CDM

ORIGINAL

Solid Waste Authority of Palm Beach County
North County Resource Recovery Facility Site

Unique & Innovative Facilities

- Use landfill gas to recycle wastewater and lime sludges for beneficial use as fertilizer and quicklime
- Concurrently eliminates sludge disposal to fragile environment

Lime Recalcination and Biosolids Pelletization Facilities

Request for an Amendment Leading to a Modification of Power Plant Site Certification PA84-20

Revised to Include Information Requested in FDEP Letter Dated August 16, 2002

January 2003

Volume II: Consolidated Air Permit Application ELSA Forms for Modification of Prevention of Significant Deterioration (PSD) Permit No. PSD-FL-108, and Title V Air Operating Permit No. 0990234-003-AV

2678 33750
33752

SOLID WASTE AUTHORITY OF PALM BEACH COUNTY
NORTH COUNTY RESOURCE RECOVERY FACILITY

REVISED REQUEST FOR AMENDMENT LEADING TO MODIFICATION OF POWER PLANT SITE CERTIFICATION PA84-20

Revised to Include Information Requested in FDEP Letter Dated August 16, 2002

LIME RECALCINATION AND BIOSOLIDS PELLETIZATION FACILITIES

Volume II of III

Submitted to:
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SITING COORDINATION OFFICE
TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301

RECEIVED
JAN 16 2003
BUREAU OF AIR REGULATION

Prepared for:
Solid Waste Authority of Palm Beach County
7501 North Jog Road
West Palm Beach, Florida 33412

Prepared by:
Camp Dresser & McKee Inc.
1601 Belvedere Road, Suite 211 South
West Palm Beach, Florida 33406

October 2002

1/13/03
Alex H. Makled, P.E., DEE
Florida Registered Engineer
Engineer Number 45935

Contents

Section 1
Application Information

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BUREAU OF AIR REGULATION

Department of Environmental Protection

DIVISION OF AIR RESOURCES MANAGEMENT

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Identification of Facility Addressed in This Application

1. Facility Owner/Company Name : Solid Waste Authority of Palm Beach Co.	
2. Site Name : North County Resource Recovery Facility	
3. Facility Identification Number : 0990234	[ ] Unknown
4. Facility Location : Solid Waste Authority of Palm Beach County North County Resource Recovery Facility Street Address or Other Locator : 7501 North Jog Rod City : West Palm Beach County : Palm Beach	Zip Code : 33412-2414
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official :

Name : Donald L. Lockhart
Title : Executive Director

2. Owner or Authorized Representative or Responsible Official Mailing Address :

Organization/Firm : Solid Waste Authority of Palm Beach Co
Street Address : 7501 North Jog Road
City : West Palm Beach
State : FL Zip Code : 33412-2414

3. Owner/Authorized Representative or Responsible Official Telephone Numbers :

Telephone : (561)640-4000 Fax : (561)683-4067

4. Owner/Authorized Representative or Responsible Official Statement :

I, the undersigned, am the owner or authorized representative of the non-Title V source addressed in this Application for Air Permit or the responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions units.*

[signature] 11/4/02

Signature Date

* Attach letter of authorization if not currently on file.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type
	Class I Landfill Flare, Flare #3	
	Backup Flare for Both Facilities, Flare #2	
	Lime Recalcination Facility Kiln Process	
	Biosolids Pelletizing Facility Dryer Train	

Purpose of Application and Category

Category I : All Air Operation Permit Applications Subject to Processing Under Chapter 62-213, F.A.C.

This Application for Air Permit is submitted to obtain :

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for an existing facility which is classified as a Title V source.

[ ] Initial air operation permit under Chapter 62-213, F.A.C., for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number :

[ ] Air operation permit renewal under Chapter 62-213, F.A.C., for a Title V source.

Operation permit to be renewed :

[**X**] Air operation permit revision for a Title V source to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number :
PSD-FL-108(E)

Operation permit to be revised :
0990234-003-AV

[ ] Air operation permit revision or administrative correction for a Title V source to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application.

Operation permit to be revised/corrected :

[ ] Air operation permit revision for a Title V source for reasons other than construction or modification of an emissions unit.

Operation permit to be revised :

Reason for revision :

Category II : All Air Operation Permit Applications Subject to Processing Under Rule 62-210.300(2)(b), F.A.C.

This Application for Air Permit is submitted to obtain :

[ ] Initial air operation permit under Rule 62-210.300(2)(b), F.A.C., for an existing facility seeking classification as a synthetic non-Title V source.

Current operation/construction permit number(s) :

[ ] Renewal air operation permit under Fule 62-210.300(2)(b), F.A.C., for a synthetic non-Title V source.

Operation permit to be renewed :

[ ] Air operation permit revision for a synthetic non-Title V source.

Operation permit to be revised :

Reason for revision :

Category III : All Air Construction Permit Applications for All Facilities and Emissions Units

This Application for Air Permit is submitted to obtain :

[**X**] Air construction permit to construct or modify one or more emissions units within a facility (including any facility classified as a Title V source).

Current operation permit number(s), if any :
PSD-FL-108(E)

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

Current operation permit number(s) :

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Application Processing Fee

Check one :

[X] Attached - Amount : $7500.00 [ ] Not Applicable.

Construction/Modification Information

1. Description of Proposed Project or Alterations : This is a major modification to the existing NCRRF SWA Site. A Lime Recalcination Facility (LRF) and Biosolids Pelletizing Facility (BPF) are being proposed on the SWA site, adjacent to the existing Class I Landfill. Gas from the landfill will be used to fire a kiln to recalcinate lime at the LRF and a kiln to dry sludge at the BPF. Natural gas will be available as a backup fuel. The facility will only draw as much landfill gas as may potentially be needed at any one time by both facilities, 2300 scfm. Any unused gas w be combusted at a backup flare located near the proposed facilities. Also included with this application are a minor revision to the Title V permit only (not included in the PS permit modification application) for a new landfill gas flare on the existing SWA site. The increase in landfill gas generation at the Class I Landfill requires the existing landfill gas collection flare blower to be supplemented by an additional 3,500scfm blower and flare. The existing Class I Landfill blower is designed for 1,800 scfm of landfill gas. Once the 2,300 scfm back flare at the LRF and BPF site is operational, the existing 1,800 scfm flare will be decommissioned. This application contains a request to modify the existing PSD Permit No. PSD-FL-108(E) for constructic of the LRF, the BPF, the 2,300-scfm backup flare required for the proposed facilities and the decommissioning of the existing 1,800-scfm flare. This application is also to revise the existing Title V Permit No. 0990234-003-AV for these facilities, plus the addition of a flare for the Class I Landfill with a design flow rate of 3,500 scfm. For reasons explained in Volume III, Section 1, the 3,500-scfm flare at the Class I Landfill is exempt from PSD permitting.
2. Projected or Actual Date of Commencement of Construction :
3. Projected Date of Completion of Construction :

Professional Engineer Certification

1. Professional Engineer Name : Alex H. Makled Registration Number : 45935 .
2. Professional Engineer Mailing Address :

Organization/Firm : Camp Dresser & McKee Street Address : 1601 Belvedere Rd, Suite 211 S City : West Palm Beach	State : FL Zip Code : 33406
3. Professional Engineer Telephone Numbers : Telephone : (561)689-3336	Fax : (561)689-9713

4. Professional Engineer Statement :

I, the undersigned, hereby certify, except as particularly noted herein, that :*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollutant control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain a Title V source air operation permit (check here [ ] if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [✓] if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [✓] if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature (seal) 1/13/03

Date 1/13/03

No. 45935

* Attach any exception to certification statement.

Application Contact

1. Name and Title of Application Contact : Name : Alex H. Makled Title : Vice President
2. Application Contact Mailing Address : Organization/Firm : Camp Dresser & McKee Street Address : 1601 Belvedere Rd, Suite 211 S City : West Palm Beach State : FL Zip Code : 33406
3. Application Contact Telephone Numbers : Telephone : (561)689-3336 Fax : (561)689-9713

Application Comment

Section 2
Facility Information

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility, Location, and Type 11

1. Facility UTM Coordinates :
   Zone : 17 East (km) : 585.80 North (km) : 2960.20

2. Facility Latitude/Longitude :
   Latitude (DD/MM/SS) : 26 46 Longitude (DD/MM/SS) : 80 8 45

3. Governmental Facility Code :	4. Facility Status Code :	5. Facility Major Group SIC Code :	6. Facility SIC(s) :
3	A	49	

7. Facility Comment :

This is a municipal Waste to Energy facility with active Class I and Class III landfills, each equipped with exisiting active gas collection and control systems. The SWA proposes to add a lime recalcination facility and biosolids pelletizing facility that would utilize gas from the Class I landfill. The proposed facilities would have a 2,300 scfm backup flare.The existing 1,800-scfm flare will be decommissioned. The Class I landfill 3,500-scfm flare will be a separate project, exempt from PSD.

Facility Contact

1. Name and Title of Facility Contact :
   Donald L. Lockhart
   Executive Director

2. Facility Contact Mailing Address :
   Organization/Firm : Solid Waste Auth. of Palm Beach Co.
   Street Address : 7501 North Jog Road
   City : West Palm Beach State : FL Zip Code : 33412-2414

3. Facility Contact Telephone Numbers :
   Telephone : (561)640-4000 Fax : (561)683-4067

Facility Regulatory Classifications

1. Small Business Stationary Source?	N
2. Title V Source?	Y
3. Synthetic Non-Title V Source?	N
4. Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?	Y
5. Synthetic Minor Source of Pollutants Other than HAPs?	N
6. Major Source of Hazardous Air Pollutants (HAPs)?	Y
7. Synthetic Minor Source of HAPs?	N
8. One or More Emissions Units Subject to NSPS?	Y
9. One or More Emission Units Subject to NESHAP?	Y
10. Title V Source by EPA Designation?	N
11. Facility Regulatory Classifications Comment :	

B. FACILITY REGULATIONS

Rule Applicability Analysis

Applicable rules are discussed in Volume III, Section 2.0, Air Quality Regulations

B. FACILITY REGULATIONS

List of Applicable Regulations

The Title V Core List (dated 03/01/02), attached.

40 CFR 60 Subpart HH - Standards of Performance for Lime Manufacturing Plants

40 CFR 60 Subpard WWW - Standards of Performance for Municipal Solid Waste Landfills

40 CFR 61 Subpart E - National Emissions Standard for Hazardous Air Pollutants (NESHAP) - Mercury

40 CFR 64 - Compliance Assurance Monitoring Rule

Title V Core List
Effective: 03/01/02

[**Note:** The Title V Core List is meant to simplify the completion of the "List of Applicable Regulations" for DEP Form No. 62-210.900(1), Application for Air Permit - Long Form. The Title V Core List is a list of rules to which all Title V Sources are presumptively subject. The Title V Core List may be referenced in its entirety, or with specific exceptions. The Department may periodically update the Title V Core List.]

Federal: ***(description)***

40 CFR 61, Subpart M: NESHAP for Asbestos.

40 CFR 82: Protection of Stratospheric Ozone.
40 CFR 82, Subpart B: Servicing of Motor Vehicle Air Conditioners (MVAC).
40 CFR 82, Subpart F: Recycling and Emissions Reduction.

State: ***(description)***

CHAPTER 62-4, F.A.C.: PERMITS, effective 06-01-01

62-4.030, F.A.C.: General Prohibition.
62-4.040, F.A.C.: Exemptions.
62-4.050, F.A.C.: Procedure to Obtain Permits; Application.
62-4.060, F.A.C.: Consultation.
62-4.070, F.A.C.: Standards for Issuing or Denying Permits; Issuance; Denial.
62-4.080, F.A.C.: Modification of Permit Conditions.
62-4.090, F.A.C.: Renewals.
62-4.100, F.A.C.: Suspension and Revocation.
62-4.110, F.A.C.: Financial Responsibility.
62-4.120, F.A.C.: Transfer of Permits.
62-4.130, F.A.C.: Plant Operation - Problems.
62-4.150, F.A.C.: Review.
62-4.160, F.A.C.: Permit Conditions.
62-4.210, F.A.C.: Construction Permits.
62-4.220, F.A.C.: Operation Permit for New Sources.

CHAPTER 62-210, F.A.C.: STATIONARY SOURCES - GENERAL REQUIREMENTS, effective 06-21-01

62-210.300, F.A.C.: Permits Required.
62-210.300(1), F.A.C.: Air Construction Permits.
62-210.300(2), F.A.C.: Air Operation Permits.
62-210.300(3), F.A.C.: Exemptions.
62-210.300(5), F.A.C.: Notification of Startup.
62-210.300(6), F.A.C.: Emissions Unit Reclassification.
62-210.300(7), F.A.C.: Transfer of Air Permits.
62-210.350, F.A.C.: Public Notice and Comment.

62-210.350(1), F.A.C.: Public Notice of Proposed Agency Action.
62-210.350(2), F.A.C.: Additional Public Notice Requirements for Emissions Units Subject to Prevention of Significant Deterioration or Nonattainment-Area Preconstruction Review.
62-210.350(3), F.A.C.: Additional Public Notice Requirements for Sources Subject to Operation Permits for Title V Sources.

62-210.360, F.A.C.: Administrative Permit Corrections.
62-210.370(3), F.A.C.: Annual Operating Report for Air Pollutant Emitting Facility.
62-210.400, F.A.C.: Emission Estimates.
62-210.650, F.A.C.: Circumvention.
62-210.700, F.A.C.: Excess Emissions.

62-210.900, F.A.C.: Forms and Instructions.
62-210.900(1), F.A.C.: Application for Air Permit - Title V Source, Form and Instructions.
62-210.900(5), F.A.C.: Annual Operating Report for Air Pollutant Emitting Facility, Form and Instructions.
62-210.900(7), F.A.C.: Application for Transfer of Air Permit - Title V and Non-Title V Source.

CHAPTER 62-212, F.A.C.: STATIONARY SOURCES - PRECONSTRUCTION REVIEW, effective 08-17-00

CHAPTER 62-213, F.A.C.: OPERATION PERMITS FOR MAJOR SOURCES OF AIR POLLUTION, effective 04-16-01

62-213.205, F.A.C.: Annual Emissions Fee.
62-213.400, F.A.C.: Permits and Permit Revisions Required.
62-213.410, F.A.C.: Changes Without Permit Revision.
62-213.412, F.A.C.: Immediate Implementation Pending Revision Process.
62-213.415, F.A.C.: Trading of Emissions Within a Source.
62-213.420, F.A.C.: Permit Applications.
62-213.430, F.A.C.: Permit Issuance, Renewal, and Revision.
62-213.440, F.A.C.: Permit Content.
62-213.450, F.A.C.: Permit Review by EPA and Affected States
62-213.460, F.A.C.: Permit Shield.

62-213.900, F.A.C.: Forms and Instructions.
62-213.900(1), F.A.C.: Major Air Pollution Source Annual Emissions Fee Form.
62-213.900(7), F.A.C.: Statement of Compliance Form.

CHAPTER 62-296, F.A.C.: STATIONARY SOURCES - EMISSION STANDARDS, effective 03-02-99

62-296.320(4)(c), F.A.C.: Unconfined Emissions of Particulate Matter.

62-296.320(2), F.A.C.: Objectionable Odor Prohibited.

CHAPTER 62-297, F.A.C.: STATIONARY SOURCES - EMISSIONS MONITORING, effective 03-02-99

62-297.310, F.A.C.: General Test Requirements.
62-297.330, F.A.C.: Applicable Test Procedures.
62-297.340, F.A.C.: Frequency of Compliance Tests.
62-297.345, F.A.C.: Stack Sampling Facilities Provided by the Owner of an Emissions Unit.
62-297.350, F.A.C.: Determination of Process Variables.
62-297.570, F.A.C.: Test Report.
62-297.620, F.A.C.: Exceptions and Approval of Alternate Procedures and Requirements.

<u>**Miscellaneous**</u>:

CHAPTER 28-106, F.A.C.: Decisions Determining Substantial Interests
CHAPTER 62-110, F.A.C.: Exception to the Uniform Rules of Procedure, effective 07-01-98
CHAPTER 62-256, F.A.C.: Open Burning and Frost Protection Fires, effective 11-30-94
CHAPTER 62-257, F.A.C.: Asbestos Notification and Fee, effective 02-09-99
CHAPTER 62-281, F.A.C.: Motor Vehicle Air Conditioning Refrigerant Recovery and Recycling, effective 09-10-96

C. FACILITY POLLUTANTS

Facilitv Pollutant Information

1. Pollutant Emitted	2. Pollutant Classification
VOC	B
PM	B

D. FACILITY POLLUTANT DETAIL INFORMATION

Facility Pollutant Information Pollutant 1

1. Pollutant Emitted :	VOC
2. Requested Emissions Cap :	(lbs/hour) (tons/year)
3. Basis for Emissions Cap Code :	
4. Facility Pollutant Comment : Regulated pollutant is NMOC	

D. FACILITY POLLUTANT DETAIL INFORMATION

Facility Pollutant Information Pollutant 2

1. Pollutant Emitted : PM		
2. Requested Emissions Cap :	(lbs/hour)	(tons/year)
3. Basis for Emissions Cap Code :		
4. Facility Pollutant Comment :		

D. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements for All Applications

1. Area Map Showing Facility Location :	Appendix A
2. Facility Plot Plan :	Appendix B
3. Process Flow Diagram(s) :	Appendix C
4. Precautions to Prevent Emissions of Unconfined Particulate Matter :	Appendix D
5. Fugitive Emissions Identification :	NA
6. Supplemental Information for Construction Permit Applica	Appendix E

Additional Supplemental Requirements for Category I Applications Only

7. List of Proposed Exempt	Appendix F
8. List of Equipment/Activities Regulated under Title	NA
9. Alternative Methods of Operation :	NA
10. Alternative Modes of Operation (Emissions	NA
11. Identification of Additional Applicable	NA
12. Compliance Assurance Monitoring	Appendix G
13. Risk Management Plan Verification :	NA
14. Compliance Report and Plan :	Appendix H
15. Compliance Certification (Hard-copy Requir	Appendix I

Section 3
Emissions Unit Information

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section ___2___

Lime Recalcination Facility Kiln Process

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

   [X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   [ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

   [X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   [ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   [ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

III. EMISSIONS UNIT INFORMATION

A. TYPE OF EMISSIONS UNIT
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Type of Emissions Unit Addressed in This Section

1. Regulated or Unregulated Emissions Unit? Check one :

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

2. Single Process, Group of Processes, or Fugitive Only? Check one :

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

Emissions Unit Information Section 1

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Backup Flare for Both Facilities, Flare #2		
2. Emissions Unit Identification Number : [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : C	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : Flare to be used only if the LRG and/or BPF are offline. It will be designed only to handle the combined gas need of the lime kiln and sludge dryer, 2,300 scfm. If both facilities are in operation, the flare will not be in use. Once the flare is online/operational, the existing 1,800 scfm flare currently in use at the Class I landfill, will be decommissioned.		

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Lime Recalcination Facility Kiln Process		
2. Emissions Unit Identification Number : [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : C	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : The LRF will recalcinate 100 dry ton / day lime by exposing it to high temperatures in a kiln. The rotary kiln will combust landfill gas (counter-current) with gases exiting through an ESP and 100-foot stack		

Emissions Unit Information Section 3

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Biosolids Pelletizing Facility Dryer Train		
2. Emissions Unit Identification Number : [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : C	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : The BPF will dry sewage sludge to fertilizer pellets. Exhaust gases will go through a venturi scrubber and regenerative thermal oxidizer		

B. GENERAL EMISSIONS UNIT INFORMATION
(Regulated and Unregulated Emissions Units)

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section : Class I Landfill Flare, Flare #3		
2. Emissions Unit Identification Number : [ ] No Corresponding ID [ ] Unknown		
3. Emissions Unit Status Code : C	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code : 49
6. Emissions Unit Comment : 3,500-scfm blower and flare for future expansion of Class I Landfill gas collection system.		

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Emissions Unit Control Equipment 1

1. Description : The flare will be an enclosed candle-stick flare, and will not be steam-assisted.	
2. Control Device or Method Code :	23

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Emissions Unit Control Equipment 1

1. Description : Electric Precipitator used to control fine particulate matter. A low NOx burner will also be used.	
2. Control Device or Method Code :	10

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Emissions Unit Control Equipment 1

1. Description : A Regenerative Thermal Oxidizer at the end of the process will be used for VOC, NH3, CO, and H2S control. A low NOx burner will be used.	
2. Control Device or Method Code :	99

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Emissions Unit Control Equipment 2

1. Description : A venturi scrubber located upstream of the RTO for fine particulate matter control.	
2. Control Device or Method Code :	53

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Emissions Unit Control Equipment 1

1. Description : The flare is a control device for destruction of NMOC in landfill gas. It will be an enclosed candlestick, non-steam-assisted flare.	
2. Control Device or Method Code :	23

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Emissions Unit Details

1. Initial Startup Date :	01-Dec-2004	
2. Long-term Reserve Shutdown Date :		
3. Package Unit : Manufacturer : LFG Technologies, Inc. or equivalent		Model Number :
4. Generator Nameplate Rating :	MW	
5. Incinerator Information : Dwell Temperature : Dwell Time : Incinerator Afterburner Temperature :		 Degrees Fahrenheit Seconds Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	76	mmBtu/hr	
2. Maximum Incinerator Rate :		lb/hr	tons/day
3. Maximum Process or Throughput Rate :	2300		scfm of LFG
4. Maximum Production Rate :			
5. Operating Capacity Comment : Blower and flare capacity is 2,300 scfm of gas with a heat content up to 573 Btu/scf.			

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 2
Lime Recalcination Facility Kiln Process

Emissions Unit Details

1. Initial Startup Date :	01-Dec-2004
2. Long-term Reserve Shutdown Date :	
3. Package Unit : Manufacturer : FFE Minerals, Metso Minerals (or equiv.)	Model Number :
4. Generator Nameplate Rating :	MW
5. Incinerator Information : Dwell Temperature : Dwell Time : Incinerator Afterburner Temperature :	 Degrees Fahrenheit Seconds Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	32	mmBtu/hr
2. Maximum Incinerator Rate :	lb/hr	tons/day
3. Maximum Process or Throughput Rate :	172	dry tons/day
4. Maximum Production Rate :	100	dry tons/day
5. Operating Capacity Comment : Primary fuel is landfill gas. Backup fuel is natural gas. 313 wet tons per day (at 55% solids), or 172 dry tons/day of lime sludge is processed to produce 100 dry tons/day of recalcined lime.		

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 3
Biosolids Pelletizing Facility Dryer Train

Emissions Unit Details

1. Initial Startup Date :	01-Dec-2004
2. Long-term Reserve Shutdown Date :	
3. Package Unit : Manufacturer : Andritz Dryer Drum (or equiv.)	Model Number : DDS-70 (or equiv.)
4. Generator Nameplate Rating :	MW
5. Incinerator Information : Dwell Temperature : Dwell Time : Incinerator Afterburner Temperature :	 Degrees Fahrenheit Seconds Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate :	22	mmBtu/hr
2. Maximum Incinerator Rate :	lb/hr	tons/day
3. Maximum Process or Throughput Rate :	34	dry tons/day
4. Maximum Production Rate :		
5. Operating Capacity Comment : Facility is expected to use 8,261 dscfm of landfill gas. Natural gas will be available as a backup fuel.		

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule :	
24 hours/day	7 days/week
52 weeks/year	8,760 hours/year

C. EMISSIONS UNIT DETAIL INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Emissions Unit Details

1. Initial Startup Date :
2. Long-term Reserve Shutdown Date :
3. Package Unit : Manufacturer : LFG Specialties, or equivalent Model Number : PCF1434I12
4. Generator Nameplate Rating : MW
5. Incinerator Information : Dwell Temperature : Degrees Fahrenheit Dwell Time : Seconds Incinerator Afterburner Temperature : Degrees Fahrenheit

Emissions Unit Operating Capacity

1. Maximum Heat Input Rate : 116 mmBtu/hr
2. Maximum Incinerator Rate : lb/hr tons/day
3. Maximum Process or Throughput Rate : 3500 scfm of LFG
4. Maximum Production Rate :
5. Operating Capacity Comment : Blower and flare capacity is 3,500 scfm of landfill gas with a heat content of 573 Btu/scf.

Emissions Unit Operating Schedule

Requested Maximum Operating Schedule : 24 hours/day 7 days/week 52 weeks/year 8,760 hours/year

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Rule Applicability Analysis

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Rule Applicability Analysis

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Rule Applicability Analysis

D. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Rule Applicability Analysis

List of Applicable Regulations

40 CFR 60 Subpard WWW - Standards of Performance for Municipal Solid Waste Landfills

List of Applicable Regulations

40 CFR 60 Subpart HH - Standards of Performance for Lime Manufacturing Plants

40 CFR 60 Subpard WWW - Standards of Performance for Municipal Solid Waste Landfills

40 CFR 64 - Compliance Assurance Monitoring Rule

List of Applicable Regulations

40 CFR 60 Subpard WWW - Standards of Performance for Municipal Solid Waste Landfills

40 CFR 61 Subpart E - National Emissions Standard for Hazardous Air Pollutants (NESHAP) - Mercury

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

List of Applicable Regulations

40 CFR 60 Subpart WWW - Standards of Performance for Municpal Solid Waste Landfills

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	Backup Flare #2	
2. Emission Point Type Code :	1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point)		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common : Exit Temperature = 1832 °K		
5. Discharge Type Code :	V	
6. Stack Height :	23	feet
7. Exit Diameter :	0.1	feet
8. Exit Temperature :	999	°F
9. Actual Volumetric Flow Rate :	127263	acfm
10. Percent Water Vapor :	6.50	%
11. Maximum Dry Standard Flow Rate :	33366	dscfm
12. Nonstack Emission Point Height :	0	feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 238.004 North (km) : 269.096		

14. Emission Point Comment :

Emission point coordinates are State Planar (km)

App. E shows the calculation of the flare air flow rate in dscfm and acfm. Exit temperature is at least 1400 degrees F.

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	LRF Stack	
2. Emission Point Type Code :	1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point)		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common : none		
5. Discharge Type Code :	V	
6. Stack Height :	100	feet
7. Exit Diameter :	2.7	feet
8. Exit Temperature :	402	°F
9. Actual Volumetric Flow Rate :	22255	acfm
10. Percent Water Vapor :	33.72	%
11. Maximum Dry Standard Flow Rate :	13632	dscfm
12. Nonstack Emission Point Height :	0	feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 237.847	North (km) : 269.059	

14. Emission Point Comment :

Emission point coordinates are State Planar (km)

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	BPF Stack	
2. Emission Point Type Code :	1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point)		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common : none		
5. Discharge Type Code :	V	
6. Stack Height :	137	feet
7. Exit Diameter :	1.9	feet
8. Exit Temperature :	207	°F
9. Actual Volumetric Flow Rate :	11120	acfm
10. Percent Water Vapor :	6.50	%
11. Maximum Dry Standard Flow Rate :	8261	dscfm
12. Nonstack Emission Point Height :	0	feet
13. Emission Point UTM Coordinates : Zone : 17 East (km) : 238.051 North (km) : 268.985		

14. Emission Point Comment :

Emission point coordinates are State Planar (km)

E. EMISSION POINT (STACK/VENT) INFORMATION

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Emission Point Description and Type :

1. Identification of Point on Plot Plan or Flow Diagram :	Class I Lfl Fare #3	
2. Emission Point Type Code :	1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking : (limit to 100 characters per point)		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common :		
5. Discharge Type Code :	V	
6. Stack Height :	38	feet
7. Exit Diameter :	1.1	feet
8. Exit Temperature :	999	°F
9. Actual Volumetric Flow Rate :	12519	acfm
10. Percent Water Vapor :	10.15	%
11. Maximum Dry Standard Flow Rate :	3145	dscfm
12. Nonstack Emission Point Height :	0	feet
13. Emission Point UTM Coordinates : Zone : 0 East (km) : 0.000 North (km) : 0.000		

14. Emission Point Comment :

Exit temp. is at least 1400 deg F. (Item 8. above is limited to 3 digits.)

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Flaring of landfill gas from the Class I Landfill	
2. Source Classification Code (SCC) : 30600108	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.14	5. Maximum Annual Rate : 1,209.00
6. Estimated Annual Activity Factor :	
7. Maximum Percent Sulfur : 0.01	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 573	
10. Segment Comment : See Appendix E for calculation of landfill gas energy content.	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Combustion of landfill gas in a rotary kiln used to recalcinate lime. (Natural gas is available as a backup fuel.)	
2. Source Classification Code (SCC) :	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.02	5. Maximum Annual Rate : 202.90
6. Estimated Annual Activity Factor :	
7. Maximum Percent Sulfur : 0.01	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 573	
10. Segment Comment :	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Combustion of landfill gas from Class I landfill to fire the sludge dryer used for the biosolids pelletizing process. (Natural gas is available as a backup fuel.)	
2. Source Classification Code (SCC) :	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.50	5. Maximum Annual Rate : 4,342.00
6. Estimated Annual Activity Factor :	
7. Maximum Percent Sulfur : 0.01	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 573	
10. Segment Comment :	

F. SEGMENT (PROCESS/FUEL) INFORMATION

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Segment Description and Rate : Segment 1

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode) : Flaring of gas from the gas system expansion at the Class I Landfill.	
2. Source Classification Code (SCC) : 30600108	
3. SCC Units : Million Cubic Feet Burned (all gaseous fuels)	
4. Maximum Hourly Rate : 0.21	5. Maximum Annual Rate : 1,839.60
6. Estimated Annual Activity Factor :	
7. Maximum Percent Sulfur : 0.01	8. Maximum Percent Ash :
9. Million Btu per SCC Unit : 573	
10. Segment Comment : See Appendix E for calculation of landfill gas energy content.	

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 1
Backup Flare for Both Facilities, Flare #2

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - CO			NS
2 - VOC	023		EL
3 - NOX			NS
4 - PM10			NS
5 - SO2			NS

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
3 - NOX	024		EL
4 - CO			NS
5 - VOC	023		EL
1 - PM10	010		EL
2 - SO2			NS

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - NOX	024		EL
2 - VOC	023		EL

G. EMISSIONS UNIT POLLUTANTS
(Regulated and Unregulated Emissions Units)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
1 - CO			NS
2 - VOC	023		EL
3 - NOX			NS
4 - PM10			NS
5 - SO2			NS

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **CO**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 26.1300000 lb/hour	114.4000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 0 Reference : Vendor Data	Units lbs/MMBtu
7. Emissions Method Code : 1	
8. Calculations of Emissions : EF = 0.33 lbs/MMBtu Landfill gas flow = 2300 scfm Energy content of gas = 573 Btu/scf 2300 * 573.3 * (1/10^6) Btu/MMBtu * 60 min/hour * 8760 hours/year = 693,051 MMBtu/yr 693,051 * 0.33 * 5e-4 tons/lbs =114.4 tpy	
9. Pollutant Potential/Estimated Emissions Comment :	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **VOC**

2. Total Percent Efficiency of Control : 98.00 %

3. Potential Emissions :
   0.3400000 lb/hour 1.5000000 tons/year

4. Synthetically Limited?
   [ ] Yes [X] No

5. Range of Estimated Fugitive/Other Emissions:
   to tons/year

6. Emissions Factor 98 Units percent removal
   Reference : NSPS, AP-42

7. Emissions Method Code : 3

8. Calculations of Emissions :

   Landfill gas flow rate = 2300 scfm * 1/35.31 m3/ft3 * 60 min/hr * 8760 hr/yr = 34.24 million scm/yr

   MW of NMOC (as hexane) = 86.17 g/mol
   NMOC concentration = 595 ppmdv (AP-42)
   NMOC destruction efficiency of 98% (0.02)

   595 ppmdv * 41.57 mol/m3 * 86.17 g/mol = 2131342 $\mu g/m^3$
   2131342 ug/m3 * 1e-06 g/ug * 34.24 million scm/yr = 73 Mg/yr (uncontrolled)
   73 * 1.0132 ton/Mg = 74 tpy uncontrolled
   = 16.9 lbs/hr uncontrolled

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

74 * 0.02 = 1.5 tons/yr (controlled)
(1.5 * 2000 lbs/ton)/ 8760 hrs/yr = 0.34 lbs/hr

9. Pollutant Potential/Estimated Emissions Comment :

See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Potential/Estimated Emissions : Pollutant 3

1. Pollutant Emitted : **NOX**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 5.2300000 lb/hour	22.9000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 0 Units lbs/MMBtu Reference : Vendor information	
7. Emissions Method Code : 1	
8. Calculations of Emissions : EF = 0.066 lbs/MMBtu Landfill gas flow rate = 2300 scfm Energy content of gas = 573 Btu/scf 2300 * 573.3 * (1/10^6) Btu/MMBtu * 60 min/hour * 8760 hours/year = 693,051 MMBtu/yr 693,051 * 0.066 * 5e-4 tons/lbs = 22.9 tpy	
9. Pollutant Potential/Estimated Emissions Comment :	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Potential/Estimated Emissions : Pollutant 4

1. Pollutant Emitted : **PM10**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 1.2700000 lb/hour 5.5600000 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor 17 Units lb/MMdscf meth Reference : AP-42
7. Emissions Method Code : 3
8. Calculations of Emissions : Landfill methane emission = 1244.3 dscfm = 0.075 10^6 dscf/hr Emission factor = 17 lbs/10^6 dscf methane 0.075 * 17 =1.3 lbs/hr 1.9 lbs/hr * 8760 hrs/yr * 1 ton/2000 lbs = 5.56 tons/year
9. Pollutant Potential/Estimated Emissions Comment : See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Potential/Estimated Emissions : Pollutant 5

1. Pollutant Emitted : **SO2**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 2.3000000 lb/hour	10.1000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor Units Reference : mass balance, AP-42	
7. Emissions Method Code : 3	

8. Calculations of Emissions :

Landfill gas flow rate: 3.423 E+07 m³/yr
Concentration of S in Landfill Gas:100 ppmV
MW of S: 32.06 g/mol
Ratio of MWs SO2/S: 2

3.423 E+07 m³/yr * 100/1000000 = 3,423 m³/yr of S

3,423 m3/yr * 1/1000 kg/g * 32.06 g/mol * 41.57 mol/m³ = 4,562 kg/yr of S
4,562 * 2 = 9,124 kg/yr of SO2
= 2.3 lbs/hr

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

= 9.3 tpy
9. Pollutant Potential/Estimated Emissions Comment : See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **PM10**
2. Total Percent Efficiency of Control : 99.00 %
3. Potential Emissions : 1.5200000 lb/hour 6.7000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor 0 Units gr/dscf @ 10%O2 Reference : FEE, Vendor
7. Emissions Method Code : 2
8. Calculations of Emissions : Emission Factor: 0.013 gr/dscf @10% O2 Exit flow: 13632 dscfm @ 10% O2 0.013 * 13632 * (1 g/15.43 grain) * (1 min/60 second) = 0.19 g/s EF = 0.19 g/s 1 ton = 907200 g 3600 second = 1 hour 8760 hours = 1 year 0.19 * (1/907200) * 3600 * 8760 = 6.65 tons/year

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

9. Pollutant Potential/Estimated Emissions Comment :

   Emission calculation based on vendor information (FEE Minerals USA)

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **SO2**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 1.4000000 lb/hour 6.1000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor 0 Units lbs/hr/scfm Reference : EPA
7. Emissions Method Code : 4
8. Calculations of Emissions : Emission factor assumes 100 ppmv sulfur in landfill gas EF: .000998 lbs/hr/scfm Flow: 1400 scfm (max design flow rate) 0.000998 * 1400 scfm = 1.4 lbs/hr
9. Pollutant Potential/Estimated Emissions Comment : See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Potential/Estimated Emissions : Pollutant 3

1. Pollutant Emitted : **NOX**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 16.0100000 lb/hour	71.0000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 0 Units lbs/MMbtu Reference : Vendor Information	
7. Emissions Method Code : 5	
8. Calculations of Emissions : EF: 0.485 lbs/MMBtu Heating rate: 33 MMBtu/hr 0.485 * 33 = 16.01 lbs/hr	
9. Pollutant Potential/Estimated Emissions Comment : Emission calculation based on vendor information (FEE Minerals USA) See Appendix E	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Potential/Estimated Emissions : Pollutant 4

1. Pollutant Emitted : **CO**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 8.9200000 lb/hour	39.1000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 150 Units ppmv Reference : Vendor Information	
7. Emissions Method Code : 5	
8. Calculations of Emissions :	
9. Pollutant Potential/Estimated Emissions Comment : Emission calculation based on vendor information (FEE Minerals USA) See Appendix E	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Potential/Estimated Emissions : Pollutant 5

1. Pollutant Emitted : **VOC**

2. Total Percent Efficiency of Control : %

3. Potential Emissions :
   2.2300000 lb/hour 9.7600000 tons/year

4. Synthetically Limited?
   [ ] Yes [ ] No

5. Range of Estimated Fugitive/Other Emissions:
   to tons/year

6. Emissions Factor 20 Units ppmv @3% O2
   Reference : Vendor Information

7. Emissions Method Code : 5

8. Calculations of Emissions :

   20 ppmv @ 3% O2 = 12.18 ppm @10% O2
   flow rate: 13632 dscfm or 6.43 dscm/sec

   (12.18 mol CO/1e+6 moles) * 41.57 moles/dscm * 86.18 g/mole = 0.044 g/dscm

   0.044 * 6.43 = 0.28 g/sec

   0.28 * 1.1e-6 ton/g * 3600 sec/hour * 8760 hrs/year = 9.76 ton/year

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

9. Pollutant Potential/Estimated Emissions Comment :

   Emission calculation based on vendor information (FEE Minerals USA)
   See Appendix E

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **NOX**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 1.6000000 lb/hour	7.0000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 2 Reference : Vendor Information	Units lbs/hour
7. Emissions Method Code : 5	
8. Calculations of Emissions : 1.6 lbs/hour 8760 hours/year 1.6 * 8760 * 5e-4 tons/lb = 7.0 tpy	
9. Pollutant Potential/Estimated Emissions Comment : Emission Factor provided by North American Burner. See Appendix E	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **VOC**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 0.3000000 lb/hour	1.3000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 0 Units lbs/hr Reference : Vendor Information	
7. Emissions Method Code : 5	
8. Calculations of Emissions : Emission Factor: 0.3 lbs/hr 8760 hours per year 0.3 * 8760 * 5e-4 tons/lbs = 1.3 tpy	
9. Pollutant Potential/Estimated Emissions Comment : Emission Factor provided by Andritz. See Appendix E	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION

(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Potential/Estimated Emissions : Pollutant 1

1. Pollutant Emitted : **CO**
2. Total Percent Efficiency of Control : %
3. Potential Emissions : 39.7000000 lb/hour 174.0000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No
5. Range of Estimated Fugitive/Other Emissions: to tons/year
6. Emissions Factor 0 Units lb/MMBtu Reference : Vendor Data
7. Emissions Method Code : 1
8. Calculations of Emissions : EF = 0.33 lb/MMBtu Flare heat input = 3,500 scfm * 573.3 Btu/scf * 60 min/hr = 120.4 MMBtu/hr 120.4 MMBtu/hr * 0.33 lb CO/MMBtu = 39.7 lb/hr 39.7 lb/hr * 24 hr/day * 365 day/yr * 1/2000 ton/lb = 174.0 ton/year
9. Pollutant Potential/Estimated Emissions Comment :

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Potential/Estimated Emissions : Pollutant 2

1. Pollutant Emitted : **VOC**	
2. Total Percent Efficiency of Control : 98.00 %	
3. Potential Emissions : 0.5600000 lb/hour	2.4000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 98 Units percent removal Reference : AP-42 and NSPS	
7. Emissions Method Code : 3	

8. Calculations of Emissions :

Landfill gas flow rate = 3,500 scfm * 1/35.31 m3/ft3 * 60 min/hr = 5947.3 m3/hr

NMOC conc. in landfill gas = 595 ppmdv (AP-42)
MW of NMOC (as hexane) = 86.17 g/mol
NMOC destruction efficiency by flare = 98% (0.02)

595 ppmdv * 41.57 mol/m3 * 86.17 g/mol = 2131342 ug/m3
2131342 ug/m3 * 5947.3 m3/hr * 1e-06 g/ug * 1/453.59 lb/g = 27.9 lb/hr uncontrolled NMOC
27.9 lb/hr * 0.02 = 0.56 lb/hr controlled NMOC
0.56 lb/hr * 24 hr/day * 365 day/yr * 1/2000 ton/lb = 2.4 ton/yr controlled NMOC

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

9. Pollutant Potential/Estimated Emissions Comment :

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Potential/Estimated Emissions : Pollutant 3

1. Pollutant Emitted : **NOX**	
2. Total Percent Efficiency of Control : %	
3. Potential Emissions : 7.9500000 lb/hour	34.8000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No	
5. Range of Estimated Fugitive/Other Emissions: to	tons/year
6. Emissions Factor 0 Reference : Vendor information	Units lb/MMBtu
7. Emissions Method Code : 1	
8. Calculations of Emissions : EF = 0.066 lb/MMBtu flare heat input = 3,500 scfm * 573.3 Btu/scf * 60 min/hr = 120.4 MMBtu/hr 120.4 MMBtu/hr * 0.066 lb/MMBtu = 7.95 lb/hr NOx 7.95 lb/hr * 24 hr/day * 365 day/yr * 1/2000 ton/lb = 34.8 ton/yr	
9. Pollutant Potential/Estimated Emissions Comment :	

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION

(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Potential/Estimated Emissions : Pollutant 4

1. Pollutant Emitted : **PM10**

2. Total Percent Efficiency of Control : %

3. Potential Emissions :
   1.8800000 lb/hour 8.2000000 tons/year

4. Synthetically Limited?
   [ ] Yes [X] No

5. Range of Estimated Fugitive/Other Emissions:
   to tons/year

6. Emissions Factor 17 Units lb/MMdscf meth
   Reference : AP-42

7. Emissions Method Code : 3

8. Calculations of Emissions :

   EF = 17 lb PM10 per million dscf methane
   Methane = 58.5% by volume of landfill gas
   landfill gas flow rate = 3145 dscfm
   Methane flow rate = 3145 dscfm * 0.585 = 1839.8 dscfm methane

   17 lb / 10^6 dscf * 1839.8 dscfm * 1e-06 * 60 min/hr = 1.88 lb/hr
   1.88 lb/hr * 24 hr/day * 365 day/yr * 1/2000 ton/lb = 8.2 ton/yr

9. Pollutant Potential/Estimated Emissions Comment :

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Potential/Estimated Emissions : Pollutant 5

1. Pollutant Emitted : **SO2**		
2. Total Percent Efficiency of Control :	%	
3. Potential Emissions :	3.4900000 lb/hour	15.3000000 tons/year
4. Synthetically Limited? [ ] Yes [X] No		
5. Range of Estimated Fugitive/Other Emissions:	to	tons/year
6. Emissions Factor Reference : Mass balance, AP-42	Units	
7. Emissions Method Code : 3		
8. Calculations of Emissions : Assume all sulfur in landfill gas is converted to SO2 in flare. Upper bound conc. of sulfur (S) in landfill gas = 100 ppmv MW of S = 32.06 g/mol Ratio of MWs SO2/S = 2 Landfill gas flow = 3,500 scfm * 1/35.31 m3/ft3 * 60 min/hr = 5947.3 m3/hr 100 ppmv * 41.57 mol/m3 * 32.06 g/mol = 133273 ug/m3 S in gas 133273 ug/m3 * 5947.3 m3/hr * 1e-06 g/ug * 1/453.59 lb/g * 2 = 3.49 lb/hr SO2 3.49 lb/hr * 24 hr/day * 365 day/yr * 1/2000 ton/lb = 15.3 ton/yr SO2		

H. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units Only - Emissions Limited Pollutants Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

9. Pollutant Potential/Estimated Emissions Comment :

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Pollutant Information Section 2

Allowable Emissions 1

1. Basis for Allowable Emissions Code : RULE	
2. Future Effective Date of Allowable Emissions :	
3. Requested Allowable Emissions and Units : 98.00 percent removal	
4. Equivalent Allowable Emissions : lb/hour	tons/year
5. Method of Compliance : 40 CFR 60.18	
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Required by 40 CFR 60 Subpart WWW HCl is emitted in less than threshold amounts, and not emissions limited, so it is not reported in H. See Appendix D.	

Emissions Unit Information Section 2
Lime Recalcination Facility Kiln Process

Pollutant Information Section 1

Allowable Emissions 1

1. Basis for Allowable Emissions Code :		
2. Future Effective Date of Allowable Emissions :		
3. Requested Allowable Emissions and Units :		
4. Equivalent Allowable Emissions :	lb/hour	tons/year
5. Method of Compliance :		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Not applicable		

Emissions Unit Information Section 2
Lime Recalcination Facility Kiln Process

Pollutant Information Section 2

Allowable Emissions 1

1. Basis for Allowable Emissions Code :		
2. Future Effective Date of Allowable Emissions :		
3. Requested Allowable Emissions and Units :		
4. Equivalent Allowable Emissions :	lb/hour	tons/year
5. Method of Compliance :		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Not applicable		

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Information Section 3

<u>Allowable Emissions</u> 1

1. Basis for Allowable Emissions Code :	
2. Future Effective Date of Allowable Emissions :	
3. Requested Allowable Emissions and Units :	
4. Equivalent Allowable Emissions : lb/hour	tons/year
5. Method of Compliance :	
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Not Applicable	

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Pollutant Information Section 4

Allowable Emissions 1

1. Basis for Allowable Emissions Code :	
2. Future Effective Date of Allowable Emissions :	
3. Requested Allowable Emissions and Units :	
4. Equivalent Allowable Emissions : lb/hour	tons/year
5. Method of Compliance :	
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Not applicable	

Emissions Unit Information Section 3
Biosolids Pelletizing Facility Dryer Train

Pollutant Information Section 1

<u>Allowable Emissions</u> 1

1. Basis for Allowable Emissions Code :	
2. Future Effective Date of Allowable Emissions :	
3. Requested Allowable Emissions and Units :	
4. Equivalent Allowable Emissions : lb/hour	tons/year
5. Method of Compliance :	
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : Not Applicable. PM10, VOC, NH3, SO2, CO and H2S are all emitted in less than threshold amounts and are not emissions limited, so they are not reported in Section H. See Appendix D.	

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Pollutant Information Section 2

Allowable Emissions 1

1. Basis for Allowable Emissions Code :	RULE	
2. Future Effective Date of Allowable Emissions :		
3. Requested Allowable Emissions and Units :	98.00	percent removal
4. Equivalent Allowable Emissions :	lb/hour	tons/year
5. Method of Compliance : 40 CFR 60.18		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode) : 40 CFR Subpart WWW		

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 1
Backup Flare for Both Facilities, Flare #2

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	05		
2. Basis for Allowable Opacity :	RULE		
3. Requested Allowable Opacity :			
	Normal Conditions :	5	%
	Exceptional Conditions :	20	%
	Maximum Period of Excess Opacity Allowed :	5	min/hour
4. Method of Compliance : EPA Reference Method 22 (40 CFR 60 Appendix A)			
5. Visible Emissions Comment : 40 CFR 60.18(c)(1): no visible emissions (<5% opacity), as determined by Method 22, except for peridos not exceeding 5 minutes during two consecutive hours.			

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 2
Lime Recalcination Facility Kiln Process

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	05		
2. Basis for Allowable Opacity :	RULE		
3. Requested Allowable Opacity :			
Normal Conditions :		5	%
Exceptional Conditions :		20	%
Maximum Period of Excess Opacity Allowed :		5	min/hour
4. Method of Compliance :			
Method 22 (40 CFR Appendix A)			
5. Visible Emissions Comment :			
40 CFR 60.18(c)(1): no visible emissions (<5% opacity), as determined by Method 22, except for periods not exceeding 5 minutes during two consecutive hours.			

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 3
Biosolids Pelletizing Facility Dryer Train

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	05
2. Basis for Allowable Opacity :	RULE
3. Requested Allowable Opacity : Normal Conditions : 5 % Exceptional Conditions : 20 % Maximum Period of Excess Opacity Allowed : 5 min/hour	
4. Method of Compliance : Method 22 (40 CFR 60 Appendix A)	
5. Visible Emissions Comment : 40 CFR 60.18(c)(1): no visible emissions (<5% opacity), as determined by Method 22, except for periods not exceeding 5 minutes during two consecutive hours.	

I. VISIBLE EMISSIONS INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Visible Emissions Limitation : Visible Emissions Limitation 1

1. Visible Emissions Subtype :	05		
2. Basis for Allowable Opacity :	RULE		
3. Requested Allowable Opacity :			
	Normal Conditions :	5	%
	Exceptional Conditions :	20	%
	Maximum Period of Excess Opacity Allowed :	5	min/hour
4. Method of Compliance : EPA Reference Method 22 (40 CFR 60 Appendix A)			
5. Visible Emissions Comment : 40 CFR 60.18(c)(1): no visible emissions (<5% opacity), as determined by Method 22, except for periods not exceeding 5 minutes during two consecutive hours.			

J. CONTINUOUS MONITOR INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Information Section

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :					
PM :	C	SO2 :	C	NO2 :	C
4. Baseline Emissions :					
PM :		lb/hour		tons/year	
SO2 :		lb/hour		tons/year	
NO2 :				tons/year	
5. PSD Comment :					
As per FAC 62-212.400, PM, SO2, and NO2 collateral emissions resulting from a control devices are not considered significant					

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :		
PM : C	SO2 : C	NO2 : C
4. Baseline Emissions :		
PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year
5. PSD Comment :		

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[X] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :		
PM : C	SO2 : C	NO2 : C
4. Baseline Emissions :		
PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year
5. PSD Comment :		

K. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENT TRACKING INFORMATION

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

PSD Increment Consumption Determination

1. Increment Consuming for Particulate Matter or Sulfur Dioxide?

[ ] The emissions unit is undergoing PSD review as part of this application, or has undergone PSD review previously, for particulate matter or sulfur dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after January 6, 1975. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after January 6, 1975, but before December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after December 27, 1977. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, the baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

2. Increment Consuming for Nitrogen Dioxide?

[ ] The emissions unit addressed in this section is undergoing PSD review as part of this application, or has undergone PSD review previously, for nitrogen dioxide. If so, emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source pursuant to paragraph (c) of the definition of "major source of air pollution" in Chapter 62-213, F.A.C., and the emissions unit addressed in this section commenced (or will commence) construction after February 8, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] The facility addressed in this application is classified as an EPA major source, and the emissions unit began initial operation after February 8, 1988, but before March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] For any facility, the emissions unit began (or will begin) initial operation after March 28, 1988. If so, baseline emissions are zero, and emissions unit consumes increment.

[ ] None of the above apply. If so, baseline emissions of the emissions unit are nonzero. In such case, additional analysis, beyond the scope of this application, is needed to determine whether changes in emissions have occurred (or will occur) after the baseline date that may consume or expand increment.

