SEWERAGE & WATER BOARD OF NEW ORLEANS

EAST BANK WASTEWATER TREATMENT PLANT

FLUIDIZED BED INCINERATOR

OPERATION & MAINTENANCE PLAN

REVISED OCTOBER 7, 1996

Prepared by Professional Services Group
S.J. Shulin & J.R. Mayfield

EAST BANK FBI SYSTEM

O & M PLAN

TABLE OF CONTENTS

SECTION 1 - INTRODUCTION

1.0	General	Page 1
1.1	O&M Plan Organization	Page 1
1.2	Other O & M References	Page 2
1.3	System Overview	Page 3

SECTION 2 - MONITORING & REPORTING

2.0	General	Page 5
2.1	Monitoring	Page 5
2.1.1	Monitoring - FBI System	Page 5
2.1.2	Monitoring Emissions	Page 6
2.2	Record Keeping	Page 7
2.3	Reporting	Page 8
	Example Forms	
	Oxygen Analyzer Daily Calibration	
	CEM Calibration Reports	
	40 CFR Part 60, Subpart A, §60.7	
	40 CFR Part 60, Subpart O, §60.153 & §60.154 & §60.155	

SECTION 3 - OPERATIONS

3.0	General	Page 10
3.1	Operator Responsibility	Page 10
	Fluidizing Incinerator S.O.P.	

SECTION 4 - EMERGENCY RESPONSE

4.0	General	Page 13
4.1	Annunciator Alarms	Page 13
4.2	Low Wet Scrubber Differential Pressure Procedure	Page 14
4.3	High Scrubber Exhaust O2 Level Procedure	Page 14
4.4	CEM Procedure	Page 15

SECTION 5 - PERSONNEL TRAINING

5.0	General	Page 16
5.1	New Employee Training	Page 16
5.2	Continuing Training	Page 16
5.3	Training Records	Page 16

SECTION 6 - OPERATIONS RECORDS

6.0	General	Page 17
6.1	Operator Logs	Page 17
6.2	Computer Printouts	Page 18
	Example Forms	
	FBI Daily Log	
	Log Book (Journal) Sheet	
	Corrective Maintenance Work Order	

SECTION 7 - LAB SAMPLING

7.1	Field Sampling	Page 19
7.2	Lab Sampling	Page 19

SECTION 8 - PREVENTIVE MAINTENANCE

8.0	General	Page 20
8.1	Preventive Maintenance Task Handling	Page 20
8.2	Preventive Maintenance Records	Page 21
	Example Forms	
	Scheduled Maintenance Task Report	
	Task Report Printout (2 examples)	
	Equipment Numbering System Key	

SECTION 1
INTRODUCTION

1.0 *GENERAL*

This Operation and Maintenance (O/M) Plan will ensure that the Fluidized Bed Incinerator (FBI) and its air pollution control devices are operated and maintained in a manner consistent with good air pollution control practices in minimizing emissions in accordance with 40 CFR Part 60, Subparts A, & O, and manufacturers' specifications and recommended procedures for the FBI and its air pollution control devices.

The operator will have a plan of action and procedures on the FBI continuous monitoring equipment when the FBI is fire sludge into the incinerator. This plan will better assist the operator in maintaining the performance of the FBI when burning sludge and staying in compliance of the permitting authority [40 CFR Part 60, Subparts A, & O].

The Owner and Operators will be able to better maintain records for the required reports and the data that must be a part of the compliance reports.

1.1 *O&M PLAN ORGANIZATION*

This book consists of eight sections as follows:

Chapter 1 - Introduction includes overall general information about the FBI system, its components as design data.

Chapter 2 - Monitoring & Reporting includes information about the monitoring, record keeping and reporting activities required by Federal and State regulation.

Chapter 3 - Operations includes a description of system operation with emphasis on the operator's responsibilities in helping meet regulation requirements. This section also includes the Standard Operating Procedures (SOPs) for startup, normal operation, normal shutdown and emergency shutdown.

Chapter 4 - Emergency Response includes instructions for reacting to system operating problems.

Chapter 5 - Personnel Training includes a description of the plant training program for the operating personnel.

Chapter 6 - Operations Records includes descriptions of the logs and forms maintained by the operators to document system operation.

Chapter 7 - Lab Sampling includes descriptions of the field and lab sampling program for monitoring system operation.

Chapter 8 - Preventive Maintenance includes PM system descriptions plus equipment and instruments preventive maintenance schedules and logs.

1.2 *OTHER O & M REFERENCES*

Numerous O & M references are located in the Control Room to help plant personnel in operating, controlling and maintaining the FBI system and air pollution control monitoring system. These reference includes:

The Solids SOP Book - This book is the basic day-to-day guide for system operation. Each operator is issued a personal copy of this book for reference to FBI and filter press operations to insure proper operating procedures are followed. The book is updated annually or whenever any major system changes occurs. A copy of the FBI SOP Instructions (section F) is included in Chapter 3 of this manual. The master copy of the SOP is kept in the Control Room.

The Dorr-Oliver O&M Manual on the Fluid Bed Incinerator - This book provides additional system information. Of primary importance are the general theory discussions on FBI operations, the expanded operating procedures write up, the routine maintenance instructions and instructions for operation of the heat exchanger. This manual is also located in the Control Room.

NOTE: Since preparation of the Dorr-Oliver O&M Manual, numerous changes have been made to this system. The most important changes are the addition of a new Venturi Scrubber, Schwing Pump Monitoring System and a Continuous Emission Monitoring System (CEM). The elimination of some systems from the FBI was done during incinerator rehab. The top feed system was changed to a side feed system. Cooling Air Blower was eliminated and the Fluidizing Air Blower is used in its place. The Sand Make up System will be eliminated and the sand will be added by pneumatic truck.

The Dorr-Oliver FBI Equipment O&M Manual Volumes XI & XII (blue books) - These books include a copy of the previous mentioned Dorr-Oliver O&M Manual plus

parts drawings and instructions for the FBI and its support systems (fluidizing air blower, heat exchanger, venturi scrubber, etc.). These books are important as sources of information on individual equipment operation and maintenance procedures. These books are kept in the Control Room and in the Maintenance Building.

Siemens Continuous Emission Monitoring (CEM) System O&M Manual - This book provides detailed instructions on setup, operation and maintenance on the CEM. **Only instrumentation personnel are allowed to work on and calibrate and maintain the CEM system.** The operators are to monitor the air flow, filter and to log the pressure of the calibration gases. NOTE: If an operator at the CEM panel sees a red "NOT READY" light, this indicate that the system needs the attention of an instrumentation tech. This book is located in the Instrumentation Tech Office.

Schwing Pump and Flow Metering System O&M Manual - This book provides information on the operator's daily P/M checks and maintenance P/M requirements. The manual also provides a troubleshooting guide which is also included in the Control Room SOP Manual for the Schwing Pump System.

The FCI Flowmeter (gas), Waste, Oil and Yokogawa Oxygen Analyzer O&M Manuals - These books provide installation, operation, calibration, maintenance and troubleshooting instructions of individual pieces of equipment. These books are maintained in the Instrumentation Tech Office.

40 CFR PART 60 BOOK - This book provides the information on the code of federal regulations. A copy of 40 CFR Part 60 Subpart O, §60.153 "Monitoring of operations" and §60.154 "Test methods and procedures" and §60.155 "Reporting" are included in Chapter 2 of this manual.

1.3 *SYSTEM OVERVIEW*

The FBI system was added to the East Bank Plant during 1978 for disposal of waste activated sludge (WAS) removed from the plant secondary treatment process. The system is designed for 24 hours/day, 7 days/week operations with scheduled shutdowns for system P/M, inspection and maintenance repairs. The Dorr-Oliver FBI has a design capacity of 40.65 tons dry solids per day at 20% cake solids. The system design criteria and flow diagram are included at the end of this chapter.

Dewatered WAS from the plant sludge dewatering units is pumped (**Schwing Pump**) to the FBI on a continuous basis. The **FBI** is a refractory brick lined vessel that allows mixing of the cake into the hot fluidizing bed of sand at the bottom of the bed. The **FBI sand bed** temperature is maintained around 1300deg. F to 1500deg. F for complete burning of the sludge solids to inorganic ash.

The sand bed is fluidized (kept in suspension) by a continuous supply of air from the **fluidizing air blower.** Under normal sludge burning operating conditions, this air flow is approximately 6000 - 8500 scfm. The fluidized sand bed is heated by the burning sludge and grease solids and also by auxiliary fuels (oil or gas) which are pumped into the bed. The action of the fluidized bed grinds the sludge cake to small particles which are more easily and completely burned.

The FBI **Heating System** includes the **Preheat Burner System**. This system is used to bring the FBI temperature up from a cooled start to the operating temperature. When the temperature reaches the low end of the operating range, the Incinerator interlock allows the start of the auxiliary fuels or when the temperature falls below 1150deg.F (burning on oil) the interlock allows restart of the preheat burner to raise the bed temperature. The **auxiliary fuel (oil or gas) guns system** is used to maintain and control the Incinerator bed temperature when sludge is being burned or when the unit is being heated. Once the auxiliary system is in use, the preheat burner is turned down at a controlled rate (as prescribed by the SOP or Dorr-Oliver Manual) and then shutdown.

The **Heat Exchanger** allows recovery of heat from the Incinerator exhaust gas for preheating of air into the **Incinerator Windbox**. This allows a more efficient FBI combustion process.

The **Venturi Scrubber** provides cooling of the gases and the removal of the ash particles in the Incinerator exhaust gas flow. The solids (ash) are trapped in the venturi throat area where water is injected at 170 to 210 GPM. The ash slurry drains to the **Ash Pumps** discharge to the **Ash Lagoons** where it is dewatered. Water for the scrubber operation is provided from the **Plant Utility Water Pumps.**

The Venturi Scrubber is not just an ash collection device. It should be recognized as an air pollution control device primarily used for Particulate Matter (PM) removal in order to improve ambient air quality. The ash is the PM that the scrubber removes from the FBI's exhaust gas stream.

The **High Pressure Water Spray Pump** provides a supply of atomizing quenching water to the gas inlet to the heat exchanger. This action reduces the temperature of the gases and protects the heat exchanger tube sheets against thermal expansion.

The **Utility Water System** provides high quality water to the incinerator high pressure water pump and seal water to the scrubber ash pumps.

The **Utility Air** is provided for the cooling and purging the Roof Spray Guns system and for clearing out the oil guns for insertion and for withdrawing the guns.

SECTION 2
MONITORING & REPORTING

2.0 *GENERAL*

The Fluidized Bed Incinerator (FBI) system operates under 40 CFR Part 60, Subparts A & O plus 40 CFR Part 503 regulations. These regulations dictate the monitoring, record keeping and reporting requirements for the system.

2.1 *MONITORING*

2.1.1 Monitoring - FBI System

The FBI operation is monitored through various instruments. These include:

Wet Scrubber Differential Pressure Instrument - A differential pressure sensor/transmitter measures the pressure drop across the scrubber venturi and transmits the data to the recorder on the Control Panel and also to the Incinerator Data Log Computer. This data is continuously recorded to meet 40 CFR regulations. This instrument must be calibrated to +/- 1 inch water gauge accuracy. (See 40 CFR Part 60, Subpart O, §60.153 (b) (1))

Scrubber Exhaust O_2 Analyzer System - The Oxygen Analyzer system is used to run the Incinerator along with the CEM system. This probe is located just above the Scrubber exhaust. The analyzer provides a local % O_2 level readout with a data signal transmitted to the recorder on the Control Panel and also to the Incinerator Data Computer. This O_2 monitoring system must be calibrated every 24 hours (by the operator) to +/- 5% accuracy. **NOTE**: The calibration for this analyzer is done at the local panel (see FBI's SOP, pages SOP-8 & SOP-9 for calibrating instructions). (See 40 CFR Part 60, Subpart O, §60.153 (b) (2))

Sludge Flow Meter - The waste sludge flow meter measures flow to the system and provides a signal for gpm at total gallons readouts and a chart flow record or the Control panel. The data is also sent to the Incinerator Data Computer and to the Operations Computer. This meter is calibrated and checked with the portable flowmeter every six months (or as needed of suspected discrepancy arises). A +/- 5% accuracy must be maintained. Total solids test results are entered onto the operations computer daily and the computer determines tons of solids treated the that day. (See 40 CFR Part 60, Subpart O, §60.153 (a) (1))

Bed & Exhaust Temperature - Thermocouples are provided for monitoring the temperature level in the fluidized bed and the reactor exhaust/heat exchanger inlet gas. The bed temperature is monitored by three thermocouples. The bed temperature signals are transmitted to the chart recorder on the Control Panel and the Incinerator Data Computer. All three bed temperature are recorded with an average temperature computed and recorded by the computer. The reactor exhaust temperature is also transmitted to the chart recorder and the Incinerator Data Computer. The thermocouples electrical signals are tested every six months (or as needed if problems occur) . A. +/- 5% accuracy must be maintained. (See 40 CFR Part 60, Subpart O, §60.153 (b) (3))

Fuel Flow - Fuel oil is the primary fuel and natural gas is the backup fuel. Fuel oil flow is measured by a meter on the fuel line with data transmitted to a gpm readout on the Control Panel and to the Incinerator and Operations Computers. The mechanical flow counter reading at the fuel oil pump is recorded each shift. The daily counter total is used to check the computer meter total readout accuracy. A +/- 5% accuracy is required for this system. Any discrepancy results in issuance of a work order to check meter calibration. (See 40 CFR Part 60, Subpart O, §60.153 (b) (4))

The natural gas flow is measured by the FCI Flowmeter Model GF90 on the gas line with data transmitted to scfm readout on the FBI's data log computer. The gas readings is also taking from the LCD window on the yellow nema type 4x enclosure box located downstair by the gas line on the ground level in the Solids Bluiding. (See the FCI Flowmeter manual for calibration, installation, operation and maintenance)

Sludge Analysis -The representative sludge charged grab samples are collected from the Schwing (sludge) Pump discharge cylinder located on the 4550 level in the Solids Bluiding. The procedures for collection and analysis of a daily grab sample of the sludge to be fired, shall be done in accordance with §60.154 (b) (4) and (b) (5). (See 40 CFR Part 60, Subpart O, §60.153 (b) (5))

2.1.2 Monitoring Emissions

The emissions from the scrubber are monitored for oxygen (O_2) and carbon monoxide (CO) levels to ensure compliance with 40 CFR Part 503 regulations. The emissions are monitored through the Continuous Emission Monitoring System (CEM) with components for monitoring O_2 and CO levels. O_2 and CO level readouts are provided at the CEM with signals transmitted to the Incinerator Data Computer for recording.

Note 1: The CEM automatically calibrates its span every 24 hours

during the morning shift. The CEM must be performance tested quarterly according to 40 CFR, Part 60, Appendix B, Sections 2, 3 and 6. **This system is tested monthly**. Testing is started by request.

Note 2: The CEM reports are generated automatically on a monthly basis and include all required data.

Note 3: **Only the instrument techs are allowed to operate this system.**

2.2 *RECORD KEEPING*

As noted above, all continuously recorded data is transmitted to one or both of the computers. The Incinerator Data Computer data logging systems genarates daily, monthly, quarterly and semi-annual reports in accordance with 40 CFR Part 60, Subpart O, §60.153 (c) (d)

NOTE: The recordkeeping provisions of §60.153 (c) but not the recordkeeping exemptions of 60.153 (d) , become applicable whenever the Particulate Matter (PM) emission rate exceeds 0.38 kg/Mg (0.75 lb/ton) dry sludge input during any subsequent FBI performance test. The recordkeeping procedures are different depending on whether the measured PM emission rate is above or below 0.38 kg/Mg (0.75 lb/ton) dry sludge input.

The Incinerator Data Computer generates reports and maintain records of the occurrence and duration of any startup, shutdown, or malfunction, and recordkeeping in accordance with 40 CFR Part 60, Subpart A & O and Part 503. (See 40 CFR Part 60 Subpart A, §60.7 (b) (f))

Additional data that must be maintained and reported on the semi-annual report when these limits are exceeded include: (see 40 CFR Part 60, Subpart O, §60.153)

1. Scrubber pressure drop averaged over each hour of incinerator operation. See §60.153 (c) (1)
2. Scrubber exhaust oxygen level averaged over each hour of incinerator operation. See §60.153 (c) (2)
3. Temperature of the bed and freeboard zones averaged over each hour of incinerator operation. §60.153 (c) (3)
4. The rate of sludge charged to the incinerator averaged over each hour of incinerator operation. see §60.153 (c) (3)
5. The incinerator fuel usage averaged over each 8 hours. See §60.153 (c) (3)

6. The moisture and volatile solids content of the sludge charged to the incinerator over that period. See §60.153 (c) (3)

As noted, the CEM data is automatically transmitted to the computer data logging system for automatic monthly printouts. In addition to the operating data and calibration result printout, a CEM maintenance log is maintained to record all calibration and maintenance activities. Also, any downtime of the CEM must be documented, i.e., record the time period out of service with the reason.

NOTE: If the system is down for more than 72 hours, the DEQ should be contacted. Provide information on the known or presumed reason for the trouble, steps being taken to correct the trouble, the expected duration of CEM shutdown and the length of time the incinerator will operate during the shutdown. All reasonable efforts must be taken to return the CEM to service as quickly as possible.

The Oxygen Analyzer Daily Calibration log is kept in a notebook at the Analyzer. Calibration information is entered on this sheet to maintain a permanent record and the operator enters the time, oxygen calibration level and initials on the Incinerator Log Book sheet.

In addition to instrument generated data recorded on charts or the computers, operator logs are maintained for backup and operations control purposes. The Incinerator Log Book log data is collected and recorded hourly over each shift.

All logs and routine maintenance records must be maintained for at least 2 years.

2.3 Reporting

Reports on system operations and maintenance are required to be sent to DEQ on a scheduled basis . These reports are prepared by the Plant Manager. The reporting schedule is as follows:

Every Three Months

Submit the CEMS Performance Testing reports generated by the computer (see 40 CFR Part 60 Appendix B Sections 2, 3 and 6)

Every Six Months

Submit scrubber differential pressure and/or exhaust O2 level data for periods that data is out of range (pressure less than 26" W.C. for more than 15 minutes or O2 level about 6.4% firing on fuel oil or 6.1% firing on gas

for more than 1 hour). Data on bed and exhaust temperatures, sludge feed rates and fuel feed rates must also be included (see 40 CFR Part 60, Subpart A & O and Part 503).

Submit information on preventive maintenance, training and operating procedures used to ensure system meets operating requirements. (see 40 CFR Part 60, Subpart A & O and Part 503).

Recorded data should be reported in the required semi-annual report in accordance with Subpart O, §60.155 (a) or §60.155 (a) and (b) and Subpart A, §60.7 (b), (c), (d), and (f), as follows:

> If the Particulate Matter emission rate was found to be below 0.38 kg/Mg (0.75 lb/ton) dry sludge input during the last FBI performance test, then only the data required to be reported under Subpart O, §60.155 (a) (1) (i) and §60.155 (a) (2) is to be submitted.
>
> If the Particulate Matter emission rate was found to exceed 0.38 kg/Mg (0.75 lb/ton) dry sludge input during the last FBI performance test, then all of the data required to be reported under Subpart O, §60.155 (a) (1) (ii) and (a) (2) (but not §60.155 (a) (1) (i)) and §60.155 (b) (1) thru (b) (6) is to be submitted.

