11.0\ \mu m$ And Either: For all sampling points in a run, $\Delta P_{min\ acceptable} \leq \Delta P < \Delta P_{max\ acceptable}$ Or: $80\% \leq \%I \leq 120\%$ and no more than one (1) sampling point with a $\Delta P > \Delta P$ max acceptable or $\Delta P < \Delta P$ min acceptable.					
D_{50} min	Minimum 50% cut point for run (μm)	8.93	9.15	8.92	
D_{50} max	Maximum 50% cut point for run (μm)	9.85	9.69	9.92	
D_{50}	Overall 50% cut point for run (μm)	9.4	9.4	9.4	
ΔP min acc	Minimum acceptable velocity head (in H_2O)	0.97	0.96	0.96	
ΔP min	Minimum velocity head for run (in H_2O)	1.30	1.40	1.30	
ΔP max	Maximum velocity head for run (in H_2O)	1.60	1.60	1.60	
ΔP max acc	Maximum acceptable velocity head (in H_2O)	2.64	2.62	2.61	
# ΔP unacc.	Number of points outside acceptable range	0	0	0	
%I	Overall percent isokinetic for run (%)	108	105	109	107

[1] Run 1 was aborted due to scrubber problems.

[2] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-16
Unit 1 Stack - Continuous Emissions Monitoring (NOx)

Run No.	1	2	3	Average
Date (1994)	October 26	October 26	October 26	
Start Time (approx.)	13:13	14:40	16:01	
Stop Time (approx.)	14:13	15:40	17:01	
Gas Conditions				
O_2 Oxygen (dry volume %)	10.7	10.9	10.8	**10.8**
CO_2 Carbon dioxide (dry volume%)	8.9	8.6	8.8	**8.8**
Flow Conditions[1]				
Q_a Volumetric flow rate, actual (acfm)	141,500	147,900	147,900	**145,767**
Q_{std} Volumetric flow rate, standard (dscfm)	83,300	87,090	87,090	**85,827**
Continuous Emissions Monitoring				
Nitrogen Oxides				
C Concentration (ppmdv)	107	106	105	**106**
C Concentration corrected to 7% O_2 (ppm)	146	149	144	**146**
C Concentration corrected to 12% CO_2 (ppm)	144	148	144	**145**
E Emission rate (lb/hr)	63.8	66.4	65.7	**65.3**
E Emission rate, F_d factor (lb/10^6Btu)[2]	0.251	0.255	0.248	**0.251**
E Emission rate (ton/yr)[3]	297	296	293	**295**

[1] Flow conditions are obtained from simultaneous H_2SO_4 testing.
[2] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[3] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-17
Unit 1 SDA Inlet and Stack - Continuous Emissions Monitoring (SO_2 and CO)

Run No.	1	2	3	Average
Date (1994)	October 24	October 24	October 24	
Start Time (approx.)	10:18	12:00	13:36	
Stop Time (approx.)	11:18	13:00	14:36	
Unit 1 SDA Inlet				
Gas Conditions				
O_2 Oxygen (dry volume %)	10.3	10.0	10.0	**10.1**
CO_2 Carbon dioxide (dry volume%)	9.0	9.0	9.3	**9.1**
Continuous Emissions Monitoring				
Sulfur Dioxide				
C Concentration (ppmdv)	56	85	115	**85**
C Concentration corrected to 7% O_2 (ppm)	74	108	146	**109**
C Concentration corrected to 12% CO_2 (ppm)	75	113	148	**112**
Carbon Monoxide				
C Concentration (ppmdv)	27	23	23	**25**
C Concentration corrected to 7% O_2 (ppm)	36	29	30	**32**
C Concentration corrected to 12% CO_2 (ppm)	37	31	30	**32**
Unit 1 Stack				
Gas Conditions				
O_2 Oxygen (dry volume %)	10.8	10.6	10.6	**10.7**
CO_2 Carbon dioxide (dry volume%)	8.9	9.0	9.1	**9.0**
Flow Conditions[1]				
Q_a Volumetric flow rate, actual (acfm)	168,500	162,400	162,400	**164,400**
Q_{std} Volumetric flow rate, standard (dscfm)	99,150	96,170	96,170	**97,200**
Continuous Emissions Monitoring				
Sulfur Dioxide				
C Concentration (ppmdv)	1	8	8	**6**
C Concentration corrected to 7% O_2 (ppm)	2	11	11	**8**
C Concentration corrected to 12% CO_2 (ppm)	2	11	10	**8**
E Emission rate (lb/hr)	1.4	8.0	7.5	**5.6**
E Emission rate, F_d factor ($lb/10^6Btu$)[2]	0.0048	0.0269	0.0253	**0.0190**
E Emission rate (ton/yr)[3]	5.7	32.2	30.4	**22.7**
RE Removal Efficiency (%)[4]	97.3	89.6	92.8	**93.2**
Carbon Monoxide				
C Concentration (ppmdv)	26	22	23	**24**
C Concentration corrected to 7% O_2 (ppm)	36	30	31	**32**
C Concentration corrected to 12% CO_2 (ppm)	35	30	30	**32**
E Emission rate (lb/hr)	11.2	9.4	9.6	**10.0**
E Emission rate, F_d factor ($lb/10^6Btu$)[2]	0.0373	0.0316	0.0322	**0.0337**
E Emission rate (ton/yr)[3]	43.9	37.8	38.6	**40.1**

[1] Flow conditions were obtained from simultaneous PM_{10} testing.
[2] Calculated with an F_d factor of 9,570 $dscf/10^6Btu$.
[3] The tons/yr result is based on unit's average flow rate for the test program (88,600 dscfm), assuming 100% availability of the unit.
[4] Removal efficiency was based on ppm @ 7% O_2.

RESULTS

Table 2-18
Unit 2 Stack - Particulate and Visible Emissions

Run No.[1]		2	3	4	Average
Date (1994)		October 18	October 18	October 19	
Start Time (approx.)		12:14	15:34	08:45	
Stop Time (approx.)		15:21	17:39	11:39	
Gas Conditions					
T_s	Temperature (°F)	293	291	292	**292**
B_{wo}	Moisture (volume %)	15.79	16.47	14.65	**15.64**
O_2	Oxygen (dry volume %)	10.7	10.5	10.4	**10.5**
CO_2	Carbon dioxide (dry volume %)	9.0	9.0	8.9	**9.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	150,600	147,400	152,100	**150,000**
Q_{std}	Standard conditions (dscfm)	89,420	86,990	91,680	**89,360**
Particulate					
C	Concentration (gr/dscf)	0.0005	0.0006	0.0003	**0.0005**
C	Corrected to 7% O_2 (gr/dscf)	0.0007	0.0008	0.0004	**0.0007**
C	Corrected to 12% CO_2 (gr/dscf)	0.0007	0.0008	0.0005	**0.0006**
E	Emission rate (lb/hr)	0.417	0.427	0.264	**0.369**
E	Emission rate (lb/10^6Btu)[2]	1.56E-03	1.61E-03	9.33E-04	**1.37E-03**
E	Emission rate (ton/yr)[3]	1.84	1.94	1.14	**1.64**
Visible Emissions					
Start Time (approx.)		12:45	15:40	09:00	
Stop Time (approx.)		13:45	16:40	10:00	
	Average opacity	0	0	0	**0**
	Maximum reading	0	0	0	**0**

[1] Run 1 was aborted due to a filter back-up.
[2] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[3] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-19
Unit 2 Stack - Sulfuric Acid Mist

Run No.		1	2	3	Average
Date (1994)		October 24	October 24	October 24	
Start Time (approx.)		09:06	11:10	12:58	
Stop Time (approx.)		10:39	12:13	15:05	
Gas Conditions					
T_s	Temperature (°F)	291	290	289	290
B_{wo}	Moisture (volume %)	17.87	18.23	18.32	18.14
O_2	Oxygen (dry volume %)	11.2	11.4	10.8	11.1
CO_2	Carbon dioxide (dry volume %)	8.6	8.6	8.9	8.7
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	161,500	157,600	155,400	158,200
Q_{std}	Standard conditions (dscfm)	93,640	91,020	89,860	91,510
Sulfuric Acid Mist					
C	Concentration as SO_2 (ppmdv)	2.2	2.3	2.3	2.2
C	Concentration corrected to 7% O_2 (ppm)	3.1	3.4	3.1	3.2
C	Concentration corrected to 12% CO_2 (ppm)	3.0	3.2	3.1	3.1
E	Emission rate (lb/hr)	3.1	3.2	3.1	3.1
E	Emission rate (lb/10^6Btu)[1]	0.011	0.012	0.011	0.012
E	Emission rate (ton/yr)[2]	13	14	14	14

[1] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[2] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-20
Unit 2 Stack - Lead

Run No.		1	2	3	Average
Date (1994)		October 20	October 20	October 20	
Start Time (approx.)		09:24	12:36	16:15	
Stop Time (approx.)		11:35	14:59	18:20	
Gas Conditions					
T_s	Temperature (°F)	289	288	289	289
B_{wo}	Moisture (volume %)	16.75	16.23	17.10	16.69
O_2	Oxygen (dry volume %)	10.8	10.8	10.7	10.8
CO_2	Carbon dioxide (dry volume %)	9.1	9.2	9.3	9.2
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	153,500	152,400	152,700	152,900
Q_{std}	Standard conditions (dscfm)	90,640	90,740	89,870	90,420
Lead (Pb)[1]					
C	Concentration (µg/dscm)	<2.4	<2.4	<2.4	<2.4
C	Concentration @ 7% O_2 (µg/dscm)	<3.3	<3.3	<3.3	<3.3
C	Concentration @ 12% CO_2 (µg/dscm)	<3.1	<3.1	<3.1	<3.1
C	Concentration (gr/dscf)	<1.0E-06	<1.0E-06	<1.1E-06	<1.0E-06
C	Concentration @ 7% O_2 (gr/dscf)	<1.4E-06	<1.4E-06	<1.4E-06	<1.4E-06
C	Concentration @ 12% CO_2 (gr/dscf)	<1.4E-06	<1.4E-06	<1.4E-06	<1.4E-06
E	Emission rate (lb/hr)	<8.1E-04	<8.1E-04	<8.1E-04	<8.1E-04
E	Emission rate (tons/yr)[2]	<3.5E-03	<3.5E-03	<3.6E-03	<3.5E-03
E	Emission rate (lb/10^6Btu)[3]	<2.9E-06	<2.9E-06	<3.0E-06	<2.9E-06

< Denotes that the analyte was below the detectable limit.
[1] See Project Overview for discussion of laboratory results.
[2] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
[3] Calculated using an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-21
Unit 2 Stack - Fluoride

Run No.[1]		1	3	4	Average
Date (1994)		October 21	October 21	October 21	
Start Time (approx.)		10:52	13:50	15:22	
Stop Time (approx.)		11:57	14:52	16:59	
Gas Conditions					
T_s	Temperature (°F)	294	292	290	292
B_{wo}	Moisture (volume %)	19.09	18.16	18.06	18.44
O_2	Oxygen (dry volume %)	9.9	10.8	11.0	10.6
CO_2	Carbon dioxide (dry volume %)	9.9	9.2	9.0	9.4
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	163,300	162,000	161,700	162,300
Q_{std}	Standard conditions (dscfm)	92,820	93,450	93,650	93,310
Fluoride					
C	Concentration (ppmdv)	<0.037	<0.039	<0.042	<0.040
C	Concentration @ 7% O_2 (ppm)	<0.047	<0.054	<0.059	<0.053
C	Concentration @ 12% CO_2 (ppm)	<0.045	<0.051	<0.056	<0.051
E	Emission rate (lb/hr)	<1.1E-02	<1.1E-02	<1.2E-02	<1.2E-02
E	Emission rate (lb/10^6Btu)[2]	<3.5E-05	<4.1E-05	<4.4E-05	<4.0E-05
E	Emission rate (ton/yr)[3]	<0.046	<0.049	<0.052	<0.049

[1] Run 2 was invalid due to a failed leak check.
[2] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[3] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
< Indicates that the analyte was below detectable limit.

RESULTS

Table 2-22
Unit 2 Stack - Volatile Organic Compounds and Total Hydrocarbons

Run No.	1	2	3	Average
Date (1994)	October 24	October 24	October 24	
Start Time (approx.)	12:44	15:14	17:37	
Stop Time (approx.)	14:44	17:14	19:37	
Gas Conditions[1]				
B_{wo} Moisture in sample (% by volume)	18.32	16.52	16.52	17.12
O_2 Oxygen (dry volume %)	10.8	10.0	10.0	10.3
CO_2 Carbon dioxide (dry volume%)	8.9	10.0	10.0	9.6
Flow Conditions[1]				
Q_a Volumetric flow rate, actual (acfm)	155,400	164,000	164,000	161,100
Q_{std} Volumetric flow rate, standard (dscfm)	89,860	97,110	97,110	94,690
Volatile Organic Compounds				
Benzene				
C Concentration (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 7% O_2 (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<7E-06	<8E-06	<8E-06	<8E-06
E Emission rate (lb/10^6Btu)[3]	<6E-09	<6E-09	<6E-09	<6E-09
Toluene				
C Concentration (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 7% O_2 (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppmdv)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<1E-05	<1E-05	<1E-05	<1E-05
E Emission rate (lb/10^6Btu)[3]	<8E-09	<8E-09	<8E-09	<8E-09
Ethylene Benzene				
C Concentration (ppmdv)	<1E-06	<1E-06	<1E-06	<1E-06
C Concentration corrected to 7% O_2 (ppmdv)	<2E-06	<1E-06	<1E-06	<2E-06
C Concentration corrected to 12% CO_2 (ppmdv)	<2E-06	<1E-06	<1E-06	<1E-06
E Emission rate (lb/hr)	<2E-06	<2E-06	<2E-06	<2E-06
E Emission rate (ton/yr)[2]	<7E-06	<8E-06	<8E-06	<8E-06
E Emission rate (lb/10^6Btu)[3]	<6E-09	<6E-09	<6E-09	<6E-09
Xylene				
C Concentration (ppmdv)	<5.5E-06	<5.6E-06	<5.6E-06	<5.6E-06
C Concentration corrected to 7% O_2 (ppmdv)	<7.6E-06	<7.1E-06	<7.1E-06	<7.3E-06
C Concentration corrected to 12% CO_2 (ppmdv)	<7.5E-06	<6.7E-06	<6.7E-06	<6.9E-06
E Emission rate (lb/hr)	<8.2E-06	<9.0E-06	<8.9E-06	<8.7E-06
E Emission rate (ton/yr)[2]	<3.6E-05	<3.6E-05	<3.6E-05	<3.6E-05
E Emission rate (lb/10^6Btu)[3]	<3.0E-08	<2.8E-08	<2.8E-08	<2.9E-08
Total Hydrocarbons (as propane)				
C Concentration (ppmdv)	1.6	<1	<1	<1
C Concentration corrected to 7% O_2 (ppmdv)	2.2	<2	<2	<2
C Concentration corrected to 12% CO_2 (ppmdv)	2.2	<1	<1	<2
E Emission rate (lb/hr)	1.0	<0.8	<0.8	<0.9
E Emission rate (ton/yr)[2]	4.3	<3.5	<3.5	<3.8
E Emission rate (lb/10^6Btu)[3]	3.6E-03	<2.5E-03	<2.5E-03	<2.9E-03

< Denotes that the analyte was below the detectable limit.

[1] Gas and flow conditions are obtained from simultaneous Method 8 and 201A testing.

[2] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), *assuming 100% availability of the unit.*

[3] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-23
Unit 2 Stack - PCDDs (by individual cogener), Total TEF

Run No.		1	5	6	Average
Date (1994)		October 17	October 18	October 18	
Start Time (approx.)		08:43	12:14	16:40	
Stop Time (approx.)		12:59	16:22	20:48	
Gas Conditions					
T_s	Temperature (°F)	292	293	292	292
B_{wo}	Moisture (volume %)	17.08	16.10	15.30	16.16
O_2	Oxygen (dry volume %)	10.9	10.1	10.8	10.6
CO_2	Carbon dioxide (dry volume %)	9.0	8.7	8.7	8.8
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	150,200	149,800	140,400	146,800
Q_{std}	Standard conditions (dscfm)	87,610	88,700	83,970	86,760
PCDDs (Total TEF)					
2,3,7,8-TCDD					
C	Concentration @ 7% O_2 (ng/dscm)	ND	ND	ND	ND
E	Emission rate (lb/hr)	ND	ND	ND	ND
Other TCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.55E-01	6.37E-02	4.29E-02	8.72E-02
E	Emission rate (lb/hr)	3.66E-08	1.63E-08	1.02E-08	2.10E-08
1,2,3,7,8-PeCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.69E-02	1.02E-02	1.07E-02	1.26E-02
E	Emission rate (lb/hr)	3.99E-09	2.60E-09	2.56E-09	3.05E-09
Other PeCDD					
C	Concentration @ 7% O_2 (ng/dscm)	5.75E-01	2.42E-01	1.56E-01	3.24E-01
E	Emission rate (lb/hr)	1.36E-07	6.18E-08	3.71E-08	7.82E-08
1,2,3,4,7,8-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	3.10E-02	2.04E-02	2.15E-02	2.43E-02
E	Emission rate (lb/hr)	7.32E-09	5.20E-09	5.12E-09	5.88E-09
1,2,3,6,7,8-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	8.17E-02	5.86E-02	5.64E-02	6.56E-02
E	Emission rate (lb/hr)	1.93E-08	1.50E-08	1.34E-08	1.59E-08
1,2,3,7,8,9-HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	1.16E-01	7.90E-02	8.05E-02	9.17E-02
E	Emission rate (lb/hr)	2.73E-08	2.02E-08	1.92E-08	2.22E-08
Other HxCDD					
C	Concentration @ 7% O_2 (ng/dscm)	7.30E-01	5.05E-01	4.86E-01	5.73E-01
E	Emission rate (lb/hr)	1.72E-07	1.29E-07	1.16E-07	1.39E-07
1,2,3,4,6,7,8-HpCDD					
C	Concentration @ 7% O_2 (ng/dscm)	5.64E-01	4.33E-01	4.29E-01	4.75E-01
E	Emission rate (lb/hr)	1.33E-07	1.11E-07	1.02E-07	1.15E-07
Other HpCDD					
C	Concentration @ 7% O_2 (ng/dscm)	5.64E-01	4.33E-01	4.29E-01	4.75E-01
E	Emission rate (lb/hr)	1.33E-07	1.11E-07	1.02E-07	1.15E-07
1,2,3,4,6,7,8,9-OCDD					
C	Concentration @ 7% O_2 (ng/dscm)	8.74E-01	6.63E-01	5.90E-01	7.09E-01
E	Emission rate (lb/hr)	2.06E-07	1.69E-07	1.41E-07	1.72E-07
Total PCDDs					
C	Concentration @ 7% O_2 (ng/dscm)	3.71	2.51	2.30	2.84
E	Emission rate (lb/hr)	8.75E-07	6.40E-07	5.49E-07	6.88E-07

ND = Non-detected value.

RESULTS

Table 2-24
Unit 2 Stack - PCDFs (by individual cogener), Total TEF

Run No.		1	5	6	Average
Date (1994)		October 17	October 18	October 18	
Start Time (approx.)		08:43	12:14	16:40	
Stop Time (approx.)		12:59	16:22	20:48	
Gas Conditions					
T_s	Temperature (°F)	292	293	292	292
B_{wo}	Moisture (volume %)	17.08	16.10	15.30	16.16
O_2	Oxygen (dry volume %)	10.9	10.1	10.8	10.6
CO_2	Carbon dioxide (dry volume %)	9.0	8.7	8.7	8.6
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	150,200	149,800	140,400	146,800
Q_{std}	Standard conditions (dscfm)	87,610	88,700	83,970	86,760
PCDFs (Total TEF)					
2,3,7,8-TCDF					
C	Concentration @ 7% O_2 (ng/dscm)	2.54E-02	1.27E-02	1.07E-02	1.63E-02
E	Emission rate (lb/hr)	5.99E-09	3.25E-09	2.56E-09	3.93E-09
Other TCDF					
C	Concentration @ 7% O_2 (ng/dscm)	9.05E-01	3.95E-01	3.38E-01	5.46E-01
E	Emission rate (lb/hr)	2.14E-07	1.01E-07	8.06E-08	1.32E-07
1,2,3,7,8-PeCDF					
C	Concentration @ 7% O_2 (ng/dscm)	5.64E-02	2.29E-02	ND	2.64E-02
E	Emission rate (lb/hr)	1.33E-08	5.85E-09	ND	6.39E-09
2,3,4,7,8-PeCDF					
C	Concentration @ 7% O_2 (ng/dscm)	1.18E-01	5.66E-02	5.90E-02	7.87E-02
E	Emission rate (lb/hr)	2.79E-08	1.50E-08	1.41E-08	1.90E-08
Other PeCDF					
C	Concentration @ 7% O_2 (ng/dscm)	1.21E+00	5.05E-01	4.24E-01	7.12E-01
E	Emission rate (lb/hr)	2.85E-07	1.29E-07	1.01E-07	1.72E-07
1,2,3,4,7,8-HxCDF					
C	Concentration @ 7% O_2 (ng/dscm)	3.10E-01	2.14E-01	2.04E-01	2.43E-01
E	Emission rate (lb/hr)	7.32E-08	5.46E-08	4.86E-08	5.88E-08
1,2,3,6,7,8-HxCDF					
C	Concentration @ 7% O_2 (ng/dscm)	8.74E-02	5.86E-02	5.64E-02	6.75E-02
E	Emission rate (lb/hr)	2.06E-08	1.50E-08	1.34E-08	1.63E-08
2,3,4,6,7,8-HxCDF					
C	Concentration @ 7% O_2 (ng/dscm)	2.00E-01	1.48E-01	1.40E-01	1.63E-01
E	Emission rate (lb/hr)	4.72E-08	3.77E-08	3.33E-08	3.94E-08
1,2,3,7,8,9-HxCDF					
C	Concentration @ 7% O_2 (ng/dscm)	5.64E-03	5.10E-03	5.37E-03	5.37E-03
E	Emission rate (lb/hr)	1.33E-09	1.30E-09	1.28E-09	1.30E-09
Other HxCDF					
C	Concentration @ 7% O_2 (ng/dscm)	5.24E-01	3.39E-01	3.19E-01	3.94E-01
E	Emission rate (lb/hr)	1.24E-07	8.65E-08	7.62E-08	9.55E-08
1,2,3,4,6,7,8-HpCDF					
C	Concentration @ 7% O_2 (ng/dscm)	7.04E-01	5.35E-01	5.10E-01	5.83E-01
E	Emission rate (lb/hr)	1.66E-07	1.37E-07	1.22E-07	1.41E-07
1,2,3,4,7,8,9-HpCDF					
C	Concentration @ 7% O_2 (ng/dscm)	4.23E-02	3.57E-02	3.49E-02	3.76E-02
E	Emission rate (lb/hr)	9.98E-09	9.10E-09	8.32E-09	9.13E-09
Other HpCDF					
C	Concentration @ 7% O_2 (ng/dscm)	1.55E-01	1.17E-01	9.93E-02	1.24E-01
E	Emission rate (lb/hr)	3.66E-08	2.99E-08	2.37E-08	3.01E-08
OCDF					
C	Concentration @ 7% O_2 (ng/dscm)	1.92E-01	1.63E-01	1.42E-01	1.66E-01
E	Emission rate (lb/hr)	4.52E-08	4.16E-08	3.39E-08	4.03E-08
Total PCDFs					
C	Concentration @ 7% O_2 (ng/dscm)	4.53	2.61	2.34	3.16
E	Emission rate (lb/hr)	1.07E-06	6.66E-07	5.59E-07	7.65E-07

ND = Non-detected value.