3. Increment Consuming/Expanding Code :		
PM :	SO2 :	NO2 :
4. Baseline Emissions :		
PM :	lb/hour	tons/year
SO2 :	lb/hour	tons/year
NO2 :		tons/year
5. PSD Comment :		

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 1

Backup Flare for Both Facilities, Flare #2

Supplemental Requirements for All Applications

1. Process Flow Diagram :	Appendix C
2. Fuel Analysis or Specification :	NA
3. Detailed Description of Control Equipment :	Appendix J
4. Description of Stack Sampling Facilities :	Appendix K
5. Compliance Test Report :	NA
6. Procedures for Startup and Shutdown :	Appendix L
7. Operation and Maintenance Plan :	Appendix M
8. Supplemental Information for Construction Permit Application :	Appendix E
9. Other Information Required by Rule or Statue :	See Vol III

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	NA

14. Acid Rain Application (Hard-copy Required) :

NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 2

Lime Recalcination Facility Kiln Process

Supplemental Requirements for All Applications

1. Process Flow Diagram :	Appendix C
2. Fuel Analysis or Specification :	NA
3. Detailed Description of Control Equipment :	Appendix J
4. Description of Stack Sampling Facilities :	Appendix K
5. Compliance Test Report :	NA
6. Procedures for Startup and Shutdown :	Appendix L
7. Operation and Maintenance Plan :	Appendix M
8. Supplemental Information for Construction Permit Application :	Appendix E
9. Other Information Required by Rule or Statue :	See Vol. III

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	Appendix G

14. Acid Rain Application (Hard-copy Required) :

NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 3

Biosolids Pelletizing Facility Dryer Train

Supplemental Requirements for All Applications

1. Process Flow Diagram :	Appendix C
2. Fuel Analysis or Specification :	NA
3. Detailed Description of Control Equipment :	Appendix J
4. Description of Stack Sampling Facilities :	Appendix K
5. Compliance Test Report :	NA
6. Procedures for Startup and Shutdown :	Appendix L
7. Operation and Maintenance Plan :	Appendix M
8. Supplemental Information for Construction Permit Application :	Appendix E
9. Other Information Required by Rule or Statue :	NA

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :	NA
11. Alterntive Modes of Operation (Emissions Trading) :	NA

12. Identification of Additional Applicable Requirements :	NA
13. Compliance Assurance Monitoring Plan :	NA
14. Acid Rain Application (Hard-copy Required) :	
NA	Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
NA	Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
NA	New Unit Exemption (Form No. 62-210.900(1)(a)2.)
NA	Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

L. EMISSIONS UNIT SUPPLEMENTAL INFORMATION

Emissions Unit Information Section 4

Class I Landfill Flare, Flare #3

Supplemental Requirements for All Applications

1. Process Flow Diagram :
2. Fuel Analysis or Specification :
3. Detailed Description of Control Equipment :
4. Description of Stack Sampling Facilities :
5. Compliance Test Report :
6. Procedures for Startup and Shutdown :
7. Operation and Maintenance Plan :
8. Supplemental Information for Construction Permit Application :
9. Other Information Required by Rule or Statue :

Additional Supplemental Requirements for Category I Applications Only

10. Alternative Methods of Operations :
11. Alterntive Modes of Operation (Emissions Trading) :

12. Identification of Additional Applicable Requirements :
13. Compliance Assurance Monitoring Plan :
14. Acid Rain Application (Hard-copy Required) : Acid Rain Part - Phase II (Form No. 62-210.900(1)(a)) Repowering Extension Plan (Form No. 62-210.900(1)(a)1.) New Unit Exemption (Form No. 62-210.900(1)(a)2.) Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)

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Solid Waste Authority of
Palm Beach County
NCRRF Site
Facility # 0990234
Title V permit modification
Copy 1 of 4

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Title V permit modification
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NCRRF Site
Facility # 0990234
Title V permit modification
Copy 4 of 4

Appendix A
Area Map

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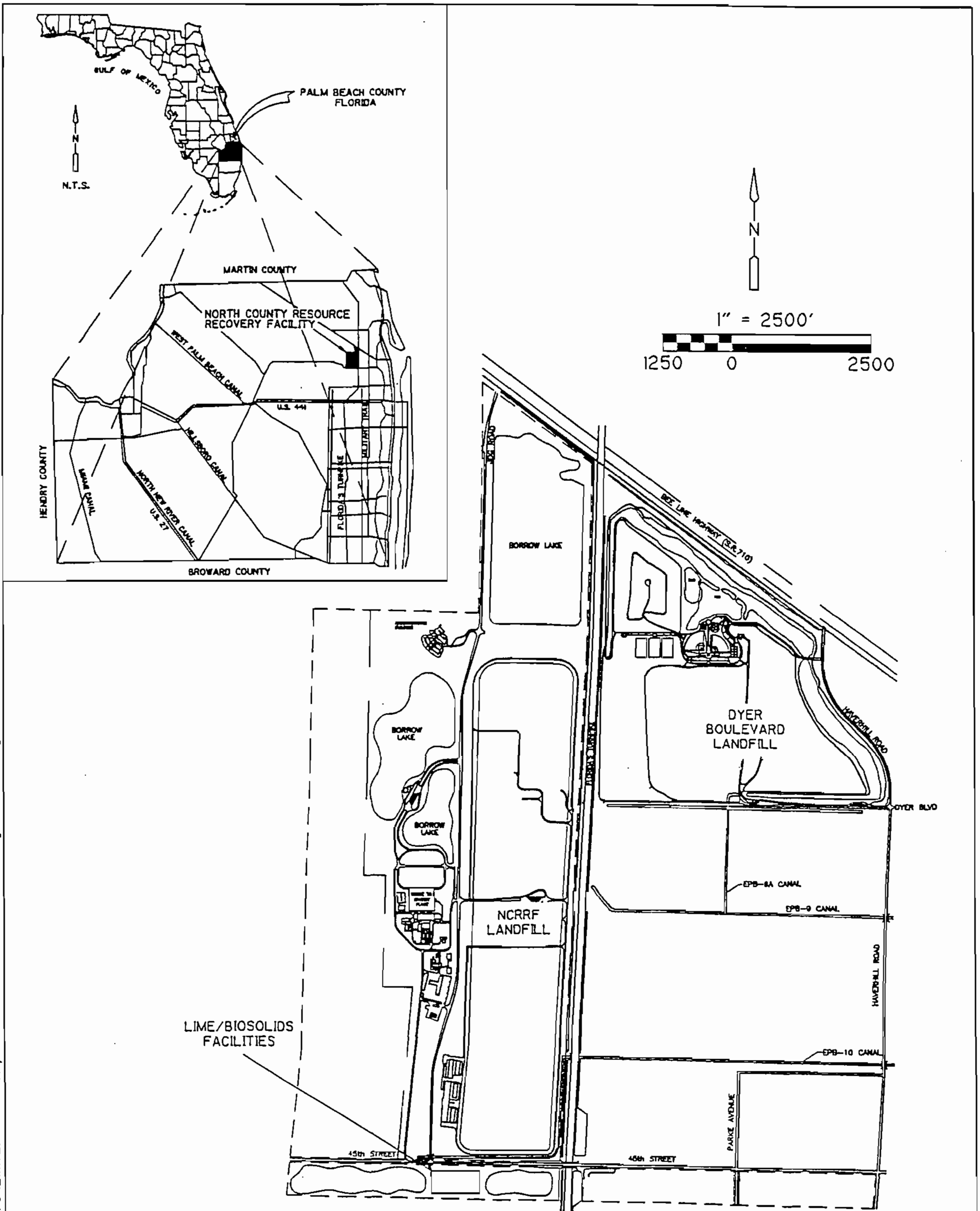
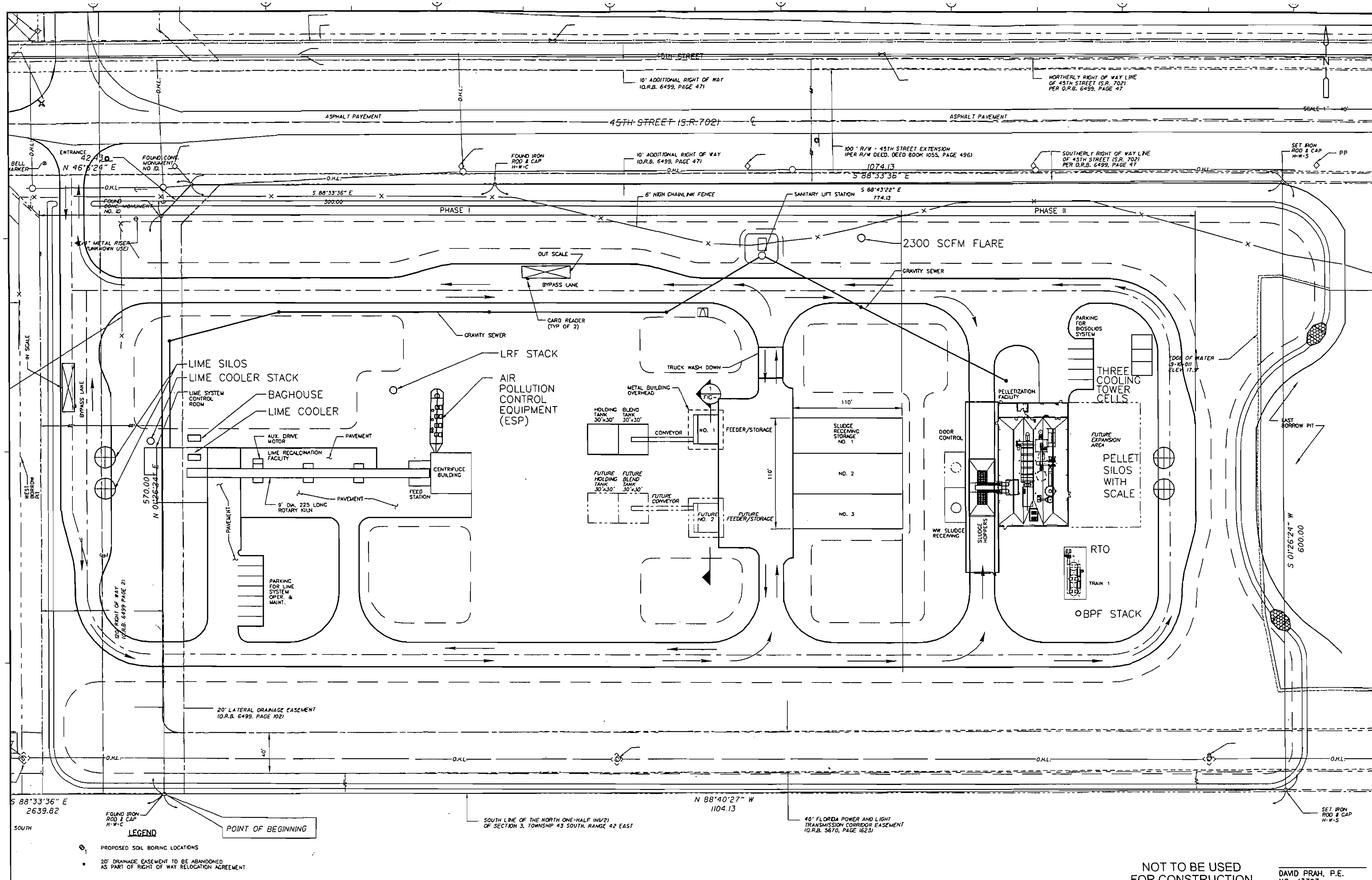


Solid Waste Authority of Palm Beach County
NCRRF and Dyer Boulevard Landfill Water Use Allocation

CDM

Appendix A
Area Map

Appendix B
Facility Plot Plan



NOT TO BE USED FOR CONSTRUCTION

DAVID PRAH, P.E.
NO. 43393

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. HILL
DRAWN BY: O. AUST
SHEET CHK'D BY: O. PRAH
CROSS CHK'D BY: J. HILL
APPROVED BY: O. PRAH
DATE: MAY 2002

CDM Camp Dresser & McKee Inc.
2310 Maitland Center Parkway, Suite 300
Maitland, Florida 32751
Tel: 407-660-2552
Cert. of Authorization No. 20

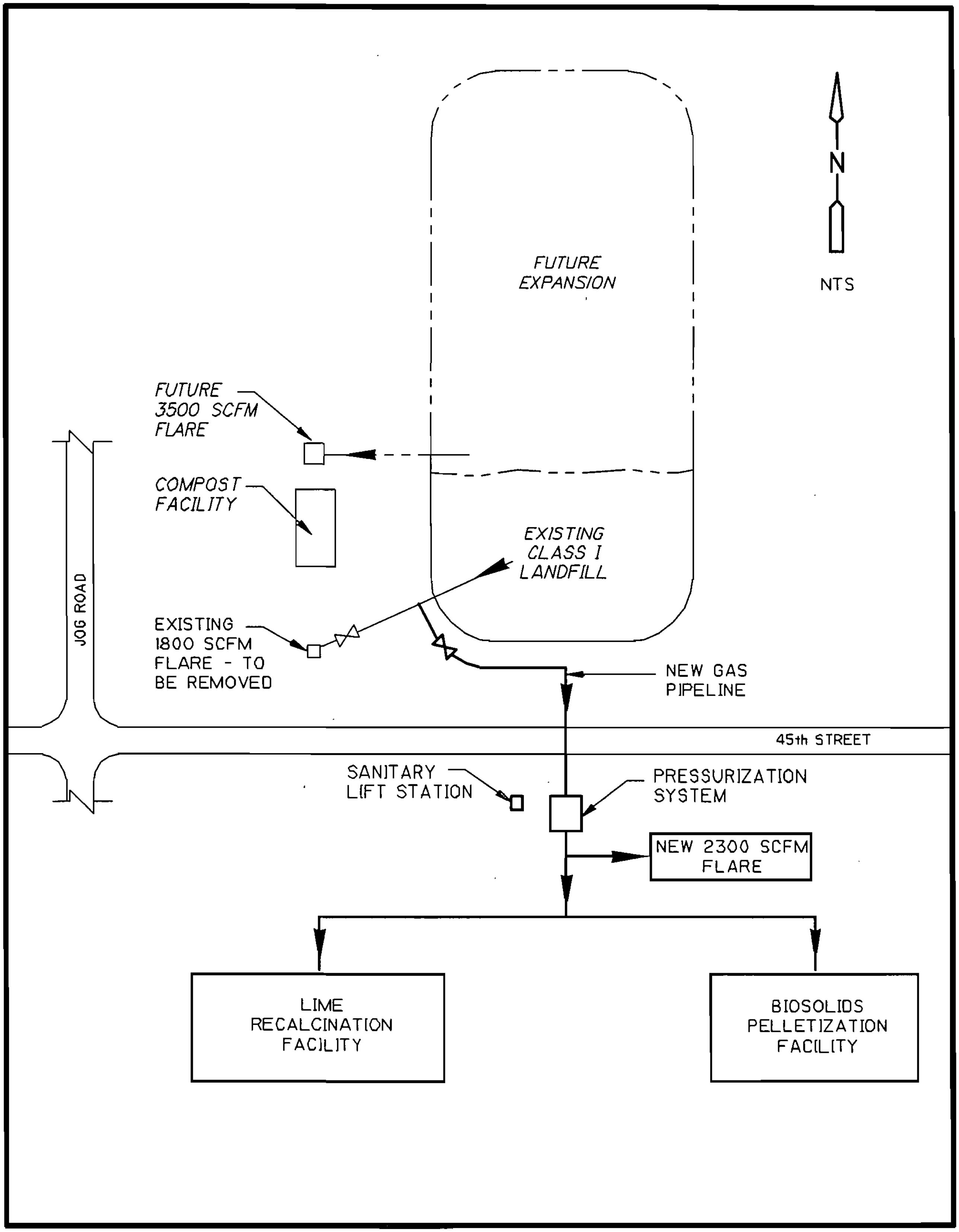
SOLID WASTE AUTHORITY
OF PALM BEACH COUNTY
7501 NORTH JOG ROAD

LIME RECALCINATION FACILITY

LIME RECALCINATION FACILITY AND
BIOSOLIDS PELLETIZATION FACILITY

PROJECT NO. 2678-33750
FILE NAME: FIGURE13.DWG

SHEET NO.
FIGURE B-1



L:\2678\33750\Lime\30P\REPORT\FIGB-2 10/15/02 16:41:06 8:07:20 gerthjl

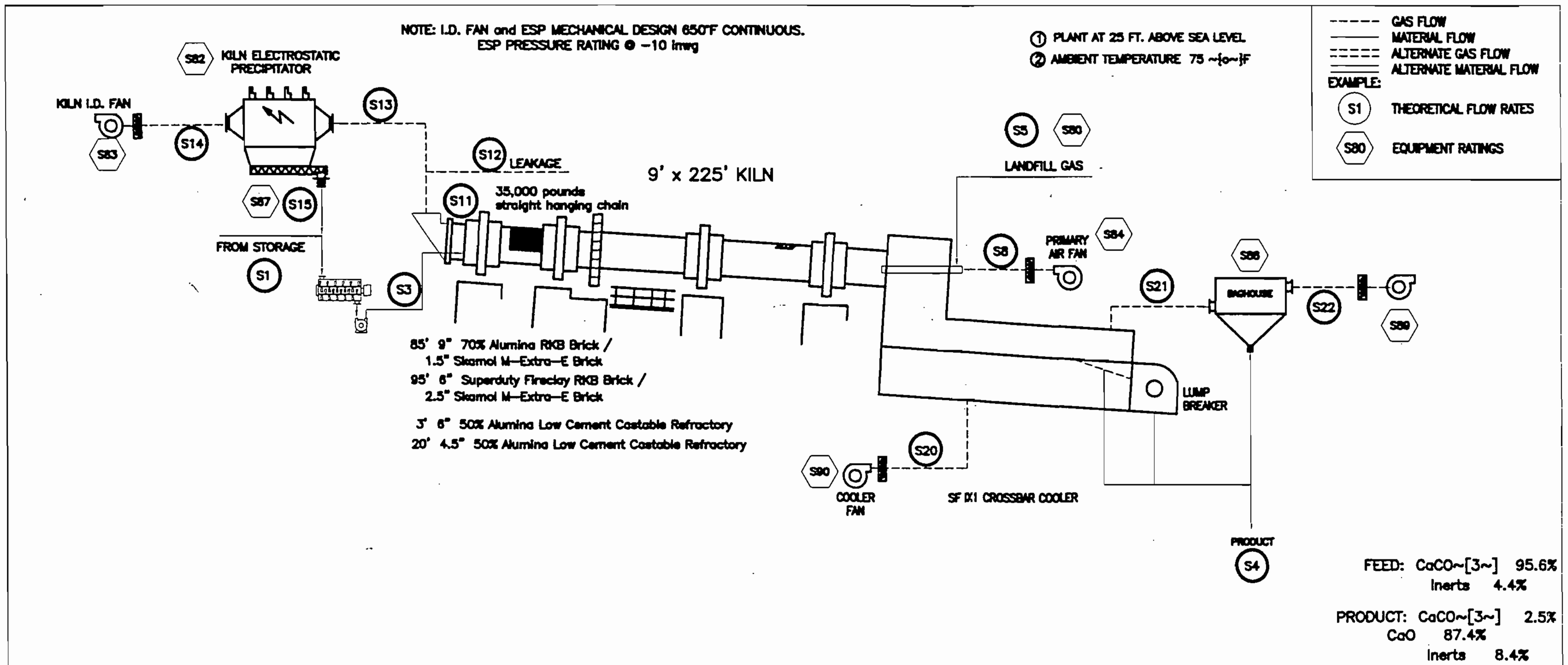
CDM

Figure No. B-2
Tie-in of Landfill
Gas Collection to the
LRF and BPF

Appendix C
Process Flow Diagrams

SOLID/LIQUID/GAS	UNITS	S1	S3	S4	S8	S11	S12	S13	S14	S15	S20	S21	S22	S82	S83	S84	S87	S88	S89
MASS FLOW – SOLID	LB/HR	14354.8	16437.2	8332.7	0.0	2083.2	0.0	2083.2	0.6	2082.5	0.0	0.0	0.0	4243.3	0.6	0.0	4165.1	4553.9	0.9
MASS FLOW –LIQUID	LB/HR	8798.1	8798.0	0.0						0.0							0.0		
MASS FLOW – GAS	LB/HR				4056.5	47741.1	6000.0	53741.1	53741.1		34642.2	10080.0	10080.0	53846.6	55210.7	5254.1		34642.2	34642.2
MASS FLOW – TOTAL	LB/HR	23152.9	25235.3	8332.7	4056.5	49824.3	6000.0	55824.3	53741.8	2082.5	34642.2	10080.0	10080.0	58089.9	55211.4	5254.1	4165.1	39196.1	34643.1
VOLUME	ACFM				853.9	19725.9	1349.7	21355.9	21043.0		7531.0	1763.3	1785.1	24752.6	25379.7	1181.9		13282.4	13282.4
VOLUME	NCFM				837.7	10606.6	1239.0	11850.3	11850.3		7153.7	2081.6	2081.6	11873.6	12174.4	1085.0		7153.7	7153.7
VOLUME	GAL/MIN																		
TEMPERATURE	°F	100.0	110.8	140.0	75.0	450.0	75.0	417.5	402.5	402.5	90.0	125.0	125.0	550.0	550.0	75.0	550.0	425.0	425.0
STATIC PRESSURE	INWG				28.0	–1.5	0.0	–3.5	–4.5		26.0	165.5	158.5	–5.5	–5.5	0.0		–12.0	–12.0
DENSITY	LB/ACF				0.0792	0.0403	0.0741	0.0419	0.0426		0.0767	0.0953	0.0941	0.0363	0.0363	0.0741		0.0435	0.0435
DENSITY	LB/GAL																		
DUST LOAD	GR/ACF				0.00	12.32	0.00	11.38	0.00		0.00	0.00	0.00	20.00	0.00	0.00		40.00	0.01
H_2O DEW POINT	°F				0.00	166.45	0.00	161.52	161.42		0.00	0.00	0.00	161.32	161.32	0.00		0.00	0.00
COMPOSITION H_2O	VOL % H_2O				0.00	37.78	0.00	33.81	33.81		0.00	0.00	0.00	33.81	33.81	0.00		0.00	0.00
COMPOSITION O_2	VOL % O_2				20.88	1.31	20.88	3.37	3.37		20.88	20.88	20.88	3.37	3.37	20.88		20.88	20.88

FUEL STREAMS	UNITS	S5	S80
MASS FLOW	LB/HR	5878.10	7641.52
HEAT RELEASE	MMBTU/HR	30.4638	39.6030
DENSITY LIQUID	LB/GAL		
DENSITY GAS	LB/NCF	0.0707	0.0707
FLOWRATE LIQUID	GAL/MIN		
FLOWRATE GAS	NCFM	1385.69	1801.40
FLOWRATE SOLID	DRY STPH		
	WET STPH		
TEMPERATURE	°F	60.0	60.0
DRY LHV	BTU/LB	5182.6	5182.6
SURFACE MOISTURE	% H_2O	0.00	0.00
ULT ANALYSIS C	%	31.14	31.14
ULT ANALYSIS H	%	6.15	6.15
ULT ANALYSIS O	%	38.32	38.32
ULT ANALYSIS H_2O	%	0.00	0.00
ULT ANALYSIS N	%	24.39	24.39
ULT ANALYSIS S	%	0.00	0.00
ULT ANALYSIS ASH	%	0.00	0.00



SOURCE:
FFE MINERALS USA INC.

NOT TO BE USED
FOR CONSTRUCTION

DAVID PRAH, P.E.
NO. 43393

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. HILL
DRAWN BY: M. BANDA
SHEET CHK'D BY: D. PRAH
CROSS CHK'D BY: J. HILL
APPROVED BY: D. PRAH
DATE: SEPTEMBER 2002

CDM Camp Dresser & McKee Inc.

SOLID WASTE AUTHORITY
OF PALM BEACH COUNTY
7501 NORTH JOG ROAD

LIME RECALCINATION FACILITY

ENERGY AND MATERIAL BALANCE
DIAGRAM

PROJECT NO. 2678–33752
FILE NAME: FIGURE–1.dwg
SHEET NO.
Figure C-1

Appendix D
Precautions to Prevent Emissions of Unconfined Particulate Matter

Appendix D
Precautions to Prevent Emissions of Unconfined Particulate Matter

In accordance with the guidance contained in 62-296.320(4)(b)4.a., Florida Administrative Code, Control of Unconfined Particulate Matter, the following dust control measures are practiced at the Solid Waste Authority of Palm Beach County North County Resource Recovery Facility:

- All parking lots and permanent drives are paved;
- A water truck sprays water as a dust suppressant to unpaved roads and active unpaved areas;
- Landfill areas that are closed are promptly revegetated; and
- Ash is quenched with water prior to landfilling.

APPENDIX E
SWA Lime Recalcination Facility and Sludge Pelletization Facility
Emission Calculation Tables

The tables in this Appendix include the emission inventory for the SWA Lime Recalcination and Biosolids Pelletizing Facility PSD permit modification, along with calculation and information support documentation for the inventory.

Table Number	Table Name	Description
E-1	Estimated Maximum Potential Emission Rates	Summary of emission factors and emission rates for PSD pollutants emitted from the LRF, BPF, and flares
E-2	Estimated Emission Rates for the Lime Kiln	Calculation of the lime kiln emissions based on Vendor (FFE Minerals, Dave Gunkle) Information
E-3	Estimated PM Emission Rates for Baghouses, Lime Silos, Sludge Pelletizing Silos	Calculation of PM/PM10 emissions from the proposed baghouses, based on vendor information (Lime: FFE Minerals, Dave Gunkle; BPF: Andritz, Peter Commerford)
A-4	Cooling Tower Air Emissions - PM	Calculation of PM emissions from the cooling tower based on known design parameters and AP-42 estimates.
E-5	Methane Emission Rates	Calculation of Methane and NMOC emission rates for the lime kiln.
E-6	HAP Emission Rates	Calculation of HAP emission rates for the lime kiln, based on default HAP concentrations in landfill gas as listed in AP-42
E-7	Methane Emission Rates	Calculation of Methane and NMOC emission rates for the biosolids pelletizing dryer.
E-8	HAP Emission Rates	Calculation of HAP emission rates for the biosolids pelletizing dryer, based on default HAP concentrations in landfill gas as listed in AP-42
	Existing Flare Emission Calculations	
E-9	Methane Emission Rates	Calculation of Methane and NMOC emission rates for the existing flare.
E-10	HAP Emission Rates	Calculation of HAP emission rates for the existing flare, based on default HAP concentrations in landfill gas as listed in AP-42

E-11	Estimated Emissions for the Existing Flare	Calculation of CO, NO_X, PM, SO2 and HCl based on AP-42 emission factors.
New Backup Flare Emission Calculations (Scenario: All LFG going to Flare)		
E-12	Exit Gas Flow Rate Calculations	Calculation of exit flow and velocity from the flare
E-13	Methane Emission Rates	Calculation of Methane and NMOC emission rates for the proposed flare.
E-14	HAP Emission Rates	Calculation of HAP emission rates for the proposed flare, based on default HAP concentrations in landfill gas as listed in AP-42
E-15	Secondary Pollutant Emission Rates from Flare	Calculation of CO and NO_X emissions based on vendor information. Calculation of SO_2 and HCl based on AP-42 calculations and flare data.

Table E-1
SWA Lime Recalcination Facility and Biosolids Pelletization Facility
Estimated Maximum Potential Emission Rates

Source	Emissions, by Air Pollutant																									
	Particulate Matter				Sulfur Dioxide				Nitrogen Oxides				Carbon Monoxide				Lead				Volatile Organic Compounds				Total HAP	
	Emission Factor	Units	lb/hr	ton/year	Emission Factor	Units	lb/hr	ton/year	Emission Factor	Units	lb/hr	ton/year	Emission Factor	Units	lb/hr	ton/year	Emission Factor	Units	lb/hr	ton/year	Emission Factor	Units	lb/hr	ton/year	lb/hr	ton/year
Lime Recalcination Facility																										
Rotary Kiln (Landfill Gas)[4]	0.013	gr/dscf @ 10% O2	1.62	6.7	9.98E-04	lb/hr/scfm[1]	1.40	6.1	0.485	lbs/MMBtu	16.01	70.1	150.00	ppmv @ 10% O2	8.92	39.1	—	—	—	—	20	ppmv @ 3% O2	2.23	9.76	—	0.13
Cross-bar lime cooler	0.010	gr/dscf @ 10% O2	0.15	0.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Storage Silo (2 Silos)	1.50E-02	gr/dscf actual	2.78E-03	1.2E-02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Facility Subtotal	—	—	—	7.3	—	—	—	6.1	—	—	—	70.1	[illegible]	[illegible]	[illegible]	39.1	—	—	—	—	—	—	—	9.76	0.03	0.13
Biosolids Pelletizing Facility																										
One 200-wtpd Train (Andritz)	0.78	lb/hour[3,4]	0.78	3.4	0.93	lb/hour[2]	0.93	4.1	1.6	lb/hour[2]	1.6	7.0	0.39	lb/hour[2]	0.39	1.7	8.3E-05	lb/hour[2]	8.3E-05	3.6E-04	0.3	lb/hour[2]	0.3	1.3	—	0.09
Odor Control Unit																										
Storage Silos (2 Silos)	0.015	gr/dscf actual	3.02E-04	1.32E-03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cooling Towers	0.019	lbs/10³ gal drift	3.47E-04	1.52E-03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Recycle Bin w/ Baghouse	0.015	gr/dscf actual	3.38E-01	1.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Facility Subtotal (one train)	—	—	—	4.9	—	—	—	4.1	—	—	—	7.0	[illegible]	[illegible]	[illegible]	1.7	—	—	—	0.0	—	—	—	1.3	0.02	0.09
Proposed LRF/BPF Back-up Flare Emissions																										
Flare[7]	17	lbs/10⁶ dscf CH4	1.26914	5.6	9.98E-04	lb/hr/scfm	2.295	10.1	0.07	lb/MMBtu	5.226	22.9	0.33	lb/MMBtu	26.13	114.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.34	1.48	0.07	0.30
Current, Actual Landfill Flare Emissions																										
Actual Flare Emissions (2000)[8]	17	lbs/10⁶ dscf CH4	0.52574	2.3	9.98E-04	lb/hr/scfm[1]	0.878	3.8	40	lbs/10⁶ dscf CH4	1.237	5.4	750	lbs/10⁶ dscf CH4	23.19	101.6	—	—	—	—	—	—	0.129	0.6	0.03	0.12
Totals																										
Total	—	—	—	9.9	—	—	—	8.3	—	—	—	71.7	—	—	—	12.9	—	—	—	0.0	—	—	—	10.5	—	0.2
Emission Thresholds																										
PSD Significant Increase (Major Modification)				25 (15 PM_{10})				40				40				100				0.6				40		25

Bold Text denotes an excedence of the PSD threshold

Notes:

[1] Assumes a 100 ppmv sulfur dioxide concentration in the landfill gas which is a conservative estimate for the Class I landfill (based on a 68.9 ppm concentration previously sampled at the Class I flare inlet)
Lime kiln combusts about 1,400 scfm of landfill gas. 200-wtpd sludge dryer combusts about 900 scfm of landfill gas.

[2] Emissions based on vendor information (Andritz), dated May 2, 2002, attached. BACT emission rate for low-NOx burner from North American Burner.

[3] Emissions are from the dryer stack only. Particulate matter emissions from screens, recycle bin, and storage silos not included.

[4] Emissions based on Vendor information (FFE Minerals USA Inc.) estimates of flue gas concentrations at ESP exit: 150 ppmv CO @ 10% O2; 0.013 gr/dscf PM. NO_X Emissions based on BACT for low-NOx burner (Coen): 0.485 lbs/MMBtu

[5] Emissions factors calculated based on estimated baghouse emission rate of 0.015 gr/dscf.

[6] See "Netting Calculation" spreadsheet for details. Based on maximum LFG production (year 2019, build-out) minus the amount of gas used by the Sludge Pelletizing and Lime Recalcination Facilities

[7] NOx and CO emission factors are based on vendor guarantees (See Table A-15)

[8] Emission factors for PM, CO and NOx are from AP-42, Table 2.4-5, consistent with current air permits for this flare. SO_X emission factors based on calculations from AP-42 Section 2.4.

Table E-2
SWA Lime Recalcination Facility and Sludge Pelletization Facility
Estimated Emission Rates for the Lime Kiln

PM Concentration	0.013	gr/dscf of PM	10%	O_2 conc.
Flue gas flow at stack exit	13631.6	dscfm, with	10%	O_2 conc.
NO_X Concentration	0.485	lbs NO_X/MMBtu	33	MMBtu/hr
CO Concentration	150	ppmv, corrected	10%	O_2 conc.
VOC Concentration	20	ppmv, corrected	3%	O_2 conc.

Flow 11909.5 ncfm @ 32 °F, 3.36% O_2 conc., 33.72% H_2O, by vol.

Temperature Correction: 12780.9
Moisture Correction: 8471.2
Oxygen Correction: 13631.6 dscfm

PM Emissions

Calculate PM emission rate per unit

$$\frac{0.013 \text{ grains}}{1 \text{ dscf}} \cdot \frac{13631.6347 \text{ dscf}}{1 \text{ min}} \cdot \frac{1 \text{ g}}{15.43 \text{ grain}} \cdot \frac{1 \text{ min}}{60 \text{ second}} = \frac{0.19 \text{ g}}{\text{second}}$$

Calculate PM emission rate for facility

$$\frac{0.19 \text{ g}}{\text{sec/unit}} \quad 1 \text{ units} = \frac{0.19 \text{ g}}{\text{sec}}$$

$$\frac{0.19 \text{ g}}{\text{second}} \cdot \frac{1 \text{ ton}}{907200 \text{ g}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hour}} \cdot \frac{24 \text{ hour}}{1 \text{ day}} \cdot \frac{365 \text{ days}}{1 \text{ year}} = \frac{6.65 \text{ ton}}{\text{year}}$$

Nitrogen Dioxide Emissions

Adjusted NO_X emissions

$$\frac{0.49 \text{ lbs } NO_X}{\text{MMBtu}} \cdot \frac{33 \text{ MMBtu}}{1 \text{ hr}} \cdot \frac{24 \text{ hour}}{1 \text{ day}} \cdot \frac{365 \text{ days}}{1 \text{ year}} \cdot \frac{1 \text{ ton}}{2000 \text{ lbs}} = \frac{70.10 \text{ ton}}{\text{year}}$$

* 0.25 lbs/MMBtu, emission rate from FFE.

Carbon Monoxide Emissions

Adjusted CO emissions

$$\frac{150 \text{ ppmv}}{@ 10\% \ O_2 \text{ conc.}} \cdot \frac{(20.9\% - 10\%) \ O_2 \text{ conc.}}{(20.9\% - 10\%) \ O_2 \text{ conc.}} = \frac{150.0 \text{ ppmv}}{@ 10\% \ O_2}$$

Dry volumetric flow rate for unit

$$\frac{13632 \text{ dscfm}}{@ 10\% \ O_2} \cdot \frac{1 \text{ dscm}}{35.31 \text{ dscf}} \cdot \frac{1 \text{ min}}{60 \text{ second}} = \frac{6.43 \text{ dscm}}{1 \text{ sec}}$$

CO emission rate for unit

$$\frac{150.00 \text{ mol CO}}{1.E{+}06 \text{ moles}} \cdot \frac{41.57 \text{ moles}}{1 \text{ dscm}} \cdot \frac{28.01 \text{ g}}{1 \text{ mole}} = \frac{0.175 \text{ g}}{\text{dscm}}$$

$$\frac{0.175 \text{ g}}{\text{dscm}} \cdot \frac{6.43 \text{ dscm}}{1 \text{ sec}} = \frac{1.12 \text{ g}}{\text{sec}}$$

Calculate CO emissions for the facility

$$\frac{1.12 \text{ g}}{\text{sec/unit}} \cdot 1 \text{ units} = \frac{1.12 \text{ g}}{\text{sec}}$$

$$\frac{1.12 \text{ g}}{\text{sec}} \cdot \frac{1 \text{ ton}}{907200 \text{ g}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hour}} \cdot \frac{24 \text{ hour}}{1 \text{ day}} \cdot \frac{365 \text{ days}}{1 \text{ year}} = \frac{39.06 \text{ ton}}{\text{year}}$$

Volatile Organic Compound Emissions (MSW Landfill NSPS Limit)

Adjusted VOC emissions

$$\frac{20 \text{ ppmv}}{@ 3\% \ O_2 \text{ conc.}} \cdot \frac{(20.9\% - 10\%) \ O_2 \text{ conc.}}{(20.9\% - 3\%) \ O_2 \text{ conc.}} = \frac{12.18 \text{ ppmv}}{@ 10\% \ O_2}$$

Dry volumetric flow rate for unit

$$\frac{13632 \text{ dscfm}}{@ 10\% \ O_2} \cdot \frac{1 \text{ dscm}}{35.31 \text{ dscf}} \cdot \frac{1 \text{ min}}{60 \text{ second}} = \frac{6.43 \text{ dscm}}{1 \text{ sec}}$$

VOC emission rate for unit

$$\frac{12.18 \text{ mol CO}}{1.E{+}06 \text{ moles}} \cdot \frac{41.57 \text{ moles}}{1 \text{ dscm}} \cdot \frac{86.18 \text{ g}}{1 \text{ mole}} = \frac{0.044 \text{ g}}{\text{dscm}}$$

$$\frac{0.044 \text{ g}}{\text{dscm}} \cdot \frac{6.43 \text{ dscm}}{1 \text{ sec}} = \frac{0.28 \text{ g}}{\text{sec}}$$

Calculate VOC emissions for the facility

$$\frac{0.28 \text{ g}}{\text{sec/unit}} \cdot 1 \text{ units} = \frac{0.28 \text{ g}}{\text{sec}}$$

$$\frac{0.28 \text{ g}}{\text{sec}} \cdot \frac{1 \text{ ton}}{907200 \text{ g}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hour}} \cdot \frac{24 \text{ hour}}{1 \text{ day}} \cdot \frac{365 \text{ days}}{1 \text{ year}} = \frac{9.76 \text{ ton}}{\text{year}}$$

Table E-3
SWA Lime Recalcination Facility and Sludge Pelletization Facility
Estimated PM Emission Rates for Baghouses, Lime Silos, Sludge Pelletizing Silos

Cross-Bar Lime Product Cooler with Baghouse

baghouse airflow 1700 dscfm
PM Concentration 0.01 gr/dscf 10% O_2 conc.

Calculate PM emission rate per unit:

$$\frac{0.01\ \text{grains}}{1\ \text{dscf}} \cdot \frac{1700\ \text{dscf}}{1\ \text{min}} \cdot \frac{1\ \text{g}}{15.43\ \text{grain}} \cdot \frac{1\ \text{min}}{60\ \text{second}} = \frac{0.02\ \text{g}}{\text{second}}$$

Calculate PM emission rate for facility

$$\frac{0.02\ \text{g}}{\text{sec/unit}} \quad 1\ \text{units} = \frac{0.02\ \text{g}}{\text{sec}}$$

$$\frac{0.02\ \text{g}}{\text{second}} \cdot \frac{1\ \text{ton}}{907200\ \text{g}} \cdot \frac{60\ \text{sec}}{1\ \text{min}} \cdot \frac{60\ \text{min}}{1\ \text{hour}} \cdot \frac{24\ \text{hour}}{1\ \text{day}} \cdot \frac{365\ \text{days}}{1\ \text{year}} = \frac{0.64\ \text{ton}}{\text{year}}$$

Biosolid Pellet, Recycle Bin Baghouse

baghouse airflow 2625 dscfm
PM Concentration 0.015 gr/dscf of PM

Calculate PM emission rate per unit:

$$\frac{0.015\ \text{grains}}{1\ \text{dscf}} \cdot \frac{2625\ \text{dscf}}{1\ \text{min}} \cdot \frac{1\ \text{g}}{15.43\ \text{grain}} \cdot \frac{1\ \text{min}}{60\ \text{second}} = \frac{0.04\ \text{g}}{\text{second}}$$

Calculate PM emission rate for facility

$$\frac{0.04\ \text{g}}{\text{sec/unit}} \quad 1\ \text{units} = \frac{0.04\ \text{g}}{\text{sec}}$$

$$\frac{0.04\ \text{g}}{\text{second}} \cdot \frac{1\ \text{ton}}{907200\ \text{g}} \cdot \frac{60\ \text{sec}}{1\ \text{min}} \cdot \frac{60\ \text{min}}{1\ \text{hour}} \cdot \frac{24\ \text{hour}}{1\ \text{day}} \cdot \frac{365\ \text{days}}{1\ \text{year}} = \frac{1.48\ \text{ton}}{\text{year}}$$

Lime Storage Silos

PM Concentration 0.015 gr/dscf of PM
Volume of each Silo 25977.04 dscf
Max mass of lime in silo 500 tons of lime
Throughput 100 tons/day
Amount of air displaced 5195.409 dscf/day

Calculate PM emission rate per unit:

$$\frac{0.015\ \text{grains}}{1\ \text{dscf}} \cdot \frac{5195.4\ \text{dscf}}{1\ \text{day}} \cdot \frac{1\ \text{g}}{15.43\ \text{grain}} \cdot \frac{1\ \text{day}}{24\ \text{hour}} \cdot \frac{1\ \text{hour}}{60\ \text{min}} \cdot \frac{1\ \text{min}}{60\ \text{second}} = \frac{5.8\text{E-}05\ \text{g}}{\text{second}}$$

Calculate PM emission rate for facility

$$\frac{5.85\text{E-}05\ \text{g}}{\text{sec/unit}} \quad 6\ \text{units} = \frac{3.51\text{E-}04\ \text{g}}{\text{sec}}$$

$$\frac{3.51\text{E-}04\ \text{g}}{\text{second}} \cdot \frac{1\ \text{ton}}{907200\ \text{g}} \cdot \frac{60\ \text{sec}}{1\ \text{min}} \cdot \frac{60\ \text{min}}{1\ \text{hour}} \cdot \frac{24\ \text{hour}}{1\ \text{day}} \cdot \frac{365\ \text{days}}{1\ \text{year}} = \frac{1.22\text{E-}02\ \text{ton}}{\text{year}}$$

Biosolids Pelletizing Silo (accounts for 2 trains in 2 silos)

PM Concentration 0.015 gr/dscf of PM
Annual Biosolid Production 25018.56 dry tons/year
ρ of Biosolid produced 40.58 lbs/cf
Amount of air displaced 3378.22 dscf/day 2.34598

Calculate PM emission rate per unit:

$$\frac{0.015\ \text{grains}}{1\ \text{dscf}} \cdot \frac{3378.2\ \text{dscf}}{1\ \text{day}} \cdot \frac{1\ \text{g}}{15.43\ \text{grain}} \cdot \frac{1\ \text{day}}{24\ \text{hour}} \cdot \frac{1\ \text{hour}}{60\ \text{min}} \cdot \frac{1\ \text{min}}{60\ \text{second}} = \frac{3.8\text{E-}05\ \text{g}}{\text{second}}$$

Calculate PM emission rate for facility

$$\frac{3.80\text{E-}05\ \text{g}}{\text{sec/unit}} \quad 1\ \text{units} = \frac{3.80\text{E-}05\ \text{g}}{\text{sec}}$$

$$\frac{3.80\text{E-}05\ \text{g}}{\text{second}} \cdot \frac{1\ \text{ton}}{907200\ \text{g}} \cdot \frac{60\ \text{sec}}{1\ \text{min}} \cdot \frac{60\ \text{min}}{1\ \text{hour}} \cdot \frac{24\ \text{hour}}{1\ \text{day}} \cdot \frac{365\ \text{days}}{1\ \text{year}} = \frac{1.32\text{E-}03\ \text{ton}}{\text{year}}$$

Table E-4

Solid Waste Authority of Palm Beach County
Biosolids Pelletizing Facility
Cooling Tower Air Emissions - Particulate Matter

A. Flow Rate Across ALL Cooling Towers (3 operating)	1523	gal/min	
B. Amount of Dissolved Particulate Matter (PM)	45	mg/L	
C. Amount of Dissloved PM (AP-42)	1.900E-05	lbs/gal	AP-42, Table 13.4-1, 1/
D. Drift as a Percentage of Recirculating Rate	0.020%	AP-42, Table 13.4-1, 1/95	
E. Total Drift of all towers (A*D*60)	18.276	Gal/hour	
F. Total PM10 Emissions within Drift (C*E)	3.47E-04	lbs/hour	
G. Hours of Operations	8760	hours/year	
H. Annual PM10 Emissions for tower (F*G/2000)	1.52E-03	TPY	
I. Annual PM_{10} Emissions for one tower (H/3)	5.07E-04	TPY	
Emission Rate (g/s) - per tower	1.46E-05		
	1.16E-04	lbs/hr	

Table E-5
SWA Lime Recalcination Facility and Sludge Pelletization Facility
Methane Emission Rates - Landfill Gas to Lime Kiln

Kiln Burner Gas Flow Design Capacity:	1000.0	scfm	14883336.36 m^3/year
Methane Content of Landfill Gas:	58.5%	(percent by volume)	
Total Methane Flow to Kiln Burner:	585.5	scfm	8713869.89 m^3/year
MW of Methane	16		

Methane Emission Rate

Pollutant	Methane Flow Rate (m^3/year)	Methane Flow Rate (m^3/minute)	Methane (Mg/yr)*
Class I Landfill			
Methane	8713870	16.6	5,796

*41.57 Conversion from std. m^3/yr to g/yr.

0.276315002

NMOC Emission Rate

Pollutant	Concentration of NMOC (ppmv)	MW of NMOC (g/mol)	Concentration of NMOC (μg/m³)	NMOC, Uncontrolled (Mg/yr)	NMOC, Uncontrolled (tpy)	NMOC, Controlled* (tpy)	NMOC, Controlled* (lbs/hr)
Class I Landfill							
NMOC	595	86.2	2,131,589	32	32	1	0.147

* 98% Control of NMOC assumed for calculation

Table E-6

SWA, Lime Kiln HAP Emissions

Input Information:

NMOC concentration in landfill gas:	595	ppmdv expressed as hexane with MW of:		86.17
Equivalent mass/volume conc. is:	2131341.7	ug/m3	[ug/m3 = (ppm)41.57(MW)]	
NMOC em. rate:	32	Mg/yr	1.005998122 g/s	

HAP	Molecular Weight	Default Conc. (ppmv)	Mass Conc. (ug/m3)	Emissions (Mg/yr)	Emissions (tons/yr)
1,1,1-Trichlorethane (methyl chloroform)	133.42	0.480	2617.38	3.90E-02	3.95E-02
1,1,2,2-Tetrachloroethane	167.85	1.11	7614.63	1.13E-01	1.15E-01
1,1,2-Trichloroethane	133.42	0.100	545.29	8.12E-03	8.22E-03
1,1-Dichloroethane (ethylidene dichloride)	98.95	2.35	9503.60	1.41E-01	1.43E-01
1,1-Dichloroethene (vinylidene chloride)	96.94	0.201	796.35	1.19E-02	1.20E-02
1,2-Dichloroethane (ethylene dichloride)	98.96	0.407	1646.11	2.45E-02	2.48E-02
1,2-Dichloropropane (propylene dichloride)	112.98	0.18	831.15	1.24E-02	1.25E-02
Acrylonitrile	53.06	6.33	13727.00	2.04E-01	2.07E-01
Benzene	78.11	1.91	6097.40	9.08E-02	9.20E-02
Carbon disulfide	76.13	0.583	1813.97	2.70E-02	2.74E-02
Carbon tetrachloride	153.84	0.004	25.15	3.74E-04	3.79E-04
Carbonyl sulfide	60.07	0.490	1202.98	1.79E-02	1.81E-02
Chlorobenzene	112.56	0.254	1168.48	1.74E-02	1.76E-02
Chloroethane	64.52	1.25	3296.17	4.91E-02	4.97E-02
Chlorform	119.39	0.03	146.38	2.18E-03	2.21E-03
Chloromethane (methyl chloride)	50.49	1.21	2496.87	3.72E-02	3.77E-02
Dichlorobenzene	147.00	0.213	1279.68	1.90E-02	1.93E-02
Dichloromethane (methylene chloride)	84.94	14.3	49642.42	7.39E-01	7.49E-01
Ethylbenzene	106.16	4.61	20001.68	2.98E-01	3.02E-01
Hexane	86.17	6.57	23138.02	3.44E-01	3.49E-01
Mercury	200.61	0.000292	2.39	3.56E-05	3.61E-05
Methyl ethyl ketone (2-butanone)	72.10	7.09	20892.29	3.11E-01	3.15E-01
Methyl isobutyl ketone (hexone)	100.16	1.87	7654.92	1.14E-01	1.15E-01
Perchloroethylene (tetrachloroethylene)	165.83	3.73	25279.97	3.76E-01	3.81E-01
Toluene	92.13	39.3	147978.38	2.20E+00	2.23E+00
Trichloroethylene	131.40	2.82	15144.30	2.25E-01	2.28E-01
Vinyl chloride	62.50	7.34	18749.11	2.79E-01	2.83E-01
Xylenes	106.16	12.1	52498.99	7.81E-01	7.92E-01
Total Uncontrolled VOC HAPs (before burner)					6.57E+00
Total Mercury					3.61E-05
Total Controlled VOC HAPs					1.31E-01
Total HAPs					**0.13**

Table E-7

SWA Lime Recalcination Facility and Sludge Pelletization Facility

Methane Emission Rates - Landfill Gas to Biosolids Pelletizing Facility

Flare Gas Flow Design Capacity:	670.0	scfm	9971835.36 m^3/year
Methane Content of Landfill Gas:	58.5%	(percent by volume)	
Total Methane Flow to Flare:	392.3	scfm	5838292.82 m^3/year
MW of Methane	16		

Methane Emission Rate

Pollutant	Methane Flow Rate to Flare (m^3/year)	Methane Flow Rate to Flare (m^3/minute)	Methane (Mg/yr)*
Class I Landfill			
Methane	5838293	11.1	3,883

*41.57 Conversion from std. m^3/yr to g/yr.

0.185131051

NMOC Emission Rate

Pollutant	Concentration of NMOC (ppmv)	MW of NMOC (g/mol)	Concentration of NMOC (µg/m³)	NMOC, Uncontrolled (Mg/yr)	NMOC, Uncontrolled (tpy)	NMOC, Controlled* (tpy)	NMOC, Controlled* (lbs/hr)
Class I Landfill							
NMOC	595	86.2	2,131,589	21	22	0	0.098

* 98% Control of NMOC assumed for calculation

Table E-8

SWA, Biosolids Pelletizing Dryer HAP Emissions

Input Information:

NMOC concentration in landfill gas:	595	ppmdv expressed as hexane with MW of:		86.17
Equivalent mass/volume conc. is:	2131341.71	ug/m3	[ug/m3 = (ppm)41.57(MW)]	
LANDFILL 1995 NMOC em. rate:	21	Mg/yr	0.67401874	g/s

HAP	Molecular Weight	Default Conc. (ppmv)	Mass Conc. (ug/m3)	Emissions (Mg/yr)	Emissions (tons/yr)
1,1,1-Trichlorethane (methyl chloroform)	133.42	0.480	2617.38	2.61E-02	2.64E-02
1,1,2,2-Tetrachloroethane	167.85	1.11	7614.63	7.59E-02	7.69E-02
1,1,2-Trichloroethane	133.42	0.100	545.29	5.44E-03	5.51E-03
1,1-Dichloroethane (ethylidene dichloride)	98.95	2.35	9503.60	9.48E-02	9.60E-02
1,1-Dichloroethene (vinylidene chloride)	96.94	0.201	796.35	7.94E-03	8.05E-03
1,2-Dichloroethane (ethylene dichloride)	98.96	0.407	1646.11	1.64E-02	1.66E-02
1,2-Dichloropropane (propylene dichloride)	112.98	0.18	831.15	8.29E-03	8.40E-03
Acrylonitrile	53.06	6.33	13727.00	1.37E-01	1.39E-01
Benzene	78.11	1.91	6097.40	6.08E-02	6.16E-02
Carbon disulfide	76.13	0.583	1813.97	1.81E-02	1.83E-02
Carbon tetrachloride	153.84	0.004	25.15	2.51E-04	2.54E-04
Carbonyl sulfide	60.07	0.490	1202.98	1.20E-02	1.22E-02
Chlorbenzene	112.56	0.254	1168.48	1.17E-02	1.18E-02
Chloroethane	64.52	1.25	3296.17	3.29E-02	3.33E-02
Chlorform	119.39	0.03	146.38	1.46E-03	1.48E-03
Chloromethane (methyl chloride)	50.49	1.21	2496.87	2.49E-02	2.52E-02
Dichlorbenzene	147.00	0.213	1279.68	1.28E-02	1.29E-02
Dichlormethane (methylene chloride)	84.94	14.3	49642.42	4.95E-01	5.02E-01
Ethylbenzene	106.16	4.61	20001.68	1.99E-01	2.02E-01
Hexane	86.17	6.57	23138.02	2.31E-01	2.34E-01
Mercury	200.61	0.000292	2.39	2.39E-05	2.42E-05
Methyl ethyl ketone (2-butanone)	72.10	7.09	20892.29	2.08E-01	2.11E-01
Methyl isobutyl ketone (hexone)	100.16	1.87	7654.92	7.63E-02	7.74E-02
Perchloroethylene (tetrachloroethylene)	165.83	3.73	25279.97	2.52E-01	2.55E-01
Toluene	92.13	39.3	147978.38	1.48E+00	1.50E+00
Trichloroethylene	131.40	2.82	15144.30	1.51E-01	1.53E-01
Vinyl chloride	62.50	7.34	18749.11	1.87E-01	1.89E-01
Xylenes	106.16	12.1	52498.99	5.24E-01	5.30E-01
Total Uncontrolled VOC HAPs (before burner)					4.40E+00
Total Mercury					2.42E-05
Total Controlled VOC HAPs					8.81E-02
Arsenic (from biosolids drying)					1.44E-05
Cadmium (from biosolids drying)					3.65E-05
Chromium (from biosolids drying)					1.37E-04
Mercury (from biosolids drying)					9.48E-06
Nickel (from biosolids drying)					1.25E-04
Total HAPs					**0.09**

SWA Lime Recalcination Facility and Sludge Pelletization Facility
Landfill Gas Flow Information

SWA Flare Log Sheets

	Class 1						Class 3					
	LFG Components				Flow*	Downtime	LFG Components				Flow*	Downtime
Date	CH_4	CO_2	O_2	Balance	(dscfm)	(hours)	CH_4	CO_2	O_2	Balance	(dscfm)	(hours)
Flare Logs for 2000												
January-00	47.2		6.8	41.1	762	8.75	38.5		3.3		631	9.00
February-00	58.0		2.0		687	2.25	40.4		3.3		603	42.35
March-00	52.6	25.0	3.0	20.5	688	10.75	35.4	28.4	2.3	33.7	515	36.00
April-00	55.0	26.7	3.3	15.3	586	37.30	40.9	33.5	2	21.6	354	10.00
May-00	57.9	25.0	3.3	13.7	560	54.40	40.1	32.9	1	22.3	355	8.85
June-00	58.4	24.5	3.3	13.8	564	32.30	43.7	32.6	1	23.1	392	6.50
July-00	63.3	39.8	1.7	7.9	571	12.10	45.3	32.7	1	21.1	395	3.50
August-00	58.5	27.0	2.6	15.8	655	13.60	44.2	45.3	1.7	31.6	332	0.00
September-00	57.1	21.6	2.0	18.3	569	18.30	44.6	26.4	1.8	27.2	302	10.60
October-00	62.6	27.4	1.8	9.6	444	2.70	47.7	31	1.7	19.5	320	45.22
November-00	58.5	26.2	4.1	12.4	471	2.50	43.6	30.6	2.6	23.2	336	17.90
December-00	59.4	30.4	2.0	8.1	740	23.95						
Annual Average	57.4	27.4	3.0	16.0	608	18.24	42.2	32.6	2.0	24.8	412	17.3
Flare Logs for 2001												
January-01	59.4	48.3	1.2	7	1098	9.75	38.9	28.7	3.2	29.2	379	2.60
February-01	60.1	31.3	1.1	7.6	1120	7.60	37.4	26.8	4.0	32.1	418	1.10
March-01	58.3	31.9	1.7	8.4	1096	4.50	37.3	27.6	4.3	30.5	387	5.10
April-01	55.8	30.6	2.2	11.5	1113	4.65	38.7	28.7	3.0	29.5	297	10.80
May-01	58.5	30.8	1.6	9.2	1147	3.10	37.1	26.1	2.9	25.1	313	20.20
June-01	60.4	31.7	1.1	6.7	1154	0	38.0	29.5	2.8	29.6	450	0
July-01	63.4	31.7	0.8	4.2	1153	5.25	42.7	31.0	2.2	24.4	376	23.00
August-01	60.5	30.7	1.5	7.2	1170	18.80	44.3	32.3	1.8	31.5	416	9.25
September-01	62.1	30.9	1.0	6.1	1202	5.10	45.2	32.5	1.5	21.2	431	19.30
October-01	61.1	30.3	1.4	13	1170	1.80	40.9	29.6	3.5	26.5	402	0
November-01	59.8	29.7	1.8	8.5	1146	4.00	37.8	28.5	4.2	26.8	366	0
December-01	58.1	29.3	2.2	10.4	1122	2.40	36.3	27.9	4.3	30.9	416	6.50
Annual Average	59.8	32.3	1.5	8.3	1141	5.58	39.6	29.1	3.1	28.1	388	8.15
Two Year Averages												
	58.5	30.0	2.2	12.2	880.4	11.4	40.8	30.6	2.6	26.7	399.3	12.5

* Flows on log sheets labeled as cfm. Justin Gattuso confirmed via email that cfm=scfm. The flows presented have been corrected to dscfm based on the moisture content listed in the Nov 2000 flare test report.