NOTE: The numbers that trigger reporting under 40 CFR Part 60, Subpart O, §60.155 (a) (1) and (a) (2) were determined during the FBI performance test conducted November 30 through December 2, 1994, because the measured Particulate Matter emission rates were below 0.38 kg/Mg (0.75 lb/ton) dry sludge input.

Every Twelve Months - (On February 19th)

Submit CEM Report with average monthly concentrations of oxygen and carbon monoxide. Also include CEM calibration and maintenance logs (see 40 CFR Part 503).

Oxygen Analyzer Daily Calibration

Month________

Date	Time	Operator	Span Air	Set	Zero	Remarks

Table 1 Calibration Drift Determination Results						
	Day	Date	Time	Reference Value	CEM Value	Difference
Zero	1					
	2					
	3					
	4					
	5					
High	1					
	2					
	3					
	4					
	5					

Table 2
Calibration Error Determination Results

Run Number	Calibration Value	CEM Response	Differences		
			Zero	Mid	High
1-Zero					
2-Mid					
3-High					
4-Mid					
5-Zero					
6-High					
7-Zero					
8-Mid					
9-High					
Mean Difference (Calibration Error)					

Table 3
Data Records for CEM

Date: ___/___/___

End Time	ppm, (raw)	% Stack Moisture	% Oxygen, Dry	ppm, (dry @ 7% O_2)
1 am				
2 am				
3 am				
4 am				
5 am				
6 am				
7 am				
8 am				
9 am				
10 am				
11 am				
12 pm				
1 pm				
2 pm				
3 pm				
4 pm				
5 pm				
6 pm				
7 pm				
8 pm				
9 pm				
10 pm				
11 pm				
12 am				

Table 4: Monthly CEM Report

Hourly Averages (ppm, dry @ 7% oxygen)

Hr / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								
15																								
16																								
17																								
18																								
19																								
20																								
21																								
22																								
23																								
24																								
25																								
26																								
27																								
28																								
29																								
30																								
31																								

Monthly Average (dry @ 7% oxygen) = _____ ppm.

DATE	CYL. GAS	E	F	CYL. GAS	E	F	CYL. GAS	E	F	OP. INT.
01-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
02-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
03-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
04-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
05-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
06-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
07-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
08-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
09-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
10-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
11-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
12-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
13-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
14-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
15-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
16-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
17-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
18-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
19-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
20-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
21-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
22-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
23-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
24-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
25-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
26-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
27-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
28-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
29-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
30-Apr-96	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			
	Carbon Monoxide 162 ppm /N2			Nitrogen Zero			O2 8.04% Bal Nitrogen			

40 CFR PART 60, SUBPART A, §60.7

§ 60.5 Determination of construction or modification.

(a) When requested to do so by an owner or operator, the Administrator will make a determination of whether action taken or intended to be taken by such owner or operator constitutes construction (including reconstruction) or modification or the commencement thereof within the meaning of this part.

(b) The Administrator will respond to any request for a determination under paragraph (a) of this section within 30 days of receipt of such request.

[40 FR 58418, Dec. 16, 1975]

§ 60.6 Review of plans.

(a) When requested to do so by an owner or operator, the Administrator will review plans for construction or modification for the purpose of providing technical advice to the owner or operator.

(b)(1) A separate request shall be submitted for each construction or modification project.

(2) Each request shall identify the location of such project, and be accompanied by technical information describing the proposed nature, size, design, and method of operation of each affected facility involved in such project, including information on any equipment to be used for measurement or control of emissions.

(c) Neither a request for plans review nor advice furnished by the Administrator in response to such request shall (1) relieve an owner or operator of legal responsibility for compliance with any provision of this part or of any applicable State or local requirement, or (2) prevent the Administrator from implementing or enforcing any provision of this part or taking any other action authorized by the Act.

[36 FR 24877, Dec. 23, 1971, as amended at 39 FR 9314, Mar. 8, 1974]

§ 60.7 Notification and record keeping.

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification as follows:

(1) A notification of the date construction (or reconstruction as defined under § 60.15) of an affected facility is commenced postmarked no later than 30 days after such date. This requirement shall not apply in the case of mass-produced facilities which are purchased in completed form.

(2) A notification of the anticipated date of initial startup of an affected facility postmarked not more than 60 days nor less than 30 days prior to such date.

(3) A notification of the actual date of initial startup of an affected facility postmarked within 15 days after such date.

(4) A notification of any physical or operational change to an existing facility which may increase the emission rate of any air pollutant to which a standard applies, unless that change is specifically exempted under an applicable subpart or in § 60.14(e). This notice shall be postmarked 60 days or as soon as practicable before the change is commenced and shall include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the facility before and after the change, and the expected completion date of the change. The Administrator may request additional relevant information subsequent to this notice.

(5) A notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with § 60.13(c). Notification shall be postmarked not less than 30 days prior to such date.

(6) A notification of the anticipated date for conducting the opacity observations required by § 60.11(e)(1) of this part. The notification shall also include, if appropriate, a request for the Administrator to provide a visible emissions reader during a performance test. The notification shall be postmarked not less than 30 days prior to such date.

(7) A notification that continuous opacity monitoring system data results will be used to determine compliance with the applicable opacity standard during a performance test required by § 60.8 in lieu of Method 9 observation data as allowed by § 60.11(e)(5) of this part. This notification shall be postmarked not less than 30 days prior to the date of the performance test.

(b) Any owner or operator subject to the provisions of this part shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.

(c) Each owner or operator required to install a continuous monitoring system (CMS) or monitoring device shall submit an excess emissions and monitoring systems performance report (excess emissions are defined in applicable subparts) and/or a summary report form (see paragraph (d) of this section) to the Administrator semiannually, except when: more frequent reporting is specifically required by an applicable subpart; or the CMS data are to be used directly for compliance determination, in which case quarterly reports shall be submitted; or the Administrator, on a case-by-case basis, determines that more frequent reporting is necessary to accurately assess the compliance status of the source. All reports shall be postmarked by the 30th day following the end of each calendar half (or quarter, as appropriate). Written reports of excess emissions shall include the following information:

(1) The magnitude of excess emissions computed in accordance with § 60.13(h), any conversion factor(s) used, and the date and time of commencement and completion of each time period of excess emissions. The process operating time during the reporting period.

(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventative measures adopted.

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.

(4) When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.

(d) The summary report form shall contain the information and be in the format shown in figure 1 unless otherwise specified by the Administrator. One summary report form shall be submitted for each pollutant monitored at each affected facility.

(1) If the total duration of excess emissions for the reporting period is less than 1 percent of the total operating time for the reporting period and CMS downtime for the reporting period is less than 5 percent of the total operating time for the reporting period, only the summary report form shall be submitted and the excess emission report described in § 60.7(c) need not be submitted unless requested by the Administrator.

(2) If the total duration of excess emissions for the reporting period is 1 percent or greater of the total operating time for the reporting period or the total CMS downtime for the reporting period is 5 percent or greater of the total operating time for the reporting period, the summary report form and the excess emission report described in § 60.7(c) shall both be submitted.

FIGURE 1—SUMMARY REPORT—GASEOUS AND OPACITY EXCESS EMISSION AND MONITORING SYSTEM PERFORMANCE

Pollutant (Circle One—SO_2/NO_x/TRS/H_2S/CO/Opacity)
Reporting period dates: From _____ to _____

Company:
Emission Limitation _____
Address:
Monitor Manufacturer and Model No. _____
Date of Latest CMS Certification or Audit _____
Process Unit(s) Description:
Total source operating time in reporting period[1] _____

Emission data summary [1]		CMS performance summary [1]	
1. Duration of excess emissions in reporting period due to:		1. CMS downtime in reporting period due to:	
a. Startup/shutdowns _____	_____	a. Monitor equipment malfunctions _____	_____
b. Control equipment problems _____	_____	b. Non-Monitor equipment malfunctions _____	_____
c. Process problems _____	_____	c. Quality assurance calibration _____	_____

Emission data summary [1]		CMS performance summary [1]	
d. Other known causes	____	d. Other known causes	____
e. Unknown causes	____	e. Unknown causes	____
2. Total duration of excess emission	____	2. Total CMS Downtime	____
3. Total duration of excess emissions × (100) (Total source operating time).	%[2]	3. (Total CMS Downtime) × (100) (Total source operating time).	%[2]

[1] For opacity, record all times in minutes. For gases, record all times in hours.
[2] For the reporting period: If the total duration of excess emissions is 1 percent or greater of the total operating time or the total CMS downtime is 5 percent or greater of the total operating time, both the summary report form and the excess emission report described in § 60.7(c) shall be submitted.

On a separate page, describe any changes since last quarter in CMS, process or controls. I certify that the information contained in this report is true, accurate, and complete.

Name

Signature

Title

Date

(e)(1) Notwithstanding the frequency of reporting requirements specified in paragraph (c) of this section, an owner or operator who is required by an applicable subpart to submit excess emissions and monitoring systems performance reports (and summary reports) on a quarterly (or more frequent) basis may reduce the frequency of reporting for that standard to semiannual if the following conditions are met:

(i) For 1 full year (e.g., 4 quarterly or 12 monthly reporting periods) the affected facility's excess emissions and monitoring systems reports submitted to comply with a standard under this part continually demonstrate that the facility is in compliance with the applicable standard;

(ii) The owner or operator continues to comply with all recordkeeping and monitoring requirements specified in this subpart and the applicable standard; and

(iii) The Administrator does not object to a reduced frequency of reporting for the affected facility, as provided in paragraph (e)(2) of this section.

(2) The frequency of reporting of excess emissions and monitoring systems performance (and summary) reports may be reduced only after the owner or operator notifies the Administrator in writing of his or her intention to make such a change and the Administrator does not object to the intended change. In deciding whether to approve a reduced frequency of reporting, the Administrator may review information concerning the source's entire previous performance history during the required recordkeeping period prior to the intended change, including performance test results, monitoring data, and evaluations of an owner or operator's conformance with operation and maintenance requirements. Such information may be used by the Administrator to make a judgment about the source's potential for noncompliance in the future. If the Administrator disapproves the owner or operator's request to reduce the frequency of reporting, the Administrator will notify the owner or operator in writing within 45 days after receiving notice of the owner or operator's intention. The notification from the Administrator to the owner or operator will specify the grounds on which the disapproval is based. In the absence of a notice of disapproval within 45 days, approval is automatically granted.

(3) As soon as monitoring data indicate that the affected facility is not in compliance with any emission limitation or operating parameter specified in the applicable standard, the frequency of reporting shall revert to the frequency specified in the applicable standard, and the owner or operator shall submit an excess emissions and monitoring systems performance report (and summary report, if required) at the next appropriate reporting period following the noncomplying event. After demonstrating compliance with the applicable standard for another full year, the owner or operator may again request approval from the Administrator to reduce the frequency of reporting for that standard as provided for in paragraphs (e)(1) and (e)(2) of this section.

(f) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by this part recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records.

(g) If notification substantially similar to that in paragraph (a) of this section is required by any other State or local agency, sending the Administrator a copy of that notification will satisfy the requirements of paragraph (a) of this section.

(h) Individual subparts of this part may include specific provisions which clarify or make inapplicable the provisions set forth in this section.

[36 FR 24877, Dec. 23, 1971, as amended at 40 FR 46254, Oct. 6, 1975; 40 FR 59418, Dec. 18, 1975; 45 FR 5617, Jan. 23, 1980; 48 FR 48335, Oct. 18, 1983; 50 FR 53113, Dec. 27, 1985; 52 FR 9781, Mar. 26, 1987; 55 FR 51382, Dec. 13, 1990; 59 FR 12422, Mar. 16, 1994; 59 FR 47265, Sept. 15, 1994]

§ 60.8 Performance tests.

(a) Within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of such facility shall conduct performance test(s) and furnish the Administrator a written report of the results of such performance test(s).

(b) Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart unless the Administrator (1) specifies or approves, in specific cases, the use of a reference method with minor changes in methodology, (2) approves the use of an equivalent method, (3) approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance, (4) waives the requirement for performance tests because the owner or operator of a source has demonstrated by other means to the Administrator's satisfaction that the affected facility is in compliance with the standard, or (5) approves shorter sampling times and smaller sample volumes when necessitated by process variables or other factors. Nothing in this paragraph shall be construed to abrogate the Administrator's authority to require testing under section 114 of the Act.

(c) Performance tests shall be conducted under such conditions as the Administrator shall specify to the plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of the performance tests. Operations during periods of startup, shutdown, and malfunction shall not constitute representative conditions for the purpose of a performance test nor shall emissions in excess of the level of the applicable emission limit during periods of startup, shutdown, and malfunction be considered a violation of the applicable emission limit unless otherwise specified in the applicable standard.

(d) The owner or operator of an affected facility shall provide the Administrator at least 30 days prior notice of any performance test, except as specified under other subparts, to afford the Administrator the opportunity to have an observer present.

(e) The owner or operator of an affected facility shall provide, or cause to be provided, performance testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such facility. This includes (i) constructing the air pollution control system such that volumetric flow rates and pollutant emission rates can be accurately determined by applicable test methods and procedures and (ii) providing a stack or duct free of cyclonic flow during performance tests, as demonstrated by applicable test methods and procedures.

(2) Safe sampling platform(s).

40 CFR PART 60, SUBPART O, §60.153 & §60.154 & §60.155

§ 60.153 Monitoring of operations.

(a) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall:

(1) Install, calibrate, maintain, and operate a flow measuring device which can be used to determine either the mass or volume of sludge charged to the incinerator. The flow measuring device shall be certified by the manufacturer to have an accuracy of ±5 percent over its operating range. Except as provided in paragraph (d) of this section, the flow measuring device shall be operated continuously and data recorded during all periods of operation of the incinerator.

(2) Provide access to the sludge charged so that a well-mixed representative grab sample of the sludge can be obtained.

(3) Install, calibrate, maintain, and operate a weighing device for determining the mass of any municipal solid waste charged to the incinerator when sewage sludge and municipal solid waste are incinerated together. The weighing device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any multiple hearth, fluidized bed, or electric sludge incinerator subject to the provisions of this subpart shall comply with the requirements of paragraph (a) of this section and:

(1) For incinerators equipped with a wet scrubbing device, install, calibrate, maintain and operate a monitoring device that continuously measures and records the pressure drop of the gas flow through the wet scrubbing device. Where a combination of wet scrubbers is used in series, the pressure drop of the gas flow through the combined system shall be continuously monitored. The device used to monitor scrubber pressure drop shall be certified by the manufacturer to be accurate within ±250 pascals (±1 inch water gauge) and shall be calibrated on an annual basis in accordance with the manufacturer's instructions.

(2) Install, calibrate, maintain and operate a monitoring device that continuously measures and records the oxygen content of the incinerator exhaust gas. The oxygen monitor shall be located upstream of any rabble shaft cooling air inlet into the incinerator exhaust gas stream, fan, ambient air recirculation damper, or any other source of dilution air. The oxygen monitoring device shall be certified by the manufacturer to have a relative accurancy of ±5 percent over its operating range and shall be calibrated according to method(s) prescribed by the manufacturer at least once each 24-hour operating period.

(3) Install, calibrate, maintain and operate temperature measuring devices at every hearth in multiple hearth furnaces; in the bed and outlet of fluidized bed incinerators; and in the drying, combustion, and cooling zones of electric incinerators. For multiple hearth furnaces, a minimum of one thermocouple shall be installed in each hearth in the cooling and drying zones, and a minimum of two thermocouples shall be installed in each hearth in the combustion zone. For electric incinerators, a minimum of one thermocouple shall be installed in the drying zone and one in the cooling zone, and a minimum of two thermocouples shall be installed in the combustion zone. Each temperature measuring device shall be certified by the manufacturer to have an accuracy of ±5 percent over its operating range. Except as provided in paragraph (d) of this section, the temperature monitoring devices shall be operated continuously and data recorded during all periods of operation of the incinerator.

(4) Install, calibrate, maintain and operate a device for measuring the fuel flow to the incinerator. The flow measuring device shall be certified by the manufacturer to have an accuracy of ±5 percent over its operating range. Except as provided in paragraph (d) of the section, the fuel flow measuring device shall be operated continuously and data recorded during all periods of operation of the incinerator.

(5) Except as provided in paragraph (d) of this section, collect and analyze a grab sample of the sludge fed to the incinerator once per day. The dry sludge content and the volatile solids content of the sample shall be determined in accordance with the method specified under §60.154(c)(2), except that the determination of volatile solids, step (3)(b) of the method, may not be deleted.

(c) The owner or operator of any multiple hearth, fluidized bed, or electric sludge incinerator subject to the provisions of this subpart shall retain the following information and make it available for inspection by the Administrator for a minimum of 2 years:

(1) For incinerators equipped with a wet scrubbing device, a record of the measured pressure drop of the gas flow through the wet scrubbing device, as required by paragraph (b)(1) of this section.

(2) A record of the measured oxygen content of the incinerator exhaust gas, as required by paragraph (b)(2) of this section.

(3) A record of the rate of sludge charged to the incinerator, the measured temperatures of the incinerator, the fuel flow to the incinerator, and the total solids and volatile solids content of the sludge charged to the incinerator, as required by paragraphs (a)(1), (b)(3), (b)(4), and (b)(5) of this section.

(d) The owner or operator of any multiple hearth, fluidized bed, or electric sludge incinerator subject to the provisions of this subpart from which the particulate matter emission rate measured during the performance test required under §60.154(d) is less than or equal to 0.38 g/kg of dry sludge input (0.75 lb/ton) shall be required to comply with the requirements in paragraphs (a), (b), and (c) of this section during all periods of this incinerator following the performance test except that:

(1) Continuous operation of the monitoring devices and data recorders in paragraphs (a)(1), (b)(3), and (b)(4) of this section shall not be required.

(2) Daily sampling and analysis of sludge feed in paragraph (b)(5) of this section shall not be required.

(3) Recordkeeping specified in paragraph (c)(3) of this section shall not be required.

(e) The owner or operator of any sludge incinerator other than a multiple hearth, fluidized bed, or electric incinerator or any sludge incinerator equipped with a control device other than a wet scrubber shall submit to the Administrator for approval a plan for monitoring and recording incinerator and control device operation parameters. The plan shall be submitted to the Administrator:

(1) No later than 90 days after October 6, 1988, for sources which have provided notification of commencement of construction prior to October 6, 1988.

(2) No later than 30 days after the notification of commencement of construction, for sources which provide notification of commencement of construction on or after October 6, 1988.

(3) At least 90 days prior to the date on which the new control device becomes operative, for sources switching to a control device other than a wet scrubber.

[36 FR 24877, Dec. 23, 1971, as amended at 53 FR 39415, Oct. 6, 1988]

§60.154 Test methods and procedures.

(a) In conducting the performance tests required in §60.8, the owner or operator shall use as reference methods and procedures the test methods in Appendix A of this part or other methods and procedures as specified in this section, except as provided for in §60.8(b).

(b) The owner or operator shall determine compliance with the particulate matter emission standards in §60.152 as follows:

(1) The emission rate (E) of particulate matter for each run shall be computed using the following equation:

$$E = K(c_s Q_{sd})/S$$

where:

E=emission rate of particulate matter, g/kg (lb/ton) of dry sludge input.

c_s=concentration of particulate matter, g/dscm (g/dscf).