RESULTS

Table 2-25
Unit 2 Stack - PCDDs and PCDFs, Total TEF

Run No.[1]		1	5	6	Average
Date (1994)		October 17	October 18	October 18	
Start Time (approx.)		08:43	12:14	16:40	
Stop Time (approx.)		12:59	16:22	20:48	
Gas Conditions					
T_s	Temperature (°F)	292	293	292	**292**
B_{wo}	Moisture (volume %)	17.08	16.10	15.30	**16.16**
O_2	Oxygen (dry volume %)	10.9	10.1	10.8	**10.6**
CO_2	Carbon dioxide (dry volume %)	9.0	8.7	8.7	**8.8**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	150,200	149,800	140,400	**146,800**
Q_{std}	Standard conditions (dscfm)	87,610	88,700	83,970	**86,760**
Total PCDDs and PCDFs (Total TEF)					
C	Concentration (ng/dscm)	5.93	3.98	3.38	**4.43**
C	Concentration @ 7% O_2 (ng/dscm)	8.24	5.12	4.65	**6.00**
C	Concentration @ 12% CO_2 (ng/dscm)	7.90	5.49	4.66	**6.01**
E	Emission rate (lb/hr)	1.94E-06	1.31E-06	1.11E-06	**1.45E-06**
E	Emission rate (ton/yr)[2]	8.76E-06	5.81E-06	5.21E-06	**6.59E-06**
E	Emission rate (lb/10^6Btu)[3]	7.40E-09	4.60E-09	4.17E-09	**5.39E-09**

[1] Runs 2, 3 and 4 were invalid due to failed leak checks.
[2] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
[3] Calculated with an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-26
Unit 2 SDA Inlet and Stack - Sulfur Dioxide (by EPA M6C) and Hydrogen Chloride

Run No.[1]		6	7	8	Average
Date (1994)		October 21	October 21	October 21	
Start Time (approx.)		10:36	12:01	14:21	
Stop Time (approx.)		11:37	13:06	15:24	
Outlet Gas Conditions					
T_s	Temperature (°F)	283	279	280	**281**
B_{wo}	Moisture (volume %)	18.46	18.46	17.49	**18.14**
O_2	Oxygen (dry volume %)	10.8	10.8	10.3	**10.6**
CO_2	Carbon dioxide (dry volume %)	9.3	9.2	9.0	**9.2**
Q_{std}	Volumetric flow rate (dscfm)[2]	92,820	33,450	93,650	**93,310**
Sulfur Dioxide					
Unit 2 SDA Inlet					
C	Concentration (ppmdv)	62	42	80	**62**
C	Concentration @ 7% O_2 (ppm)	80	55	103	**79**
C	Concentration@ 12% CO_2 (ppm)	82	56	102	**80**
Unit 2 Stack					
C	Concentration (ppmdv)	6	6	13	**8**
C	Concentration @ 7% O_2 (ppm)	8	9	17	**11**
C	Concentration@ 12% CO_2 (ppm)	8	9	17	**11**
E	Emission rate (lb/hr)	5.5	6.0	12.1	**7.9**
E	Emission (ton/yr)[3]	23.3	25.4	52.9	**33.9**
E	Emission rate (lb/10^6Btu)[4]	0.0190	0.0210	0.0411	**0.0271**
RE	Removal Efficiency (%)[5]	90.1	84.0	83.3	**85.8**
Hydrogen Chloride					
Unit 2 SDA Inlet					
C	Concentration (ppmdv)	672	468	657	**599**
C	Concentration @ 7% O_2 (ppm)	933	586	896	**805**
C	Concentration@ 12% CO_2 (ppm)	886	624	858	**789**
Unit 2 Stack					
C	Concentration (ppmdv)	20.3	18.9	20.4	**19.9**
C	Concentration @ 7% O_2 (ppm)	27.9	26.0	26.7	**26.9**
C	Concentration@ 12% CO_2 (ppm)	26.2	24.7	27.2	**26.0**
E	Emission rate (lb/hr)	10.7	10.0	10.8	**10.5**
E	Emission (ton/yr)[3]	45.4	42.4	45.7	**44.5**
E	Emission rate (lb/10^6Btu)[4]	0.0380	0.0354	0.0364	**0.0366**
RE	Removal Efficiency (%)[5]	97.0	95.6	97.0	**96.5**

[1] Runs 1, 2 and 4 were invalid due to the plant's atomizer controller valve problems, and Runs 3 and 5 were invalid due to failed final leak checks.
[2] Volumetric flow rate obtained from simultaneous Method 13B testing.
[3] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
[4] Calculated using an F_d factor of 9,570 dscf/10^6Btu.
[5] Removal efficiency was based on ppm @ 7% O_2.

RESULTS

Table 2-27
Unit 2 Stack - Ammonia

Run No.		1	2	3	Average
Date (1994)		October 17	October 17	October 17	
Start Time (approx.)		11:28	14:00	15:30	
Stop Time (approx.)		12:28	15:00	18:24	
Gas Conditions					
T_s	Temperature (°F)	289	294	294	**292**
B_{wo}	Moisture (volume %)	16.48	15.89	15.96	**16.11**
O_2	Oxygen (dry volume %)	10.7	10.5	11.1	**10.8**
CO_2	Carbon dioxide (dry volume %)	8.0	8.5	8.8	**8.4**
Ammonia					
C	Concentration (ppmdv)	1.02	1.39	1.35	**1.25**
C	Concentration @ 7% O_2 (ppm)	1.39	1.86	1.92	**1.72**
C	Concentration@ 12% CO_2 (ppm)	1.52	1.97	1.85	**1.78**

RESULTS

Table 2-28
Unit 2 SDA Inlet and Stack - Mercury

Run No.[1]		1	3	4	Average
Date (1994)		October 19	October 19	October 19	
Start Time (approx.)		08:52	15:59	20:19	
Stop Time (approx.)		11:46	19:24	23:03	
Unit 2 SDA Inlet					
Gas Conditions					
T_s	Temperature (°F)	393	395	398	**395**
B_{wo}	Moisture (volume %)	14.41	11.94	13.22	**13.19**
O_2	Oxygen (dry volume %)	10.9	10.8	10.9	**10.9**
CO_2	Carbon dioxide (dry volume %)	9.0	9.0	9.0	**9.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	165,700	159,300	162,800	**162,600**
Q_{std}	Standard conditions (dscfm)	87,750	86,590	86,940	**87,090**
Mercury					
C	Concentration (µg/dscm)	312	135	213	**220**
C	Concentration @ 7% O_2 (µg/dscm)	433	186	296	**305**
C	Concentration @ 12% CO_2 (µg/dscm)	416	180	284	**293**
C	Concentration (gr/dscf)	1.36E-04	5.90E-05	9.31E-05	**9.61E-05**
C	Concentration @ 7% O_2 (gr/dscf)	1.89E-04	8.13E-05	1.29E-04	**1.33E-04**
C	Concentration @ 12% CO_2 (gr/dscf)	1.82E-04	7.87E-05	1.24E-04	**1.28E-04**
E	Emission rate (lb/hr)	0.102	0.0438	0.0694	**0.0719**
E	Emission rate (ton/yr)[2]	0.461	0.200	0.315	**0.325**
E	Emission rate (lb/10^6Btu)[3]	3.89E-04	1.67E-04	2.66E-04	**2.74E-04**
Unit 2 Stack					
Gas Conditions					
T_s	Temperature (°F)	293	290	287	**290**
B_{wo}	Moisture (volume %)	16.18	15.67	15.58	**15.81**
O_2	Oxygen (dry volume %)	10.3	10.7	10.1	**10.4**
CO_2	Carbon dioxide (dry volume %)	9.4	8.2	9.0	**8.9**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	149,400	142,900	143,600	**145,300**
Q_{std}	Standard conditions (dscfm)	88,340	85,340	86,160	**86,610**
Mercury					
C	Concentration (µg/dscm)	20.9	19.0	23.3	**21.1**
C	Concentration @ 7% O_2 (µg/dscm)	27.4	25.9	30.0	**27.8**
C	Concentration @ 12% CO_2 (µg/dscm)	26.6	27.8	31.0	**28.5**
C	Concentration (gr/dscf)	9.12E-06	8.31E-06	1.02E-05	**9.20E-06**
C	Concentration @ 7% O_2 (gr/dscf)	1.20E-05	1.13E-05	1.31E-05	**1.21E-05**
C	Concentration @ 12% CO_2 (gr/dscf)	1.16E-05	1.22E-05	1.36E-05	**1.25E-05**
E	Emission rate (lb/hr)	6.91E-03	6.08E-03	7.51E-03	**6.83E-03**
E	Emission rate (ton/yr)[2]	3.09E-02	2.81E-02	3.44E-02	**3.11E-02**
E	Emission rate (lb/10^6Btu)[3]	2.27E-05	2.15E-05	2.48E-05	**2.30E-05**
RE	Removal Efficiency (% by weight)	93.3	86.1	89.2	**89.5**

[1] Run 2 at the SDA Inlet was invalid due to a failed leak check.
[2] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
[3] Calculated using an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-29
Unit 2 Stack - Beryllium

Run No.		1	2	3	Average
Date (1994)		October 20	October 20	October 20	
Start Time (approx.)		09:23	12:50	15:34	
Stop Time (approx.)		11:35	15:00	18:19	
Gas Conditions					
T_s	Temperature (°F)	292	292	292	**292**
B_{wo}	Moisture (volume %)	17.34	16.88	16.64	**16.95**
O_2	Oxygen (dry volume %)	10.8	11.0	10.9	**10.9**
CO_2	Carbon dioxide (dry volume %)	9.2	9.2	8.9	**9.1**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	151,700	150,800	152,400	**151,600**
Q_{std}	Standard conditions (dscfm)	88,700	88,500	89,830	**89,010**
Beryllium (Be)					
C	Concentration (µg/dscm)	<0.013	<0.013	<0.013	**<0.013**
C	Concentration @ 7% O_2 (µg/dscm)	<0.018	<0.019	<0.018	**<0.018**
C	Concentration @ 12% CO_2 (µg/dscm)	<0.017	<0.017	<0.017	**<0.017**
C	Concentration (gr/dscf)	<5.6E-09	<5.8E-09	<5.6E-09	**<5.7E-09**
C	Concentration @ 7% O_2 (gr/dscf)	<7.8E-09	<8.1E-09	<7.8E-09	**<7.9E-09**
C	Concentration @ 12% CO_2 (gr/dscf)	<7.3E-09	<7.5E-09	<7.6E-09	**<7.5E-09**
E	Emission rate (lb/hr)	<4.3E-06	<4.4E-06	<4.3E-06	**<4.3E-06**
E	Emission rate (tons/yr)[1]	<1.9E-05	<2.0E-05	<1.9E-05	**<1.9E-05**
E	Emission rate (lb/10^6Btu)[2]	<1.6E-08	<1.7E-08	<1.6E-08	**<1.6E-08**

< Denotes that the analyte was below the detectable iimit.

[1] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.

[2] Calculated using an F_d factor of 9,570 dscf/10^6Btu.

RESULTS

Table 2-30
Unit 2 Stack - Arsenic

Run No.		1	2	3	Average
Date (1994)		October 21	October 24	October 24	
Start Time (approx.)		15:22	09:03	11:47	
Stop Time (approx.)		17:29	11:10	13:50	
Gas Conditions					
T_s	Temperature (°F)	286	296	295	**292**
B_{wo}	Moisture (volume %)	18.02	17.09	17.37	**17.49**
O_2	Oxygen (dry volume %)	10.8	10.8	10.7	**10.8**
CO_2	Carbon dioxide (dry volume %)	9.2	9.2	9.0	**9.1**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	169,100	158,600	156,800	**161,500**
Q_{std}	Standard conditions (dscfm)	98,470	92,280	90,890	**93,880**
Arsenic (As)					
C	Concentration (µg/dscm)	<0.116	<0.124	<0.126	**<0.122**
C	Concentration @ 7% O_2 (µg/dscm)	<0.160	<0.171	<0.171	**<0.167**
C	Concentration @ 12% CO_2 (µg/dscm)	<0.151	<0.162	<0.167	**<0.160**
C	Concentration (gr/dscf)	<5.07E-08	<5.44E-08	<5.49E-08	**<5.33E-08**
C	Concentration @ 7% O_2 (gr/dscf)	<6.98E-08	<7.49E-08	<7.48E-08	**<7.31E-08**
C	Concentration @ 12% CO_2 (gr/dscf)	<6.61E-08	<7.10E-08	<7.31E-08	**<7.01E-08**
E	Emission rate (lb/hr)	<4.28E-05	<4.30E-05	<4.27E-05	**<4.29E-05**
E	Emission rate (tons/yr)[1]	<1.72E-04	<1.84E-04	<1.86E-04	**<1.80E-04**
E	Emission rate (lb/10^6Btu)[2]	<1.43E-07	<1.54E-07	<1.54E-07	**<1.50E-07**

< Denotes that the analyte was below the detectable limit.

[1] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-31
Unit 2 Stack - PM_{10}

Run No.		1	2	3	Average
Date (1994)		October 21	October 24	October 25	
Start Time (approx.)		19:24	15:53	11:25	
Stop Time (approx.)		21:29	18:02	13:27	
Gas Conditions					
T_s	Temperature (°F)	290	287	293	290
B_{ws}	Moisture (volume %)[1]	17.04	16.52	16.10	16.55
O_2	Oxygen (dry volume %)	11.0	10.0	10.8	10.6
CO_2	Carbon dioxide (dry volume %)	9.0	10.0	8.8	9.3
Volumetric Flow Rate					
Q_a	Stack, actual conditions (acfm)	177,100	164,000	167,200	169,400
Q_{std}	Stack, standard conditions (dscfm)	103,800	97,110	98,620	99,840
Q_{ca}	Cyclone, actual conditions (acfm)	0.663	0.652	0.657	0.657
Q_{cstd}	Cyclone, standard conditions (dscfm)	0.389	0.386	0.388	0.387
Total Particulate					
m_n	Matter collected (g)	0.0019	0.0023	0.0013	0.0018
C	Concentration (gr/dscf)	0.0006	0.0008	0.0004	0.0006
C	Concentration corrected to 7% O_2 (gr/dscf)	0.0009	0.0010	0.0006	0.0008
C	Concentration corrected to 12% CO_2 (gr/dscf)	0.0009	0.0009	0.0006	0.0008
E	Total particulate emission rate (lb/hr)	0.572	0.631	0.3636	0.522
E	Total particulate emission rate (ton/yr)	2.50	2.76	1.59	2.29
PM_{10}					
m_n	Matter collected in front half acetone (g)	0.0008	0.0012	0.0011	0.0010
m_n	Matter collected in front half filter (g)	-0.0002	0.0000	0.0002	0.0000
m_n	Total matter collected (g)	0.0006	0.0012	0.0013	0.0010
C	Concentration (gr/dscf)	0.0002	0.0004	0.0004	0.0003
C	Concentration corrected to 7% O_2 (gr/dscf)	0.0003	0.0005	0.0006	0.0005
C	Concentration corrected to 12% CO_2 (gr/dscf)	0.0003	0.0005	0.0006	0.0004
E	PM_{10} emission rate (lb/hr)	0.173	0.338	0.364	0.291
E	PM_{10} emission rate (ton/yr)[1]	0.657	1.37	1.46	1.16
Acceptance Criteria (M201A):					
	For a run, 9.0 $\mu m \leq D_{50} \leq 11.0\ \mu m$				
	And Either:				
	For all sampling points in a run, ΔPmin acceptable $\leq \Delta P < \Delta P$max acceptable				
	Or:				
	80% ≤ %I ≤ 120% and no more than one (1) sampling point with a $\Delta P > \Delta P$ max acceptable or $\Delta P < \Delta P$ min acceptable.				
D_{50} min	Minimum 50% cut point for run(μm)	8.66	9.21	8.07	
D_{50} max	Maximum 50% cut point for run (μm)	9.50	9.56	11.35	
D_{50}	Overall 50% cut point for run (μm)	9.3	9.4	9.4	
ΔP min acc	Minimum acceptable velocity head (in H_2O)	0.98	0.96	0.96	
ΔP min	Minimum velocity head for run (in H_2O)	1.40	1.40	1.30	
ΔP max	Maximum velocity head for run (in H_2O)	1.90	1.60	1.70	
ΔP max acc	Maximum acceptable velocity head (in H_2O)	2.68	2.62	2.62	
# ΔP unacc.	Number of points outside acceptable range	0	0	0	
%I	Overall percent isokinetic for run (%)	101	108	106	105

[1] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.

RESULTS

Table 2-32
Unit 2 SDA Inlet and Stack - Continuous Emissions Monitoring (SO_2, NOx and CO)

Run No.[1]	1	2	3	Average
Date (1994)	October 21	October 21	October 21	
Start Time (approx.)	10:36	12:06	14:24	
Stop Time (approx.)	11:36	13:06	15:24	
Unit 2 SDA Inlet				
Gas Conditions				
O_2 Oxygen (dry volume %)	10.1	10.2	10.1	**10.1**
CO_2 Carbon dioxide (dry volume%)	9.1	9.1	9.4	**9.2**
Continuous Emissions Monitoring				
Sulfur Dioxide				
C Concentration (ppmdv)	62	42	80	**62**
C Concentration corrected to 7% O_2 (ppm)	80	55	103	**79**
C Concentration corrected to 12% CO_2 (ppm)	82	56	102	**80**
Carbon Monoxide				
C Concentration (ppmdv)	31	28	27	**29**
C Concentration corrected to 7% O_2 (ppm)	40	36	34	**37**
C Concentration corrected to 12% CO_2 (ppm)	41	36	34	**37**
Unit 2 Stack				
Gas Conditions				
O_2 Oxygen (dry volume %)	10.6	10.7	10.4	**10.6**
CO_2 Carbon dioxide (dry volume%)	9.0	8.9	9.1	**9.0**
Flow Conditions[2]				
Q_a Volumetric flow rate, actual (acfm)	163,300	162,000	161,700	**162,300**
Q_{std} Volumetric flow rate, standard (dscfm)	92,820	93,450	93,650	**93,300**
Continuous Emissions Monitoring				
Sulfur Dioxide				
C Concentration (ppmdv)	6	6	13	**8**
C Concentration corrected to 7% O_2 (ppm)	8	9	17	**11**
C Concentration corrected to 12% CO_2 (ppm)	8	9	17	**11**
E Emission rate (lb/hr)	5.5	6.0	12.1	**7.9**
E Emission rate, F_d factor (lb/10^6Btu)[3]	0.0190	0.0210	0.0411	**0.0271**
E Emission rate (ton/yr)[4]	23.3	25.4	52.9	**33.9**
RE Removal Efficiency (%)[5]	90.1	84.0	83.3	***85.8***
Nitrogen Oxides				
C Concentration (ppmdv)	111	107	114	**111**
C Concentration corrected to 7% O_2 (ppm)	149	146	151	**149**
C Concentration corrected to 12% CO_2 (ppm)	147	145	150	**147**
E Emission rate (lb/hr)	73.6	71.7	76.3	**73.9**
E Emission rate, F_d factor (lb/10^6Btu)[3]	0.2559	0.2503	0.2598	**0.2553**
E Emission rate (ton/yr)[4]	313	303	321	**313**
Carbon Monoxide				
C Concentration (ppmdv)	30	26	25	**27**
C Concentration corrected to 7% O_2 (ppm)	40	35	34	**36**
C Concentration corrected to 12% CO_2 (ppm)	40	35	33	**36**
E Emission rate (lb/hr)	12.0	10.4	10.4	**10.9**
E Emission rate, F_d factor (lb/10^6Btu)[3]	0.0418	0.0364	0.0353	**0.0378**
E Emission rate (ton/yr)[4]	51.1	44.1	43.7	**46.3**

[1] Runs 1, 2 and 3 correspond to Runs 6, 7 and 8 of HCl testing, respectively.
[2] Flow conditions were obtained from simultaneous Method 13B testing.
[3] Calculated with an F_d factor of 9,570 dscf/10^6Btu.
[4] The tons/yr result is based on unit's average flow rate for the test program (90,110 dscfm), assuming 100% availability of the unit.
[5] Removal efficiency was based on ppm @ 7% O_2.

RESULTS

Table 2-33
Ash Building Stack - Particulate and Visible Emissions

Run No.		1	2	3	Average
Date (1994)		October 26	October 26	October 26	
Start Time (approx.)		10:20	12:00	14:15	
Stop Time (approx.)		11:28	13:31	15:17	
Gas Conditions					
T_s	Temperature (°F)	86	88	88	88
B_{wo}	Moisture (volume %)	2.35	2.54	2.90	2.59
O_2	Oxygen (dry volume %)	20.8	20.8	20.8	20.8
CO_2	Carbon dioxide (dry volume %)	0.0	0.2	0.2	0.1
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	26,180	26,520	26,180	26,290
Q_{std}	Standard conditions (dscfm)	24,750	24,900	24,500	24,720
Particulate					
C	Concentration (gr/acf)	0.0006	0.0009	0.0005	0.0006
C	Concentration (gr/dscf)	0.0006	0.0009	0.0005	0.0007
C	Corrected to 7% O_2 (gr/dscf)	0.0838	0.1301	0.0744	0.0961
C	Corrected to 12% CO_2 (gr/dscf)[1]	N/A	0.0561	0.0321	0.0441
E	Emission rate (lb/hr)	0.128	0.200	0.112	0.147
E	Emission rate (ton/yr)	0.560	0.875	0.492	0.642
Visible Emissions					
Start Time (approx.)		10:20	12:00	14:15	
Stop Time (approx.)		11:20	13:00	15:15	
	Average opacity	0	0	0	0
	Maximum reading	0	0	0	0

[1] The CO_2 content for Run 1 was 0.0%, therefore the 12% CO_2 correction is undefined. Runs 2 and 3 are averaged.

RESULTS

Table 2-34
Lime Silo - Visible Emissions

Run No.	1	Average
Date (1994)	October 19	
Start Time (approx.)	12:05	
Stop Time (approx.)	13:35	
Visible Emissions		
Average opacity	0	0
Maximum reading	0	0

Procedures for Startup and Shutdown

Exhibit 14

LEE COUNTY RESOURCE RECOVERY FACILITY

BOILER
SYSTEM DESCRIPTION

INDEX

1.0 INTRODUCTION

1.1 PURPOSE

The combustion of refuse (by the Martin Stoker System) converts the chemical energy in the refuse to thermal energy in the furnace. The boiler is aligned with the stoker so that when the combustion unit is operating, a seal is formed to prevent air in-leakage into the furnace. The boiler is comprised of furnace waterwalls forming an enclosed area for the refuse to burn and a flow path for the hot flue gases to pass through. The boiler contains and absorbs the thermal energy generated by the combustion of refuse and converts the feedwater into high pressure, superheated steam. This steam is supplied to the facility for in-house consumption and to a main steam turbine and generator, where it is then converted into electrical energy.

1.2 SYSTEM OVERVIEW

The two refuse fired steam generators are each single drum, top supported, three pass, water tube types, with an integral welded waterwall cooled furnace, superheater, and economizer.

Each combustion unit has a nominal capacity of 250,000,000 BTU/hr heat input when firing refuse having a higher heating value (HHV) of 5000 Btu/lb.

The following table lists the design boiler performance data:

NOTE: Actual temperatures, pressures, and flows may be slightly different than design, due to normal fouling of heat transfer surfaces, refuse HHV, excess air, and other factors.

Operating Performance Data (at MCR)

Steam Flow	169,049	lbs/hr
Fuel Burned (Refuse)	25	Tons/hr
Steam Temp at SH Outlet	830	DEG F
Water Temp at Economizer inlet	300	DEG F
Water Temp at Economizer outlet	520	DEG F
Flue Gas Temp at Economizer outlet	425	DEG F*
Overfire Air Temp	300	DEG F
Underfire Air Temp	300	DEG F
Excess Air in Flue Gas	110	Percent
Furnace Draft	-0.3	In. W.C.
Steam Pressure at SH Outlet	865	PSIG

* 430° F for a clean boiler. Maximum of 505° F for an in service boiler.

The major sections of the boiler (in the order of water/steam flow) are the economizer tubes, drum, convection tubes, waterwall tubes and superheater tubes.

Boiler feedwater first passes through the economizer tubes where it is heated from 300° F to 520° F. Feedwater then enters the drum which provides the water storage to supply the convection and waterwall tube supply headers. It also provides for the separation of the steam and water. The water is boiled in the convection (generating) tubes and in the waterwall tubes. The waterwall tubes, in addition to providing steam generation surface area, act as a physical and thermal barrier between the hot furnace gases and the outside of the boiler. The steam generated in these tubes naturally rises to the drum.

The saturated steam (550° F) is separated from the water in the drum and then routed to the primary superheater section where the temperature is raised from 550° F (saturated) to 658° F (superheated). The steam then passes the primary attemperator where it is mixed with a feedwater spray to keep it no higher than the design temperature of 658° F.

Steam is then routed to the intermediate superheater section where the steam temperature is raised from 658° F to 761° F. The steam then passes the secondary attemperator where it is mixed with a feedwater spray to keep it no higher than design temperature of 761° F.

Steam is then routed to the final superheater section where the temperature is raised to 830° F. From here, the steam exits the boiler and is distributed to the various auxiliary steam loads, the turbine generator and/or the air cooled condenser.