Average Monthly Summary for 1997

Date	Flows					
	Class 1			Class 3		
	scfm	moisture*	dscfm	scfm	moisture*	dscfm
January-97	774	6%	728	373	6%	351
February-97	761	6%	715	347	6%	326
March-97	817	6%	768	345	6%	324
April-97	752	6%	707	337	6%	317
May-97	806	6%	758	431	6%	405
June-97	716	6%	673	446	6%	419
July-97	800	6%	752	506	6%	476
August-97	757	6%	712	463	6%	435
September-97	656	6%	617	447	6%	420
October-97	552	6%	519	423	6%	398
November-97	625	6%	588	280	6%	263
December-97	833	6%	783	298	6%	280
Annual Average	737.417		693.2			367.9

* Moisture content as listed in Nov 2000 flare test report

Flare Lab Testing Results from Annual Report

year	Flows					
	Class 1			Class 3		
	scfm	moisture*	dscfm	scfm	moisture*	dscfm
1996	648	6%	609	407	6%	383
1997	682	6%	641	435	6%	409
1998	645	6%	606	422	6%	397
1999	652	6%	613	544	6%	511
2000	409	6%	384	237	6%	223
2001	975	6%	917	371	6%	349

* Moisture content as listed in Nov 2000 flare test report

Comparison of Actual and Predicted LFG Flows - Class 1

Year	Actual	LandGEM	% @ flare		Run Averag	Predicted Capture
1996	609	869	70%		70%	
1997	693	1,001	69%		70%	
1998	606	1,138	53%		64%	
1999	613	1,284	48%		60%	
2000	608	1,457	42%		56%	
2001	1,141	1,639	70%		58.6%	
2002		1,811				1,413
2003		1,998				1,559
2004		2,188				1,707
2005		2,379				1,856
2006		2,574				2,008
2007		2,769				2,160
2008		2,967				2,314
2009		3,167				2,470
2010		3,368				2,627
2011		3,571				2,785
2012		3,775				2,945
2013		3,982				3,106
2014		4,190				3,268
2015		4,401				3,433
2016		4,613				3,598
2017		4,827				3,765
2018		5,042				3,933
2019		5,259				4,102
2020		5,148				4,015

Actual numbers taken from SWA 1997 Monthly summaries, and the SWA Flare Logs for 2000 and 2001. LandGEM numbers are gas emission rates predicted for the Class I Landfill using the EPA's Landfill Gas Emission Model and information on exceptance rates as presented in the 2001 Landfill Depletion Model.

Flare Lab Testing Results from Annual Report

	Composition of Class 1			
year	CH_4	CO_2	O_2	N_2
1996	59.2%	27.2%	1.4%	11.5%
1997	54.0%	24.0%	4.5%	14.0%
1998	66.8%	24.0%	1.3%	5.3%
1999	35.6%	7.7%	13.8%	46.9%
2000	60.3%	32.7%	1.5%	5.5%
2001	55.5%	34.2%	2.1%	6.7%
Average:	55.2%	25.0%	4.1%	15.0%

Flare Lab Testing Results from Annual Report

	Composition of Class 3			
year	CH_4	CO_2	O_2	N_2
1996	49.0%	36.4%	75.0%	13.8%
1997	44.9%	34.0%	1.9%	14.0%
1998	36.2%	24.6%	4.5%	27.5%
1999	27.9%	12.3%	13.2%	52.7%
2000	46.9%	34.4%	2.1%	16.7%
2001	42.2%	31.2%	6.9%	16.1%
Average:	41.2%	28.8%	17.3%	23.5%

Comparison of Actual and Predicted LFG Flows - Class 3

Year	Actual	LandGEM	% to flare		Average %	Predicted Capture
1996	383	709	54%		47%	
1997	368	800	46%		47%	
1998	387	863	45%		47%	
1999	511	929	55%		47%	
2000	412	990	42%		47%	
2001	399	1,036	39%		47%	
2002		1,079			47%	504
2003		1,133			47%	529
2004		1,186			47%	554
2005		1,239			47%	578
2006		1,292			47%	603
2007		1,344			47%	627
2008		1,395			47%	651
2009		1,447			47%	675
2010		1,498			47%	699
2011		1,549			47%	723
2012		1,599			47%	746
2013		1,650			47%	770
2014		1,699			47%	793
2015		1,750			47%	817
2016		1,800			47%	840
2017		1,849			47%	863
2018		1,898			47%	886
2019		1,947			47%	909
2020		1,996			47%	931

Actual numbers taken from SWA 1997 Monthly summaries, and the SWA Flare Logs for 2000 and 2001. LandGEM numbers are gas emission rates predicted for the Class I Landfill using the EPA's Landfill Gas Emission Model and information on exceptance rates as presented in the 2001 Landfill Depletion Model.

SWA Lime Recalcination Facility and Sludge Pelletization Facility
Landfill Gas Flow Estimation Calculations

From Gasflowa.xls (J. Curro, 1/31/02)

Capture Rate End of Year Flow Rate			Landgem Flow Prediction	Year	Methane Concentration			
					2000 Avg.	2001 Avg.	5 yr. Avg.	Ind. Avg.
75%	*78%*	80%			57.40%	59.80%	55.20%	50%
1230	1279	1311	1,639	2001				
1358	1413	1449	1,811	2002				
1499	1559	1599	1,998	2003	*Jul, 04*	*Feb, 03* ; Nov, 03	*Jan, 04*	
1641	1707	1751	2,188	2004	Jan, 04; **Nov, 04**	**May, 04**	Aug, 04	
1784	1856	1903	2,379	2005			**Apr, 05**	Oct, 05
1931	2008	2059	2,574	2006				*Jan, 06;* **Jul, 06**
2077	2160	2215	2,769	2007				

Firing Rate		Flow (scfm)			
Lime Kiln	33MMBtuh	958	920	996	1100
Dryer	23MMBtuh	668	641	694	767
Total	56MMBtuh	1626	1561	1691	1867

Table E-9

SWA Lime Recalcination Facility and Sludge Pelletization Facility

Methane Emission Rates - Existing Flare

Flare Actual Flow Rate:	880.4	scfm	13102687.80	m^3/year
Methane Content of Landfill Gas:	58.5%	(percent by volume)		
Total Methane Flow to Flare:	515.4	scfm	7671338.87	m^3/year
MW of Methane	16			

Methane Emission Rate

Pollutant	Methane Flow Rate to Flare (m^3/year)	Methane Flow Rate to Flare (m^3/minute)	Methane (Mg/yr)*
Class I Landfill			
Methane	7671339	14.6	5,102

*41.57 Conversion from std. m^3/yr to g/yr.

0.24325656

NMOC Emission Rate

Pollutant	Concentration of NMOC (ppmv)	MW of NMOC (g/mol)	Concentration of NMOC (µg/m³)	NMOC, Uncontrolled (Mg/yr)	NMOC, Uncontrolled (tpy)	NMOC, Controlled* (tpy)	NMOC, Controlled* (lbs/hr)
Class I Landfill							
NMOC	595	86.2	2,131,589	28	28	1	0.129

* 98% Control of NMOC assumed for calculation

Table E-10

SWA, Existing Flare HAP Emissions

Input Information:

NMOC concentration in landfill gas:	595	ppmdv expressed as hexane with MW of:			86.17
Equivalent mass/volume conc. is:	2131341.71	ug/m3	[ug/m3 = (ppm)41.57(MW)]		
NMOC Controlled Emission Rate	28	Mg/yr	0.88564009	g/s	

HAP	Molecular Weight	Default Conc. (ppmv)	Mass Conc. (ug/m3)	Emissions (Mg/yr)	Emissions (tons/yr)
1,1,1-Trichlorethane (methyl chloroform)	133.42	0.480	2617.38	3.43E-02	3.48E-02
1,1,2,2-Tetrachloroethane	167.85	1.11	7614.63	9.98E-02	1.01E-01
1,1,2-Trichloroethane	133.42	0.100	545.29	7.15E-03	7.24E-03
1,1-Dichloroethane (ethylidene dichloride)	98.95	2.35	9503.60	1.25E-01	1.26E-01
1,1-Dichloroethene (vinylidene chloride)	96.94	0.201	796.35	1.04E-02	1.06E-02
1,2-Dichloroethane (ethylene dichloride)	98.96	0.407	1646.11	2.16E-02	2.19E-02
1,2-Dichloropropane (propylene dichloride)	112.98	0.18	831.15	1.09E-02	1.10E-02
Acrylonitrile	53.06	6.33	13727.00	1.80E-01	1.82E-01
Benzene	78.11	1.91	6097.40	7.99E-02	8.10E-02
Carbon disulfide	76.13	0.583	1813.97	2.38E-02	2.41E-02
Carbon tetrachloride	153.84	0.004	25.15	3.30E-04	3.34E-04
Carbonyl sulfide	60.07	0.490	1202.98	1.58E-02	1.60E-02
Chlorbenzene	112.56	0.254	1168.48	1.53E-02	1.55E-02
Chloroethane	64.52	1.25	3296.17	4.32E-02	4.38E-02
Chlorform	119.39	0.03	146.38	1.92E-03	1.94E-03
Chloromethane (methyl chloride)	50.49	1.21	2496.87	3.27E-02	3.32E-02
Dichlorbenzene	147.00	0.213	1279.68	1.68E-02	1.70E-02
Dichlormethane (methylene chloride)	84.94	14.3	49642.42	6.51E-01	6.59E-01
Ethylbenzene	106.16	4.61	20001.68	2.62E-01	2.66E-01
Hexane	86.17	6.57	23138.02	3.03E-01	3.07E-01
Mercury	200.61	0.000292	2.39	3.14E-05	3.18E-05
Methyl ethyl ketone (2-butanone)	72.10	7.09	20892.29	2.74E-01	2.77E-01
Methyl isobutyl ketone (hexone)	100.16	1.87	7654.92	1.00E-01	1.02E-01
Perchloroethylene (tetrachloroethylene)	165.83	3.73	25279.97	3.31E-01	3.36E-01
Toluene	92.13	39.3	147978.38	1.94E+00	1.96E+00
Trichloroethylene	131.40	2.82	15144.30	1.98E-01	2.01E-01
Vinyl chloride	62.50	7.34	18749.11	2.46E-01	2.49E-01
Xylenes	106.16	12.1	52498.99	6.88E-01	6.97E-01
Total Uncontrolled VOC HAPs (before flare)					5.79E+00
Total Mercury					3.18E-05
Total Controlled VOC HAPs					1.16E-01
Total HAPs					**0.12**

Table E-11
SWA Lime Recalcination Facility and Sludge Pelletization Facility
Estimated Emission Rates for the Existing Flare

AP-42 Emission Factors

NO_X	40	lbs/10^6 dscf Methane
CO	750	lbs/10^6 dscf Methane
PM	17	lbs/10^6 dscf Methane

Class 1

Flare Flow Rate (current)	880	dscfm
% Methane	58.5%	

Class 3

Flare Flow Rate (current)	399.3	dscfm
% Methane	40.8%	

* Flow Rate is the two-year average taken from the SWA Flare Log Sheets for 2000 and 2001. Unclear whether cfm is acfm, scfm, or dscfm. Methane is also the two year average from SWA Flare Log Sheets for 2000 and 2001. Sulfur data taken from November 2000 Flare Inlet gas testing

PM Emissions

Calculate Total Methane emissions from the flares (current)

Class 1 Flare	880	dscf / min	*	58.5%	methane	=	515.4	dscf / min methane
Class 3 Flare	399	dscf / min	*	40.8%	methane	=	163.0	dscf / min methane

Calculate Total PM_{10} emissions from the flares

Class 1	515.43 /	dscf / min	*	17 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 2.30 ton / year
Class 3	163.03 /	dscf / min	*	17 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 0.73 ton / year

CO Emissions

Calculate Total Methane emissions from the flares (current)

Class 1 Flare	880	dscf / min	*	58.5%	methane	=	515.4	dscf / min methane
Class 3 Flare	399	dscf / min	*	40.8%	methane	=	163.0	dscf / min methane

Calculate Total CO emissions from the flares

Class 1	515.43 /	dscf / min	*	750 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 101.59 ton / year
Class 3	163.03 /	dscf / min	*	750 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 32.13 ton / year

NOX Emissions

Calculate Total Methane emissions from the flares (current)

Class 1 Flare	880	dscf / min	*	58.5%	methane	=	515.4	dscf / min methane
Class 3 Flare	399	dscf / min	*	40.8%	methane	=	163.0	dscf / min methane

Calculate Total NOX emissions from the flares

Class 1	515.43 /	dscf / min	*	40 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 5.42 ton / year
Class 3	163.03 /	dscf / min	*	40 / 1	lbs / 10^6 dscf	*	1 / 1E+06	10^6 dscf / dscf	*	60 / 1	min / hour	*	8760 / 1	hour / year	*	1 / 2000	ton / lbs	= 1.71 ton / year

SWA Lime Recalcination Facility and Sludge Pelletization Facility
Exit Gas Flow Rate Calculations - Proposed Backup Flare

Maximum Potential Gas Flow Rate

Flare Gas Flow Design Capacity:	2300	scfm
cf of air needed to combust 1 cf of LFG:	15.7	(ratio)
Exit Gas Flow Rate:	36110	scfm

Gas going to LRF (33 MMBtu/hr):	958.6
Gas going to BPF (23 MMBtu/hr):	668.1

	Actual	Standard
Moisture Content of Gas (%):	7.6%	0%
Temperature of Gas (°F):	1400	68

Conversion from scfm to dscfm:

$$\frac{36110 \ \text{ft}^3}{\text{minute}} * (1 - 0.076) = \frac{33{,}366 \ \text{dscf}}{\text{minute}}$$

Converstion from scfm to acfm:

$$\frac{36110 \ \text{ft}^3}{\text{minute}} * \frac{(459.67°\text{R} + 1400°\text{F})}{(459.67°\text{R} + 68°\text{F})} = \frac{127{,}263 \ \text{acf}}{\text{minute}}$$

SWA Lime Recalcination Facility and Sludge Pelletization Facility
Methane Emission Rates - Proposed Backup Flare

Flare Gas Flow Design Capacity:	2300	scfm	34231673.63 m^3/year
Methane Content of Landfill Gas:	58.5%	(percent by volume)	
Total Methane Flow to Flare:	1346.6	scfm	20041900.74 m^3/year
MW of Methane	16		

Methane Emission Rate

Pollutant	Methane Flow Rate to Flare (m^3/year)	Methane Flow Rate to Flare (m^3/minute)	Methane (Mg/yr)*
Class I Landfill			
Methane	20041901	38.1	13,330

*41.57 Conversion from std. m^3/yr to g/yr.

Table E-14

SWA, Proposed Backup Flare HAP Emissions

Input Information:

NMOC concentration in landfill gas:	595	ppmdv expressed as hexane with MW of:		86.17
Equivalent mass/volume conc. is:	2131341.71	ug/m3	[ug/m3 = (ppm)41.57(MW)]	
NMOC Emission Rate	73	Mg/yr	2.31379568	g/s

HAP	Molecular Weight	Default Conc. (ppmv)	Mass Conc. (ug/m3)	Emissions (Mg/yr)	Emissions (tons/yr)
1,1,1-Trichlorethane (methyl chloroform)	133.42	0.480	2617.38	8.96E-02	9.08E-02
1,1,2,2-Tetrachloroethane	167.85	1.11	7614.63	2.61E-01	2.64E-01
1,1,2-Trichloroethane	133.42	0.100	545.29	1.87E-02	1.89E-02
1,1-Dichloroethane (ethylidene dichloride)	98.95	2.35	9503.60	3.25E-01	3.30E-01
1,1-Dichloroethene (vinylidene chloride)	96.94	0.201	796.35	2.73E-02	2.76E-02
1,2-Dichloroethane (ethylene dichloride)	98.96	0.407	1646.11	5.64E-02	5.71E-02
1,2-Dichloropropane (propylene dichloride)	112.98	0.18	831.15	2.85E-02	2.88E-02
Acrylonitrile	53.06	6.33	13727.00	4.70E-01	4.76E-01
Benzene	78.11	1.91	6097.40	2.09E-01	2.12E-01
Carbon disulfide	76.13	0.583	1813.97	6.21E-02	6.29E-02
Carbon tetrachloride	153.84	0.004	25.15	8.61E-04	8.72E-04
Carbonyl sulfide	60.07	0.490	1202.98	4.12E-02	4.17E-02
Chlorbenzene	112.56	0.254	1168.48	4.00E-02	4.05E-02
Chloroethane	64.52	1.25	3296.17	1.13E-01	1.14E-01
Chlorform	119.39	0.03	146.38	5.01E-03	5.08E-03
Chloromethane (methyl chloride)	50.49	1.21	2496.87	8.55E-02	8.66E-02
Dichlorbenzene	147.00	0.213	1279.68	4.38E-02	4.44E-02
Dichlormethane (methylene chloride)	84.94	14.3	49642.42	1.70E+00	1.72E+00
Ethylbenzene	106.16	4.61	20001.68	6.85E-01	6.94E-01
Hexane	86.17	6.57	23138.02	7.92E-01	8.03E-01
Mercury	200.61	0.000292	2.39	8.20E-05	8.30E-05
Methyl ethyl ketone (2-butanone)	72.10	7.09	20892.29	7.15E-01	7.25E-01
Methyl isobutyl ketone (hexone)	100.16	1.87	7654.92	2.62E-01	2.66E-01
Perchloroethylene (tetrachloroethylene)	165.83	3.73	25279.97	8.65E-01	8.77E-01
Toluene	92.13	39.3	147978.38	5.07E+00	5.13E+00
Trichloroethylene	131.40	2.82	15144.30	5.18E-01	5.25E-01
Vinyl chloride	62.50	7.34	18749.11	6.42E-01	6.50E-01
Xylenes	106.16	12.1	52498.99	1.80E+00	1.82E+00
Total Uncontrolled VOC HAPs (before flare)					1.51E+01
Total Mercury					8.30E-05
Total Controlled VOC HAPs					3.02E-01
Total HAPs					**0.30**

SWA Lime Recalcination Facility and Sludge Pelletization Facility
Secondary Pollutant Emission Rates - Backup Flare

Flare Gas Flow Design Capacity:	2300	scfm	34231673.63	m^3/year
Methane Content of Landfill Gas:	58.5%	(percent by volume)		
Total Methane Flow to Flare:	1346.6			
Energy content of methane:	980	Btu/ft^3	34603.8	Btu/m^3

CO and NOx Emission Rates Based on Vendor Emission Factors

Pollutant	Methane Flow Rate to Flare (scfm)	Energy input to flare (MMBtu/yr)	Emission Factor (lb/MMBtu)	Emissions from Flare (lb/yr)	Emissions from Flare (ton/yr)
Class I Landfill					
Carbon Monoxide	1347	693617.5	0.33	228893.8	114.45
Nitrogen Oxides	1347	693617.5	0.066	45778.8	22.89

SO2 and HCl Emission Rates Based on Mass Balance

Pollutant	Total Landfill Gas Flow Rate to Flare (Std. m^3/yr)	Concentration of S or Cl in Landfill Gas (ppmV)	Emission rate of S or Cl (m^3/yr)	Molecular Weight of S or Cl (g/gmol)	Temperature at Standard Conditions (°C)	Uncontrolled Mass Emissions of S or Cl (kg/yr)	Control Efficiency (%)	Ratio of Molecular Weights SO_2/S or HCl/Cl	Controlled Mass Emissions of Pollutant (kg/yr)	Controlled Mass Emissions of Pollutant (lb/hr)	Controlled Mass Emissions of Pollutant (ton/yr)
Class I Landfill											
Sulfur - Sulfur Dioxide	34231674	100	3423.17	32.06	20	4562.74	0	2.00	9117.23	2.3E+00	10.1
Chlorine - Hydrogen Chloride	34231674	42.0	1437.73	35.45	20	2118.72	91	1.03	196.17	4.9E-02	0.22

The emission rates for CO and NO_X are based on information provided by vendors. Because a vendor has not been selected for the backup flare, two vendors were contacted for emissions data for enclosed flares. The higher emissions estimate was selected, and 10 percent was added to account for uncertainty of additional vendors possibly bidding on the flare. LFG Specialties estimates enclosed flare NO_X emission rates to be 0.06 lb/MMBtu and CO to be 0.29 lb/MMBtu (Kalani and Nardelli, "Landfill Gas Flare Emissions", presented at SWANA 20th Annual Landfill Gas Symposium, March, 1996). Perennial Energy, Inc., provided a verbal guarantee for an enclosed flare of 0.06 lb/MMBtu NO_X, and 0.15 lb/MMBtu CO (Larry Conner, phone conversation, November 21, 2001.) The calculation of SO_2 and HCl is from: U.S. EPA, *Compilation of Air Pollutant Emission Factors*, Report No. AP-42, Fifth Edition, Supplement C, Section 2.4, updated November, 1997.

Appendix F
List of Proposed Exempt Activities

APPENDIX F

LIST OF PROPOSED EXEMPT/INSIGNIFICANT ACTIVITIES

Source	Quantity	Description	Reason for Exemption
Cross-Bar Lime Cooler	1	lime product cooler	Criteria emissions < 5 ton/yr (See Appendix E)
Lime Storage Silo	2	approximately 3800 m3	Criteria emissions < 5 ton/yr (See Appendix E)
Biosolids Pellet Storage Silo	2	approximately 3800 m3	Criteria emissions < 5 ton/yr (See Appendix E)
Cooling Tower (3 cells)	1	1523 gpm	Criteria emissions < 5 ton/yr (See Appendix E)
Emergency Motor	1	gasoline-powered motor to rotate hot LRF Kiln during power outage	Rule 62-210.300 3.(a)20., F.A.C.

Emissions Calculations for Gasoline and Diesel Industrial Engines

Emission Factors are from AP-42, Section 3.3

	NOx	CO	SOx	PM10
Emission Factors (lb/hp-hr)	0.031	6.68E-03	2.05E-03	2.20E-03
Emissions, by Equipment Type (ton/yr)*				
Pump	0.29016	0.0625248	0.019188	0.020592
Tub Grinder	3.8688	0.833664	0.25584	0.27456

Note:

* Based on operation 6 days/week, 52 weeks/year.

Appendix G
Compliance Assurance Monitoring (CAM) Plan

The Compliance Assurance Monitoring (CAM) Rule, 40 Code of Federal Regulation (CFR) 64 was written to provide a "reasonable assurance" of continuous compliance with emissions limitations or standards in cases where the underlying requirement for an emissions unit does not require continuous emissions monitoring, and for units that are part of major sources that have Title V operating permits. As described in Volume III, Section 2, the Lime Recalcination Facility's (LRF's) lime kiln has a particulate matter (PM) emissions limit of 0.60 pounds PM per ton of limestone feed from the New Source Performance Standards (NSPS) for Lime Manufacturing Plants (40 CFR 60 Subpart HHH). Compliance with this limit is based on an initial stack test, rather than continuous monitoring.

The CAM Rule applies to a pollutant-specific emissions limit for a unit at a major source required to have a Title V permit, if the unit satisfies all of the following criteria:

1. The unit is subject to an emissions limitation, other than an exempt (defined below) emissions limitation;

2. The unit uses a control device to achieve compliance with the emissions limitation; and

3. The unit has potential pre-control device emissions of the regulated air pollutant that will equal or exceed the amount, in tons per year required for a source to be classified as a major source (100 tons/year for criteria air pollutants, and 10 tons/year for an individual Hazardous Air Pollutant (HAP)).

The exempt emissions limitations include any National Emissions Standard for HAP (NESHAP) or NSPS proposed after November 15, 1990. The other exemptions are not relevant to this project.

The Lime Manufacturing NSPS were promulgated in 1984, so the PM and opacity limits for the LRF kiln are not exempt, and Criterion 1), above, is met. The LRF will have an electrostatic precipitator (ESP) to control PM emissions, so Criterion 2), above is also met. Uncontrolled PM emissions from the LRF kiln could be up to 1,770 tons per year, so Criterion 3), above, is also satisfied (Uncontrolled PM emissions are based on an emission factor of 97 lbs PM per ton of lime produced, from EPA, Compilation of Air Pollutant Emission Factors, Report No. AP-42, Vol. I, Fifth Edition, Section 11.17, February, 1998, Table 11.7-2, "gas-fired calcimatic kiln"). Therefore, a CAM plan is required for PM emissions from the LRF kiln's ESP. As described in Section 2.9 of Volume III, the LRF kiln is the only emissions unit in the proposed project to which the CAM Rule would apply.

The schedule for submitting the CAM plan for the LRF's PM emissions is governed by 40 CFR 64.5. This section differentiates between "large" pollutant-specific emissions units and "other" pollutant specific emissions units. "Large" units are those units, which taking control devices into account, would emit the applicable air pollutant in an amount that would make the unit a "major" source by itself. "Other" units are all pollutant-specific emissions required to have CAM plans that are not "large." In this case, the LRF kiln would be a "large" pollutant-specific emissions unit if it had the potential to emit PM, after the ESP, of 100 tons/year. The LRF kiln's maximum potential controlled PM emission rate would be 6.7 tons/year, so it is an "other" pollutant-specific emissions unit. 40 CFR 64.5(b) states that for "other" pollutant-specific emissions units, the owner or operator is required to submit the CAM plan as part of the renewal of the Title V permit. It is not required to be submitted with Title V permit revisions. The Solid Waste Authority of Palm Beach County's (SWA) Title V permit for the North County Resource Recovery Facility (NCRRF) site was effective on October 30, 2000. The permit has a five-year term, and will be required to be renewed before October 30, 2005. Therefore, the CAM plan is not included with this Title V permit revision application, but will be provided with SWA's application for renewal of the Title V permit in 2005, if required at that time.

It is likely that Maximum Achievable Control Technology (MACT) standards for Lime Manufacturing Plants (40 CFR 63 AAAAA) will be promulgated in the next year, before the NCRRF Title V permit expires. These MACT standards will likely contain a PM limit that is more stringent than that in the NSPS (Joseph Wood, EPA OAQPS, Project Lead for Lime Manufacturing MACT Rule Development, telephone conversation, October 1, 2002). The new MACT rule will also likely have PM compliance monitoring requirements that meet the requirements of the CAM Rule. The new MACT standard, therefore, would supplant the NSPS PM limit, as well as fulfill the CAM requirement without a separate CAM plan. 40 CFR 70.7(f)(1)(i) requires that Title V permits be reopened to incorporate new rules if there are three years or more remaining in the Title V permit's term. If a Title V facility is affected by a new rule with less than three years remaining in the permit term, the requirements of the new rule are incorporated at permit renewal. There will be fewer than three years remaining in the NCRRF's Title V permit after October 30, 2002. Therefore, it is likely that the new Lime Manufacturing Plant MACT standard will be incorporated into the Title V permit at its renewal, replacing the requirement to provide a CAM plan at that time.

A CAM plan for the LRF kiln, therefore, is not being provided with this Title V permit revision application. SWA will work with the Florida Department of Environmental Protection (FDEP) to follow the development of the new MACT standard for lime production facilities, and incorporate a CAM plan and/or the new MACT requirements into the Title V permit renewal application in 2005. This approach to CAM Rule compliance was recommended by FDEP (Jonathan Holtom, PE II, Bureau of Air Regulation, FDEP, telephone conversation, October 4, 2002).

Appendices H and I
Compliance Report, Plan and Certification

Appendices H and I have been combined. Please See Appendix H.

Appendix J
Descriptions of Control Equipment

Specification for Baghouse
on Lime Cooler Exhaust

Specification for Baghouse
On Lime Cooler Exhaust

One F.L.S. Airtech ® Model 210C12(6) Jet-Pulse dust collector designed for the following operating conditions and specifications:

MODEL NO.	210C12(6)
APPLICATION	MATREIAL HANDLING
DUST	LIME
INLET DUST LOAD	40 GRS/ACF
VOLUME	13,280 ACFM 425 F.
DESIGN STATIC PRESSURE	-20 " W.G.
CLOTH AREA	3,959 FT.2
AIR TO CLOTH RATIO	3.35:1

SPECIFICATION
FOR
F.L.S. AIRTECH, INC. ® MODEL 210C12(6) WALK-IN PLENUM
TYPE JET-PULSE COLLECTOR
(ONE COMPARTMENT)

GENERAL

The jet-pulse on line cleaning dust collector is a semi-shop assembled unit with an automatic self-cleaning system that utilizes pulse jets of high pressure air to provide efficient, thorough cleaning with no internal moving parts. Top bag removal, walk-in plenum design, provides the ability to remove the snap-in/out filter bags. Self-supporting cages and venturi nozzles allow for inspection and replacement without tools or clamping mechanisms.

WALK IN PLENUM

One (1) full bag height walk-in clean air plenum, fabricated from 12 ga. carbon steel with sloped roof, welded construction, designed for –20" w.g. internal pressure. Hinged and gasketed access door with quick acting, lever-type latches, one 6" diameter compressed air header, and one blow pipe per row of 15 bags are included.

HOUSING

One (1) compartment bag housing fabricated from 12 ga. carbon steel, welded construction, designed for -20 w.g.internal pressure.

TUBESHEET

Fabricated from 3/16" plate carbon steel with bag support holes spaced on 8" centerlines.

HOPPER

One (1) pyramid type, fabricated from 10 ga. carbon steel, welded construction, designed for –20" w.g. pressure and 65 lbs./ft.^{3} bulk density at 2/3 hopper height. The hopper slide slope is 60 minimum side slope with 53 minimum valley angle. Access door is fabricated steel hinged and gasketed.

SERVICE PLATFORM

One external platform at tubesheet level, complete with 1" x 3/16" bar grating, 4" x 1/4" toeboard, 1" diameter handrails, and 2-1/2" x 3/8" handrail post.

STRUCTURAL SUPPORTS

Supports provide 4'-0" clearance under the discharge of the rotary lock. Columns and bracing are designed to withstand 30 lbs/ft.2 and 100 mph windload.

LADDER/CAGE

One safety caged ladder to provide access to the tube sheet platform.

PAINT

External single coat of shop primer on SSPC-SP2 (hand tool cleaning).

BAGS

One (1) compartment bag housing fabricated from 12 ga. carbon steel, welded construction, designed for -20 w.g.internal pressure.

TUBESHEET

Fabricated from 3/16" plate carbon steel with bag support holes spaced on 8" centerlines.

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LADDER/CAGE

One safety caged ladder to provide access to the tube sheet platform.

PAINT

External single coat of shop primer on SSPC-SP2 (hand tool cleaning).

BAGS

Made from 6" diameter x 12'-0" long 16 oz./yd^2 woven fiberglass with snap-in bag collar. Maximum operating temperature is 500 F.

The dust collector contains 14 rows of 15 bags per row, for a total of 210 filter bags representing 3,956 ft.^{2} cloth area.

CAGES

Fabricated in one piece, made of twenty vertical 11 ga. carbon steel wires, solid bottom cap, and protective bag collar.

VENTURI

The venturi is manufactured by a metal spinning operation made from 18 ga. carbon steel. It is flange supported and fastened to the cage top collar.

PULSE VALVES

One pulse valve for each row of bags, mounted on air header. Solenoid valves are grouped in enclosures.

PRESSURE GAUGE

One magnehelic pressure gauge to register pressure differential across the dust collector. The gauge is furnished with 20'-0" of tubing, and fittings for field mounting.

TIMER

Automatic sequential controllers that activates the solenoids, which controls the pulse valve for each bag row. Controls are provided to adjust the length of time between valves being energized and the length of time that the valve is energized. Solid state timer, Model WJ in NEMA 4 enclosure for 115 V, single phase, 60 Hz.

DUST DISCHARGE SYSTEM

One (1) rotary lock with 1/2 H.P. T.E.F.C. motor, for pyramid hopper discharge.

ASSEMBLY

The dust collector is shipped in pre assembled sections for field assembly. Bags, cages with venturis, valves, timer, rotary lock, and any equipment offered as an add-on item, are shipped separately for field installation.

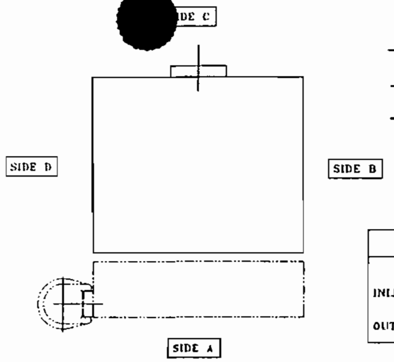
cdm210c

MODEL REQUIRED
FOR LIME COOLER
EXHAUST - S.W.A.

SELECT MODEL SIZE

MODEL SIZE	FILTER AREA FT²	FILTER AREA M²		DIMENSIONS B	DIMENSIONS C	DIMENSIONS D	EST. WEIGHTS WITH SUPPORTS	EST. SHIPPING WEIGHT	EST. SHIPPING DIMENSIONS LENGTH X WIDTH X HEIGHT
210C10(6)	3299	306	9'-8" 2946mm	30'-0" 9144mm	2'-10" 864mm	3'-0" 914mm	12916# 5859 Kg.	10510# 4767 Kg.	30'-0"(9144mm) X 10'-8"(3251mm) X 11'-4"(3454mm)
210C12(6)	3959	368		34'-0" 10363mm			14897# 6757 Kg.	12491# 5666 Kg.	34'-0"(10363mm) X 10'-8"(3251mm) X 11'-4"(3454mm)
210C14(6)	4618	429		38'-0" 11582mm			16198# 7347 Kg.	13792# 6256 Kg.	38'-0"(11582mm) X 10'-8"(3251mm) X 11'-4"(3454mm)
225C10(6)	3535	329	10'-4" 3150mm	30'-0" 9144mm	3'-0" 914mm	3'-2" 965mm	13355# 6058 Kg.	10949# 4966 Kg.	30'-0"(9144mm) X 11'-4"(3454mm) X 11'-4"(3454mm)
225C12(6)	4241	394		34'-0" 10363mm			15406# 6988 Kg.	13000# 5897 Kg.	34'-0"(10363mm) X 11'-4"(3454mm) X 11'-4"(3454mm)
225C14(6)	4948	460		38'-0" 11582mm			16750# 7598 Kg.	14344# 6506 Kg.	38'-0"(11582mm) X 11'-4"(3454mm) X 11'-4"(3454mm)
240C10(6)	3770	350	11'-0" 3353mm	30'-7" 9322mm	3'-0" 914mm	3'-2" 965mm	13992# 6347 Kg.	11500# 5216 Kg.	30'-7"(9322mm) X 12'-0"(3658mm) X 11'-4"(3454mm)
240C12(6)	4524	421		34'-7" 10541mm			16123# 7313 Kg.	13631# 6183 Kg.	34'-7"(10541mm) X 12'-0"(3658mm) X 11'-4"(3454mm)
240C14(6)	5278	491		38'-7" 11760mm			17538# 7955 Kg.	15046# 6825 Kg.	38'-7"(11760mm) X 12'-0"(3658mm) X 11'-4"(3454mm)
255C10(6)	4006	372	11'-8" 3556mm	31'-2" 9500mm	3'-2" 965mm	3'-4" 1016mm	14650# 6645 Kg.	12072# 5476 Kg.	31'-2"(9500mm) X 12'-8"(3861mm) X 11'-4"(3454mm)
255C12(6)	4807	447		35'-2" 10719mm			16859# 7647 Kg.	14281# 6478 Kg.	35'-2"(10719mm) X 12'-8"(3861mm) X 11'-4"(3454mm)
255C14(6)	5607	521		39'-2" 11938mm			18319# 8309 Kg.	15741# 7140 Kg.	39'-2"(11938mm) X 12'-8"(3861mm) X 11'-4"(3454mm)
270C10(6)	4242	394	12'-4" 3759mm	31'-9" 9677mm	3'-2" 965mm	3'-4" 1016mm	15304# 6942 Kg.	12640# 5734 Kg.	31'-9"(9677mm) X 13'-4"(4064mm) X 11'-4"(3454mm)
270C12(6)	5090	473		35'-9" 10897mm			17594# 7981 Kg.	14930# 6772 Kg.	35'-9"(10897mm) X 13'-4"(4064mm) X 11'-4"(3454mm)
270C14(6)	5937	552		39'-9" 12116mm			19098# 8663 Kg.	16434# 7454 Kg.	39'-9"(12116mm) X 13'-4"(4064mm) X 11'-4"(3454mm)
285C10(6)	4477	416	13'-0" 3962mm	32'-4" 9855mm	3'-4" 1016mm	3'-6" 1067mm	15969# 7244 Kg.	13215# 5994 Kg.	32'-4"(9855mm) X 14'-0"(4267mm) X 11'-4"(3454mm)
285C12(6)	5372	499		36'-4" 11074mm			18339# 8319 Kg.	15585# 7069 Kg.	36'-4"(11074mm) X 14'-0"(4267mm) X 11'-4"(3454mm)
285C14(6)	6267	583		40'-4" 12294mm			19887# 9021 Kg.	17133# 7772 Kg.	40'-4"(12294mm) X 14'-0"(4267mm) X 11'-4"(3454mm)
300C10(6)	4713	438	13'-8" 4166mm	32'-11" 10033mm	3'-4" 1016mm	3'-6" 1067mm	16645# 7550 Kg.	13799# 6259 Kg.	32'-11"(10033mm) X 14'-8"(4470mm) X 11'-4"(3454mm)
300C12(6)	5655	526		36'-11" 11252mm			19097# 8662 Kg.	16251# 7371 Kg.	36'-11"(11252mm) X 14'-8"(4470mm) X 11'-4"(3454mm)
300C14(6)	6597	613		40'-11" 12471mm			20687# 9384 Kg.	17841# 8093 Kg.	40'-11"(12471mm) X 14'-8"(4470mm) X 11'-4"(3454mm)
315C10(6)	4949	460	14'-4" 4369mm	33'-6" 10211mm	3'-6" 1067mm	3'-8" 1118mm	17331# 7861 Kg.	14399# 6531 Kg.	33'-6"(10211mm) X 15'-4"(4674mm) X 11'-4"(3454mm)
315C12(6)	5938	552		37'-6" 11430mm			19894# 9024 Kg.	16962# 7694 Kg.	37'-6"(11430mm) X 15'-4"(4674mm) X 11'-4"(3454mm)
315C14(6)	6927	644		41'-6" 12649mm			21530# 9766 Kg.	18598# 8436 Kg.	41'-6"(12649mm) X 15'-4"(4674mm) X 11'-4"(3454mm)
330C10(6)	5184	482	15'-0" 4572mm	34'-1" 10389mm	3'-6" 1067mm	3'-8" 1118mm	17977# 8154 Kg.	14959# 6785 Kg.	34'-1"(10389mm) X 16'-0"(4877mm) X 11'-4"(3454mm)
330C12(6)	6221	578		38'-1" 11608mm			20621# 9354 Kg.	17603# 7985 Kg.	38'-1"(11608mm) X 16'-0"(4877mm) X 11'-4"(3454mm)
330C14(6)	7257	675		42'-1" 12827mm			22301# 10116 Kg.	19283# 8747 Kg.	42'-1"(12827mm) X 16'-0"(4877mm) X 11'-4"(3454mm)

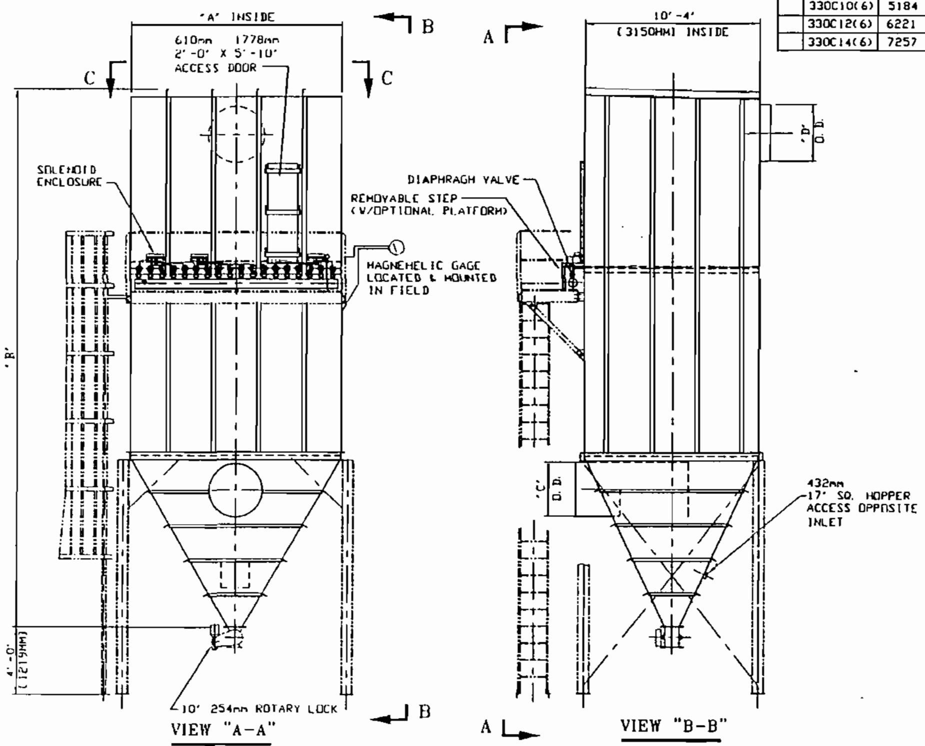
REQUIRE SPECIAL SHIPPING CLEARANCE APPROVAL (models 300C10(6) – 330C14(6))



VIEW "C-C"

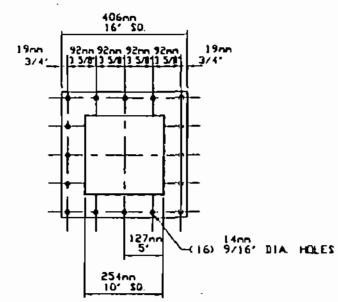
CUSTOMER OPTIONS (CHECK ONE)

	SIDE A	SIDE B	SIDE C	SIDE D
INLET LOCATION	☐	☐	☐	☐
OUTLET LOCATION	N/A	☐	☐	☐



VIEW "A-A"

VIEW "B-B"



HOPPER DISCHARGE FLANGE

COLLECTOR SHOWN WITH OPTIONAL LADDER, PLATFORM, HANDRAIL, SUPPORTS & ROTARY LOCK

REV. NO.	DR.	CHD.	APPR.	DATE	ZONE	MICRO

FLSMIDTH AIRTECH
Bethlehem, Pa. 18017 USA

DR. FRH	"C" SERIES JET PULSE COLLECTOR
CHD.	MODEL SIZE 210C(6) - 330C(6)
APPR.	WITH HOPPER
DATE 3APR97	STANDARD
SCALE	DRAWING NUMBER 336-97-4-0182 — REV. 1 — SHEET NO. 1 OF 1
MICRO	

DWG. NO 336-97-4-0182

Specification for
Dry Electrostatic Precipitator

Specification for
Dry Electrostatic Precipitator

SPECIFICATION

FOR

DRY ELECTROSTATIC PRECIPITATOR

County of Palm Beach, Florida
Lime Reburning Kiln

Prepared by
Camp Dresser & McKee

SPECIFICATION NO.

REV	DATE	DESCRIPTION	PAGES	BY	APPROVED BY

TABLE OF CONTENTS

PAGE NO.

1. SCOPE

1.1 Application

This specification is for an electrostatic precipitator and accompanies for County of Palm Beach Florida, Camp Dresser & McKee Company Project No.xxx.

The Bidder shall design, furnish, fabricate, and deliver one (1) electrostatic precipitator complete with all components, accessories, and services mandated by this specification. It is not the intent of this document to specify completely all of the details for design and construction of this equipment. However, the equipment shall conform in all respects to high standards of engineering, design, and workmanship.

The precipitator shall be designed for particulate removal on a lime reburning kiln. The precipitator shall be of a single chamber design. The precipitator shall be shop fabricated to the greatest extent practical.

The precipitator bid shall be confined to an arrangement and design which has been proven by past operating experience in existing units of comparable capacity and design conditions. A list of such installations where precipitators of similar design are in service shall be provided with the quotation.

1.2 Equipment and Services by Bidder

The intent of this section is to outline the major portions of the Bidder's scope of supply. This listing is not all-inclusive and the Bidder shall provide complete operable systems.

1.2.1 Structural

	Bidder	Others
a. Precipitator support steel design and supply	X	
b. Foundations design and supply		X
c. Anchor bolts		X
d. Design and supply of ductwork from induced draft fan to precipitator inlet plenum		X
e. Review design of ductwork from induced draft fan to precipitator inlet plenum		X

	Bidder	Others
f. Access facilities (stairs, ladders, walkways, platforms, and handrails) from grade and boiler building to top of precipitator	x	
g. T-R monorail system including hoists and motors	x	
h. Shop painting	x	
i. Touch-up painting		x
j. Insulation	Engineer -ing only	x

1.2.2 Mechanical

	Bidder	Others
a. Penthouse blower system	x	
b. Inlet and outlet plenums	x	
c. Inlet and outlet expansion joints		x
d. Inlet and outlet gas distribution devices	x	
e. Access doors	x	
f. Precipitator bottom hoppers and outlet rotary valves	x	
g. Ash collection, transport, and storage system		x
h. Collecting electrodes	x	
i. Discharge electrodes	x	
j. Rapper system	x	
k. I.D. fan		x
l. Stack		x

1.2.3 Electrical/Controls

	Bidder	Others
a. Transformer rectifiers	x	

	Bidder	Others
b. Bus bar and bus ducts	x	
c. Rectifier control consoles	x	
d. Undervoltage relay protection	x	
e. Rapper controls and panels	x	
f. Alarm point outputs to DCS	x	
g. Grounding of precipitator		x
h. Safety key interlock system	x	
i. MCC/electrical distribution panel		x
j. Field mounted instruments		x
k. Interface connections for remote operations	x	
l. Motors integral to equipment furnished	x	
m. Low voltage electrical power wiring, control wiring, and lighting		x
n. Non-integral standard NEMA frame motors, starters, and contactors, unless specifically included in this specification		x
o. Motor control center for precipitator to include: **1.** Combination starters for the rappers, if required **2.** Combination starters for the fans, etc., as required **3.** 110 V controls as applicable.		x
p. Hardware/software required for DCS interface	x	
q. Penthouse pressure & temperature transmitters.	x	
r. Flue-gas pressure & temperature transmitters each field & outlet plenum		x

1.2.4 General

	Bidder	Others
a. 304 Stainless steel name tags on all equipment and instruments.	x	
b. Engineering design specification for insulation and lagging and attachment.	x	
c. Erection of precipitator		x
d. Construction/Erection/QA advisor(s)	x	
e. Start-up engineer(s)	x	
f. Performance test		x
g. Training program for plant personnel (see option)		x
h. Operations and maintenance manuals	x	
i. Priced spare parts list	x	
j. Spare gasket for each door	x	
k. Air conditioned control/electrical room		x

1.3 Equipment and Services by Others

See Paragraph 1.2.

1.4 Terminal Points

The terminal points list is included to clearly identify end points of equipment supplied. All equipment on the precipitator side of each point shall be supplied.

1.4.1 Flue Gas

a. Inlet flange of precipitator inlet plenum.

b. Outlet flange of precipitator outlet plenum.

1.4.2 Ash

Outlet flange of precipitator hopper rotary valves.

1.4.3 Electrical

Equipment up to and including T/R distribution cabinet, T/R console and rapper control cabinet.

1.4.4 Structural

Owner furnished support steel and foundations.

1.4.5 Ambient Air

Inlet to silencer (id required) for penthouse blower(s).

1.5 Information Required

1.5.1 Information Required with Proposal

a. Outline drawings showing general arrangement, approximate weights, dimensions, sampling and instrument port locations, and space clearance requirements for proposed equipment including platforms, ladders, column locations, and loads.

The Bidder shall provide copies of general drawings in AutoCAD 2000 on 3 1/2-in. computer disk or CD.

b. Specifications and descriptive data on proposed equipment, including detailed equipment and motor list, showing: horsepower, rpm, and application data.

c. Completed Bidder Data Sheets, Attachments A and B with all blanks filled in. For consideration, the Bidder must complete the attached data sheets. The requested information in any other format is not acceptable for evaluation.

d. Submit correction factors in the form of performance guarantee curves. Performance test data will be corrected for actual operating conditions from these curves in the determination of conformance with performance guarantees. Correction factors for capacity shall as a minimum range from 70 percent to 110 percent of design gas flow. The Bidder shall identify the design operating point on each curve.

Submit the following curves for the precipitator and state the accepted method for interpolation of the curves:

(1) Guaranteed particulate emission values plotted against varying gas flow (acfm) for a range of inlet dust loadings. As a minimum, the range of inlet dust loadings shall include 50 percent to 200 percent of the design inlet loading.

(2) Guaranteed draft loss values (inches wg) plotted against varying gas flow (acfm).

e. Names and addresses of installations, within the last 10 years, of similar design and same equipment.

f. ANY EXCEPTIONS TO THIS SPECIFICATION MUST BE LISTED CLEARLY IN THE PROPOSAL. Should there be serious objections which would prohibit giving a competitive bid, the Engineer shall be notified, in writing, so that changes can be considered and all Bidders notified. If in full compliance with this specification, so state in proposal. This specification shall serve as the Owner's technical portion of the purchase order.

g. Statement of performance guarantee based upon precipitator design criteria and fuel data given in Section 2.0.

h. Furnish tabulations, lists, write-ups, or other suitable descriptions defining the extent to which furnished equipment and materials are factory assembled.

i. Bidder's drawing schedule showing dates of submittal of all Bidder drawings to include both initial and final submittal (See data needs list, Attachment C). Attachment C must be completely filled in, expanded, as required, and returned with bid. The Owner and Engineer shall review all preliminary drawings and return them to the Bidder's facility within fifteen (15) working days from receipt of same. All dates shall be from award of verbal purchase order.

j. The Bidder shall submit a copy of Bidder's Quality Assurance/Quality Control Program.

k. Master Bill of Materials list sample.

See Section 1.5.2.c.

1.5.2 Information Required with Contract

a. Approval Drawings to the Owner and Engineer shall include, but not necessarily be limited to, the following:

(1) Precipitator arrangement drawings include front, rear, both sides, and top views in sufficient detail to allow setting of interconnecting platforms and to identify all access points and clearances required for equipment

removal. Show Owner interface points, loads, and breeching movements.

(2) Foundation load requirements to include dead load, live load, wind, thermal and/or seismic loads at each load point. Drawing should show all loads and load points. Load diagrams identifying fixed and expansion load points with expansion load point movements.

(3) Electrical system single-line diagrams to show all Bidder furnished items as well as items to be furnished by Owner.

(4) Terminal plans and connections for all electrical and process control/indication/monitoring equipment and control panels shall show all Owner connection points both schematically and physically.

(5) Elementary wiring diagrams for the control of all motor operated devices and magnetic contactors supplying other electrical loads.

(6) Instrumentation loop sheets, specification sheets, and installation details for all instrument devices used for process control, monitor, or indication purposes.

(7) Panel outline drawings showing physical dimensions of all Vendor furnished panels.

b. Operating and Maintenance Instruction Manuals, 12 required, in accordance with the attached INSTRUCTIONS TO BIDDERS, shall be provided to the Owner by the Vendor and shall contain at least the following:

(1) Description and assembly drawings of each item of furnished equipment.

(2) Parts nomenclature.

(3) Wiring and piping diagrams.

(4) Procedures for start-up, troubleshooting, and operation of unit.

(5) Instructions for assembly and reassembly of all items of equipment furnished as required for normal operation and maintenance.

(6) General arrangement drawings.

(7) Precipitator guarantee and performance data including performance and emissions curves.

c. The Vendor shall provide a Master Bill of Materials list to the Owner and Engineer. This list shall be received no later than 2 months prior to the start of precipitator delivery.

The list is to be suitable for use as a check list to verify field receipt of all Vendor's fabrications, piece parts, sub-supplier equipment and materials to be furnished, delivered, as a part of the purchase order.

The Bidder shall include a sample master bill of materials list in the proposal.