Q_{sd}=volumetric flow rate of effluent gas, dscm/hr (dscf/hr).

S=charging rate of dry sludge during the run, kg/hr (lb/hr).

K=conversion factor, 1.0 g/g [4.409 $lb^2/(g\text{-}ton)$].

(2) Method 5 shall be used to determine the particulate matter concentration (c_s) and the volumetric flow rate (Q_{sd}) of the effluent gas. The sampling time and sample volume for each run shall be at least 60 minutes and 0.90 dscm (31.8 dscf).

(3) The dry sludge charging rate (S) for each run shall be computed using either of the following equations:

$$S = K_m S_m R dm/\theta$$

$$S = K_v S_v R dv/\theta$$

where:

S=charging rate of dry sludge, kg/hr (lb/hr).

S_m=total mass of sludge charged, kg (lb).

B_{mm}=average mass of dry sludge per unit mass of sludge charged, mg/mg (lb/lb).

θ=duration of run, min.

K_m=conversion factor, 60 min/hr.

S_v=total volume of sludge charged, m^3 (gal).

B_{mv}=average mass of dry sludge per unit volume of sludge charged, mg/liter (lb/ft^3).

K_v=conversion factor, 60×10^{-3} (liter-kg-min)/(m^3-mg-hr) [3.021 (ft^3-min)/(gal-hr)].

(4) the flow measuring device of §60.153(a)(1) shall be used to determine the total mass (S_m) or volume (S_v) of sludge charged to the incinerator during each run. If the flow measuring device is on a time rate basis, readings shall be taken and recorded at 5-minute intervals during the run and the total charge of sludge shall be computed using the following equations, as applicable:

$$S_m = \sum_{i=1}^{n} Q_{mi}\,\theta_i$$

$$S_v = \sum_{i=1}^{n} Q_{vi}\,\theta_i$$

where:

Q_{mi}=average mass flow rate calculated by averaging the flow rates at the beginning and end of each interval "i", kg/min (lb/min).

Q_{vi}=average volume flow rate calculated by averaging the flow rates at the beginning and end of each interval "i", m^3/min (gal/min).

θ_i=duration of interval "i", min.

(5) Samples of the sludge charged to the incinerator shall be collected in nonporous jars at the beginning of each run and at approximately 1-hour intervals thereafter until the test ends, and "209 F. Method for Solid and Semisolid Samples" (incorporated by reference—see §60.17) shall be used to determine dry sludge content of each sample (total solids residue), except that:

(i) Evaporating dishes shall be ignited to at least 103 °C rather than the 550 °C specified in step 3(a)(1).

(ii) Determination of volatile residue, step 3(b) may be deleted.

(iii) The quantity of dry sludge per unit sludge charged shall be determined in terms of mg/liter (lb/ft^3) or mg/mg (lb/lb).

(iv) The average dry sludge content shall be the arithmetic average of all the samples taken during the run.

(6) Method 9 and the procedures in §60.11 shall be used to determine opacity.

(c) [Reserved]

(d) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall conduct a performance test during which the monitoring and recording devices required under §60.153(a)(1), (b)(1), (b)(2), (b)(3), and (b)(4) are installed and operating and for which the sampling and analysis procedures required under §60.153(b)(5) are performed. The owner or operator shall provide the Administrator at least 30 days prior notice of the performance test to afford the Administrator the opportunity to have an observer present.

(1) For incinerators that commenced construction or modification on or before April 18, 1986, the performance test shall be conducted within 360 days of the effective date of these regulations unless the monitoring and recording devices required under §60.153(a)(1), (b)(1), (b)(2), (b)(3), and (b)(4) were installed and operating and the sampling and analysis procedures required under §60.153(b)(5) were performed during the most recent performance test and a record of the measurements taken during the performance test is available.

(2) For incinerators that commence construction or modification after April 18, 1986, the date of the performance test shall be determined by the requirements in §60.8.

[54 FR 6658, Feb. 14, 1989, as amended at 54 FR 27015, June 27, 1989; 59 FR 5108, Feb. 3, 1994]

§60.155 Reporting.

(a) The owner or operator of any multiple hearth, fluidized bed, or electric sludge incinerator subject to the provisions of this subpart shall submit to the Administrator semi-annually a report in writing which contains the following:

(1) A record of average scrubber pressure drop measurements for each period of 15 minutes duration or more during which the pressure drop of the scrubber was less than, by a percentage specified below, the average scrubber pressure drop measured during the most recent performance test. The percent reduction in scrubber pressure

drop for which a report is required shall be determined as follows:

(i) For incinerators that achieved an average particulate matter emission rate of 0.38 kg/Mg (0.75 lb/ton) dry sludge input or less during the most recent performance test, a scrubber pressure drop reduction of more than 30 percent from the average scrubber pressure drop recorded during the most recent performance test shall be reported.

(ii) For incinerators that achieved an average particulate matter emission rate of greater than 0.38 kg/Mg (0.75 lb/ton) dry sludge input during the most recent performance test, a percent reduction in pressure drop greater than that calculated according to the following equation shall be reported:

$$P = -111E + 72.15$$

where P=Percent reduction in pressure drop, and

E=Average particulate matter emissions (kg/megagram)

(2) A record of average oxygen content in the incinerator exhaust gas for each period of 1-hour duration or more that the oxygen content of the incinerator exhaust gas exceeds the average oxygen content measured during the most recent performance test by more than 3 percent.

(b) The owner or operator of any multiple hearth, fluidized bed, or electric sludge incinerator from which the average particulate matter emission rate measured during the performance test required under §60.154(d) exceeds 0.38 g/kg of dry sludge input (0.75 lb/ton of dry sludge input) shall include in the report for each calendar day that a decrease in scrubber pressure drop or increase in oxygen content of exhaust gas is reported a record of the following:

(1) Scrubber pressure drop averaged over each 1-hour incinerator operating period.

(2) Oxygen content in the incinerator exhaust averaged over each 1-hour incinerator operating period.

(3) Temperatures of every hearth in multiple hearth incinerators; of the bed and outlet of fluidized bed incinerators; and of the drying, combustion, and cooling zones of electric incinerators averaged over each 1-hour incinerator operating period.

(4) Rate of sludge charged to the incinerator averaged over each 1-hour incinerator operating period.

(5) Incinerator fuel use averaged over each 8-hour incinerator operating period.

(6) Moisture and volatile solids content of the daily grab sample of sludge charged to the incinerator.

(c) The owner or operator of any sludge incinerator other than a multiple hearth, fluidized bed, or electric incinerator or any sludge incinerator equipped with a control device other than a wet scrubber shall include in the semi-annual report a record of control device operation measurements, as specified in the plan approved under §60.153(e).

[53 FR 39417, Oct. 6, 1988]

§ 60.156 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 111(c) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities which will not be delegated to States: §60.153(e).

[53 FR 39418, Oct. 6, 1988]

Subpart P—Standards of Performance for Primary Copper Smelters

SOURCE: 41 FR 2332, Jan. 15, 1976, unless otherwise noted.

§ 60.160 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in primary copper smelters: Dryer, roaster, smelting furnace, and copper converter.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

[42 FR 37937, July 25, 1977]

§ 60.161 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning

SECTION 3
OPERATIONS

3.0 *GENERAL*

As noted in Section 1, the operations for the FBI system are provided in Section F of the Solids SOP Book. The SOPs include detailed instructions for the operation of the FBI system. They are intended to be used as necessary as a reference and guide for day-to-day operations of the system. For this reason, each operator is provided with a personal copy of the SOPs.

These SOPs are also included in this section for reference. The major SOP instructions include:

System Startup - Page 1
Normal Operation Procedure - Page 5
Normal Shutdown Procedure - Page 13
Furnace Interlocks and Controls - Page 15
Log Book and Sampling - Page 17
Troubleshooting - Attachment I
Electrical Interlock Diagram - Attachment II
Process Diagram - Attachment III
O_2 System Troubleshooting - Attachment IV

3.1 OPERATOR RESPONSIBILITY

The operators are required to maintain a smooth steady operating environment with a minimum of changes to sludge air and fuel feed rates. The main operating goal for an operator is to handle a shift run of sludge (up to 1.7 dry tons/hour as long as Exhaust O_2 Analyzer readings remain in range) while meeting all regulatory standards. Additional important guidelines are:

- Maintain a bed temperature in the 1300 - 1450 degree F range for maximum efficiency and savings of fuel.
- Frequently check air flows, temperature levels, pressure readouts, O_2 level and oil consumption.
- Monitor and control process in direct relation to the O2 analyzer level.

-Make sure O_2 analyzer is calibrated once every 24 hours (usually 1st shift). This must be logged on the O_2 daily log sheet and recorded on the chart with date, time and operators initials (See page 8 of SOP). Also, in the operators' log book.

The parameters (wet scrubber pressure drop and exhaust gas Oxygen content) and numbers that trigger reporting under 40 CFR Part 60, Subpart O, §60.155 (a) (1) and (a) (2) were determined during the FBI performance test conducted November 30 through December 2, 1994. The numbers resulting from that test are subject to change if future performance test is conducted.

Recorded data should be reported in the required semi-annual report in accordance with Subpart O, §60.155 (a) or §60.155 (a) and (b) and Subpart A, §60.7 (b), (c), (d), and (f), as follows:

> If the Particulate Matter emission rate was found to be below 0.38 kg/Mg (0.75 lb/ton) dry sludge input during the last FBI performance test, then only the data required to be reported under Subpart O, §60.155 (a) (1) (i) and §60.155 (a) (2) is to be submitted.
>
> If the Particulate Matter emission rate was found to exceed 0.38 kg/Mg (0.75 lb/ton) dry sludge input during the last FBI performance test, then all of the data required to be reported under Subpart O, §60.155 (a) (1) (ii) and (a) (2) (but not §60.155 (a) (1) (i)) and §60.155 (b) (1) thru (b) (6) is to be submitted.

To ensure compliance with federal regulations for operation of the FBI, the operator must pay close attention to the several monitoring systems as explained below.

The Scrubber differential pressure is automatically controlled by a set point to maintain a 37" W.C. level. The differential pressure level must never fall below 26" W C for more than 15 minutes. If a low level occurs; check for low air flow, check the sludge feed for top low solids or a low pumping rate and check for a mechanical problem at the piston disc controller. If a high level occurs, check for too high air flow, high water flow (gpm), clogging of the pressure taps or mechanical problems with the piston disc controller. If problems persist, contact the supervisor or maintenance.

The exhaust O_2 level must not exceed 6.1% (natural gas auxiliary heating) or 6.4% (fuel oil auxiliary heating) for more than 1 hour. The O_2 level is function of air, sludge and fuel flow rates. At high O_2 levels, check the sludge feed rate and solids levels or adjust the air flow (keep in mind a maximum air flow of 8500

cfm). Also, recheck the calibration and the O_2 probe. If a low O_2 level occurs, reduce the feed rate of the sludge and/or makeup fuel, check the air flow rate and verify that the O_2 analyzer calibration is correct. If problems persist, contact the supervisor or maintenance. (See FBI's SOP, pages SOP-12 and SOP-13)

Note: The O_2 monitoring system is a two part system. The O_2 analyzer at the scrubber exhaust has a specific O_2 probe (and is calibrated once every 24 hours). The CEM includes an O_2 monitoring system to backup the O_2 analyzer readout. The O_2 analyzer has a local readout plus the data is recorded on the control panel strip recorded and on the computer data system. The CEM has a local readout plus the data is recorded in the computer data system.

The CEM also provides continuous readout and recording of the exhaust carbon monoxide (CO) level. The CO level must not exceed 100 ppm when averaged over a 4 hour period. If a high CO level occurs, check for excess solids or fuel rates, check for too low an air feed rate and check the CEM filters. If the problem seems to be at the CEM, notify the supervisor and the instrument tech for recalibration.

The fuel oil feed system is equipped with two flow measurement and recording systems. At the end of each shift, check the two meter readouts for a discrepancy of 5% or greater. If a difference occurs between the fuel oil mechanical flow meter and the computer readouts, issue a work order to check both systems for recalibration.

The Sludge Feed System is equipped with two sludge flow metering systems; the waste sludge flow meter and the Schwing Pump feed monitoring system. At the end of each shift, compare the sludge feed totals of two systems. If a difference of 10% or greater occurs, issue a work order to check both systems for recalibration.

The remainder of this section is the FBI SOPs:

System Startup - Page 1
Normal Operation Procedure - Page 5
Normal Shutdown Procedure - Page 13
Furnace Interlocks and Controls - Page 15
Log Book and Sampling - Page 17
Troubleshooting - Attachment I
Electrical Interlock Diagram - Attachment II
Process Diagram - Attachment III
O_2 System Troubleshooting - Attachment IV

FROM: S. J. SHULIN
DATE: 5 JANUARY 1996 REV. 2

FLUIDIZING INCINERATOR S.O.P.

I. SYSTEM START UP.

A. Check out and equipment walk through.

1. Verify main gas valve is open. (At first level by venturi.)
2. FLUIDIZING air blower.
   a. Verify that Flow control valve is closed. (At first level behind Heat exchanger and Furnace.)
   b. Verify that the by-pass damper is closed. (At first level back of furnace.)
3. Scrubber ash pumps.
   a. Verify that seal water is on.
4. Ash polymer system.
5. Pre-heat burner blower.
6. High pressure water pump.
7. Check out all roof spray guns.
   a. Open the compress air valve for the roof sprayer. (At third level at stair way.)

8. Verify Oxygen Analyzer System is on line.

9. Verify that utility air valve is open. (At basement by stairway and furnace.)

B. Start up Scrubber Ash System.

C. Open Main utility water valve for scrubber. (At first level by stairway and furnace.)

1. Adjust Venturi water valves. (At first level in front Venturi.)

a. Main valve to 150 GPM (flowmeter)

b. Small valve to 30 GPM (flowmeter)

c. Venturi Throat shaft cooling water valve open. (At level directly below main and small water valve. Read on PSI gage.)

2. Turn on Ash pump.

a. Keep water level in the middle of sight glass.

b. Adjusting the Ash Pump speed by adjusting the A C variable speed control. (Located in basement on wall by Scrubber Ash pumps.)

D. Start FLUIDIZING Blower.

E. Burner System Start-Up.

1. Start <u>Preheat Burner Blower</u> at Burner Control Panel. (Push start button.)

a. Open Blower air valve above blower.

2. Open <u>BY-PASS VALVE</u>.

2 a. Set air Flow to 5500 scfm.

b.Set Magnehelic at or above 6" W.C.

3. System Satisfied Light at Control Panel. (Must have following conditions for Light.)

a.The FLUIDIZING Air Flow must be above 5500 scfm.

b.Windbox temperature must be below 1800deg.F

c.Constriction Plate Pressure must be below 42"

W.C.(This is indicated in Control Room on the Westronic PT.

12.

d.Heat Exchanger inlet temperature must be below

1700deg. F

e.Preheat Burner Blower must be running.

f.Preheat Burner differential pressure at Magnehelic be above 2"W.C.

g.Heat Exchanger air outlet temperature below 1300 deg.F

4. Open Pilot gas valve.

5. Press the "Purge" push-button.(the Limit satisfied light must be satisfied.)

a.Purge time of 2 minutes is required before

pressing the "Preheat Burner Start" button.

6. Adjust Main Valve to minimum flame.(Located just above the gas Burner.)

7. Press the "Preheat Burner Start" button. NOTE: Holding in start button until start button is lit.

3 a.If Burner dose not light go back to step #4 and repeat your action.

b.At this time two thing will happen:

(1)The pilot solenoid valve will open and the pilot will light.

(2)Once the pilot light has been stable (10 seconds) the main flame solenoid valve will open and the main flame will ignited.

(3)Actuates a timer relay which after 10 seconds will extinguish the pilot flame. NOTE: If flame does not go out, close pilot gas valve.

(4)If the main flame is unstable, it will be extinguished when the pilot flame is extinguished. The alarm will sound and the "Flame Failure" light will come on. NOTE: Go back to step #4 and repeat and re-ignite burner.

F.PREHEAT BURNER OPERATION.

1.If the Reactor is at ambient temperature, gradually bring flame up SLOWLY (At a rate of 100 deg. F per hour.) Using the main gas valve directly above burnerIf the temperatures are high you can bring the burner to last temperature and resume your heat up.

2.At full firing rate of the Preheat Burner is achieved. The Windbox temperature should at all time be kept below 1800 deg. F.

3.The main flame air flow rate should always be adjusted so that the flame is generally contained within the preheat burner tunnel, in any case the flame should never be allowed to impinge directly on the underside of the refractory arch constriction plate.

4.FLUIDIZING air flow must be above 5500 SCFM

5.When interlock temperature is reaches ether 1150 deg. F Bed Oil gun or 1350 deg. F for Bed gas systems. Once interlock are satisfied, start by selecting bed Oil or Gas injected into bed. (NOTE: See Operation Set Up for Oil System Operation.)

6.At that time started reducing Preheat burner and air flow from the bypass damper.

7.Start opening the Blower Air Control Valve to start the air flow through Heat Exchanger (NOTE: If you start getting high temperature alarm in the Heat Exchanger during the heat up. Start opening the Blower Air Control Valve as necessary to control Heat Exchanger temperature. Do not exceed 7000 SCFM total air flow.)

8.When temperature in Windbox reaches 1350 deg. F. The Preheat Burner can be turn OFF and the Bypass Damper can be closed. Also to close the air valve above the Pre-heat Blower. NOTE: Do not close to fast with out opening the Blower Air Control Valve. If the air flow drops below 5000 SCFM the bed gas will trip out.

II. NORMAL OPERATION PROCEDURE.

A. Operation set up Injector OIL SYSTEM.

1.Start Small booster pump. (Location outside by the main oil storage tank).

a.Make sure that the valve at the bottom of the tank is open before starting the oil pump.

2.Turn the OIL/GAS selected switch to OIL.

3.Check to see if the interlock light is ON. Note: If it is not on, the oil system can not be started. (See Furnace Interlocks and Controls.)

4.Start Injector Oil Pump by pushing the HAND button.(At the Control Panel.)

5.Turn the OIL SPEED KNOB halfway.

6.Go down to the basement to start the OIL flowing.

a.To start the oil to flow. There is TWO MAXON VALVE that must be set. This is done by starting with MAXON valve on the LIFT side above the oil pump. This must be open FIRST. This is done by pushing the handle back and then pulling forward. The word OPEN should appear in the center window. Then repeat the action on the valve to the right.

7.Installing the BED OIL GUNS.

a.Connect the air line to rear of the Oil Gun and Turn on the air (to clear gun and a pathway the protection piping).

b.Push the Oil Gun into the housing (with the air on) all the way forward.

c.Disconnected air line.

d.Connect OIL LINE to gun (small port). NOTE: Check oil gauge to see if pressure goes down. Make shore that valve is open. If not, the gun may be plugged. Try to clear by disconnecting the oil line and reconnecting the air line. If still plugged, DO NOT USE. Pull gun back 1 ½ feet and disconnect air line.

e.Continue same process to all remaining Oil Gun.

f.Return to the control room and set the desired pumping speed for operation.

g.NOTE: The oil guns should be check when making the equipment walk through.