The boiler is equipped with sootblowers which use steam to remove ash deposits adhering to the economizer, convection and superheater tubes. Removal of these ash deposits ensures maximum boiler efficiency and performance.

Two auxiliary gas burners per unit, are designed to maintain a minimum furnace temperature during periods of startup prior to the firing of refuse, normal operation and refuse burn out during shutdown.

Maintaining the top of furnace temperature at a minimum temperature ensures that a minimum combustion zone temperature of 1800° F with a flue gas residence time of greater than one second. Combustion products must remain at or above 1800° F for at least one second to ensure elimination of any dioxins which may be present.

NOTE: The minimum furnace roof temperature for the combustion of refuse will be determined during environmental testing.

The forced draft, overfire air, and seal air fans are supplied to provide air for combustion. The induced draft fan provides a negative draft in the furnace. For details, see the Combustion Air and Flue Gas System Descriptions.

2.0 COMPONENTS

Boiler Manufacturer: Distral Energy Corp.

The following component information is for one boiler. All identification tags are relevant to Boiler No. 1. The suffix is A, for Boiler No. 1; The suffix is B after for boiler No. 2.

2.1 DRUM

The drum serves as the storage area for the water that is supplied to the convection tube and waterwall tube supply headers.

The water level is maintained by a 3 element feedwater regulator.

It also serves to collect the steam generated in the waterwall and convection tubes and separates the water by the use of 52 centrifugal and 26 channel steam separators to produce a dry saturated steam.

Penetrations exist in the drum for:

a. Saturated steam outlet (crossover)
b. Water sampling
c. Continuous blowdown
d. Drum level indications
e. Feed water inlet
f. Safety valves (two)
g. Pressure indication
h. Access manholes (two)
i. Vents (two)
j. Chemical feed
k. Steam sample
l. Downcomers

The drum is 60" in diameter and 40' 6" long. In addition to local sight glasses and a pressure gauge, the following remote instrumentation/control is provided:

Identification	Function
HS-0003A/B	Drum level hold P/B for water column
LSLL-0003A/B	Drum level switch for water column low low
LSHH-0003A/B	Drum level switch for water column high high
LALL-0003A/B	Drum level alarm for water column low low
LAHH-0003A/B	Drum level alarm for water column high high
LT-0004A/B	Drum level transmitter to feedwater controller
PSH-0005A/B	Drum pressure switch high to auxiliary burner control
PT-0007A/B	Drum pressure indication
PIR-0007A/B	Drum pressure indication rate
PAH-0007A/B	Drum pressure alarm high
LE-0008A/B	Drum level indication element "EYE-HYE"
HS-0008A/B	Drum level test switch
LI-0008A1/A2 A/B	Drum level test indication
LSH-0008A/B	Drum level switch high
LAH-0008A/B	Drum level alarm high
LSL-0008A/B	Drum level switch low
LAL-0008A/B	Drum level switch alarm low
LAL-0008A/B	Drum level switch alarm low

2.2 DOWNCOMERS/HEADERS

Steam produced in the generating tubes rises to and collects in the drum. Downcomers and headers serve to naturally circulate water from the drum to the generating tubes.

Two downcomers, one on either side of the boiler, connect the bottom of the drum to the bottom of the generating bank and waterwall headers. These Headers serve to distribute the water to an entire tube bank or waterwall.

2.3 TUBES

Tubes act as the heat transfer interface between the hot gases on the outside and the cooler water or steam on their inside. The waterwall tubes have a membrane (metal strip) welded between them, thus forming walls. This makes the water walls an air tight boundary, preventing any air in-leakage into the furnace.

The generator, superheater, and economizer tubes are spaced apart to allow the flue gas to flow around them.

In order to prevent tube (gas side) erosion, the first two rows of the superheater and economizer banks are fitted with stainless steel tube shields. The first row of tubes on each side of the soot blower cavities are also equipped with shields.

HEATING SURFACE AREAS	SQUARE FOOTAGE
Screen between 1st and 2nd pass	146 ft^2
Convection Evaporator	5,637 ft^2
Screen between Evap and Superheater	177 ft^2
Superheater III	5,069 ft^2
Superheater II	5,150 ft^2
Superheater I	12,327 ft^2
Economizer	33,720 ft^2

2.4 SUPERHEATER

The superheater accepts saturated steam from the drum and raises the steam temperature via additional furnace heat. This extra heat increases thermal efficiency by raising the steam quality to 100% (0% moisture) and raising the temperature above saturation (superheated). This dry superheated steam is then directed to the turbine.

The superheater is divided into three sections: primary, intermediate and final. The primary superheater is divided into two sets of tube banks (Primary Superheater SH1A and Primary Superheater SH1B). The intermediate superheater is comprised of a single tube bank. The final superheater also consists of a single tube bank. The primary superheater has 12 rows of tubes in each bank, the intermediate and final only have 10 rows per bank.

Spray water attemperators are provided between primary superheater and the intermediate superheater, and between the intermediate superheater and the final superheater. These attemperators are used to control the final boiler outlet temperature.

The superheater is protected from over pressurization by a mechanical safety valve, set at 920 PSIG, and an electromatic relief valve (power safety), set at 900 PSIG. Indication and control of the power safety is provided in the control room.

The superheater is provided with the following instrumentation:

Identification	Function
TE-0162A/B	Superheater inlet temperature element
TIR-0162A/B	Superheater inlet temperature indication rate
TE-0109A/B	Primary superheater outlet temperature element
TIR-0109A/B	Primary superheater outlet temperature indication rate
TE-0107A/B	Intermediate superheater outlet temperature element
TIR-0107A/B	Intermediate superheater outlet temperature indication rate

TT-0107A/B	Intermediate superheater outlet temperature transmitter
TIC-0107A/B	Intermediate superheater outlet temperature controller
TE-0105A/B	Finishing superheater outlet temperature element
TIR-0105A/B	Finishing superheater outlet temperature indication rate
TT-0105A/B	Finishing superheater outlet temperature transmitter
TIC-0105A/B	Finishing superheater outlet temperature controller
TAH-0105A/B	Finishing superheater outlet temperature alarm high
TAL-0105A/B	Finishing superheater outlet temperature alarm low
PSHH-0117A/B	Superheater outlet pressure switch high high to electromatic pressure relief valve.
PSHH-0121A/B	Superheater outlet pressure switch high high to stoker controls
PAHH-0121A/B	Superheater outlet pressure alarm high high
PT-0102A/B	Superheater outlet pressure transmitter
PIR-0102A/B	Superheater outlet pressure indication rate
FE-0101A/B	Superheater outlet flow element
FT-0101A/B	Superheater outlet flow transmitter

2.5 ATTEMPERATORS (MS-DS-101A, MS-DS-101B)

The superheater outlet steam temperature is controlled by spraying feedwater, as required, into the superheated steam path.

Superheater outlet steam temperature is controlled via two spray valves. The primary attemperator (MS-DS-101B), controlled by the coordinated action of temperature controllers TIC-0106 and TIC-0107, sprays feed water into the superheater steam line between the primary and intermediate superheater tube banks.

The secondary attemperator (MS-DS-101A), controlled by the coordinated action of temperature controllers TIC-0104 and TIC-0105, sprays feedwater into the superheater steam line between the intermediate and finishing tube banks.

In addition to local thermometers the following remote instrumentation/control is provided:

Identification	Function
TE-0104A/B	Intermediate superheater outlet temperature element
TT-0104A/B	Intermediate superheater outlet temperature transmitter
TIC-0104A/B	Intermediate superheater outlet temperature controller
TIR-0104A/B	Intermediate superheater outlet temperature instrument rate
TY-0104A/B	Intermediate superheater outlet temperature relay to TCV
TCV-0104A/B	Intermediate superheater outlet temperature control valve
ZSC-0104A/B	Intermediate superheater outlet temperature control valve indication closed
ZSL-0104A/B	intermediate superheater outlet temperature control valve indication closed light
TE-106A/B	Primary superheater outlet temperature element
TT-106A/B	Primary superheater outlet temperature transmitter
TIC-106A/B	Primary superheater outlet temperature controller
TIR-106A/B	Primary superheater outlet temperature instrument rate
TY-106A/B	Primary superheater outlet temperature relay to TCV
TCV-106A/B	Primary superheater outlet temperature

	control valve
ZSC-106A/B	Primary superheater outlet temperature control valve indication closed
ZSL-106A/B	Primary superheater outlet temperature control valve indication closed light

2.6 ECONOMIZER

The economizer accepts feedwater from the feedwater system and heats it to 501° F prior to being delivered to the drum. This accomplishes two objectives. Firstly, heat is extracted from the furnace exhaust gases, which increases overall unit efficiency. Secondly, the feedwater being heated before it enters the drum, is at a closer temperature to the water in the drum which lowers thermal stress in the drum.

2.7 AUXILIARY BURNER

Manufacturer: Peabody

Each auxiliary burner is equipped with its own fan to supply combustion air to the auxiliary gas burner and purge combustible gases from the burner prior to startup. The auxiliary gas burner warms the boiler during startup. It is used to bring the furnace roof temperature to minimum temperature prior to lighting off refuse, to maintain minimum furnace temperature when necessary during operation and while burning off grates during shutdown. The burner design provides positive mixing of air and natural gas at all loads without stratification.

NOTE: The minimum furnace roof temperature for the combustion of refuse will be determined during environmental testing.

There are two auxiliary burners per boiler. An auxiliary burner windbox purge air fan provides continuous burner purge/cooling air for each burner while the burner is in standby during normal combustion of refuse. The auxiliary burners are located in opposite furnace sidewalls approximately 25 feet above the stoker grate.

The auxiliary burner safety system is designed to act independently of any analog controls or human operator action. The burners are installed and operated in accordance with all applicable codes. The fuel safety logic includes automatic burner purge and required functions in preparation for lighting off. For more information on the auxiliary burners, consult the Auxiliary Burner System Description.

2.8 SOOTBLOWERS

Manufacturer: Copes-Vulcan
Model: 16 Retractable T-20E
32 Rotary D-5E

Sootblowers are used to remove the ash deposits that adhere to the economizer, convection and superheater tube surfaces, utilizing high pressure superheated steam. Removing fly ash from boiler surfaces prevents:

a. Loss of steaming capacity from the reduction of heat transfer.

b. Fan efficiency loss due to blockage of flue gas paths

Sootblower supply steam is superheated steam (325 PSIG at the sootblower header) with a blowing pressure of 170 - 225 PSIG. The system is operated via a sootblower control panel mounted in the control room.

The convection section is equipped with eight sootblowers (retractable), the superheater is equipped with twenty (8 retractable and twelve rotary), and the economizer is equipped with twenty sootblowers (rotary). The rotary sootblowers are designed to have a blowing duration of ten seconds each and the retractable elements operate with a blowing duration of six and a half minutes each.

2.9 BLOWDOWN SYSTEM

The purpose of the boiler blowdown system is to control the concentration of solids in the boiler water. Boiler blowdown is comprised of continuous blowdown and intermittent blowdown systems.

The continuous blowdown consists of the following continuous streams which are received and cooled in the continuous blowdown flash tank and the continuous blowdown heat exchanger.

a. Boiler 1 drum continuous blowdown

b. Boiler 2 drum continuous blowdown

c. Water sample cooler drains

The flashed steam recovered in the continuous blowdown flash tank is vented to the deaerator. The cooled blowdown from the continuous blowdown heat exchanger is drained to the intermittent blowdown tank.

Periodically, the boiler water headers, downcomers, soot blower headers and water columns are blown down. This intermittent blowdown is routed directly to the intermittent blowdown tank.

The boiler intermittent blowdown tank also accepts miscellaneous drains and steam trap returns. The mixed continuous and intermittent streams are cooled and discharged to the cooling tower basin.

2.9.1 Continuous Blowdown Tank (BD-TK-001)

The continuous blowdown flash tank allows for flashing and recovery of steam. The boiler steam drums may be continuously blown down (i.e. a portion of the water circulating in the steam drum is removed) to reduce the level of dissolved solids from the boiler water. Blowdown water is "flashed" in the continuous blowdown flash tank and the flashed steam is vented to the deaerator to improve steam cycle efficiency. Flashing is the process whereby a high temperature and high pressure liquid is suddenly reduced in pressure without a significant change in temperature. A portion of the water (approx. 33%) will flash to wet steam, the rest will remain in liquid form.

The continuous blowdown flash tank operating pressure 80 PSIG at 440 ^{0}F is determined by the operating pressure of the deaerator since the vapor line from the flash tank is connected directly to the deaerator.

In addition to local pressure gauges, temperature gauges and local sight glass, the following remote instrumentation/control is provided:

Identification	Function
LC-2206	Continuous blowdown tank level control
LV-2206	Continuous blowdown tank level valve
LSH-2204	Continuous blowdown tank level switch high
LAH-2204	Continuous blowdown tank level alarm high
LSL-2205	Continuous blowdown tank level switch low

LAL-2204	Continuous blowdown tank level alarm low

The level in the continuous blowdown flash tank is maintained by a local level controller (LC-2206) and a drain control valve (LV-2206).

The flow rate from the continuous blowdown flash tank is monitored by FT-2207.

The continuous blowdown flash tank is protected against over pressurization by a relief valve (PSV-2203), which is set at 88 psig.

2.9.2 Continuous Blowdown Heat Exchanger (BD-HX-001)

The continuous blowdown heat exchanger transfers heat from the boiler blowdown water to the deaerator make-up water. By extracting this energy before discharging the blowdown water to the Intermittent Boiler Blowdown Tank BD-HX-002, the plant efficiency is maintained.

In addition to local pressure gauges, temperature gauges and local sight glass, the following remote instrumentation/control is provided:

Identification	Function
FE-2207	Continuous blowdown heat exchanger flow element
FT-2207	Continuous blowdown heat exchanger flow transmitter
FIR-2207	Continuous blowdown heat exchanger flow instrument rate

2.9.3 Intermittent Boiler Blowdown Tank (BD-TK-001)

The intermittent boiler blowdown tank serves to receive blowdown from the sources listed below and vent the associated steam to the atmosphere:

a. Continuous blowdown heat exchanger

b. Boiler and superheater upper drain headers

c. Boiler and superheater lower drain headers

d. Main steam header drains

e. Turbine extraction header drains

f. Sootblower drains

The intermittent boiler blowdown tank vents through the roof of the facility and exhausts any flashed steam to atmosphere. The water from the intermittent boiler blowdown tank is routed through a static mixer (BD-AG-001) to the cooling tower basin.

The water is cooled when necessary by circulating water return in the static mixer prior to entering the settling basin. Temperature Controller TIC-0432 maintains this temperature.

In addition to local pressure gauges, temperature gauges and local sight glass, the following remote instrumentation/control is provided:

Identification	Function
TIC-0423	Intermittent blowdown tank temperature control
TCV-0423	Intermittent blowdown tank temperature control valve
TSH-2213	Intermittent blowdown tank discharge temperature switch high
TAH-2213	Intermittent blowdown tank discharge temperature alarm high

3.0 OPERATION

3.1 COLD PLANT START-UP

3.1.1 Verify the spray dryer absorbers and baghouses are ready for startup.

3.1.2 Verify the flyash handling system is ready for startup.

3.1.3 Verify the Martin System is ready for startup.

3.1.4 Close the boiler and economizer drains.

3.1.5 Open the boiler drum vents.

3.1.6 Verify the main stop/check angle valve as well as main steam supply valves are closed and associated drains are open.

3.1.7 Open the superheater vents and drains.

3.1.8 Open the economizer inlet stop valve.

3.1.9 Set the feedwater regulator valve to manual and close it.

3.1.10 Open the feedwater regulator stop valves and close the bypass valve.

3.1.11 Commence filling the boiler by either the boiler fill pump DW-PU-003 or the electric feed pump FW-PU-001A. When using the latter manually opening the feedwater regulating valve to achieve a flow rate of approximately 60,000 lbs/hour. Stop filling when approximately -7 inches is indicated in the drum.

3.1.12 Place the induced draft (ID) fan inlet damper in manual and close it.

3.1.13 Open the forced draft (FD) and overfire air (OFA) fan dampers.

3.1.14 Start the induced draft fan, verify satisfactory operation.

3.1.15 Place the induced draft fan inlet damper control in automatic with a setpoint of -0.3" WC.

3.1.16 Close the underfire air dampers and set the overfire air dampers to 0% open.

3.1.17 Place the forced draft (FD) fan inlet damper in manual and close it.

3.1.18 Set the overfire air (OFA) fan inlet damper in manual and close it.

3.1.19 Start the seal air fan.

3.1.20 Attempt to start both the overfire and forced draft fans. They should <u>not</u> start due to the low drum Level interlock.

3.1.21 Continue filling the boiler to a level approximately two inches below normal level.

3.1.22 Start the forced draft fan. Verify proper operation.

3.1.23 Start the overfire air (OFA) fan. Verify proper operation.

3.1.24 Shut down the induced draft fan and verify that the overfire air and forced draft fans trip.

3.1.25 Verify the stoker controls are set for startup.

3.1.26 Verify the baghouse is in service.

3.1.27 Start the induced draft fan. Verify satisfactory operation.

3.1.28 Place the induced draft (ID) fan damper control on automatic with a setpoint of -0.3" WC.

3.1.29 Start the seal air fan. Verify satisfactory operation.

3.1.30 Start the forced draft (FD) fan. Verify satisfactory operation.

3.1.31 Place the forced draft (FD) fan inlet damper control on automatic with a setpoint of 16" WC.

3.1.32 Start the overfire air (OFA) fan.

3.1.33 Line up the steam distribution system for a cold plant startup as per the Steam Distribution System Description.

3.1.34 In accordance with burner management requirements, purge and light off the auxiliary propane burners.

3.1.35 Once the auxiliary gas burners are lit, reduce the over fire and forced draft fans to minimum.

3.1.36 In accordance with the attached boiler startup curve (see appendix), slowly increase the gas burner firing rates.

3.1.37 As boiler pressure increases, the steam distribution will automatically come up to the correct operating pressures and temperatures.

3.1.38 Boiler air preheaters can be placed in service whenever needed. Ensure the condensate return valve to the deaerator is open. Ensure that the individual coil steam traps are valved in for service. Slowly open the steam supply block valve(s) for the air preheater to be placed in service. Any combinations of the, six sets of coils can be placed in service as needed.

3.1.39 At 25 PSIG shut the drum and superheater vents.

3.1.40 At 75 PSIG place the steam traps in service.

3.1.41 At 500 PSIG, ensure that the electromatic relief valve is placed in service. Upon achieving 865 PSIG boiler pressure, allow the boiler conditions to stabilize.

3.1.42 As the high pressure header reaches 865 PSIG, the bypass steam pressure controller (PIC-0123) will begin to open pressure control valve PV-0123. This will admit steam to the by-pass condenser and maintain the high pressure header at 865 PSIG.

3.1.43 Start the boiler, scrubber and baghouse residue and flyash handling equipment.

3.1.44 Start the boiler chemical feed system.

3.1.45 When the spray dryer absorber inlet temperature reaches 350^0 F, place it into service.

3.1.46 Monitor the furnace temperatures. Adjust the gas burners to achieve stable flue gas temperatures.

NOTE: The required furnace temperature for placing the unit on refuse will be determined by furnace traverses to be performed during emission testing. All references to temperatures are only estimates. As the boiler and furnace surfaces foul, expected temperatures will rise.

3.1.47 Place the induced draft (ID) fan inlet damper control in manual and reduce the furnace pressure to 0" WC.

3.1.48 Start two Martin hydraulic pumps.

3.1.49 Open the refuse feed chute damper and commence charging the hopper. The initial several charges of refuse should be selected for apparent dryness and burning qualities.

3.1.50 Place the induced draft fan inlet damper in automatic with a setpoint of -0.3" WC.

3.1.51 Observe the refuse on the feed table, once it lights off and there is fire all the way across, proceed.

3.1.52 Start the forced draft fan and raise the set point to 16"WC.

3.1.53 Start the overfire air fan and raise the set point to 19" WC.

3.1.54 Manually stroke the feeders with two twenty inch strokes.

3.1.55 Observe the fire development on the grates.

3.1.56 Place the forced draft fan inlet damper in automatic with a setpoint of 16" WC.

3.1.57 Place the combustion unit on refuse as per the Martin Stoker System Description.

3.1.58 If the superheater header temperature is greater than 800° F, open the superheater attemperator stop valves and adjust the attemperator setpoint to 830° F.

NOTE: With a clean furnace it is not expected to require superheater attemperation for several weeks. During sootblowing and other operations, attemperation may be required.

3.1.59 Open the continuous blowdown isolation valve. Set the metering valve $^1/_4$ turn open from the closed seat.

3.2.60 Start the thermal denox equipment.

3.2.61 Start the Carbon injection system.

3.2 Combustion Unit Startup (Hot Plant)

3.2.1 Verify that the spray dryer absorbers and baghouses are ready for startup.

3.2.2 Verify that the flyash handling equipment is ready for startup.

3.2.3 Verify that the Martin System is ready for startup.

3.2.4 Close the boiler and economizer drains.

3.2.5 Open the boiler drum vents.

3.2.6 Verify the main stop/check angle valve and the main steam supply valves are closed and their associated drains are open.

3.2.7 Open the superheater vents and drains.

3.2.8 Open the economizer inlet stop valve.

3.2.9 Place the feedwater regulator in manual and close it.

3.2.10 Open the feedwater regulator stop valves and close the bypass valve.

3.2.11 Commence filling the boiler by manually opening the feedwater regulator to achieve a flow rate of approximately 60,000 lbs/hour. Stop filling when approximately -7 inches is indicated in the drum.

3.2.12 Place the induced draft (ID) fan inlet damper to manual and close it.

3.2.13 Open the forced draft (FD) and overfire air (OFA) fan dampers.

3.2.14 Start the induced draft fan, verify satisfactory operation.

3.2.15 Place the induced draft fan inlet damper control in automatic with a setpoint of -0.3" WC.

3.2.16 Close the underfire air and overfire air dampers on the Martin panel.

3.2.17 Place the forced draft (FD) fan inlet damper in manual and close it.

3.2.18 Place the overfire air (OFA) fan inlet damper in manual and close it.

3.2.19 Start the seal air fan.

3.2.20 Attempt to start both the overfire and forced draft fans. They should <u>not</u> start due to the low drum level interlock.

3.2.21 Continue filling the boiler to a level approximately two inches below the normal water level.

3.2.22 Start the forced draft fan. Verify satisfactory operation.

3.2.23 Start the overfire air (OFA) fan. Verify satisfactory operation.

3.2.24 Shut down the induced draft fan and verify that the overfire air and forced draft fans trip.

3.2.25 Verify that the stoker controls are set for startup.

3.2.26 Verify that the baghouse is in service.

3.2.27 Start the induced draft fan. Verify satisfactory operation.

3.2.28 Place the induced draft fan damper control in automatic with a setpoint of -0.3" WC.

3.2.29 Start the seal air fan. Verify satisfactory operation.

3.2.30 Start the forced draft fan. Verify satisfactory operation.

3.2.31 Place the forced draft fan inlet damper control in automatic with a setpoint of 16" WC.

3.2.32 Start the overfire air fan.

3.2.33 Line up the steam distribution for a hot plant startup as per the Steam Distribution System Description.

3.2.34 In accordance with burner management requirements, purge and light off the auxiliary gas burners.

3.2.35 Once the auxiliary gas burners are lit, secure the overfire air and forced draft fans.

3.2.36 In accordance with the boiler startup curve (see appendix), slowly increase the gas burner firing rates.

3.2.37 At 25 PSIG close the boiler and superheater vents.

3.2.38 At 75 PSIG place the steam traps in service and close the steam line drains.

3.2.39 Close the superheater drains when a steady flow of dry steam flows from each.

3.2.40 At 500 PSIG, ensure that the electromatic relief valve is placed in service. Upon achieving 880 PSIG boiler pressure, allow the boiler conditions to stabilize.

3.2.41 Start the chemical feed system.

3.2.42 As the high pressure header reaches 865 PSIG, place the by-pass steam pressure controller (PIC-0123) in automatic, with a setpoint of 2 to 3 PSIG above the main steam header pressure. This will admit steam to the by-pass condenser and maintain pressure slightly above the main steam header pressure.

3.2.43 Slowly open the boiler stop valve (MS-V-001A or MS-V-001B).

3.2.44 By-pass steam pressure controller PIC-0123 will automatically close, due to having a higher setpoint than header pressure.