1.6 Performance Guarantee

1.6.1 Acceptance Test

a. An Acceptance Test to evaluate operating performance against the performance guarantees shall be performed for the precipitator by the Owner or his designee. The tests will be conducted at a mutually agreed time within the warranty period as set forth in the Purchase Agreement. The Vendor shall witness all acceptance tests.

b. Prior to conducting an Acceptance Test, the precipitator shall be operated through a minimum two (2) week period without equipment or operations modifications except for routine maintenance.

c. For all performance guarantees, three (3) test runs performed by the Owner shall establish an acceptance test value. Performance guarantee curves (as described in paragraph 1.5.1 e) shall be used to evaluate test data for actual operating conditions. The average of the three- (3) test runs must achieve the performance guarantee to demonstrate particulate emissions compliance.

d. The precipitator must demonstrate compliance with the performance guarantee in order to be accepted by the Owner as having passed its respective acceptance test.

e. The Owner shall notify the Vendor of whether a precipitator passes or fails its respective acceptance test.

f. In the event that a precipitator fails to demonstrate performance equal to or superior to the performance guarantees, the Vendor shall have a period of 60 calendar days for equipment or operation adjustments and re-testing. This 60-day period begins with the Owner's notification to Vendor of a precipitator's acceptance test failure.

g. If a precipitator fails to demonstrate compliance with its performance guarantees within the 60-day period for adjustments and re-testing, then the precipitator shall be deemed in non-compliance with the specification. In this event, the rights and responsibilities of the Vendor and Owner shall be as set forth in the Purchase Order.

h. The entire cost, including freight and labor, for any additional testing or equipment modifications in order to satisfy a performance guarantee shall be borne by the Vendor. Any work or required downtime for these purposes shall be at the Owner's convenience.

i. **Particulate Emission Tests**

The particulate removal efficiency and emissions of the precipitator shall be determined by measuring the particulate content of the incoming and effluent gases. These measurements shall be taken at the inlet and outlet plenum ducts in accordance with EPA Test Method 17, EPA Standards of Performance for New Stationary Sources (40 CFR Part 60).

Condensables will not be included in the determination of particulate collection efficiency.

j. **Draft Loss**

The draft loss across the precipitator shall be measured by performing traverses of the inlet and outlet plenum ducts. The traverses shall be performed in accordance with EPA Method 1. The measured draft losses shall be corrected for actual operating gas flows using the guaranteed correction curve (as described in paragraph 1.5.1.e.2).

1.6.2 Performance

Performance guarantees shall be provided with the proposal, stating that the electrostatic precipitator system will meet the range of operating requirements listed in Section 2.0.

The Bidder's proposal shall include the following performance guarantees for the precipitator.

a. The Bidder shall guarantee a maximum draft loss at design gas flow conditions for the precipitator. The draft losses shall be measured from the precipitator inlet plenum to the precipitator outlet plenum.

b. The precipitator particulate emission shall not exceed the limits given in the following table:

	Guaranteed Performance
Lime Reburning Kiln Precipitator Grains/DSCF, 3 hour test average	0.010

(1) All emissions data shall be based on EPA measurement standards.

2. DESIGN DATA

2.1 General

The precipitator shall be designed for continuous, heavy-duty, 24 hour per day, service. Only materials and workmanship suitable for this service and which will require minimum maintenance and downtime shall be used. The precipitator shall be remotely operated and monitored from an operator control room located approximately 500 feet away.

2.2 Lime Reburning Kiln Precipitator

2.2.1 Installation will be downstream of a lime reburning kiln with an induced draft fan.

2.2.2 The precipitator shall be designed for the specified gas flow while satisfying the criteria for maximum allowable particulate emissions (paragraph 2.2.4. f).

2.2.3 In no case shall the emissions level be greater than the maximum values given in 2.2.4. The Bidder shall take all necessary corrective actions to achieve these guarantees.

2.2.4 The combination fuel power boiler electrostatic precipitator design criteria is as follows:

a. Flue Gas Flow, ACFM	Design	24,876
b. Gas Density, lb/ft^3	Design	0.0363
c. Flue Gas Temp., °F	Design Operating	550
	Structural Design	650
d. Flue Gas Moisture, % vol.		33.72%
e. Inlet grain loading, gr/acf		20.0
f. Outlet particulate load, gr/DSCF-design		0.010

2.3 Structural Design

2.3.1 The following design criteria shall be the basis for all structural design of the precipitators and related equipment:

a. Metal temperature, °F	650
b. Internal pressure, in. water	- 10

2.4 Miscellaneous Criteria and Services

2.4.1 The precipitator shall be installed and operated at elevation 10 feet nominal above mean sea level. All drawings shall reference grade elevation as "actual."

2.4.2 The precipitators shall be installed outdoors. The ambient temperature range is 10°F to 100°F.

2.4.3 The equipment shall be designed and supported to withstand seismic and wind forces in accordance Note – need FL codes

2.4.4 The following utility services will be available. All remaining utility services to the precipitator shall be provided by the Bidder.

a.	Compressed air	60 psig
b.	Instrument air	60 psig, -10°F wet bulb
c.	Water	50 psig, 98°F at grade
d.	Electrical	120/240 Volt, 1-phase, 60-hertz; 480 Volt, 3-phase, 60-hertz; 4160 Volt, 3-phase, 60-hertz

3. DETAILED REQUIREMENTS OF EQUIPMENT

3.1 Standards and Codes Applicable

3.1.1 All applicable codes in effect as of the date of purchase and any subsections thereof, as applicable, shall govern design, fabrication, testing and selection of equipment and materials supplied. These include, but are not limited to, the following:

AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standard Institute
ASCE	American Society of Civil Engineers—Minimum Design
ASCE7	American Society of Civil Engineers—Minimum Design Loads for Buildings and Other Structures
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWS	American Welding Society
EPA	Environmental Protection Agency
IEEE	Institute of Electrical and Electronic Engineers
IGCI	Industrial Gas Cleaning Institute, Inc.
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
FBC	FLORIDA Building Code

3.1.2 Local, state, and federal regulations in effect as of the date of purchase shall be complied with.

3.1.3 Bidder shall warrant that all materials, equipment, and other items furnished by Bidder in connection with this specification and that Purchaser's use in accordance with Vendor's operating instructions shall comply with all such applicable laws, rules, regulations and codes.

3.2 Precipitator

3.2.1 Bidder shall quote maximized shop assembly of the unit and provide an estimate of field erection time and labor.

3.2.2 The precipitator shall be of single chamber design. The chamber walls and roof shall be of single wall construction with external stiffeners as required.

3.2.3 All seams and joints inside the precipitator shall be seal welded.

3.2.4 Provide a ventilated weatherproof roof enclosure complete with structural steel framework, and ribbed aluminum roofing, to cover the transformer/rectifiers and other penthouse roof mounted equipment.

3.2.5 Monorail beams shall be provided for transporting and lowering precipitator equipment to the ground level from penthouse roof.

3.2.6 The penthouse of the precipitator shall be gas-tight and provided with a positive pressure ventilation system supplied with heated, clean air to prevent condensation. The necessary temperature switches and control devices for the heater/blower set operation shall be included.

3.3 Precipitator Ash Collection System

3.3.1 Bidders shall furnish a rotary valve on the outlet of each ash hopper.

3.3.2 The ash collection system downstream of hopper outlet rotary valves shall be by Owner.

3.3.3 Precipitator hopper electric heaters with maintenance access shall be furnished as recommended.

3.4 Precipitator Discharge Electrodes

3.4.1 The discharge electrode system preferred shall be either of the rigid frame or rigid electrode design.

3.4.2 A steel or alloy steel suitable for the service specified shall be the material of construction.

3.5 Precipitator Collecting Electrodes

3.5.1 The collecting electrodes shall be constructed of steel or alloy steel suitable for the service specified.

3.5.2 Height of collecting electrodes shall be selected to minimize re-entrainment of ash during rapping.

3.6 Precipitator Electrode Rapping System

3.6.1 A complete mechanical rapping system shall be provided. The rapping system shall be of the mechanical type with "tumbling hammers" installed on a rotating shaft. To minimize rapping spikes, one rapper will be required for each collector sheet.

3.6.2 The rappers shall operate in a manner such that maximum dust collection will be maintained during the rapping process.

3.6.3 All rapper controls and drive mechanisms shall be located such that they are accessible for maintenance without shutting down the precipitator. All necessary passages through the precipitator enclosure shall be sealed watertight.

3.6.4 Each electrical field shall be separately rapped in order to reduce the percentage of the treatment zone that can be disturbed at any time.

3.6.5 The Bidder shall provide a list of all monitoring and control variables (such as status, start/stops, alarms, etc.) for interface to a distributed control system.

3.7 Structural System

3.7.1 Supporting Structure

a. Furnish the complete supporting structure for the inlet plenum, chamber, and outlet plenum including all columns, girders, and beams down to the expansion bearing plate interface plane. Precipitator structure shall accommodate loads for walkways.

b. Supply these loads itemized as follows:

Loads at <u>each</u> column point:

Dead Load
Live Load
Wind Shear-N/S Axis
Wind Shear-E/W Axis
Wind Axial Load-Uplift
Wind Axial Load-Compression
Seismic Shear-N/S Axis
Seismic Shear-E/W Axis
Seismic Axial Load - Uplift
Seismic Axial Load - Compression

3.8 Electrical Requirements

3.8.1 General

All insulators and wiring materials required to electrically connect the transformer/rectifier units to the precipitator electrodes shall be provided. The high voltage lead from the rectifier to the precipitator shall consist of a conductor in a bolted metal-enclosed weatherproof bus duct, allowing for disassembly. Electric space heaters shall be provided for operation on 120-volt, 60-Hz source. The bus duct shall include necessary insulators and duct supports and fittings, and shall be supplied, formed to exact length, ready for bolting to the equipment.

3.8.2 Transformer/Rectifier Units

a. The transformer/rectifiers shall be located on top of the cold roof and preferably be of the same size. The access doors to all electrically hazardous areas shall be key interlocked (Kirk preferred) with the main supplies and adequate grounding provisions made for personnel safety. This equipment shall be designed such that the plant area shall be free from any radio noise or interference caused by the rectifiers when operating. Supply a key for each door. Only one set of keys shall be furnished. All keys/locks shall be accessible without hazards to personnel.

b. Each high voltage transformer shall be a single phase, silicon oil immersed, self-cooled unit contained in a welded steel case. Transformers shall have copper windings, i.e., aluminum not acceptable. Transformers shall be rated for 55 °C rise OA at base kVA rating.

c. The rectifier shall be full-wave type. Each rectifier set shall be mounted directly on its respective high voltage transformer case.

d. Each transformer/rectifier shall be mounted on a base which forms a tank or containment vessel of sufficient volume to contain the entire quantity of oil in the transformer in order to prevent loss of this fluid to the surrounding area in the event of leakage.

e. The primary voltage supply to the transformer will be 480-volt, single-phase, 60-hertz.

f. High voltage insulators shall be 85 percent fused alumina and shall be located out of the gas stream.

g. Each transformer/rectifier shall be provided with a temperature gauge, liquid level gauge, sampling connections, drain valve, and weatherproof terminal box with gasketed removable cover. The terminal box shall contain transformer primary connections, rectifier positive terminals, ground terminal, and interface to control electronics.

h. The high voltage connections from the T/R unit to the electrode bus sections shall be enclosed in a weatherproof, corrosion-resistant bus duct. The high voltage connection to each bus section shall have a disconnect switch that when opened will ground the electrode. The disconnect switchblades shall be visible for verification of switch position. Access to the high voltage disconnect switch shall be secured by a key interlock switch. This switch shall be keyed to the open position of the disconnect switch in the TR set primary winding.

i. The Vendor shall provide a list of all monitoring and control variables (such as status, start/stop, alarms, etc.) for interface to a distributed control system.

j. Interior of bus duct and air switches shall be covered with a white epoxy coating.

3.8.3 Transformer/Rectifier Control Cabinet

a. Provide a NEMA 12 transformer/rectifier (T/R) control cabinet to be housed in the motor control center room.

b. The T/R control cabinet shall house a main circuit breaker, key-interlocked to the precipitator access doors, and the T/R transformer controls.

c. The T/R control cabinet shall house all contactors, control transformers, branch circuit protection, rectifier protection devices, indicating instruments (including a-c and d-c ammeter and, a-c and d-c voltmeter), timers, overcurrent protection systems and rectifier's undervoltage power and control system, plus local control devices on door and provisions for remote alarm.

d. Provide a 480/120 volt transformer and panelboard for supplying all 120-volt a-c necessary for the control of the rectifier units. This equipment shall also be housed in the T/R control cabinet.

3.8.4 Rapper Controls

Rapper controls shall be integral with the Automatic Voltage Controllers.

3.8.5 Alarms

Contacts shall be furnished for the alarms to be located in the mill control room. The annunciation will be part of the distributive control system, and the required interface devices shall be provided. The Bidder's proposal shall include a list of alarms.

3.8.6 Grounding

Devices for positively grounding the high-voltage system of the precipitator prior to personnel entering the enclosure shall be provided. The bus duct disconnect switch shall ground the precipitator when opened.

3.9 Insulation and Lagging

3.9.1 Supply engineering design specification for insulation and lagging for all exposed surfaces of the precipitator and related equipment. Insulating materials shall be securely anchored to the insulated surface. Lagging shall not serve to support or hold insulation in place. All insulation material shall be non-asbestos.

3.9.2 Where required for inspection and maintenance purposes, insulation and lagging shall be installed in readily removable and replaceable sections, i.e., hinged doors with latches. Where near-horizontal areas may be exposed to occasional foot traffic, lagged insulation shall be adequately stiff to support such traffic without distortion of the insulation or lagging.

3.9.3 Specify type and thickness of insulation and lagging. Insulation shall be of sufficient thickness (4-in. minimum) to ensure a surface temperature not to exceed 130°F with a ambient temperature of 100°F and an air velocity of 50 feet per minute at the face of the lagging. Insulation will also maintain the inside surface of the precipitator above the dew point with ambient air temperature as specified herein and a wind velocity of 50 feet per minute at the face of the lagging.

3.10 Accessories

3.10.1 Access Doors

a. Access doors shall be of the dust-tight, hinged design with internal insulation and compression latch mechanism. The exterior shall be hot-dip galvanized.

b. Access doors shall be furnished as follows:

(1) In the precipitator shell—not less than one door between each adjacent pair of electrical fields located at the elevation of the bottom of the electrodes.

(2) In precipitator roof (hot roof deck)—one for access to each bus section.

(3) Inlet and outlet plenum where applicable—one in each plenum.

(4) Other—Furnish other doors as required wherever his design dictates to ensure proper operation, inspection, cleaning, and maintenance of the equipment.

3.10.2 Key Interlocks

All access doors through which personnel might come in contact with high voltage equipment shall be key-interlocked to prevent opening before the precipitator power supply is de-energized and the equipment connected to ground. All locks and keys shall be constructed entirely of Type 304 or Type 316 stainless steel, and the exposed portions shall be housed in a steel enclosure with a hinged and gasketed cover.

3.10.3 Ductwork and Breeching

a. The precipitator inlet and outlet plenums shall be provided by Bidder, and designed to be self-supporting.

b. Duct layout to precipitator inlet plenum and from the precipitator outlet plenum will be submitted to the Precipitator Vendor for review. It shall be the responsibility of the Precipitator Vendor to assure the duct layout and design will give an even gas distribution within the precipitator. It shall be the responsibility of the Precipitator Vendor to mark on these drawings all of the necessary test connections and nozzles for testing of the unit upon completion of erection.

3.10.4 Controls

a. Supply a recommended control diagram for equipment reflecting the necessary minimum controls and interlocks required for precipitator operation. Quote all solid state controls.

b. All pertinent alarms and status indications shall be wired to the mill's digital control system as 4-20 mA signals.

c. Furnish as an option, provisions for a digital interface for all control signals to the Owner's DCS.

4. QUALITY PROVISIONS

4.1 Construction/Erection Advisor

4.1.1 The Bidder shall include with materials supply, the services of a Construction/Erection Advisor, full time during installation of the precipitator.

4.1.2 The Vendor's Construction/Erection Advisor shall have full authority to act on the Vendor's behalf in order to monitor construction quality control, provide weekly progress reports to the Owner, and advise Owner of potential construction discrepancies, omissions, or deviations from approved drawings and specifications.

4.1.3 The Construction/Erection Advisor shall be available on the job-site until completion of the installation of all Vendor supplied materials. This shall include any subcontract supply items.

4.1.4 Release of the Construction/Erection Advisor by Owner shall be effective upon conditional acceptance of all Vendor supplied equipment for initial operation.

Detailed Description of Regenerative Thermal Oxidizer

Detailed Description of Regenerative Thermal Oxidizer

A Detailed Description of a Particular Manufacturer's Regenerative Thermal Oxidizer is presented in Appendix M in the O&M Manual of the CECO Abatement Systems Regenerative Thermal Oxidizer System

SECTION 13267

REGENERATIVE THERMAL OXIDIZER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary and install complete and performance test regenerative thermal oxidizing equipment as shown on the Drawings and as specified herein.

B. The following equipment is included under this Section:

1. One regenerative thermal oxidizer.

2. Electrical devices and controls.

1.02 RELATED WORK

A. Electric motors are included in Section 01171.

B. Field painting is included in Section 09902.

C. Refer to Section 11000 for additional specific technical requirements.

D. Induced draft fans are included in Section 15861.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings showing details of fabrication, electrical control diagrams, anchor bolt drawings, erection and adjoining equipment interfaces for all equipment furnished under this Section.

B. Submit complete wiring diagrams, cabinet and device layout drawings.

C. Provide samples of ceramic bed material and all types of insulating materials required.

D. Provide guarantee for regenerative thermal oxidizer thermal efficiency and hydrocarbon destruction.

E. All design calculations and shop drawings shall be prepared by or under the supervision of a professional engineer registered in the State of Florida, who shall stamp these calculations and drawings.

F. The supplier shall furnish design calculations to the Engineer for review for conformance with applicable criteria. Calculations shall be in proper sequence, clear and complete. The review of these calculations shall not relieve the supplier of any obligation or responsibility contained in the contract.

G. The RTO supplier shall furnish as part of the shop drawing review process a detailed written warranty from the equipment manufacturer stating that this equipment package will perform as stated in PART 1, and, further that, in the event that the equipment does not perform as required, supplier will make such modifications as are necessary to achieve compliance or replace the equipment as required all at no additional cost to the Owner. In the event that the equipment meets the mechanical and process requirements but exceeds the thermal efficiency limits, the manufacturer shall warrant that it will pay damages equal to the difference between actual and warranty consumption based on the then current energy rate and 87,600 hours (10 years) for each unit so deficient.

H. Operation and Maintenance Data

1. Provide, in accordance with Section 01730, copies of operation and maintenance manuals and equipment start-up reports.

2. Services of a manufacturer's representative shall be provided in accordance with Section 13265.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

B. American Welding Society (AWS)

1. AWS D1.1 - American Welding Society Code.

C. Factory Mutual (FM)

D. Underwriters Laboratories (UL)

E. National Electrical Manufacturers Association (NEMA)

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The equipment specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacture and assembly of the equipment furnished. Upon request, furnish to the Engineer the manufacturer's qualification data including value of like work, location and references.

B. Coordinate the interface between the RTO and associated equipment. All necessary engineering drawings and details shall be furnished to the Engineer.

1.06 SYSTEM DESCRIPTION

A. The regenerative thermal oxidizer (RTO) shall be a ceramic bed type which shall oxidize odor-causing constituents in the gas stream to non-odorous products of combustion. The RTO shall be designed for a minimum of 92 percent thermal efficiency as defined by Thermal Efficiency = Combustion Chamber Temp - Out Temp/Combustion Chamber Temp - In Temp. The RTO shall have a minimum incineration temperature of 1450 degrees F and shall be designed to operate continuously at 1800 degrees F. The incineration temperature is the average temperature of the combustion chamber of the RTO which shall be maintained as a continuous operating condition. The RTO shall be designed so that the combustion chamber shall have a gas residence time of at least one second at its design incineration temperature and shall be designed for a destruction efficiency of not less than 95 percent of the hydrocarbon inlet loading or a discharge limit of 50 ppm as methane, whichever is less stringent. The RTO shall consist of a combustion chamber which feeds three energy recovery chambers containing ceramic heat exchange media. The air passes through the ceramic beds (that have been preheated in a previous cycle) and is heated by the stoneware and enters the central chamber at a temperature very close to the incineration temperature. The oxidation process is completed in the central chamber. A gas burner maintains a constant incineration temperature. The maximum fuel use per RTO shall be 50 therms per hours. There shall be no increase in particulate emissions over the inlet conditions.

1. The RTO shall be designed for continuous 24 hours/day, seven days/week throughput of contaminated gas at the following inlet conditions:

a.	Air Flow	9,554 ACFM
b.	Temperature	110 degrees F
c.	Humidity	0.183 lbs H_2O/lb dry air
d.	THC*	400 ppm average
		280 ppm to 512 ppm range

* The (total hydrocarbons) concentrations are reported as parts per million by volume as propane (C_3H_8).

B. The regenerative thermal oxidizer shall be sized and configured to fit into the footprint as shown on the Drawings.

1.07 MAINTENANCE

A. Spare Parts

1. Provide the following spare parts, carefully packed in labeled cartons, tagged with identification of part number, part name, manufacturer and point of use.

	Quantity	Description
a.	1	Complete Burner Assemblies
b.	2	Diverter Valves
c.	100 percent	Stoneware for One System
d.	1	Valve Drive Motor
e.	2	Flame Monitors
f.	2	Burner Controllers
g.	1 set	Valve Stems

2. In addition, furnish a list of all spare and replacement parts available for the equipment, with a current price list. The list of prices shall hold firm for the Owner for 1 year.

PART 2 PRODUCTS

2.01 MATERIALS

A. The energy recovery chambers shall be fabricated from 1/4-in thick ASTM A36 grade steel plate, continuously welded, air tight construction.

1. Each recovery chamber shall be pre-fitted to ensure a trouble free field installation, and pre-insulated with ceramic fiber soft insulation.

2. All recovery chambers shall include a stainless steel ASTM A240, Type 304L stainless steel support grid and gas distribution baffle on the cold face side of the heat recovery bed; and the required quantities of stoneware.

3. The vertically mounted recovery chambers shall sit directly on the foundation to minimize contact points and to provide uniform weight distribution.

B. The regenerative heat exchanger media shall consist of ceramic matrix saddles, chemically and thermally stable for rapid heat-up for temperatures up to 2300 degrees F.

C. Each recovery chamber shall have one horizontal tee section, complete with lifting lugs. The tee section shall bolt together to form the combustion chamber. Tee section shall be fabricated from 1/4-in thick ASTM Grade A36 steel plate, continuously welded, airtight construction.

1. Tee section shall be pre-fitted to ensure a trouble-free field installation and preinsulated with ceramic fiber soft insulation.

2. Two controlling thermocouples shall be located in the combustion chamber assembly.

3. The combustion chamber shall be designed to minimize short circuiting between recovery chambers.

D. All internal insulation shall be ceramic fiber type, modular construction. The insulation shall be a soft, flexible fiber blanket compound with integral stainless steel reinforcement and mounting components.

1. All track work, mounting components, and insulation to be shop installed and fitted prior to shipment.

2. The insulation shall be capable of operating at temperatures up to 2300 degrees F. All parts of the RTO including inlet and outlet ducts, manifolds, etc, which shall have a surface temperature greater than 140 degrees F, shall be insulated to limit the maximum surface temperature to 140 degrees F, at normal operating conditions. All insulation shall be covered with 20 gauge, smooth finish, aluminum jacket.

E. The inlet manifold shall be fabricated from 12 gauge ASTM A240, Type 304L stainless steel using stainless steel companion angle flanges all welded to the manifold. Access ports for inspection on both sides of the valves and manifolds and expansion fittings shall be provided.

F. The outlet manifold shall be fabricated from 12 gauge ASTM A240, Type 304L stainless steel, using stainless steel companion angle flanges all welded to the manifold. Access ports for inspection on both sides of the valves and manifolds and expansion fittings shall be provided.

G. Inlet/Outlet Manifold location - Both the Inlet and Outlet manifolds shall be located on the same side of the RTO so that the unit will be located in proper relationship with the process system.

H. The valve transition shall be fabricated from 12 gauge ASTM A240, Type 304L stainless steel with stainless steel angle reinforcement adequate for the temperatures and pressures involved. Stainless steel angle bracing shall be provided to transfer the load from the manifolds and valves to the foundation.

I. Diverter valves shall be manufactured with heavy duty cast high temperature steel bodies, stainless steel shaft, solid bushings and shall be metal to metal step-seat butterfly valves.

1. The valves must be capable of operation up to 1,000 degrees F. Leakage shall not exceed more than 0.5 percent at rated airflow, pressure and temperatures.

2. Valves shall be accessible from both sides to facilitate inspection.

3. Valves shall be individually operated by hydraulic, pneumatic or electric actuators. Valves shall be equipped with position proof switches for verification of open and close.

J. An airflow control system shall be provided to maintain a preset inlet pressure which will automatically control airflow through the oxidizer.

1. The control system shall consist of an AC variable speed drive control (furnished under another Section) for the RTO fan, transmitter and instrumentation to sense and control process exhaust fluctuations.

K. Two burners at the required rating for each RTO shall be included for maintaining the combustion chamber temperature. The burner shall be designed to operate on natural gas. The burner shall include factory assembled gas train, combustion blower and all required safety features meeting all codes.

1. The burner fuel trains shall include all safeguards, motorized shut-off valves with automatic reset, pressure switches, regulators, test cocks; vent valves, filters, solenoids, pressure reducing valves, pressure gauges required for approval to code.

2. Each burner shall be capable of firing independently and able to provide full combustion chamber heat requirements. Burner combustion blowers shall shut off during normal unit operation to minimize air leakage.

L. Controls Section

1. General

a. The RTO controls shall provide automatic and semi-automatic startup of each unit. All controls for operation of the RTO and interfaces to completely integrate with the pelletizer control system shall be supplied by the manufacturer. The controls shall have automatic FM approved safety shut-down features, hard wired, in the burner circuitry. All safety controls for the safe operation, or as required by FM, shall be supplied. Individual instrumentation controlling process variables shall be available with an isolated 4-20 mA output signal for remote indication.

b. All instrumentation required for operation by the manufacturer shall be of the latest revision of the instrument company. All electronic instrumentation shall be of the solid-state type and receive transmission signals generated by thermocouples or 4-20 mA signals generated by other required transmitters. Individual control instruments shall be in accordance with Sections 13301 and 13265.

c. All recorder readouts shall be linear. Recorders shall be 4 pen, strip chart type by Honeywell or equal.

d. All field-mounted instrumentation shall be of NEMA 4X design or designed for operation in damp, dusty and slightly corrosive service conditions. All field mounted switches and relays shall be hermetically sealed.

e. All equipment, cabinets and devices furnished as part of the Contract shall be heavy duty type, designed for continuous industrial service. The system, where practical, shall contain products of a single manufacturer and shall consist of equipment models which are currently in production.

f. All control equipment shall be designed to operate on 60 Hz, 110 VAC, plus or minus 10 percent, except where specifically noted.

g. All RTO mounted electrical devices and sensors shall be wired to terminal blocks mounted inside suitable NEMA 4X enclosures.

h. Control Cabinet - A free standing NEMA 12 control cabinet shall be included for each unit and shall be positioned as shown on the Drawings. The cabinet shall be completely prewired using terminal strips within the cabinet. The cabinet shall be tested prior to shipment to minimize any field rewiring.

2. Controlled Parameters

a. The RTO manufacturer shall supply all controls required or necessary to make a complete and safe functional system.

b. The flame safeguard shall consist of a FM approved flame interruption device and shall be wired to operate with a continuous or intermittent pilot as mandated by FM for the burner it serves. Flame response time shall be 0.8 seconds. All wiring from the safeguard to the burner train shall be hard wired and independent of the RTO's logic controller. The safeguard shall be wired for non-recycling in the event of flame failure or limit shut-down.

c. Ultra-violet flame detectors (scanners) shall be utilized.

d. The temperature sensing elements shall be of the thermocouple type. The type of thermocouple shall be governed by the temperature ranges it will monitor. All thermocouples shall be placed in Type 316 stainless steel thermowells and be long enough to accurately monitor temperature conditions. Thermocouples shall be type J for operation below 1000 degrees F and Type K for above 1000 degrees F. The RTO will be equipped with the following thermocouples as a minimum:

1) Inlet temperature - indication

2) Fan inlet temperature - shutdown

3) Fan inlet temperature - recorder

4) Combustion Chamber temperature - shutdown

5) Combustion Chamber temperature - #1 burner control

6) Combustion Chamber temperature - #2 burner control

7) Combustion Chamber temperature - recorder

e. A pressure sensor transmitter shall be supplied to control the inlet pressure to the RTO. The pressure transmitter operating in conjunction with a controller shall control the RTO fan to maintain a preset draft condition in the inlet duct.

f. Controllers shall be individually applied to the process variable for which the control is intended. Controllers shall be equal to Honeywell, UDC-3000. All controllers shall be position proportionating-relay output type. No servo amplifiers at the final control device will be accepted. Controllers shall be capable of retransmitting the process variable by way of a 4-20 mA output for remote indication or usage. If required, slave relays working in conjunction with the controller output contacts shall operate the final control device.

g. All components of the instrumentation and control system shall be as specified in Section 13265, to assure full compatibility with pelletizing control system.

M. Fuel Trains - The burner fuel trains shall be prepiped and prewired, to terminal strips, within NEMA 3R equivalent enclosures. All instrumentation on the trains shall be of NEMA 4X construction. Pressure switches shall be Honeywell, Mercoid, GE Control Components, or equal. All gas safety valves (2 per burner train) shall be motorized quick starting equal to Maxon series 8000. The gas trains shall be equipped per FM, IRI, and Florida Fuel Gas Code standards. Gas control motors shall be Honeywell 831E. Gas regulators shall be rated for incoming pressure - Rockwell; Eaton Corp.; ITT General Controls or equal.

2.03 FABRICATION

A. The regenerative thermal oxidizers shall be factory built, tested and shipped for installation in the field.

B. All miscellaneous hardware shall be hot-dip galvanized or stainless steel.

2.04 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Surface preparation and shop prime painting shall be as specified in Section 09901 and is included in the work of this Section.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this Contract. All pertinent data and dimensions shall be verified by the Contractor.

3.02 INSTALLATION

A. Installation of regenerative thermal oxidizers shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. The manufacturer's representative shall supervise the installation of the equipment as required for proper installation.

3.03 PERFORMANCE TESTING

A. The RTO supplier shall conduct performance test (each process train, separately) of the regenerative thermal oxidizers as generally described in the following paragraphs to demonstrate that this subsystem of the overall pelletization system can successfully achieve the mechanical, process and thermal performance requirements set forth in Paragraph 1.06 above.

B. The RTO supplier shall provide all equipment and supplies necessary to conduct two 8 hour performance tests on each installed RTO, including an accurate means for measuring air flow, temperature, gas flow, particulates and total hydro-carbon concentration as determined by EPA, Method 25A (from 40 CFR), necessary to assess whether or not the RTO meets the specified performance requirements.

C. All testing shall be the responsibility of the RTO supplier. The laboratory performing the analyses shall be subject to the approval of the Engineer and the Florida Department of Environmental Protection. The RTO supplier shall supply all the necessary equipment and supplies needed to perform the analysis.

D. If, in the opinion of the Engineer, the system does not meet the parameters of the guaranteed performance test, the RTO supplier shall then have 30 days in which to perform at his/her expense, any supplemental testing, equipment adjustments, changes or additions and request permission to conduct an additional retest of the non-acceptable system. In the event that the equipment does not perform as required, the RTO supplier shall make such modifications that are necessary to achieve compliance or replace the equipment as required all at no additional cost to the Owner. In the event that the equipment meets the mechanical and process requirements but exceeds the thermal efficiency limits, the manufacturer shall pay damages equal to the difference between actual and warranty consumption based on the then current energy rate and 87,600 hours (10 years) for each regenerative thermal oxidizer so deficient.

END OF SECTION

Detailed Description of Venturi Scrubber

Detailed Description of Venturi Scrubber

A Detailed Description of a Particular Manufacturer's Venturi Scrubbing System is presented in Appendix M in the O&M Manual of the Envirocare Hydromist Venturipak Wet Scrubber System, Section 1.

SECTION 13262

VENTURI WET SCRUBBER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, transportation and incidentals required and install, test and make ready for operation the equipment required to remove particulate matter from the sludge processing air stream as shown on the Drawings and as specified herein.

1. Furnish one venturi wet scrubber as part of this Section. The following system components shall be included for each scrubber:

a. Venturi wet scrubber, with adjustable damper.

b. Cyclonic separator.

c. Support structure.

d. Spray header with tangential open pipe inlets.

1.02 RELATED WORK

A. Electric Motors are included in Section 01171.

B. Refer to Section 11000 for additional specific technical requirements.

C. Induced Draft Fans are included in Section 15861.

D. Process Air Ductwork is included in Section 15893.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings showing details of fabrication, erection and adjoining equipment interfaces for all equipment furnished under this Section.

B. Provide manufacturer's rating curves showing pump characteristics of discharge head, capacity, brake horsepower, efficiency, required net positive suction head, and total pumping unit weight. This information shall be prepared specifically for the pumps proposed. Catalog sheets showing a family of curves will not be acceptable.

C. Provide literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the detail requirements.

D. Provide Sequence of Operations specific to the proposed equipment if it differs from Paragraph 1.07C below.

E. Provide certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished.

F. Provide foundation and anchor bolt plans and details.

G. Provide schematic electrical wiring diagrams and other data as required by the Engineer.

H. Provide design data, test reports, certificates of compliance, performance curves, particle size verses collection efficiency curves, and warranty data on particulate removal efficiencies.

I. Provide experience and similar applications list.

J. Provide welders' qualification certificates, certifying that welders which will be used for all welding procedures comply and meet the quality requirements of ASME Section IX. Provide certified welding procedures which will be used for all welding processes.

K. Operation and Maintenance Data

1. Provide in accordance with Section 01730, operation and maintenance manuals and equipment start-up reports.

2. Services of a manufacturer's representative shall be provided in accordance with Section 13265.

1.04 REFERENCE STANDARDS

A. 29 CFR 1926 Safety and Health Regulations for Construction.

B. American Institute of Steel Construction (AISC)

C. American Iron and Steel Institute (AISI)

D. American National Standards Institute (ANSI)

E. American Society of Mechanical Engineers (ASME)

1. Boiler and Pressure Vessel Code.

2. Code for Pressure Piping B31.3, category D fluid service.

F. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel

2. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels

3. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes

4. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.

5. ASTM A320 - Standard Specification for Alloy Steel Bolting Materials for Low-Temperature Service.

6. ASTM A325 - Standard Specification for Strength Bolts for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

7. ASTM A403 - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.

8. ASTM A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip

9. ASTM A484 - Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings

10. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs

11. ASTM F594 - Standard Specification for Stainless Steel Nuts

G. American Welding Society (AWS)

1. Code D1.1 - Structural Welding Code Steel

H. Underwriters Laboratories (UL)

I. Environmental Protection Agency (EPA)

1. 40 CFR Part 60, Appendix A

a. Method 5; Determination of Point Emissions from Stationary Sources

b. Method 9; Visual Determination of the Opacity of Emissions from Stationary Sources

J. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications - The equipment specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacture and assembly of the equipment furnished. Upon request, furnish to the Engineer manufacturer's qualification data including value of like work, locations and references.

B. Qualifications for Welding Procedures and Operators - Comply with the requirements of ASME Boiler and Pressure Vessel Code, "Welding and Brazing Qualification", Section IX.

C. Provide inspection, examination, and testing in accordance with ASME B31.3 category D fluid service.

D. Coordinate the interface between the venturi wet scrubber manufacturer and the interfacing equipment. All necessary engineering drawings and details will be furnished to the Engineer.

E. The venturi wet scrubber and appurtenances shall be manufactured by:

1. Envirocare Systems, Novato, CA
2. Amerex, Inc., Woodstock, GA
3. Clean Gas Systems, Inc., Farmingdale, NY
4. Emtrol Corp., Hauppauge, NY
5. W.W. Sly Manufacturing Company, Cleveland, OH
6. Or equal.

F. The Contract Documents direct attention to certain required features of this system and equipment, but do not purport to contain all details entering into the equipment design. Furnish and install this equipment complete in all details and ready for operation.

1.06 SYSTEM DESCRIPTION

A. Performance Requirement

1. The Venturi Wet Scrubber shall treat the exhaust stream from the tray condenser of the sludge dryer system and achieve a nominal collection efficiency of 96 percent.
2. The venturi wet scrubber shall provide removal of fine particulates with a pressure drop no greater than 20-in W.C. at 9,600 ACFM, gas at 180 degrees F with 0.183 pounds water per pound dry air.
3. A variable throat damper shall allow adjustment for pressure drop in the range of 15 to 25-in W.C. minimum.

PART 2 PRODUCTS

2.01 SITE CONDITIONS

A. Maximum Height: 25-ft floor to top of cyclonic separator flange.

B. Maximum Footprint: 10-ft by 15-ft.

C. The Drawings and this Section have been based upon the equipment of Envirocare Systems. Equivalent alternative designs manufactured by Amerex, Inc., Emtrol Corp. or equal shall be considered provided that any and all revisions required to the design, including architectural, structural, process piping, instrumentation, plumbing, HVAC and electrical, be accomplished at no additional cost to the Owner. All cost incurred by the Engineer in reviewing the above submittal shall be paid by the Contractor regardless of whether or not the alternative arrangement is accepted.

2.02 MATERIALS

A. Venturi Scrubber and Cyclonic Separator

1. Exterior structural, shapes and plate

   a. ASTM A240, Type 304L stainless steel

2. Venturi Throat

   a. ASTM A240, Type 304L stainless steel

3. Damper and Damper Shaft

   a. ASTM A240, Type 304 or 304L stainless steel

4. Interior vortex breaker in recirculation tank.

   a. ASTM A240, Type 304L stainless steel.

5. Bolts, nuts, washers

   a. ASTM F593, Stainless Steel

   b. ASTM F594, Stainless Steel

6. Gaskets: Suitable for service

   a. Neoprene

   b. Or equal

7. Access doors

   a. ASTM A240, Type 304 or 304L stainless steel

   b. Or equal

B. Exterior Supports

1. ASTM A240, Type 304L stainless steel Supports and stiffeners throughout.

2. ASTM A36 Steel optional on Cyclonic Separator Base only and welded to separator with a poison pad.

C. Water spray header, inlets and flanged pipe connections.

1. Pipe

    a. ASTM A312, Type 304L stainless steel

2. Fittings

    a. ASTM A403, Type 304L stainless steel

D. All hardware shall be stainless steel unless otherwise specified.

2.03 FABRICATION

A. Design and fabricate component sections to minimize field assembling.

B. Design to minimize deformation and vibration of casing.

C. Design to fully support section.

D. Weld gas tight.

E. Provide lifting lugs, minimum four each section.

F. Inlet and outlet flanges.

1. Drilled holes to match the mating equipment, breeching and ductwork.

2. Minimum angle size: 3-in by 3-in by 1/2-in.

3. ANSI B16.1, Type 125 lb.

G. Flue gas connections: round cross section

1. Venturi Scrubber Inlet: 3-ft-6-in ID

2. Cyclonic Separator Outlet: 3-ft-6-in ID

H. Access Doors

1. Minimum size 18-in by 15-in rectangular or 20-in round.

2. Quick-tightening clamp bolts.

3. Gasketed sealing surfaces.

    a. Acid resistant

    b. Rated for temperature encountered

    c. Gastight

4. Hinges: Size for 200 percent of weight of door.

5. Appropriately worded warning signs.

6. Locate to clear obstructions when opened.

I. Pre-assemble all components to assure proper fit upon field assembly.

J. Disassemble for shipment to minimize damage.

K. Box non-shop assembled component parts and provide exterior labeling of contents.

L. Minimize disassembly to minimize field erection.

M. Maximum shipping weight per shop assembled section, lbs: 8000

2.04 VENTURI SCRUBBER

A. Housing thickness - 3/16-in minimum.

B. Provide access doors on top and side of flooded elbow above water line to allow for interior inspection and cleaning of venturi.

C. Drain: 2-in diameter, flanged.

D. Venturi throat damper

1. Type: Conical, leaf, pivoted plate or butterfly.

2. Variable throat to provide adjustment in pressure drop overall in venturi scrubber and cyclonic separator.

3. Manual handwheel operation.

E. Venturi spray header.

1. Provide sufficient quantity, size and locations of tangential open pipe water inlets for venturi.

2. All water inlets shall be combined on a single 4-in diameter, flanged spray header.

F. Air flow shall be in a downward direction.

G. Provide two 1-in NPT threaded and capped ports at each of the following locations.

1. Inlet to venturi scrubber

2. Flooded elbow section

3. Outlet from Cyclonic Separator

2.05 CYCLONIC SEPARATOR

A. Housing thickness - 3/16-in minimum.

B. Provide access door on top and bottom above waterline to allow for interior inspection and cleaning of cyclonic separator.

C. Drain: 4-in diameter, flanged.

D. Pump Suction: 4-in diameter, flanged.

E. Overflow: 4-in diameter, flanged.

F. Transitions:

1. Angle of top cone, maximum: 45 degrees

2. Angle of bottom cone, minimum: 30 degrees

2.06 SUPPORT

A. Design to support total weight of venturi scrubber, flooded elbow and cyclonic separator filled with water to top of flue gas inlet.

B. Provide support structure to support from structural floor beams.

C. Design support structure for all vertical loads.

D. Provide bracing for horizontal loads.

2.07 PIPING

A. Provide the flanged connections, headers and tangential open pipe inlets as specified below.

B. Pipe for use with welded connections shall be manufactured in accordance with ASTM A312 in Type 304L welded stainless steel. Pipe shall be Schedule 10S and manufactured to nominal pipe sizes as listed in ANSI B36.19.

C. Flanged pipe ends shall be made up of Type 304L angle face rings with hot dipped galvanized ductile iron, back-up flanges with 125 lb drilling pattern.

D. Fittings for use with welded connections shall be manufactured in accordance with ASTM A403, Class WP-W in Type 304L welded stainless steel. All fittings shall be Schedule 10S, butt weld type.

2.8 SHOP PAINTING

A. Surface preparation and shop prime painting shall be as specified in Section 09901 and is included in the work of this Section.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this Contract. All pertinent data and dimensions shall be verified by the Contractor.

3.02 INSTALLATION

A. All equipment shall be installed in accordance with the instructions of the manufacturer and as shown on the Drawings.

B. During installation and before the plant equipment is placed in operation, the manufacturer shall inspect and prepare a detailed Inspection and Testing Report which certifies that all units and accessories have been properly installed, adjusted and made ready for operation, all by a qualified representative at no additional cost.

C. All angle face ring joints for piping shall be cleaned interior and exterior, of all welded spatter, stains and sharp edges after fabrication. Butt welded joints require only exterior cleaning.

D. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

E. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the above tests.

3.03 FIELD TESTS

A. Perform visual examination as specified in ASME B31.3 for piping. Replace or repair defective components and workmanship until the acceptance criteria is met at no additional cost to the Owner.

B. Perform air leakage and hydrostatic tests. The Engineer shall be given a 7 day notice to witness test operations.

C. Provide all equipment and supplies necessary to conduct a performance test on each installed venturi wet scrubber including an accurate means for measuring air flow, temperature, humidity and particulate concentration and other apparatus necessary to assess whether or not the system meets the performance requirements specified in Paragraph 1.06 above. The schedule of the performance test shall be subject to the approval of the Engineer. Prior to the performance test, submit a plan of all work, measurements and details of the performance test to the Engineer for approval. All testing will be the responsibility of the Contractor. The laboratory or person performing the analysis shall be subject to the approval of the Engineer. Supply all the necessary equipment and supplies needed to perform the analysis. A laboratory certified by the State of Florida shall be used to perform the analysis.

D. If, in the opinion of the Engineer, the system does not meet the warranty, the Contractor shall then have 30 days in which to perform at the Contractor's expense, any supplemental testing, equipment adjustments, changes or additions and request an additional retest of the non-acceptable system.

E. If, after a second and final test, the equipment fails to meet the performance requirements, remove and replace the venturi wet scrubbers with equipment that meets the performance requirements at no additional cost to the Owner.

END OF SECTION

Appendix L
Startup, Shutdown and Malfunction Conditions

The Information contained in this appendix relates to how start-up, shutdown and malfunction conditions of the Lime Recalcination Facility (LRF) and Biosolids Pelletization Facility (BPF) can affect air pollutant emissions and the air pollution control systems.

L.1 Startup, Shutdown and Malfunction Conditions for the LRF

L.1.1 Introduction

It is generally recognized that air pollutant emissions from a lime kiln facility are lowest when the facility is operated under steady state conditions with all components of the system (i.e. kiln, lime sludge feed system, burner train, product conveying and cooling system, air pollution control equipment, induced draft (ID) fan, etc.) are on line. Periods of warm-up, start-up, shutdown and malfunction are unstable, transitory in nature and usually outside the normal operating range of the equipment. Therefore, these periods warrant special consideration from an air emissions and permitting standpoint. This fact is noted in the following excerpt from the general provisions of the New Source Performance Standards (NSPS) (40CFR, Part 60, 60.8, c).

> *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.*

The North County Resource Recovery Facility's (NCRRF) current Title V Air Operating Permit allows air emission excursions up to three hours in duration per occurrence during periods of startup, shutdown, and malfunction at the NCRRF before the excursion is considered a permit violation. SWA requests that this same three-hour excursion be applied to startup, shutdown and malfunction periods at the BPF and LRF.

L.1.2 Exclusionary Periods

Based on the above, the following exclusionary periods are defined for the LRF:

- **Warm-up:** Warm-up are those periods in which landfill or natural gas is being fired into the kiln and the kiln is being brought up to (or being maintained at) operating temperature, but no lime sludge is being fed to the kiln.

- **Startup**: Startup is the period beginning with the feeding of lime sludge into the kiln and ending when steady state operation is achieved. It takes approximately 12 hours from when lime first enters the kiln to when steady state conditions are achieved.

- **Shutdown:** Shutdown is the period starting when the feeding of lime sludge into the kiln stops (with the intention of bringing the unit off line) to when the last of the lime product leaves the kiln and the lime product cooler. Shutdown can be expected to take up to approximately six hours.

- **Cool Down**: Cool down is the period following shutdown during which the temperature of the kiln is gradually lowered to near ambient conditions. Cool down starts when the last of the lime product leaves the kiln and the product cooler to when the kiln burner and fan are turned off. During cool down the kiln burner may be on low fire for extended periods of time to allow the kiln to slowly cool.

- **Malfunction or Upset**: A malfunction is any sudden and unavoidable failure of air pollution control equipment or process equipment to operate in a normal and usual manner. The term "malfunction" does not apply to operator error, poor maintenance, poor operation, or any other equipment or process upset that can reasonably be prevented. A malfunction or upset condition can occur due to an equipment trip or failure. Some equipment outages are minor and can be fixed relatively quickly while the facility is still in operation. Other more serious outages will require immediate shutdown of the process and repair of the faulty component.

L.1.3 Air Emissions During Exclusionary Periods

Based on the current Title V Operating Permit conditions for the NCRRF, the following permit conditions for the LRF are proposed:

1. During periods of Warm-up and Cool Down (when no lime sludge is being fed to the kiln), the facility will not be considered to be in operation, so the particulate matter and opacity limits from 40 CFR 60 Subpart HH (Lime Manufacturing NSPS) would not apply. However, the non-methane organic compound control requirement from 40 CFR 60 Subpart WWW (Landfill Gas NSPS) would apply to the burning of landfill gas during these periods. In addition, the Electrostatic Precipitator (ESP) would come on-line, and be hot and ready during the Warm-up, and would be remain operating during Cool Down.

2. During periods of Startup and Shutdown (as defined above), air emission excursions above permit emissions limits of up to three hours per occurrence would be allowed. The ESP on the kiln exhaust, and the baghouse on the lime cooler exhaust, would be operating during Startup and Shutdown, and all air emissions would pass through one of these two control devices.

3. During periods of Malfunction, air emission excursions of up to three hours per occurrence would be allowed for each equipment malfunction. Particulate matter emissions would be controlled by the ESP or the lime cooler baghouse, unless the malfunction was to the air pollution control equipment itself (see Section L.1.5, below). Consistent with the requirements of SWA's Power Plant Siting Conditions of Certification, No. PA-84, Section III., SWA will report to the FDEP Southeast District any malfunctions that "compromise the integrity of the operation", any air pollution control equipment malfunctions exceeding two hours, and any continuous opacity monitor malfunctions exceeding four hours.

L.1.4 Operational Sequences

The following section briefly describe the operational sequences which occur during warm-up, startup, shutdown, cool down and malfunction periods.

Warm-Up

A warm-up begins with starting of the ID fan to establish air flow through the system. Then the kiln burner is lit and the kiln is rotated and gradually brought up to operating temperature. Heating up of the kiln should be done slowly at the rate of about 100 degrees per hour to allow the bricks to expand evenly. Towards the end of the warm-up period, the kiln ESP is energized, and the product conveying and cooling equipment (cross-bar cooler, cooler blower and ID fan, and the cooler baghouse) are started. Then the feeding of lime sludge to the kiln can begin.

Start-Up

Start-up begins with the feeding of lime sludge to the kiln. As the feed rate of lime sludge is gradually increased, the rate of fuel firing to the burner will gradually increase. From the time lime sludge is first introduced into the kiln, it will take approximately 12 hours for the kiln to reach a steady state operating condition.

Shutdown

The general procedure for shutdown will be to stop the feeding of lime sludge to the kiln but continue firing fuel to the kiln burner until the kiln is clear of lime. The shutdown procedure is expected to take up to six hours after the feeding of lime sludge has stopped. During shutdown the burner firing rate will gradually decrease as the last of the lime sludge is discharged from the kiln. Also, during shutdown the last of the lime product is being cleared from the product cooling and conveying equipment.

Cool Down

Once the kiln is clear of lime, the kiln burner can be set to a lower firing rate to allow the kiln to slowly cool down to ambient conditions. Cool down, like warm-up, is done slowly to allow the bricks to gradually adjust to the changing temperature without thermally shocking the refractories. Usually a full cool down to ambient conditions is only done when an internal inspection or repair of the kiln refractories is required. In other instances, necessary repairs can be made during the cool down period and a restart (or warm-up) of the equipment can begin. The ESP and lime cooler baghouse will be shut down sometime during this period.

Malfunction

In general, only the equipment which experienced the trip or malfunction will need to be restarted. The severity of the equipment trip or malfunction will dictate whether just the tripped equipment can be quickly restarted, or whether the kiln burner and lime feed systems must be shut down and the upset condition corrected before a restart can be initiated.

L.1.5 Malfunctions

The following section describes the type of malfunctions that can be expected to occur. Malfunctions can be classified into four categories: kiln malfunctions, air pollution control malfunctions, lime feed or product conveying malfunctions and miscellaneous malfunctions.

Kiln Malfunctions

Kiln malfunctions include loss of burner train, ID fan, kiln motor or gear drives. Also under rare circumstances a dam or ring can form in the kiln damming up the flow of lime through the kiln. The dam must be removed for the operation to continue. Depending on the severity of the malfunction, the problem can either be fixed with the system staying on-line or the kiln must be shut down and the problem corrected before operation is resumed.

Air Pollution Control Equipment Malfunctions

Malfunctions in this group typically consist of loss of a field in the ESP, broken bags in the cooler baghouse, or loss of the baghouse pulsed air cleaning system. Some of these malfunctions can be quickly fixed (such as a trip of a transformer/rectifier on one of the ESP fields), in which case it would not be worth shutting down the whole system to correct the problem. For any other malfunctions that could take more than three hours to repair, the kiln burner and feeds to the system will be shut down while the malfunction is corrected.

Lime Feed and Product Conveying Malfunctions

For the lime feed systems, malfunctions include failures of the lime sludge receiving, blending, storage, pumping, dewatering and conveying equipment. Many of these systems have redundant units (i.e. two sludge pumps, two dewatering centrifuges, etc.) so that shut down of the system can be avoided. However, for product conveying, there is only one product cooler and if it gets jammed with a large chunk of lime or its blower or ID fan fail, then shutdown the kiln burner and stopping all feeds to the kiln will be required if the problem cannot be corrected within three hours.

Miscellaneous Malfunctions

Miscellaneous malfunctions are related to equipment and processes not directly tied to the kiln, air pollution control, lime mud or product feed systems. These typically include: loss of electrical power from the power grid, loss of the landfill gas pressurization or refrigeration systems, or insufficient supply of landfill gas. The kiln will have natural gas as a backup fuel so that problems with the landfill gas supply or preparation systems should not cause a shutdown of the lime kiln.

L.2 Start-up, Shutdown and Malfunction Conditions for the BPF

L.2.1 Introduction

Similar to the LRF, air pollutant emissions from the BPF are lowest when the facility is operated at steady-state conditions with all components of the system (i.e. furnace, dryer, wet sludge feed systems, product handling and conveying systems, air pollution control equipment, condenser and cooling tower, ID fan, regenerative thermal oxidizer (RTO), etc.) on line. Periods of warm-up, startup, shutdown and malfunction are unstable, transitory in nature and usually outside the normal operating range of the equipment. Therefore, these periods warrant special consideration with respect to air emissions limits.