B.Bring Bed temperature to 1500 deg.F

1.Open Sludge Feed line to FB1. NOTE: Open valve slowly because of pressure build up in Feed lines. If opened to fast the sludge will rush into the Furnace and cool it very rapidly, also the air flow will drop to the point that the Bed Gas and Oil could be lost.

2.Once valve are open, use air line to Purge all feed nozzles to insure all Sludge feed line are cleared.

3.If running on Gas put "Bed Gas" control in AUTO. NOTE: This is done because and operator's duty takes the operator away from the Control Room. To get ready to start the feeding of Sludge.

4.Check to see if the OXYGEN ANALYZER has been Calibrated in the last 24 HOURS. If not then it M U S T be calibrated and logged in the LOG BOOK and on the CHART RECORDED (NOTE: Operator must put on chart recorder the date, time and his initial).

5.Calibrating O2 system.

a.Go to the O2 field panel (Located on first level by Scrubber)and open door.

b.PUSH CALB. And follow the instructions.

c.TURN ON the valve to the reference AIR.

d.Wait for reading to stabilize (About 2 to 3 minutes).

e.Then answer the YES QUESTION. NOTE: The display should show 20.7 (plus or minus .2 on read).

f.TURN OFF AIR and TURN ON Calibration GAS (the is gas coming form the cylinder).

g.Wait for the reading to stabilize (About 2 to 3 minutes).

h.Then answer the YES QUESTION. NOTE: The display should show 1.00 (plus or minus .002 on reading.

i.TURN OFF Calibration GAS and answer YES.

j.TURN ON air valve to purge out the line. When the reading starts to move up. TURN OFF air line and wait for the stabilizing to be completed NOTE: If a problem with the calibration repeat Calibration procedure. If problem with calibration continues, contact Maintenance.

k.PUSH the up arrow (^) for the cell temperature. NOTE: The display should show 751 deg C.

l.PUSH the DISP.. button for the LED to go back to the graft read out. The system is now back on line.

6. Starting Feed Operation.

7.Start Feed Pump or pumps at low feed rate. NOTE: The screw or screws should be half cover with cake.

8.To load out the Furnace takes about 45 minutes. A low feed rate should be maintain during this period. After this time period. The feed rate can be increased to the required burn need.

9.Air Flow should be between 6000 & 8500 SCFM. NOTE: The air flow that is needed for incineration is governed by the Oxygen reading.

10.The best area for the Oxygen to be at is between 3 - 4%.

11.When using "Bed Gas" the control should be put into MANUAL for normal operation.

11.Start ASH polymer unit.

C.Furnace Profile.

1. Operation ranges (Temperature and Pressures)

a.HEAT EXCHANGER INLET	140 - 170 deg.F
b.HEAT EXCHANGER AIR OUTLET	1050 - 1240 deg.F
c.WINDBOX TEMPERATURE	1050 - 1200 deg.F
d.REACTOR BED TEMP. #4 (Gas)	1400 - 1525 deg.F
(Oil)	1250 - 1525 deg.F
e.REACTOR BED TEMP. #5 (Gas)	1400 - 1525 deg.F
(Oil)	1250 - 1525 deg.F
f.10HEAT EXCHANGER GAS INLET	1500 - 1650 deg.F
g.HEAT EXCHANGER GAS OUTLET	1030 - 1070 deg.F
h.SCRUBBER VENTURI GAS OUTLET	150 - 200 deg.F
i.SCRUBBER WATER TEMPERATURE	70 - 150 deg.F
j.FLUIDIZING AIR FLOW	6000 - 8500 SCFM
k.BED LEVEL	50 - 68 "WC
l.CONSTRICTION PLATE DIFF.	25 - 41 "WC
m.WINDBOX PRESSURE	105 - 140 "WC
n.FREEBOARD PRESSURE	25 - 40 "WC
o.SCRUBBER DIFFERENTIAL PRESS	25 - 45 "WC
p.OXYGEN	3 - 6 %

2. Alarm Limits: LOW and HIGH limits.

a.HEAT EXCHANGER INLET	N/A - 300 deg.F
b.HEAT EXCHANGER AIR OUTLET	700 - 1250 deg.F
c.WINDBOX TEMPERATURE	800 - 1750 deg.F
d.REACTOR BED TEMP. #4 (Gas)	1350 - 1560 deg.F
(Oil)	1250 - 1560 deg.F
e.REACTOR BED TEMP. #5 (Gas)	1350 - 1560 deg.F
(Oil)	1250 - 1560 deg.F
f.HEAT EXCHANGER GAS INLET	N/A - 1550 deg.F
g.HEAT EXCHANGER GAS OUTLET	N/A - 1200 deg.F
h.SCRUBBER VENTURI GAS OUTLET	150 - 250 deg.F
i.SCRUBBER WATER TEMPERATURE	N/A - 250 deg.F
j.FLUIDIZING AIR FLOW	5500 - N/A SCFM
k.BED LEVEL	47 - 68 "WC
l.CONSTRICTION PLATE DIFF.	17 - 42 "WC
m.WINDBOX PRESSURE	70 - 145 "WC
n.FREEBOARD PRESSURE	N/A - 50 "WC
o.SCRUBBER DIFFERENTIAL PRESS	27 - 55 "WC
p.OXYGEN	2 - 6 %

3. General Operation Information

a. Sludge burning - The sludge feed to the furnace must be constant and the cake dry as possible. Feed should be

increased slowly and to observes the furnace trend. The time limit between feed adjustment should be 30 minutes. This allows the furnace to adjust to the new feed rate and an operator to watch the temperature profile of the unit. Operators should watch the Air Flow Chart this give an operator a visual on the sludge loading in the Incinerator.

(1) Air Flow increased on the chart

(a)WAS sludge is getting thinner.

(b)Feed to Filter Press was lost or lost of polymer to press.

(c)Lost of feed pump.

(2)Air Flow decreased on the chart

(a)WAS sludge is getting thicker.

(b)Increase feed rate.

(c)Increase sludge feed pump.

NOTE: The Oxygen (O2) Chart will follow the air flow in same way. When loading increase the O2 will fall and loading decrease the O2 will increase.

b.Oxygen (O2) Chart- This give an operator important information in his operation.

c. O2 at 2%

(1)Over loading sludge feed.

(a)Slow feed pump.

(b)Low feed to Filter Press

(c)FBI Air flow set to low.

d.02 at 3 to 6%

(1)BEST area for Burning.

(2)02 at 7 to 8%

(a)Increase Sludge feed.

(b)Decrease FBI Air flow.

4.C E M equipment. (In the MCC room.) NOTE: This system is automated and all reading are shown on the computer Control Console.

a.Check to see if air is flowing.

b.Check air filter in front of the top panel.

c. Any problem contact Solids MGR. or Maintenance MGR.

III. NORMAL SHUTDOWN PROCEDURE.

A. Planned Shutdown-Is when the FBI would be needed to be stop for Maintenance work or for a night. Also when the FBI is going to be in a stand-by mod.

1.Stop Feed to Furnace.

a.Stop Filter press and Sludge Feed Pump or Pumps, also grease feed (if feeding).

b.Close all Sludge Feed Valve to the FBI and purge lines with air.

NOTE: The Sludge Valve should be closed every time that the FBI is to be Shutdown.

2.Heat up the Bed Temperature.

a.Short Shutdown of 1 to 8 hours. Heat unit to 1525 deg.F

b.Long Shutdown of 9 to 24 hours. Heat unit to 1600 deg.F

3.Shut down processor for OIL GUNS.

a.Disconnect OIL LINE from Oil Gun and close valve.

b.Connect air line to the rear or the gun and turn on the air. NOTE: CHECK OIL LINE HOSE BEFORE TURNING ON AIR.

c.Pull the Oil Gun back 1 ½ feet (with air still on).

d.Disconnect air line and move on to the next Guns

e.Continue the same procedure for all Oil Guns.

f.Turn OFF Oil Pump (at control panel).

4.Closing the FBI Air Control Valve.

5.Stop FBI Air Blower.

6.Turn off Ash Polymer System.

7.Close manual shut-off valves on Utility water to Scrubber and stop Ash pump. (If required for Maintenance work. If <u>not</u> leave water and pump running.)

B.EMERGENCY Shutdown Procedures.

1.FLUIDIZING Air Blower STOP push-button.

2.STOP Sludge Feed Pump or Pumps.

3.STOP all Filter Presses.

4.CLOSE ALL Sludge Feed Valve.

5.DISCONNECT oil line from all Oil Guns and close valves.

a.DO NOT: blower air throw the Oil guns when the Bed is not fluidized.

b.Pull Guns back 1 ½ feet

6.Then follow normal shutdown procedures.

IV. FURNACE INTERLOCKS AND CONTROLS.

A.Unplanned Shutdown (Preheat Burner).

1.FLUIDIZING air flow below 5000 SCFM

2.Windbox temperature in excess of 1800 deg.F

3.Constriction Plate Differential pressure excess of 42" W.C.

4.Preheat Burner Blower Failure.

5.Heat Exchanger inlet temperature in excess of 1800 deg.F

6.Heat Exchanger Air Outlet Temperature above 1300 deg.F

7.Gas supply less than 2 PSI and above 8 PSI range.

8.ANY momentary or extended power failure.

B. Unplanned Shutdown (Bed Gas Guns).

1. FLUIDIZING air flow below 5000 SCFM.

2. Bed temperature below 1325 deg.F

3. Bed temperature above 1600 deg.F

4. Heat Exchanger Gas inlet temperature above 1650 deg.F

5. Heat Exchanger air outlet temperature above 1300deg.F

6. ANY momentary or extended POWER FAILURE.

C. Unplanned Shutdown (Bed Oil Gun).

1. FLUIDIZING air flow below 5000 SCFM.

2. Bed temperature below 1150 deg.F

3. Bed temperature above 1600 deg.F

4. Heat Exchanger GAS inlet temperature above 1650 deg.F

5. Heat Exchanger AIR outlet temperature above 1300 deg.F

6. ANY momentary or extended POWER FAILURE.

a. Will lose Bed Oil MAXON VALVE (In basement).

b. Well lose Tank INCINERATOR FUEL PUMP (outside by Oil Storage Tank).

D. Unplanned Shutdown (Sludge Feed Pump - Schwing)

1. Bed temperature below 1300 deg.F

2. Bed temperature above 1600 deg.F

3. FLUIDIZING air flow below 5000 SCFM

4. Heat Exchanger Gas inlet temperature above 1650 deg.F

5.Heat Exchanger Air outlet temperature above 1300 deg.F

6.OXYGEN content of Stack Gas to fall below 2% for over 2 minutes.

E.ALARM CONDITION - TROUBLE SHOOTING

1.SEE ATTACHMENT I

F.INTERLOCK DIAGRAM (Dorr-Oliver)

1.SEE ATTACHMENT II

G.PROCESS FLOW DIAGRAM (Dorr-Oliver)

1.SEE ATTACHMENT III

V. LOG BOOK AND SAMPLING (FBI)

A.Log Book Entry.

1.Beginning Shift Entry.

a.Polymer Batch #

b.W A S Transfer #

c.North Sludge Pump #

d.South Sludge Pump #

e.Oil Meter #

f.Gas Meter #

g.Polymer added _____ Bags

2.Timed Entry During Normal Shift

a.All entry will be in hours (an example 1530hrs.)

b.Next: Briefed by (name of operator who briefed you)

c.Make an Equipment Check (every 2 hour)

(1)Ref. Area I. System start up. A. Check out and equipment walk though.

d.Log all Information that follow:

(1)Any changes in Process.

(2)Work Done (CLEANING OF THE FILTER PRESS AREA or PM)

(3)The CALIBRATING THE O2 ANALYZER.

(4)Repairs or any correction done to any equipment.

(5)All Phone call on problem or status.

(6)Maintains calls (to who, and when they arrive and leave plant).

3.All Sampling (R A W 3 minimum and Cake 3 minimum)

a.Polymer added

b.Any information that may help the operation or operators. NOTE: Do not put personal information about other on what they should be doing or what you feel about them. This Log Book is a legal document and should be fill out in a Professional manner.

4.Ending your log.

a.Polymer Batch # and Total #

b.W A S Transfer # and Total #

c.North Sludge Pump # and Total#

d.South Sludge Pump # and Total#

e.Oil Meter # and Total #

f.Gas Meter # and Total #

g.Pump Speeds - NORTH (A)____ (B)_____

SOUTH (A)____ (B)_____

h.Polymer Pounds used # or inch used.

i.TOTAL TONS

B.Sampling

1.W A S sample 1 per every 2 hour.

2.Cake sample 1 per every 2 hour (at Schwing).

3.Filter Press Filtrate 2 per 8 hours.

4.Ash Water Filtrate 2 per 8 hours

ATTACHMENT I

8. ALARM CONDITION - TROUBLE SHOOTING

	SYMPTOM		CAUSE	REMEDY
8.1	Flame Failure		NOTE: Items 8.1.1 through 8.1.3 will occur only during ignition, while items 8.1.4 through 8.1.12 can occur both at initial ignition and after sustained operation.	
		8.1.1	Pilot flame fails to ignite becuase it is not receiving fuel.	1. Open all manual shut-off valves on the natural gas supply line. 2. Check that the solenoid valves will permit flow through them when actuated.
		8.1.2	Pilot flame will not ignite because it does not receive a spark.	1. Remove the spark plug from the pilot assembly and check for a spark, while the ignition button is pressed on the instrument panel during a regular burner ignition cycle. Be sure to manually shut off the natural gas fuel supply during this check. Replace spark plug if it is defective. 2. Ignition transformer is not receiving a power supply. Check for any loose or disconnected terminals. 3. Ignition transformer appears to be defective. Remove it from its mountings, and have it checked by a properly equipped shop. Renew if defective.

8. ALARM CONDITION - TROUBLE SHOOTING

	SYMPTOM		CAUSE		REMEDY
8.1	Flame Failure	8.1.3	Pilot flame will not ignite because the Preheat Burner Blower is not running.	1.	Check that the Preheat Burner Blower pushbutton on the instrument panel has been pushed and that the motor reset is in.
				2.	Check that this blower is developing pressure.
		8.1.4	Pilot flame will not ignite because fuel/air proportional regulators are defective.	1.	Before removing or disassembling the two pressure balance regulators in the pilot system, the operator must be sure that all other causes have been thoroughly checked and eliminated since these regulators are factory set and generally will involve considerable trial and error work in the field in order to achieve the correct settings. Nevertheless, if the pressure regulators are found to be the cause, they should be disassembled and thoroughly inspected and cleaned, with any obviously worn parts replaced.

3. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM	CAUSE	REMEDY
	3.1.5 Pilot flame ignites, but its presence is not relayed by the Fireye flame supervised system.	1. Remove flame scanner from the Burner and clean the protective sight glass union. 2. Install spare flame scanner if defective. 3. Check that the vacuum tubes in the Fireye chassis are heated up. Replace any defective tubes. 4. Remove Fireye chassis from the Instrument Panel and have it checked out at a properly equipped shop.
	3.1.6 Pilot flame is stable but Preheat Burner flame will not ignite because fuel oil, or gas is not getting to the burner.	1. Open all manual shut-off valves in the respective fuel system and be sure the fuel system is set at low fire. 2. Check that the Preheat Burner Fuel Selector switch on the Instrument Panel is in the proper position. 3. Check the fuel oil storage tank level or natural gas supply. 4. Check the condition of the Preheat Burner fuel oil strainer.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM		CAUSE	REMEDY
			5. Check that the fuel solenoid valves are actuated and open to permit flow. 6. Check that the Preheat Burner Fuel Oil Pump is developing pressure or the gas pressure is available at the burner. 7. Check that the overload heaters in the Preheat Burner Fuel Oil pump starter have not tripped out the circuit.
8.1.7	Pilot flame is stable but main Preheat Burner flame will not ignite because air butterfly valves are incorrectly set.		1. Check the setting of the Preheat Burner combustion air valve. 2. Check that the setting of the Atomizing Air Butterfly valve.
8.1.8	Fireye chassis does not relay flame sighting.		1. Follow the steps outlined in Section 8.1.5 above.
8.1.9	Windbox High Temperature		1. Relight the Burner, but at a lower fuel setting.
8.1.10	Plate Drop exceeded 42" W. C.		1. Reduce the total air flow if it is above 7000 SCFM. 2. Clean out the pressure tap assemblies in the Windbox and Bed.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM	CAUSE	REMEDY
	8.1.11 Fluidizing Air Flow is below 5000 SCFM.	1. Increase the total air flow above 5000 SCFM.
	8.1.12 Heat Exchanger inlet temperature is above 1650°F	1. Normally it is not necessary to have the Preheat Burner on when the Heat Exchanger inlet temperature is above 1650°F. However, since the Windbox temperature will be quite high at this time, the Burner must be immediately re-ignited but at a very low flame so as to decrease the windbox temperature gradually. Refer to Section 5 for specific instructions.
8.2 Windbox Temperature Abnormal (Below 800°F; Above 1800°F)	8.2.1 Preheat Burner firing at too high a rate for above 1800°F	1. This alarm condition will have shut down the Preheat Burner. Relight the Burner but at a lower flame setting as outlined in Section 5.
	8.2.2 Serious bypassing of exchanger causing low windbox temperature	1. Check with oxygen analyzer that bypassing is occurring. Repair requires an extensive shutdown. 2. At start-up system may not have heat-up beyond the 800°F yet.
8.3 Bed High Temperature (1550°F)	8.3.1 Too much fuel oil being admitted through the Bed Guns.	1. Decrease the flow rate of fuel.
	8.3.2 Bed guns are shut off and the heat value of the sludge is increasing. (Less likely possibility).	1. Decrease the sludge feed rate or increase the air rate so that the proce will operate with more excess air.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM	CAUSE	REMEDY
	8.3.3 Bed Temperature indicator reads all the way up scale	1. This is an indication that Bed Thermocouple well is burned out. Replace thermocouple with spare unit.
8.4 Bed Low Temperature (1250°F for oil; 1355°F for gas)	8.4.1 Heat value of sludge decreasing	1. Increase the flow rate of fuel to Bed Guns.
	8.4.2 Operating with too much excess oxygen in the stack	1. If operating Temperature Control in the "AUTO" position, increase the "set point" 2. Decrease Air Flow
	8.4.3 Heat Exchanger being by-passed	1. Check that the gate valve between the fluidizing air blower and the preheat burner blower is completely shut.
	8.4.4 Fluidizing Air flow is below 5000 SCFM	1. Below an air flow rate of 5000 SCFM both the Bed Guns and the Feed system are shut down. Increase air flow rate and restart the Feed system.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM	CAUSE	REMEDY
	8.4.5 Freeboard spray nozzles are worn and have lost their spray pattern, thereby pouring water into the bed.	1. Remove both spray assemblies and test spray patterns of nozzles. 2. Replace defective nozzles with spare units.
8.5 Heat Exchanger High Temperature (1650°F)	8.5.1 Lack of sufficient water flow or pressure in the "normal spray system"	1. Increase number of sprays operating by increasing output signal of Heat Exchanger Inlet Gas Temperature Controller. 2. Check that all other manual shut-off valves in the spray system are open. 3. Check that the solenoid valves in the system are actuated and permit flow through them when actuated. 4. Check that supply water pressure is adequate and spray water pump is operating
	8.5.2 Sand level in bed is too low	1. Add sand
	8.5.3 Process is operated with insufficient excess oxygen	1. Decrease sludge feed rate or increase air flow rate.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