3.2.45 Once the startup pressure control valve (PV-0123) is closed, close the steam header isolation valve (MS-V-005A or MS-V-005B).

3.2.46 Start the boiler, scrubber and baghouse residue and flyash handling equipment.

3.2.47 When the spray dryer absorber inlet temperature reaches 350° F, place it into service.

3.2.48 Monitor the furnace temperatures. Adjust the gas burners to achieve stable flue gas temperatures with a maximum gas burner output.

NOTE: The required furnace temperature for placing the unit on refuse will be determined by furnace traverses to be performed during emission testing. All references to temperatures are only estimates. As the boiler and furnace surfaces foul, expected temperatures will rise.

3.2.49 Place the induced draft fan inlet damper control in manual and reduce the furnace pressure to 0" WC.

3.2.50 Open the refuse feed chute damper and commence charging the hopper. The initial several charges of refuse should be selected for apparent dryness and burning qualities.

3.2.51 Place the induced draft fan inlet damper in automatic with a setpoint of -0.3" WC.

3.2.52 Start the forced draft fan.

3.2.53 Start the overfire air fan.

3.2.54 Observe the refuse on the feed table, verify there is fire all the way across.

3.2.55 Manually stroke the feeders with two twenty inch strokes.

3.2.56 Observe the fire development on the grates.

3.2.57 Place the forced draft fan inlet damper in automatic with a setpoint of 16" WC and place the OFA damper to "AUTO" and raise set point to 18" WC.

3.2.58 Start the Martin System as per the Martin Stoker System Description.

3.2.59 If the superheater header temperature is greater than 800° F, open the superheater attemperator stop valves and adjust the attemperator setpoint to 830° F.

NOTE: With a clean furnace it is not expected to require superheater attemperation for several weeks. During sootblowing and other operations, attemperation may be required.

3.2.60 When all conditions are stable switch the fuel controller to "steam flow" and adjust the setpoint to 160,000 lbs/hour.

3.2.61 Open the continuous blowdown isolation valve. Open the continuous blowdown throttle valve $^1/_4$ turn from closed seat.

3.2.62 Start the thermal denox equipment.

3.2.63 Start the Carbon injection system.

3.3 Combustion Unit Shutdown

3.3.1 Line up steam distribution for shutdown as per the Steam Distribution System Description.

3.3.2 Discontinue feeding refuse to the feed chute hopper.

3.3.3 Turn off the air controller. From now on control the underfire air dampers on manual.

3.3.4 Switch the fuel controller to "steam flow" and adjust the indicator to the proper setpoint.

3.3.5 Reduce the boiler load to 50%. This corresponds to a steam flow of 85,000 lbs/hour. Adapt all furnace settings to load according to the Martin Stoker Setting Table.

3.3.6 Monitor refuse level in the feed chute. As soon as refuse level drops below the damper, close it.

3.3.7 When the furnace gas temperature drops below 1,400° F at the side wall thermocouple, light off the auxiliary burner and ensure that 380° F at boiler outlet is maintained.

3.3.8 Adjust the burner firing rate to hold 380° F boiler

outlet gas temperature, and 1,400° F furnace temperature.

3.3.9 When steam flow drops to 15,000 lbs/hour, open the startup steam isolation valve (MS-V-005A, or MS-V-005B) for the unit being shut down.

3.3.10 Place the startup steam header pressure controller in automatic with a setpoint of 1 PSIG above the header pressure.

3.3.11 Slowly close the main steam stop (MS-V-001A, or MS-V-001B) for the unit being shut down.

Important: Make sure that you maintain steam flow for superheater cooling until the gas temperature at the superheater inlet is below 750° F.

3.3.12 Shut down the stoker as per the Martin Stoker System Description.

3.3.13 Shut down the auxiliary burners when refuse on the grate is burned out.

3.3.14 Shutdown spray dryer absorber as per its system description.

3.3.15 Initiate a cleaning cycle for the baghouse. After the cleaning cycle, take the baghouse compartments out of service as draft allows.

3.3.16 Monitor the boiler pressure and control cool down rate by adjusting the startup pressure controller setpoint.

3.3.17 Shut down the forced draft fan.

3.3.18 Shut down the overfire air fan.

3.3.19 Shut down the induced draft and seal air fans.

3.3.20 Secure the feedwater supply to the superheater attemperator.

3.3.21 Raise the steam drum level to the "high level" alarm.

NOTE: Do not exceed the high level alarm or the main turbine will trip.

3.3.22 Isolate the feedwater regulating valve.

3.3.23 Secure the chemical feed to the boiler.

3.3.24 Secure the continuous blowdown.

3.3.25 At 500 PSIG drum pressure, valve out the electromatic relief valve and place the control switch in the "off" position.

3.3.26 When boiler pressure is below 40 PSIG, open the steam drum vents.

3.3.27 Secure the startup steam line.

3.4 NORMAL OPERATION

3.4.1 Boiler drum level is maintained by a three element feedwater control loop utilizing the coordinated operation of Drum Level Controller LIC-004 and Feedwater Flow Controller FIC-0028.

3.4.2 Boiler outlet pressure is maintained by the main turbine governor (operating in the "inlet pressure" control mode) and/or the main steam bypass condenser (via Inlet Pressure Controller PIC-123)

3.4.3 Boiler load (steaming rate) is maintained by the automatic operation of the stoker system. See the Martin Stoker System Description for details.

3.4.4 Boiler outlet steam temperature is maintained by the automatic operation of the primary attemperator (TIC-0106) and the secondary attemperator (TIC-0104).

3.4.5 Boiler water should be sampled and tested for chemistry at least once per shift. Boiler chemicals are continuously introduced at a metered rate. See the Chemical Feed System Description for details.

3.4.6 As required by boiler water analysis, adjust the boiler continuous blowdown.

3.4.7 Auxiliary Burner

If furnace roof temperature goes below a selected value as detected by the average furnace roof temperature signal (TY-0601), the low furnace temperature alarm (TAL-0601) will annunciate. The auxiliary gas burner should be started at this time. The furnace roof temperature will be maintained at an average temperature as set by Furnace Temperature Controller TAL-0601. The burner should be left in service until the refuse fire has stabilized and is maintaining adequate furnace temperature.

NOTE: The minimum furnace roof temperature for the combustion of refuse will be determined during environmental testing.

If the furnace side wall temperature as sensed by the average of TE-0601A1 and TE-0601A2 is below 800° F, a ventilation (air purge) of the furnace will be required prior to burner light off. This would normally only occur on boiler startup.

3.4.8 Sootblowers

The sootblowers are operated as required to maintain the boiler operating parameters within design specifications. Sootblowing is performed when there is an increase in boiler exit gas temperature, increase in boiler gas path differential pressure, a decrease in boiler gas flow or when buildup of deposits on boiler tubes is noted from the temperature and pressure trends in the boiler. The sootblowers may be operated manually or by the automatic sequencing unit. For detailed instructions, see the Copes Vulcan Equipment Operations Manual.

3.5 BOILER BLOWDOWN

The design normal continuous blowdown rate is 2375 lb/hour for each boiler. Boiler drum and steam samples will normally be taken once per shift. The blowdown and chemical feed rates are dependant upon the results of the laboratory analysis and adjusted accordingly.

3.5.1 The boiler headers and downcomers must be blown down at a frequency recommended by the water treatment chemical supplier to remove sediment which may collect there. Manually operated valves are opened to blow water to the intermittent blowdown tank. It is advisable to blow the headers and downcomers when the boiler is not firing but still pressurized (i.e., when the unit is taken off line immediately after the auxiliary burner is secured). If the headers or downcomers need to be blown down while the boiler is on line, the following should be observed:

A short, rapid blowdown is most effective in removing the sediment from the header and preventing tube overheating and possible damage (when boiler is firing). Limit the duration of the blowdown (from time flow starts until the valve is shut and flow stops) to 20 seconds.

The water columns are periodically blown down. A "level hold" pushbutton is located next to each water column and level chamber blowdown valve set to disable the boiler low level trip when blowing down the column and chamber.

NOTE: One "level hold" pushbutton is located at each side of the drum.

Depression of the "level hold" pushbutton prevents tripping the boiler as a result of level (chamber and water column level decrease when the blowdown valves are opened). Upon completion of the column blowdown, the blowdown valves are closed and the pushbutton is released. This restores the boiler tripping capability of the level switches upon detection of a "low low" drum level.

3.5.3 The continuous blowdown heat exchanger is not intended to maintain any specific makeup water temperature for the deaerators. The purpose is to recover a portion of the heat in the blowdown water, which would otherwise be wasted. Blowdown water and makeup water flows are regulated independently. Demineralized water makeup flowing from the continuous blowdown heat exchanger to the deaerator is regulated by a deaerator level control valve (LV-2206).

3.5.4 Sediment will collect on the bottoms of the continuous blowdown flash tank and boiler intermittent blowdown tank. This sediment must be blown down before it builds up to the point where it interferes with flow. This is done by periodically opening the appropriate drain valve for a short duration. Ensure that the drain valve is fully closed after the sediment has been blown down.

4.0 REFERENCES

4.1 PIPING AND INSTRUMENTATION DRAWINGS

Description	Drawing Number
Superheater and Economizer	7102-E-220101
Combustion Air and Stoker	7102-E-220102
Flue Gas	7102-E-220103
Air Heater	7102-E-220106
Boiler Feedwater	7102-E-220107
Turbine Generator Steam	7102-E-220108
Boiler Blowdown and Sample Steam	7102-E-220112
Boiler Furnace	7102-E-220118
Boiler Drums and Drains	7102-E-220119
Burner Management and Propane gas	7102-E-220122

4.2 LOGIC DIAGRAMS

Burners Control Interface	510014
Induced Fan Draft	510022
Forced Draft Fans	510023
Overfire Air Fan	510024
Seal Air Fan	510025
Boiler Ventilation Sequence	510026

4.3 VENDOR MANUALS

Vendor	Equipment	Equipment Manual
Martin GMBH	Martin Stoker	Appendix A
Distral	Boilers	O&M Manual
ABB	Baghouse/Scrubber	O&M Manual
Peabody	Auxiliary Burners	O&M Manual

Operation and Maintenance Plan

Exhibit 15

LEE COUNTY SOLID WASTE RESOURCE RECOVERY FACILITY

OPERATION AND MAINTENANCE PLAN

MARCH 1994

OGDEN MARTIN SYSTEMS
OF
LEE, INC.

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1.0 PROJECT RESPONSIBILITIES

1.1 Ogden Martin Systems of Lee, Inc.

Ogden Martin Systems of Lee, Inc. (OMSL) is responsible for the construction, operation and maintenance of the Lee County Solid Waste Resource Recovery Facility (the Facility) by agreement between OMSL and Lee County (the County).

1.2 Ogden Martin Systems, Inc.

Ogden Martin Systems, Inc. (OMS) retains liaison with Martin GmbH and provides engineering, technical and administrative support as well as overall operational and business direction for the facility. Located in the OMS office in Fairfield, New Jersey, the Executive Vice President, Facility Operations has overall responsibility for the Lee County Project.

1.3 Ogden Services Corporation

Ogden Services Corporation (OSC) furnishes the management, supervisory and hands-on personnel for the Facility as well as technical and administrative support as required, to properly operate and maintain the Facility. Located in the OSC Fairfield, NJ. office, the Vice President, Resource Recovery Operations is responsible for OSC services at the Lee County Resource Recovery Facility as well as other OMS plants.

2.0 FACILITY MANAGEMENT

2.1 Management Responsibilities

Working in accordance with operational guidelines and business directives set forth by OMS, the Facility Manager and Facility Manager of Administration have dual responsibility for implementing OMSL contractual obligations with the County. The Facility Manager, and the Manager of Administration, have full authority for operational coordination and business dealings with the County and relations with the community in general.

The Chief Engineer will assume the Facility Manager's role during his/her absence from the plant. In the event that neither the Manager or the Chief Engineer are in the plant, the Maintenance Supervisor is in charge. During off-normal working hours, weekends

and holidays, the Shift Supervisor on watch at the time has first-hand responsibility for the operation and well-being of the Facility. However, all of the above mentioned management personnel are on call when not actually in the plant.

2.2 Coordination with Lee County

Routine day-to-day coordination of waste deliveries and residue disposal as well as other matters related to the operation of the Facility will be conducted by the Facility Manager with the County.

Based on current operating conditions, equipment availability, maintenance schedules, and storage and handling capabilities, the Facility Manager will provide the County representative with information that will allow advanced planning and anticipation of alternate disposal requirements.

Conversely, where possible, the Facility will be advised of any anticipated changes in traffic flow, type of waste or amounts of waste to be delivered and thus will be in better position to handle unusual situations by rescheduling personnel, modifying maintenance plans or adjusting operating conditions.

This coordination will provide the means of responding to emergency conditions or forced outages at the Facility by immediate notification and, if necessary the implementation of prearranged, alternate routing of deliveries.

In accordance with the Service Agreement, county representatives may, with reasonable prior notice, observe and inspect the Facility for any purpose. While on the plant property, the representatives shall comply with the safety rules and other appropriate regulations of the Facility as well as any emergency orders that may be issued by the Facility management.

2.3 Procedures and Documentation

A list of the Facility procedures and other documentation is provided below:

Reference Library

The Facility Reference Library is an organized collection of vendor, engineering and construction documentation. Manufacturer data and information such as manuals, diagrams, shop drawings and ordering information is catalogued and stored by equipment number or system, as appropriate, and cross-referenced by manufacturer as

well as purchase order number. In addition, installation and start-up data, set points and calibration readings, and as-built diagrams are filed together with the manufacturer's information.

A complete file of plant as-built drawings is maintained in the Reference Library.

Operating Manual

The Facility Operating Manual comprises eight (8) major sections including Operating Plan, Environmental Compliance Plan, Spill Prevention, Fire and General Emergency Plan, Crisis Plan, Waste Control Plan, Hazard Communication Program, and System Descriptions.

The System Descriptions are primarily related to the design and components of individual systems of the plant. Each is based on specific manufacturer data as well as the design engineers intentions, philosophy and operational criteria for the system. The Operating Instructions are based on actual, as-built arrangements and the specific operational requirements of the facility.

The System Descriptions describe, in detail, the purpose, components, instrumentation/control and interlocking as well as the start-up, operation and shutdown of individual systems of the Facility. Each Description includes technical references, precautions, set points, indications and other such information that is specific to the individual system and necessary or helpful to its safe and efficient operation.

Maintenance Management System - Implementation Manual

This manual provides detailed information regarding the computer-based maintenance program and the various input data that must be developed and loaded into the program. OMSL will utilize GP Mate developed by GP Solutions, Inc. as the computerized maintenance management system. The purpose of the GP Mate system is to provide greater control of maintenance functions by automating the flow of maintenance information. The manual is tailored for specific codes and information related to the Facility.

The major sections of the manual include:

a) General Description
b) Computer Location
c) System Description
d) Commands

e) Backing Up
f) Diskette Maintenance
g) Creating the Database
h) System Management
i) Specific Operating Procedures
j) Reports/Menus
k) Glossary

Employee Manual

Upon reporting to the Facility, each new employee is issued a copy of the Employee Manual which he/she retains throughout the period of his/her employment at the facility. Revisions and additions to the Manual are issued to each employee as they occur. Periodically all Manuals are called in, checked for completeness and condition, corrected as necessary and returned to the employees.

The Employee Manual is a compendium of documents and information that is critical to the employee's conduct and well being in his/her job. The Manual comprises:

a) Employee Handbook
b) Employee Work Rules
c) Hazard Communications Program

The following is a brief description of the various sections of the Manual:

Employee Handbook and Work Rules, jointly prepared by the Plant Manager and the OSC Fairfield staff, contain specific information regarding work rules, policies and guidelines for the employee.

Hazard Communication (HazCom) Program, in accordance with OSHA rules, addresses chemical safety, personnel training and the chemicals and other materials used at the Facility. The HazCom Program includes management and employee responsibilities, manufacturers data and instructions for personnel protection, precautions, cleanup procedures, first aid, and other pertinent information.

2.4 Reporting

The Facility Manager is responsible for preparing periodic reports which are to be distributed to OMS and OSC as well as various documentation required by the County and appropriate governmental agencies.

Reports Required by the Service Agreement:

Local Monthly Reports, submitted by OMSL on or before the fifteenth (15) day of each month to the County. These reports include : (1) hourly electricity generated each day and summary totals of electricity delivered to Florida Power & Light during the preceding month; (2) the anticipated operating schedule for the next preceding month; (3) the total amount of any materials consumed with respect to the operation of the facility during such preceding month; (4) the quantities of Recovered Resources generated other than electricity during such preceding month; (5) Pass Through Costs incurred during such preceding month; (6) waste received during such preceding month; (7) waste processed during such preceding month; (8) estimated higher heating value of waste processed during such preceding month; (9) Residue shipped during such preceding month; (10) steam generation during such preceding month; (11) steam generation per ton of waste processed during such preceding month; (12) boiler make-up water during such preceding month; (13) Facility electric usage during such preceding month; (14) availability during such preceding month; and (15) boiler utilization for such preceding month.

The following are brief descriptions of the various reports required by OMS and OSC:

Daily Status Report, provides a verbal update of operating conditions and major problems or events. By telephone to the OSC Fairfield office each business day morning.

Weekly Activities Report, providing detailed information covering operating parameters, equipment status and problems. Telecopied to the OSC/OMS Fairfield offices each Friday.

Monthly Operations Report, providing a summary of facility operations, maintenance, safety, personnel, community relations and environmental compliance during the preceding month.

2.5 Quality Control

The Facility has implemented an on-going Quality Assurance/ Quality Control (QA/QC) Program. The goal of the QA/QC Program is to monitor several key aspects of the Facility's operation and provide timely warning of unacceptable conditions or adverse trends.

The basis of the Program is the routine review and evaluation of

key operating data and plant activities, supplemented by the periodic, first-hand inspection of the Facility. Utilizing the information and data provided in the reports described in Section 2.4, the OMS Operations Department as well as the OSC Operations Department in Fairfield each examine specific aspects of Facility operations. Typically, the groups, independently as well as mutually, if appropriate, review and evaluate information and data looking for trends or indications of:

a) Declining equipment performance or reliability.
b) Potential equipment failures.
c) Reoccurring problems or failures.

3.0 FACILITY STAFF

3.1 Organization

The Facility is operated round-the-clock, seven (7) days per week, fifty-two (52) weeks per year by a staff of full-time Ogden employees. The Facility is organized into three (3) major groups or departments:

- management/administration
- operations
- maintenance

Position Descriptions

Facility Manager, reporting to the OSC Vice President of Regional Operations, has overall responsibility for the safe, efficient, and reliable functioning of the Facility. In carrying out these responsibilities, the Facility Manager manages and directs the operational and maintenance requirements of the plant through the Chief Engineer and Maintenance Supervisor. In addition, the Facility Manager oversees the support, administrative and business functions carried out by the Facility office staff.

The Facility Manager is responsible for coordination and liaison with the County and for assuring cooperation with local authorities and appropriate government agencies.

The position of Facility Manager requires an individual with not less than fifteen (15) years of experience that includes in-plant management and supervisory responsibilities for day-to-day operating and/or maintenance functions. A minimum of two (2) of the required fifteen (15) years experience must be in a mass burn electric generating facility with a processing capacity of four hundred (400) TPD or greater. While a degree is most preferable, directly related management experience, with proven performance, is

acceptable.

Manager of Administration, reporting to the OMS Assistant Vice President-Facility Administration in Fairfield, NJ and working in conjunction with the Facility Manager, will act as a liaison with community officials, customers, subcontractors and suppliers. The Manager of Administration will review, determine appropriate cost coding and approve all Vouchers for Payment from local vendors. He/she also assists plant personnel in implementation of maintenance and inventory control programs, preparation of reports, budgets and scheduling of events.

The position of Manager of Administration requires an individual having a Bachelor's Degree in Accounting or Finance and preferably previous experience in the solid waste or electrical utility industries.

Chief Engineer, reporting to the Facility Manager, is second in command and responsible for the operation of the Facility. The Chief Engineer organizes and coordinates the day-to-day activities of the operations personnel, establishes priorities for repair work and projects, helps plan and schedule outage work and provides technical guidance or, if required, direction during unusual operations or in regard to problems associated with equipment repairs.

The Chief Engineer conducts or participates in studies to improve the plant operations, maintenance, or equipment and will monitor the effectiveness of plant manuals and procedures, instituting changes or additions, as required.

The Chief Engineer, having responsibility for safety, environmental compliance and the technical aspects of the plant operation, assists in recruiting, interviewing and selecting operations personnel and directs their initial training. The Chief Engineer oversees the training of operators for upgrading and general proficiency to ensure the availability of promotable people, the plants's readiness to meet emergency or unusual situations and safe and efficient day-to-day operations.

The position of Chief Engineer requires an individual having at least ten (10) years experience, including supervision of the day-to-day operation of mass-burn, resource recovery equipment or fossil-fueled electric generating units. While a degree is desirable, hands-on operating experience and utility training is acceptable.

Maintenance Supervisor, reporting to the Facility Manager, coordinates and supervises the day-to-day activities of the maintenance group and administers the Maintenence Management System.

The Maintenance Supervisor's duties include reviewing and assisting in establishing day-to-day work order priorities, planning and scheduling maintenance work, and inspecting and approving completed work. He oversees tasks, and provides technical assistance, and safety training as required.

The Maintenance Supervisor directs the development of maintenance procedures and instructions and assists in the evaluation and development of recommendations for plant improvements. He monitors tool and spare parts requirements and verifies that adequate provisions for such items are included in the inventory control systems.

The position of Maintenance Supervisor requires an individual having at least ten (10) years experience in power and/or industrial plant mechanical or electrical maintenance. While a degree is desirable, a management/supervisory background that crosses craft boundaries and encompasses maintenance planning and support areas such as spare parts control and subcontractor coordination is acceptable.

Shift Supervisor, reporting to the Chief Engineer, is responsible for the safe and efficient operation of the Facility during an assigned shift. The Shift Supervisor supervises the personnel assigned to his shift and directs their actions as necessary. During the period of the assigned shift, he routinely tours the plant and oversees the activities of the operators.

In the event of emergencies or unusual operations, the Shift Supervisor will, if necessary, direct or personally perform the required operations or corrective actions as well as coordinate the activities of all personnel involved.

The Shift Supervisor is responsible for approving all requests for removing equipment from service for maintenance, or other purposes, and for ensuring that the equipment is properly cleared and tagged in accordance with plant procedures.

During nighttime hours, weekends, and holidays, the Shift Supervisor has on-the-scene responsibility for the plant's well-being in the absence of the Facility Manager and the Chief Engineer.

The position of Shift Supervisor requires at least eight (8) years

experience in power or resource recovery plant operations. Background should include hands-on operations and supervisory experience with high pressure boilers and electric generation equipment. A high school education and/or formal technical or utility operator training is required.

Shift Engineer, working under the direction of the Shift Supervisor, is responsible for remotely monitoring and controlling plant equipment and systems from the control room.

The duties of the Shift Engineer include the safe and efficient operation of the plant equipment in accordance with established operating procedures, as well as coordinating operators throughout the plant, logging operating activities and recording pertinent data. The Shift Engineer must report equipment malfunctions or trends which indicate possible trouble and take appropriate action to correct abnormal operating conditions or emergency situations, without first-hand supervision or direction.

The position of Shift Engineer requires at least five (5) years experience in the hands-on operation of high pressure boilers and electric generating equipment. A high school education and/or formal technical or utility training is required.

Auxiliary Engineer, working under the general supervision of the Shift Supervisor and the direction of the Shift Engineer, is responsible for the operation and inspection of various systems and equipment as assigned. Normally, the assigned areas include the boilers, turbine generator and associated systems such as fans, grates, ash and scrubber systems and water plant operations.

In addition, the Auxiliary Engineer operates the refuse cranes and is responsible for proper pit management including mixing, stacking and monitoring of refuse. He is also responsible for maintaining correct levels of refuse fuel in the furnace charging hoppers.

The duties of the Auxiliary Engineer include the safe and efficient operation of the assigned equipment in accordance with established operating procedures. He is responsible for recording data, reporting equipment malfunctions or trends which indicate possible trouble, and performing actions as directed to correct abnormal operating conditions or emergency situations.

In performing his duties, the Auxiliary Engineer normally works under the direction of the Shift Supervisor. However, during emergencies or unusual situations, the Auxiliary Engineer must take appropriate action on his own initiative to prevent equipment damage or injury to personnel.

The position of Auxiliary Engineer requires previous experience in the operation of mechanical equipment. A high school education and/or formal technical or apprentice training is required.