L.2.2 Exclusionary Periods

The following exclusionary periods are defined for the BPF:

- **Warm-up:** Warm-up are those periods in which landfill or natural gas is being fired in the dryer furnace and the system is being brought up to (or being maintained at) operating temperature, but no biosolids are being fed to the dryer.

- **Startup**: Startup is the period beginning with the feeding of biosolids into the dryer and ending when steady state operation is achieved. It takes approximately six hours from when biosolids first enter the dryer to when steady-state conditions are achieved.

- **Shutdown**: Shutdown is the period starting when the feeding of biosolids into the dryer stops (with the intention of bringing the unit to cool down) to when the last of the biosolids product leaves the dryer and product cooler. Shutdown can be expected to take up to approximately three hours.

- **Cool Down**: Cool down is the period following shutdown during which the temperature of the dryer, dryer furnace and RTO are gradually lowered to near ambient conditions. Cool down starts when the last of the biosolids product leaves the dryer and product cooler to when the dryer and RTO burners, ID fan and RTO exhaust fan are turned off. During cool down the dryer and RTO burners may be on low fire for extended periods of time to allow the dryer furnace and RTO to slowly cool.

- **Malfunction or Upset:** A malfunction is any sudden and unavoidable failure of air pollution control equipment or process equipment to operate in a normal and usual manner. The term "malfunction" does not apply to operator error, poor maintenance, poor operation, or any other equipment or process upset that can reasonably be prevented. A malfunction or upset condition can occur due to an equipment trip or failure. Some equipment outages are minor and can be fixed relatively quickly while the facility is still in operation. Other more serious outages will require immediate shutdown of the process and repair of the faulty component.

L.2.3 Air Emissions During Exclusionary Periods

Based on the current Title V Operating Permit conditions for the NCRRF, the following permit conditions for the BPF are proposed:

1. During periods of Warm-up and Cool Down (when no biosolids are being fed to the dryer), the facility is not considered to be in operation and air emission limits would not apply. Only the non-methane organic compound control requirement from 40 CFR 60 Subpart WWW (Landfill Gas NSPS) would apply to the burning of landfill gas during these periods. The air pollution control equipment (tray condenser, venturi scrubber, and RTO) would come on-line during Warm-up, and remain operational until Cool Down.

2. During periods of Startup and Shutdown (as defined above), air emission excursions above permit emissions limits of up to three hours per occurrence would be allowed. The tray condenser, venturi scrubber, and RTO would be operating during Startup and Shutdown, and all exhaust gases would go through these control devices.

3. During periods of Malfunction, air emission excursions of up to three hours per occurrence would be allowed for each piece of equipment. Air emissions would be controlled, unless the malfunction was with the tray condenser, venturi scrubber or RTO (see Section L.2.5, below). Consistent with the requirements of SWA's Power Plant Siting Conditions of Certification, No. PA-84, Section III., SWA will report to the FDEP Southeast District any malfunctions that "compromise the integrity of the operation", and any air pollution control equipment malfunctions exceeding two hours.

L.2.4 Operational Sequences

The following sections briefly describe the operational sequences which occur during warm-up, startup, shutdown, cool down and malfunction periods.

Warm-Up

A warm-up begins with the starting of the ID fan to establish air flow through the system. Then water flow through the tray condenser, venturi scrubber and cooling tower is started. Next the RTO is brought on line by starting its burners and exhaust fan. The dryer drum is then rotated, the dryer burner is lit, and the system is brought up to operating temperature. The product handling and conveying equipment (vibrating screen, crusher and numerous screw conveyors and bucket elevators) are then started. The feeding of sludge to the kiln can then begin.

Startup

Startup begins with the feeding of biosolids into the dryer. As the feed rate of biosolids is gradually increased, the rate of fuel firing to the burner will gradually increase. From the time sludge is first introduced into the dryer, it will take approximately six hours for the dryer system to reach a steady state operating condition.

Shutdown

The general procedure for shutdown will be to stop the feeding of biosolids to the dryer but continue firing fuel to the dryer burner until the dryer and product conveying and cooling systems are clear of biosolids. As the biosolids are cleared from the system, the burner firing rate will gradually decrease. Once the product handling and conveying systems are cleared of biosolids, these systems can be shut down. The shutdown procedure is expected to take approximately six hours after the feeding of biosolids has stopped. The air pollution control equipment will continue to operate during shutdown.

Cool Down

Once the system is clear of biosolids, the dryer burner and RTO burners are set to low firing rates to allow the dryer, dryer furnace and RTO to gradually cool down to ambient conditions. Once these systems have sufficiently cooled, the dryer and RTO burners can be turned off, the dryer ID fan and RTO exhaust fan shut down, and the water flows to the condenser, venturi scrubber and cooling tower shut down.

Malfunction

In general, only the equipment which experienced the trip or malfunction will need to be restarted. The severity of the equipment trip or malfunction will dictate whether just the tripped equipment can be quickly restarted or whether the dryer burner and biosolids feed systems must be shut down and the upset condition corrected before a restart can be initiated.

L.2.5 Malfunctions

The following section describes the types of malfunctions that can be expected to occur. Malfunctions can be classified into four categories: dryer malfunctions, air pollution control malfunctions, sludge feed or product conveying malfunctions and miscellaneous malfunctions.

Dryer Malfunctions

Dryer malfunctions include loss of burner train, ID fan, dryer drum motor or gear drives. Depending on the severity of the malfunction, the problem can either be fixed with the system staying in operation or the dryer must be shut down and the problem corrected before operation is resumed. Loss of the dryer ID fan is a serious malfunction which would require immediate shutdown of the system.

Air Pollution Control Equipment Malfunctions

Malfunctions in this group typically consist of loss of water flow to the condenser, venturi scrubber or cooling tower, a blockage in the polycyclone or venturi scrubber, or loss of the RTO or its exhaust fan. Some of these malfunctions can be quickly fixed (such as a trip of one of the water pumps) and thus it would not be worth shutting down the whole system to correct the problem. For any other malfunctions that could take more than three hours to repair, the dryer burner and feeds to the system would have to be shut down to correct the problem.

Biosolids Feed and Product Handling/Conveying Malfunctions

Malfunctions of the the biosolids feed systems could include failures of the biosolids receiving, conveying and feeding equipment (live bottom hoppers, screw conveyors, bucket elevator and pug mill mixer). Many of these systems have redundant units (i.e. two live bottom hoppers, two bucket elevators with associated screw conveyors, etc.) so that shut down of the dryer system can be avoided. However, for product cooling and conveying, there is only one set of equipment, and if one component of this equipment gets jammed, then stopping the biosolids feed to the kiln will be required if the malfunction cannot be corrected within three hours.

Miscellaneous Malfunctions

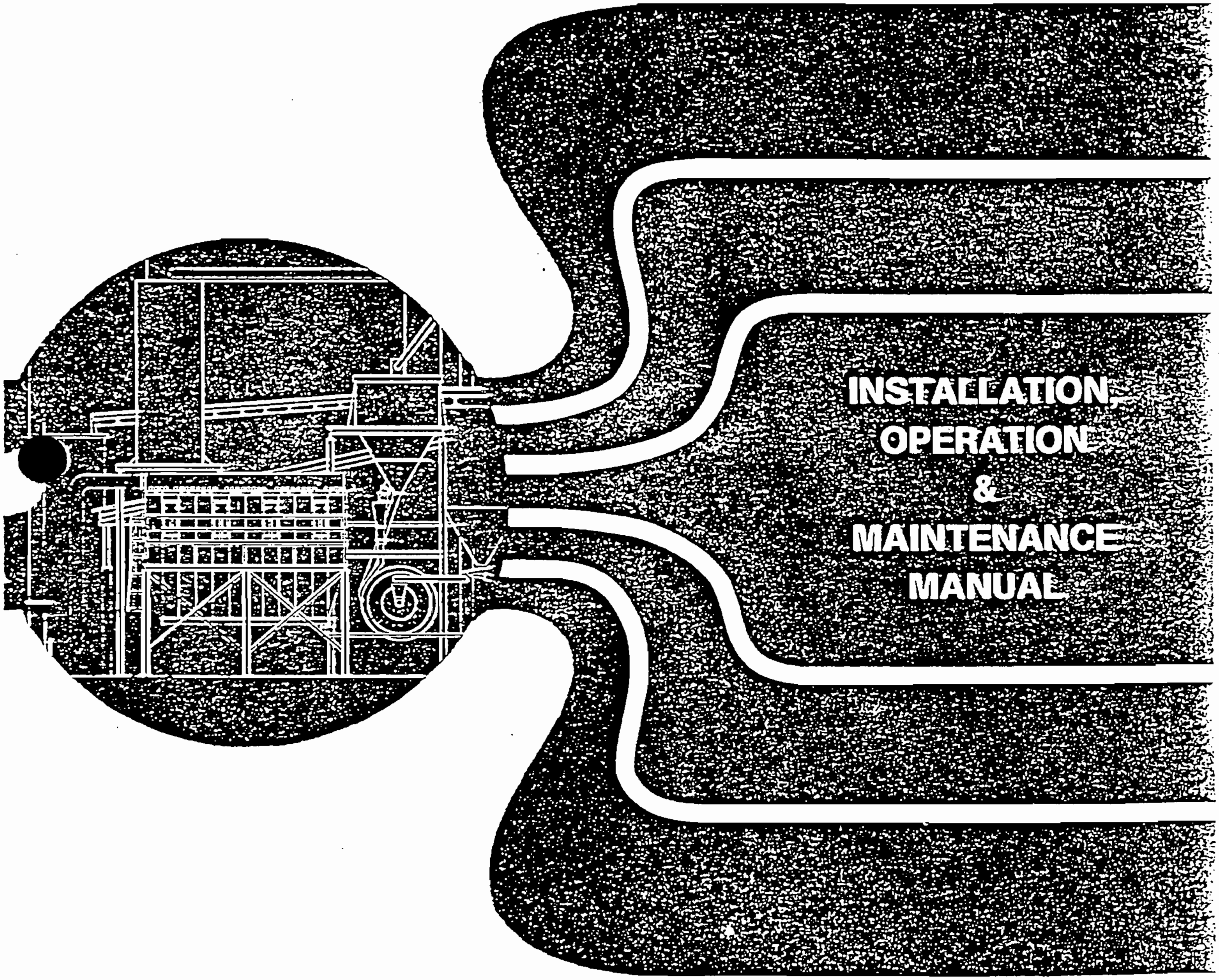
Miscellaneous malfunctions are related to equipment and processes not directly tied to the dryer, air pollution control, biosolids feed or product handling systems. These typically include: loss of electrical power from the power grid, loss of the landfill gas pressurization or refrigeration systems, insufficient supply of landfill gas. The dryer will have natural gas as a backup fuel so that problems with the landfill gas supply or preparation systems should not cause shut down of the BPF.

Appendix M
Operations and Maintenance Plans

Operation and Maintenance Manual for
Baghouse on Lime Cooler Exhaust

Operations and Maintenance Manual for Baghouse On Lime Cooler Exhaust

FABRI-JET™
&
ULTRA
FABRIC FILTERS



ULTRA INDUSTRIES INC.
FABRIC FILTER DIVISION

OPERATING PRINCIPLES

FABRI-JET™ and ULTRA dust collectors remove 99.9% of dust particles quickly, efficiently. Units operate by this simple method:

Dust-laden air enters the hopper where heavier particles drop out of the air stream. Lighter particles are trapped in the air stream and rise.

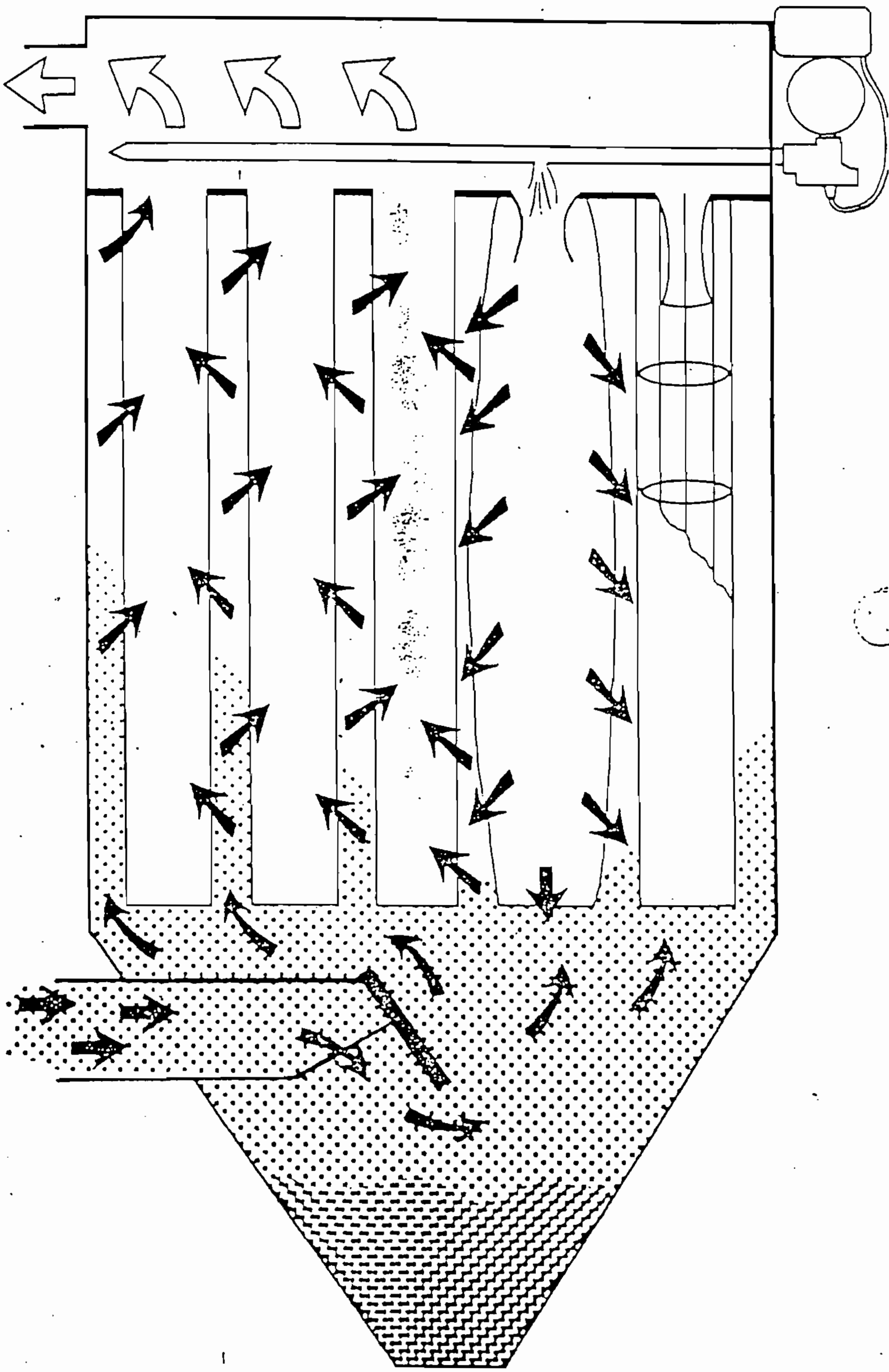
As the air passes through the filter bags, dust particles are collected on the outside surface of the filter bags and the cleaned air is exhausted from the collector.

At precise intervals, jets of high pressure air pass through the venturis, inducing a strong flow of secondary air, briefly reversing the air flow through the bags.

Shock waves pass down the inside of the bags, flexing the bags outward. The reversed air flow dislodges accumulated dust from the bag and the dust drops into the hopper.

With this method of cleaning, airflow through a row of bags is reversed for only a fraction of a second, resulting in steady airflow through the collector. The system is therefore maintained at steady-state conditions.

Collection operation is controlled by an easily-adjusted solid state timer. A Magnahelic gauge permits optimum regulation of the timer. Pulse durations and pulse intervals can be simply and accurately set at the timer to minimize air consumption.



RECEIVING YOUR COLLECTOR

Congratulations on selecting a FABRI-JET™ or ULTRA collector for state of the art, efficient, thorough air pollution control and product recovery. We urge that you read and follow the instructions and advice which follow. We want you to be thoroughly satisfied with your collector.

SHIPMENT

FABRI-JET™ and ULTRA collectors have been designed to minimize customer assembly. Air headers, solenolds, air piping and air pressure gauges are all shipped mounted on the collectors, completely piped for operation.

Housings for the FABRI-JET™ and ULTRA Models BB, CB, CF and SQ collectors are shipped as completey welded assemblies. Larger rectangular collectors are shipped in two subassemblies. The hopper is often inverted and nested inside the main housing. Walk-in plenums for top bag removal collectors are shipped as a separate subassembly.

Timers, bags, bag clamps, cages and differential pressure gauges are shipped separate from the collector. These shipments are carefully marked for identification.

INSPECTION

FABRI-JET™ and ULTRA collectors are carefully inspected before shipment to ensure high quality workmanship. Heavy skids and secure truck cribbing are used but at times damages do occur during shipment. We recommend that you inspect your collector when it is received for any possible damage — if there is any damage or a shortage, it should be noted on your bill of lading. Purchaser should file claims against the carrier within a few days of receipt of the shipment. Damage incurred in transit is the responsibility of the common carrier. Since it is the manufacturers policy to ship F.O.B. the factory, any claims must be initiated against the carrier by the purchaser.

STORAGE

The standard finish for the outside of the collector is one coat of factory primer, unless additional finish coats or special coatings were specified.

If additional protection is required because of lengthy outside storage, corrosive atmosphere or other conditions, the collector should be given an additional protective coat while the prime coat is in good condition.

Bags and cages, which will arrive in a separate shipment to avoid shipping damage, should be stored in a dry, indoor location.

MOUNTING THE DIFFERENTIAL PRESSURE GAUGE

INSTALLATION All accessories and a detailed instruction sheet are packed in the box with your gauge.

LOCATION Mount the gauge in a location that is free from excessive vibration and where the temperature does not exceed 140°F. Avoid direct sunlight.

CONNECTING GAUGE For a permanent installation it is recommended that ¼" O.D. copper tubing be used with regular compression fittings. An in-line paper filter will prevent dust from getting into the gauge line. If this is not used, it is recommended that a loop be placed in the high pressure line that leads from the dirty air housing so that dust does not enter the gauge.

Adjust the differential pressure gauge to indicate zero.

INSTALLING THE COMPRESSED AIR CLEANING SYSTEM

AIR CONSUMPTION The average amount of air that is consumed is listed on the drawing for each collector. This is based on a six second pulse interval, "OFF-TIME", and a pulse duration of .05 seconds, "ON TIME", which are average settings for most applications and can be varied up or down depending on the type of dust and dust loading. For example with a very light dust loading the "OFF TIME" could be set at 12 to 18 seconds thus reducing the air requirements to ½ or ⅓ of the stated volume. A corresponding reduction in the size of the air supply piping may be made.

AIR SUPPLY PIPING A 1" to 2½" O.D. compressed air supply pipe furnishing 85 to 100 psig air (whether all or no other equipment on the same line is used) should be connected to the air header. Refer to RECOMMENDED PIPE SIZES table below. Higher pressures shorten bag life, lower pressures do not adequately clean the filter bags. It is good practice to blow down the air supply piping before connecting it to the air header. This removes any debris in the supply pipe before it is connected to your collector..

AIR QUALITY Dirt, scale, or foreign matter in the piping can cause problems of the air pulsing system. Oil in the air supply can eventually cause plugging of the bags. Water in the system can cause valve problems plus the chance of freeze-up in a cold atmosphere. It is, therefore, necessary that the air be clean, dry and oil-free. The air receiver should have an automatic moisture drain. In-line air filters with automatic drains may suffice if moisture content is not too great and if kept from freezing. However, if a large amount of moisture or oil is present, a desiccant-type filter is recommended.

RECOMMENDED PIPE SIZES

Total free air consumption	Up to 100 ft.	Up to 500 ft.	Up to 1,000 ft.
up to 50 SCFM	1" O.D.	1¼" O.D.	1¼" O.D.
51 to 100 SCFM	1¼" O.D.	1½" O.D.	2" O.D.
101 to 200 SCFM	1½" O.D.	2" O.D.	2½" O.D.

INSTALLING THE FILTER BAGS

SIDE BAG REMOVAL COLLECTORS

1. Slip filter bag over the cage, making sure that the bag seam is not over the split in the p collar of cage. (See Fig. 1.)
2. Bottom of bag must be tight against the cage bottom, the seam should be straight and all wrinkles smoothed out.
3. Fold the top of the bag (about two inches) over the top of cage, smooth out the inside folds, and make sure that bag does not overlap the annular groove on inside of cage (trim off excess bag length if necessary). (See Fig. 2.)
4. Slip on the bag clamp (loosely). The tightening mechanism should not be over the bag seam. (See Fig. 3.)
5. Slide the bag and cage upward over the bag cup until the cage snaps into place on the groove in the bag cup. Bag and cage assembly should fit tight against tubesheet for proper alignment. (See Fig. 4.)
6. Tighten bag clamp. It is important that a ⅜″ socket be used: a screwdriver may slip and puncture the bag. (See Fig. 5.)
7. Check to make sure that bags are hanging straight, and do not touch other bags or the collector housing. (See Fig. 6.)
8. Install the remaining bags in the same manner.
9. Close and tighten all access doors.

FIG. 1


FIG. 2

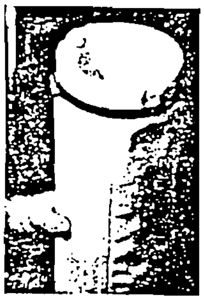
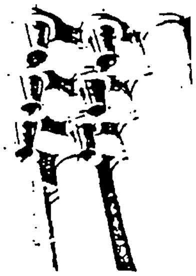

FIG. 3


FIG. 4


FIG. 5


FIG. 6


TOP BAG REMOVAL COLLECTORS

1. From the top side of the tubesheet, lower the bag into the housing up to the bag cuff.
2. The bag cuff has two sewn-in steel bands. Collapse the cuff into a U-shape and lower the bag until one of the bands is below the tubesheet and one above. Then let the cuff spring back to its original shape. Smooth the cuff around the hole. The cuff should form a perfect seal at the tubesheet.
3. Lower the cage assembly into the bag and press firmly into place.
4. Install the remaining bags in the same manner.
5. Locate a blowpipe over each row of bags and connect each blowpipe to the air header by slipping the blowpipe into the coupling at the collector wall and tightening the collar.
6. Close and tighten all access doors.

INSTALLING THE SOLID STATE TIMER

1. The **FABRI-JET™** and **ULTRA** timer is a completely solid state switching unit manufactured to rigid specifications. The timer is capable of switching up to 10 outputs at 1 amp each with 115 volts line input. Each output is capable of handling one solenoid on each air header and can handle up to six headers for a total of sixty solenoids, i.e. sixty rows of filter bags per timer.

2. The timing range is fully adjustable for optimum collector performance. The "ON TIME" (pulse duration) is adjustable from .05 seconds to .5 seconds. The "OFF TIME" (interval between pulses) can be varied from 1.5 to 30 seconds. An indicator light for "power on" is prominently located on the board as well as lights which indicate which row of bags is being cleaned. If desired, the timer can be activated by an external differential pressure switch. In this arrangement the cleaning cycle would be used only when it is necessary, as determined by a preset pressure drop across the tubesheet.

3. The standard timer is shipped in a NEMA 4, weatherproof enclosure for mounting by the customer. Other enclosures are available for hazardous applications.

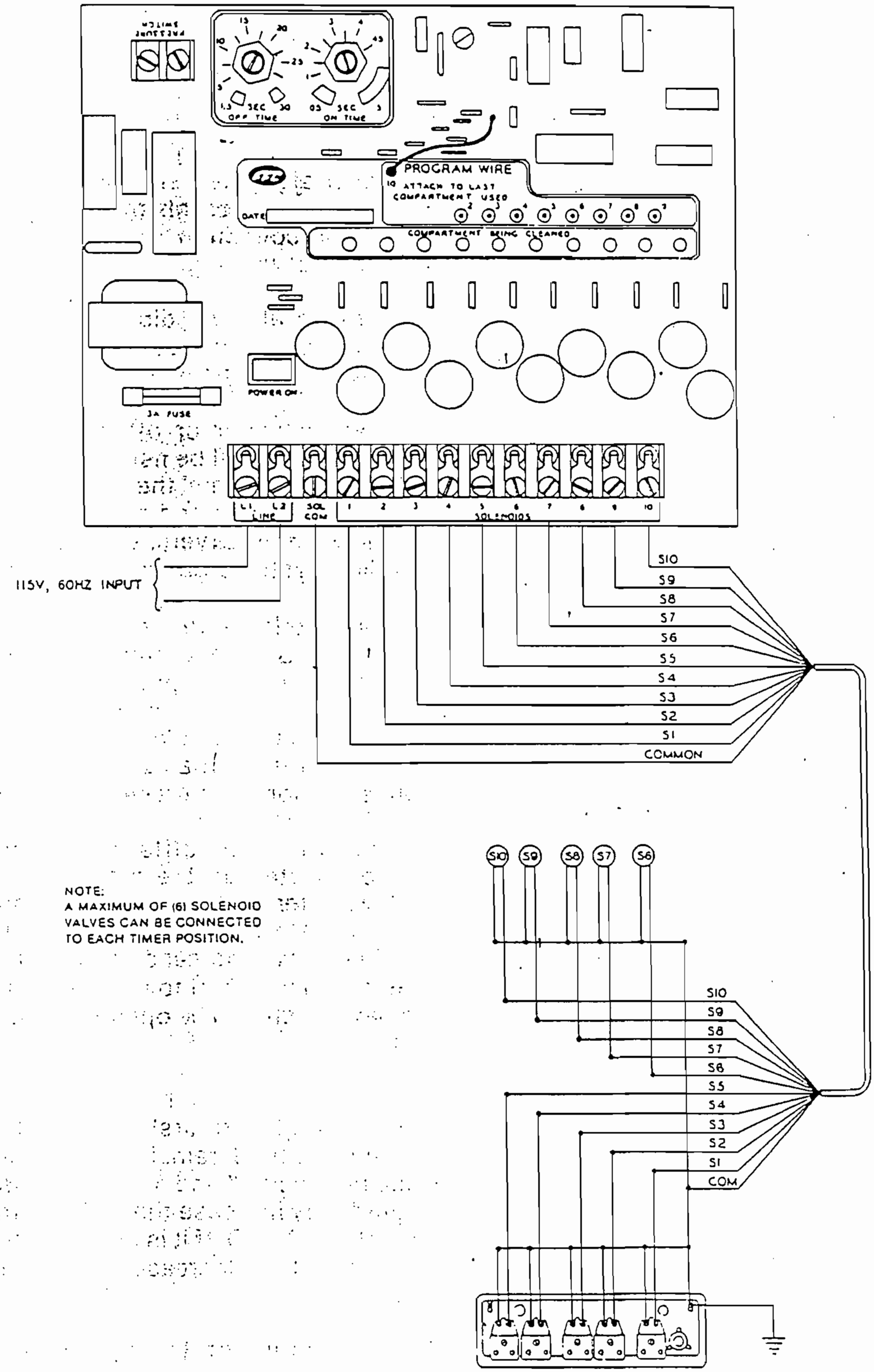
4. If the timer is to be mounted on the collector, vibration mounts should be provided. It is more desirable to mount the timer away from the collector in an accessible location that is free from vibration. The timer should not be exposed to temperatures over 120°F.

5. Install an "ON-OFF" switch in the power supply to the timer. Connect 115 volt, single phase, 60 Hz, 10 amperes input through this switch to timer terminals marked "Line L1" and "L2". In grounded systems connect neutral of line to "L2".

6. Connect wiring between the timer and solenoid valves; one side of each solenoid to the timer common terminal marked "SOL COM.", and the other side of the first solenoid to the timer output terminal marked "Solenoids 1", the second solenoid to "Solenoids 2", etc.

7. The black program wire in the timer should be connected to the "COMPARTMENT USED" socket number which is the same number as the highest numbered "Solenoids" terminal which is used. For example: if eight solenoids are connected to the timer, the program wire should be connected to the number 8 "COMPARTMENT USED" socket.

8. On collectors with more than one air header, one wire from each solenoid is connected to the timer terminal marked "SOL COM." The other wire from the first valve on each header should be connected to the timer terminal marked "Solenoids 1", the second valve on each header to "Solenoids 2", etc. On certain collectors the number of solenoid valves on each header differ. For example: a collector may have a total of 26 valves with three air headers. Two would have 9 valves, the third 8. The solenoids would be connected in sequence to the timer, with three wires on positions one through eight. On the ninth post there would be only two solenoid wires. The program wire would be connected to the ninth "COMPARTMENT USED" socket.



NOTE:
A MAXIMUM OF (6) SOLENOID VALVES CAN BE CONNECTED TO EACH TIMER POSITION.

INITIAL SYSTEM START UP

AUXILIARY EQUIPMENT

Inspect all equipment before start-up to see that there are no foreign objects in rotating equipment and that safety equipment is in place.

Start the fan, screw conveyor and/or airlock and inspect for proper rotation and that all equipment runs smoothly. After making the necessary corrections turn all this equipment off.

DUCTWORK

See that all connections are tight and that all cleanout ports are closed. The ductwork must be free of debris.

STARTING SYSTEM

1. All doors and ports should be closed, with timer and auxiliary equipment off. Turn on compressed air to collector and inspect the system for leaks. If air is leaking from any blowpipe with the timer off. there may be a leak between its solenoid and diaphragm valve. Inspect the ¼″ O D tubing between the solenoids and diaphragm valves to be certain that all connections are tight and there are no leaks. The tubing must not be crimped. Shut off compressed air supply.

2. Turn on timer. The red "power on" indicator should light. Turn "OFF TIME" and "ON TIME" knobs fully counterclockwise. The individual timing lights should blink at 1.5 second intervals and the corresponding solenoid valves will be activated (audible).

3. Turn on the air supply to the air header. All solenoid valves should be operating and the exhaust air from each valve can be felt.

Let the collector pulse for ten minutes to clear all lines then set "OFF" time to between six to ten seconds with 85 psig air supplied. Later this may be adjusted to suit your collection requirements based on the dust loading.

4. Turn on all dust discharge equipment such as rotary valves, screw conveyors, etc.

5. If water vapor or other condensables are present, it will be necessary to preheat the system so that the surface temperature of the piping and collector are above the dew point. Dryers, coolers and some grinding systems are common examples.

6. Start the fan with the fan damper set at about half-flow and run for 30 minutes because it is good practice to introduce the dust stream to a new bag at a reduced rate. This is particularly true when very fine solids (less than 2 microns) or high concentrations are present.

7. Observe the differential pressure gauge. At start-up the pressure drop will be low. After 30 minutes of operation the bags will start to be coated, the filtering efficiency will increase and the pressure differential will start to rise. Then the main fan damper should be opened to the design setting.

8. When the collector has stabilized (may require eight hours) the differential pressure should remain steady at some value between 1″ and 6″ W.G. If it is below 4″ gradually increase the "OFF" time until it reaches 4″ W.G. If it is over 4″ the "OFF" time should be decreased until it reaches 4″ W.G.

9. Temperature of the system must be controlled to remain below the maximum temperature capability of the filter bags.

10. The collector is now ready for use.

USING YOUR COLLECTOR

STANDARD START UPS Subsequent start ups (exception: after new bags are installed follow the INITIAL SYSTEM START UP procedure) should begin with all systems off. Turn on in the following sequence:

1. Filter bags installed, all ports, access doors and rotating equipment closed with safety equipment, (belt guards, etc.) in place.

2. Turn on compressed air.

3. After pressure reaches 85 psig minimum, turn on timer.

4. Turn on all dust discharge equipment.

5. Turn on main fan. Preheat system if necessary.

You have purchased equipment to filter 99.9% of dust particles. If the collector discharge is visible refer to the TROUBLE SHOOTING CHECK LIST that follows.

SHUTTING DOWN YOUR COLLECTOR

DUST CONTROL AND PNEUMATIC CONVEYING SYSTEMS Reverse start-up procedure. First turn off the fan, wait five to ten minutes and turn off the timer and discharge (auxiliary) equipment.

PROCESS SYSTEM Dryers and the system to the collector discharge should be run until empty and heat maintained at a reduced rate until the collector metal surfaces and filter bags are dry. Then proceed as above.

ROUTINE MAINTENANCE

INSPECTION Frequency will vary as widely as there are operating conditions. Your experience will be the best guide. In general proceed as follows:

1. Daily adjust timer "OFF" time to achieve differential pressure of 4" W.G.

2. Weekly check timer and solenoid valves for proper operation. Usually listening to determine that there is an uniform time interval between solenoid air discharge blasts will suffice.

3. Monthly lubricate fan, rotary valve and screw conveyor. Inspect seals on latter two for dust loss.

4. Quarterly inspect filter bags for condition and that every bag clamp is *tight.*

5. Inspect, clean and replace air supply and differential filters as operating conditions require.

SAFETY Before entering dust collector:

1. Run cleaning mechanism 20 minutes with fan off to clean the filter bags.

2. Run solids out of the hopper.

3. Lock out electrical power on all rotating equipment.

4. If toxic gases and/or solids are present purge collector housing and block off inlet duct.

5. Install catwalks and safety cables.

6. Secure access doors in open position or remove doors by lifting from the hinge pins.

7. Use buddy system.

8. Wear respirator.

9. Use common sense.

TROUBLE SHOOTING CHECK LIST

First be sure that you have used the complete STANDARD START UP procedure.

PROBLEMS & PROBABLE CAUSES (SOLUTIONS)

VISIBLE EXHAUST DUST LOSS

1. Missing bag, dust loss will be constant not in synchronization with valve blasts. (Locate and replace missing bags.)

2. Improperly installed bags. Loose clamps or bag tops not clamped between cages and venturi collars. Constant dust loss. (Reinstall bags and cages properly.)

3. Holes in bags from mechanical damage during installation, abrasion, thermal or corrosive attack or wear. Generally in synchronization with valve blasts. (Replace worn or damaged bags with bags made from filter medium suitable for application. Plugging venturis with 3″ diameter rubber plugs from the clean air (plenum) side of the collector is a quick temporary measure until the bags can be replaced.)

4. Dust in plenum after bags fail. (Always clean plenum before installing new bags.)

INSUFFICIENT AIR PRESSURE

5. Piping leaks. (Tighten fittings.)

6. Additional usage from plant system. (Revise system to furnish adequate air supply.)

ENTIRE ROW OF BAGS INADEQUATELY CLEANED

7. Debris in diaphragm valve.

8. Dirt in solenoid plunger. (Remove solenoid cover and clean.)

9. Solenoid valve inoperative. Electric, solenoid, or timer fault. (Establish power to solenoid and proper wiring to timer. Check solenoid and if O.K. change wiring at timer to next unused terminal and move program wire to highest numbered terminal used or replace timer. If solenoid defective, replace.)

RANDOM BAG INADEQUATELY CLEANED

10. Debris in air distribution pipe hole. (Remove debris.)

HIGH DIFFERENTIAL PRESSURE

11. Excessive air flow. (Adjust fan damper until pressure gauge indicates proper pressure.)

12. Compressed air pressure below 75 psig. (See paragraphs 5 & 6.)

13. Solenoids skipping. (See paragraph 9.)

14. Reverse leakage through rotary valve. (Check rotary valve for wear or damage and correct.)

15. Dust on inside of bags after previous bag failure. (Clean plenum and inside of bags.) (See paragraph 4.)

16. Blinding (plugging) of bags due to condensables. (Change operations upstream so that liquids remain vaporized through unit. May be necessary to insulate the collector. Usually operating the collector with no solids flowing through will permit recovery.)

17. Re-entrainment of dust due to hopper overloading, bridging, or plugging. (Run out dust from discharge system with main fan off, consider increasing capacity of discharge system or reducing load and consider installing hopper vibrators.

18. Improper timer sequence. (Inspect timer for proper solenoid wiring and program wire position.)

19. Defective timer. (Return timer to us for repair or replace.)

20. Bags too tight. (If bags were cleaned they may have shrunk and are too tight to permit proper flexing. Replace bags.)

IMPROPER PULSING

21. Solenoid valves not working. (See paragraph 9.)

22. Continuous air flow through diaphragm valve. (See paragraphs 7 & 8. Leak in tubing between solenoid and diaphragm valves.)

INSUFFICIENT DUST COLLECTION (SYSTEM VOLUME TOO LOW)

23. Fan running backwards. (Correct fan rotation.)

24. High differential pressure. (See paragraphs 5 through 9, 16, 17, 18 & 19.)

25. Fan belt slippage. (Tighten or replace belts.)

26. Air short-circuiting between collection point(s) and fan. (Stop leaks.)

27. Additions to system. (Increase system capacity.)

28. System blockage. (Use proper shut-down procedure. Inspect piping for foreign material and remove. See paragraphs 9 and 15 through 19. Bags should feel soft to the hand or be replaced.)

SHORT BAG LIFE

29. High temperature. (Bleed in ambient air and/or replace with bags of high temperature rated fabric.)

30. Chemical attack. (Contact us for recommendation.)

31. Localized wear from rubbing. (Straighten cages so that bags do not rub against each other or the collector housing. Replace bags and corroded or broken cages. Wear at air inlet may require an inlet baffle.)

TIMER MALFUNCTION

32. "Power on" indicator light not on. (Ascertain that timer "ON-OFF" switch is on, that timer wiring is connected, and that indicator bulb is good. Inspect for blown fuse. Replace with 3 amp., 3 AG fuse. Do not use slow blow type.)

33. Solenoids skipping. (See paragraph 9.)

UNUSUAL DIFFERENTIAL PRESSURE GAUGE READINGS

34. Unusual readings. (Inspect gauge filter, replace if plugged.) Blocked gauge tubing. (Disconnect and remove blockage. If blockage occurs frequently, install filter and replace it routinely.)

REPLACEMENT PARTS

Your ULTRA and FABRI-JET™ collectors use the finest components available. To ensure continued trouble free operation of your collector we recommend that only factory engineered components be used. The following components are suggested to be kept on hand to maintain trouble free service.

1. A spare set of filter bags and bag clamps.
2. Extra solenoid valves and diaphragm valves.
3. A spare timer board for multi-collector installations.

Our collector components can be used to maintain peak performance of collectors manufactured by Mikro Pul, Flex-Kleen and other leading manufacturers.

Operation and Maintenance Manual for
Dry Electrostatic Precipitator

Operations and Maintenance
Manual for
Dry Electrostatic Precipitator

1

BEFORE YOU BEGIN

1.1 ABOUT THIS MANUAL

Overview

This manual describes the basic operation and maintenance of the ENELCO® Electrostatic Precipitator. For information not included in this manual, contact the Environmental Elements Corporation, Field Engineering/Service Department.

Note: This manual does not attempt to cover all details of maintenance and operation. We recommend that the operator insert additional information based on experience.

If You Are a New User

The Environmental Elements Electrostatic Precipitator separates and collects suspended solids or liquids from gases. The equipment has been designed and constructed for simplicity and safety of operation, with a minimum of maintenance. At the same time, however, the principles of electrostatic precipitation are very different from those governing other types of electrical equipment. For this reason, it is important for you to be familiar with the procedures described in this manual.

What Does This Manual Include?

This manual includes the following sections:

SECTION	*DESCRIPTION*
Before You Begin	General description of the manual and its contents
Safety Precautions	Vital safety precautions for avoiding hazards associated with precipitators
Principles of Precipitation	General overview of the precipitation process
Equipment	Functional descriptions of: • internal components of the precipitator • electrical control and instrumentation
Starting Up the Precipitator	Procedures for activating the precipitator
Operating the Precipitator	Procedures for: • operating the control console • operating the precipitator
Shutting Down the Precipitator	Procedures for shutdown preparations, and for shutting down for brief or extended periods

(continued)

2

SAFETY PRECAUTIONS

2.1 GENERAL PRECAUTIONS

Common Hazards

Electrostatic precipitators (ESPs) can pose the following hazards to personnel performing inspection, maintenance or repairs.

- electrical shock
- fire or explosion
- oxygen deficiency
- toxic chemicals and gases
- hot dust
- hopper-related hazards

These hazards, and the precautions to be taken against them, are described in greater detail in the following pages.

General Precautions

Before attempting to open or enter the precipitator, you must observe the following precautions:

- Shut down the precipitator, using the key interlock system
- Ground the transformer-rectifier with safety ground devices
- Verify that no dust has accumulated behind the dry bottom doors
- Verify that no harmful gas is present in the precipitator
- Shut down the ash removal equipment

2.2 PREVENTING ELECTRICAL SHOCK

Using the Key Interlock System

An electrostatic precipitator uses **extremely dangerous high voltage!** While the key interlock system prevents contact with energized parts of the high voltage system, this feature does not replace established safety measures. **YOU MUST USE THE KEY INTERLOCK SYSTEM TO SHUT DOWN THE PRECIPITATOR.** Use the following procedure.

Step	*Action*
1	Turn the OFF/RESET/ON switch (S1) in the control console to "Off". This de-energizes the associated transformer-rectifier (T/R) and frees an interlock key, which is then used to ground the T/R set. **This must be done for each T/R set.** *Note* The Key Interlock System schematic (Drawing D-810, located in Vol 3, Section 2) details the key interlock system and grounding procedure.
2	Manually ground all high voltage components of the precipitator before making any attempt to enter the precipitator, the insulator compartments or bus ducts. Safety grounding devices are provided for this purpose.

Using the Safety Grounding Devices

Use the following procedure to attach the grounding devices to the precipitator discharge electrodes in the insulator compartment (penthouse).

Step	*Action*
1	Clamp one end of the safety grounding device to a metal part of the precipitator structure that is connected to the station ground.
2	Attach free end of cable to the high voltage system member nearest the point of access. Continue, using other cables until all bus sections are grounded.

Before Welding Rigitrodes™

Observe the following precautions before performing any welding on the Rigitrode™ system.

- Verify that all bus bars are disconnected at the insulator top plates
- Provide a visible ground wire from the insulator top plate to ground.

2.3 PREVENTING FIRE OR EXPLOSION

Warning

Fires can occur in any precipitator and ductwork during startup, operation, or shutdown!

Potential Causes

The following table lists possible causes of fire and explosion, along with methods for prevention.

Cause	*Prevention*
Fuel feed problem or turbine trip in boiler	Monitor boiler operation closely. Use established plant procedures to prevent boiler upset or trip conditions.
Unstable operation during startup	Observe safe startup procedures (see Chapter 5, ***Starting Up the Precipitator***). Attend to all high level alarms immediately.
Improper purging during shutdown	Observe safe shutdown procedures (see Chapter 7, ***Shutting Down the Precipitator***).
Flammable gas contacting a source of ignition (e.g., cigarettes, matches, welding, cutting torches, static electricity, etc.)	Control combustible and oxygen levels by purging completely and ventilating thoroughly before allowing personnel to enter the precipitator. Keep work area well ventilated during service. Establish a monitoring program to guard against pockets of flammable gas.

In Case of Hopper Fire

If a fire or explosion occurs, the precipitator should be shut down to contain the damage. Fires should be allowed to burn out. If the fire is in the hopper, however, the fly ash should be removed via the ash conveying system.

2.4 HAZARD: OXYGEN DEFICIENCY

Causes of Oxygen Deficiency

In entering a confined space, flue gas will displace the existing atmosphere and reduce the oxygen content below the normal level of 20.8%. Combustible gases from collected particulate (e.g., methane, H_2S, etc.) can create pockets with reduced oxygen levels. Purging the unit during cooling does not always replace the flue gases with ambient air, and local gas pockets may remain.

Effects of Oxygen Deficiency

Oxygen levels below 20.8% result in rapid disability and death. Because the effects of oxygen deprivation are subtle, the victim commonly fails to recognize the symptoms, ignoring the danger until unable to escape from the hazardous environment.

Common symptoms of oxygen deprivation are a rapid pulse and increased rate of respiration, leading to loss of consciousness, irregular heartbeat, and muscular twitching. Unconsciousness and death can be sudden.

2.5 HAZARD: TOXIC CHEMICALS AND GASES

Typical Compounds

Any of the following chemicals and compounds may be found within a precipitator, depending upon its application:

CO	H_2S	Total Reduced Sulfur (TRS)
Arsenic	Cadmium	Beryllium
Lead	Alkali	Acids
Zinc	Organic Solvents	SO_2
		SO_3

Identifying the Risks

At the time of startup, a detailed analysis should be performed to determine the precise contaminants normally present in the precipitator.

Before personnel are permitted to enter, the air within the precipitator should be analyzed by a qualified safety officer with properly calibrated and maintained equipment.

Note Because oxygen and gas levels may change over time, this analysis should be repeated periodically while personnel are within the precipitator.

Training Personnel in Risk Management

A comprehensive risk management policy should be established and taught to all employees concerned with the operation, maintenance or repair of the precipitator. This policy should include the following:

- potential chemical hazards
- use of protective gear
- symptoms of exposure
- procedures for rescuing a victim of exposure

(continued)

TOXIC CHEMICALS AND GASES

(continued)

Monitoring Gases Within the Precipitator

The EPA recommends the following procedures for testing gases within the precipitator.

Preparing to Sample Gases

Step	*Action*
1	Shut down the precipitator, using the procedure described in Chapter 7, ***Shutting Down the Precipitator.***
2	Empty, purge, clean, and ventilate the precipitator as much as possible.
3	Open all access doors.
4	Lock out all electrical and mechanical equipment.
5	Isolate the dust collection area by closing dampers.

Sampling the Gases

Step	*Action*
1	Sample the precipitator gases at each of the access doors.
2	While remaining outside, use probes to sample gases inside the precipitator. *Note* Because many meters require oxygen near ambient levels in order to function, it is vital that the area be vented as thoroughly as possible before sampling.
3	Using probes, take samples in enclosed areas where pockets of gas would be likely to form.
4	If sufficient oxygen is present, the tester may enter the space and take samples from areas inaccessible from outside the shell. Pay particular attention to breathing zone areas. *Note* **The tester must wear an air-supplied positive-pressure respirator while taking these samples.**

Acting Upon Test Results

Depending upon the test results, the EPA recommends the following action:

- If flammable gases are still present, purge and ventilate the precipitator until the concentration is 10% of the lower explosive limit before personnel may enter.
- If the space contains insufficient oxygen, or toxic concentrations of other gases, all personnel entering the space must use an appropriate air-supplied respirator.

2.6 HAZARD: HOT DUST

Dangers of Hot Dust

Hot dust is very fluid, and it can quickly engulf and fatally burn a person. Dust temperature averages about 400°F.

Hopper Hazards

Because hot dust may accumulate behind the hopper access doors, these doors should be opened VERY CAREFULLY. Do not open the doors or enter the hopper until the precipitator has been shut down and the amount of accumulated dust, if any, is known. Unless maintenance or an inspection cannot be performed otherwise, the hopper doors should remain closed and locked at all times.

Checking for Accumulated Dust

After shutting down the precipitator, completely empty the hoppers, using the ash removal system. Before any personnel enter the hopper area, it is crucial that the following tests be completed satisfactorily.

Step	*Action*
1	Open the small port in each hopper door to see whether dust is trapped behind the door.
2	Strike the hopper door with a hammer. If the hopper is empty, you will hear a resounding ring. If it is full, the ash on the surface will muffle the blow, producing a dull thud.
3	To verify that no dust has lodged in the doorways, the corners, or the valleys of the pyramidal hoppers, perform an internal inspection from the top of the collecting surfaces, or from catwalks or lower-level access doors. Pay particular attention to the inlet and outlet plenums (nozzles), as these may accumulate enough dust to fill the hopper.

(continued)

2.6 HAZARD: HOT DUST

Final Test for Impounded Dust

The inner hopper door is fitted with U-shaped brackets, which capture the latch bar and provide the pressure to keep the door firmly against the shell. **If all of the preceding tests have been completed satisfactorily,** test for dust behind the door by using the following procedure.

Step	*Action*
1	To relax the pressure while the bar is inside the "U" shaped bracket, loosen the screw until the door can be moved away from the shell. **Because the inner door may be dislodged and fall open, do not loosen the screw completely.** ***Result:*** When the door moves away from the shell, if any dust is impounded behind the door, it will run out of the gap between the door and the shell. The door will still be kept in place by the latching bar.
2	When the pressure of the dust behind the door is eliminated, remove the latching bar and open the door. Have an escape path available if dust surges out.

If any dust has accumulated, it must be dislodged and removed before personnel enter the hopper. To do this, use any of the following methods while standing on the lower catwalk.

- washing with a high-pressure water hose
- air lancing
- mechanical vibration (via hammers or vibrators)
- poking
- prodding

Do not attempt to remove the dust while inside the hopper. Falling dust can injure, suffocate or bury a person.

2.7 HOPPER-RELATED HAZARDS

Awkward Access

Due to the hopper angles, small door openings, and lack of internal handholds, personnel entering the hoppers can face a risk of falling. Proper temporary access equipment (e.g., scaffolds, ladders, handrails, etc.) should be installed according to OSHA regulations before maintenance personnel are allowed to enter.

Moving Dust

Do not operate the ash removal system (screws, drag chains, etc.) if personnel are inside or at risk of falling into the hoppers. When dust moves into the hopper, it becomes fluid and provides an unstable footing. Scaffolds on which workers may be standing can shift and float. Personnel can be engulfed in the moving dust.

3

PRINCIPLES OF PRECIPITATION

3.1 OVERVIEW

Elements of an Electrostatic Precipitator

An electrostatic precipitator consists of discharge electrodes of relatively small diameter (such as wire or the pins on a Rigitrode), positioned between collecting surfaces (plates or tubes). Between these collecting surfaces pass gases carrying entrained solid or liquid particles. Between the collecting surfaces and the electrodes is a unidirectional, high-potential field with rectified high voltage.

Charging the Particles

The discharge electrodes are of negative polarity, while the collecting surfaces are at ground potential and considered positive polarity. At and above a specific voltage, a corona discharge forms near the surface of the discharge electrode. This corona is a visible sign that positive and negative ions have been produced in the gas near the discharge electrode.

The positively and negatively charged gas ions are attracted to surfaces of opposite polarity. In moving toward these surfaces, the ions attach themselves to the solid or liquid particles entrained in the gas, in turn charging the particles either positive or negative.

Migration of the Charged Particles

The negative ions move toward the positive collecting surface, and the positive ions move toward the negative electrode. Because the ionization takes place near the discharge electrode, the negative ions have a greater distance to travel. Thus, more entrained particles are charged negative than positive. This results in a greater collection of particles on the grounded collecting surface than on the negative discharge electrode.

Discharging the Charged Particles

On reaching the collecting surface, the particles give up their charge and serve as a conductor for additional deposits of charged particles. Through cohesive, adhesive and electrostatic forces, a layer of collected particles is built up on the collecting surfaces.

Removing the Precipitated Particles

After a sufficient layer of particles has accumulated, they must be removed to maintain optimum operation. In a dry dust precipitator, rappers are used periodically to dislodge the ash buildup on the plates, causing the ash to fall into the hoppers.

Dust removal equipment removes the ash from the hoppers. Hopper vibrators are run periodically to keep the ash fluidized for removal.

4

EQUIPMENT

4.1 PRECIPITATOR COMPONENTS

Areas of the Precipitator

The dry dust precipitator includes the following areas:
- Weather enclosure
- Penthouse
- Treatment zone
- Collection/disposal zone

Weather Enclosure

The weather enclosure is located on the precipitator roof, and contains the following components:

Component	Description
Transformer/ rectifier (T/R)	Supplies high voltage with unidirectional current to the discharge electrode system.
Automatic rapping system	Removes collected material from both the discharge electrodes and the collecting surfaces The EEC Field Engineer will perform initial adjustments of the rapping system at startup.
Fan(s)	Ventilates the weather enclosure to keep equipment cool.
Penthouse pressurization heating system	Prevents moisture from forming on the high voltage system insulators in the precipitator penthouse. *Important:* To maintain the insulators in good condition, penthouse heaters must be operating at the following times: • at least four hours before the precipitator is activated. • whenever gas is passing through the precipitator • during all but lengthy outages
Fan(s)	Provides positive pressurization to prevent flue gases from infiltrating the penthouse from the treatment zone.
Plate rappers	Trigger impact against the collecting plates to dislodge collected particulate.

(continued)

PRECIPITATOR COMPONENTS

(continued)

Penthouse

The penthouse is located between the precipitator roof and the treatment zone, and typically includes the following components:

Component	Description
High-voltage support system	Transports high voltage to the discharge electrodes suspended in the treatment zone.
Insulators	Isolate the high voltage system from the precipitator casing, which is at ground potential. Composed of alumina, the insulators are kept dry by the penthouse pressurization/heating system. *Important:* To prevent "arc-over", insulators must be kept free ofdust and moisture at all times.
Rapper spring plate assembly	Transfers high voltage to the electrode frame, and provides a means of rapping (cleaning) the electrode frames.

Precipitator Treatment Zone

The precipitator treatment zone is a box like enclosure, open to the ductwork on the ends. Gas enters at one end (inlet), is cleaned of suspended particles, and is discharged through the other end (outlet).The precipitator treatment zone contains the following components:

Component	Description
Collecting surfaces	A vertical arrangement of collecting surfaces forms multiple gas passages. Passages are parallel to the gas flow, and open to the ductwork at the precipitator inlet and outlet. Collecting surfaces are usually placed in series to form fields.

High-voltage discharge electrodes	Negatively charged electrodes are suspended between the collecting surfaces from high-voltage frames. These frames are suspended by the high-voltage support system. Below the gas passages, the discharge electrodes are guided by a rigid frame suspended from the electrodes. The discharge electrodes may be aligned in the passages, using adjustments built into the high voltage structure support system.
Plate rapper anvils and rapper rods	Transmit the force from the rappers to collecting plates, dislodging the fly ash.
Gas distribution devices	Located at the inlet and outlet of the precipitator chamber, gas distribution devices regulate the velocity in all gas passages.