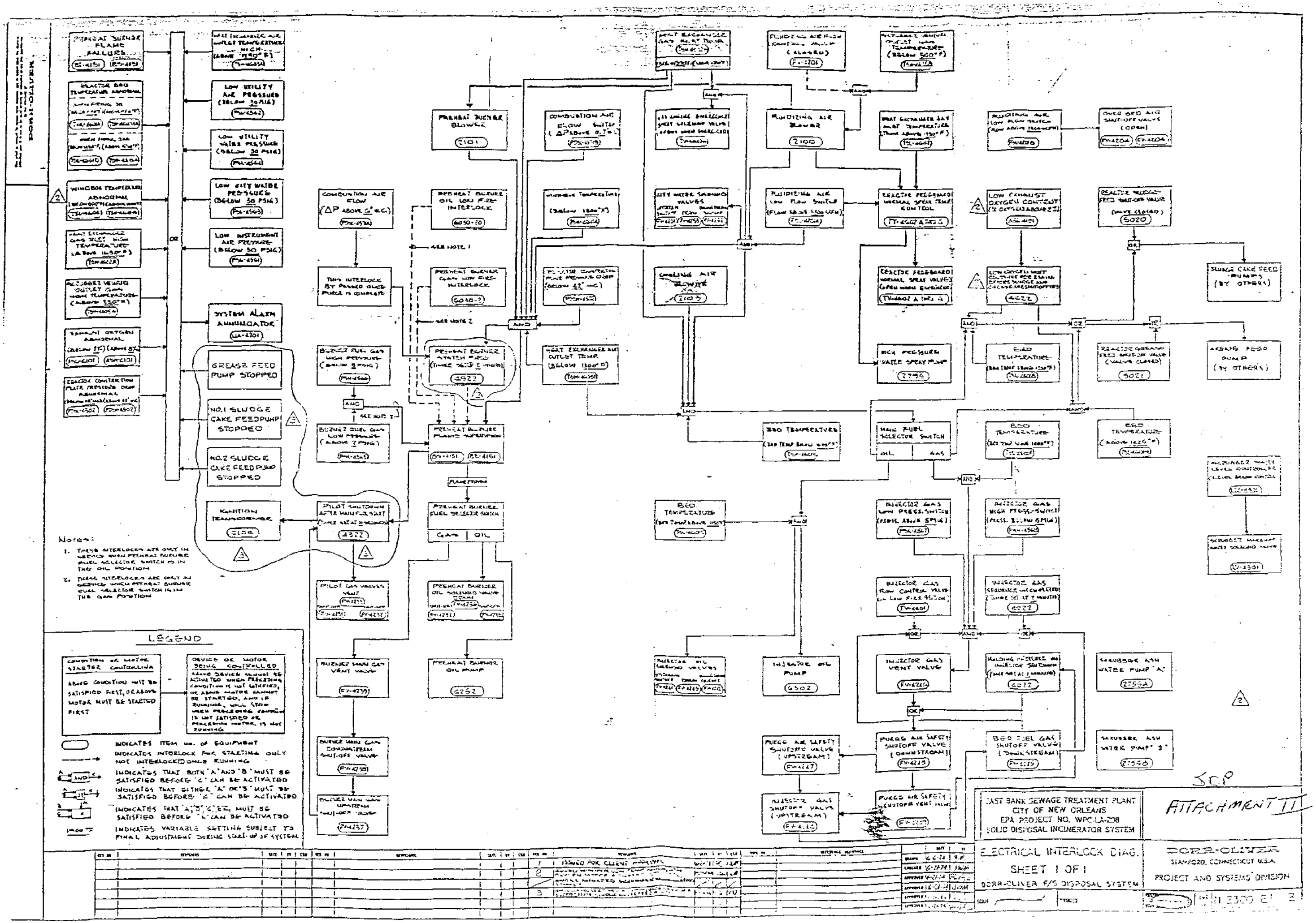
SYMPTOM	CAUSE	REMEDY
	8.5.4 Spray Nozzle plugged	1. Remove spray nozzle assembly from the reactor freeboard and inspect. 2. Test the spray action of the nozzles by connecting the assembly to an external water supply. 3. Dismantle and clean nozzles.
8.6 Heat Exchanger Air Outlet Temperature High (Above 1250°F)	8.6.1 Leak in Heat Exchanger tubing	1. Check for leak with oxygen analyzer. If a leak is present an extensive shutdown will be required.
	8.6.2 Spray water system failing to cool reactor exhaust gases	1. Check exhaust temperature for accuracy. 2. Check proper operation of gas inlet temperature controller
8.7 Scrubber Venturi Gas Outlet High Temperature	8.7.1 Insufficient or no water flow to Venturi throat.	1. Open all manual valves on water lines leading to Venturi throat. 2. Check for correct flows and pressures in lines.
	8.7.2 Spray nozzle failure	1. Remove spray nozzle from Venturi throat and inspect.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

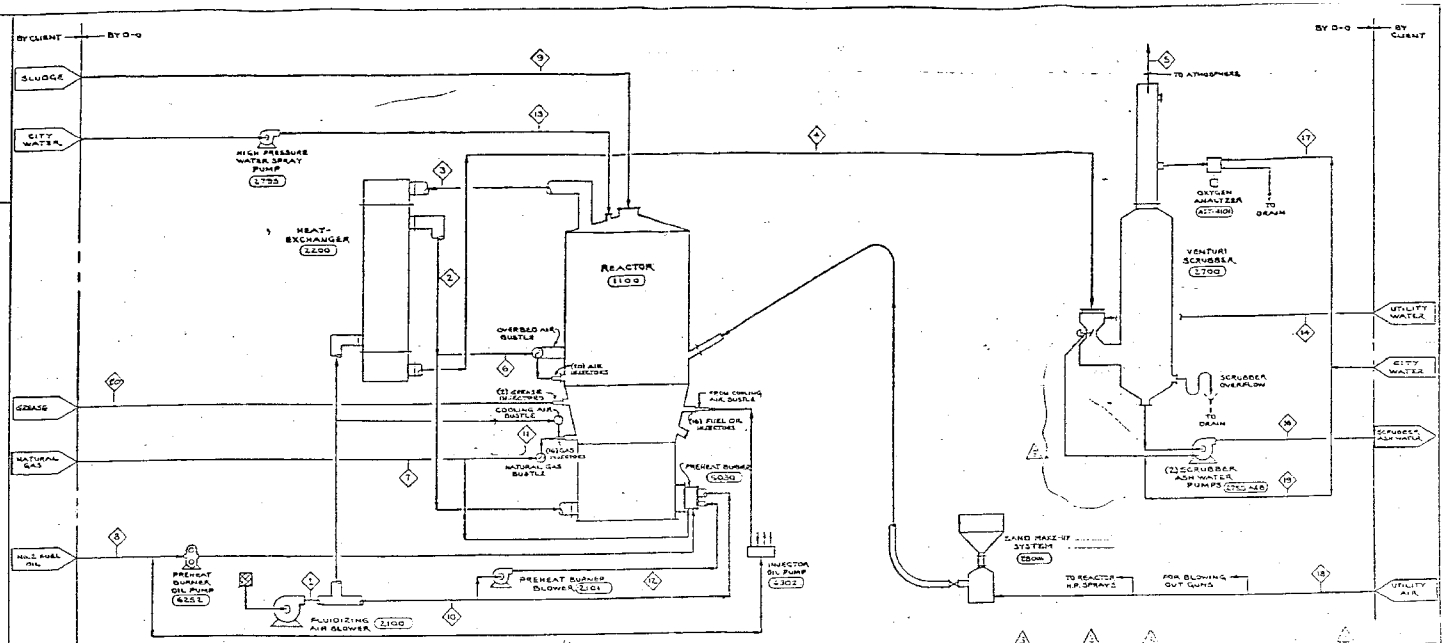
SYMPTOM	CAUSE	REMEDY
8.8 High Exhaust Oxygen (above 8%)	8.8.1 Volatile content in sludge decreasing	1. Decrease air flow or increase sludge pump speed.
	8.8.2 Sludge not being fed to the Reactor	1. Check that sludge is being fed to the Sludge Cake Feed Pumps. 2. Check that valves in sludge line are open.
8.9 Low Exhaust Oxygen (2%)	8.9.1 Volatile content in sludge increasing	1. Increase air flow or decrease sludge pump speed.
	8.9.2 Air Flow restricted	1. Check air flow rate indicator
8.10 Reactor Constriction Plate Pressure Drop Abnormal (Below 18" w.g.;Above 42" w.g.)	8.10.1 If Preheat Burner is on for High Plate drop	1. Follow steps outlined in Section 8.1.10 above
	8.10.2 Windbox and/or Bed Pressure taps are clogged.	1. Remove the pressure taps from the Reactor and check that all passages are clear.
	8.10.3 Fluidizing Air too Low Causing Low Plate Drop	1. Increase air flow
	8.10.4 Serious Leaking of Sand Into Windbox Through a Blown Tuyere Hole Indicated By Low Plate Drop	1. Visually Check Windbox by Briefly turning on preheat Burner or shutting down and opening Inspection Door
8.11 Low Utility Air Pressure (Below 30 psig)	8.11.1 Air Pressure Has Dropped Beneath Set Point	1. Check Source of Utility Air for Probable Cause.

8. ALARM CONDITION - TROUBLE SHOOTING (Continued)

SYMPTOM	CAUSE	REMEDY
8.12 Low City Water Pressure (Below 30 psig)	8.12.1 City Water Pressure Has Dropped Beneath Set Point	1. Check Back Along City Water Piping for closed Valve, etc.
8.13 Low Utility Water Pressure (Below 30 psig)	8.13.1 Utility Water Pressure Has Dropped Beneath Set Point	1. Check back along Utility Water Piping for Closed Valve, other large drawoff, etc.
8.14 Sludge Cake Feed Pump Stopped	8.13.1 The Bed Temperature is too high or too low, air flow too low, Heat Exchanger inlet temperature too high, or Oxygen in Exhaust gas too low.	1. Check the list of interlocks described in Section 7, paragraph 7.8. 2. If interlocks are satisfied, check overload heaters and "Reset."
8.15 Low Instrument Air Pressure (Below 30 psig)	8.15.1 Instrument Air Pressure has Dropped Beneath Set Point	1. Check back along instrument air piping for closed valve or other restriction. 2. Check instrument air compressor.
8.16 Grease Feed Pump Stopped	8.16.1 Interlocks have stopped the Pump	1. Check list of interlocks
	8.16.2 Someone at Grease Concentrator Has Stopped the Pump	1. Check for reason.



PREHEAT BURNER FLAME FAILURE
LOW UTILITY AIR PRESSURE (BELOW 30 PSIG)
LOW UTILITY WATER PRESSURE (BELOW 30 PSIG)
LOW CITY WATER PRESSURE (BELOW 30 PSIG)
LOW INSTRUMENT AIR PRESSURE (BELOW 30 PSIG)
SYSTEM ALARM ANNUNCIATOR
GREASE FEED PUMP STOPPED
NO.1 SLUDGE CAKE FEEDPUMP STOPPED
NO.2 SLUDGE CAKE FEEDPUMP STOPPED
IGNITION TRANSFORMER
OR
COMBUSTION AIR FLOW (ΔP ABOVE 2" W.C.)
THIS INTERLOCK BY PASSED ONCE PURGE IS COMPLETE
PREHEAT BURNER BLOWER (2101)
PREHEAT BURNER OIL LOW FIRE INTERLOCK
PREHEAT BURNER GAS LOW FIRE INTERLOCK
SEE NOTE 1
SEE NOTE 2
PREHEAT BURNER PURGE (4922)
PREHEAT BURNER FLAME SUPERVISION
BURNER FUEL GAS HIGH PRESSURE
BURNER FUEL GAS LOW PRESSURE
PILOT SHUTDOWN AFTER MAIN FLAME START (4322)
PREHEAT BURNER FUEL SELECTOR SWITCH
GAS
OIL
PILOT GAS VALVES
PREHEAT BURNER OIL SOLENOID VALVE
PREHEAT BURNER OIL PUMP (2252)
BURNER MAIN GAS VENT VALVE
BURNER MAIN GAS DOWNSTREAM SHUT-OFF VALVE
BURNER MAIN GAS UPSTREAM SHUT-OFF VALVE
COMBUSTION AIR FLOW SWITCH
HEAT EXCHANGER AIR OUTLET TEMP. (BELOW 1300°F)
COOLING AIR BLOWER (2103)
FLUIDIZING AIR BLOWER (2100)
FLUIDIZING AIR LOW FLOW SWITCH
REACTOR FREEBOARD NORMAL SPRAY TEMP. CONTROL
REACTOR FREEBOARD NORMAL SPRAY VALVES
HIGH PRESSURE WATER SPRAY PUMP (2795)
MAIN FUEL SELECTOR SWITCH
BED TEMPERATURE
LOW EXHAUST OXYGEN CONTENT
REACTOR SLUDGE FEED SHUT-OFF VALVE (VALVE CLOSED) (5020)
REACTOR GREASE FEED SHUT-OFF VALVE (VALVE CLOSED) (5021)
SLUDGE CAKE FEED PUMP (BY OTHERS)
GREASE FEED PUMP (BY OTHERS)
OVER BED AIR SHUT-OFF VALVE (OPEN)
INJECTOR OIL PUMP (6502)
INJECTOR GAS LOW PRESS. SWITCH
INJECTOR GAS HIGH PRESS. SWITCH
INJECTOR GAS VENT VALVE
PURGE AIR SAFETY SHUTOFF VALVE (DOWNSTREAM)
PURGE AIR SAFETY SHUTOFF VALVE (UPSTREAM)
INJECTOR GAS SHUTOFF VALVE (UPSTREAM)
BED FUEL GAS SHUTOFF VALVE (DOWNSTREAM)
SCRUBBER ASH WATER PUMP 'A' (2755A)
SCRUBBER ASH WATER PUMP 'B' (2755B)
Notes:
1. THESE INTERLOCKS ARE ONLY IN SERVICE WHEN PREHEAT BURNER FUEL SELECTOR SWITCH IS IN THE OIL POSITION
2. THESE INTERLOCKS ARE ONLY IN SERVICE WHEN PREHEAT BURNER FUEL SELECTOR SWITCH IS IN THE GAS POSITION
LEGEND
CONDITION OR MOTOR STARTER CONTROLLING
ABOVE CONDITION MUST BE SATISFIED FIRST, OR ABOVE MOTOR MUST BE STARTED FIRST
DEVICE OR MOTOR BEING CONTROLLED
INDICATES ITEM NO. OF EQUIPMENT
INDICATES INTERLOCK FOR STARTING ONLY NOT INTERLOCKED ONCE RUNNING
INDICATES THAT BOTH 'A' AND 'B' MUST BE SATISFIED BEFORE 'C' CAN BE ACTIVATED
INDICATES THAT EITHER 'A' OR 'B' MUST BE SATISFIED BEFORE 'C' CAN BE ACTIVATED
INDICATES THAT 'A','B','C', ETC. MUST BE SATISFIED BEFORE 'X' CAN BE ACTIVATED
INDICATES VARIABLE SETTING SUBJECT TO FINAL ADJUSTMENT DURING START-UP OF SYSTEM
ISSUED FOR CLIENT
EAST BANK SEWAGE TREATMENT PLANT
CITY OF NEW ORLEANS
EPA PROJECT NO. WPC-LA-208
SOLID DISPOSAL INCINERATOR SYSTEM
ELECTRICAL INTERLOCK DIAG.
SHEET 1 OF 1
DORR-OLIVER F/S DISPOSAL SYSTEM
DORR-OLIVER
STAMFORD, CONNECTICUT U.S.A.
PROJECT AND SYSTEMS DIVISION
ATTACHMENT II
SCP



LOCATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	18	19	20
MATERIAL	FLUIDIZING AIR FLOW	AIR FROM HEAT-EXCHANGER	REACTOR EXHAUST GAS	HEAT-EXCH. EXHAUST GAS	SCRUBBER EXHAUST GAS	OVERFIRE AIR	NATURAL GAS FUEL RATE	NO.2 FUEL OIL RATE	FEED RATE	PREHEAT COMBUSTION AIR	COOLING AIR	PREHEAT ATMIZING AIR	CITY WATER TO H.P. SPRAYS	UTILITY WATER FOR SCRUBBER MAKEUP	SCRUBBER ASH WATER	CITY WATER TO OXYGEN ANALYZER	UTILITY AIR	SEAL WATER	GREASE FEED
DESIGN RATE (SLUDGE PLUS GREASE) NAT. GAS	7908 SCFM	15,900 ACFM	48,142 ACFM	34,700 ACFM	20,800 ACFM	2360 ACFM	202 SCFM (DESIGN)	1.5 GPM (DESIGN)	3-5 GPM (DESIGN) 4.1 GPM (MAX.)	—	700 SCFM	—	2.1 GPM	157 GPM	147 GPM	2 GPM	300 SCFM (MAX)	6 GPM	1.4 GPM (DESIGN) 2.3 GPM (MAX)
NO.2 OIL	7732 SCFM	15,000 ACFM	47,218 ACFM	34,000 ACFM	20,400 ACFM	2360 ACFM													
DESIGN RATE (SLUDGE ALONE) NAT. GAS	7715 SCFM	16,350 ACFM	47,125 ACFM	33,350 ACFM	20,100 ACFM	2330 ACFM	188 SCFM (DESIGN)	1.03 GPM (DESIGN)	3-5 GPM (DESIGN) 4.1 GPM (MAX)	—	700 SCFM	—	2.0 GPM	157 GPM	147 GPM	2 GPM	300 SCFM (MAX)	6 GPM	—
NO.2 OIL	7485 SCFM	16,300 ACFM	45,200 ACFM	32,100 ACFM	19,870 ACFM	2360 ACFM													
DESIGN RATE FOR REACTOR PREHEATING	8000 SCFM	4400 SCFM	8200 SCFM	8200 SCFM	7800 SCFM (DRY)	2000 SCFM	250 SCFM	2.03 GPM	—	6100 SCFM	—	4600 SCFM	—	157 GPM	147 GPM	2 GPM	300 SCFM (MAX)	6 GPM	—
TEMPERATURE, °F	120	1200	1600	1013	185 (DESIGN)	1200	60	60	60	120	120	120	60	90	135	60	70	60	60
PRESSURE, PSIG	4.7	4.0	1.4	0.3	0.0	4.0	10	.5	50 (AT PUMP)	3.2	8.0	5.2	300	50	100	50	120	50	50

NOTES:
1. PLANT FLOW 12.2 MGD.
2. DESIGN FEED RATE:
   A) TOTAL FEED TO REACTOR 16,940 LB/HR WAS 600 LB/HR GREASE
   B) MOISTURE CONTENT @ 80% FOR WAS = 13552 LB/HR
   @ 50% FOR GREASE = 333 LB/HR
   C) TOTAL DRY SOLIDS @ 20% FOR WAS = 3388 LB/HR
   @ 50% FOR GREASE = 332 LB/HR
   D) VOLATILE SOLIDS @ 60% FOR WAS = 2033 LB/HR
   @ 90% FOR GREASE = 300 LB/HR
   E) HEAT VALUE — = 8590 BTU/LB V.S. FOR WAS
   = 16,000 BTU/LB FOR GREASE
3. PLANT OPERATION TO BE 24 HRS/DAY, 7 DAYS/WK.
4. PLANT ELEVATION - SEA LEVEL
5. NATURAL GAS @ 1000 BTU/SCF
   NO.2 OIL @ 135,900 BTU/GAL
6. UTILITY AIR AVAILABLE AT 100 PSIG.
   CITY WATER AVAILABLE AT 50 PSIG.
   UTILITY WATER AVAILABLE AT 50 PSIG.
7. ELECTRICAL CHARACTERISTICS:
   440 VOLT/3 Ø/60 CYCLE

REV NO	REVISIONS	DATE	BY	CKD	APP NO	APPROVED	DATE	BY	CKD	APP NO	PROJECT	DATE	BY	CKD	APP NO	DESIGN NOTICES

DRAWN			
CHECKED			
APPROVED			
APPROVED			
APPROVED			
DATE	—	PARTS	

LAST SAVE SANDAL TEST OF PLANT CITY OF NEW ORLEANS
FOR PROJECT NO. NOC-15-CVS
SOLID SLUDGE INCINERATION SYSTEM

SCP ATTACHMENT III

PROCESS FLOW DIAGRAM
SOLID SLUDGE INCINERATION SYSTEM
MUNICIPAL WASTE DISPOSAL UNIT

DORR-OLIVER
STAMFORD, CONNECTICUT U.S.A.
PROJECT AND SYSTEMS DIVISION

DWG NO. 14-2300-F3

New System
O2

11. TROUBLESHOOTING

This chapter describes the checking and restoring methods when the ZASC converter self-diagnosis function detected errors or other troubles occur.