Equipment Operator, working under the direction of the Shift Supervisor, is responsible for the safe and effective operation and maintenance of front end loaders and other mobile equipment as assigned. Primary assignment includes supporting efficient tipping operations by policing the floor, controlling traffic and inspecting for unacceptable waste. Assignments may also include sweeping roadways and paved areas of the site, loading residue and ferrous trucks and supporting the maintenance or operating groups, as necessary.

The position of Equipment Operator requires previous experience in operating front end loaders and other mobile equipment. A high school education and/or technical or apprentice training is required.

Maintenance Mechanic, working under the supervision of the Maintenance Supervisor, is responsible for performing various maintenance and repair work. Typically, the Maintenance Mechanic's principal duties include the inspection and maintenance work required for rotating machinery and equipment. The Mechanic may inspect and adjust, as necessary, the mechanical alignment, balance, level, and general condition of pumps, fans, and other rotating equipment throughout the plant and as required, check, repair, adjust or replace couplings, bearings, and mounts.

The Mechanic performs preventative maintenance tasks including routine vibration tests and will actively participate in the periodic tear down and internal inspection of major equipment.

The Maintenance Mechanic uses various shop equipment in the performance of his/her assigned tasks, such as the repair or rebuilding of sootblower drives, gearboxes, speed reducers, pumps, and other assemblies.

The position of Maintenance Mechanic requires at least five (5) years experience in the repair and maintenance of mechanical equipment. A high school education and/or formal technical or apprentice training is required.

Instrument/Electrical (I & E) Technician, working under the supervision of the Maintenance Supervisor, is responsible for performing routine maintenance and emergency repairs of the plant instrumentation and control systems and all electrical equipment.

Typically, the I & E Technician's assignments include preventative maintenance as well as troubleshooting and repair of generator instrumentation, control circuits, combustion control systems, drum level controls, recorders, and alarms.

The I & E Technician is capable of testing and trouble-shooting pneumatic, electrical, and electronic control equipment and components down to the individual printed circuit board or equivalent, as well as troubleshooting and repair of circuit breakers, motor control centers, generator, transformers, electrical metering, protective relays, and preventative maintenance.

The position of I & E Technician requires at least five (5) years experience in maintenance, trouble-shooting and repair of pneumatic devices, electrical and electronic systems and components. A high school education and/or formal technical training is required.

Purchasing/Warehouse Person, reporting to the Facility Manager, is responsible for the day-to-day computer operation of the Maintenance Management System, planning and scheduling of materials and supplies for work projects, purchasing, shipping, receiving and inventory control. The Purchasing/Warehouse Person works closely with the Chief Engineer and Maintenance Supervisor to ensure the ready availability of consumables, parts, maintenance tools and supplies at all times.

The position of Purchasing/Warehouse Person requires at least five (5) years experience in purchasing, and planning work assignments and/or projects including materials availability and manpower scheduling.

Experience should include first hand knowledge of computer operations. A high school education and formal technical or business administration training is required.

Secretary, working under the directions of the Facility Manager, is responsible for performing various administrative and clerical duties. Areas of involvement include personnel administration, payroll, reports preparation and records retention.

The position of Secretary requires at least five (5) years experience in clerical/administrative work including computer/word processor operations as well as a typing speed of 45 words per minute. A high school education and business school training is required.

A/P Clerk, reporting to the Facility Manager, is responsible for performing various typing, filing, bookkeeping, or other clerical assignments as directed.

The position of A/P Clerk requires previous experience in clerical assignments and typing speed of 45 words per minute. A high school education and/or formal business training is required. Training and experience with computer word processing such as Word Perfect is a must.

Utility Person, working under the direction of the Chief Engineer, will perform various hands-on manual tasks as assigned.

The position requires a high school education or equivalent training.

3.2 Recruiting

In the event of vacancies within the staff, current OSC employees, in particular management and senior hands-on supervisory personnel at our other resource recovery plants will be reviewed as candidates. Where possible, subject to the needs of the plants, and budget restraints, qualified Ogden employees are first reassigned to any open positions before outside advertising is utilized to obtain potential candidates.

Clerical, administrative and hourly, hands-on personnel are recruited from the local area. Recruiting is expanded outside the area only if qualified candidates are unavailable locally.

3.3 Training

A comprehensive in-house training program is used to prepare newly hired personnel to assume positions at the Facility. The program supplements basic on-the-job training with various specific classroom instruction.

All employees are encouraged to pursue outside education and home study through the Education Assistance Program.

PERSONNEL TRAINING PLAN

To prepare Ogden Martin Resource Recovery Facility personnel at all position levels within the plant, a comprehensive training program is initiated and implemented during the construction/start-up phase and is an ongoing program throughout the life of the plant. The

program serves as the basis for plant familiarization and upgrading training as well as covering the training of candidates who are required to satisfy the Qualification and Certification of Resource Recovery Operators Standard, ASME, QRO-1-1989.

The training is separated into two distinct phases, familiarization training and on-going training.

FAMILIARIZATION TRAINING

The familiarization training course commences with an introduction to the Company which includes its history, organizational structure, policies and procedures. This is immediately followed by an introduction to safety, stressing its importance at all times. The Hazard Communication Standard lesson reviews labelling, Material Safety Data Sheets, including the handling and use of ammonia, propane, acids and caustics.

It also includes a review of the safety/emergency equipment and a tour of the facility in order to sight safety lockers and their contents, Material Safety Data Sheets in their correct locations, emergency eye baths and emergency showers. An explanation of the Company Safety Program covers such topics as accident investigation and reporting while a review of Company safety rules includes eye protection, clearance and locking procedures and confined space entries. The next subject to be addressed is that of environmental concerns and includes a study of the various legislation which has been introduced since 1970 with a special emphasis on the Clean Air Act (1990), especially relating to the New Source Performance Standard and Emission Guidelines. The facility's permit to operate is then reviewed directly. Instruction is given on the Waste Control Plan which includes the definitions of the various waste classifications, screening procedures and the handling of hazardous, nonprocessible, unacceptable and untreatable waste. The four plans which comprise the Contingency Plan are then presented, these plans are the Environmental Compliance Plan, the Spill Prevention Control and Counter Measure Plan, the Fire and General Emergency Plan and the Crisis Management Plan.

During the facility construction/start-up phase shift supervisors and company training staff prepare plant specific system descriptions. Each system description gives the purpose of the system, an overview of the system, specific details of each major component within the system together with design capabilities and pertinent parameters. System operational modes are also described. The system descriptions are used as the standard text in conjunction with Logic Diagrams, Piping and Instrument Drawings and Electrical One Line Drawings to provide a detailed overall technical training presentation of the plant on a system by system

basis. In addition major equipment and chemical supply vendors' training staff provide specific training according to the identified training need. This instruction is conducted in the classroom and when appropriate is supplemented by hands on demonstrations on the actual equipment. Correct operating and maintenance of the equipment, in accordance with the vendor's instructions is emphasized.

Key personnel are required to attend a First Aid and Cardiac Pulmonary Resuscitation (CPR) training course. This course is organized as soon as possible after commercial operation of the plant has been achieved and is to be conducted by the American Red Cross or an equivalent certified instructor.

ON-GOING TRAINING

The on-going basic training program consists of five training sections:

1. Power Plant Fundamentals.

2. Martin Stoker Training Modules.

3. Systems Training Enhancement Program (STEP).

4. Environmental Compliance Training Program.

5. Other identified training needs by vendors, community colleges and vocational training schools as well as in-house specialists.

The Power Plant Fundamentals is a computer assisted training program, which takes on average, ninety hours to complete, and is administered by the Chief Engineer assisted by the facility Training Coordinator. The objective of this course is to present a thorough explanation of the technical and safety related aspects found in modern power generation facilities. It is not specific to any process or technology except for the final module which specifically addresses the Martin Stoker. The program touches on a wide range of generic power generation topics intended to prepare the trainee to understand the complex, site specific systems.

The primary target audience for this program is those employees that have limited formal power plant training. However, it also refines the knowledge base of experienced personnel. Although written from an operations perspective maintenance personnel benefit greatly from its subject matter and are consequently included in the program.

Each computerized lesson commences and proceeds with presentations on the monitor screen of written text, graphics and simple animation sequences. On completion of these sequences the computer goes into a testing sequence and requires the student to respond to questions displayed on the screen.

When the trainee has completed the test the computer compiles and records the score. The trainee must maintain a running average of seventy percent on all lessons completed to move on to the next lesson. The student cannot progress to the next lesson unless a score of seventy percent is achieved.

The Martin Stoker Training Program is divided into two separate parts, the first part consisting of a ten hour formal classroom session followed by approximately five hours of individual instruction (One on One training) in the plant.

The formal classroom training instructor utilizes the lesson method of instruction in order to maximize verbal interaction and ensure active trainee participation. These lessons are enhanced by the use of video tapes and overhead transparencies. Safety, good combustion practices and environmental compliance are stressed and explained throughout the program.

Martin Stoker instruction in the plant consists of both hands on and observation training and all trainees are required to complete a One on One checklist and sign off on it.

The second part of the Martin Stoker Training Program consists of the trainee working through the twenty two modules contained within the Martin Stoker Training Manual. Each module covers specific subject matter related to Martin Stoker construction and operation. These modules are stand alone in that they may be given in any sequence, however, suggested prerequisites are provided for each one and should normally be adhered to. The modules follow a uniform format which includes prerequisites and objectives of the module followed by the purpose, description, operation and checks of the specific system/equipment.

These operations oriented modules contain information on the recognition and prevention of specific problems besides addressing specific safety and environmental concerns.

The Chief Engineer administers this program. Questions which arise during the study of materials are directed to the trainees immediate supervisor. After studying the material the trainee requests to take the Qualification Test for that module. The Chief Engineer administers and scores the test. A score of seventy percent is an acceptable score and allows the trainee to progress to the next module. The trainee continues working through the

modules until all modules associated with his specific job duties have been completed.

The Systems Training Enhancement Program (STEP) is the site specific on-going training program for all systems and equipment with the exception of the Martin Stoker. It consists of study assignments that identified trainees must complete to gain the knowledge required to perform specific job tasks. The STEP materials focus on the job tasks that must be performed for the proper operation of equipment rather than the engineering or construction associated with it.

The assignments are developed from job specific task lists identified and compiled in job analyses of the utility person, equipment operator, auxiliary engineer and shift engineer positions for the Ogden Martin facility. The assignments are usually categorized within each of the four job positions according to the engineering systems which make up the plant.

All STEP assignments follow a uniform format and learning sequence directing the trainee to plant reference materials such as Piping and Instrumentation Drawings, Operating Instructions, system descriptions and vendor materials. The assignments also guide the trainee in system walkdowns. The study questions play a major role in each study assignment.

The Chief Engineer administers the STEP course. The Shift Supervisor must be satisfied that the student understands the performance of the subject task before moving on to the next assignment.

After completing all of the assignments for a particular system, the student takes the System Qualification Examination. This examination is a pencil and paper test that the Chief Engineer administers and scores. The trainee must obtain a score of seventy percent to be considered qualified. Upon successful completion of the examination, the student advances to the next system assignments.

Maintenance training is an on-going requirement and is prepared and implemented according to the identified need using vendor training sources, technical seminars, and in-house maintenance specialists such as Martin stoker maintenance specialists, continuous emissions monitoring specialists and other support staff.

The purpose of the Environmental Compliance Training Program is to raise the level of environmental awareness among all the employees at the Ogden facilities by providing the necessary knowledge to operate and maintain the plant in an environmentally sound manner. Included in this program is a general overview of environmental

compliance and its importance to Ogden and the community, an overview of environmental legislation, permits and regulations, pollution control systems, enforcement agencies, critical housekeeping areas and employee environmental responsibilities. A detailed presentation of the entire combustion train and combustion process is given, including the Continuous Emissions Monitoring System (CEMS). Proper maintenance on the Air Pollution Control System is emphasized.

The ongoing supervisory training is intended to prepare hourly personnel for advancement into supervisory positions as well as to enhance the skills of existing management people. The materials for this course include existing corporate programs as well as purchased training courses and various specifically developed information.

The Chief Engineer in coordination with Ogden training management, identifies and schedules refresher training on an annual basis. Refresher training courses are primarily concerned with Federal, State and local laws and regulations, environmental permit compliance, emergency operations and response procedures. Changes or revisions to systems or equipment are also addressed as necessary. Such training may be conducted by the facility supervisory staff, Ogden home office personnel or outside vendors and consultants.

In addition, instruction is provided immediately, as required, for specific key operations or maintenance personnel covering changes or modifications to laws, regulations, or permits affecting facility operations.

A detailed outline has been developed for the provisional Resource Recovery Operator Examination (QRO-1-89) and is supported with recommended reference materials. In addition it is anticipated that a booklet of typical examination question examples will be developed by the American Society of Mechanical Engineers and will be available as a further study aid. A review of the outline and examination question examples will be conducted for those persons required to qualify, specifically the Facility Manager, the Chief Engineer and the Shift Supervisors.

TRAINING RECORDS

To ensure accurate training records are maintained at the Ogden Martin Facility and by the Training Department at the Fairfield office the following training forms are used:

1. Personal Training Record.
2. Training Course Record.

3. Monthly Training Report.

A Personal Training Record form is maintained in each employees' Personnel File and all training courses and seminars attended by the employee are entered on this form. In addition a record of each training course and seminar including the names of attenders, dates and duration are entered on a Training Course Record form. This original form is placed in the Training Register, which is a loose leaf binder, the Training Coordinator being responsible for ensuring copies of the completed original forms are sent to the Fairfield office for inclusion in the duplicate Training Register. Finally the Training Coordinator ensures that the Monthly Training Report form is completed in a timely manner and dispatched to the Fairfield office with all other Facility Monthly Returns by the due date.

4.0 FACILITY OPERATIONS

4.1 Shift Organization

The Operations Department consists of four (4) shift crews, each comprising one Shift Supervisor, one Shift Engineer and three Auxiliary Engineers. The shift crews provide 24-hour coverage, seven days per week on a rotating shift basis with the support of Equipment Operators scheduled to cover normal receiving hours.

Reporting to the Chief Engineer, each Shift Supervisor is responsible for the safe and efficient operation of the boilers, turbine generator, water plant, and all auxiliary systems and equipment during an assigned shift. In carrying out these responsibilities, it is the Shift Supervisor's duty to oversee the work of all operators and other personnel assigned to the shift and to direct and supervise the operation of the plant equipment and other related activities, as necessary. While using the Central Control Room as the base of operations, the Shift Supervisor routinely inspects or visits all areas of the plant in accordance with the conditions or events taking place at the time.

Working under the direction of the Shift Supervisor, each crew includes a Shift Engineer assigned as control room operator. It is the Shift Engineer's responsibility to operate and monitor the boilers and water plant from the control room and to coordinate operating functions of the Auxiliary Engineers. Auxiliary Engineers receive control room training for the purpose of advancement, as well as for relief in the event of illness or vacations. Each shift normally assigns one Auxiliary Engineer to operate the refuse crane while the others serve as roving and water plant operators, monitoring various equipment and systems throughout the plant.

During normal refuse receiving hours one Equipment Operator will control and maintain the tipping floor while the second handles ash loading and/or other various routine assignments. If required by waste deliveries or pit management needs, the Equipment Operator may also be assigned to operate the second refuse crane during receiving hours.

4.2 Refuse Receiving

The Facility will be open to receive processible waste from 6:00 a.m. to 4:00 p.m., Monday through Saturday except for legal holidays when the scales are closed.

All haulers are provided a copy of the OMSL Rules and Regulations for Waste Delivery/Scale House Operations, which are included in the Waste Control Plan.

4.3 Residue Removal

OMSL will, during the receiving hours listed in 4.2, load out ash as well as sludge from the on site water treatment plant. The County shall transport and dispose of this residue at an appropriate landfill.

4.4 By-Pass Waste

The Facility Manager, routinely coordinating with the County, shall notify them of any anticipated by-passing requirements due to scheduled outage of equipment or other planned reduction of capacity. In such cases, no more than a 50% reduction in throughput will normally be scheduled at any time. However, in the event of an expected shutdown of the remainder of the plant during an outage period or an unplanned total plant shutdown, the County will be notified as soon as possible that by-passing of waste to the landfill may be necessary.

4.5 Facility Shutdown

In the event that the facility is forced to shut down waste processing operations, the following actions will be taken:

Refuse haulers will be directed to the alternate disposal site if storage is not available at the Facility.

The Facility Manager or Emergency Coordinator will initiate the use of odor control chemicals in the refuse pit if waste odor can be detected outside the plant.

A fire watch shall be assigned to the charging floor when refuse is stored in the pit, and the pit shall be observed continuously. The fire watch shall be in radio contact with the control room.

4.6 Waste Screening

As a normal part of their assigned duties, the Facility personnel working in the tipping area observes the waste being discharged into the refuse pit. Typically, it is the crane and equipment operators who watch for unacceptable materials and those items which may contain or be hazardous waste. In addition, on a routine, periodic basis, solid waste trucks are directed to empty their load on the tipping floor for inspection. The trucks are normally selected based on areas of pickup or type of industry being served. Haulers having a history of bringing hazardous or unacceptable waste into the Facility are checked more frequently.

If unacceptable waste is found in the refuse pit, it is removed with the overhead crane and set aside for disposal at the appropriate landfill.

In cases where the material is considered to be a possible immediate threat, such as explosives or ruptured drums, the material is left in place, roped off if possible, and personnel and traffic evacuated from the area. The appropriate governmental agency or local authority is contacted immediately. Removal of all hazardous materials from the Facility is in accordance with State and Federal regulations, utilizing only licensed or approved hazardous waste haulers and approved disposal sites.

Refer to the Waste Control Plan for specific details.

4.7 Recovered Ferrous Materials

The Facility operates a ferrous recovery system which removes the vast majority of ferrous from the residue stream produced in the combustion process. This ferrous will be sold on the open market with the purchaser responsible for removal from the Facility.

4.8 Communications

Facility communications incorporates four systems to ensure

effective response to emergencies as well as efficient conduct of routine operations and maintenance. The following is a brief description of the systems.

- Telephones

Telephones are located in each office, control room, and shop. These phones allow communication to agencies off-site as well as between sets in the plant. The plant telephone system is used for emergency services contact as well as for everyday transfer of information.

- Page/Address

The Page/Address system has stations throughout the plant including the control room, crane pulpit, and key offices. The system provides the capability of public address announcements, as well as two way private conversation by cutting out the speakers when a handset at one of the speaker stations is picked up. Five channels are provided which allows five separate conversations at once.

- Radios

Handheld radios are carried by supervisors, shift operators and key maintenance personnel. Base stations are located in the control room and crane pulpit and mobile units are located in each loader. These radios assure that prompt communication is available at anytime.

- E-Mail System

Each personnel computer which is part of the Local Area Network (LAN) and tied, via modem, to OMS in Fairfield is equipped with electronic mail (E-mail) capability. The modem link to Fairfield allows OMSL to network to both Fairfield and all plants on the link. This system allows for the transfer of electronic data such as word processed reports, operational and maintenance data and spare parts availability either intra-OMSL or to other OMS locations.

4.9 Security

The Facility will be located within a seven foot high galvanized chain link fence plus one foot of 3 strands of barbed wire which will follow the site perimeter and include manually and motor controlled gates.

The gates will be closed at all times except during receiving hours.

The entry gate shall be monitored via CCTV and 2 way communication from the control room. During non-receiving hours no person shall be admitted to the Facility unless cleared by the control room.

5.0 FACILITY MAINTENANCE

5.1 Organization

The maintenance department consists of hands-on maintenance personnel working under the coordinator and supervision of the Maintenance Supervisor. The maintenance force normally works from 7:00 a.m. to 3:30 p.m., with one half hour for lunch, five days per week, Monday through Friday. Off-hour repairs or emergencies will be covered, as required, by on-duty personnel, or by overtime help.

Working under the direction of the Facility Manager, the Maintenance Supervisor plans and schedules routine repairs and day-to-day preventative maintenance work. It is intended that the permanent maintenance staff will be sufficient to conduct normal, running maintenance work and to troubleshoot and repair routine equipment problems and failures. However, major repair, replacement, or outage work necessitates the use of outside contract forces as do requirements for unusual or highly specialized expertise such as scale maintenance and calibration. Basing maintenance work assignments on operational priorities established by the Chief Engineer, the Maintenance Supervisor is responsible for the effective and efficient utilization of manpower and materials.

Most major outage work is performed by the permanent Facility personnel while a few are assigned to conducting running maintenance on the equipment and systems that remain in service. During such outages, specific members of the maintenance staff are utilized to supervise the work of outside personnel in particular areas such as major equipment disassemble, inspection and/or repairs as well as electrical or control systems calibration and testing. In the event of a total plant shutdown, the entire staff, including operations personnel together with outside assistance, is utilized as required to return the plant to operation as soon as possible.

Minimization of Cooling Tower Cell downtime is to be given priority status. In the event a Cooling Tower Cell comes out of service efforts will be concentrated on bringing it back on line as soon as possible. This will include calling in additional labor and working continuously if need be until the unit is started back up.

5.2 Maintenance Management System

OMSL will utilized a fully interactive Maintenance Management System developed by GP Solutions named GP Mate. The purpose of the GP Mate system is to provide greater control of maintenance functions by automating the flow of maintenance information. The flow of information through the system is designed to be the same as the flow of information through the OMSL maintenance organization.

The System consists of five interrelated modules:

WORK ORDERS
INVENTORY CONTROL
EQUIPMENT DATA
PERSONNEL
PURCHASING

Following are descriptions of each of the modules that make up the Maintenance Management System.

Work Orders

The work order module allows control of maintenance activities by scheduling corrective and preventive maintenance, generating work orders, and maintaining an equipment history file of closed work orders. The system allows for initiation, planning, costing, and tracking of work orders. Interfaces are provided with the inventory control, purchasing and equipment data modules.

Two types of work orders can be initiated, scheduled and closed out by the system based on the type of maintenance involved:

Corrective: This work order is for maintenance that occurs in response to a problem with an equipment item. The work order is scheduled on a one-time basis by the user.

Preventive: This work order convert repetitive maintenance of an equipment item and is automatically scheduled based on either elapsed calendar time and/or equipment operating hours.

Inventory Control

The inventory control module tracks the spare parts that are purchased, received, stored, issued and used in the plant. This module includes a spare parts database that stores information on all spare parts in the plant. This information can be used in planning of scheduling maintenance and in procuring spare parts. It can also be used to maintain configuration control of the

warehouse.

Equipment Data

The equipment data module contains the reference information for plant equipment. The equipment information is used as the basis for writing work orders and drives all GP Mate functions. The equipment data module contains two databases: the equipment database and the master parts database. There is also a capability to update meter reading information. Meter readings are used to schedule certain preventive maintenance activities.

Purchasing

The purchasing module represents the purchasing process, from submitting purchasing requisitions to receiving parts and invoicing matching. The system distinguishes between purchase requisition and purchase orders. The purchase module will allow creation of purchase orders, receiving against purchase orders, creation of contracts of "blanket" orders and matching against suppliers invoices.

Personnel

The personnel module contains employee information. This information is used when scheduling work orders and calculating labor costs. Special features of this module are: Employee information; Labor projections; and time card entries.

Reports

The system allows for multiple management reports. The following are only a small representative sample:

- Delinquent Work Orders - Preventative Maintenance
- Work Order Status - Preventative Maintenance Ready to Issue
- Work Order Status - Preventative Maintenance Issued
- Work Order Status - Repairs
- Overdue Work Orders - Repairs
- Completed Work Orders - Repairs
- Work Order Variance - Repairs
- Maintenance History Analysis - Preventative Maintenance and Repairs

5.3 Preventative Maintenance Implementation

The preventative maintenance program at the facility covers all systems and component equipment. Initially, the recommendations provided by each manufacturer are incorporated with our own

experience at existing Ogden plants as well as the expertise of our Facility and home office staffs. Each piece of equipment is reviewed for inspection, testing, lubrication and routine. adjustment and/or change-out recommendations and time frequency requirements. Work orders are prepared for each independent task and time frequency. These work orders then form the basic preventative maintenance program which is modified - increased, decreased or adjusted - as the actual work is conducted and specific needs become apparent.

At the beginning of each work week, the Prevention Maintenance portion of the Maintenance Management System prints out individual work order cards, each a specific preventative maintenance task that must be performed within a given time period - usually within one week. The Maintenance Supervisor assigns the work to his/her personnel in accordance with the craft required and the priority needs of repair work. Except in emergency cases, preventative maintenance work shall be conducted as an on-going, continuous function of the maintenance group and not allowed to be side-tracked by other activities.