(continued)

PRECIPITATOR COMPONENTS
(continued)

Collection/Disposal Area

Collected materials, dislodged from the discharge electrodes and collecting surfaces, fall through the gas passages into the hoppers below. The collected material is then removed from the hoppers by the dust removal system.

The collection/disposal area of a utility boiler precipitator includes the following components:

Component	*Description*
Hopper discharge flange	Provides collection point for customer-supplied ash removal equipment

4.2 ELECTRICAL CONTROL & INSTRUMENTATION

Control Console

The operating controls for the T/R unit are remotely located in a self-contained control console. The control console provides the following meters, which display the voltage at various points of the transformer-rectifier and precipitator.

Meter	*Description*
Voltmeter (VM)	Indicates the AC RMS voltage on the primary circuit of the T/R.
Ammeter (AM)	Reads the AC RMS current in the primary circuit of the T/R.
Milliammeter (MA)	Indicates DC current flowing in the precipitator field. The milliammeter is connected in the ground side of the rectifier. *Note:* If there is an open circuit, the miliammeter is protected from high voltage by surge arrestor(s) located in the T/R set low voltage junction box.
Kilovolt meter (KV)	Indicates the DC voltage on the discharge electrodes. *Note:* If there is an open circuit, the kilovolt meter is protected from high voltage by surge arrestor(s) located in the T/R set low voltage junction box.

(continued)

ELECTRICAL CONTROL & INSTRUMENTATION
(continued)

Transformer-Rectifier Operating Controls

The table below lists the most vital T/R controls. For complete information, see technical manual ME-100.

Control	Description
Off/Reset-On Key Interlock (S1)	Also called the Control Console switch. Has two settings: Off/Reset and On. To turn off and/or reset the alarm circuit, set S1 to "Off/Reset" if contactor K1 opens due to any alarm or loss of line voltage ***Note:*** An alarm is not generated if the console is turned off by means of S1.
Secondary Voltage Limit Thumbwheels	Sets the maximum secondary voltage allowed before the Digicon Optipulse Control limits the T/R console in Automatic mode. The absolute high limit is factory set for the specific T/R size.
Integral Grounding Device	Air switch located above the tank. The external operating handle is key interlocked, prohibiting movement while energized. Before you can turn and lock the switch, you must deenergize the transformer-rectifier and transfer the operating key (KI) from the control console switch (S1) to its alternate lock in the transformer-rectifier switch. The switch can only be locked in the ground position.

Internal Components of the T/R Control Console

The internal components of the transformer/rectifier control console are listed and described in detail in technical manual ME-100.

5

STARTING UP THE PRECIPITATOR

5.1 PRELIMINARY STARTUP PROCEDURES

Precautions to Take Before Starting Up

Take the following precautions before energizing the precipitator.

STEP	ACTION
1	Inspect the precipitator for tools or debris.
2	To check for unobserved grounds, disconnect the high voltage bus in the penthouse and measure the resistance of each field to ground, using a 1000-volt megger. The result should be between 100 mega-ohms and infinity. *Note:* Collecting electrodes and Rigitrodes™ must be centered between the collecting surfaces, no more than 3/4 inches off the center line.
3	Start the penthouse pressurization/heating system no less than 4 hours before you energize the precipitator.
4	Visually inspect each T/R set for signs of damage: • fluid leaks • bowed access covers or tank walls (indicating high internal pressure)
5	Verify that fluid level is within the acceptable range.
6	Close and lock the precipitator and insulator compartment doors, using the key interlock procedure described in Drawing D810, Section 2 of volume 3.

Systems to Start Up Before Energizing the Precipitator

The following systems must be operating when the precipitator is started up.

System	*Must be operating when...*
Collected material conveying system	gas is passing through precipitator
Discharge electrode and collecting surface rappers	when the precipitator is energized
Penthouse heating and pressurization system	four hours before precipitator is energized.
Floor heaters	four hours before gas begins passing through precipitator
Slide gates	(open) before starting I.D. fan

(continued)

5.2 STARTUP PROCEDURES

Precautions to Take Before Energizing the Transformer-Rectifier

Do not allow the transformer-rectifier to become disconnected from the load while energized!

The rectifier switches are interlocked to prevent the T/R from becoming disconnected while the switches are being operated. Before moving the rectifier switch, verify that the control console circuit breaker is open and locked out.

Energizing and Regulating the Transformer-Rectifier

To energize the T/R and regulate it for proper operation, use the following procedure.

Step	*Action*
1	Turn the high voltage selector switch (located on or above the T/R) to the "HV" (full wave) position. *Result* The access key is held captive and the operating key is released, allowing power to be applied to the unit from the control console (for more information, see Drawing D810 in Section 2 of volume 3).
2	Verify that the auto-test switch (S2, located on the control console) is in the Automatic position and that the thumbwheel switches are properly set.
3	Turn switch S1 to the "On" position. (See the Drawing D810 for a detailed description of this sequence.)
4	Check the meters on the control consoles to verify that power is increasing to normal operating levels. Refer to the Troubleshooting section of technical manual ME-100 if any problems occur.

Note: Once adjusted at time of start up, the automatic voltage control should not require readjustment unless precipitator operating conditions change greatly. If, at any time, there is evidence that the automatic voltage control is not functioning properly, refer to technical manual ME-100: *Digicon Optipulse Controller and Rectifier Control Console.*

6

OPERATING THE PRECIPITATOR

6.1 OPERATING THE CONTROL CONSOLE

Introduction

You may operate the precipitator control console in either of the following modes:
- **Test:** Sets up conditions for testing circuits and precipitator performance
- **Automatic:** Sets up conditions for normal operation

For more information, see drawing D807, in Section 2 of volume 3.

How to Operate the Console in Test Mode

Caution: Do not leave the consoles running in test mode. Some of the automatic control features are not active in the test mode; therefore, precipitator performance must be closely monitored by maintenance personnel.

Step	*Action*
1	To apply power to the control console, close the circuit breaker, which is located in the control console or in the motor control center. *Result:* The control console is energized, and the white light (WIL) lights.
2	To operate the control console under test mode, place the automatic/test selector switch (S2) in the test position. *Note:* Do not leave the precipitator unattended when it is operating in the test mode!
3	Before closing the main contactor (K1), be sure that the test control potentiometer (R8) is turned fully counter-clockwise.
4	Close contactor K1 by turning the selector switch (S1) to the "On" position. ***Result:*** The high-voltage T/R is energized, indicated by the red "High Voltage On" light (RIL).
5	Regulate precipitator voltage by slowly turning the test control potentiometer (R8) clockwise. *Note:* In Test mode, all voltage and current trips are active. The DOC will trip the T/R control console if the default sparkover rate of 240 spm is exceeded.

(continued)

OPERATING THE CONTROL CONSOLE

(continued)

How to Operate the Console in Automatic Mode

STEP	*ACTION*
1	To apply power to the control console, close the circuit breaker, which is located in the control console or in the motor control center. ***Result:*** The control console is energized, and the white light (WIL) lights.
2	To operate the control console under automatic mode, place the automatic/test selector switch (S2) in the automatic position.
3	Close contactor K1 by turning the selector switch (S1) to the "ON" position. ***Result:*** The high-voltage T/R is energized, indicated by the red "High Voltage On" light (RIL).
4	Adjust the secondary voltage of the precipitator to the sparkover point, the T/R voltage limit, or the T/R current limit by turning the Secondary Voltage Limit Switch thumbwheels on the DOC.
5	The spark response switch regulates the controller reaction time to sparking. Refer to technical manual ME-100 for details. DO NOT CHANGE WITHOUT AUTHORIZATION FROM EEC.

Note: The location of the components, the wiring diagrams, and the electrical schematics can be found with the electrical drawings in the Appendix. For more detailed information on operating the console, see technical manual ME-100.

6.2 OPERATING THE PRECIPITATOR

Introduction

Because the precipitator's collecting efficiency increases as the applied voltage increases, voltage should be kept at a point that produces a light sparking condition or current limit. The Digicon Optipulse Controller automatically maintains the T/R's voltage output at this ideal level.

How Is the High Voltage Set Point Determined?

The ENELCO® Field Engineer determines the high voltage set point according to the existing conditions of gas loading (usually at rated gas volume). Normally, as the set point is at the upper limit, this operating value will be varied automatically as the gas load conditions vary. If the spark rate becomes excessive, however, this point can be lowered.

Note: If one or more conditions change significantly within the precipitator, the T/R control console will reflect the change.

How Do Varying Conditions Affect Precipitation?

The factors listed below illustrate common influences on the effectiveness of the precipitator.

Moisture

An increase in the moisture content of the gas will increase electrical conductivity. This causes a decrease in sparkover voltage and an increase in precipitating current. The presence of water vapor improves precipitation, and an inadequate amount is a restriction to good performance.

Dust Concentration

An increase in dust concentration is usually accompanied by a decrease in sparkover voltage and precipitating current. The increase in dust concentration can result in an increase in the amount of dust that is collected. However, as the dust concentration is increased, the amount of dust that is not collected will also increase. In addition, the discharge electrodes and collecting surfaces will demand more frequent rapping.

A decrease in dust concentration reverses these conditions: while the sparkover voltage and precipitating current are higher, less dust is collected and less dust is emitted.

(continued)

OPERATING THE PRECIPITATOR

(continued)

Flow Rate

An increase in gas velocity will decrease the collecting efficiency and increase the amount of dust not collected. It is best to operate at or below the rating of the precipitator.

Cleanliness of Electrodes and Collecting Surfaces

Limiting the accumulation of dust on the discharge electrodes and collecting surfaces is essential to the efficiency of the precipitator. For the recommended rapping timing and pattern, see drawings A890 and A891.

Component	*Effect of Dust Buildup*
Discharge Electrodes	Reduces the corona discharge, thus reducing precipitating current.
Collecting Surfaces	Reduces clearance between electrode and collecting surface, thus lowering collecting efficiency. Reduces clearance between the discharge electrodes and the collecting surfaces, which can lower sparkover voltage. Increases re-entrainment of collected particulate matter, which decreases collecting efficiency.

7

SHUTTING DOWN THE PRECIPITATOR

7.1 EMERGENCY SHUTDOWN

Shutting Down in an Emergency

To shut down the transformer/rectifier completely, open the circuit breaker.

7.2 SHUTTING DOWN FOR AN EXTENDED PERIOD

Preliminary Procedure

Before shutting down the precipitator for an extended period, use the following procedure.

Step	Action
1	Shut down boiler.
2	Shut down I.D. fan.
3	Close I.D. fan isolation gate, preventing particulate and gas from exiting the precipitator.
4	Turn off all fields. ***Important:*** The outlet field should continue to operate at the lower kV setting **only if** the following conditions apply • Opacity excursion is not allowed at shutdown • Natural draft is allowed (i.e., the fan damper is open) If internal inspection or repair is being performed, the damper should remain open to allow air movement through the box.
5	Rap down plates for at least four hours, using clean-down program # 2.
6	After the rappers are turned off, the ash removal equipment should continued to operate for at least four hours.
7	Continue with the following procedure: ***Before Opening the Penthouse.***

(continued)

SHUTTING DOWN FOR AN EXTENDED PERIOD

(continued)

Before Opening the Penthouse

Step	Action
1	Perform preliminary procedures.
2	Turn off penthouse blower/heaters.
3	Turn off outlet field.
4	Follow T/R grounding procedure described on Drawing D810, Key Interlock System (see Section 2 of this volume).
5	Open the following access doors: • Weather enclosure • Precipitator floor
6	Allow the penthouse to cool to 100°F or below, according to your facility's confined space entry procedure.
7	Check for hazardous gases and verify that sufficient O_2 is present in the precipitator. Follow established plant procedures for entering confined space. See Chapter 2, ***Safety Procedures***, for further information.

When Opening the Penthouse

Use the following procedure when opening the penthouse.

Step	Action
1	Enter according to established procedures for confined spaces.
2	Ground **all** high-voltage bus bars with grounding devices provided.
3	With a portable sniffer available, open one hot roof door.
4	Look for glowing material on plates or on hopper floor. If any is present, **SHUT DOOR IMMEDIATELY AND EXIT PENTHOUSE.** Repeat steps 3 and 4 hourly until no glowing material is present.
5	Carefully open remaining doors, checking at each door for glowing material. If any material is present, **SHUT ALL DOORS IMMEDIATELY AND EXIT THE PENTHOUSE.**
6	After all doors are open, exit the penthouse.
7	**Mark all open doors to prevent unauthorized entry.**

(continued)

SHUTTING DOWN FOR AN EXTENDED PERIOD

(continued)

Opening the Dry Bottom

Step	Action
1	Using the peepholes and other safety features, check for collected material lodged behind the doors.
2	<u>If no dust is visible,</u> open the door while leaving the interlock locked. This prevents the door from springing open, possibly exposing you to hot dust.
3	When dust has finished spilling out, close the door and unlock the interlock.
4	While leaving an escape path available, open the door away from you.
5	Attach ground cables to the Rigitrode™ frame.
6	Repeat steps 1-5 for all remaining doors.

Before Entering the Precipitator

Observe the following precautions before entering the precipitator box.

Step	Action
1	Allow the box to cool with all doors open for 12-16 hours, or until the internal temperature is below 100°F.
2	Follow established company procedures for working in enclosed space.
3	**Ensure that a qualified safety officer is present at all times when personnel are inside the precipitator.**

7.3 SHUTTING DOWN FOR A BRIEF PERIOD

Preliminary Procedure

Before shutting down the precipitator for a brief period (less than 48 hours), use the following procedure.

Step	***Action***
1	Shut down boiler.
2	Close I.D. fan isolation gate.
3	Turn off all fields, except outlet field.
4	Rap down plates for at least four hours, using clean-down program # 2.
5	After the rappers are turned off, the ash removal equipment should continue to operate for at least two hours.
6	Continue with the following procedure: ***Before Opening the Penthouse.***

Before Opening the Penthouse

Before opening the penthouse or allowing personnel to enter, perform the following procedure.

Step	***Action***
1	Turn off the penthouse heaters. To allow the area to cool, keep the blower operating.
2	Follow the key interlock procedure for grounding the T/R.
3	Open the access doors in the weather enclosure floor (or penthouse roof)

8

MAINTAINING THE PRECIPITATOR

8.1 PRELIMINARY MAINTENANCE

Recording Normal Meter Readings

On a daily basis, monitor the readings of the metering system in the precipitator control room. Establish a normal range for these meters; this will enable you to note any radical changes.

Preparing Plan View Maps

Before performing regular inspections, prepare a plan view map of each field showing plates, electrodes and rapper rods. This will assist you in inspecting the upper and lower portions of the precipitator treatment area.

For Additional Information

Further requirements and procedures for maintenance and inspection are listed in the auxiliary manuals for precipitator components. **Before performing maintenance or inspection, personnel should be familiar with all available procedures.**

8.2 DAILY INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Daily Inspection

The following items should be inspected on a daily basis.

Step	Action
1	Visually verify that all rappers are operating properly.
2	Check all T/R oil temperatures. Note the highest temperature recorded by the red "memory" needle.
3	Listen for sounds of arcing in and around the T/R sets.
4	Record a complete set of T/R readings under a known set of boiler operating conditions. Compare these readings with the desired readings. *Note* The following readings indicate trouble and should be investigated: • low voltage and high current • normal voltage and low current
5	Verify that the automatic T/R controllers (DOCs) are functioning properly.
6	Observe readings given by the metering system in the control room. Note any radical variations from the normal pattern (see ***Preliminary Maintenance***).
7	Verify that the stack opacity monitor is functioning properly.
8	Verify that all blowers are operating properly. Check penthouse blower filters and replace (if necessary).
9	Verify that the penthouse pressurization/heating system is operating properly.
10	Check for any new casing gas leaks or worsening of known leaks.
11	Check for any liquid leaks.
12	Check all expansion joints during a routine walk-down. Observe signs of leakage and ensure that leaks are repaired at the earliest opportunity.
13	Verify that the dust removal equipment is functioning properly.

8.3 WEEKLY INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Weekly Inspections

The following procedures should be performed weekly, or according to the facility's precipitator maintenance program.

Step	Action
1	Check all motor bearings for high temperature and signs of excessive vibration.
2	Verify that all blower filters are clean. Replace dirty filters when necessary. Maintain a record of filter changes to diagnose possible problems. *Note* While this procedure should be performed weekly immediately after initial startup, the intervals may be lengthened as the precipitator continues to operate

8.4 MONTHLY INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Monthly Inspections

The following items should be inspected on a monthly basis.

Step	Action
1	Check all drive belts for tightness and general condition.
2	Check the overall condition of individual rappers, including (but not limited to) ground straps, boots, and rapper body.
3	Check for loose nuts or broken track welds on rapper all-thread rods.
4	Visually inspect the general condition of all T/Rs.
5	Inspect the outer access doors and gaskets. Note any signs of leakage. Repair leaks at the earliest opportunity.

8.5 SEMI-ANNUAL INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Weather Enclosure (or Roof)

Step	Action
1	Verify that all rapper boot clamps are in place.
2	Verify that seals are tight on all cold roof doors.
3	Check bus bar path and connections for dirt and close clearances.

Penthouse Area

Step	Action
1	Check for evidence of tracking or cracks in high voltage support insulators.
2	Verify that venturi holes are clear on high-voltage support insulator top plate
3	Verify that the 2" nut retainer (keeper angle) on the high voltage frame support rod is in position.
4	Check for signs of tracking on or warping of the melamine rapper rods. Wipe down where necessary.
5	Check rapper tube purge holes for plugging or corrosion. Ensure that holes are open to allow purge air flow.
6	Check for accumulation of dust in penthouse. Vacuum clean if necessary. Determine the cause of excessive accumulations and take corrective action.
7	Check ceiling insulation or floor block insulation for damage or uncovered areas. Repair uncovered areas as required.
8	Check the bus bar jumper connections and welds to the top plate of the high voltage support insulator.
9	(If applicable) Verify that insulator band heaters are tight around perimeter of the high voltage insulator. Test heaters for proper ohmic value.
10	(If applicable) Check thermal tape around joints of the casing heat piping.
11	Look for signs of wall buckling, condensation, air inleakage, or corrosion.
12	Check melamine rods for tightness in lower sockets.
13	Check the integrity of the expansion joints in the heater purge air system.

(continued)

SEMI-ANNUAL INSPECTION PROCEDURES

(continued)

Inside Upper Treatment Area

Step	Action
1	Check for excessive bridging or buildups that might cause grounding or close clearances. *Note* **Perform this check before cleaning the precipitator.**
2	Check inside bell housing for tracking or buildups.
3	Verify that the nozzles are pointed in the proper direction.
4	Clean between plate support channel and wall, and support beams.
5	Measure distance from the bottom of the bell house to the hanger rod, ensuring that at least the minimum clearance recommended by the manufacturer is maintained.
6	Check for loose Rigitrodes™ and tighten where necessary.
7	Check mine bolts for wear where the mine bolt passes through the upper toe of the place support channel.
8	Verify that the channel spacer bar is loose but secure.
9	Verify that the four studs are present on the rapper anvils and that the rapper rods are between the studs.

Inside Lower Treatment Area

Step	Action
1	Check for loose Rigitrodes™.
2	Verify that perforated plate rapper is intact.
3	Check perforated plates for binding on sides or bottom.
4	Check inlet/outlet plenum perforated plates for pluggage and buildups.
5	Check for excessively loose plate tadpole pins and worn guide strips.
6	At several points, observe and map clearance between walls and baffles to the plate and electrode frames.
7	Inspect access doors and gaskets for tight seals or corrosion.
8	Check the condition of the Teflon™ anti-sway bars. Verify that the Teflon™ is clean and flexible.

(continued)

SEMI-ANNUAL INSPECTION PROCEDURES

(continued)

Collection/Disposal Zone

Step	Action
1	Inspect the access doors and gaskets for tight seals or corrosion.
2	Inspect the screw conveyor (if supplied) for bent flights.
3	Inspect hopper walls for warping or evidence of corrosion.
4	Check for pluggage in the ash removal system.

Cleaning the Precipitator

The following areas should be cleaned with a dry clean cloth or electric cleaner at least twice a year.

- all standoff insulators
- outside surfaces of the high-voltage support insulators
- inside surfaces of high voltage insulators

8.6 ANNUAL INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Weather Enclosure (or Roof)

Step	Action
1	Verify that rapper rods are free in their exit bushings.
2	Verify that the air switch is functioning properly.
3	Verify that the T/R switch blade is in good condition.
4	Check the T/R oil level. Add oil if necessary.
5	Run carbon and dielectric tests on T/R oil.
6	Check the operation of the key interlock system; lubricate locks with dry graphite. **Do not use oil lubricant with the key interlock system.**

Inside Upper Treatment Area

Step	Action
1	Check for separation of tadpole pins from the plate's top edge.
2	By shining a flashlight down the length of the plate, check for: • bowing plates or Rigitrodes™ • bent pins • possible close clearances • general alignments Note any significant differences in the field maps.

(continued)

ANNUAL INSPECTION PROCEDURES

(continued)

Inside Lower Treatment Area

Step	Action
1	Take random pin-to-baffle and pin-to-plate measurements.
2	Check above baffle between fields for buildups.
3	Check for bowed plates by measuring from plate to plate.
4	Look for corrosion on collecting plates, possible thinning of plates, or holes in plates
5	Check for signs of excessive heat.
6	Verify that the "J" hooks holding the perforated plates in position are fixed to the casing wall.

Collection/Disposal Zone

Step	Action
1	Check tightness and condition of bearings and couplings.

Rapper Controls

To establish a base line for future inspection and analysis, a reference sheet should be created, containing the desired settings for the rapper system.

Step	Action
1	Confirm the system timing sequence for each field from the reference sheet.
2	Confirm the impact rapper lift from the reference sheet.

Outside the Precipitator Shell

Step	Action
1	Check the external condition of insulation and lagging for any missing pieces or areas in need of repair.

8.7 BIENNIAL INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Precipitator

The following areas should be inspected at least once every two years.

Step	Action
1	Verify balanced draw and correct current level on all phases of all motors and heaters.
2	Check piston exposure on all rappers, and verify that all rapper bodies are true to plumb.
3	Measure field clearances to determine whether realignment is required.
4	Check inside the T/R controllers and rapper panel for dust buildup.
5	Megger T/Rs and compare recorded readings against equipment baseline data.
6	Check hopper corners for buildups and corrosion.
7	Megger hopper heaters, replace if necessary.

High Voltage Controllers

Step	Action
1	Check accuracy of all control console meters.
2	Calibrate primary current overload relay.
3	Test all alarm and trip functions by simulation.
4	Torque check all wiring connections on both high-voltage and low-voltage systems.
5	Inspect the precipitator ground grid and ground connections. Inspect connections to T/Rs, control consoles and structure to earth.

8.8 TRIENNIAL INSPECTION PROCEDURES

Purpose

This section is intended to be used as a guideline rather than as an exact listing of all possible points for inspection. The inspectors at your facility are encouraged to develop their own supplementary list.

Areas for Triennial Inspection

The following areas should be inspected at least every three years.

Step	Action
1	Check plate thickness to determine the degree of corrosion.
2	Check duct work approaching and exiting the precipitator for areas of buildup or failed turning vanes.

9

TROUBLESHOOTING GUIDE

9.1 GENERAL TROUBLESHOOTING PROCEDURES

Common Problems

The following table lists common problems that occur in precipitators, along with ways to prevent or correct them.

Component	Possible Problem	Prevention/Correction
Insulators	Dust buildup	Open insulator compartments and clean surfaces. **Do not apply polish.** Such substances may trigger electric flashover, causing insulator failure.
	Cracks	Replace, using new gaskets.
	Carbon tracking	Realign high voltage frames (if needed)
T/R Unit	Inadequate ventilation (due to high ambient temperature trip)	T/R units are self-cooled and depend entirely upon surrounding air for dispersing heat. Ensure adequate ventilation and airflow around tank. *Note* A temperature indicator is provided.
T/R Tank	Poor fluid quality	The T/R units are shipped filled with transformer fluid. Samples of the fluid from T/R tank should be tested for conductivity at least once every six months. Keep records of test results.
	Insufficient fluid (due to high T/R temperature)	Check the fluid level regularly. If the tank needs to be refilled with fluid, use only type specified on nameplate. *Note:* A sight glass is provided.
Control Console	Dust buildup	Vacuum internal parts occasionally. ***Warning:*** Do not disturb wiring or connections.
	Loose connection(s)	Tighten the connection(s).
	Evidence of burning	Check for loose connection; tighten or replace wiring. DO NOT SPLICE.
	High ambient temperature trip	Verify that fans are working correctly. Check filters (if supplied). Replace if necessary.

(continued)

GENERAL TROUBLESHOOTING PROCEDURES

Common Problems (continued)

Component	*Possible Problem*	*Prevention/Correction*
Collecting surfaces	Excessive dust buildup (>1/4")	Clean before re-energizing. Adjust rapping frequency.
Discharge electrodes	Dust buildup	Clean before re-energizing. Adjust rapping frequency.
	Unequal clearance between electrodes and collecting surfaces	Each electrode must be spaced no more than 3/4" off the centerline between the collecting surfaces.
Interlocks	Difficult to operate	Apply powdered graphite to a key. Insert and turn the key in the lock. **DO NOT USE OIL.**
	Damaged chains	Repair chains.
Perforated plates	Plugged with dust deposits	Clean.
Penthouse pressurization/ heating system	Dust in penthouse area	Clean/change filters often. Verify that fans are operating properly. Check precipitator roof doors for proper fit and seal.
	Low penthouse temperature	Check heater operation. Verify that the thermocouple and thermostat are operating properly.
High voltage support insulators	Dust buildup	Open insulator compartments and clean surfaces.
	Cracks	Replace, using new gaskets. Realign high voltage frames (if necessary).
	Carbon tracking	

(continued)

GENERAL TROUBLESHOOTING PROCEDURES

Common Problems (continued)

Component	*Possible Problems*	*Prevention/Correction*
Rappers	Piston is not lifting	Perform diagnostic inspection: • Verify that rapper panel is ON • Check rapper panel for loose wires. • Check rapper coil and DC output card for short circuit(s) • Check rapper for magnetic charge Report findings to EEC Field Service.
	Piston is hitting top of rapper	Perform diagnostic inspection: • Check number of pulses indicated in the rapper panel program • Check the exposure of the rapper piston. Report findings to EEC Field Service.
Door gaskets	Deterioration or in-leakage	Replace as necessary
Ductwork	Deterioration	Call Environmental Elements Corporation
	Leaks	Tighten bolts
Structural joints	Leaks or general deterioration	Call Environmental Elements Corporation

9.2 DIAGNOSING AND SOLVING SPECIFIC PROBLEMS

High Spark Rates

It is normal in most applications for the inlet fields of the precipitator to spark. An excessively high spark rate that inhibits the power input of any field, however, may indicate a problem. Some of the more likely causes follow.

Possible Cause	Action
High dust concentration in flue gas	Check boiler operation
	Check operation of any pre-collectors
High gas velocity through the precipitator	Check boiler operation
	Check gas distribution devices for blockages or damage
Dust build-ups within the precipitator	Check rappers
	Check dust conveying system
Close or unequal clearances within the precipitator	Inspect and correct clearances
T/R failure	Follow megger instructions to determine the T/R condition; contact Environmental Elements Corporation Field Service.
Insulator failure	Verify that penthouse heating system is working and is being activated four hours before the precipitator is started up. Inspect high voltage support insulators, high voltage rapper rods, and all other HV distribution stand-off insulators. Replace any insulators that are cracked or show signs of electrical tracking.
Grounded field	Perform an internal inspection to determine the cause of the ground.
High air flow	Check boiler operation.
High moisture content in flue gas	Check boiler operation.

(continued)

DIAGNOSING AND SOLVING SPECIFIC PROBLEMS (continued)

Abnormal Power Readings

Many precipitator problems may be indicated and possibly diagnosed by using the T/R voltage and current meters. Some of the more obvious indications follow.

Meter Indications	*Probable Cause(s)*	*Action(s)*
Zero voltage, all other indicators normal	Bad voltmeter	Repair/replace
	Grounded field	Inspect, remove ground
	Failed T/R	Megger T/R to confirm; call EEC Field Service
Zero voltage, excessively high current, and shutoff on overcurrent	Overloaded conveying system	Check dust level and remove excessive amounts
	Grounded high voltage component	Inspect, remove ground
	Failed T/R	Megger T/R to confirm, contact EEC Field Service
Voltages slowly decrease as current increases, and shut off on under-voltage alarm	Dust bridges within the precipitator	Check rappers
		Check dust conveying system
	Overloaded conveying system	Check dust level and remove excessive amounts
Milliameter reads zero; all other meters show normal readings	Bad milliameter	Repair/replace
	T/R failure	Megger T/R to confirm, contact EEC Field Service
Field operates at kV limit of T/R rating; all other meters read zero or very low	Faulty kV metering circuit resistors	Replace the failed resistor(s)
	Possible open-circuited metering resistor in T/R low voltage junction box	

(continued)

DIAGNOSING AND SOLVING SPECIFIC PROBLEMS (continued)

Increased Opacity

All the problems mentioned above can result in higher opacity levels (increased dust emission). Other items that could cause an increase in opacity follow.

Possible Cause	*Action*
Improper rapper cycle times and/or intensity	Readjust rapper times and/or intensity according to Drawings A890 and A891.
Improper gas flow distribution, causing high gas velocity in areas of the precipitator, and reducing the treatment time	Check distribution media for damage or blockage
Precipitator is full of dust, causing re-entrainment of collected dust	Remove dust and verify that removal system is working properly
Flue gas leakage around the treatment zone (above, below, or along the sides)	Check baffling for damage
Gas volume above the rated design, causing increased velocity within the precipitator and reducing treatment time	Conduct pitot tube traverse to determine gas volume
Improperly adjusted controls	See technical manual ME-100 to correct control problems
Change in dust particle size	Verify boiler operation. Verify that coal supplier has not changed.

Additional Resources

For additional information, refer to the following resources:

Resource	*Information Provided*
Appendix	Mechanical and electrical schematic drawings and diagrams
Technical Manual ME-100	Installation, operation, maintenance, and troubleshooting details of the Digicon Optipulse Controller and Rectifier Control Console
Auxiliary Manuals	Installation, operation, maintenance and troubleshooting details of precipitator components manufactured by contracted vendors

Operation and Maintenance Manual for Venturi Scrubber

501.000 Subcooler Venturi Scrubber

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ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001 Operation & Maintenance Manual

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Operation & Maintenance Manual

for the

HydroMist VenturiPak ™

Off-Gas Wet Scrubbing System

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OPERATION AND MAINTENANCE MANUAL

OUTLINE

ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.1 Section 1: Hydromist Venturipak Wet Scrubber Introduction

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OPERATION AND MAINTENANCE MANUAL

SECTION 1

HYDROMIST VENTURIPAK™ WET SCRUBBER INTRODUCTION

HYDROMIST VENTURIPAK™ SCRUBBER SYSTEM

The VenturiPak™ scrubber system (U.S. Patent 5,279,646 and patents pending) consists of a multiple impingement scrubber / sub-cooler stages, a venturi stage, and a high efficiency mist eliminator stage. The venturi stage consists of multiple venturi elements combined with counter airflow water sprays centered at each venturi throat inlet. Each venturi element is removable to provide flexibility in scrubbing performance and application. The HydroMist VenturiPak™ scrubber system is an improved venturi scrubber system which provides high efficiency, adjustable scrubbing of sub-micron and condensable particulate by:

1. Sub-cooling and condensing condensable gases prior to the venturi scrubbing stage.
2. Providing pre-atomization of the venturi stage water via proprietary high-pressure water spray nozzles.

The HydroMist VenturiPak™ Scrubber System consists of:

1. Two- (2) Under Tray Spray Lances with two- (2) EnviroCare SpiralMist nozzles per lance.
2. Two- (2) Dual-Orifice™ sub-cooler impingement trays.
3. One- (1) Vane Type Condenser Mist Eliminator at recycle gas discharge.
4. Two- (2) Condenser Mist Eliminator Spray Lances each with two- (2) EnviroCare RainDrop nozzles.
5. One- (1) Dual-Orifice™ venturi impingement tray.
6. Split Gas Flow: Under design conditions 24,422 ACFM of off-gas @ 132°F & 10.5% by volume moisture recycles back to the dryer after flowing through the condenser mist eliminator. 7,047 ACFM @ 105°F flows through the venturi impingement tray then onto the venturi stage.
7. The HydroMist venturi stage contains five- (5) HydroMist Venturi assemblies each with a 3/8" MPT water feed port. Each venturi assembly includes one- (1) EnviroCare SpiralMist venturi nozzle.
8. One- (1) Venturi Water Feed Lance with internal and external connection nipples and accessories to connect to venturi assembly water feed port.
9. One- (1) Mesh Type Venturi Stage Mist Eliminator at the discharge of the venturi stage shell.

10. One- (1) venturi Stage Mist Eliminator Spray Lance with two- (2) EnviroCare SpiralMist nozzles.

11. One- (1) Booster Pump Skid with high-pressure water pump & accessories sized to supply sufficient water pressure and flow to the venturi assemblies.

The HydroMist VenturiPak™ scrubber for this application is configured as shown on EnviroCare's process & instrumentation drawing C100-6079 and general arrangement drawing C500-6079, reduced copies of both can be found in Appendix A. Appendix A also includes drawings for all of the major components of the HydroMist VenturiPak™ off-gas scrubbing system.

The system includes a sub-cooler impingement tray stage, a condenser mist eliminator stage, a venturi impingement tray stage, a HydroMist venturi stage & booster pump skid and venturi mist eliminator stage. Water flows and gas conditions for all stages are shown on drawing C100-6079. (Appendix A)

Details for each stage can be found in the remaining sections of this manual.

501.001.2 Section 2: Sub-Cooler Impingement Tray Stage

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OPERATION AND MAINTENANCE MANUAL

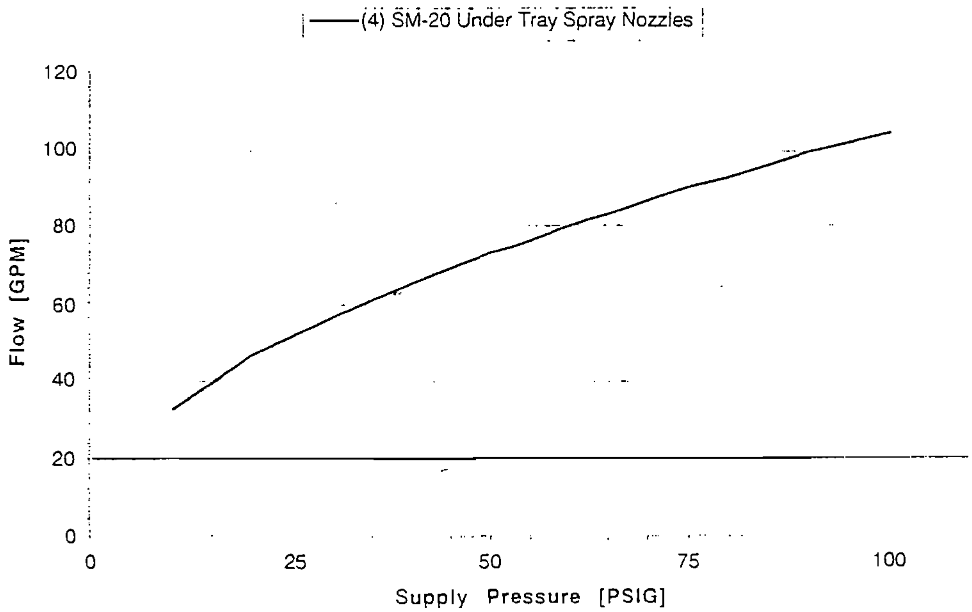
SECTION 2

SUB-COOLER IMPINGEMENT TRAY STAGE

SUB-COOLER IMPINGEMENT TRAY STAGE

The sub-cooler stage is comprised of two- (2) under tray spray lances with two- (2) SpiralMist spray nozzles on each lance and two levels of impingement trays each with one- (1) Dual-Orifice™ impingement tray. The under tray spray nozzles spray upward and are sized to supplement the cooling of the incoming gases (saturating the gases), to capture larger particles and to wash the bottom of the lower impingement plate (preventing build-up). Some of the spray water is carried into the lower tray section where it adds to the tray water flow. The under tray spray nozzles are connected to "low pressure" plant water and should operate at no less than 40 psig. See drawing C112-6079 in Appendix A for lance design details. A water flow curve for the under tray spray nozzles is shown below (Figure 1). <u>PERIODIC INSPECTION OF THE TRAY SPRAY NOZZLES IS RECOMMENDED TO CHECK FOR CLOGGING AND/OR WEAR</u>.

FIGURE 1- SM20 TOTAL FLOW vs PRESSURE



The impingement tray stages form droplets as the gases pass through the flooded Dual-Orifice™ impingement trays. The interaction between the droplets and the gas results in the collection of the smaller particulate (down to 2 micron) and sub-cooling of the gas stream. Sub-cooling causes water vapor and condensable gases in the saturated gas stream to condense into a collectable particulate. The condenser tray water flow should be set at no less than 468 gpm ensuring that the gases exiting the condenser and being recycled back to the dryer do not exceed 130 °F but should not drop below 125°F. PERIODIC INSPECTION OF THE PLATES IS RECOMMENDED TO CHECK FOR CLOGGING OR THE ACCUMULATION OF MATERIAL.

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ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.3 Section 3: Condenser Mist Eliminator Stage

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OPERATION AND MAINTENANCE MANUAL

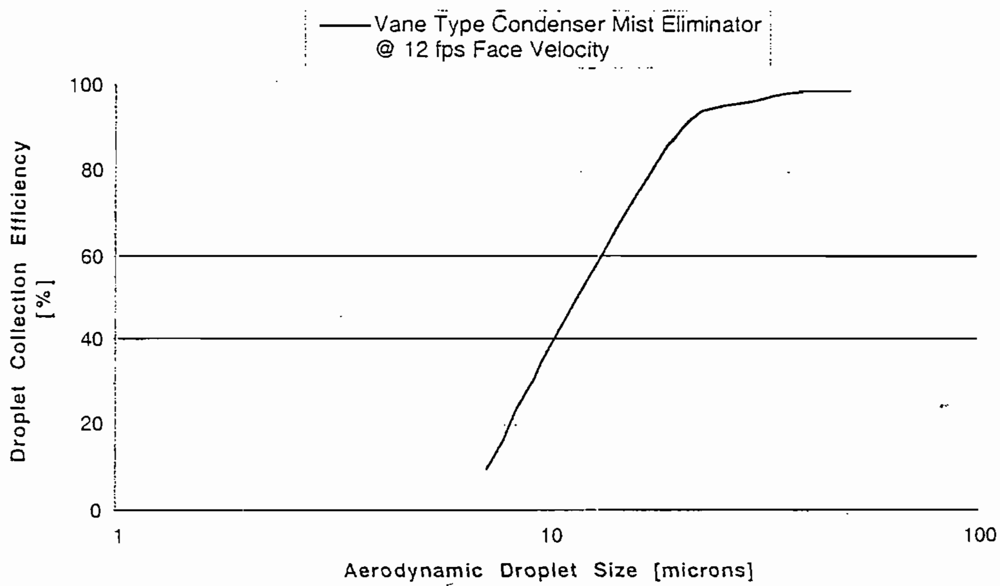
SECTION 3

CONDENSER MIST ELIMINATOR STAGE

CONDENSER MIST ELIMINATOR STAGE

The Condenser Mist Eliminator is located at the recycle gas discharge of the condenser shell. The system design calls for approximately 75% of the gas flow that exits the sub-cooler impingement tray stage to recycle back to the dryer via the condenser mist eliminator stage. This vane type, 316-SS, sectional mist eliminator is designed for maximum collection of entrained water droplets from the sub-cooler impingement tray stage. This unit provides droplet separation and collection over a wide range of gas flow velocities, typically 75-100% of design. A typical droplet collection efficiency curve (Figure 2) for this style moisture removal device is shown below.

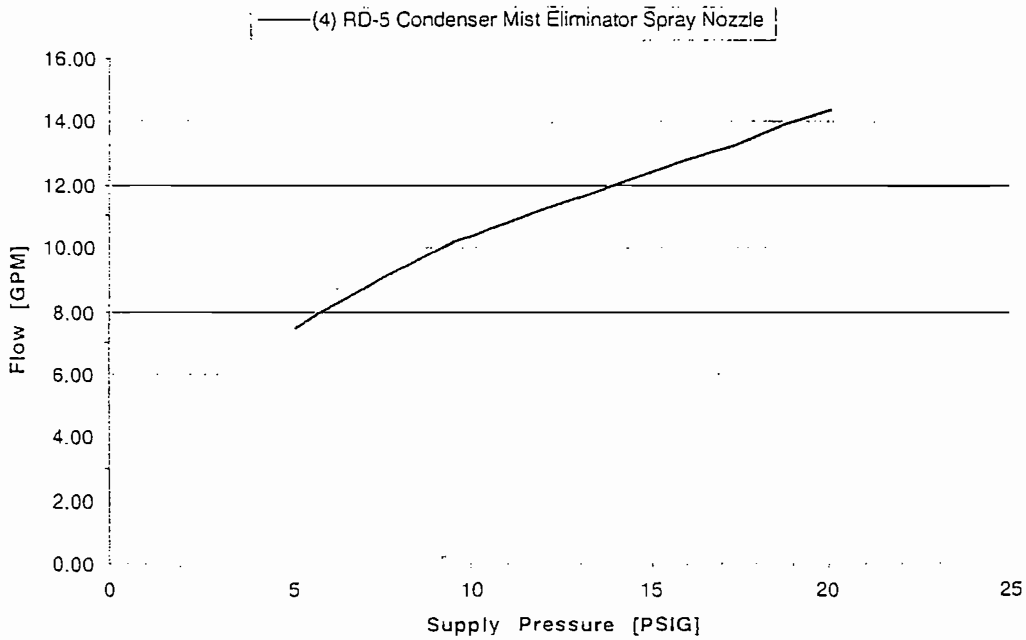
FIGURE 2- MIST ELIMINATOR
COLLECTION EFFICIENCY vs DROPLET SIZE



The mist eliminator is divided into four- (4) sections for ease of installation and maintenance.

Two Condenser Mist Eliminator spray lances are included downstream of the vane type mist eliminator. Each lance includes two- (2) RainDrop spray nozzles centered over the mist eliminator to provide continuous washing with clean water. Continuous washing prevents particle build up by ensuring proper drainage of captured particulate laden droplets from the mist eliminator vanes under various operating conditions. See drawing C114-6079 Appendix A for lance design details. The nozzle is connected to "low pressure" potable water through a pressure reduction valve, which should be set to supply approximately 7psig of water pressure to the lance. A water flow curve for the lance can be found below. (Figure 3)

FIGURE 3- RD5 FLOW vs PRESSURE



PERIODIC INSPECTION OF THE SPRAY NOZZLE AND VANE MIST ELIMINATOR FOR CLOGGING AND WEAR IS RECOMMENDED.

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ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.4 Section 4: Venturi Impingement Tray Stage

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OPERATION AND MAINTENANCE MANUAL

SECTION 4

VENTURI IMPINGEMENT TRAY STAGE

VENTURI IMPINGEMENT TRAY STAGE

The system design calls for the remaining 25% of the gas flow that exits the sub-cooler impingement tray stage to flow through the venturi impingement stage and then onto additional particulate removal stages before exiting the system via the venturi stage ID fan and outlet stack. The venturi impingement tray stage is comprised one- (1) Dual-Orifice™ impingement tray. The impingement tray stage forms droplets as the gases pass through the flooded Dual-Orifice™ impingement tray. The interaction between the droplets and the gas results in the additional collection of the smaller particulate (down to 2 micron) and additional sub-cooling of the gas stream. The additional sub-cooling causes more water vapor and condensable gases in the saturated gas stream to condense. The venturi tray water flow should be set at no less than 135 gpm ensuring that the gases entering the HydroMist venturi stage do not exceed 105 °F. PERIODIC INSPECTION OF THE PLATE IS RECOMMENDED TO CHECK FOR CLOGGING OR THE ACCUMULATION OF MATERIAL.

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ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.5 Section 5: Hydromist Venturi Stage & Booster Pump Skid

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OPERATION AND MAINTENANCE MANUAL

SECTION 5

HYDROMIST VENTURI STAGE & BOOSTER PUMP SKID

HYDROMIST VENTURI STAGE

The HydroMist Venturi Stage captures the residual fine, sub-micron particulate including condensable constituents that penetrate the impingement stages. The venturi stage consists of a solid venturi diaphragm with mounting locations for five- (5) HydroMist venturi assemblies. The venturi stage also includes one- (1) Venturi Water Feed Lance, which includes all the accessories necessary to connect the high-pressure water supply from the Booster Pump Skid to the venturi assemblies.

An illustration of the venturi assembly can be found on the following page. (Figure 4) The HydroMist venturi assembly consists of the mounting plate, low energy loss inlet, throat, outlet cone assembly, feed water connection & outlet deflector plate.

The mounting plate is oversized to allow for fabrication of the venturi assembly in one piece. This allows the assembly to be installed and removed through the access door above the venturi mounting plate diaphragm. The venturi flange bolts to the top of the venturi stage diaphragm. Neoprene gaskets are provided between the venturi flange and the mounting plate to prevent gas leakage or bypass.

The venturi water feed lance is fabricated in two pieces. The exterior connection and accessories allow for connection to supply piping that runs from the Booster Pump Skid. The interior connections and accessories allow for mating of the feed lance to the venturi assembly via a high-pressure hose. The water feed tubing in the venturi assembly runs the length of the venturi and feeds the venturi spray nozzle. Each venturi includes one- (1) SpiralMist spray nozzle that injects atomized water counter current to the process gas flow. This design provides an elevated relative velocity differential between the water and particulate laden gas stream, and thus the HydroMist venturi stage produces extremely high particulate collection efficiencies. The spray lance to venturi assembly connection details are shown in detail on drawing C110-6079. (Appendix A) The recommended operating pressures for the venturi water feed lance is 200psig. The water connection for the spray lance (as well as all other lances) is accomplished via a flexible metal hose with a hand isolation valve. All lances include a pressure gauge to provide operating pressure indication. <u>PERIODIC INSPECTION OF THE VENTURI SPRAY NOZZLES IS RECOMMENDED TO CHECK NOZZLE CLOGGING AND/OR WEAR.</u> Frequency depends on the quality of water supplied to the Booster Pump Skid, but should be performed at least bi-annually.

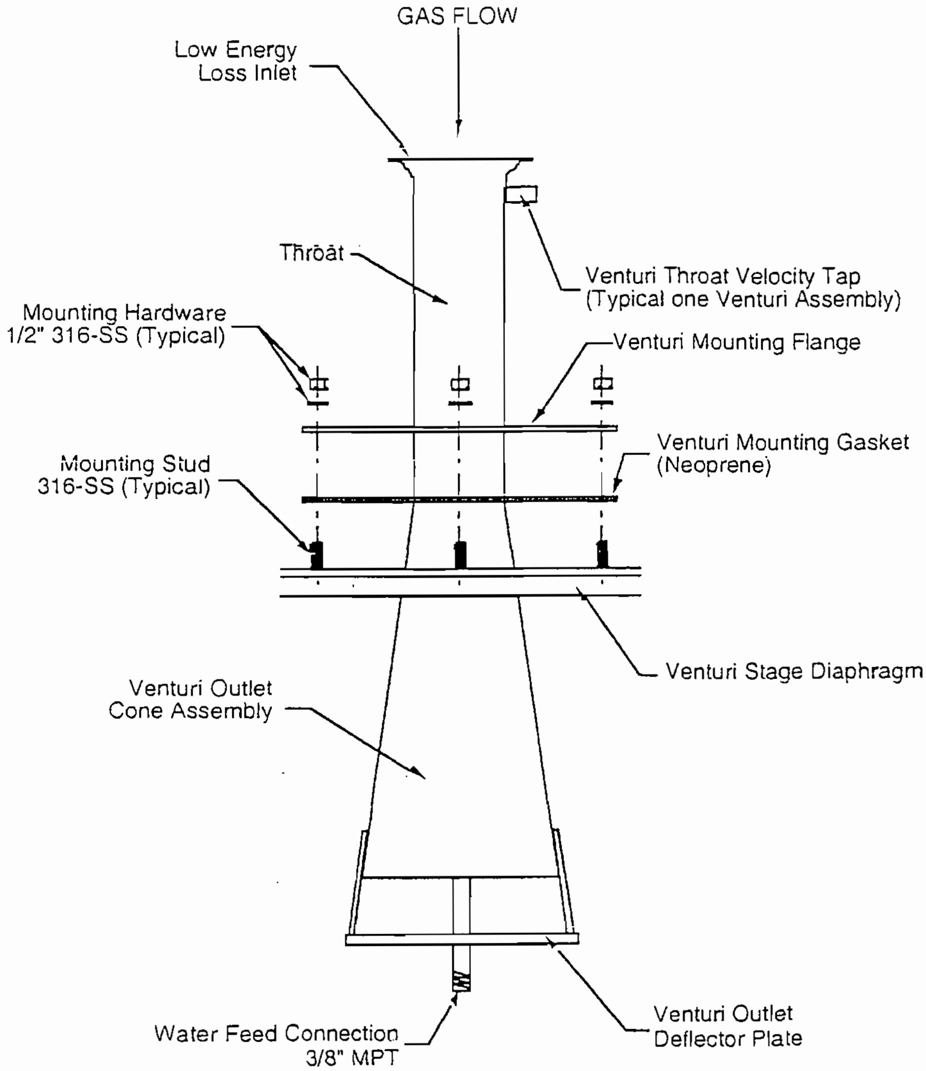
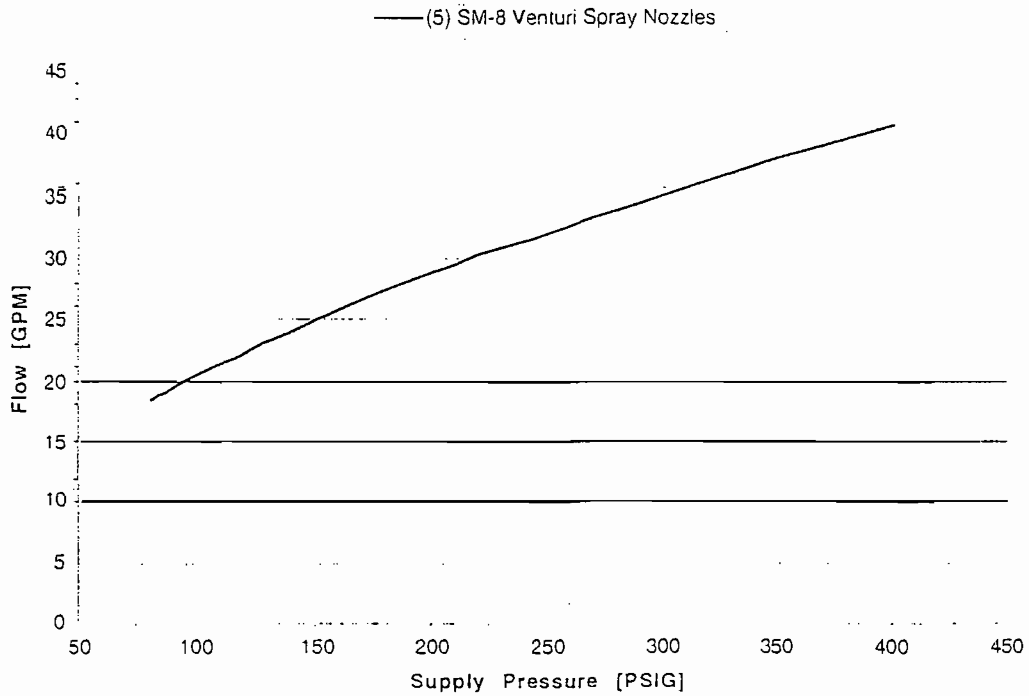


FIGURE 4- HYDROMIST VENTURI ASSEMBLY

Figure 5 shows the water flow curve for the SpiralMist venturi spray nozzles.

FIGURE 5- SM8 FLOW vs PRESSURE



Several inches below the outlet cone assembly a mist deflector arranged to deflect the scrubbed process gases and spray mist. These deflectors are designed to cause the mist from the venturi outlet cones to agglomerate into droplets which fall into the venturi shell bottom and pass to drainage. The deflector plates deflect the fog and captured particulate passing through the venturi cones. Any residual liquid mist is captured in the mist eliminator stage. It is covered in the Venturi Mist Eliminator Stage section.

BOOSTER PUMP SKID

The Booster Pump Skid (shown on drawing C200-6079) contains the high-pressure pump necessary to boost the venturi water supply to the necessary pressure. "Low-Pressure" plant water (40psig) is enters the skid through a dual basket water strainer. The basket strainer's perforated screen basket is sized to remove debris in the feed water that would otherwise clog the venturi spray nozzles. <u>PERIODIC CLEANING OF THE OPERATING BASKET SHOULD BE COMPLETED.</u> Frequency depends on the quality of water supplied to the Booster Pump Skid, but should be performed at least bi-weekly. The water continues through the water piping, or water train, and into a water booster pump. Here the water pressure is increased to 200 psig depending on the inlet water pressure. The now high-pressure water flows through a check valve then an orifice style flow meter. The flow meter includes a local display and a 4-20mA analog signal for customer remote display as desired.