11.1 Disposal When an Error Code is Displayed

11.1.1 Types of Error Codes

There are nine types of error that can be detected with the self-diagnosis function of ZASC converter. When these errors occur (except for digital circuit failures), the corresponding error codes are displayed in the data display. In the message display, error messages are also displayed. In addition, if more than one error occurs simultaneously, the letter " H " is also displayed in the message display. In this case, by selecting the displayed message using the auxiliary message display key " HELP ", individual error that occurred can be confirmed.

Error codes and their contents are shown in Table 11.1.

Table 11.1 Error Codes, Their Contents and States When Each Error Occurs

Error code	Error contents	State when the error occur
E - - 1	Sensor failure (cell)	The analyzer goes to the fail mode and power to the detector heater is automatically turned off.
E - - 2	Sensor temperature error "Low"	The analyzer goes to the fail mode and power to the detector heater is automatically turned off.
E - - 3	Sensor temperature error "High"	The analyzer goes to the fail mode and power to the detector heater is automatically turned off.
E - - 4	A/D (analog circuit) failure	The analyzer goes to the fail mode and power to the detector heater is automatically turned off.
E - - 5	Calibration value error "Zero"	(Displayed in calibration) The current zero point calibrated value is not employed.
E - - 6	Calibration value error "Span"	(Displayed in calibration) The current span calibrated value is not employed.
E - - 7	EMF stabilization time-over	(Displayed in calibration) The current calibrated value is not employed.
E - - 8	ROM or RAM failure	The analyzer goes to the fail mode and power to the detector heater is automatically turned off.
□□□□ (Display disappears)	Digital circuit failure Power interruption occurs	The analyzer goes to the fail mode and power to the detector heater is automatically turned off. (Displayed in turning power on again after power off) Data value default.

Errors displayed with error code " E - - 5 ", " E - - 6 ", or " E - - 7 " are those generated in carrying out automatic or semi-automatic calibration. If these errors occur, that error code and oxygen concentration value are alternately displayed in the data display. The error is released when the analyzer returns to the measurement mode and, at the same time, the error code display disappears. The error message display is cleared by pressing the measurement mode select key " DISP "

(Note) Re-calibration after an error occurred should be performed after examining that setpoints and piping conditions are not improper.

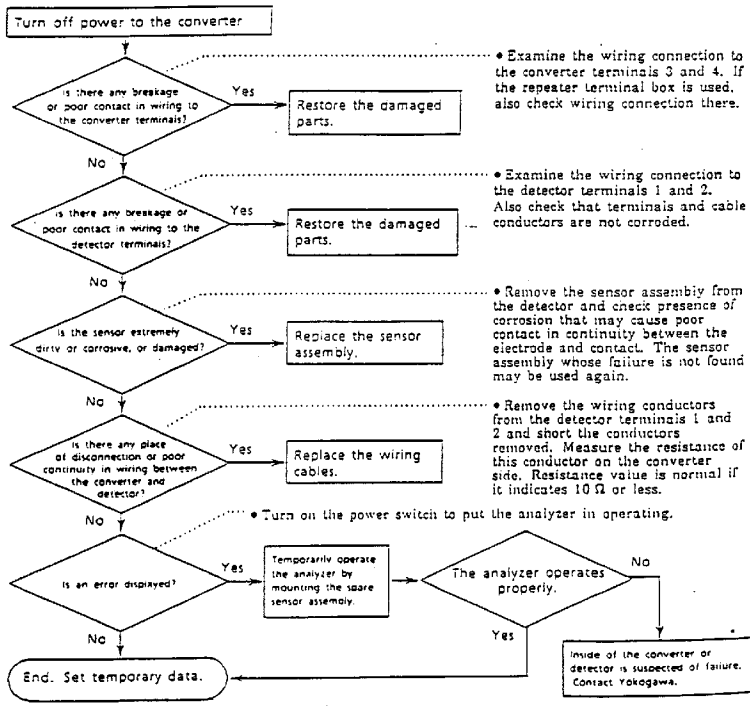
Errors displayed with error code "E--1", "E--2", "E--3", "E--4" or "E--8" including digital circuit failure occur generally caused by equipment failures. If these errors occur, the converter stops the supply of power to the detector heater and holds the output signal at the value immediately before the error occurrence (preset value if "2" is set with function No. D-2). When these errors occur, turn off the converter power and practice restoration. The error code display is released after the equipment is restored and operates normally.

11.1.2 Causes of "E--1 Sensor (Cell) Failure" and Procedure for Restoration

<Causes>

(1) Failure in wiring between the converter and the detector (poor contact of terminal connections, disconnection, etc.)
(2) Sensor (cell) assembly failure (damage, deterioration)
(3) Failure in the sensor (cell) assembly mounting part (poor continuity between the sensor electrode and the contact, etc.)
(4) Wiring system failure inside the detector (disconnection, etc.)

<Locating the Failure and Taking Measures>



SOP-IV-2

11.1.3 Causes of "E--2 Sensor Temperature Error (Low)" and Procedure for Restoration

This error occurs when the sensor temperature after warm-up (in steady state operation) is lower than 730°C (1346°F).

<Causes>

(1) Fuse (F1 and/or F2) for the detector heater in the converter is blown.

(2) Failure in wiring between the converter and the detector (poor contact of terminal connections, disconnection, shortcircuiting, etc.)

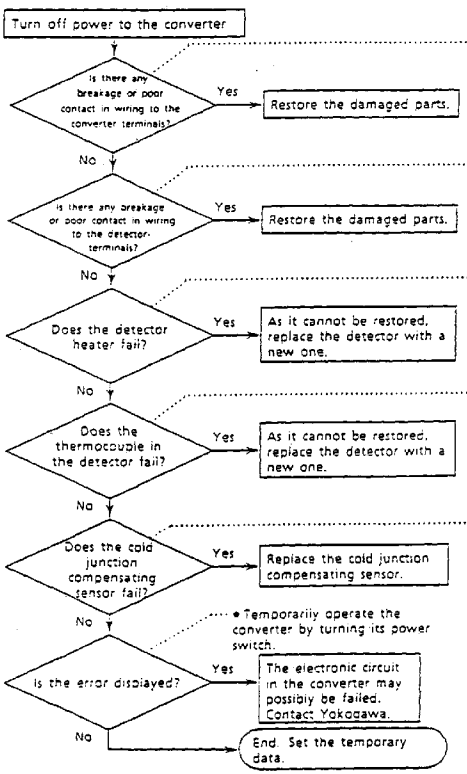
(3) Failure of Sensor for cold junction compensation at the detector terminal board (poor contact in terminal connections, or failure)

(4) Failure of thermocouple in the detector (disconnection, shortcircuiting in wiring inside the detector)

(5) Failure of the heater inside the detector (disconnection, etc.)

(6) Electronic circuit failure inside the converter

<Locating the Failure and Taking Measures>



• Examine fuses (F1 and F2) for the detector heater whether or not they are blown and then check wiring connections to the converter terminals 5, 6, 7, 8, 16, and 17. If the repeater terminal box is used, also check the connections inside the box.

• Examine wiring connections to the detector terminals 3, 4, 5, 6, 7, and 8. Check if the terminal and cable conductors are not corroded. Also check that wiring is not shortcircuited between the converter and the detector.

• Remove wiring to the converter terminals 16 and 17 and measure resistance between these leadwires. If it is 90 Ω or lower, it is normal. In addition, lead resistances between the converter and detector are normal if they are 10 Ω or less.

• Remove wiring to the converter terminals 5 and 6 and measure resistance between these leadwires. If it is 15 Ω or lower, it is normal. In addition, lead resistances between the converter and detector are normal if they are 10 Ω or less.

• Examine that the cold junction compensating sensor leadwires connected to wiring terminals 7 and 8 in the detector are not disconnected. If the cold junction compensating sensor is normal, the voltage across terminals 7 and 8 is about 0.4 to 0.7 V (varies with ambient temperatures).

11.1.4 Causes of "E--3 Sensor Temperature Error (High)" and Procedure for Restoration

This error occurs when the converter detects that the sensor temperature is higher than 780°C (1436°F). It also occurs if the converter detects failure of the heater circuit and temperature measuring and controlling circuit during warm-up.

<Causes>

If the error code is displayed in steady state operation, the following is considered as the causes.

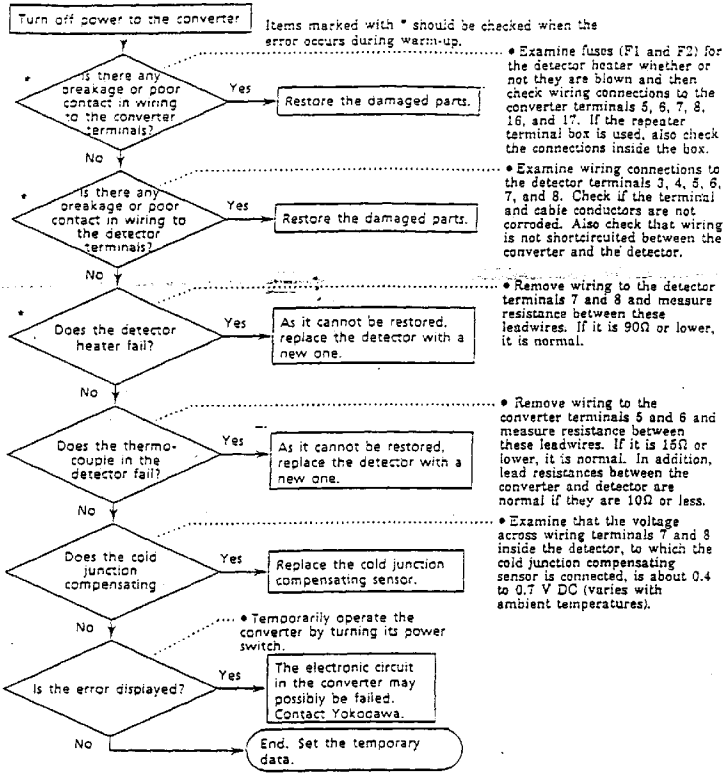
(1) Cold junction compensating sensor failure at the detector terminal board.
(2) Failure of thermocouple in the detector
(3) Failure of electronic circuits in the converter.

Next, if the error code is displayed during warm-up, the following is considered as the causes.

(1) Fuses (F1 and/or F2) in the converter for the detector heater are blown.
(2) Wiring failure between the converter and the detector (poor contact at the terminal connections, disconnection, shortcircuiting, etc.)
(3) Failure of the heater in the detector (disconnection, etc.)

SOP-IV-4

<Locating the Failure and Taking Measures>



11.1.5 Causes of "E--4 A/D (Analog Circuit) Failure" and Procedure for Restoration

This error occurs when the electric circuit of the converter does not operate normally.

<Causes>

(1) The analog circuits of the converter contains a failure.

(2) The supply voltage significantly drops (15% or more of the rating).

<Locating the Failures and Measures>

Once turn off the converter power switch and turn on the power switch again, then check whether or not the operation is normal.

If the operation is normal, it is considered that the error may be caused by temporary failure of power system, such as voltage drop or influence of noise. If the cause is clear and the error may possibly occur with the same cause, take suitable measures to prevent re-occurrence.

If the error occurs again, it may be caused with the converter electric circuits, such as CPU card. In this case, it is not so easy to find the failed part and to restore. If the error occurs again, contact Yokogawa. Confirm that power system is not in failure by checking the supply voltage and others to make sure of it.

11.1.6 Causes of "E--5 Calibration Value Error (Zero)" and Procedure for Restoration

This error occurs when the zero point correction factor (see subsection 9.1.3) exceeds the range 100±30% in the automatic and semi-automatic calibrations.

<Causes>

(1) The oxygen concentration of zero gas and the value set with function No. C-1 do not agree or the span gas is accidentally used as the zero gas.

(2) The zero gas does not flow by the specified quantity (about 600 ml/min).

(3) The sensor (cell) is damaged and the cell emf contains an error.

<Locating the Cause of Failure and Taking Measures>

(1) To make sure, carry out the calibration once more. Before calibration, examine the following. If they are not in normal state, correct them.

- Does the value set in the function No. C-1 agree with the zero gas oxygen concentration?
- Does the calibration gas tubing have measures to no zero gas leakage?

(2) If the error does not occur in re-calibration, it is considered as the cause of the error in the first calibration that the calibrating conditions were not proper. In this case, no particular restoration is necessary. Restart the steady state operation.
If the error also occur in re-calibration, it is considered as the cause of error occurrence that the sensor deteriorates or is damaged. Confirm that the error corresponds to one or more of the following phenomena and replace it with a new sensor (see 10.1.4).

- When zero gas is passed, the sensor (cell) emf indicated with function No. A-3 greatly differs from the theoretical value in that oxygen concentration.
- When three kinds of gas (zero gas, span gas, and the gas having approximately middle oxygen concentration between the above two) are measured, correlation cannot be found in these measured data for oxygen concentration.

In addition, check the sensor deterioration or damage which caused the error occurrence whether or not it abruptly occurs by the following phenomena. If abrupt occurrence may be suspected, check the check valve located at the inlet of detector

calibration gases whether or not the valve has failed. Check valve failure causes condensed water in the calibration gas tubing, which is the cause of sensor breakage.

- Examine historical data of the zero point correction factor displayed with function No. B-1. Permissible range of the zero point correction factor is 100±30%.
- Examine the sensor (cell) internal resistance displayed with function No. B-3. A new sensor shows the value of 200 Ω or less. While the dissipated sensor approaching to the end of the life indicates the value of 3 to 10 kΩ.
- Examine the sensor integrity data (five grade evaluation of 5 to 1) displayed with function No. B-4. A sensor in good state shows "5".

11.1.7 Causes of "E – –6 Calibration Value Error (Span)" and Procedure for Restoration

This error occurs when the span point correction factor (see subsection 9.1.3) exceeds the range 0±18% in the automatic and semi-automatic calibrations.

<Causes>

(1) The oxygen concentration of span gas and the value set with function No. C-0 do not agree or the zero gas is accidentally used as the span gas.

(2) The span gas does not flow by the specified quantity (about 600 ml/min).

(3) The sensor (cell) is damaged and the cell emf contains an error.

<Locating the Cause of Failure and Taking Measures>

(1) To make sure, carry out the calibration once more. Before calibration, examine the following. If they are not in normal state, correct them.

- Does the value set in the function No. C-0 agree with the span gas oxygen concentration?
- Does the calibration gas tubing have measures to no span gas leakage?

(2) If the error does not occur in re-calibration, it is considered as the cause of the error in the first calibration that the calibrating conditions were not proper. In this case, no particular restoration is necessary. Restart the steady state operation.
If the error also occur in re-calibration, it is considered as the cause of error occurrence that the sensor deteriorates or is damaged. Confirm that the error corresponds to one or more of the following phenomena and replace it with a new sensor (see Section 10.1.4).

- When span gas is passed, the sensor (cell) emf indicated with function No. A-3 greatly differs from the theoretical value in that oxygen concentration.
- When three kinds of gas (zero gas, span gas, and the gas having approximately middle oxygen concentration between the above two) are measured, correlation cannot be found in these measured data for oxygen concentration.

In addition, check the sensor deterioration or damage which caused the error occurrence whether or not it abruptly occurs by the following phenomena. If abrupt occurrence may be suspected, check the check valve located at the inlet of detector calibration gases whether or not the valve has failed. Check valve failure causes condensed water in the calibration gas tubing, which is the cause of sensor breakage.

- Examine historical data of the span point correction factor displayed with function No. B-0. Permissible range of the span point correction factor is 0±18%.
- Examine the sensor (cell) internal resistance displayed with function No. B-3. A new sensor shows the value of 200 Ω or less.
While the dissipated sensor approaching to the end of the life indicates the value of 3 to 10 kΩ.

- Examine the sensor integrity data (five grade evaluation of 5 to 1) displayed with function No. B-4. A sensor in good state shows "5".

11.1.8 Causes of "E--7 EMF Stabilization Time Over" and Procedure for Restoration

This error occurs when the sensor (cell) emf is not stabilized even if the calibration time is over because the sensor part of the detector is not filled with calibration gas (zero and span gases) at the one -touch calibration.

<Causes>

(1) Flow of the calibration gas is small (specified flow : about 600 ml/min).
(2) Measuring gas flows toward the tip of the detector probe.
(3) Sensor (cell) response is deteriorated.

<Locating the Cause of Failure and Taking Measures>

(1) Examine the setting time with function No. C-4 whether or not it is suitable. If not suitable, modify the setpoint and perform recalibration again. Carry out recalibration after confirming that the tubings does not leak and flowing calibration gas by the specified rate (about 600 ml/min).
(2) When calibration is normally carried out, continue the steady state operation.
If the error occurs again, replace the sensor assembly after checking that whether or not the error corresponds to the following.
- Dust significantly sticks to the detector probe tip. — If dust sticks, clean it (see 10.1.2).

If the error occurs in calibration even after the sensor assembly is replaced, influence of measuring gas flow is considered as the cause. Make the measuring gas not flow toward the detector probe tip by changing the mounting position of the detector or in other means.

11.1.9 Causes of "E--8 ROM and RAM Failure" and Procedure for Restoration

This error occurs when ROM contents reading and/or writing memory to RAM are not possible.

<Causes>

(1) ROM and RAM pins are not fully inserted into the socket.
(2) High supply voltages exceeding the specifications are applied or the effect of noise is given to ROM and RAM.
(3) ROM and/or RAM failed.
(4) Failure occurred in digital circuits on the CPU board and others.

<Locating the Cause of Failure and Taking Measures>

Once turn off the converter power switch. After confirming that the supply voltage satisfies the specification, turn on the power switch again to operate the converter.