After performing the assigned preventative maintenance work, each mechanic reports back to the Maintenance Supervisor and returns the work order card. The mechanic will note all work performed, materials used and hours expended on the work card and also will note the as-found conditions, if appropriate, and any changes or recommendations which are felt to be necessary. With the Supervisor's approval, the information provided by the mechanic is entered into the computer and the work order is closed out. The information and the work completed become part of the history for the equipment and the work order is then set back on the computer calendar for issuing again at the proper frequency.

5.4 Outage Work

Scheduled outages include the periodic inspection, cleaning and repair, as required, of each boiler and its associated grate system and auxiliaries. Overall management and liaison for the outage work is provided by the facility supervisory staff and the inspection tasks supervised or conducted by the Facility personnel and manufacturer's representatives.

Through strict adherence to manufacturer's operating recommendations and preventative maintenance procedures as well as sound power plant management and engineering practices, unscheduled outages resulting from unforeseen failures will be kept to an absolute minimum. However, since such occurrences can happen at any time, the Facility staff is prepared to properly evaluate conditions and take immediate action to commence repairs. The

Facility Manager and Chief Engineer are notified immediately in the event of a trip or forced shutdown of a major system resulting in reduced capacity of the Facility. Working in conjunction with the Chief Engineer and the Maintenance Supervisor, the Facility Manager determines the extent of the damage or problem and the type of assistance or service required to accomplish the necessary repairs and return the equipment to service as soon as possible. In reacting to an emergency shutdown and in managing and directing the resultant outage, the Facility Manager has the capability to call upon the Ogden engineering staff, or any other Ogden divisions as appropriate, as well as the design engineer, equipment manufacturers, local contractors, and other suppliers.

5.5 Spare Parts and Supplies

The facility is stocked with a proper inventory of spare parts for all equipment, as well as materials and supplies necessary to sustain on-going operations and maintenance activities. The facility staff monitors and maintains a predetermined level of inventory of such parts and supplies. The staff also tracks specific items that are more frequently used as well as those that are used less than originally anticipated. Normal inventory levels of such items are adjusted as necessary.

The initial stock of spare parts is based primarily on the recommendations of the equipment manufacturers, and the operational requirements contained in the service agreement. That information, supplemented by Ogden's experience at our other resource recovery plants, the specific objectives and operating conditions at the facility and the first-hand experience of the facility staff and technical support personnel, is utilized to purchase and establish inventory levels for the parts. Similarly, consumable materials, supplies, tools and related equipment are purchased and stocked based on vendor recommendations and our experience.

The objects of our parts and supplies inventory program is to ensure that every possible effort is made to anticipate the normal preventative maintenance needs of the major equipment as well as critical subsystems or components in the plant. In addition, consideration is given to potential failures or reoccurring problems.

Our goal is to achieve maximum availability of the plant and at least the design efficiency and intended effectiveness of its systems as well as to ensure the safety of the plant staff and our neighbors. The inventory program seeks to find a level of stock that is optimum for the needs of the facility in achieving those goals.

6.0 ADMINISTRATION

Administrative functions including, but not being limited to, payroll, purchasing, inventory control, facility reporting, personnel administration, records retention and operation of the computer-based maintenance program are carried out by the clerical and administrative group of the facility.

6.1 Personnel Administration

The various requirements of personnel administration for the OSC employees at the Facility include:

- Weekly payroll
- Health and Welfare programs
- Equal Employment Opportunity reporting
- Promotions, transfers, and terminations
- Travel expense reimbursement
- Labor relations and employee discipline
- Accident and incident report processing

6.2 Inventory Control

Utilizing the system-wide, OMS inventory program, the staff monitors and conducts storeroom operations including the receiving, inspecting, storing, and requisitioning of stock items, the proper withdrawals and accounting of materials, periodic inventory counts and security of all materials and supplies.

6.3 Purchasing

Routine purchasing of inventory replacement as well as additional stock items is conducted by the Facility staff and is subject to the approval of the Facility Manager.

When purchasing materials, parts, tools, equipment or services, the facility staff prepares and reviews all quotations, selects or recommends the vendor, prepares the purchase order forms, receives the material and approves vendor invoices for payment.

Minor purchases are paid locally and reported on the OMSL plant account.

6.4 Records Retention

All plant records pertaining to the operation and maintenance of the Facility are retained in a central location in the record storage room. The files are directly controlled by the individual so designated by the Facility Manager. The records, including all operating logs and reports, purchasing information, and maintenance reports are readily available in hard copy for review. All records are kept on file for a period of five years. The company may dispose of such records; provided, however, that prior to any such disposal the company will first offer in writing to give such records to the County.

7.0 ENVIRONMENTAL CONTROLS

7.1 Compliance Assurance

The objectives of the Environmental Compliance Assurance Program, included as Appendix 1., are to ensure that the specific operating limits of each permit are strictly adhered to and that all monitoring, records and reporting requirements are followed.

7.2 Pest Control

Pest/vector control for the Facility is subcontracted to a qualified local company. Priority of selection of the contractor is based on qualifications and experience with similar types of plants and/or large industrial or commercial facilities having significant pest control requirements.

The control program is intended to provide, at least once per month, applications of spray and traps throughout the refuse handling areas and administrative areas. Selection of the contractor has also been based on the program that the vendor proposes to implement. The program will be closely monitored by the designated Facility Safety Coordinator and will be adjusted, as required, to seasonal changes, throughput variations or simply the actual effectiveness of the program.

7.3 Litter Control

Litter control throughout the site is routinely conducted on a daily basis. Under the direction of the Shift Supervisor, the tipping floor is policed and swept as an on-going procedure during hours of receiving waste. In addition, the access roads, parking facilities and other paved areas and unpaved areas of the site

including fences are policed as needed each waste delivery day. Various areas within the buildings themselves are policed by the operation or maintenance group who utilizes or is assigned responsibility for them.

7.4 Dust Control

As a means of dust control, it is normal routine that all doors to the main building and auxiliary structures throughout the facility site are kept closed except when being used.

Dust control in the main building is further achieved by drawing boiler combustion air from the tipping hall. The forced draft fan inlet ducts are located near the tipping hall roof, in the area above the refuse feed hoppers. Air-borne dust is thus carried into the combustion process with the combustion air.

During periods of dry weather or other times of heavy dust conditions, the refuse pit is sprayed with water. Roadways and other paved areas throughout the facility site are routinely cleaned with a mechanical sweeper. Particular attention is paid to the entrance and exit roadways at the ash handling building.

7.5 Odor Control

All doors at the tipping building are closed at times other then receiving hours.

The refuse is sprayed with a deodorizer as needed.

The tipping building is designed to operate at a negative pressure. The forced draft fans take air from the tipping building for the combustion process thereby maintaining the negative pressure in the building. Odors are removed along with the air for combustion.

7.6 Noise Control

The Facility will maintain noise levels in accordance with those levels referenced in the Lee County Noise Ordinance. Energy releasing equipment such as safety valves and vents are equipped with silencers. Trucks not properly equipped and exceeding the permitted noise level (66 dBA at the Facility boundary from 7:00 a.m. to 10:00 p.m. and 55 dBA from 10:00 p.m. to 7:00 a.m.) will be denied access to the Facility.

8.0 RISK-MANAGEMENT

8.1 Safety Program

The Safety Program utilized at the Facility was developed specifically for Ogden resource recovery plants and is currently in us at all of our sites. The overall program is centrally coordinated and monitored from the OSC Fairfield office but implementation is conducted by each plant in accordance with its specific needs. The program provides initial training followed by on-going review and updating on safety practices, techniques and problems and encourages employee awareness and active participation.

The Facility will designate one key personnel to serve as the Safety Coordinator for the plant. Working under the overall guidance and support of the Safety Manager, the Facility Safety Coordinator is responsible for accomplishing the various prerequisite procurement and arrangements as well as implementing, coordinating and maintaining the on-going program.

Basically, the Program includes the following major components:

- Newly hired employees receive orientation on the Facility Safety Program and specific instruction regrading HazCom, work rules, personal safety and the Clearance and Tagging Procedure.

- A full-plant safety meeting is conducted once each month. Its purpose is to introduce the Safety Theme for the month and present basic training or information concerning that subject. Typically, the meeting program includes video tapes, workbooks, demonstrations, handout materials and active participation by the employees. The OSC Safety Manager's system-wide report, for the preceding month, is summarized and pertinent points, such as findings of unsafe conditions and/or significant accidents or near-accidents, are discussed in detail.

- Individual work group safety meetings are held weekly, during the normal work day for the maintenance and administrative/clerical staffs and during the assigned shift of each operations team. The agenda of each meeting is established in accordance with the monthly theme. The meetings typically address a particular safety rule, procedure, tool, protective equipment, or potentially hazardous condition. In addition, the details and conditions of any recent accidents within the plant, especially those relating to the tasks performed by the individual work group are fully discussed with emphasis on avoiding previous

mistakes. Where appropriate, the meetings utilize visual aids and demonstration gear and always allow ample time for questions and discussion.

- Minutes of all safety meetings are recorded and filed in the facility. The minutes include the leader's name and main topics of discussion, a list of the attenders, unanswered questions, if any, and recommendations which may have been brought up. The Safety Coordinator will follow up on all questions or recommendations with the assistance of the Safety Manager, if necessary.

- First Aid instruction is provided for all members of the facility staff. Arrangements are usually made with a local agency or association that is qualified to conduct American Red Cross First Aid instruction.

- In compliance with the Federal Hazard Communication Standard, operators and maintenance personnel as well as administrative employees, where appropriate, receive specific instruction regrading the hazards associated with the chemicals utilized at the facility, precautions to be followed, and the location of the manufacturer's information concerning each chemical. This file is maintained in up-to-date condition in the control room, with the master set kept in the Administrative office.

- Fire prevention and fire fighting instruction are periodically conducted for all employees in the facility.

- In accordance with OSHA requirements, detailed accident reports and records are prepared and maintained at the facility. In addition, Workmen's Compensation reports are forwarded to the appropriate insurance carrier and copies of all reports are forwarded to the Ogden Services Fairfield office.

- A thorough investigation of all accidents is conducted to ascertain the cause and methods of preventing a reoccurrence. If appropriate, the facility staff is assisted by members of the Ogden Services Fairfield staff.

- Routine inspection and testing of all safety related equipment and protective devices includes emergency breathing gear, fire fighting equipment, first aid supplies, and gas detectors. The objective is to demonstrate the correct operability of the piece of equipment, its availability for use in an emergency and its physical condition with regard to its future use.

- Safety bulletins or posters are posted on the Facility bulletin boards. Such bulletins include information

concerning accidents, hazards or hazardous conditions occurring elsewhere in the industry as well as safety reminders.

- Monthly plant inspections are conducted by the Facility Safety Committee. This committee consists of the Safety Coordinator and one member from management, operations and maintenance. The inspections are intended to seek out potential or current safety hazards including permanent equipment and building features, housekeeping problems, personnel working habits, clearance violations, and tool failures. In addition to the inspections by the Safety Committee, the Ogden Services Fairfield staff periodically surveys the plant. These inspections also cover safety equipment, training, records and other aspects of the Facility Safety Program. All inspections are followed by a written report of the findings and recommendations where necessary. Follow up inspections are performed by the home office staff when serious safety problems are found. Copies of all reports are retained in the facility as well as forwarded to the Ogden Services Fairfield office.

8.2 Safety Equipment

In order to maintain and enhance worker safety, OMSL is outfitted with all required and up-to-date plant and personnel safety devices. Each plant worker is issued personnel devices such as safety harnesses, hard hats, sight protection, hearing protection and protective clothing. The shift supervisors are required to maintain and issue the larger and limited stocked items such as portable SCBA units, respirators, hazardous gasses detection meter, and stretchers. There are also a number of fully stocked first-aid stations through out the plant. These devices along with user training ensures the plant meets all OSHA and local worker safety mandates.

8.3 Contingency Plan

The Facility Manager has developed comprehensive Emergency Plans of response for the following conditions:

- Spill Prevention Control and Counter Measure Plan
- Fire and General Emergency Plan
- Crisis Management Plan

These procedures are designed to permit frame of reference for all types of emergencies and will in all cases provide for close coordination and cooperation with local agencies.

8.4 Fire-Prevention/Fire Fighting

An integral part of both the Safety Program and the Emergency Plans, fire prevention and inspection, and fire fighting capability is among the top priority requirements of the Facility. Employee awareness of the possibility and dangers of fire as well as the means of preventing fires shall be a frequent topic of Safety Meetings and the subject of bulletin board posters. Training sessions and drills will also instruct employees in:

- Emergency escape procedures and route assignments.
- Emergency equipment operation or shutdown procedures.
- Emergency rescue and medical assignments.
- Fire fighting team assignments and response procedures.
- Fire reporting, communications and coordination procedures with local fire authorities.

The designated Facility Safety Coordinator contacts the Local Fire Department to review the Facility's fire procedures and to establish an effective method of communication and coordination with that authority. The local authority has been invited to offer recommendations for in-plant fire response and assistance in training the Facility staff.

MALCOLM PIRNIE

6

Enhanced Monitoring Plan

Exhibit 16

ENHANCED MONITORING PLAN

The 40 CFR Part 64 rule as proposed, replaces enhanced monitoring with compliance assurance monitoring (CAM). CAM moves away from the original plans emission monitoring/tracking requirements and focuses on proper maintenance and operation of air pollution control equipment as well as the emission source itself. This rule is yet to be promulgated. However, based on our review of the draft rule, we anticipate no new requirements.

MALCOLM PIRNIE

7

7.0 EMISSIONS CALCULATIONS

BOILER FEED WATER

The following chemicals are used in the treatment of the boiler feed water water at the Facility:

Chemical	Usage Rate (tons/yr)	% Volatile by Wt.
CL-2871	0.2	80
BL-1357	2.9	81
BL-1280	0.7	93
BL-1551	0.7	100
BL-1748	1.0	89
BL-1749	5.9	88

According to Mr. Tim Reid of Chemtreat,Inc., (1-800-521-2395, ext. 136), only two of the listed chemicals (BL-1280 and BL-1551) contain volatiles that are photochemically reactive. Conservatively assuming that 100% of the volatile content of these chemicals is released to the atmosphere, VOC emissions would be as follows:

$$((0.7) \times (0.93)) + ((0.7) \times (1.0)) = 1.4 \text{ tons/yr. VOC}$$

We propose these emissions be deemed insignificant.

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

MATERIAL SAFETY DATA SHEET

SECTION I

TRADE NAME

CHEMTREAT CL-2871

CHEMICAL NAME AND SYNONYMS

Blend of Nitrite and Molybdate Salts and Organic Corrosion Inhibitors in Water

EMERGENCY TELEPHONE NO.

(800) 424-9300

ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Nitrous acid, sodium salt	7632-00-0	<10	120 mg/kg (Rats)	NIF	NE
Molybdic acid, disodium salt	7631-95-0	>1	2810 mg/kg (Rats)	NIF	5 mg/m³ OSHA/ACGIH

SECTION III PHYSICAL DATA

BOILING POINT (°F)	≥212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.17
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY WEIGHT(%)	80
VAPOR DENSITY (AIR=1)	NE	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	~11.9
APPEARANCE AND ODOR	Light straw-colored liquid. Mild odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	Not Flammable	FLAMMABLE LIMITS % by Vol.	Lel None	Uel None

TINGUISHING MEDIA: Not Flammable. Use extinguishing media appropriate to the surrounding fire.

IAL FIRE FIGHTING PROCEDURES: If product is involved in a fire, firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep containers cool with water spray to minimize the potential of decomposition.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NE	NE

EFFECTS OF OVEREXPOSURE

Eye irritant. Skin and respiratory tract irritant. Harmful if swallowed.

HEALTH EFFECTS

Overexposure to sodium nitrite in this product may produce low blood pressure, nausea, headache, weakness and cyanosis. Persons with pre-existing diseases of the cardiovascular system or bone marrow or skin disorders or impaired pulmonary function may be more susceptible to the effects of this product.

PRIMARY ROUTE OF ENTRY

Eye and Skin contact
Inhalation
Ingestion

EMERGENCY FIRST AID PROCEDURE

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, induce vomiting immediately by giving two (2) glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	STABLE	√	Extreme heat
	UNSTABLE		

INCOMPATABILITY (Materials to Avoid)	Organics, amines, acids, reducing agents.
HAZARDOUS DECOMPOSITION PRODUCTS	Toxic nitrogen oxides when heated above 914°F.

HAZARDOUS POLYMERIZATION				CONDITIONS TO AVOID
MAY OCCUR		NO	√	None Known

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION (ecify Type)	When TLV is exceeded, wear NIOSH-MSHA approval No. TC-23C-868 organic vapor/acid gas dual cartridge respirator with dust/mist prefilter (For Example: 3M Easi-Care)
E PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Wash thoroughly after handling. Use with adequate ventilation.
Avoid contact with eyes, skin, and clothing. Avoid breathing vapor or mist. Do not ingest.

OTHER PRECAUTIONS

Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. Keep container securely closed when not in use. For industrial use only. Keep from contact with clothing and other combustible materials. Do not store near combustible materials. Store in tightly closed container.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established
NF - Not Flammable

D.O.T. Class: Environmentally hazardous substances, liquid, n.o.s.
(Sodium nitrite)
Hazard Class 9 UN3082 PG II Class 9 Label

Timothy H. Reid / Director of Regulatory Affairs

PREPARED BY Timothy H. Reid DATE

CL-2871
Revised Edition
8/10/93

ChemTreat, Inc.

MATERIAL SAFETY DATA SHEET

REGULATORY COMPLIANCE	HAZARDOUS INGREDIENTS 1	2	3	4	5	6	7
CWA/ 304 Water Quality Criteria	No	No					
CWA/307 Priority Pollutants	No	No					
CWA/311 Hazardous Chemicals	No	No					
CAA/111 VOC	No	No					
CAA 1990 Amendments	No	No					
RCRA Land Disposal Restrictions	No	No					
CERCLA Hazardous Substances	Yes (1)	No					
SARA/302 Extremely Hazardous Substances	No	No					
SARA/313 Toxic Chemicals	No	No					
NTP/IARC/OSHA/ACGIH Carcinogen	No	No					
California Proposition 65	No	No					
MA/PA/NJ Hazardous	PA	No					

SARA SECTION 311/312 CATEGORIES	
- Acute	■ Yes □ No
- Chronic	□ Yes ■ No
- Fire	□ Yes ■ No
- Sudden Release of Pressure	□ Yes ■ No
- Reactive	□ Yes ■ No

	NFPA RATING	HMIS RATING
Health	2	2
Flammability	0	0
Reactivity	0	0

(1) CERCLA RQ: 100 lbs. (Sodium nitrite)
1400 lbs. (As product)

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME
CHEMTREAT BL-1357

CHEMICAL NAME AND SYNONYMS

Solution of Synthetic Polymer

EMERGENCY TELEPHONE NO.
(800) 424-9300
ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Sodium hydroxide	1310-73-2	<1	>500 mg/kg (Rabbits)	>2 g/kg (Rabbits)	2 mg/m³ ACGIH/OSHA Ceiling

SECTION III PHYSICAL DATA

BOILING POINT (°F)	≥212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.12
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY WEIGHT(%)	81
VAPOR DENSITY (AIR=1)	Not Applicable	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	~13.0

APPEARANCE AND ODOR: Straw-colored liquid; mild odor.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	None	FLAMMABLE LIMITS % by Vol.	Lel	None	Uel None

EXTINGUISHING MEDIA: Water, CO_2, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep containers cool with water spray to minimize the potential of decomposition.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NE	NE

EFFECTS OF OVEREXPOSURE

Mists may be irritating to the respiratory tract. This product may produce irritation upon contact with the eyes. This product may produce irritation, drying of the skin, and dermatitis upon repeated or prolonged contact with the skin.

HEALTH EFFECTS

No applicable information was found on the long term health effects of this product. Persons with pre-existing skin conditions may be more susceptible to the effects of this product.

PRIMARY ROUTE OF ENTRY

Ingestion
Skin
Eyes

EMERGENCY FIRST AID PROCEDURE

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION VI REACTIVITY DATA

STABILITY	STABLE	√	CONDITIONS TO AVOID	None Known
	UNSTABLE			

INCOMPATABILITY (Materials to Avoid)	Strong acids, strong oxidizing agents and cationic polymers.
HAZARDOUS DECOMPOSITION PRODUCTS	Oxides of carbon.

HAZARDOUS POLYMERIZATION.				CONDITIONS TO AVOID	None Known
MAY OCCUR		NO	√		

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

This material may be considered hazardous under RCRA 261.22 (Corrosivity Criteria). Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type)	When TLV is exceeded, wear NIOSH approved self-contained respirator. For Example: MSA Comfo II Respirator, GMC Cartridge (Yellow) TC#-23C-47, and Type F Filter TC#-21C-133.
EYE PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Wash thoroughly after handling. Avoid contact with eyes,skin, and clothing. Do not ingest. Do not breathe vapor or mist.

OTHER PRECAUTIONS

Keep container securely closed when not in use. Use with adequate ventilation. Store at ambient temperatures. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For industrial use only.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established

D.O.T. Class: Compound, cleaning, liquid, Corrosive Material, NA 1760

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

PREPARED BY John A. Nygren/Technical Director DATE

BL-1357
Revised Edition
May 8, 1991

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME

CHEMTREAT BL-1280

CHEMICAL NAME AND SYNONYMS

Diethylhxdroxylamine and Hydroquinone

EMERGENCY TELEPHONE NO.

(800) 424-9300

ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Diethylhxdroxylamine	3710-84-7	17.5	2190 mg/kg (Rat)	1300 mg/kg (Rabbit)	NE
Hydroquinone**	123-31-9	7.5	320 mg/kg (Rat)	NIF	2 mg/m³ OSHA

SECTION III PHYSICAL DATA

BOILING POINT (°F)	NA	SPECIFIC GRAVITY (H_2O = 1)	.995-1.05
VAPOR PRESSURE (mm Hg.)	NA	PERCENT VOLATILE BY WEIGHT(%)	~93
VAPOR DENSITY (AIR=1)	>1	EVAPORATION RATE ( )	NA
SOLUBILITY IN WATER	Complete	pH	8.0-9.0
APPEARANCE AND ODOR	Tan to brown colored liquid with amine odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	NA	FLAMMABLE LIMITS % by Vol.	Lel	NA	Uel NA

EXTINGUISHING MEDIA: Water, CO_2, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Product omits toxic gases under fire condition.

Diethylhydroxylamine vapor is heavier than air.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	NE	ACGIH TLV	NE

EFFECTS OF OVEREXPOSURE

Causes irritation of the eyes, skin, and respiratory tract. Harmful if swallowed.

HEALTH EFFECTS

No applicable information was found on the long term health effects of this product.

PRIMARY ROUTE OF ENTRY

Ingestion
Inhalation

EMERGENCY FIRST AID PROCEDURE

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	STABLE	√	Minimize overexposure to air and light. Avoid overheating.
	UNSTABLE		

INCOMPATABILITY (Materials to Avoid)	Strong oxidizers and strong acids. Incompatible with carbon steel, copper, and polyvinylchloride.
HAZARDOUS DECOMPOSITION PRODUCTS	Ammonia, diethylamine, oxides of carbon, and oxides of nitrogen.

HAZARDOUS POLYMERIZATION				CONDITIONS TO AVOID
MAY OCCUR		NO	√	None Known

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

:SPIRATORY PROTECTION (ecify Type)	When TLV is exceeded, wear NIOSH approved self-contained respirator. For Example: MSA Comfo II Respirator, GMD Cartridge (Green) TC#-23C-43, and Type F Filter TC#-21C-133.
E PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid contact with eyes, skin, and clothing. Avoid breathing mist or vapor. Do not ingest.

OTHER PRECAUTIONS

Use with adequate ventilation. For industrial use only. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established

D.O.T. Shipping Information: Not Regulated

NFPA

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

BL-1280 (InH)

7/2/91

PREPARED BY John A. Nygren DATE

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME

CHEMTREAT BL-1551

CHEMICAL NAME AND SYNONYMS

Solution of Morpholine

EMERGENCY TELEPHONE NO.