The booster pump skid also includes pressure indicators at the inlet and outlet of the pump. These should be checked periodically to ensure the pump is providing adequate boost to the pressure. To ensure efficient particulate collection at the venturi stage, the pressure at the discharge of the pump should never drop below 210 psig, and the pressure at the venturi water feed lance should never drop below 200 psig. The skid includes one safety feature to ensure the pump does not operate below its minimum required water flow. A pressure regulating valve is installed downstream of the pump. It is field set to provide pressure relief and water flow if the pump should experience a deadhead operating condition.

Gas flow through the venturi stage is measured continuously by measuring differential pressure between venturi inlet and throat. 1/4" FPT tapped ports are included on one venturi assembly and on the side of the tank for this device. Typically pressure drop across the venturi diaphragm is also measured, and 1/4" FPT ports are included on the shell for this connection as well. Any pressure taps that are not being used should be plugged during operation.

<u>Note:</u> The Booster Pump Skid requires no adjustments during normal operation. However, pressure & flow values for all components on the booster pump skid and the rest of the HydroMist VenturiPak™ off-gas scrubbing system should be logged every hour as an operational log. The recommended operating parameters for the entire scrubber system can be found on drawing C100-6079. (Appendix A) See figure 6 below for a diagram of the Booster Pump Skid.

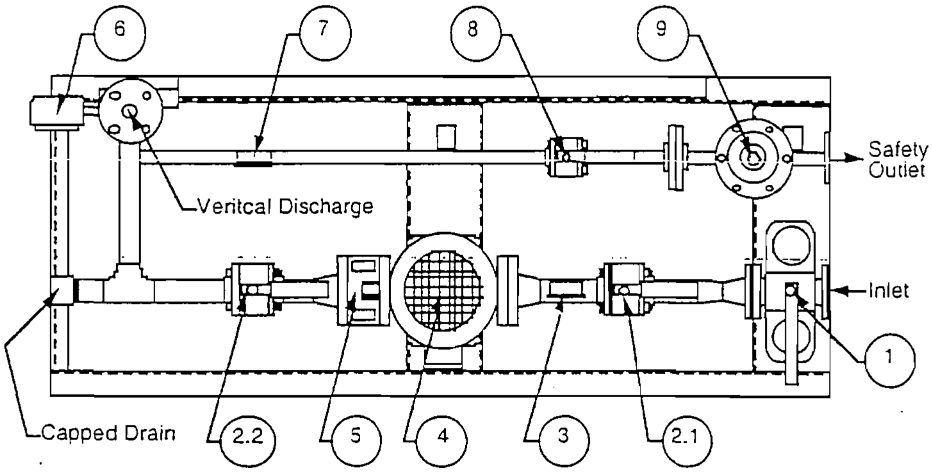


FIGURE 6 - BOOSTER PUMP SKID

Item No.	Description
1	1 1/2" Duplex Basket Strainer
2.1 & 2.2	1 1/4" Ball Valve
3	Pressure Gauge (0-160 psig)
4	Booster Pump (5hp / 480 Volt / 3 Phase / 60 Hz)
5	1 1/4" Check Valve
6	Orifice Flow Meter (0-40gpm local display & 4-20mA output)
7	Pressure Gauge (0-300 psig)
8	3/4" Ball Valve
9	3/4" Back-Pressure Regulating Valve (Safety Valve)

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ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.6 Section 6: Venturi Mist Elimination Stage

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OPERATION AND MAINTENANCE MANUAL

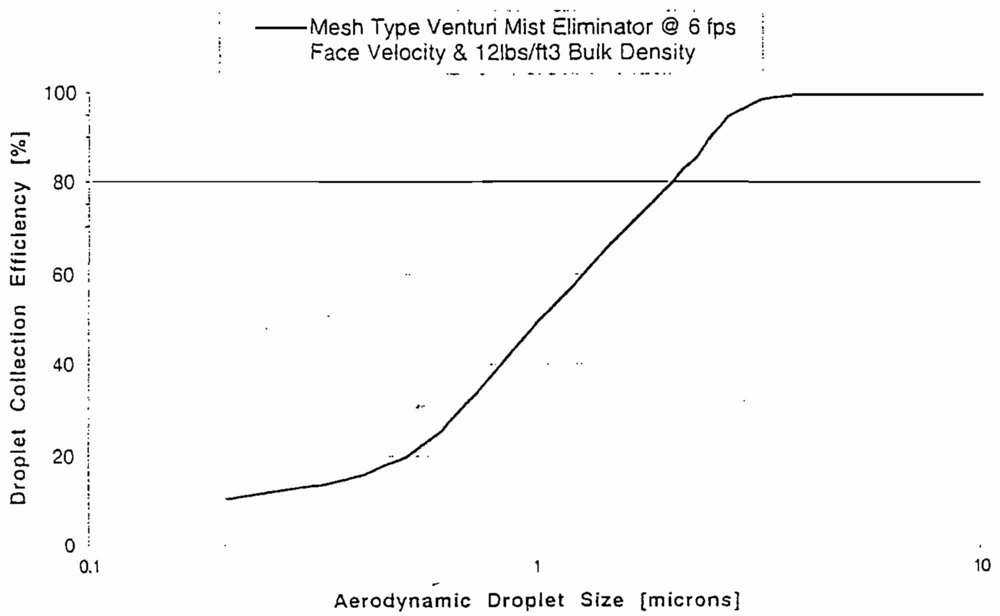
SECTION 6

VENTURI MIST ELIMINATOR STAGE

VENTURI MIST ELIMINATOR STAGE

The Venturi Mist Eliminator is located at the discharge of the venturi shell. This mesh type, 316-SS, single piece mesh pad is of an ultra efficient design for maximum collection of fine entrained droplets from the venturi stage. The mesh type mist eliminator provides excellent fine droplet separation and collection over a wide range of gas flow velocities, typically 40-100% of design. The graduated density mesh allows for superior separation of droplets laden with particulate and drainage preventing plugging of the pad without sacrificing separator efficiency. A typical droplet collection efficiency curve (Figure 7) for this style pad is shown below.

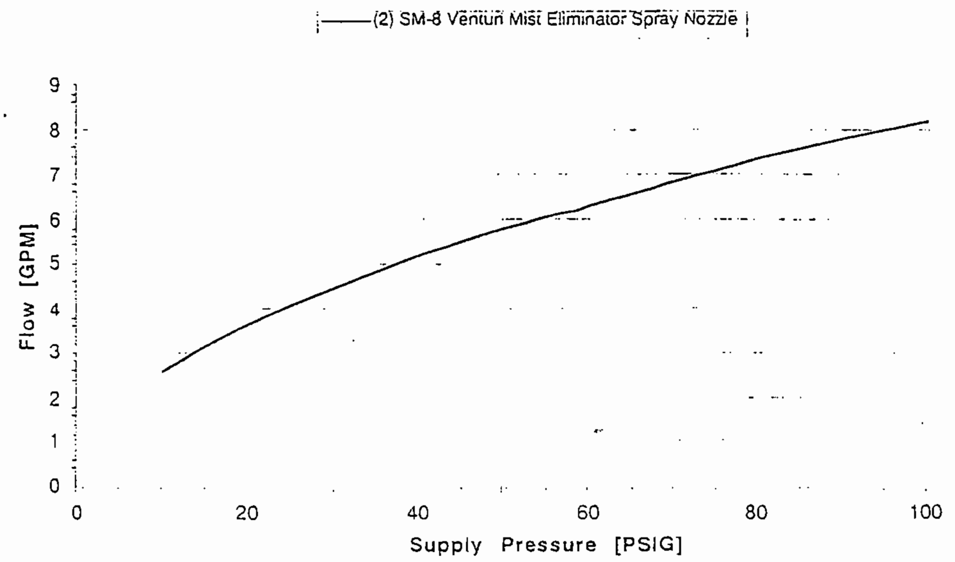
FIGURE 7- MIST ELIMINATOR
COLLECTION EFFICIENCY vs DROPLET SIZE



The Venturi Mist Eliminator is installed in a horizontal duct housing extending from the venturi shell. The housing includes a flange access port centered directly above the mesh housing for ease of maintenance and installation.

One Venturi Mist Eliminator spray lance is included just upstream of the mesh type mist eliminator. The lance includes two- (2) SpiralMist spray nozzles in front of the mist eliminator to provide continuous washing with clean water. Continuous washing prevents particle build up by ensuring proper drainage of captured particulate laden droplets from the mist eliminator mesh under various operating conditions. See drawing C111-6079 (Appendix A) for lance design details. The lance is connected to a "low pressure" potable water supply and should operate at no less than 40 psig. A water flow curve for the lance can be found below. (Figure 8)

FIGURE 8- SM8 FLOW vs PRESSURE



PERIODIC INSPECTION OF THE SPRAY NOZZLE AND MESH MIST ELIMINATOR FOR CLOGGING AND WEAR IS RECOMMENDED.

ANDRITZ

ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.7 Section 7: Start up, Operation, and Servicing

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Andritz Job Number 800-1042

OPERATION AND MAINTENANCE MANUAL

SECTION 7

START-UP, OPERATION, AND SERVICING

START-UP, OPERATION AND SERVICING

Scrubber Start-Up and Operation

The following sequence must be followed at start-up:

1. Verify all valves open as necessary to allow water flow to system.
2. Turn on water flow to the sub-cooler impingement trays.
3. Turn on water flow to the venturi impingement tray.
4. Turn on water flow to the under tray spray lances.
5. Turn on water flow to the condenser mist eliminator spray lance.
6. Turn on water flow to the HydroMist venturi assemblies. Energize the booster pump to elevate venturi feed water pressure.
7. Allow water to flow for 5 minutes to ensure all water boxes and water seals are filled before activating ID fans.
8. Begin process gas flow through scrubber.
9. Energize venturi stage ID fan. (Fan and controls by others.)
10. Turn on water flow to the venturi mist eliminator spray lance.
11. Using drawing C100-6079 from appendix A as a guide, verify that all pressures and water flows are at a minimum as detailed on drawing.
12. Walkthrough system and verify all access doors are sealed completely.
13. System should operate with very minimal changes. Condenser water flow may be varied to keep the recycled air temperature above 125°F but below 130°F.

Scrubber Shutdown

The following sequence must be followed at shutdown:

1. Shut off process gas flow through scrubber.
2. Allow water to run for 10 minutes after ID fans have finished spinning.
3. Turn off venturi feed water booster pump.
4. Turn off supply water to each location.

Inspection

Inspection of the equipment should be made as outlined below to keep operating efficiency at optimum conditions.

1. Pressure gauges should be observed daily for proper operating pressure, compared for accuracy of readings and replaced if necessary.
2. All spray nozzles should be periodically checked for clogging or wear.
3. Line strainers should be blown down daily and cleaned as required.
4. Tray and mist eliminator seals should be checked for clogging or the accumulation of material any time gas flow is shut down.

Trouble Shooting

Most operational problems associated with the HydroMist venturi scrubber stem from improper distribution of water. Many of the problems lead to or show up in the form of impingement tray plugging. Plugging is always the result of another condition or failure and does not begin without some other cause. The following chart outlines the types of problems that can be encountered and how to correct these problems.

Table I. **Plugging** -- *First Impingement Tray*

Lack of Spray Water	Check water pressure. Check for clogged under tray spray nozzles. Check strainer.
Low Plate Water Level	Increase water flow rate.
Improper Water Distribution	Level the impingement trays. Adjust internal weirs for even overflow across width of plate.
Material Adhering to Underside of Tray	Increase under tray spray water flow.

Table II. **Plugging** -- *All Impingement Trays*

Re-circulation of Solids in Water System	Limit the percent of solids in the tray water to 5% by weight. Check for clogged spray nozzles.
Low Plate Water Level	See Table I.
Improper Water Distribution	See Table I.

Table III. **Low Efficiency** -- *Excessive Particulate Emission from Scrubber*

Check items in Table I.	See Table I.
High Air Velocity blows water off trays	Check fan performance and adjust to design volume.
Low Air Velocity	Check fan performance and adjust to design volume.
Verify Sufficient Water Flow &/or Pressure to the HydroMist Venturi Assemblies	Check booster pump operation. Verify sufficient inlet pressure to booster pump skid. Check duplex basket strainer on skid. Check supply piping and strainers for plugging.

Table IV. **Low Gas Flow Volume**

Check items under Tables I. and II.	See Tables I. and II.
Check pressure drop reading across impingement stages.	Install differential pressure gauges for operator observance.
Check fan performance against design data	Adjust as required.
Check duct design system	Remove unnecessary system resistance or adjust fan performance as required.

Table V. **Water Carryover**

Check tray drains for clogging. Clogging prevents normal drain of water, allowing carry-over and re-entrainment in air stream.	Clean out drains for normal flow.
Excessive Air Volume	Check against design data.
Condenser Mist Eliminator Supply Pressure to high	Check pressure regulator setting
Change condenser mist eliminator spray nozzle location from downstream of vane (above) to upstream (below)	Contact EnviroCare for instructions.

Table VI. **Surging** -- *Pulsating airflow, loss of suction*

Water flow too high across trays -- more than drain can accommodate.	Adjust water flow down.
Frozen or plugged venturi stage drain seals.	Provide weep holes or drain to prevent freezing. Clean drains.
By passing tray seals.	Clean out seals of accumulated material.

Table VII. High Pressure Drop Across Impingement Trays (>5" ΔP)

Water Flow too high across plates	Adjust water flow. Adjust water box weirs.
Plugging	See Tables I. and II.
Excessive Air Volume	Measure and adjust.

Table VIII. High Pressure Drop Across Mist Eliminator Pad (>4" ΔP)

Check for material build-up	Clean as required.

Table IX. High Pressure Drop Across Inlet or Outlets

Check sizes of ducts	Modify as required.
Check for restrictions	Modify as required
Be sure readings are accurate and taken properly	Install pressure differential gauges for operator observance.

Table X. Scrubber Drain Connections

Bypassing drain seals or loss of seal	Drains should be sealed or trapped against differential pressure between scrubber and atmosphere as well as between scrubber stages.
Water build-up in bottom cones	Check for clogging, restricting drain connection, or loss of seal.

ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.8 Section 8: Recommended Spare Parts

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OPERATION AND MAINTENANCE MANUAL

SECTION 8

RECOMMENDED SPARE PARTS

RECOMMENDED SPARE PARTS NOTE: **QUANTITIES LISTED ARE FOR EACH UNIT (1 OF 4)**

HydroMist Venturi & Water Feed Lance

Part No.	Size	Qty.	Part Description
B110-6079-3	1 1/2"	1	QUICK CONNECT COUPLING (SOCKET X FPT)
B110-6079-4	1 1/2"	1	QUICK CONNECT COUPLING (PLUG X MPT)
B110-6079-18	1 1/2"X48"	1	HIGH-PRESSURE EXTERIOR FEED HOSE
B110-6079-19	1 1/2"	1	BALL VALVE
B110-6079-21	1 1/2""	1	Y-STRAINER PERFORATED SCREEN INSERT
B110-6079-24	1/4"	1	PRESSURE GAUGE, 0-400 PSIG, 2 1/2" DIAL
B110-6079-29	1/2"X48"	2	HIGH-PRESSURE INTERIOR FEED HOSE
B541-6079-00	4"OD	1	HYDROMIST™ VENTURI ASSEMBLY
B541-6079-2A	1/4"	5	SPIRALMIST-8 VENTURI SPRAY NOZZLE
B541-6079-11		1	VENTURI MOUNTING GASKET (NEOPRENE)

Venturi Mist Eliminator Spray Lance

Part No.	Size	Qty.	Part Description
B111-6079-2	1/4"	2	SPIRALMIST-8 VENTURI M.E. SPRAY NOZZLE
B111-6079-4	3/4"	1	QUICK CONNECT COUPLING (MPT X F-CAM)
B111-6079-5		1	LANCE MOUNTING GASKET (NEOPRENE)
B111-6079-12	1/4"	1	PRESSURE GAUGE, 0-100 PSIG, 2 1/2" DIAL
B111-6079-14	3/4"X48"	1	FLEX HOSE
B111-6079-15	3/4"	1	QUICK CONNECT COUPLING (FPT X M-CAM)
B111-6079-16	3/4"	1	BALL VALVE

Under Tray Spray Lance

Part No.	Size	Qty.	Part Description
B112-6079-2	3/8"	4	SPIRALMIST-20 UNDER TRAY SPRAY NOZZLE
B112-6079-4	1"	1	QUICK CONNECT COUPLING (MPT X F-CAM)
B112-6079-5		2	LANCE MOUNTING GASKET (NEOPRENE)
B112-6079-12	1/4"	2	PRESSURE GAUGE, 0-100PSIG, 2-1/2" DIAL
B112-6079-14	1"X48"	2	FLEX HOSE
B112-6079-15	1"	1	QUICK CONNECT COUPLING (FPT X M-CAM)
B112-6079-16	1"	2	BALL VALVE

Condenser Mist Eliminator Spray Lance

Part No.	Size	Qty.	Part Description
B114-6079-2	1/2"	1	RAINDROP-5 CONDENSER M.E. SPRAY NOZZLE
B114-6079-4	3/4"	1	QUICK CONNECT COUPLING (MPT X F-CAM)
B114-6079-5		1	LANCE MOUNTING GASKET (NEOPRENE)
B114-6079-12	1/4"	1	PRESSURE GAUGE, 0-60PSIG, 2-1/2" DIAL
B114-6079-14	3/4"X48"	1	FLEX HOSE
B114-6079-15	3/4"	1	QUICK CONNECT COUPLING (FPT X M-CAM)
B114-6079-16	3/4"	1	BALL VALVE
B114-6079-17	3/4"	1	HIGH-PRESSURE REGULATING VALVE, 2-10 PSIG

Booster Pump Skid

Part No.	Size	Qty.	Part Description
B200-6079-1	1 1/2"	2	STRAINER BASKETS, STAINLESS STEEL
B200-6079-2		1	VERTICAL PUMP REPAIR KIT
B200-6079-3	1 1/4"	1	SPRING LOADED CHECK VALVE
B200-6079-4	3/4"	1	BACK PRESSURE RELIEF VALVE REPAIR KIT
B200-6079-5	3/4"	1	FULL PORT BALL VALVE REPAIR KIT
B200-6079-6	1 1/4"	2	FULL PORT BALL VALVE REPAIR KIT
B200-6079-7	1"	1	ORIFICE FLOW METER
B200-6079-8	1/4"	2	PRESSURE GAUGE, 0-160 PSIG, 2 1/2" DIAL
B200-6079-9	1/4"	2	PRESSURE GAUGE, 0-300 PSIG, 2 1/2" DIAL

Miscellaneous Items

Part No.	Size	Qty.	Part Description
B590-6079-00	37"x81"	2	ECS SUB-COOLER IMPINGEMENT TRAY
B590-6079-0	30"x50"	1	ECS VENTURI IMPINGEMENT TRAY
B530-6079-1	72" x 72"	1	CONDENSER MIST ELIMINATOR
B543-6079-1	60"x48"	1	VENTURI STAGE MIST ELIMINATOR

ANDRITZ

ENVIRONMENT AND PROCESS TECHNOLOGIES

501.001.9 Section 9: Appendix A – Envirocare Customer Drawings

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OPERATION AND MAINTENANCE MANUAL

SECTION 9

APPENDIX A

ENVIROCARE CUSTOMER DRAWINGS

ENVIROCARE CUSTOMER DRAWINGS
(11" x 17" reduced copies)

Process & Instrumentation Drawing	C100-6079
Venturi Water Feed Lance	C110-6079
Venturi Stage Mist Eliminator Spray Lance	C111-6079
SpiralMist under Tray Spray Lances	C112-6079
Condenser Mist Eliminator Spray Lance	C114-6079
Booster Pump Skid – General Arrangement	C200-6079
HydroMist VenturiPak™ General Arrangement	C500-6079
HydroMist VenturiPak™ General Arrangement (Mirror)	C501-6079
Flange and Anchoring Details	C505-6079

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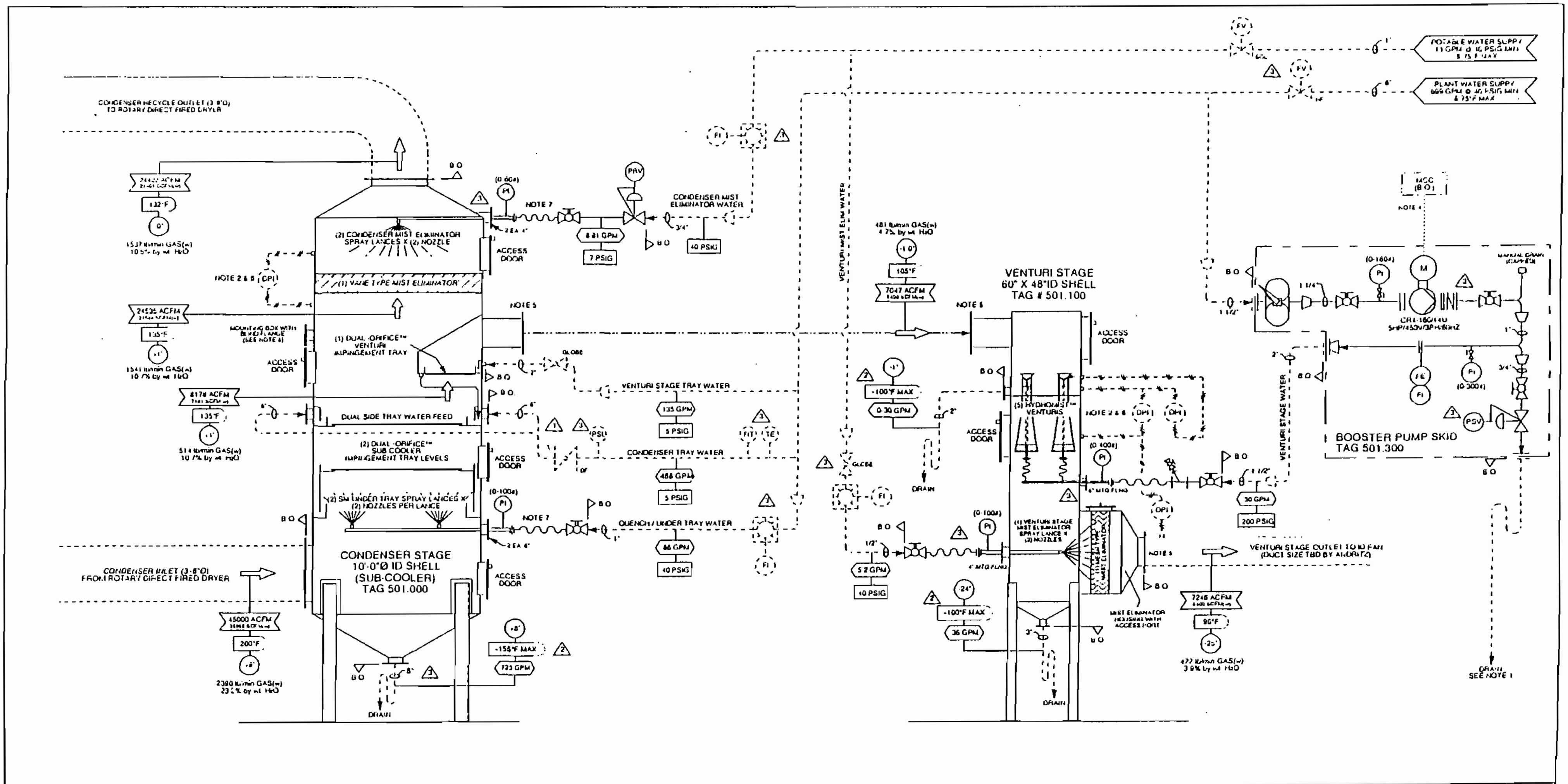

STREAM DATA:

- MASS FLOW #/HR
- WATER FLOW GPM
- GAS FLOW, ACFM
- TEMP, F
- PRESSURE, PSIG
- PRESSURE, "WC
- PLANT SUPPLY INFO
- GAS FLOW DIRECTION

LEGEND:

- PROCESS DEVICE
- BALL VALVE, FULL PORT S/S BALL, TFE SEAT
- FLEXIBLE HOSE, S/S, W/ QUICK CONNECT ENDS
- DUPLEX FILTER
- FLANGE
- PIPE REDUCER
- CHECK VALVE
- CENTRIFUGAL MOTORIZED PUMP HIGH PRESSURE, MULTIPLE STAGE
- PRESSURE REGULATING VALVE
- MIST ELIMINATOR (MESH, VANE)
- PSL - PRESSURE SWITCH LOW
- PSV - PRESSURE SAFETY VALVE
- PRV - PRESSURE REGULATING VALVE
- FT - FLOW TRANSMITTER
- FI - FLOW INDICATOR
- PT - PRESSURE TRANSMITTER
- PI - PRESSURE INDICATOR
- PAL - PRESSURE ALARM LOW
- B O - BY OTHERS
- PROCESS FLOW / PIPING
- WORK BY OTHERS
- PNEUMATIC SIGNAL LINE
- ELECTRICAL SIGNAL

NOTES:

1. IF RELIEF LINE PIPED BACK TO PUMP SUCTION THEN PROVIDE A MINIMUM OF 50 FEET OF PIPE RUN FOR WATER COOLING
2. 1/4"OD 316 SS DIFFERENTIAL PRESSURE GAUGE TUBING SUPPLIED AND INSTALLED BY OTHERS
3. PRV SETTING TO BE FINALIZED AT START-UP
4. PUMP MOTOR STARTERS TO BE SUPPLIED BY CLIENT. CUSTOMER TO SUPPLY 480VAC/3PH/60HZ POWER TO MCC'S
5. GASKETING & 316 SS MOUNTING HARDWARE SUPPLIED BY ENVIROCARE
6. ALL DP INSTUMENTATION BY OTHERS
7. TYPICAL FLEXIBLE HOSING / VALVING ASSEMBLY FOR EACH LANCE
8. MOUNTING BOX FOR FUTURE USE. SHOULD SPRAY FROM ABOVE VANE MIST ELIMINATOR CAUSE EXCESSIVE WATER CARRY-OVER, THE UPPER SPRAY LANCE CAN BE REPLACED WITH A SPRAY FROM BELOW UTILIZING THIS MOUNTING BOX
9. PUMP SIZING BASED ON 40PSIG INLET PRESSURE TO THE BOOSTER PUMP SKID. PLEASE ADVISE IMMEDIATELY IF THIS PRESSURE IS NOT AVAILABLE

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3	CUSTOMER REVIEW COMMENTS RELEASED FOR FABRICATION	MJF	DCM	12 18 00
2	CUSTOMER REVIEW COMMENTS DRAIN TEMP MAX & DRAIN PIPE SIZE	MJF	DCM	10 27 00
1	DUAL SIDE TRAY WATER FEED	MJF	DCM	10 [illegible]

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PROCESS & INSTRUMENTATION DIAGRAM

ANDRITZ-RUTHNER, INC.

MJF	9 26 00	
JJS / MJF	9 26 00	
DCM	9 26 00	6079
NONE		C100 6079

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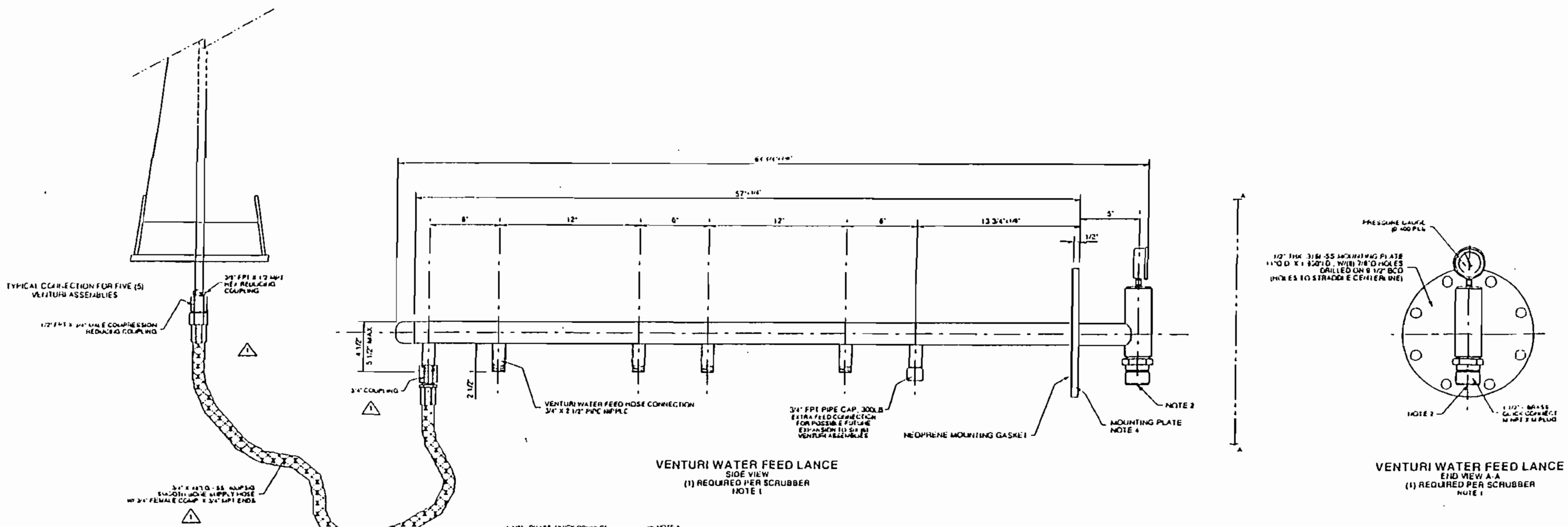

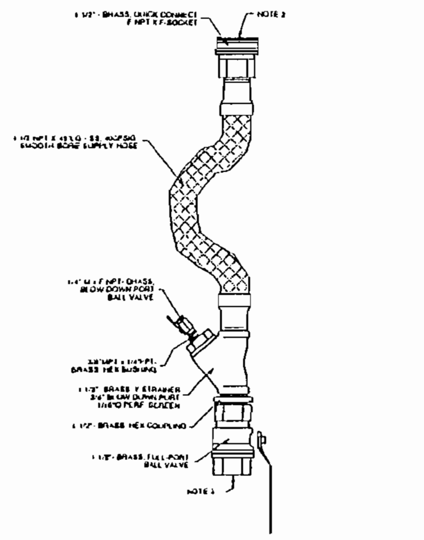

NOTES:

1. ONE (1) VENTURI WATER FEED LANCE REQUIRED PER SCRUBBER SYSTEM. WEIGHT – 80 LBS EACH. FOUR (4) TOTAL REQUIRED
2. WATER FLEX HOSE ASSEMBLY CONNECTION
3. CUSTOMER SUPPLY LINE CONNECTION. LOCATE CONNECTION POINT NO MORE THAN 30" FROM LANCE INLET TO ENSURE FLEX HOSE WILL REACH FROM CONNECTION POINT TO LANCE WITHOUT EXCESSIVE STRESS
4. MOUNT TO NOZZLE ◇L

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2				
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VENTURI WATER FEED LANCE

MJF	10 16 00	ANDRITZ-RUTHNER, INC.
MJF	10 16 00	
DCM	10 25 00	6079
3" = 1'	C110 6079	1 1

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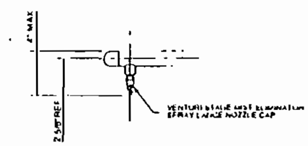
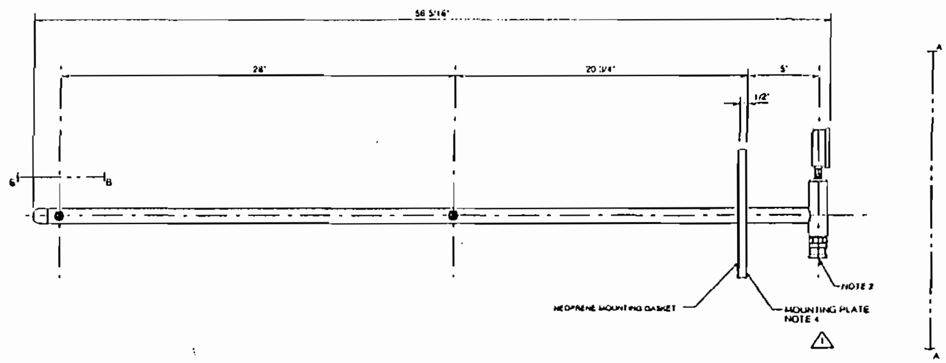
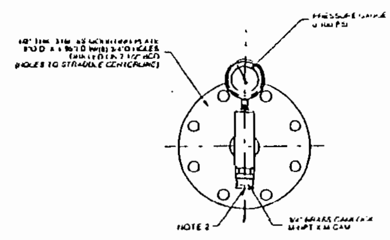


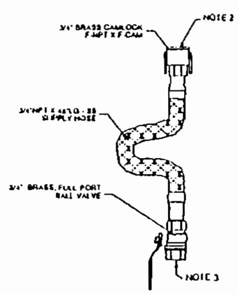
VENTURI STAGE MIST ELIMINATOR SPRAY LANCE
PLAN VIEW B-B
NOTE 1



VENTURI STAGE MIST ELIMINATOR SPRAY LANCE
SIDE VIEW
(1) REQUIRED PER SCRUBBER
NOTE 1



VENTURI STAGE MIST ELIMINATOR SPRAY LANCE
END VIEW A-A
(1) REQUIRED PER SCRUBBER
NOTE 1



WATER FLEX HOSE ASSEMBLY
(1) REQUIRED PER LANCE

NOTES:

1. ONE (1) VENTURI STAGE MIST ELIMINATOR SPRAY LANCE REQUIRED PER SCRUBBER. WEIGHT - 86 LBS EACH
2. WATER FLEX HOSE ASSEMBLY CONNECTION
3. CUSTOMER SUPPLY LINE CONNECTION. LOCATE SUPPLY LINE CONNECTION NO MORE THAN 35" FROM LANCE INLET TO ENSURE FLEX HOSE WILL REACH FROM SUPPLY TO LANCE WITHOUT EXCESSIVE STRESS
4. MOUNT TO NOZZLE ◇M

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2				
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VENTURI STAGE MIST ELIMINATOR SPRAY LANCE

ANDRITZ-RUTHNER, INC.

MJF	10 17 00	
JJS	10 17 00	
DCM	10 19 00	5379
3" = 1'		C111 6079

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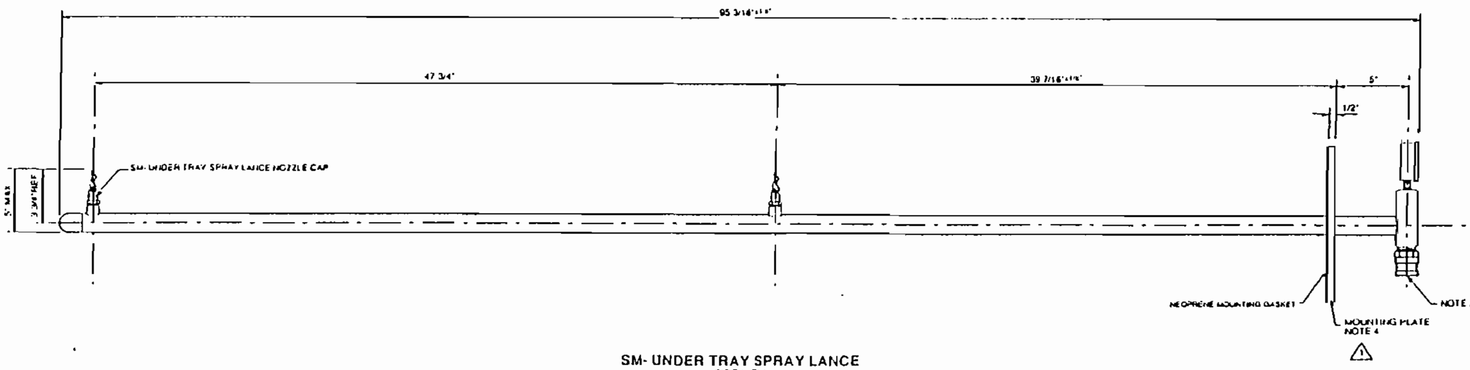
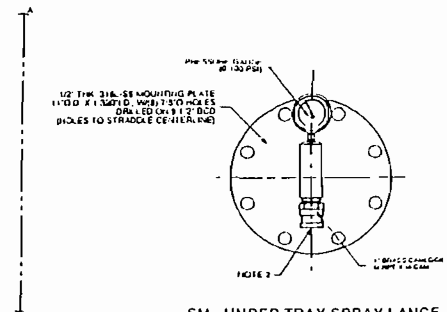
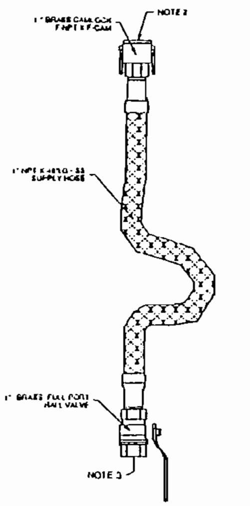


SM- UNDER TRAY SPRAY LANCE
SIDE VIEW
(2) REQUIRED PER SCRUBBER
NOTE 1



SM- UNDER TRAY SPRAY LANCE
END VIEW A-A
(2) REQUIRED PER SCRUBBER



WATER FLEX HOSE ASSEMBLY
(1) REQUIRED PER LANCE

NOTES:

1. TWO (2) SM- UNDER TRAY SPRAY LANCES REQUIRED PER SCRUBBER SYSTEM. WEIGHT - 70 LBS EACH
2. WATER FLEX HOSE ASSEMBLY CONNECTION
3. CUSTOMER SUPPLY LINE CONNECTION. LOCATE CONNECTION POINT NO MORE THAN 30" FROM LANCE INLET TO ENSURE FLEX HOSE WILL REACH FROM CONNECTION POINT TO LANCE WITHOUT EXCESSIVE STRESS
4. MOUNT TO NOZZLES C1 AND C2

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3				
2				
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SpiralMist™ UNDER TRAY SPRAY LANCES

ANDRITZ-RUTHNER, INC.

MJF	10 09 00		
MJF	10 09 00		
DCM	10 19 00	6079	
3" = 1'		C112 6079	1 1

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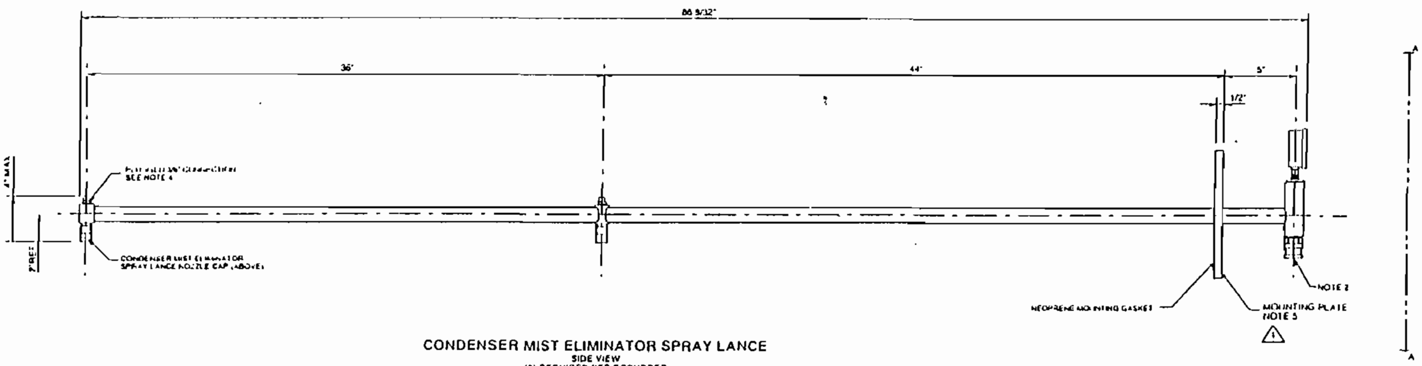
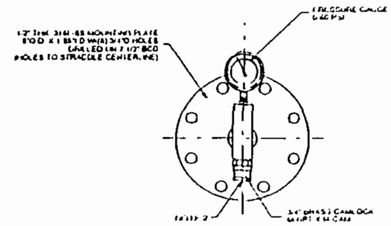
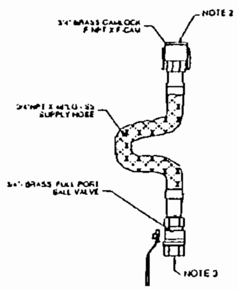


CONDENSER MIST ELIMINATOR SPRAY LANCE
SIDE VIEW
(2) REQUIRED PER SCRUBBER
NOTE 1



CONDENSER MIST ELIMINATOR SPRAY LANCE
END VIEW A-A
(2) REQUIRED PER SCRUBBER
NOTE 1



WATER FLEX HOSE ASSEMBLY
(1) REQUIRED PER LANCE

NOTES:

1. TWO (2) CONDENSER MIST ELIMINATOR SPRAY LANCES REQUIRED PER SCRUBBER. WEIGHT - 60 LBS EACH
2. WATER FLEX HOSE ASSEMBLY CONNECTION
3. PRESSURE REGULATING VALVE CONNECTION. CUSTOMER SUPPLY LINE SHOULD BE CONNECTED TO PRESSURE REGULATING VALVE. LOCATE PRESSURE REGULATING VALVE NO MORE THAN 30" FROM LANCE INLET TO ENSURE FLEX HOSE WILL REACH FROM PRV OUTLET TO LANCE WITHOUT EXCESSIVE STRETCH
4. SHOULD SPRAY FROM ... MIST ELIMINATOR CAUSE EXCESSIVE WATER CARRY OVER, THE UPPER SPRAY LANCE(S) CAN BE MOVED TO THE MOUNTING BOXES BELOW THE MIST ELIMINATOR. SHOULD THIS BECOME NECESSARY DIFFERENT SPRAY NOZZLES MUST BE INSTALLED IN THE 3/8" CONNECTION AND THE 1/2" CONNECTION MUST BE PLUGGED
5. MOUNT TO NOZZLE 11 AND 12

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3				
2				
1	CUSTOMER REVIEW COMMENTS RELEASED FOR FABRICATION	MJF	DCM	12 18 00

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CONDENSER MIST ELIMINATOR SPRAY LANCE

MJF	10 13 00	ANDRITZ-RUTHNER, INC.
JJS	10 10 00	
DCM	10 19 00	6079
3" = 1'		C111 6079

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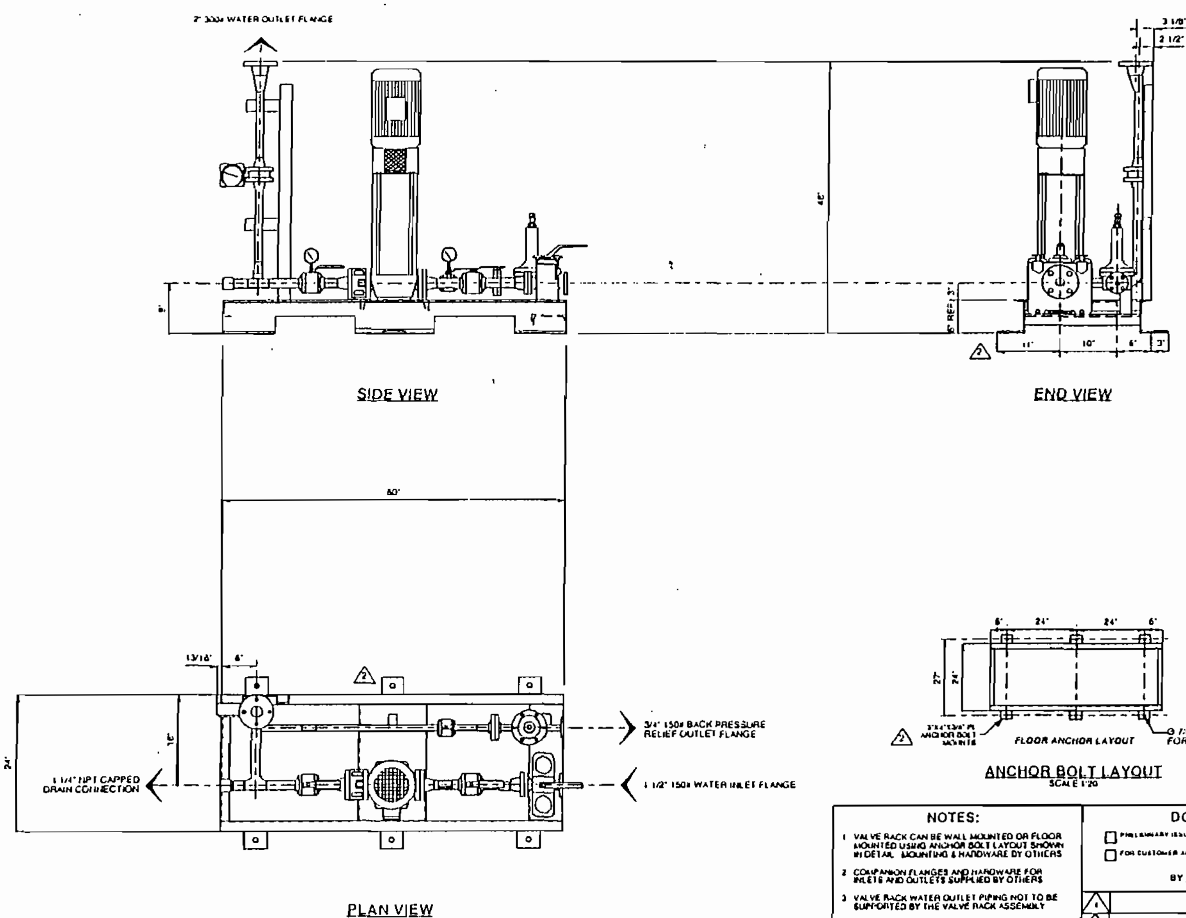

NOTES:

1. VALVE RACK CAN BE WALL MOUNTED OR FLOOR MOUNTED USING ANCHOR BOLT LAYOUT SHOWN IN DETAIL. MOUNTING & HARDWARE BY OTHERS
2. COMPANION FLANGES AND HARDWARE FOR INLETS AND OUTLETS SUPPLIED BY OTHERS
3. VALVE RACK WATER OUTLET PIPING NOT TO BE SUPPORTED BY THE VALVE RACK ASSEMBLY
4. APPROXIMATE WEIGHT 800 LBS
5. IF THE RELIEF LINE IS PIPED BACK TO THE PUMP SUCTION THEN PROVIDE A MINIMUM OF 50 FEET OF PIPE RUN FOR WATER COOLING
6. TYPICAL LAYOUT FOR ONE OF FOUR PUMP SETS
7. TAG EQUIPMENT 501 300 1
   501 300 [illegible]
   501 300 3
   501 300 4

DOCUMENT RELEASE

☐ PRELIMINARY ISSUE ☐ CERTIFIED FOR CONSTRUCTION
☐ FOR CUSTOMER APPROVAL ☐ AS BUILT

BY ________ DATE ________

SYM	REVISION	BY	CHKD APP	DATE
4				
3				
2	CUSTOMER REVIEW/COMMENTS RELEASED FOR FABRICATION	MJF	DCM	[illegible]
1	REVISED FACE TO FACE FOR BASKET STRAINER	MJF	DCM	11 30 00

[illegible]

EnviroCare Systems
27 M Commercial Blvd Novato CA 94949
Tel 415/883 3555 Fax 415/883 2855
email envirocare@envirocare.com

VALVE RACK GENERAL ARRANGEMENT

MAS	10 10 00	ANDRITZ-RUTHNER, INC.
RAY	10 10 00	
DCM	10 19 00	6079
1:10		C200-6079

SHEET 1 OF 1 REV 2

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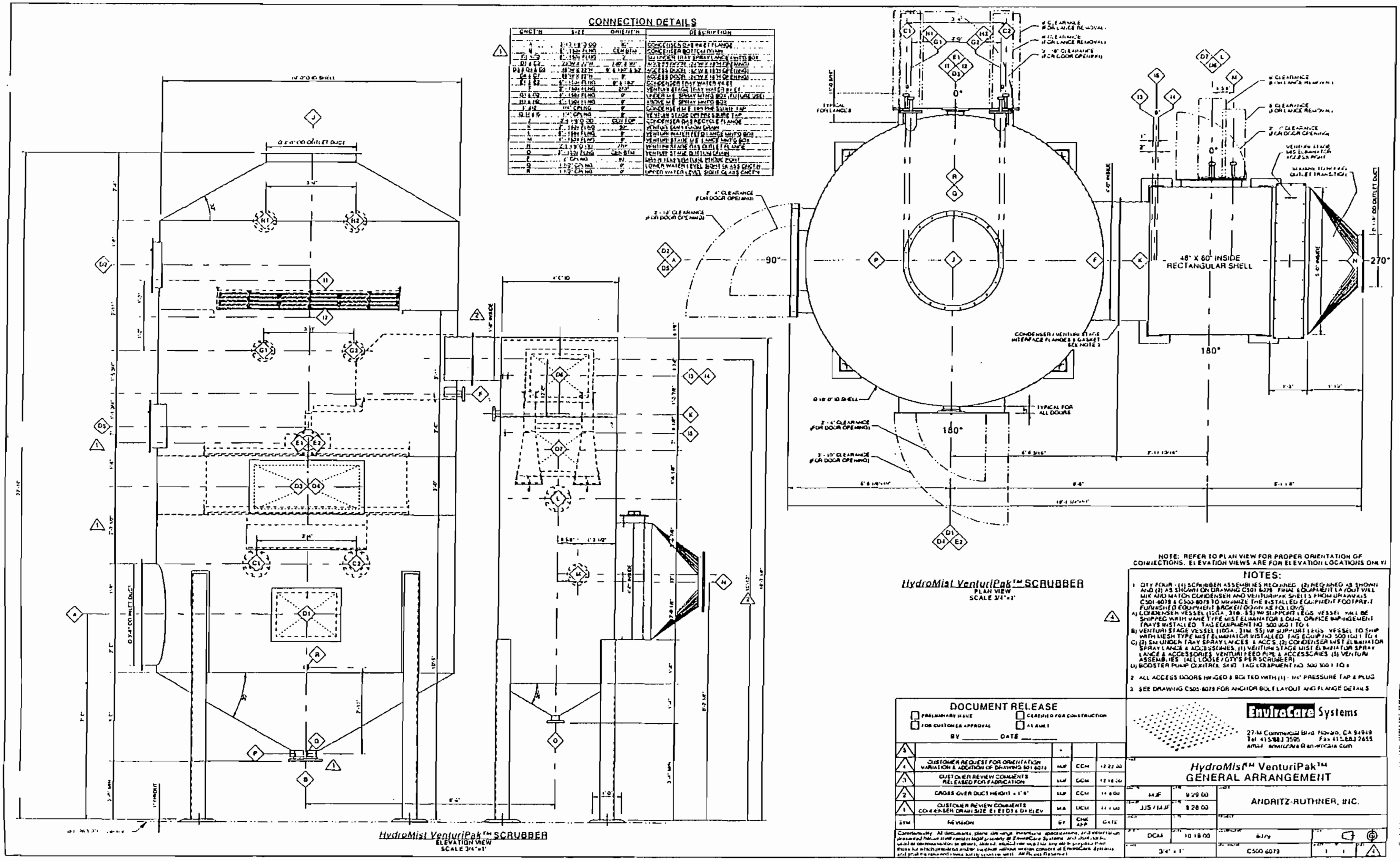

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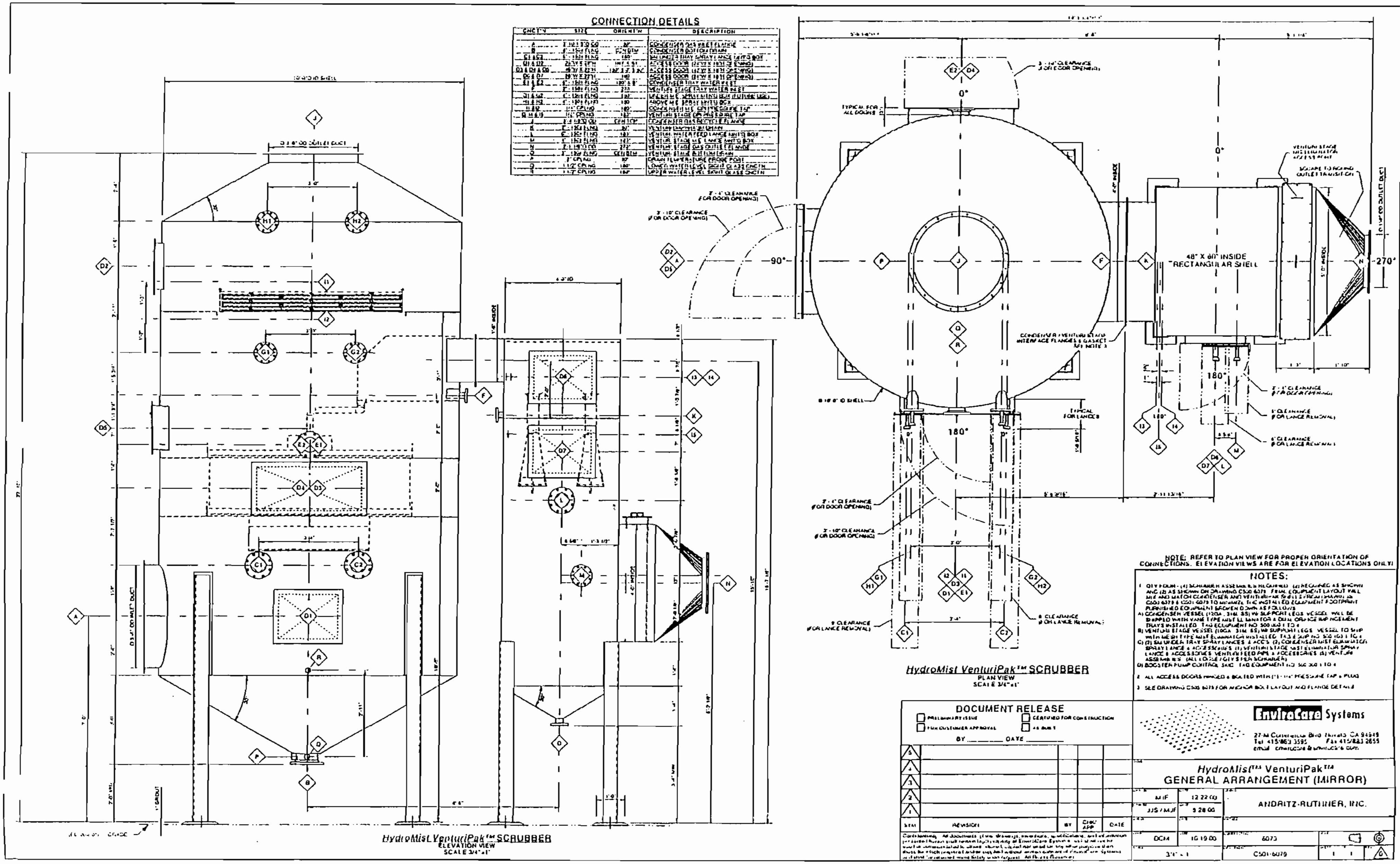

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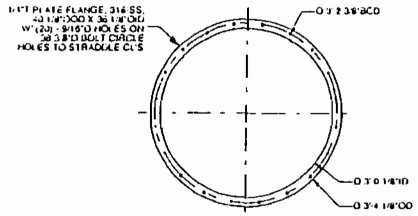
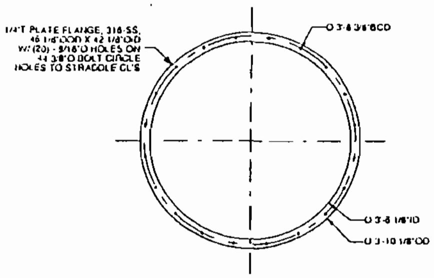
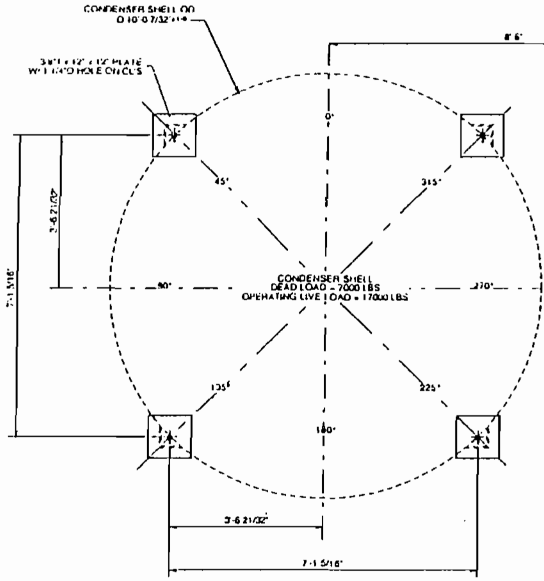


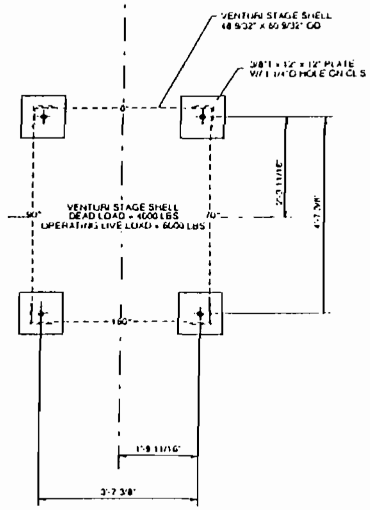
CONDENSER GAS RECYCLE OUTLET FLANGE DETAIL
SCALE 1"=1'



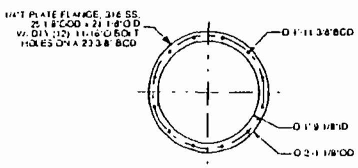
CONDENSER GAS INLET FLANGE DETAIL
SCALE 1"=1'



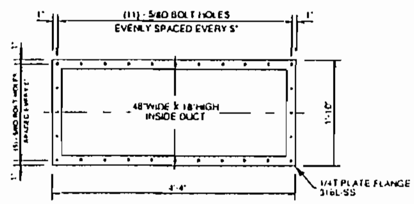
CONDENSER ANCHOR BOLT LAYOUT
SCALE 3/4"=1'



VENTURI STAGE ANCHOR BOLT LAYOUT
SCALE 3/4"=1'



VENTURI STAGE GAS OUTLET FLANGE DETAIL
SCALE 1"=1'



CONDENSER / VENTURI STAGE INTERFACE FLANGE DETAIL
SCALE 1"=1'

NOTES:

1. QTY FOUR (4) SCRUBBER ASSEMBLIES REQUIRED
2. FLANGE AND ANCHOR BOLT DETAILS ARE TYPICAL FOR ALL FOUR UNITS
3. SEE GENERAL ARRANGEMENT DRAWING C503 6078 FOR ORIENTATION DETAILS
4. NOTE THAT THE OPERATING LIVE LOAD NOTED ON THE DRAWING IS REPRESENTATIVE OF TYPICAL OPERATING CONDITIONS. SHOULD THE SHELLS BECOME COMPLETELY FLOODED WITH WATER THEY COULD HAVE THE FOLLOWING LIVE LOAD:
   CONDENSER SHELL = 110,000 LBS
   VENTURI STAGE SHELL = 21,000 LBS

DOCUMENT RELEASE

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☐ FOR CUSTOMER APPROVAL ☐ AS BUILT

BY ________ DATE ________

STAT	REVISION	BY	CHK/APP	DATE
5				
4				
3				
2				
1	CUSTOMER REVIEW COMMENTS RELEASED FOR FABRICATION	MJF	DCM	12/18/00

EnviroCare Systems
27 M Commercial Blvd. Novato, CA 94949
Tel 415/883-3595 Fax 415/883-2655
email enviroCare@envirocare.com

HydroMist™ VenturiPak™
FLANGE & ANCHORING DETAILS

MJF	9 29 00	ANDRITZ-RUTHNER, INC.	
JJS / MJF	9 28 00		
DCM	10 19 00	6078	
3/4" = 1'		C505 6079	1

Operation and Maintenance Manual for Regenerative Thermal Oxidation System

ABATEMENT SYSTEMS, INC.