If the error also occurs, repair is necessary. Contact Yokogawa.

11.1.10 Causes of Display Disappearance (Data Display) and Procedure for Restoration

Operation of the converter digital circuits is being self-checked with the watchdog timer (WDT) or clock monitor.

This error occurs when power is turned on again after power supply to the converter electrical circuit is interrupted due to power failure. This error also occurs when the converter digital circuits fail, such as time-up of the watchdog timer normally reset in a fixed period. In either case, if the error occurs, display in the data display disappears.

Next, measures when the error occurs due to the digital circuit operation failure will be described.

<Causes>

(1) Low supply voltages exceeding the specifications are applied or the effect of noise is given to disital circuits.

(2) Digital circuit failure.

<Locating the Cause of Failure and Taking Measures>

Once turn off the converter power switch. After confirming that the fuse for protecting electrical circuits in the converter is not likely to blow and the supply voltage satisfies the specification, turn on the power switch again to operate the converter.

If the error occurs again, repair is necessary. Contact Yokogawa.

SECTION 4
EMERGENCY RESPONSE

4.0 GENERAL

The operation of the FBI System is monitored through various sensors, relays, interlocks and other devices for improper operating conditions and levels. Most operating emergency situations are alarmed at the Annunciator on the Control Panel. The main exception is failure of the CEM which is indicated by the CEM Panel "Not Ready" light which is checked hourly on each shift as discussed in subsection 4.4.

The Annunciator alarms provide the operator with information that is important in a quick reaction to the trouble and a faster correction of the problem.

In the case of a potentially and dangerous condition of the FBI system, **stopping the fluidizing air blower** immediately brings the system under control. The operator is then to evaluate the situation and contact the right people. An operator does not need to have prior approval for this action; his judgment is sufficient to take such an action.

4.1 ANNUNCIATOR ALARMS

The following alarms (with set points, if applicable) are indicated by a flashing indicator and the alarm horn on the Control Panel and on the Incinerator Data Computer flow diagram.

<u>Annunciator Alarm/Set Point</u>

Flame failure
Windbox Temperature Abnormal/Below 800F;Above 1800F
Bed Temperature Abnormal/Below 1250F(oil) or 1325F (gas);Above 1550F
Heat Exchanger High Temperature/Above 1650F
Heat Exchanger Air Outlet Temperature High/Above 1250F
Scrubber Venturi Gas Outlet High Temperature/Above 250F
High Exhaust Oxygen/Above 6%
Low Exhaust Oxygen/Below 2%
Reactor Constriction Plate Pressure Drop Abnormal/Below 18";Above 42"
Low Utility Air Pressure/Below 30 psig
Low City Water Pressure/Below 30 psig
Sludge Cake Feed Pump Stopped

Low Instrument Air Pressure/Below 30 psig
Low Utility Water Pressure

The probable causes and remedies for these problems are listed in Attachment I (Troubleshooting Guide) of the SOP (in Section 3). Acknowledge any alarms when they occur and then investigate and correct the problem in a timely manner.

It should be noted that the "Sludge Cake Feed Pump Stopped" alarms serve as a general alarm for the unannunciated alarms included in the furnace interlock system (included on pages 15 & 16 of the SOP). The furnace interlock system initiates unplanned shutdowns of the fuel system in use plus the feed pump in service. The "Sludge Cake Feed Pump Stopped" alarm is then indicated and steps must be taken to determine which interlock alarm condition shut down the pump (see pages 15 through 17 of the SOP).

4.2 LOW WET SCRUBBER DIFFERENTIAL PRESSURE PROCEDURE

The scrubber system controls are preset to maintain a 37"W.C. pressure differential across the Venturi. The system must not be operated for extended periods at a level of 26"W.C. or below. Therefore, the system alarm is actuated at a 27"W.C. level. When this alarm occurs:

1. Investigate the problem - check for low or no sludge feed, low air flow, piston control stuck in the open position or other mechanical failure.

2. Correct the problem while the system remains in service, if possible.

3. If the problem cannot be corrected, advise the Plant Manager and shut down the system. Once the problem is corrected, restart the system.

4. Log the system failure in the Operators Log.

NOTE: If the alarm condition lasts more than 15 minutes, the problem and actions taken must be summarized in the Semi-annual Report to DEQ as discussed in Section 2.

4.3 HIGH SCRUBBER EXHAUST O_2 LEVEL PROCEDURE

The scrubber exhaust oxygen level must be kept below 6.4% when firing oil or 6.1% when firing natural gas. The system alarm is set at 6.0% to alert the operator before the alarm limit is exceeded. When this alarm occurs:

1. Check the process indicators for low sludge feed, excess air flow, low oil (or gas) feed or mechanical problems with the sludge feed system (belt

press or sludge cake feed pumps).

2. Adjust system feeds accordingly to bring oxygen level back into range (usually the best operation occurs in the 3 to 4% range under normal operating conditions).

3. If the system does not respond to these adjustments or the oxygen level continues on a steady increase, check the readout of the O_2 Analyzer with the CEM O_2 readout. If the Analyzer readout is not within 2% of the CEM readout, check the probe for a clogged filter and/or check the calibration.

NOTE: If the alarm condition lasts for more than 1 hour, the problem and actions taken must be summarized on the Semi-annual Report to DEQ as discussed in Section 2.

4.4 CONTINUOUS EMISSIONS MONITORING SYSTEM PROCEDURES

The CEM system is a combination of oxygen and carbon monoxide monitoring. The reaction to the system alarm for the oxygen will be similar to the steps outlined above for the O2 Analyzer alarm.

The alarm for CO has its own guidelines. The main guideline is that the CO remain under 100 ppm as averaged over a 4 hour period of incinerator operation.

1. Investigate the problem - check for low air flow, excessive sludge feeding and excessive oil (or gas) feed.

2. Correcting the problem requires adjusting the sludge feed, increase the air supply and/or fuel feeds.

2. If the system does not respond to these adjustments, notify the instrument tech for a calibration check.

NOTE: If at any time the "Not Ready" light is on, contact the Instrument Tech. Procedures to follow for logging and reporting CEM trouble are discussed in Section 2.2.

SECTION 5
PERSONNEL TRAINING

5.0 GENERAL

A high level of training is provided to ensure the FBI system operates efficiently and in a manner necessary to meet all regulatory requirements. The plant management maintains training schedules and training records to ensure each individual has the knowledge and skills to perform any assigned tasks plus be able to react to any situation.

5.1 NEW EMPLOYEE TRAINING

Each new operator is provided with 20 hours of intensive classroom and hands-on instructions in the operation of the system equipment. Then, the new operator is paired with an experienced operator for at least 2 to 3 weeks of additional hands-on training. The new operator remains in this training relationship until the operator demonstrates the ability and confidence needed to troubleshoot system problems. Plant supervisors and operators are available at all times to assist recently hired operators when the need arises.

5.2 CONTINUING TRAINING

Annual training schedules are prepared for each operator. Each operator must complete at least 16 hours of state certification training every 2 years.

In addition, the operators are surveyed every two years to evaluate their weak areas. Then, training requirements are determined for each individual for improvement of their operating skills.

5.3 TRAINING RECORDS

Records are maintained in the Plant Office for each operator. The training records include an attendance record of each course completed, both in-plant and state certification courses.

SECTION 6
OPERATIONS RECORDS

6.0 GENERAL

NOTE: For monitoring reports and records, see Section 2. For preventive maintenance records, see Section 8.

The operators are required to maintain various hand written Log Book (Journal) and to make a few entries to the computer system. Plant operations monitored by the Incinerator Data Computer are logged automatically and shift logs are printed every 8 hours.

6.1 OPERATOR LOGS

Two types of written logs are maintained; the Incinerator Log Sheet and the Log Book (Journal). The Log Sheet is a preprinted form for hourly entry of instrument readouts and end of shift computation of the amount of sludge handled, average sludge flow rate and the amount of polymer used. Each reading is entered during the operator's hourly inspection of the system. At the end of each shift, the shift operator averages all readings. At the end of the day, the three shift logs are gathered and the data averaged for entry to the Ops Data Computer. A copy of this form is included at the end of this section.

The Log Book is a 3-ring notebook with preprinted log sheets (see example at the end of this section). Entries are made at the beginning of each shift and during the shift per instructions listed in the SOP (see pages 17 & 18 in the SOP included in Section 3). Entry examples are process changes, problems, repairs, etc.

NOTE: A very important entry to the logs is the confirmation of the calibration of the Scrubber Exhaust O2 Analyzer. This is done by the 1st Shift Operator daily. Calibration data must be entered on the Oxygen Analyzer Daily calibration sheet kept in the notebook at the analyzer (see example of the fat the end of this section). A time and initial entry must also be made in the Incinerator Log Book (Journal) and on the Control Panel O_2 chart recorder.

The operators are also responsible for initiating work orders (see the copy of the form at the end of this section). Work orders provide information on the maintenance needs on the system equipment and instruments. Work order entries must be clear and concise for easy understanding by the maintenance workers.

The operators log on and off the computer at the start and end of each shift. The only other entries consist of brief descriptions of problems when the system goes out of the normal operating range and actions taken to bring the system back into proper operating range.

6.2 COMPUTER PRINTOUTS

As mentioned, the computer automatically logs process data. A computer generated shift log is automatically generated every 8 hours. CEM daily reports are generated every 24 hours. Other reports may be generated by request. All reports are maintained on file at the plant. All reports and logs are stored in boxes indefinitely (regulations require all logs and reports to be held for a period of 2 years).

Computer files are backed up on a second hard drive automatically and then at a minimum interval of two weeks, the data is backed up on an archive tape. All computer data is archived, allowing retrieval of any and all computer logged data and entries.

FLUIDIZING BED INCINERATOR
PSG* * * LOG

RAW %				CAKE %			
TIME	RAW %	TIME	RAW %	TIME	CAKE %	TIME	CAKE %

TIME										AVG **
HEAT EXCH AIR IN	1									**
HEAT EXCH AIR OUT	2									**
WINDBOX TEMP	3									**
BED TEMP	4									**
BED TEMP	5									**
HEAT EXCH GAS IN TEMP	6									**
HEAT EXCH GAS OUT TEMP	7									**
SCRU VENT GAS OUT TEMP	8									**
SCRU WATER OUT TEMP	9									**
AIR FLOW (SCFM)	10									**
BED LEVEL	11									**
CONSTR PLATE D/P	12									**
WINDBOX PRES.	17									
FREEBOARD PRESS	18									
HEAT EXCH D/P	19									
SCRU VENT D/P	20									**
OXYGEN %										**
BLOWER AMPS.										
GAS FLOW (CFM)										
OIL FLOW (GPM)										
CONTROL TEMP										**
W A S FEED (GPM)										
CAKE FEED PUMP (GPM)										

W A S TRANSFER TOTAL #		ENDING #		TOTAL #	
CAKE FEED PUMP TOTAL #		ENDING #		TOTAL #	

FEED (GPM) x RUN TIME (HRS) x WAS (TS) x 5.004 \ 2000 = TON/DAY

WAS TOTAL # x 100 \ 480 MIN = FEED (GPM)

TOTAL POLYMER BATCH # x MIN/BATCH x LBS/MIN = TOTAL POLYMER LBS. USED

=

SUPERVISOR DATE / / SHIFT RECORDED BY

DATE _____ NAME _____

SHIFT 7am to 3pm

TIME	_____	Total	TIME	_____	Total
Poly Batch Tot	_____		Poly Batch Tot	_____	_____
WAS Totalizer	_____		WAS Totalizer	_____	_____
MHI Gas	_____		MHI Gas	_____	_____
FBI Gas	_____		FBI Gas	_____	_____
FBI Oil-Mech	_____		FBI Oil-Mech	_____	_____
FBI Oil-Comp	_____		FBI Oil-Comp	_____	_____
KSP 10	_____		KSP 10	_____	_____
KSP 17	_____		KSP 17	_____	_____
Poly Added (Bags)		_____	Poly Added (Bags)		_____
Poly Pounds		_____	Poly Pounds		_____
			Total tons		_____

TIME					AVG
RAW %					
CAKE %					

COMMENTS

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

TIME _____ _____

PROFESSIONAL SERVICES GROUP, INC.

CORRECTIVE MAINTENANCE WORK ORDER

DATE __/__/__ WORK ORDER # CM_____

EQ # _____ EQ DESCRIPTION _____

DESCRIPTION OF WORK NEEDED _____

PRIORITY ____ REQUESTED DATE FOR WORK TO BE DONE __/__/__

ASSIGNED TO (to be completed by Maintenance Department)

CRAFT _____ # OF MEN REQUIRED ___ ESTIMATED MANHOURS ____

EMP # ___ __ SCHEDULED START DATE __/__/_ SCHEDULED FINISH DATE __/__/__

ACTUAL COMPLETION DATE __/__/__ DOWN TIME ____

ACTUAL LABOR USED

EMP #	REG. HOURS	OT HOURS	EMP #	REG. HOURS	OT HOURS
____	_____	_____	____	_____	_____
____	_____	_____	____	_____	_____
____	_____	_____	____	_____	_____
____	_____	_____	____	_____	_____
____	_____	_____	____	_____	_____

ACTUAL PARTS USE (Use back if more parts are used)

ITEM #	QTY USED	UNIT COST	ITEM #	QTY USED	UNIT COST
_____	_____	___.__	_____	_____	___.__
_____	_____	___.__	_____	_____	___.__
_____	_____	___.__	_____	_____	___.__
_____	_____	___.__	_____	_____	___.__
_____	_____	___.__	_____	_____	___.__

ACTUAL WORK PERFORMED

_____

_____

_____

_____

_____

_____

_____

_____

Entered in Maint Pac on __/__/__ by _____

SECTION 7
LAB SAMPLING

7.1 FIELD SAMPLING

The operators perform field tests on the waste sludge flows and sludge cake, i.e., total dry solids determinations on the moisture balance machine. A minimum of 3 samples of each flow and cake are taken each shift (two hours apart). Additional tests may be run if the operator wants more data or wishes to maintain closer control of the process.

Each sample tested is logged on the Log Sheet and in the Log Book (Journal) including the time of the test and the test results.

7.2 LAB SAMPLING

The operators also provide three individual sludge cake samples per shift and a waste sludge composite sample made up of 3 grab samples taken 2 hours apart. These samples are delivered to the plant lab personnel for total solids and volatile solids testing. The lab personnel enter the test results into the Lab Ops Process Computer for computation of the amount of sludge handled daily. This information received from the Lab is the data reported to the state in regard to the sludge loading of the incinerator.

In addition to the daily sludge samples, the operators are responsible for taking samples for the annual hazardous waste metals tests. The lab provides instructions to perform the sampling.

SECTION 8
PREVENTIVE MAINTENANCE

8.0 GENERAL

DataStream Maintenance Management Software Program MP2 for Windows 4.5 is used to control the plant maintenance activities. The software (in the Maintenance Computer) automatically generates maintenance tasks sheets on a weekly basis to ensure all maintenance scheduled to be performed is accomplished on schedule (whether daily, weekly, monthly, etc or on an operating run time basis). In addition to scheduling all required preventive maintenance, the MP2 software also provides the following functions:

1. Maintains accurate equipment information and history
2. Processes scheduled and unscheduled work orders
3. Controls parts inventory
4. Provides system analysis, reports and graphs
5. Provides equipment calibrations and instrumentation calibrations

8.1 PREVENTIVE MAINTENANCE TASK HANDLING

All required equipment and instrument inspections, adjustments, lubrication and other preventive maintenance activities are logged in the software. The software tracks maintenance activities and continuously compares those to maintenance requirements. Each week, the software generates maintenance task printouts. Two examples of the task printouts are included at the end of this section. The Maintenance Manager assigns the tasks to the mechanics and instrument techs. As the tasks are completed, the signed off task sheets are returned to the data entry clerk. Completed tasks are logged into the computer and the computer automatically reschedules the next date for those tasks.

A listing of the FBI system preventive maintenance tasks is provided at the end of this section.

The plant maintenance record system uses a standardized numbering system to identify each piece of equipment and instrument. The explanation of the numbering system codes is included at the end of the section.

8.2 PREVENTIVE MAINTENANCE RECORDS

The computer software maintains a log of all maintenance performed on the system equipment and instruments. Every six months a report is generated for submittal to DEQ to confirm that the system is being properly maintained.

PSG New Orleans - East Bank
Scheduled Maintenance Task Report for the Fluid Bed Incinerator