(800) 424-9300

ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Morpholine	110-91-8	>1	1050 mg/kg (Rats)	500 mg/kg (Rabbits)	20 ppm (Skin) ACGIH/OSHA

SECTION III PHYSICAL DATA

BOILING POINT (°F)	NE	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.04
VAPOR PRESSURE (mm Hg.) at 20°C	NE	PERCENT VOLATILE BY WEIGHT(%)	100
VAPOR DENSITY (AIR=1)	NE	EVAPORATION RATE ( )	NE
SOLUBILITY IN WATER	100%	pH at 20°C	~12.2

APPEARANCE AND ODOR: Clear, colorless liquid with fishy amine odor.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	FLAMMABLE LIMITS % by Vol.	Lel	Uel
130°F (PMCT)		NE	NE

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical or polymer foam.

SPECIAL FIRE FIGHTING PROCEDURES: Dilution of burning liquid with large volumes of water will reduce flame intensity.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Burning product can emit oxides of carbon and nitrogen.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	NIF	ACGIH TLV	TWA 20 ppm (skin) Active

EFFECTS OF OVEREXPOSURE
Corrosive to eyes and skin. Vapors and mists are irritating to the respiratory tract. Severe overexposure may produce chemical pneumonitis, pulmonary edema. Effects are similar to ammonia exposure. Harmful or fatal if swallowed.

HEALTH EFFECTS
Prolonged exposure will cause abdominal pain, nausea, vomiting, and collapse.
Persons with pre-existing skin conditions may be more susceptible to the effects of this product.

PRIMARY ROUTE OF ENTRY
Ingestion
Inhalation
Absorption through skin
Eyes

EMERGENCY FIRST AID PROCEDURE EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION VI REACTIVITY DATA

STABILITY	STABLE	√	CONDITIONS TO AVOID	Oxidizing agents and acids.
	UNSTABLE			
INCOMPATABILITY (Materials to Avoid)	Reacts with nitrosating agents, oxidizing agents and acids.			
HAZARDOUS DECOMPOSITION PRODUCTS	*Carbon monoxide, carbon dioxide, ammonia, nitric oxides, and hydrogen cyanide.*			
HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID	None Known
MAY OCCUR		NO	√	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

This material may be considered to be hazardous under RCRA 261.22 (Corrosivity Criteria) and under RCRA 40 CFR 261.21 (Ignitable Criteria).
Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RATORY PROTECTION (Specify Type)	If fumes or vapors of this product are present, wear NIOSH approved self-contained respirator. For Example: MSA Comfo II Respirator, GMD Cartridge (Green) TC#-23C-43, and Type F Filter TC#-21C-133.
EYE PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not get on skin, eyes, or clothing. Do not breathe vapor or mist. Do not ingest. Wash thoroughly after handling.

OTHER PRECAUTIONS

Combustible! Keep away from heat, fire, open flames, and oxidizers. Keep container securely closed when not in use. Use with adequate ventilation. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. Vapors of this product can travel long distances and be ignited by an ignition source. Empty containers may contain product residue including flammable vapor. Do not cut, puncture or weld on or near container.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established

RCRA Classification: Corrosivity and Ignitable RQ: 100 lbs.
D.O.T. Class: Compound, cleaning, liquid Corrosive Material, NA 1760

NFPA

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

PREPARED BY John A. Nygren DATE

BL-1551
Revised Edition
June 4, 1991

AQUATIC TOXICITY DATA

Rainbow Trout - 96 hour LC_{50} - 180 mg/l
Bluegill Sunfish - 96 hour LC_{50} - 350 mg/l

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME

CHEMTREAT BL-1748

CHEMICAL NAME AND SYNONYMS

Solution of Inorganic Phosphate and Synthetic Polymers

EMERGENCY TELEPHONE NO.

(800) 424-9300

ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Sodium polymethacrylate	54193-36-1	>1	NIF	NIF	20 ppm TWA Supplier
Sodium dihydrogen phosphate	7558-80-7	>1	8290 mg/kg (Rats)	NIF	NE

SECTION III PHYSICAL DATA

BOILING POINT (°F)	>212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.078
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY WEIGHT(%)	~89
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	~6.0

APPEARANCE AND ODOR: Pale tan liquid. Mild odor.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	FLAMMABLE LIMITS % by Vol.	Lel	Uel
None		None	None

EXTINGUISHING MEDIA: Water, CO_2, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep containers cool with water spray to minimize the potential of decomposition.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NA	NA

EFFECTS OF OVEREXPOSURE

This product may produce an irritation to the eyes and mucous membranes. Harmful if swallowed due to irritation of the throat and mucous membranes. Persons with pre-existing skin conditions may be more susceptible to the effects of this product.

HEALTH EFFECTS

No applicable information was found on the long term health effects of this product.

PRIMARY ROUTE OF ENTRY

Ingestion
Eyes

EMERGENCY FIRST AID PROCEDURE

EYES & SKIN: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. Flush skin with water. Wash clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, induce vomiting immediately by giving two (2) glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	STABLE	√	None Known
	UNSTABLE		

INCOMPATABILITY (Materials to Avoid)	Highly cationic materials, strong acids, and strong oxidizing agents.
HAZARDOUS DECOMPOSITION PRODUCTS	Oxides of carbon.

HAZARDOUS POLYMERIZATION				CONDITIONS TO AVOID
MAY OCCUR		NO	√	None Known

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type)	None required under normal conditions of use.
EYE PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid contact with eyes, skin, and clothing. Store at ambient temperatures. Do not ingest. Wash thoroughly after handling.

OTHER PRECAUTIONS

Keep container securely closed when not in use. Use with adequate ventilation. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For industrial use only.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established

D.O.T. Class: Not Regulated

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requiments of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

BL-1748 (InH)

Revised Edition 8/19/91

PREPARED BY John A. Nygren DATE

ChemTreat, Inc.

HOME OFFICE: 500 LICKINGHOLE ROAD
ASHLAND, VA. 23005-3294 • (804) 798-3231

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME
CHEMTREAT BL-1749

CHEMICAL NAME AND SYNONYMS

Solution of Inorganic Phosphate and Synthetic Polymers

EMERGENCY TELEPHONE NO.
(800) 424-9300
ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Tetrapotassium pyrophosphate	7320-34-5	>1	2980 mg/kg (Rats)	>7940 mg/kg (Rats)	NE
Sodium polymethacrylate	54193-36-1	>1	>16 g/kg (Rats)	NIF	20 ppm TWA Supplier
otassium hydroxide	1310-58-3	>1	365 mg/kg (Rats)	NIF	2 mg/m³ ACGIH & OSHA

SECTION III PHYSICAL DATA

BOILING POINT (°F)	≥212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	≈1.10
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY VOLUME (%)	~88
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	≈13.4

APPEARANCE AND ODOR: Clear colorless liquid; mild odor.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used): None | FLAMMABLE LIMITS % by Vol. | Lel: None | Uel: None

EXTINGUISHING MEDIA: Water, CO_2, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Although product will not burn, high temperatures can result in decomposition and the release of toxic vapors.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NA	NA

EFFECTS OF OVEREXPOSURE

Harmful if swallowed. Corrosive to all tissues, eyes, skin and mucous membranes. Mists and vapors can be severely irritating to the respiratory tract.

HEALTH EFFECTS

Persons with pre-existing skin conditions may be more susceptible to the effects of this product. None known except those secondary to tissue damage.

PRIMARY ROUTE OF ENTRY

Ingestion
Eyes
Skin
Inhalation

EMERGENCY FIRST AID PROCEDURE

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If ingested, call a physician at once.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	STABLE	√	None Known
	UNSTABLE		

INCOMPATABILITY (Materials to Avoid)	Highly cationic materials and strong acids.
HAZARDOUS DECOMPOSITION PRODUCTS	Oxides of carbon.

HAZARDOUS POLYMERIZATION				CONDITIONS TO AVOID
MAY OCCUR		NO	√	None Known

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION (Specify Type) If fumes or vapors of this product are present, wear NIOSH approved self-contained respirator. For Example: MSA Comfo II Respirator, GMC Cartridge (Yellow) TC#-23C-47, and Type F Filter TC#-21C-133.

E PROTECTION: Chemical splash goggles	SKIN PROTECTION: Rubber gloves, apron, and boots
VENTILATION: Local exhaust	OTHER PROTECTION: Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not get on skin, eyes, or clothing. Do not ingest. Do not breathe vapor or mist. Use with adequate ventilation. Wash thoroughly after handling.

OTHER PRECAUTIONS

Keep container securely closed when not in use. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. Use with adequate ventilation. Store at ambient temperatures.

SECTION X MISCELLANEOUS DATA

F - No Information Found NA - Not Available NE - Not Established

D.O.T. Class: Corrosive Material UN/NA Number: UN 1760

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

BL-1749 (InH)

7/18/89

PREPARED BY John A. Nygren DATE

COOLING TOWER

The following chemicals are used in the treatment of the non-contact cooling tower water at the Facility:

Chemical	Usage Rate (tons/yr)	% Volatile by Wt.
Chlorine	4	-----
CL-4123	2.7	82
CL-1461	26.4	65
CL-2150	1.3	96

According to Mr. Tim Reid of Chemtreat,Inc., (1-800-521-2395, ext. 136) none of the volatile content of these chemicals is photochemically reactive. **Therefore no emissions are caused by the cooling towers.**

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME

CHEMTREAT CL-4123

CHEMICAL NAME AND SYNONYMS

Nonferrous Metal Corrosion Inhibitor,
Sodium Tolyltriazole

EMERGENCY TELEPHONE NO.

(800) 424-9300

ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Tolyltriazole, sodium salt	64665-57-2	>1	920 mg/kg (Male Rats)	>2 g/kg (Rabbits)	10 mg/m³ Nuis. Dust ACGIH

SECTION III PHYSICAL DATA

BOILING POINT (°F)	≥212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.07
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY WEIGHT(%)	82
VAPOR DENSITY (AIR=1)	Not Applicable	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	~12.6
APPEARANCE AND ODOR	Amber-colored liquid. Mild odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	None	FLAMMABLE LIMITS % by Vol.	Lel None	Uel None
EXTINGUISHING MEDIA	Water, CO_2, Dry Chemical, Foam			
SPECIAL FIRE FIGHTING PROCEDURES	Avoid temperature extremes. Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.			
UNUSUAL FIRE AND EXPLOSION HAZARDS	During a fire, nitrogen oxides and other irritating and/or toxic gases may be generated from combustion/decomposition.			

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NA	NA

EFFECTS OF OVEREXPOSURE
SKIN & EYES: Corrosive! Causes eye and skin burns.
ORAL: Harmful if swallowed due to irritation. Irritant to throat and mucous membranes.

HEALTH EFFECTS
No applicable information was found on the long term health effects of this product.
Persons with pre-existing skin conditions may be more susceptible to the effects of this product.

PRIMARY ROUTE OF ENTRY

Ingestion
Skin
Eyes

EMERGENCY FIRST AID PROCEDURE EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION VI REACTIVITY DATA

STABILITY	STABLE	√	CONDITIONS TO AVOID	None Known
	UNSTABLE			
INCOMPATABILITY (Materials to Avoid)	Strong acids, oxidizing agents and cationic polymers.			
HAZARDOUS DECOMPOSITION PRODUCTS	Oxides of carbon and nitrogen.			
HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID	None Known
MAY OCCUR		NO	√	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

This material may be considered hazardous according to the TCLP characteristic of corrosivity.
Dispose of as unlisted hazardous waste, characteristic of corrosivity, D002.
The RQ is 100 pounds.
Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

SPIRATORY PROTECTION (Specify Type) When exposure limits are exceeded, wear MSHA/NIOSH approved full face respirator (For Example: Wilson 1200 with either Black R21 organic vapor cartridge or Yellow R5 organic vapor/acid gas cartridge.)

E PROTECTION Splashproof goggles and face shield (ANSI Z87.1 or equiv.)	SKIN PROTECTION Impervious clothing, Rubber gloves, apron, and boots
VENTILATION Mechanical local exhaust at point of vapor or mist release	OTHER PROTECTION Eye-wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not get on skin, eyes, or clothing. Do not breathe vapor or mist. Do not ingest. Wash thoroughly after handling.

OTHER PRECAUTIONS

Keep away from heat and oxidizers. Keep container securely closed when not in use. Use with adequate ventilation. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NAP - Not Applicable NE - Not Established

D.O.T. Class: Corrosive liquid, n.o.s., Corrosive Material, UN 1760

EMERGENCY FIRST AID PROCEDURE CON'T:
Note to Physician: Mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsions may be needed.

This material is a registered pesticide under FIFRA. Refer to container label for additional information.

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

Timothy H. Reid / Director of Regulatory Affairs

CL-2150

Revised Edition
5/21/93

PREPARED BY Timothy H. Reid DATE

ChemTreat, Inc.

HOME OFFICE: 4301 DOMINION BLVD.
GLEN ALLEN, VA. 23060 • (804) 965-0505

MATERIAL SAFETY DATA SHEET

SECTION I

TRADE NAME
CHEMICAL TREATMENT CL-2150

CHEMICAL NAME AND SYNONYMS

Blend of Isothiazolin's

EMERGENCY TELEPHONE NO.
(800) 424-9300
ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
5-chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	1.15	3.81 g/kg (Rats)	>5 g/kg (Rabbits)	TWA= 0.1 mg/m³
2-methyl-4-isothiazolin-3-one	2682-20-4	.35			STEL= 0.3 mg/m³ for total isothiazolones
					Manufacturer's Recommendation

SECTION III PHYSICAL DATA

BOILING POINT (°F)	212° Estimated	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.03
VAPOR PRESSURE (mm Hg.) at 20°C	17 Estimated	PERCENT VOLATILE BY WEIGHT(%)	96
VAPOR DENSITY (AIR=1)	.62 Estimated	EVAPORATION RATE ( )	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	3.0-5.0
APPEARANCE AND ODOR	Pale yellow-green liquid; mild aromatic odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	Not Applicable	FLAMMABLE LIMITS % by Vol.	Lel	NAP	Uel NAP

EXTINGUISHING MEDIA Non-Combustible

SPECIAL FIRE FIGHTING PROCEDURES Wear MSHA/NIOSH approved, pressure demand self-contained respirator and full protective gear. Use water spray to cool fire exposed containers.

UNUSUAL FIRE AND EXPLOSION HAZARDS Avoid exposure to fumes and vapors from a fire, can possibly include sulfur dioxide; hydrogen chloride and oxides of nitrogen.

SECTION V HEALTH HAZARD DATA

SHOLD LIMIT TWA=1 mg/m³ STEL=0.3 mg/m³ OSHA TLV NE ACGIH TLV NE

EFFECTS OF OVEREXPOSURE
INHALATION: Harmful if inhaled. INGESTION: Harmful or fatal if swallowed. EYE CONTACT; Corrosive to eyes; causes irreversible eye damage. SKIN CONTACT: Corrosive to the skin; causes skin burns. These effects may be delayed for hours. Harmful if absorbed through skin; may be fatal from large exposures.

HEALTH EFFECTS
Sensitization(human): Can cause allergic contact dermatitis.
Rat aerosol inhalation; LC_{50}; 4 hr.; 23C- 1.4 mg/l males; 1.5 mg/l females; (nominal, a.i.)
Corrosive under test conditions for D.O.T. skin corrosivity.

PRIMARY ROUTE OF ENTRY
Skin and Eye Contact
Ingestion
Inhalation

EMERGENCY FIRST AID PROCEDURE EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person. (Continued in Section X)

SECTION VI REACTIVITY DATA

STABILITY	STABLE	√	CONDITIONS TO AVOID	None Known
	UNSTABLE			
INCOMPATABILITY (Materials to Avoid)	Strong oxidizing agents.			
HAZARDOUS DECOMPOSITION PRODUCTS	Hydrogen chloride and oxides of sulfur and nitrogen.			
HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID	None Known
MAY OCCUR		NO	√	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wear protective clothing, splash proof goggles and impervious overshoes.
CAUTION: Keep spills out of municipal sewers and open bodies of water. Dike and absorb spill with inert material (dry earth, sand). Shovel all contaminated solids, diking material, absorbent and soil into corrosion proof drums. Seal before disposal.

WASTE DISPOSAL METHOD

r discard, this is a hazardous waste: RCRA No. D002, reportable quantity: 100 lb. (CERCLA perfund) Sec. 103). Landfill contaminated solids in sealed drums in accordance with local, te and Federal regulations. This material may be considered to be hazardous under RCRA 261.22 (Corrosivity Criteria).

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type): When TLV is exceeded, wear NIOSH approved self-contained respirator. For Example MSA Comfo II Respirator, GMC Cartridge (Yellow) TC#-23C-47, and Type F Filter TC#-21C-133.

EYE PROTECTION	SKIN PROTECTION
Chemical splash goggles	Rubber gloves, apron, and boots
VENTILATION	**OTHER PROTECTION**
Local exhaust	Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid contact with eyes, skin, and clothing. Do not ingest. Wash thoroughly after handling.

OTHER PRECAUTIONS

Keep container securely closed when not in use. Store at ambient temperatures. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For industrial use only.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established

D.O.T. Class: Compound, cleaning, liquid, Corrosive Material, NA 1760

This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

If this product contains a toxic chemical, subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

PREPARED BY John A. Nygren DATE

CL-4123

Revised Edition
October 15, 1991

Olin

MATERIAL SAFETY DATA

OCEAN NETWORK EMERGENCY PHONE 1-800-OLIN-911

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD,29 CFR 1910.1200.THIS PRODUCT MAY BE CONSIDERED TO BE A HAZARDOUS CHEMICAL UNDER THAT STANDARD.(REFER TO THE OSHA CLASSIFICATION IN SEC.I.)THIS INFORMATION IS REQUIRED TO BE DISCLOSED FOR SAFETY IN THE WORKPLACE.THE EXPOSURE TO THE COMMUNITY,IF ANY,IS QUITE DIFFERENT.

I. PRODUCT IDENTIFICATION

REVISION NO : 23
REVISION DATE : 3/02/94
PRODUCT CODE : CPE142945
FILE NUMBER : CPE00043.0001
PRODUCT NAME: CHLORINE

SYNONYMS: None
CHEMICAL FAMILY: Halogen
FORMULA: Cl_2
DESCRIPTION: Chlorinating and oxidizing agent
OSHA HAZARD CLASSIFICATION: Irritant or corrosive; skin, eye and lung hazard; toxic by inhalation; compressed gas; oxidizer

II. COMPONENT DATA

PRODUCT COMPOSITION
CAS or CHEMICAL NAME: Chlorine
CAS NUMBER: 7782-50-5
PERCENTAGE RANGE: 98-100 Volume percent
HAZARDOUS PER 29 CFR 1910.1200: Yes
EXPOSURE STANDARDS:

	OSHA(PEL)		ACGIH(TLV)	
	ppm	mg/cubic-meter	ppm	mg/cubic-meter
TWA:	0.5	1.5	1	3
CEILING:	None		None	
STEL:	1	3	3	9

III. PRECAUTIONS FOR SAFE HANDLING AND STORAGE

DO NOT TAKE INTERNALLY. AVOID CONTACT WITH SKIN, EYES AND CLOTHING. UPON CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER.
STORAGE CONDITIONS: Store in a cool, dry, well-ventilated place.
DO NOT STORE AT TEMPERATURES ABOVE: 59 Deg.C (140 Deg.F)

PRODUCT STABILITY AND COMPATIBILITY

SHELF LIFE LIMITATIONS: Indefinite

INCOMPATIBLE MATERIALS FOR PACKAGING: NOTICE - Should not be repackaged except by qualified and trained personnel.

INCOMPATIBLE MATERIALS FOR STORAGE OR TRANSPORT: Alkalis, reducing agents, organic materials

IV. PHYSICAL DATA

APPEARANCE: Greenish liquid or gas
MELTING POINT: -101 Deg.C (-149 Deg.F)
BOILING POINT: -34 Deg.C (-29 Deg.F)
DECOMPOSITION TEMPERATURE: None
SPECIFIC GRAVITY: Not Applicable
DENSITY: 88.4 lb. per cubic feet at 63 Deg.F
pH @ 25 DEG.C: Not Applicable
VAPOR PRESSURE @ 25 DEG.C: 114 psi
SOLUBILITY IN WATER: Miscible
VOLATILES, PERCENT BY VOLUME: 100
EVAPORATION RATE: Heat of Vaporization: 123.67 BTU per pound
VAPOR DENSITY: Approximately 2.5 (0.7537 lb. per cubic feet at 32 Deg.F)
MOLECULAR WEIGHT: 71
PRODUCT IS: A compressed gas
ODOR: Acrid
COEFFICIENT OF OIL/WATER DISTRIBUTION: No Data

V. PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

PERSONAL PROTECTION FOR ROUTINE USE OF PRODUCT:

RESPIRATORY PROTECTION: If air concentrations above the TLV are possible, wear a NIOSH/MSHA approved respirator.

VENTILATION: Use local exhaust ventilation to maintain levels to below the TLV.

SKIN PROTECTIVE EQUIPMENT: Wear gloves, boots, apron and a face shield with safety glasses. A full impermeable suit is recommended if exposure is possible to large portion of body.

OTHER: Emergency eye wash and safety showers must be provided in the immediate work area.

EQUIPMENT SPECIFICATIONS:

RESPIRATOR TYPE:	Wear NIOSH/MSHA approved full-face respirator equipped with chemical cartridges for chlorine gas.
GLOVE TYPE:	Neoprene
BOOT TYPE:	Neoprene
APRON TYPE:	Neoprene
PROTECTIVE SUIT:	Not normally needed

VI. FIRE AND EXPLOSION HAZARD INFORMATION

FLAMMABILITY DATA:
- FLAMMABLE: No
- COMBUSTIBLE: No
- PYROPHORIC: No
- FLASH POINT: Not Applicable
- AUTOIGNITION TEMPERATURE: Not applicable
- FLAMMABLE LIMITS AT NORMAL ATMOSPHERIC TEMPERATURE AND PRESSURE (PERCENT VOLUME IN AIR): LEL - Not Applicable UEL - Not Applicable

NFPA RATINGS:
- Health: 3
- Flammability: 0
- Reactivity: 0
- Special Hazard Warning: OXIDIZER

HMIS RATINGS:
- Health: 3
- Flammability: 0
- Reactivity: 1

EXTINGUISHING MEDIA: Use extinguishing media compatible to surrounding materials.

FIRE FIGHTING TECHNIQUES AND COMMENTS: Use water to cool containers exposed to fire, however, direct spray between fire and containers. DO NOT spray directly on container unless absolutely necessary. Water reactive material; DO NOT spray with water. Contact with reactive metals e.g., aluminum may result in the generation of flammable hydrogen gas. See Section XI for protective equipment for fire fighting.

VII. REACTIVITY INFORMATION

CONDITIONS UNDER WHICH THIS PRODUCT MAY BE UNSTABLE:
- TEMPERATURES ABOVE: None
- MECHANICAL SHOCK OR IMPACT: No
- ELECTRICAL (STATIC) DISCHARGE: No
- OTHER: Reacts vigorously with titanium, zinc, tin
- HAZARDOUS POLYMERIZATION: Will not occur
- INCOMPATIBLE MATERIALS: Alkalies, reducing agents, organic materials
- HAZARDOUS DECOMPOSITION PRODUCTS: Hydrochloric acid, hypochlorous acid

VI. FIRE AND EXPLOSION HAZARD INFORMATION

FLAMMABILITY DATA:
- FLAMMABLE: No
- COMBUSTIBLE: No
- PYROPHORIC: No
- FLASH POINT: Not Applicable
- AUTOIGNITION TEMPERATURE: Not applicable
- FLAMMABLE LIMITS AT NORMAL ATMOSPHERIC TEMPERATURE AND PRESSURE (PERCENT VOLUME IN AIR): LEL - Not Applicable UEL - Not Applicable

NFPA RATINGS:
- Health: 3
- Flammability: 0
- Reactivity: 0
- Special Hazard Warning: OXIDIZER

HMIS RATINGS:
- Health: 3
- Flammability: 0
- Reactivity: 1

EXTINGUISHING MEDIA: Use extinguishing media compatible to surrounding materials.

FIRE FIGHTING TECHNIQUES AND COMMENTS: Use water to cool containers exposed to fire, however, direct spray between fire and containers. DO NOT spray directly on container unless absolutely necessary. Water reactive material; DO NOT spray with water. Contact with reactive metals e.g., aluminum may result in the generation of flammable hydrogen gas. See Section XI for protective equipment for fire fighting.