Proposal For A

Regenerative Thermal Oxidation System

Andritz-Ruthner, Inc.

Prepared By:

CECO Abatement Systems, Inc.

4444 Lee Avenue

Downers Grove, IL 60515

630.724.0960Phone

630.968.7337 Fax

A CECO ENVIRONMENTAL COMPANY

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SCOPE OF SUPPLY AND EQUIPMENTDESCRIPTION

OXIDATION EQUIPMENT DESCRIPTION

CECO Abatement Systems proposes to furnish one (1) turnkey, Regenerative Thermal Oxidation (RTO) system . This system is designed to achieve 98% VOC destruction efficiency. This type of system has the unique ability to maintain 95% thermal efficiency while operating up to 1800 °F in the combustion chamber.

Following is a brief description of the equipment to be provided. All dimensions and design parameters are preliminary and are subject to final engineering. The proposed design is based on the CECO Abatements Systems present understanding of the process. The design basis is subject to confirmation by the buyer. As always, portions of the design are subject to change until final engineering is completed. A Process Flow Diagram (PFD) showing the flow scheme and the mass and energy balance is located in the Technical Data Section of the proposal. CECO Abatement Systems requests that you carefully review this data to insure that the basis for design is correct. Also located in the Technical Data section are the equipment specification sheets, which further detail, the scope of supply. The proposal includes skid mounting the oxidizer on a frame. By doing this, we can then mount all of the mechanical devices, piping , and electrical devices in the shop. We would then ship to the skid(s) to the jobsite for installation. In addition, we offer an installation price for the skid mounted system. In this way, we feel that Andritz's and the enduser's exposure on cost and quality are minimized.

The following is a brief summary of the proposed oxidizer system. The system that CECO Abatement Systems proposes consists of an induced draft fan and a three (3) chambered RTO. The process gases are received from the collection system tie point (assumed to be at the inlet manifold of the RTO). This gas passes through the process isolation valve before entering the inlet manifold of the RTO. Upon entering the inlet manifold, the gas passes up one heat recovery chamber (pre-heating mode), enters the combustion chamber where the VOC's are destroyed and then passes down another heat recovery chamber (heat recovery mode), and exits up the stack. The third chamber in this three (3)-chamber system is being purged of process gases in preparation to begin the pre-heating mode. Every two to three minutes the chambers are alternated from the pre-heating, purging and heat recovery modes.

Typical of combustion equipment, the oxidizer will be interlocked to provide a minimum of four (4) air changes before the burner will begin the ignition sequence during the startup of the system. To accommodate this, an isolation damper upstream of the RTO will close, separating the process from the RTO. A fresh air purge damper downstream of the isolation damper will open allowing the process gas fan to pull fresh air into the oxidizer to purge it before the burners attempt the ignition sequence. After the ignition sequence, the oxidizer will come to temperature within about four hours. Once the oxidizer reaches the temperature set point (typically 1500 deg F), the inlet isolation damper will open and the purge damper will close. At this point, the oxidizer is fully operational.

In addition to this typical mode of operation, CECO Abatement Systems has provided a gas injection system. This system is used to artificially enhance the process gas streams heating value once the system is online. The heat content of the gas stream will be increased to approximately 2.5% of the LFL (lower flammability limt).

CECO Abatement Systems will be pleased to modify the proposed system to incorporate any special design features that the purchaser may request.

Recovery Chambers

Recovery chamber flanges will be continuously welded for airtight construction. Each recovery chamber will be internally insulated with modular, soft ceramic fiber insulation down to the support grid area. Below the support grid, the units internals will be stainless steel to prevent "wicking" of moisture from the process gas stream. It has been our experience that this phenomena is partly responsible for odor issues and corrosion at other facilities All recovery chambers will include a recovery bed support grid fabricated from Type 304 stainless steel. The recovery chambers have been quoted as being manufactured from 1/4-inch A36 carbon steel. Because of the size of the manifolds, we have opted to place the access door below the support grid in each chamber.

Recovery Media

CECO Abatement Systems offers both traditional random saddle packing and structured "honeycomb" monolith blocks as the ceramic heat recovery media used in the regenerative heat exchanger of the RTO. Both elements are chemically and thermally stable for the typical heat-up and cool down cycles that RTO's are subjected to.

Systems that utilize monolith media have more favorable pressure drop and thermal recovery characteristics, resulting in reduced operating costs, but are more sensitive to thermal shock.

CECO Abatement Systems has had excellent success with both types of media in this application. With respect to this application, CECO Abatement Systems has chosen to use 25 x 25 cell monolithic heat exchange media because of its ability to be cleaned and its high heat exchange rate. Refer to the Equipment Specification Sheets located in the Technical Section of this proposal for information on the media included with the system.

Combustion Chamber

The combustion chamber is comprised of a single section, which is fastened to the recovery chambers. The chamber will be designed to accommodate the maximum internal pressure, which can be generated by the fan. If this cannot be accommodated economically, the system will be designed for the maximum possible operating pressure and the system will have appropriate pressure relief venting. Each combustion chamber section is insulated with soft ceramic fiber insulation designed to minimize heat loss as described in the next section. In addition, necessary burner mounting flanges and sight ports are provided to accommodate the burners provided.

Internal Insulation

The internal walls of the oxidizer are lined with soft, ceramic fiber insulation. This insulation is capable of operating at 2400 °F without being damaged. In this system, the amount of material used is dictated by the desired exterior temperature for the vessels (typically 80 °F above ambient); please see the Equipment Specification Sheet for details on the thickness used for this system. The mounting hardware is typically stainless steel.

Inlet Manifold & Outlet Manifolds

All manifolding and sheet metal fabrications are designed per the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Standards.

Exhaust Stack

The exhaust stack will be designed by a licensed structural engineer and will accommodate local requirements. The stack will include two sampling ports to accommodate sampling and performance testing. These ports will be in accordance with recommended practice of the EPA.

Diverter Valves

Butterfly type diverter valves as manufactured by Precision Engineered Products (or Equal) are being supplied for this project.

Refer to the Equipment Specification Sheets for specifics concerning these valves.

Oxidizer Fan, Motor, and Variable Frequency Drive

The RTO will require one exhaust fan to move the desired process gas flow through the system. The fan for this system is designed to be induced draft (upstream of the

RTO). The fan is sized to accommodate the pressure drop across the RTO with a negative 1-inWC inlet pressure.

The motor for this fan will be designed to accommodate the necessary power to move the air and will be controlled by a Variable Frequency Drive (V.F.D.). The VFD is used for process flow turndown and is controlled based upon the input from a pressure transmitter located upstream of the RTO fan.

The design basis for the fan/motor/vfd can be found in Equipment Specification Sheets.

Burners and Fuel Trains

The burner(s) provided will be designed to accommodate the heat load necessary to operate the system on a VOC free basis. In this way, the RTO can maintain temperature even when the VOC load has been minimized.

The burner(s) will include a factory assembled, IRI approved gas train, with all required safety features. The fuel to air ratio will be maintained using a mechanically linked position system which will provide "on-ratio" turndown of 16:1 (overall turndown is approximately 50:1).

Standard Control System

A control cabinet will be provided for mounting indoors near the RTO. The cabinet will have 10% open space for future mounting of control equipment and motor controls. The cabinet will be supplied completely pre-wired. As combustion controls and safeties will be hard wired. All wire will be stranded copper with 600-volt insulation type MTW. Minimum size wire will be #16 AWG for control functions and #12 AWG for power functions.

The sub panel will contain a Programmable Logic Controller (PLC), one (1) 7800 Series Honeywell digital flame safeguard flame relay per burner, an inlet pressure transducer for control of the VFD(s), a magnehelic gage, and all necessary relays, terminal strips and fuses to operate the RTO. The panel can be expanded to accommodate additional functions in the future.

The functions for the systems are accessible via Man Machine Interface (MMI). The interface will consist of graphic images that depict the operation of the RTO.

The operator interface also offers access to all P.I.D. analog loop control parameters. The PLC/operator interface will be responsible for handling the following process loops:

1. Maintaining temperature control for each burner.

2. Controlling the inlet ductwork pressure.
3. Controlling the Gas Injection output (if included).

A microprocessor based Circular Chart Recorder will provide digital indication and continuous printouts of combustion chamber, inlet, and outlet temperature, which can be used for regulatory purposes.

A modem can be included in the control panel for service diagnostics. The modem allows CECO Abatement Systems personnel to monitor and troubleshoot the operation of the RTO remotely.

GAS Injection

CECO Abatement Systems has provided a gas injection system, which offers some operational advantages (i.e. lower gas consumption) but with added risk. The gas consumption using Gas Injection will be as much as 10% less than when operating on burners but because gas is being injected into the inlet manifold, risks of deflagration are increased.

Painting

All mild steel shall receive an SP - 3 finish and will be coated with an industrial epoxy grade painting system.

INSTALLATION DESCRIPTION

CECO Abatement Systems has provided an installation price for the skid mounted option. We have attempted to account for all of the necessary work to get the system installed but the buyer should review the installation scope to insure that all necessary items such as site work, gas piping and electrical power are accounted for.

The mechanical installation of a RTO typically should consist of the following items:

- Unloading and setting the heat recovery chambers/skid on the concrete pad or platform.

- Filling the heat recovery chambers with ceramic recovery media.

- Unloading, setting and fastening the combustion chamber sections.

- Unloading, setting, and fastening the manifolding to the heat recovery chambers.

- Unloading and setting of the RTO process gas fan.

- Unloading, setting, fastening the adjacent ductwork to the RTO fan.
- Assembling the valve actuation system.
- Installation of the burners and associated gas train components.
- Unloading and installation of the exhaust stack.
- Finish/touch-up painting as required after installation is complete.

The electrical installation consists of the following items:

- Setting the control cabinet, VFD in the buyer provided control room.
- Installing the interconnecting wiring between the control cabinet and the skid mounted junction box for skid mounted instruments.
- Installing the interconnecting wiring between the control cabinet and VFD and interconnecting wiring between the motor and VFD assuming that VFD is located within 50 ft of oxidizer motor and adjacent to control panel.

Materials are normally delivered to the site approximately eighteen (18) weeks after CECO ABATEMENT SYSTEMS receives a purchase order. Expedited schedules are often accommodated and are subject to final negotiation.

FIELD SERVICE/ERECTION SUPERVISION

The base bid and optional bid includes two weeks of CECO Abatement Systems field supervision to be used for installation supervision, startup, and training. The proposal does not include standby service. All additional time will be furnished at the per diem rate of $800 plus travel and living expenses (based on an eight (8) hour work day). Overtime will be billed at 1.5 times our standard rate.

PERFORMANCE GUARANTEES

PERFORMANCE TESTING

All performance guarantees are based on the following criteria:

1. Andritz will contract a certified third party to perform the following testing procedures on the equipment:

    - EPA Method 1 and 2 for Volumetric Flow
    - EPA Method 3 for Oxygen and Carbon Dioxide
    - EPA Method 4 for Moisture
    - EPA Method 18 for Organic Compounds
    - EPA Method 25 for Total Gaseous Non-Methane Organics
    - EPA Method 25A for Total Hydrocarbon

2. The testing will be performed within thirty (30) days of the completion of installation and start-up. All testing will be performed simultaneously on the inlet and outlet of the RTO and the results are reported on a 1-hour time weighted basis. The plant will schedule full production operation for the testing period.

VOLATILE ORGANIC COMPOUNDS (VOCs)

CECO Abatement Systems guarantees that the proposed system will meet 98% destruction of TOTAL hydrocarbons from the customer's process exhaust air-stream at a minimum oxidizer inlet concentration of 300 ppmv as propane. If the inlet concentration is less than 300 ppmv as propane, CECO Abatement Systems will guarantee a maximum exhaust concentration 6 ppmv as propane.

NOx

CECO Abatement Systems guarantees that NOx emissions from the proposed systems, during normal operation, will not exceed 10 ppmv in addition to the NOx concentration measured at the oxidizer inlet. This excludes the NOx contributed via chemical bound nitrogen found in such compounds as amines, ammonia, etc.

EQUIPMENT WARRANTY

CECO Abatement Systems warrants for a period of **five (5)**years from start-up date the following components:

- Internal Insulation
- Oxidizer Housing
- Combustion and Recovery Chambers
- Inlet/Outlet Manifolds
- Fan Inlet/Outlet Ductwork
- Process Exhaust Stack
- Main Diverter Valves (Does not include soft seats, if used)

Should any defect in design, material, workmanship, or operating characteristics develop within the warranty time period, CECO Abatement Systems will replace or correct the component or defect free of charge, subject to the following conditions:

- The purchaser must agree to schedule an RTO inspection with CECO ABATEMENT SYSTEMS annually. The annual estimated cost for this service is shown under "Training/Annual Inspection" below. The purchaser will agree to address any maintenance issues brought to the attention of the purchaser by CECO Abatement Systems inspectors.

- Recommended routine maintenance must be performed and documented per CECO ABATEMENT SYSTEMS instructions at recommended intervals.

- This warranty does not apply to ordinary wear and tear, or deterioration due to corrosives in the process air stream other than those already disclosed to CECO Abatement Systems.

All other items in CECO Abatement Systems scope of supply, including blowers, motors, starters, VFD, fans, burners, etc., are covered by a one (1) year warranty based on CECO ABATEMENT SYSTEMS standard terms and conditions.

HEAT RECOVERY BEDS

CECO Abatement Systems warrants for a period of **five (5) years** from the date of delivery that the recovery media, when used properly in the normal operations of the RTO, will not cause a significant loss of performance of the system as a result of breakage caused by temperature changes or thermal cycling.

The foregoing warranty shall not cover any failure or damage to the product resulting in whole or in part from any process action or attack of any nature, physical abuse, plugging, improper handling, or operation of the RTO outside of its normal and usual operating parameters or conditions. Furthermore, if monolith media is used, at no time shall the system be operated outside the ranges and thermal design limits of the blocks as specified below:

- Maximum Heat-Up rate – 800 ^{0}F per hour over a range from 0 ^{0}F to 1800 ^{0}F.
- Maximum cool-down rate - 800 ^{0}F per hour from 1800 ^{0}F to 0 ^{0}F.
- Maximum combustion chamber temperature limit 2000 ^{0}F.

Minor damage due to normal wear and tear is excluded from this warranty. Minor thermal cracks that may occur in monolith are normal and do not impair performance - therefore, minor cracking is also excluded. In the event that specific monolithic blocks fail, CECO ABATEMENT SYSTEMS will replace the blocks in question at no additional cost. CECO ABATEMENT SYSTEMS standard terms and conditions apply.

CONDITIONS of PERFORMANCE WARRANTY

CECO Abatement Systems, Inc., guarantees that the proposed RTO system will meet 98% VOC destruction removal efficiency for a period of five (5) years from the date of start-up, subject to the following conditions:

- The purchaser must agree to schedule an RTO inspection with CECO ABATEMENT SYSTEMS annually. The annual estimated cost for this service is shown under "Training/Annual Inspection" below. The purchaser will agree to address any maintenance issues brought to the attention of the purchaser by CECO Abatement Systems inspectors.

- Recommended routine maintenance must be performed and documented per CECO ABATEMENT SYSTEMS instructions at recommended intervals.

- This warranty will become void if the main diverter valves become deteriorated due to the presence of corrosives in the process stream other than those already disclosed to CECO Abatement Systems.

- The inlet process stream constituency does not change significantly from the original design specifications included with this proposal.

- The purchaser will be responsible for all testing and re-testing.

At the end of the warranty period, the purchaser will have the opportunity to extend the performance warranty for an additional period of time at a specific level of performance less than or equal to the current level.

TRAINING/ANNUAL INSPECTION

CECO Abatement Systems Field service can be purchased at the rate of $800.00 per day plus all reasonable and customary travel and living expenses. A thorough internal and external RTO inspection is estimated to require three days to complete, including travel day each way.

MAINTENANCE SCHEDULES & RECOMMENDED SPARE PARTS

RECOMMENDED MAINTENANCE SCHEDULE

Description	Lubricant	WK	MON (1)	MONS (4)	MONS (6)	YR
MAIN DIVERTER VALVE						
Valve Seat Inspection	—				X	
Valve Shafts	Anti-Seize				X	
Valve Shaft Bearings	MobilGrease Special				X	
CHAMBER PURGE VALVES (If included)	MobilGrease Special				X	
Valve Shaft Bearing	MobilGrease Special				X	
Rod End Bearings						
MECH VALVE DRIVE SYSTEM (IF INCLUDED)	Hub City Synthetic					X
Gear Box	AGMA No. 7; 3 Qts					
	MobilGrease Special				X	
Pillow Block Bearings	MobilGrease Special				X	
Hanger Bearings	Anti-Seize				X	
Secondary Drive Shafts						
EXHAUST FAN						
External Insulation	—		X			
Wheel & Shaft Inspection	—				X	
Bearing Inspection	—		X			
Bearing Lubrication*	Consult Manufacturer					
Motor Bearing Lubrication	Consult Manufacturer				X	
PURGE FAN (If included)						
External Inspection	—	X				
Wheel & Shaft Inspection	—				X	
Bearing Inspection	—	X				
Bearing Lubrication*	Consult Manufacturer			X		
Motor Bearing Lubrication	Consult Manufacturer				X	
RTO & SYSTEM DAMPERS						
Pre-Start/Purge Valve Bearings	MobilGrease Special				X	
Pre-Start/Purge Valve Inspctn.	—				X	
Recirc. Damper Bearings	MobilGrease Special				X	
Inlet Isolatn. Damper Bearings	MobilGrease Special				X	
Inlet Bypass Damper Bearings	MobilGrease Special				X	
Face & Bypass Damper Bearings	MobilGrease Special				X	
INSULATION						
Inspection	—					X
HEAT RECOVERY MEDIA						
Inspection	—					X
MEDIA SUPPORT GRID						
Inspection	—					X
GAS BURNERS						
Discharge Sleeve Inspection	—					X
Spark Ignitor Inspection	—					
BURNER PIPE TRAIN						
Gas Shut-off Valves Leak Test	—					X
CONTROL INSTRUMENTS CALIBRATION						
UDC-2000 Controller	—					X
UDC-3000 Controller	—					X
UDC-5000 Controller	—					X
Pressure Transmitter	—					X

NO LUBE REQUIRED FOR: Valve Drive DC, Bettis/Bernard Actuators, Honeywell Burner Control Motors, Maxon Safety Shutoff Valves, Combustion Air Blower Motors, Fuel Oil Pump, Air Compressor Motors, Condensate Pump, Condensate Pump Motor

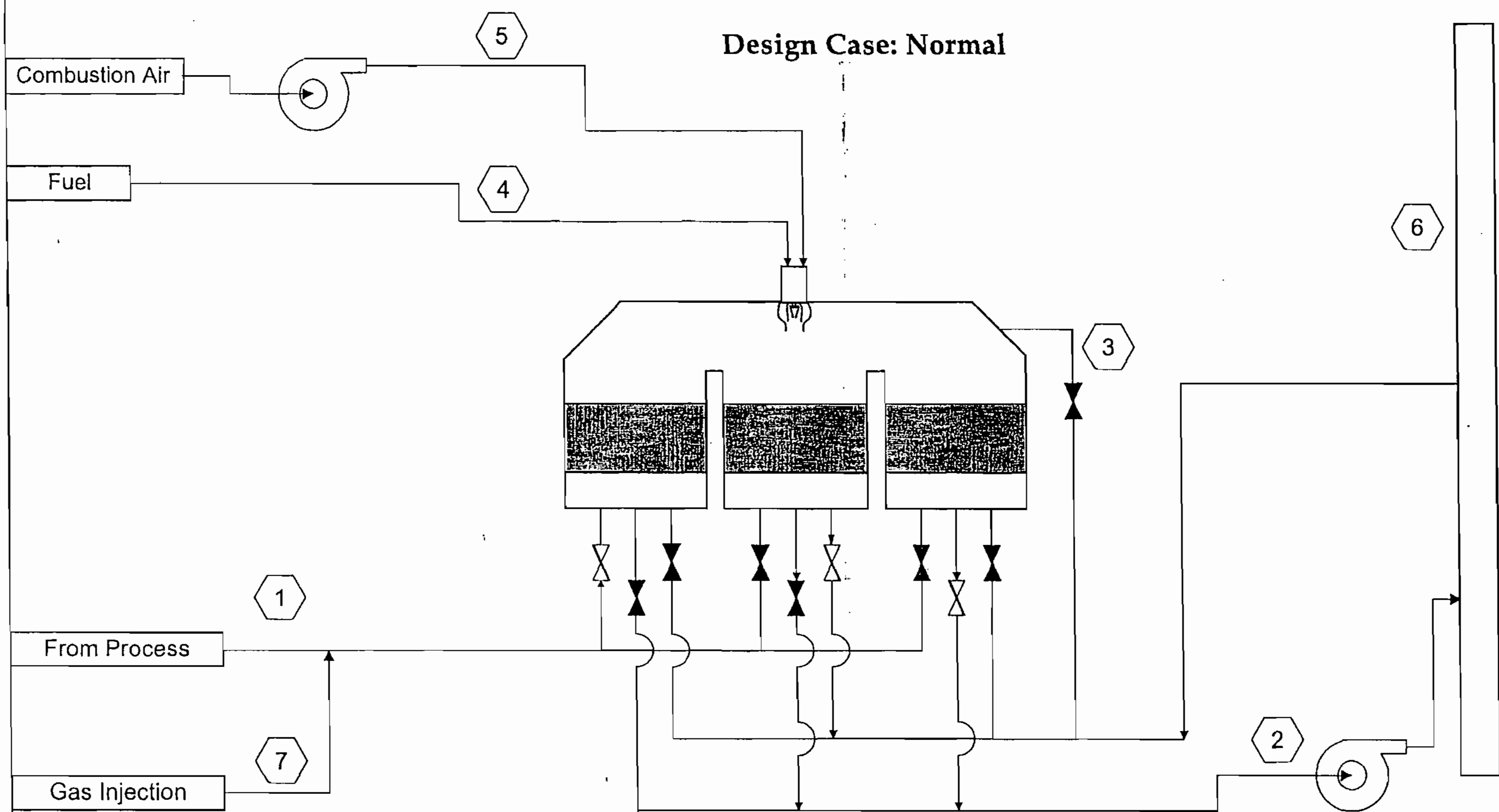
* Consult Manufacturer For Lubrication Schedule.

RTO RECOMMENDED SPARE PARTS

QTY	DESCRIPTION
1	Burner Transformers with Cable
2	UV Flame cells
2	Panel Relays
1	Comb. Chamber Thermocouple Assemblies
1	Duct Work Thermocouple Assemblies
1	Flame Guard - PC Controls
1	Main Fan Motor
1	Combustion Air Fan Motor
1	Pressure/Volume Transducer
1	Analog Input Module
1	Analog Output Module
1	16 Pt Input Module
1	16 Pt Output Module
1	PLC CPU
1	PLC Power Supply
1	Misc. Fuses

TECHNICAL DATA

Design Case: Normal



Component Name	Molecular Weight	Process Stream Stream No. 1	RTO Outlet Stream No. 2	Hot Bypass Stream No. 3	Fuel Gas Stream No. 4	Combustion Air Stream No. 5	Outlet Stream Stream No. 6	Natural Gas Injection Stream No. 7
Oxygen	31.9988	322.609208	322.609204	0.000000		8.440779	322.609204	
Nitrogen	28.013	1228.396599	1260.536487	0.000000		32.139888	1260.536487	
Water	18.0152	201.901635	210.342418	0.000000			210.342418	
Carbon Dioxide	44.0098		4.220391	0.000000			4.220391	
Ammonia	17.03		0.000000	0.000000			0.000000	
Methane	16.0426		0.000000	0.000000	4.220391		0.000000	0.000000
Total, lbmole/hr		1752.907442	1797.708500	0.000000	4.220391	40.580667	1797.708500	0.000000
Total, lbs/hr		48371.480	49609.615	0.000	67.706	1170.429	49609.615	0.000
Temperature, F		120	217	1500	70	70	217	70
Pressure		14.696	13.975	14.696	19.696	14.696	14.696	19.696
SCFM		11300	11589	0	27	261.6005406	11589	0
ACFM		12367	15560	0	20	261.6005406	14796	0
Energy, BTU/HR		622789	1878879	0	0	0	1878879	0.000
Heat of Combustion		0	0	0	1456090.236	0	0	0

Notes

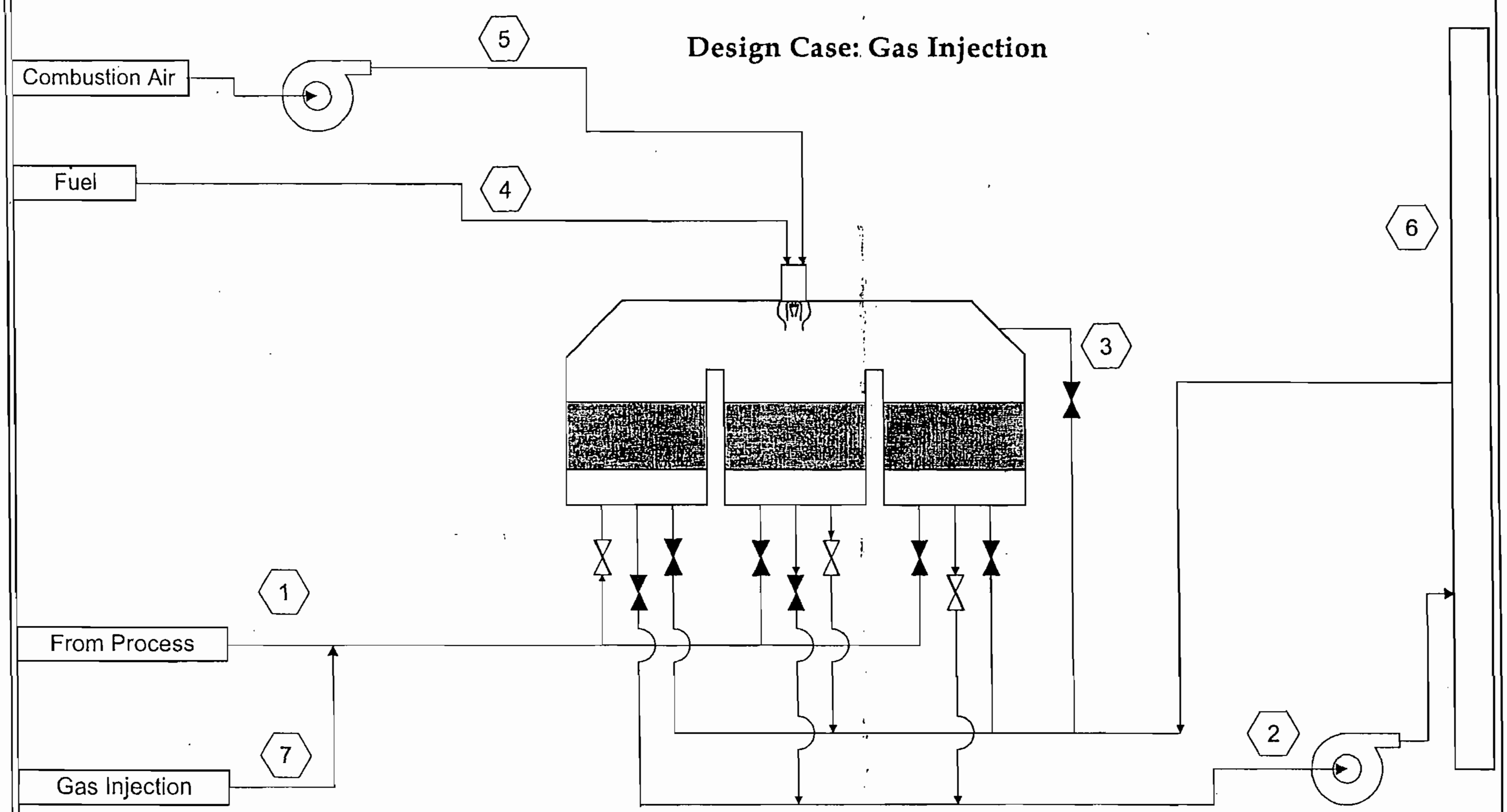
1) STP is referenced at 70 °F and 14.696 Psia
2) Heat losses are calculated at 200,000 BTU/hr
3) Calculation assumes no heat contribution from process stream.
4) Mass and Energy Balance is in lbmole/hr.

Rev. 0	CECO Abatement Systems, Inc.
By: Robert A. Cloud	Andritz-Ruthner

Andritz-Ruthner, Inc.
DESIGN CASE: Normal

Flow		11300 scfm	Nominal Airflow (SCFM)	11300
Inlet Temperature		120 deg F	Nominal Airflow (ACFM)	12367
Outlet Temperature		216.6 deg F	RTO Inlet Temperature (deg F)	120
Type Of System, Positive or Negative		Negative	RTO Inlet Static Pressure (inWC)	0
Valve Type, Poppet or Butterfly		Butterfly	Process Water Vapor (lb/hr)	3637.30
Fuel Cost	$	5.00 $/MMBTU	Process Dry Gas (lb/hr)	44734.18
Power Cost	$	0.05 $/kWhr	Combustion Chamber Temp (deg F)	1500
Plant Elevation		0 ft ASL	Organic Loading (lb/hr)	0
Local Atmospheric Pressure		14.696 psia	Solvent Gross Heating Value (BTU/lb)	No Solvent Given
Inlet Static Pressure		0 inWC	Fuel Usage (BTU/hr)	1456090
Purge Volume		0 cubic feet	Fuel Cost $/hr (@ $ / hr)	7.28
Unit Differential Pressure		-20.0 inWC	RTO Fan BHP Required (Total)	63
DRE		99%	RTO Fan Electrical Usage (kW)	50.79
GAS INJECTION On/Off		OFF	Additional System Power Requirements (kW)	1
Media Bed Depth, ft		7	Total Electrical Usage (kW)	52
Media Type (Monolith/Stoneware)		Monolith	Toral Electrical Cost (@ $ / hr)	2.6
% XSAir At Burners		15%	Static Pressure @ Design	20.0
Number of Chambers		3	Static Pressure @ Testblock	22.0
Valve Diameter		26 inches	Fan SCFM @ Testblock	12168
Manifold Diameter		26 inches	Fan;ACFM @ Testblock	16338
Combustion Chamber Temp		1500	Gas Molecular Weight	27.60
Heat Losses		200,000 BTU/hr	Fan Inlet Temp	217
Bakeout		OFF	Fan Inlet Density	0.053
Bed Area		33.809524 ft^2	%Bypass	0%

Design Case: Gas Injection



Component Name	Molecular Weight	Process Stream Stream No. 1	RTO Outlet Stream No. 2	Hot Bypass Stream No. 3	Fuel Gas Stream No. 4	Combustion Air Stream No. 5	Outlet Stream Stream No. 6	Natural Gas Injection Stream No. 7
Oxygen	31.9988	322.609208	316.430170	0.000000		0.000000	316.430170	
Nitrogen	28.013	1228.396599	1228.396599	0.000000		0.000000	1228.396599	
Water	18.0152	201.901635	208.080673	0.000000			208.080673	
Carbon Dioxide	44.0098		3.089519	0.000000			3.089519	
Ammonia	17.03		0.000000	0.000000			0.000000	
Methane	16.0426		0.000000	0.000000	0.000000		0.000000	3.089519
Total, lbmole/hr		1752.907442	1755.996961	0.000000	0.000000	0.000000	1755.996961	3.089519
Total, lbs/hr		48371.480	48421.044	0.000	0.000	0.000	48421.044	49.564
Temperature, F		120	189	1500	70	70	189	70
Pressure		14.696	13.993	14.696	19.696	14.696	14.696	19.696
SCFM		11300	11320	0	0	0	11320	19.91637521
ACFM		12367	14559	0	0	0	13863	14.86043106
Energy, BTU/HR		622789	1488713	0	0	0	1488713	0.000
Heat of Combustion		0	0	0	0	0	0	1065924.401

Notes

1) STP is referenced at 70 °F and 14.696 Psia
2) Heat losses are calculated at 200,000 BTU/hr
3) Calculation assumes no heat contribution from process stream.
4) Mass and Energy Balance is in lbmole/hr.

Rev. 0	CECO Abatement Systems, Inc.
By: Robert A. Cloud	Andritz-Ruthner

Andritz-Ruthner, Inc.
DESIGN CASE: Normal

Flow		11300 scfm	Nominal Airflow (SCFM)	11300
Inlet Temperature		120 deg F	Nominal Airflow (ACFM)	12367
Outlet Temperature		189.0 deg F	RTO Inlet Temperature (deg F)	120
Type Of System, Positive or Negative		Negative	RTO Inlet Static Pressure (inWC)	0
Valve Type, Poppet or Butterfly		Butterfly	Process Water Vapor (lb/hr)	3637.30
Fuel Cost	$	5.00 $/MMBTU	Process Dry Gas (lb/hr)	44734.18
Power Cost	$	0.05 $/kWhr	Combustion Chamber Temp (deg F)	1500
Plant Elevation		0 ft ASL	Organic Loading (lb/hr)	0
Local Atmospheric Pressure		14.696 psia	Solvent Gross Heating Value (BTU/lb)	No Solvent Given
Inlet Static Pressure		0 inWC	Fuel Usage (BTU/hr)	1065924
Purge Volume		0 cubic feet	Fuel Cost $/hr (@ $ / hr)	5.33
Unit Differential Pressure		-19.5 inWC	RTO Fan BHP Required (Total)	57
DRE		99%	RTO Fan Electrical Usage (kW)	46.30
GAS INJECTION On/Off		ON	Additional System Power Requirements (kW)	0
Media Bed Depth, ft		7	Total Electrical Usage (kW)	46
Media Type (Monolith/Stoneware)		Monolith	Toral Electrical Cost (@ $ / hr)	2.3
% XSAir At Burners		15%	Static Pressure @ Design	19.5
Number of Chambers		3	Static Pressure @ Testblock	21.5
Valve Diameter		26 inches	Fan SCFM @ Testblock	11886
Manifold Diameter		26 inches	Fan ACFM @ Testblock	15287
Combustion Chamber Temp		1500	Gas Molecular Weight	27.57
Heat Losses		200,000 BTU/hr	Fan Inlet Temp	189
Bakeout		OFF	Fan Inlet Density	0.055
Bed Area		33.809524 ft^2	%Bypass	0%

GENERAL DESIGN	
Rated Capacity:	11,300 SCFM
Design Thermal Energy Recovery:	95%
Estimated Weight of RTO (Fan & Stack Excluded):	81,276 Lbs
No. of Chambers:	3
Minimum Combustion Chamber Retention Time:	1.00 Sec.
Hot Side Bypass Included?	N/A
Cold Side Bypass Included?	N/A
Recovery Chamber Bakeout Feature Included?	Yes
Chamber Purge System Included?	N/A

MATERIAL OF CONSTRUCTION	
Material of Construction:	ASTM A-36 Carbon Steel
Chamber Wall Thickness:	3/16 in.
Internal Coating Included?	No
Insulation Type:	Soft Fiber Refractory
Insulation Manufacturer:	Unifrax or Equal
Insulation Density:	8 lb per cubic Ft.
Combustion Chamber Insulation Thickness:	8 in.
Chamber Wall Insulation Thickness:	6 in.
Bed Support Grid - Material of Construction:	304 SS

RECOVERY BEDS	
Media Type:	25x25 Monolith
Media Manufacturer:	CERAM
Bed Depth:	7 Ft.
Bed Area:	33.1 Sq. Ft.
Bed Volume:	231.4 Cubic Ft.
Bed Velocity (SCFM Basis):	342 Ft./Min Max.
Media Weight:	27,773 Lb

MANIFOLDS & DUCTWORK& STACK	
Inlet Manifold Design Velocity:	3209 Ft./Min
Inlet Manifold Diameter (Max.):	26 in.
Inlet Manifold Material of Construction:	Stainless Steel
Inlet Manifold Material Thickness:	#12 Ga.
Exhaust Manifold Design Velocity:	3743 Ft./Min
Exhaust Manifold Diameter (Max.):	26 in.
Exhaust Manifold Material of Construction:	Stainless Steel
Exhaust Manifold Material Thickness:	#12 Ga.
Process Ductwork Included?	No
Material of Construction:	N/A

MANIFOLDS & DUCTWORK& STACK Cont'd	
Expansion Joints Included?	N/A
Roof Penetrations Included?	N/A
RTO Exhaust Stack Included?	No
Exhaust Stack Height:	N/A
Exhaust Stack Diameter:	26 in.
Exhaust Stack Design Velocity:	3743 Ft./Min
Material of Construction:	N/A
Testing Platform Included?	N/A
Mode of Access:	N/A

EXTERNAL DUCTWORK INSULATION	
Inlet Manifold Insulation Included?	No
Exhaust Manifold Insulation Included?	Yes
Purge Manifold Insulation Included?	Yes
Inlet Bypass Duct Insulation Included?	N/A
Re-Circulation Duct Insulation Included?	N/A
Exhaust Stack Insulation Included?	No
Process Ductwork Insulation Included?	No
Insulation Type:	Mineral Wool
Insulation Density:	4.0 Ib per cubic Ft.
Insulation Thickness:	2.0 in. Min.
Insulation Jacketing Material:	Aluminum

RTO EXHAUST FAN	
Number of Exhaust Fans:	1
Forced or Induced Draft System:	Induced
Fan Manufacturer:	Phelps or Equal
Wheel Design:	Backward Inclined
Material of Construction:	Stainless Steel
Arrangement:	No. 8
Class:	4
Split Housing?	Yes
Access Door Included?	Yes
Lubrication Requirements:	Grease
Bearing RTDs Included?	Yes
Vibration Switches Included?	Yes
Power Requirements:	460 V, 3 Phase, 60 Hz
Motor Horsepower:	75
Motor Manufacturer:	Siemans or Equal
Motor Enclosure:	TEFC
Inverter Duty Service?	Yes

RTO EXHAUST FAN cont'd	
Motor Bearing RTDs Included?	No
Motor Winding RTDs Included?	Yes
VFD Included?	Yes
VFD Horsepower:	75
VFD Manufacturer:	Allen Bradley or Equal
VFD Type:	Pulse Width Modulated
NEMA Enclosure:	1
BURNER SYSTEM	
Number of Burners:	2
Burner Type:	Nozzle Mix
Burner Manufacturer:	MAXON
Burner Model:	Kinemax
Burner Size:	3"
Burner Fuel:	Natural Gas
Rated Output per Burner:	2 MMBtu/Hr
Over-Fire Capability:	50%
Pilot Output per Burner:	40,000 Btu/Hr.
Number of Fuel Trains:	1
Main/Blocking Valve Manufacturer:	Maxon
Main/Blocking Valve Model No.:	5000 Series
IRI Approved?	Yes
Fuel Train Enclosure Included?	No
Combustion Air Blower Motor Horsepower:	5 HP
Combustion Air Blower Filter/Silencer Included?	Yes
Burner Safeguard Type:	UV Scanner
Burner Access Platform Included?	Yes
Mode of Access:	Ladder
CONTROLS	
Control Panel Enclosure:	NEMA 12
PLC Manufacturer:	Allen Bradley
PLC Model:	SLC 504
Human-Machine Interface Manufacturer:	Allen Bradley
Human-Machine Interface Model:	Panelview 1000
Chart Recorder Manufacturer:	Honeywell
Chart Recorder Model:	DR450T Truline
Inlet Temp. Recorded?	Yes
Outlet Temp. Recorded?	Yes
Combustion Chamber Temp. Recorded?	Yes
Inlet Pressure/Flow Recorded?	No
Outlet Pressure/Flow Recorded?	No
Flame Safety Manufacturer:	Honeywell
Flame Safety Type:	UV-Scanner

CONTROLS cont'd	
Control Room Included?	No
Control Room Manufacturer:	N/A
Control Room Size:	N/A
Insulated?	N/A
Air Conditioning?	N/A
Heat?	N/A
Lighting?	N/A

HYDRAULIC SYSTEM	
Hydraulic Power Package Included?	No
Hydraulic Pump Manufacturer	N/A
Standby Pump Included?	N/A
Motor Horsepower:	N/A
Reservoir Heater Included?	N/A
Level Alarms Included?	N/A
Nitrogen Charged Accumulator Included?	N/A

PNEUMATIC SYSTEM	
Air Compressor Included?	No
Main Regulator Included?	No
Required Supply Pressure:	100 psi
Required Supply Volume:	10 scfm
Nitrogen Charged Accumulator Included?	No

VALVES	
Valve Manufacturer:	PEP or Equal
Main Diverter Valve Diameter:	26 in.
Main Diverter Valve Type:	Butterfly
Main Diverter Valve Valve Seat Style:	Knife-Blade
Mode of Valve Actuation:	Pneumatic
Actuator Manufacturer:	Parker or Equal
Actuation Speed:	1 Sec. Max.
Proximity Switches Included?	Yes
Proximity Switch Manufacturer:	NAMCO or Equal
Pre-Start Purge Valve Included?	Yes
Pre-Start Purge Valve Diameter:	20 in
Pre-Start Purge Valve Type:	Butterfly
Mode of Valve Actuation:	Pneumatic
Actuator Manufacturer:	Parker or Equal
Proximity Switches Included?	Yes
Proximity Switch Manufacturer:	NAMCO or Equal

VALVES cont'd	
Vacuum Breaker Included?	Yes
Vacuum Breaker Type:	Valve
Break Pressure:	-10 inWC
Proximity Switches Included?	No
Proximity Switch Manufacturer:	N/A
Chamber Purge Valves Included?	Yes
Chamber Purge Valve Diameter:	14 in.
Chamber Purge Valve Type:	Butterfly
Mode of Valve Actuation:	Pneumatic
Actuator Manufacturer:	Parker
Proximity Switches Included?	Yes
Proximity Switch Manufacturer:	NAMCO or Equal
Bakeout-Cooldown Valve Included?	N/A
Bakeout-Cooldown Valve Diameter:	N/A
Bakeout-Cooldown Valve Type:	N/A
Mode of Valve Actuation:	N/A
Actuator Manufacturer:	N/A
Proximity Switches Included?	N/A
Proximity Switch Manufacturer:	N/A
Bakeout Re-Circulation Valve Included?	N/A
Bakeout Re-Circulation Valve Diameter:	N/A
Bakeout Re-Circulation Valve Type:	N/A
Mode of Valve Actuation:	N/A
Actuator Manufacturer:	N/A
Proximity Switches Included?	N/A
Proximity Switch Manufacturer:	N/A
Inlet Isolation Valve Included?	Yes
Inlet Isolation Valve Diameter:	26 in
Inlet Isolation Valve Type:	Butterfly
Mode of Valve Actuation:	Pneumatic
Actuator Manufacturer:	Parker or Equal
Proximity Switches Included?	Yes
Proximity Switch Manufacturer:	NAMCO or Equal
Process Dampers Included?	No
Mode of Valve Actuation:	N/A
Actuator Manufacturer:	N/A
Proximity Switches Included?	N/A
Proximity Switch Manufacturer:	N/A

MISCELLANEOUS	
Mechanical Installation Included?	No
Electrical Installation Included?	No
Btu-Enhancement (Gas Injection) Included?	Yes
Foundations Included?	No
Fire Supression Included?	No
Exhaust Stack Silencer Included?	N/A
Skid Mounted	Yes
Performance Testing Included?	No

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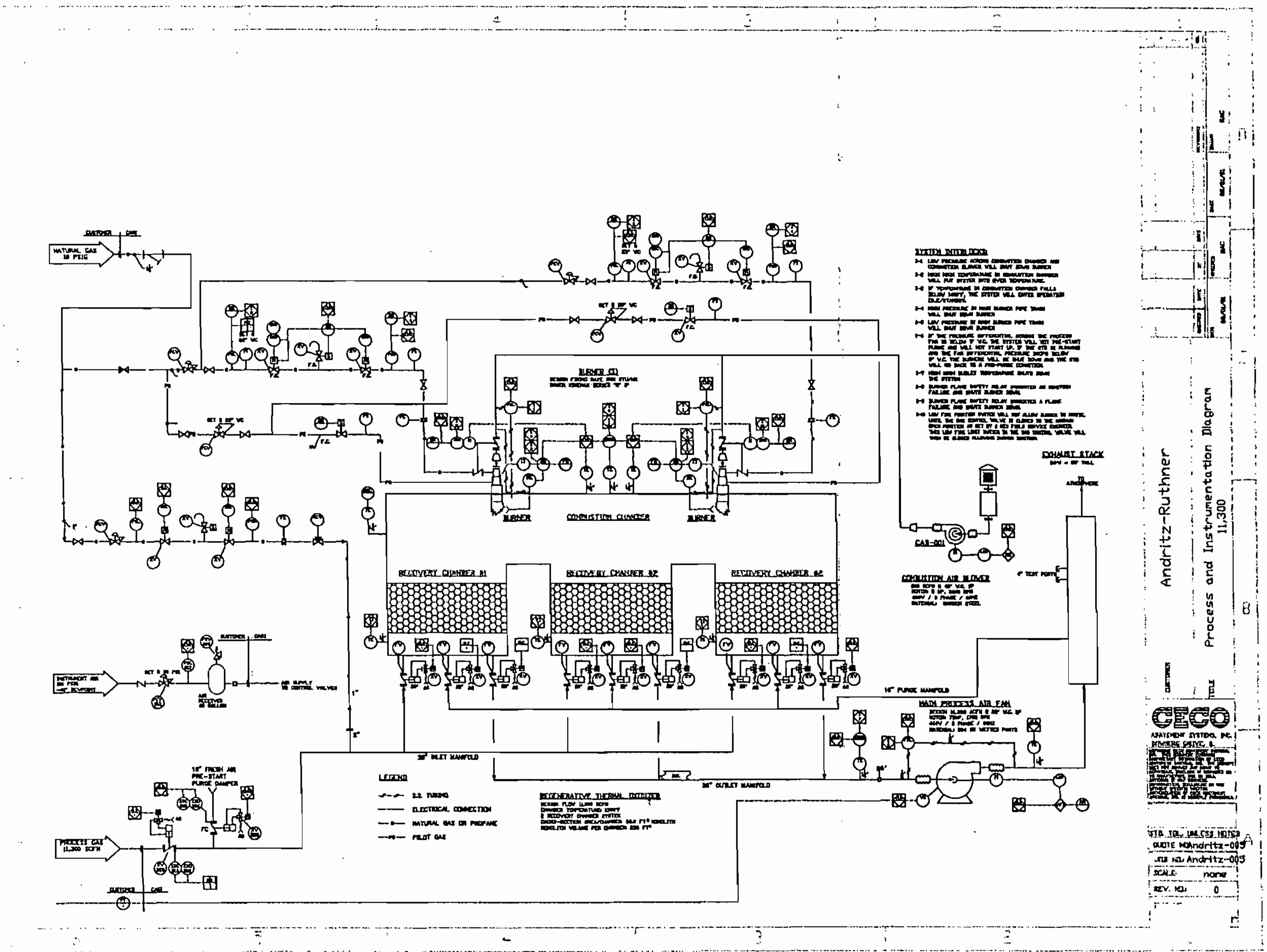

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