TASK #	DESCRIPTION	WoType	Equipment Name	Equipment Number	Task Freq Days	CRAFT
M1-72	Check FBI Ash Pump #1	EB PM	Fluid Bed Ash Pump 1	FBI-A-PMP-1	30	Oper
M1-97	Check the Roof Spray Gun	EB PM	FBI Roof Spray Gun #3	FBI-HPW-SP-GUN3	30	OPER
M2-5	Check Packing on FBI Ash Pump #1	EB PM	Fluid Bed Ash Pump 1	FBI-A-PMP-1	30	Maint
M2-6	Check Packing on FBI Ash Pump #2	EB PM	Fluid Bed Ash Pump 2	FBI-A-PMP-2	30	Maint
M1-98	Check the Roof Spray Gun	EB PM	FBI Roof Spray Gun #4	FBI-HPW-SP-GUN4	30	OPER
M1-104	Check the Roof Spray Gun	EB PM	FBI Roof Spray Gun #1	FBI-HPW-SP-GUN1	30	OPER
M1-96	Check the Roof Spray Gun	EB PM	FBI Roof Spray Gun #2	FBI-HPW-SP-GUN2	30	OPER
M1-74	Check FBI Roof Spray Pump	EB PM	Fluid Bed Roof Spray Pump	FBI-HPW-SP-PMP	30	Oper
M1-95	Check Fluid Air Motor	EB PM	FBI Fluid Air Motor	FBI-FLU-A-MTR	30	OPER
M1-99	Check Fluid Air Blower	EB PM	FBI Fluid Air Blower	FBI-FLU-A-BLW	30	OPER
M1-103	Inspect the Sample Cooler Pump	EB PM	FBI CEM Sample Cooler Pump	FBI-CEM-SAMP-P	30	OPER
M2-4	Adjust the South Cake Pump	EB PM	Sludge Cake Pump 2 Schwing	FBI-SL-F-KSP-17	30	Maint
M1-102	Inspect the CEM Filter	EB PM	FBI CEM Filter	FBI-CEM-FLT	30	OPER
M1-73	Check FBI Ash Pump #2	EB PM	Fluid Bed Ash Pump 2	FBI-A-PMP-2	30	Oper
M1-94	Inspect the Calibration Gases	EB PM	FBI CEM Calibration Gases	FBI-CEM-CAL-G	30	OPER
M1-71	Check Roof Sprays	EB PM	Fluid Bed Piping & Ducts	FBI-PIP-DUCT	30	Oper
M1-100	Check Scrubber Disk Actuator	EB PM	FBI Scrubber Disk Actuator	FBI-V-SCRB-ACT	30	OPER
M1-101	Check the Roof Spray Pump	EB PM	FBI High PSI Spray Pump	FBI-HPW-SP-PMP	30	OPER
M1-62	Check North Sludge Cake Pump	EB PM	Sludge Cake Pump 1 Mono	FBI-SL--F-KSP-10	30	Oper
M1-63	Check South Sludge Cake Pump (Schwing)	EB PM	Sludge Cake Pump 2 Schwing	FBI-SL--F-KSP-17	30	Oper
M1-69	Check FBI Fluidizing Blower	EB PM	Fluid Bed Fluidizing Blower	FBI-FLU-AIR-BLW	30	Oper
M1-70	Check FBI Preheat Blower	EB PM	Fluid Bed Preheat Blower	FBI-PRE-H-BLW	30	Oper
Q1-63	Check the Freeboard Pressure Tap	EB PM	FBI Freeboard Pressure Tap	FBI-FRBD-P-TP	90	INST
Q1-62	Check the Bed Pressure Tap	EB PM	FBI Bed Pressure Tap	FBI-RACT-P-TP	90	INST
Q1-64	Inspect the Scrubber Disk	EB PM	FBI Scrubber Disk	FBI-V-SCRB-DSK	90	OPER
Q1-61	Check the Windbox Pressure Tap	EB PM	FBI Windbox Pressure Tap	FBI-WBOX-P-TP	90	INST
Q1-60	Run the CEM Performance Test	EB PM	FBI CEM Performance Test	FBI-CEM-TEST	90	INST
Q1-45	Service the North Sludge Cake Pump	EB PM	Sludge Cake Pump 1 Mono	FBI-SL-F-KSP-10	91	Maint
Q1-46	Service South Sludge Cake Pump (Schwing)	EB PM	Sludge Cake Pump 2 Schwing	FBI-SL-F-KSP-17	91	Maint
Q1-47	Cycle FBI Duct Dampers	EB PM	Fluid Bed Piping & Ducts	FBI-PIP-DUCT	91	Oper
Q1-48	Check FBI Scrubber Packing	EB PM	Check FBI Scrubber Packing	FBI-V-SCRB	91	Maint
W2	Scrubber Differential Pressure	EB PM	Fluid Bed Venturi Scrubber	FBI-V-SCRB	182	Inst
S1-116	Calibrate the Windbox Differential Pressure	EB PM	FBI Windbox Pressure D/P	FBI-WBOX-P-DP	182	INST
S1-112	Calibrate the computer data log recorder	EB PM	Heat Exch Air Out Temp.2	FBI-WST-02-TEMP	182	INST
S1-114	Calibrate the computer data log recorder	EB PM	Heat Exch Air In Temp.1	FBI-WST-01-TEMP	182	INST
S1-118	Calibrate the WAS Flow Meter	EB PM	FBI WAS Flow Meter	FBI-WAS-FLW-MET	182	INST
S1-111	Calibrate the computer data log recorder	EB PM	Bed Temp.4	FBI-WST-04-TEMP	182	INST
S1-108	Calibrate the Scrubber Water Flow Meter	EB PM	FBI Scrubber Water Flow Meter	FBI-V-SCRB-WMET	182	INST
S1-106	Calibrate the Scrubber Thermal Couple	EB PM	FBI Scrubber Thermal Couple #3	FBI-V-SCRB-TC3	182	INST
S1-102	Calibrate the Scrubber Thermal Couple	EB PM	FBI Scrubber Thermal Couple #2	FBI-V-SCRB-TC2	182	INST
S1-105	Calibrate the Scrubber Thermal Couple	EB PM	FBI Scrubber Thermal Couple #1	FBI-V-SCRB-TC1	182	INST
S1-98	Calibrate the Scrubber Differential Pressure	EB PM	FBI Scrubber Differential Pressure	FBI-V-SCRB-DP	182	INST

PSG New Orleans - East Bank
Scheduled Maintenance Task Report for the Fluid Bed Incinerator

TASK #	DESCRIPTION	WoType	Equipment Name	Equipment Number	Task Freq Days	CRAFT
S1-85	Calibrate the Sludge Cake Feed Pump	EB PM	FBI Sludge Feed KSP-17	FBI-SL-F-KSP-17	182	INST
S1-89	Calibrate the Sludge Cake Feed Pump	EB PM	FBI Sludge Feed KSP-10	FBI-SL-F-KSP-10	182	INST
S1-109	Calibrate the computer data log recorder	EB PM	Windbox Temp.3	FBI-WST-03-TEMP	182	INST
S1-90	Calibrate the computer data log recorder	EB PM	Scrubber Gas Out Temp .8	FBI-WST-08-TEMP	182	INST
S1-110	Calibrate the computer data log recorder	EB PM	Bed Temp 5	FBI-WST-05-TEMP	182	INST
S1-76	Calibrate the computer data log recorder	EB PM	Belt #1 Flow .13	FBI-WST-13-BFL1	182	INST
S1-73	Calibrate the computer data log recorder	EB PM	Windbox Pres .17	FBI-WST-17-WBP	182	INST
S1-74	Calibrate the computer data log recorder	EB PM	Belt #1 Flow .16	FBI-WST-16-BFL4	182	INST
S1-75	Calibrate the computer data log recorder	EB PM	Belt #1 Flow .15	FBI-WST-15-BFL3	182	INST
S1-77	Calibrate the computer data log recorder	EB PM	Belt #2 Flow .14	FBI-WST-14-BFL2	182	INST
S1-80	Calibrate the computer data log recorder	EB PM	Bed Level (AVG) .11	FBI-WST-11-B-LV	182	INST
S1-79	Calibrate the computer data log recorder	EB PM	Constriction Plate Pressure .12	FBI-WST-12-PL-P	182	INST
S1-95	Calibrate the computer data log recorder	EB PM	Heat Exch Gas In Temp .6	FBI-WST-06-TEMP	182	INST
S1-81	Calibrate the computer data log recorder	EB PM	Fluid Air Flow (SCFM) .10	FBI-WST-10-A-FL	182	INST
S1-94	Calibrate the computer data log recorder	EB PM	Scrubber Water Out Temp .9	FBI-WST-09-TEMP	182	INST
S1-99	Calibrate the Thermal Coupling	EB PM	FBI Bed Temperature Thermal Couple #5	FBI-RACT-T-TC5	182	INST
S1-96	Calibrate the computer data log recorder	EB PM	Heat Exch Gas Out Temp .7	FBI-WST-07-TEMP	182	INST
S1-97	Calibrate the Thermal Coupling	EB PM	FBI Bed Temperature Thermal Couple Ctl	FBI-RACT-T-TCC	182	INST
S1-103	Calibrate the Heat Exchanger Air Flow D/P	EB PM	FBI Heat Exchanger Air Flow D/P	FBI-H-EXCH-A-DP	182	INST
S1-88	Calibrate the Thermal Coupling	EB PM	FBI Bed Temperature Thermal Couple #4	FBI-RACT-T-TC4	182	INST
S1-53	Inspect FBI Ash Pump #1	EB PM	Fluid Bed Ash Pump 1	FBI-A-PMP-1	182	Maint
S1-93	Calibrate the computer data log recorder	EB PM	Excess O2 Concentration .22	FBI-WST-22-O2FL	182	INST
S1-83	Calibrate the computer data log recorder	EB PM	Fuel (Gas) Flow (AVG) .21	FBI-WST-21-GFL	182	INST
S1-49	Test South Sludge Cake Pump (Schwing)	EB PM	Sludge Cake Pump 2 Schwing	FBI-SL--F-KSP-17	182	Maint
S1-53	Inspect FBI Ash Pump #1	EB PM	Inspect FBI Ash Pump #1	FBI-A-PMP-1	182	Maint
W9	Calibrate the FBI Oxygen Analyzer	EB PM	Fluid Bed Stack Oxygen Analyzer	FBI-GSCRB-OXY	182	Inst
S1-54	Inspect FBI Ash Pump #2	EB PM	Inspect FBI Ash Pump #2	FBI-A-PMP-2	182	Maint
S1-92	Calibrate the computer data log recorder	EB PM	Bed Level (Instant) .31	FBI-WST-31-BLVI	182	INST
W7	Calibrate the Bed Level For the FBI	EB PM	Fluid Bed Incinerator	FBI-RACT-DP	182	Inst
W6	Calibrate Constriction Plate for the FBI	EB PM	Fluid Bed Electronic Controls/Monitors	FBI-WST-12-PL-P	182	Inst
W5	Calibrate the Windbox Differential Pressure	EB PM	Fluid Bed Incinerator	FBI-WBOX--P-DP	182	Inst
W4	Fluidizing Blower Line Air Flow Differential Pressure	EB PM	Fluid Bed Fluidizing	FBI-FLU-A-DP	182	Elect
S1-78	Calibrate the computer data log recorder	EB PM	Heat Exch D/P .19	FBI-WST-19-HEDP	182	INST
S1-91	Calibrate the computer data log recorder	EB PM	Constriction Plate Pressure (Instant) .32	FBI-WST-32-PLPI	182	INST
S1-86	Calibrate the Constriction Plate D/P	EB PM	FBI Constriction Plate D/P	FBI-RACT-PLT-DP	182	INST
S1-107	Calibrate the Diesel Flow Meter	EB PM	FBI Diesel Flow Meter	FBI-FUEL-D-MET	182	INST
S1-101	Calibrate the Bed Differential Pressure	EB PM	FBI Bed Differential Pressure	FBI-RACT-DP	182	INST
W3	Heat Exchanger Air Flow Differential Pressure	EB PM	Fluid Bed Heat Exchanger	FBI-H-EXCH	182	Inst
S1-113	Calibrate the Oxygen Analyzer	EB PM	FBI Oxygen Analyzer	FBI-G-SCRB-OXY	182	INST
S1-72	Calibrate the Gas Flow Meter	EB PM	FBI Gas Flow Meter	FBI-FUEL-G-MET	182	INST
S1-100	Calibrate the Fluid Air Flow D/P	EB PM	FBI Fluid Air Flow D/P	FBI-FLU-A-DP	182	INST
S1-104	Calibrate the Freeboard Pressure D/P	EB PM	FBI Freeboard Pressure D/P	FBI-FRBD-P-DP	182	INST
S1-87	Inspect the Heated Stack Filter	EB PM	FBI CEM Heated Stack Filter	FBI-CEM-STK-FLT	182	MAINT
S1-115	Service the Ash Pump	EB PM	FBI Ash Pump 2	FBI-A-PMP-2	182	MAINT
S1-117	Service the Ash Pump	EB PM	FBI Ash Pump 1	FBI-A-PMP-1	182	MAINT

PSG New Orleans - East Bank
Scheduled Maintenance Task Report for the Fluid Bed Incinerator

TASK #	DESCRIPTION	WoType	Equipment Name	Equipment Number	Task Freq Days	CRAFT
SI-94	Calibrate the computer data log recorder	EB PM	Scrubber Differential Pressure ,20	FBI-WST-20-SDP	182	INST
SI-92	Calibrate the computer data log recorder	EB PM	Freeboard Pressure ,18	FBI-WST-18-FBP	182	INST
AI-151	Check the Preheat Blower	EB PM	FBI Preheat Blower	FBI-PRE-H-BLW	365	MAINT
AI-102	Service the FBI Fluidizing Blower	EB PM	Fluid Bed Fluidizing Blower	FBI-FLU-AIR-BLW	365	Maint
AI-103	Service FBI Preheat Blower	EB PM	Fluid Bed Preheat Blower	FBI-PRE-H-BLW	365	Maint
AI-96	Evaluate South Sludge Cake Pump (Schwing)	EB PM	Sludge Cake Pump 2 Schwing	FBI-SL--F-KSP-17	365	Maint
AI-137	SG2400-1-C16 Incinerator Blower Breaker	EB PM	SG2400-1-C16 Incinerator Blower Breaker	FBI-FLU-A-BLW-B	365	Elect
AI-106	Service FBI Roof Spray Pump	EB PM	Fluid Bed Roof Spray Pump	FBI-HPW-SP-PMP	365	Maint
AI-105	Service FBI Ash Pump #2	EB PM	Fluid Bed Ash Pump 2	FBI-A-PMP-2	365	Maint
AI-104	Service FBI Ash Pump #1	EB PM	Fluid Bed Ash Pump 1	FBI-A-PMP-1	365	Maint
AI-150	Inspect Constriction Plate Tuyeres	EB PM	FBI Constriction Plate Tuyeres	FBI-RACT-PLT-TU	365	OPER

Task Report (Full List)

Task #: 91-11 INSPECT FBI ASH PUMP #1
WoType: ES PM Expense Class: Priority: 2.00 Multitask: N In Service Task: Y

Equipment #/ Description	Next Due Last Perform	Task Freq Sched Type	Task Duration (Days)	Times Comp'd	Down Time	Must Be Down
FBI-A-PMP-1	12/9/96	(182) Days		3		N
FBI ASH PUMP 1	6/19/96	Floating				
NNNC1PM01		Floating				N
FLUID BED ASH PUMP 1						

Craft	Crew Size	Est Labor Hrs
MAINT	1	1.00

Task Instructions:

Instr Code: NN012 Last Edit Date:

TOOLS NEEDED 1/4IN HEX KEY, 10IN CRECENT WRENCH, SCEWDRIVER, HAMMER

SAMPLE THE OIL IN THE PUMP HOUSING AND REPLENTISH WITH 20W HYD OIL.

SAMPLE THE OIL IN THE GEAR REDUCER AND REPLENTISH WITH 40W HYD OIL.

FOR EACH OF THE THREE COUPLINGS, PERFORM THE FOLLOWING:
REMOVE THE COVER AND GRID, USE CAUTION NOT TO DAMAGE THE GASKET OR GRID.

THOROUGHLY CLEAN THE COUPLING COMPONENTS.

INSPECT THE COUPLING COMPONENTS FOR EXCISSIVE WEAR OR DAMAGE.

HAND PACK THE COUPLING WITH C&C GREASE.

REASSEMBLE THE COUPLING.

REMARKS:

Task Report (Full List)

Task #: A1-103 SERVICE FBI PREHEAT BLOWER
WoType: EB PM Expense Class: Priority: 2.00 Multitask: N In Service Task: Y

Equipment #/ Description	Next Due Last Perform	Task Freq Sched Type	Task Duration (Days)	Times Compl'd	Down Time	Must Be Down
FBI-PRE-H-BLW FBI PREHEAT BLOWER	8/6/96 8/7/95	(365) Days Floating		2		N
NNNC1BL02 FLUID BED PREHEAT BLOWER		Floating				N

Craft	Crew Size	Est Labor Hrs
MAINT	1	1.00

Task Instructions:

Instr Code: NN007 Last Edit Date:

CLEAN THE MOTOR, ESPECIALLY THE COOLING FAN AND FINS.

LUBRICATE THE MOTOR BEARINGS WITH C&C GREASE, 3 PUMPS EACH.

MEGGER THE MOTOR, RECORD READINGS.

REMARKS:

EQUIPMENT NUMBERING SYSTEM 3/16/92

```
A    A    AA   0    AA   00   A    0
↑PROCESS
     ↑SUB-PROCESS
          ↑SYSTEM
               ↑SYSTEM NUMBER
                    ↑UNIT
                         ↑UNIT NUMBER
                              ↑COMPONENT
                                   ↑COMPONENT NUMBER
```

Process:

A	
B	
C	COLLECTION
D	PRELIMINARY
E	
F	PRIMARY
G	SECONDARY
H	TERTIARY
I	
J	
K	DISINFECTION
L	EFFLUENT
M	
N	SOLIDS HANDLING
O	
P	PLANT GENERAL
Q	
R	
S	
T	PACKAGE PLANT
U	
V	
W	
X	N/A
Y	
Z	

SUB-PROCESS

A	ACTIVATED SLUDGE
B	FIXED BIOMASS
C	CONDITIONING/STORAGE
D	DEWATERING
E	
F	FILTRATION
G	SERVICE
H	
I	
J	
K	ODOR CONTROL
L	LIQUID TRAIN
M	
N	INCINERATION
O	
P	PUMP STATION
Q	
R	CHLORINE
S	SOLIDS
T	FACILITY
U	
V	ULTRAVIOLET
W	NETWORK
X	N/A
Y	PURE OXYGEN
Z	

SYSTEM

AE	AERATION
AS	ASH
BU	BUILDING
CF	CLARIFICATION
CL	CHLORINATION
CM	COMPOSTING
CN	CONTACT TREATMENT
CC	COMMUNICATION
CT	CHEMICAL TREATMENT
DC	DECHLORINATION
DF	DISSOLVED AIR FLOATATION
DG	DIGESTING
DR	DRYING/HEAT TREATMENT
EC	ELECTRICAL CONTROL
EL	ELECTRIC POWER
FE	FERRIC
FL	FILTERING
FU	FUEL
GD	GROUND MAINTENANCE
GG	GRINDING
GM	GRAVITY MAINS
GR	GRIT
GS	GREASE
GT	GRAVITY THICKENING
HV	HVAC
LB	LABORATORY
LM	LIME
NC	INCINERATION
NS	INSTRUMENTATION
PA	AIR PUMPING
PC	SCUM PUMPING
PD	PRESS DEWATERING
PE	SEAL WATER
PF	FLUSHING/SPRAYING PUMPING
PG	SLUDGE PUMPING
PH	PLANT WATER PUMPING
PL	LIFT PUMPING
PM	PRESSURE MAINS
PP	SUMP PUMPING
PR	RAS PUMPING
PS	SEPTAGE PUMPING
SC	SCREENING

SF	SAFETY GEAR
TE	TOOLS AND EQUIPMENT
TP	TRANSPORT
XG	OXYGEN PLANT
XX	N/A

UNIT

AC	AIR CONDITIONER
AN	ANALYZING
AP	ANALYSIS PREPARATION
BE	BREATHING EQUIPMENT
BL	BLOWER
BR	BURNER
CE	ELECTRONIC CONTROL
CF	CENTRIFUGE
CH	CHLORINATOR
CL	ELECTRIC CONTROL
CM	COMPRESSOR
CN	CONVEYOR
CT	CONCENTRATOR
DG	DIGESTER
EP	EVAPORATOR
FA	FAN
FE	FEEDER
FX	FIRE EXTINGUISHERS
GN	GENERATOR
GR	GRINDER
HT	HOIST
HX	HEAT EXCHANGER
LP	LIGHTING AND POWER
MC	MCC
MN	MONITORING
MW	MEASURING/WEIGHING
MX	MIXER
TK	TANK
PC	PNEUMATIC CONTROL
PL	PLUMBING
PM	PUMP
PR	PRESS
PT	POWER TOOLS
RB	ROTATING BIOLOGICAL CONTACTOR
RK	RAKE
SA	SAMPLING
SB	SCRUBBER
SC	SCREEN
SE	SHOP EQUIPMENT
SK	SKIMMER
SL	SLAKER
SW	SWITCHGEAR/POWER PANEL

TE	TEST EQUIPMENT
TF	TRICKLING FILTER
TH	HAND TOOLS
UV	UTRAVIOLET UNIT
VE	VEHICULAR EQUIPMENT
VH	VEHICLE
XF	TRANSFORMER
ZN	OZONATOR
XX	N/A

COMPONENT

A	ACTUATOR
B	REGULATOR
C	CONTROLS
D	DRIVE
E	ENGINE
F	FIXTURES
G	GENERATOR
H	HEATER
I	
J	
K	INJECTOR
L	ALARM
M	MOTOR
N	INDICATOR
O	
P	SIGNAL PROCESSOR
Q	
R	RECORDER
S	SENSOR
T	COUPLING
U	
V	VALVE
W	COOLER
X	DRIER
Y	
Z	N/A