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- OTHER: Reacts vigorously with titanium, zinc, tin
- HAZARDOUS POLYMERIZATION: Will not occur
- INCOMPATIBLE MATERIALS: Alkalies, reducing agents, organic materials
- HAZARDOUS DECOMPOSITION PRODUCTS: Hydrochloric acid, hypochlorous acid

OTHER: Titanium will react vigorously, resulting in spontaneous ignition, when contacted by DRY Chlorine.

Combustion will be supported in carbon steel systems and equipment containing a Chlorine environment at temperatures greater than 340 deg. F. Properly purge systems and equipment PRIOR to conducting Hot Work.

SUMMARY OF REACTIVITY:

OXIDIZER:	Yes
PYROPHORIC:	No
ORGANIC PEROXIDE:	No
WATER REACTIVE:	Yes
CORROSIVE:	Yes

VIII. FIRST AID

EYES: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Call a physician at once.

SKIN: Immediately flush with water for at least 15 minutes. Call a physician. If clothing comes in contact with the product, the clothing should be removed immediately and should be laundered before re-use.

INGESTION: Immediately drink large quantities of water. DO NOT induce vomiting. Call a physician at once. DO NOT give anything by mouth if the person is unconscious or if having convulsions.

INHALATION: If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep the person warm and at rest. Call a physician. In the event that an individual inhales enough vapor to lose consciousness, person should be moved to fresh air at once and a physician should be called immediately. If breathing has stopped, artificial respiration should be given immediately. In all cases, ensure adequate ventilation and provide respiratory protection before the person returns to work.

IX. TOXICOLOGY AND HEALTH INFORMATION

ROUTES OF ABSORPTION

Inhalation, skin, eye, ingestion

WARNING STATEMENTS AND WARNING PROPERTIES

MAY BE FATAL IF INHALED. HARMFUL IF INGESTED OR EXPOSED TO SKIN OR EYES.

HUMAN DOSE RESPONSE DATA

ODOR THRESHOLD: Approximately 1.7 mg/m3 (0.3 ppm).

IRRITATION THRESHOLD: The irritation threshold is approximately 0.5 ppm.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: The IDLH FOR chlorine is 25 ppm.

SIGNS, SYMPTOMS, AND EFFECTS OF EXPOSURE

INHALATION

ACUTE:

Inhalation of this material is irritating to the nose, mouth, throat and lungs. It may cause inflammation to the respiratory tract with the production of lung edema which can result in shortness of breath, wheezing, choking, chest pain, and impairment of lung function. The inflammation of the respiratory tract is most evident in the upper portions, but bronchioles, alveolar ducts, and alveoli may also be affected.

There is no evidence that acute inhalation of chlorine at low to moderate levels will cause permanent lung damage.

CHRONIC:

Repeated inhalation exposure may cause impairment of lung function and permanent lung damage. It may contribute to the development of bronchitis.

EYE

Irritation can occur following eye exposure to the gas with redness, pain, blurred vision, and tearing. Contact with liquid chlorine may cause burns with impairment of vision and corneal damage.

SKIN

ACUTE:

Dermal exposure can cause irritation characterized by redness, swelling and scab formation. Contact with liquid chlorine may cause burns with prolonged contact causing destruction of the dermis with impairment of the skin at site of contact to regenerate.

CHRONIC:

Effects from chronic skin exposure would be similar to those from single exposure except for effects secondary to tissue destruction.

INGESTION

ACUTE:

Irritation and/or burns can occur to the entire gastrointestinal tract, including the stomach and intestines, characterized by nausea, vomiting, diarrhea, abdominal pain, bleeding, and/or tissue ulceration. Ingestion is not a major route of exposure because chlorine is a gas at room temperature.

CHRONIC:

There are no known or reported effects from chronic exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Asthma and respiratory and cardiovascular disease

INTERACTIONS WITH OTHER CHEMICALS WHICH ENHANCE TOXICITY

None known or reported

ANIMAL TOXICOLOGY

ACUTE TOXICITY:

Inhalation LC 50: 293 ppm (1 hour, rat)
Oral LD 50: No available data. It is a gas at room temperature.
Dermal LD 50: No available data
Irritant to eyes and skin. Contact with the liquid chlorine may cause burns to eyes and skin.

AQUATIC TOXICITY:

LC 50 Bluegill: 0.44 mg/1/96 hrs
LC 50 Yellow perch: 0.88 mg/1/1 hr.
LC 50 Channel catfish (fingerling): 0.07 mg/1/96 hrs
LC 50 Daphnia magna: 0.017 mg/1/46 hrs

CHRONIC TARGET ORGAN EFFECTS IN LABORATORY ANIMALS

Inhalation exposure has produced pathological change in the lungs and nasal passages of monkeys and rats characterized by inflammation, epithelial hyperplasia with loss of cilia. In addition, damage was observed in liver and kidneys from treated rats.

DEVELOPMENTAL AND REPRODUCTIVE TOXICITY

There are no known or reported effects on reproductive function or fetal development.

CARCINOGENICTY:

This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

MUTAGENICITY:

This product is not known or reported to be mutagenic.

X. TRANSPORTATION INFORMATION

THIS MATERIAL IS REGULATED AS A DOT HAZARDOUS MATERIAL.

DOT DESCRIPTION FROM THE HAZARDOUS MATERIALS TABLE 49 CFR 172.101:
LAND: Chlorine, 2.3, UN1017, Poison Inhalation Hazard - Hazard Zone B
WATER: Same as LAND above
AIR: FORBIDDEN

HAZARD LABEL/PLACARD: CHLORINE

REPORTABLE QUANTITY: 10 lbs. (Per 49 CFR 172.101, Appendix)

EMERGENCY GUIDE NUMBER: 20

XI. SPILL AND LEAKAGE PROCEDURES

FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300.

REPORTABLE QUANTITY: 10 lbs. (Per 40 CFR 302.4)

SPILL MITIGATION PROCEDURES:
Hazardous concentrations in air may be found in local spill area and immediately downwind. Do not put water directly on this product as gas evolution may increase. This product may represent an explosion hazard, if in contact with incompatible materials. Remove all sources of ignition.

AIR RELEASE: Vapors may be suppressed by the use of a water fog. Contain all fog water for neutralization and treatment.

WATER RELEASE: This material is heavier than water. Chlorine will sink and bubble into water to form a hypochlorous acid, which will later self decompose to various materials. Stop flow of material and divert water to a holding area for treatment and neutralization.

LAND SPILL: Dike area of spill and stop flow if safe to do so. Cover area of spill with foam to reduce air contamination. Begin treatment to neutralize material as soon as possible.

SPILL RESIDUES:
Dispose of per guidelines under Section XII, WASTE DISPOSAL.

This material may be neutralized for disposal; you are requested to contact OCEAN at 800-OLIN-911 before beginning any such operation.

PERSONAL PROTECTION FOR EMERGENCY SPILL AND FIRE-FIGHTING SITUATIONS:
In case of fire, use normal fire fighting equipment.

Response to material requires the se of a full encapsulated suit and self-contained breathing apparatus (SCBA).

Additional protective clothing must be worn to prevent personal contact with this material. Those items include but are not limited to: boots, gloves, hard hat, splash-proof goggles, full face shield and impervious clothing, i.e., chemically impermeable suit.

Compatible materials for response to this material are neoprene and butyl rubber.

Protection concerns must also address the potential of the physical characteristics of this product as a compressed gas, corrosive and a poison.

XII. WASTE DISPOSAL

If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D003, D001.

If this product becomes a hazardous waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.

As a hazardous liquid waste, it must be disposed of in accordance with local, state and federal regulations in a permitted hazardous waste treatment, storage and disposal facility by treatment.

Chlorine can exist in a gaseous state, and controlled evaporation may be warranted.

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THIS MATERIAL. THE USER OF THIS MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

XIII. ADDITIONAL REGULATORY STATUS INFORMATION

TOXIC SUBSTANCES CONTROL ACT:
This product is listed on the Toxic Substances Control Act inventory.

NSF LIMITS: NSF Maximum Drinking Water Use Concentration - 30 mg/l as chlorine

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT TITLE III:
HAZARD CATEGORIES, PER 40 CFR 370.2:
HEALTH:
Immediate (Acute)
Delayed (Chronic)
PHYSICAL:
Sudden release of pressure
Reactivity

EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW, PER 40 CFR 355, APP.A:
EXTREMELY HAZARDOUS SUBSTANCE - THRESHOLD PLANNING QUANTITY:
100 lbs.
SUPPLIER NOTIFICATION REQUIREMENTS, PER 40 CFR 372.45:
This mixture or tradename product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.
CHEMICALS LISTED ARE: Chlorine

XIV. ADDITIONAL INFORMATION

MSDS REVISION STATUS: Minor revision to Section IV.

XV. MAJOR REFERENCES

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6. CERIS (Chemical Emergency Response Information System) On Line Database. Association of American Railroads.
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8. Clayton, G. and F. Clayton, Eds., Patty's Industrial Hygiene and Toxicology, Vol. 2A-C 3rd Ed., New York: John Wiley & Sons, 1981-1982.
9. Code of Federal Regulations, Titles 21, 29, 40 and 49. Washington, DC: U.S. Government Printing Office.
10. Emergency Response Guide (D.O.T.). Washington, DC: U.S. Government Printing Office, 1987.
11. Fire Protection Guide on Hazardous Materials, 9th Ed., National Fire Protection Association, Batterymarch Park, Quincy, MA, 1986.
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21. Threshold Limit Values and Biological Exposure Indices for 1988-89. Cincinnati, OH: American Conference of Government Industrial Hygienists, 1987.
22. Toxic Substances Control Act Inventory, Washington, DC: U.S. Government Printing Office, 1986.
23. Teratogenic Study with Monosodium Cyanurate Plus Chlorine in Albino Rats. Industrial Bio-Test Laboratories, Inc., 1810 Frontage Road, Northbrook, Illinois 60062, IBT No. B758c. April 18, 1972.
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26. Weill, H. et al. Late Evaluation of Pulmonary Function After Acute Exposure to Chlorine Gas. American Review of Respiratory Disease, Volume 99, (1969).
27. Patil, L. R. S. et al. The Health of Diaphragm Cell Workers Exposed to Chlorine. American Industrial Hygiene Association Journal, Volume 31. November-December, 1970.
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39. Material Safety Data Sheet, OHS04600. Occupational Health Services, Inc., p. 1-11.

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. THIS INFORMATION HAS BEEN PREPARED FOR THE GUIDANCE OF PLANT ENGINEERING, OPERATIONS AND MANAGEMENT AND FOR PERSONS WORKING WITH OR HANDLING THIS PRODUCT. OLIN BELIEVES THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION, BUT MAKES NO WARRANTY THAT IT IS. ADDITIONALLY, IF THIS MATERIAL SAFETY DATA SHEET IS MORE THAN THREE YEARS OLD, YOU SHOULD CONTACT OLIN AT THE PHONE NUMBER LISTED BELOW TO MAKE CERTAIN THAT THIS SHEET IS CURRENT.

OLIN MSDS CONTROL GROUP
Olin Corporation
120 Long Ridge Road
Stamford, CT 06904

Phone Number: (203) 356-3449

OLIN CORPORATION SUBSIDIARIES AND AFFILIATED ENTITIES: ASAHI-OLIN LTD., BRIDGEPORT BRASS CORPORATION, INDY ELECTRONICS, INC., OLIN CHLORATE CORPORATION, OLIN FABRICATED METAL PRODUCTS INC., OLIN HUNT SPECIALTY PRODUCTS INC., OLIN ELECTRONICS TECHNOLOGY, OLIN MESA CORP., OLIN SPECIALTY METALS CORPORATION, PACIFIC ELECTRO DYNAMICS, INC., PHYSICS INTERNATIONAL COMPANY, ROCKET RESEARCH COMPANY, OCG MICROELECTRONIC MATERIALS, INC.

ChemTreat, Inc.
HOME OFFICE: 4301 COMMERCE BLVD.
GLEN ALLEN, VA 23060 • (804) 965-0505

PRODUCT SAFETY DATA SHEET

SECTION I

TRADE NAME
CHEMTREAT CL-1461

CHEMICAL NAME AND SYNONYMS
Blend of Neutralized Organophosphonate, Polymer, Sodium Molybdate, and Nonferrous Metal Corrosion Inhibitor in Water

EMERGENCY TELEPHONE NO.
(800) 424-9300
ONLY IN THE EVENT OF CHEMICAL EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT(S)	CAS NO.	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
Tolyltriazole, sodium salt	64665-57-2	>1	1.6 g/kg (Rats)	>2 g/kg (Rabbits)	NE
Potassium hydroxide	1310-58-3	<5	365 mg/kg (Rats)	NIF	2 mg/m³ ACGIH & OSHA
1-Hydroxyethane-1,1-diphosphonic acid, tetrapotassium salt	14860-58-8	>1	2400 mg/kg (Rats) As the acid	>7940 mg/kg (Rabbits) As the acid	NE
Molybdic acid, disodium salt	7631-95-0	>1	245 mg/kg (Rats) AC	NIF	10.7 mg/m³ as Na_2MoO_4

SECTION III PHYSICAL DATA

BOILING POINT (°F)	≥212	SPECIFIC GRAVITY (H_2O = 1) at 20°C	~1.23
VAPOR PRESSURE (mm Hg.) at 20°C	<17.5	PERCENT VOLATILE BY WEIGHT(%)	65
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (H_2O = 1)	<1
SOLUBILITY IN WATER	Complete	pH at 20°C	~13.8
APPEARANCE AND ODOR	Straw color. Mild odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	None	FLAMMABLE LIMITS % by Vol	Lel	None	Uel None
EXTINGUISHING MEDIA	Water, CO_2, Dry Chemical, Foam				
SPECIAL FIRE FIGHTING PROCEDURES	Firefighters should wear full protective clothing including a NIOSH approved self-contained breathing apparatus.				
UNUSUAL FIRE AND EXPLOSION HAZARDS	Keep containers cool with water spray to minimize the potential of decomposition.				

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	OSHA TLV	ACGIH TLV
	NE	NE

EFFECTS OF OVEREXPOSURE

This product is corrosive to the eyes and skin. Harmful if swallowed. Vapors and mists may be irritating to the respiratory tract. Persons with pre-existing skin conditions may be more susceptible to the effects of this product.

HEALTH EFFECTS

None known except those secondary to tissue damage. This product does not contain any components listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

(See Page 4)

PRIMARY ROUTE OF ENTRY

Ingestion
Eyes
Skin

EMERGENCY FIRST AID PROCEDURE

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention. SKIN: In case of contact immediately wash with plenty of water while removing contaminated clothing. Seek medical advice. Wash and decontaminate clothing before reuse. INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. INGESTION: If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

SECTION VI REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	STABLE	√	None Known
	UNSTABLE		

INCOMPATABILITY (Materials to Avoid)	Strong acids and strong oxidizing agents.
HAZARDOUS DECOMPOSITION PRODUCTS	Oxides of carbon and nitrogen.

HAZARDOUS POLYMERIZATION				CONDITIONS TO AVOID
MAY OCCUR		NO	√	None Known

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wearing appropriate protection equipment (see Section VIII), contain spill. Using an inert chemical absorbent, collect spilled material and place in a properly labeled container for disposal.

WASTE DISPOSAL METHOD

This material may be considered to be hazardous under RCRA 261.22 (Corrosivity Criteria). Dispose of in accordance with local, state, and federal regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type) If fumes or vapors of this product are present, wear NIOSH approved self-contained respirator. For Example: MSA Comfo II Respirator, GMC Cartridge (Yellow) TC#-23C-47, and Type F Filter TC#-21C-133.

EYE PROTECTION	SKIN PROTECTION
Chemical splash goggles	Rubber gloves, apron, and boots
VENTILATION	**OTHER PROTECTION**
Local exhaust	Eye wash fountain and safety shower.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not get on skin, eyes, or clothing. Avoid breathing mists and vapors. Do not ingest. Wash thoroughly after handling.

OTHER PRECAUTIONS

Keep away from heat and oxidizers. Use with adequate ventilation. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. Keep container securely closed when not in use. Store at ambient temperatures. For industrial use only.

SECTION X MISCELLANEOUS DATA

NIF - No Information Found NA - Not Available NE - Not Established
AC - Active Component

D.O.T. Class: Corrosive Material UN/NA Number: NA 1760

NFPA

If this product contains a toxic chemical, subject to the reporting requiments of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, it is listed in Section II of this Material Safety Data Sheet followed by two asterisks (**).

John A. Nygren/Technical Director

CL-1461

Revised Edition
November 19, 1990

EPARED BY John A. Nygren DATE

ChemTreat, Inc.

SAFETY DATA SHEET

HEALTH EFFECTS

In a 30-day feeding study rats were fed diets containing 3,000, 10,000 or 30,000 ppm of (HEDP) a component of this product. At 30,000 ppm, average body weight gains of both males and females were reduced, and liver weights of males were decreased. Increased erthrocyte counts (males), decreased hemoglobin concentration (both sexes), decreased hematocrit values (both sexes), and decreased leukocyte counts (females at 84 days only) were observed at 30,000 ppm. No other hematologic, urinalysis or clinical chemistry parameter was affected. The no effect level was 10,000 ppm.

HEDP was administered to beagle dogs at dietary concentrations of 1,000, 3,000 or 10,000 ppm for 90 days. No adverse hematologic, biochemical or histopathologic effects were observed.

No mutagenic activity was observed in microbial assays using 5 Salmonella strains or in a L5178Y TK mouse lymphoma cell point mutation assay, with and without mammalian microsomal activation.

SOLVENT DEGREASER

The Facility has a cold cleaner unit in the maintenance area. This unit has a work space opening surface area of 6ft^2. Using the AP-42 emission factor for solvent loss from degreasing operations (Section 4.6, Table 4.6-2), the emissions are as follows:

Cold Cleaner, Entire Unit Emissions = 0.33 tons/yr/unit

We propose that these emissions be deemed insignificant.

SOLVENT DEGREASER

The Facility has a cold cleaner unit in the maintenance area. This unit has a work space opening surface area of $6ft^2$. Using the AP-42 emission factor for solvent loss from degreasing operations, the emissions are as follows:

$(0.08 \text{ lbs./hr./ft}^2) \times (6\text{ft}^2) = 0.48 \text{ lbs/hr. VOC}$
$(0.48 \text{ lbs./hr. VOC}) \times (8{,}760 \text{ hrs./yr.}) / (2{,}000 \text{ lbs/ton}) = 2.1 \text{ tons/yr. VOC}$

We propose that these emissions be deemed insignificant.

P.O. Box 21368
Los Angeles, CA 90021
(213) 626 1233

SOLVENT DEGREASER

MATERIAL SAFETY DATA SHEET

MATERIAL NAME	CODE	D.O.T. SHIPPING NAME
SYNOTEX ORANGE GS	0692319	NOT REGULATED
	DATE ISSUED 6/09/89	

FORMULA	CHEMICAL NAME OR SYNONYMS
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I - HAZARDOUS INGREDIENTS

	WEIGHT %	TWA / TLV
AQUA AMMONIA	1-5%	25 PPM
AROMATIC PETROLEUM DISTILLATES	1-5%	100 PPM

II - PHYSICAL DATA

APPEARANCE			VISCOSITY
ORANGE PASTE; SLIGHT AMMONIA ODOR			4000-6000 CPS
MELTING OR FREEZING POINT	**BOILING POINT**	**SOLUBILITY IN WATER**	**PERCENT VOLATILE (by weight)**
N/A	APPROX. 212 F	DILUTABLE	70-75%
SPECIFIC GRAVITY (WATER = 1)			
APPROX. 1.04			

III - FIRE AND EXPLOSION HAZARD DATA

FLASHPOINT	
ABOVE 200 F	

EXTINGUISHING MEDIA

FOAM	"ALCOHOL" FOAM	CO_2	DRY CHEMICAL	WATER FOG	OTHER
		X	X	X	NONE.

SPECIAL FIRE FIGHTING PROCEDURES

USE SELF CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS

NONE KNOWN.

IV - HEALTH HAZARD DATA

RECOMMENDED HEALTH GUIDE TWA (MAXIMUM TIME-WEIGHTED-AVERAGE CONCENTRATION FOR AN 8-HOUR WORK PERIOD)

NOT AVAILABLE.

EFFECTS OF OVEREXPOSURE

THIS MATERIAL CONTAINS CHEMICALS THAT MAY RELEASE VAPORS WHICH MAY PRODUCE IRRITATION UPON CONTACT WITH EYES OR RESPIRATORY PASSAGES. REPEATED SKIN CONTACT MAY PRODUCE SKIN RASHES OR IRRITATION. UPON OVEREXPOSURE, CONSULT A PHYSICIAN IMMEDIATELY.

EMERGENCY AND FIRST AID PROCEDURES

**SKIN: WASH THOROUGHLY WITH SOAP AND WATER. SEEK MEDICAL ATTENTION IF IRRITATION OCCURS.

**EYES: FLUSH WITH WATER FOR 15 MINUTES. SEEK MEDICAL ATTENTION IF IRRITATION OCCURS.

INHALATION: CONSULT A PHYSICIAN IF IRRITATION OF RESPIRATORY PASSAGES OCCUR.

INGESTION: CONSULT A PHYSICIAN.

(V – REACTIVITY DATA)

STABILITY	CONDITIONS TO AVOID
X STABLE UNSTABLE	NONE KNOWN.

HAZARDOUS DECOMPOSITION PRODUCTS

NONE KNOWN.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
MAY OCCUR X WILL NOT OCCUR	NONE KNOWN.

INCOMPATIBILITY (MATERIALS TO AVOID)

WATER OTHER NONE KNOWN.

(VI – SPILL OR LEAK PROCEDURE)

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

ABSORB ONTO SUITABLE ABSORBENT AND PLACE INTO APPROPRIATE CONTAINER. SMALL SPILLS MAY BE FLUSHED TO A CHEMICAL DRAIN. HANDLING MUST COMPLY WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

RECOMMENDED WASTE DISPOSAL METHODS

DISPOSAL MUST BE IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.

(VII – SPECIAL PROTECTION INFORMATION)

VENTILATION TYPE

USE LOCAL EXHAUST.

RESPIRATORY PROTECTION

CHEMICAL RESPIRATOR SUITABLE FOR ORGANIC VAPORS.

PROTECTIVE GLOVES	EYE PROTECTION
CHEMICAL RUBBER	SAFETY GLASSES AND/OR GOGGLES.

OTHER PROTECTIVE EQUIPMENT

CLOTHING SUITABLE TO PREVENT SKIN CONTACT.

(VIII – STORAGE AND LABELING)

STORAGE TEMPERATURE	INDOOR	HEATED	REFRIGERATED	OUTDOOR
MAX. --- MIN. ---	---	---	---	---

BECAUSE THIS MATERIAL IS PACKAGED IN FIBER DRUMS, OUTSIDE STORAGE IS NOT RECOMMENDED.

(IX – TOXICITY INFORMATION)

NONE KNOWN.

(X – MISCELLANEOUS INFORMATION)

NONE.

NOT APPLICABLE / NOT DETERMINED	CODE	DATE OF ISSUE	SUPERSEDES
	0692319	6/09/89	11/01/85

LIME SILO

The Facility has a lime silo for the storage of pebble lime. Particulate emissions occur when lime is loaded into the silo. These emissions are controlled by a filter baghouse.

The baghouse is designed to emit no more than 0.015 grains/acf at 1,000 acfm maximum. The Facility will receive a maximum of five (5) deliveries per week at a duration of 2 hours/delivery.

(0.015 grains/acf) x (1,000 acfm) x (1 lb/7,000 grains) = 0.0021 lbs/min
(0.0021 lbs/min) x (60 min/hr) = 0.129 lbs/hr

(5 deliveries/week) x (2 hours/delivery) = 10 hours/week
(10 hrs/week) x (52 weeks /year) x (0.129 lbs/hr) / (2,000 lbs/ton) = 0.034 tons/yr

ASH HANDLING BUILDING

The Facility operates an ash residue handling system. This system is comprised of main and inclined conveyors, scalpers, and a ferrous removal system. The equipment receives and seperates large items and metals, transports, and temporarily stores the residue. A residue handling building is the final destination for the ash and seperated metals where it is stored for subsequent off-site disposal. The ventilation of this building is controlled by a baghouse.

The baghouse is designed to emit no more than 0.015 grains/acf at 12,444 acfm maximum.

(0.015 grains/acf) x (12,444 acfm) x (1 lb/7,000 grains) = 0.027 lbs/min
(0.027 lbs/min) x (60 min/hr) = 1.6 lbs/hr

(1.6 lbs/hr) x (8,760 hrs/yr) / (2,000 lbs/ton) = 7.01 tons/yr