APPLICATION FOR
PERMIT TO CONSTRUCT AN
RDF-TO-ENERGY FACILITY
ADJACENT TO THE DUPONT KINSTON WORKS

LENOIR COUNTY, NORTH CAROLINA

Carmen Johnson 3/26/12 4/2/12 CP
54-04

SUBMITTED BY:

CAROLINA ENERGY, LIMITED PARTNERSHIP
HOUSTON, TEXAS

SUBMITTED TO:

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
SOLID WASTE SECTION
P.O. BOX 27687
RALEIGH, NORTH CAROLINA 27611-7687

AUGUST 1994

Application For
Permit To Construct An
RDF-To-Energy Facility
Adjacent To The DuPont Kinston Works

Lenoir County, North Carolina

Submitted By:

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CAROLINA ENERGY, L.P.

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SECTION 1

1.0 INTRODUCTION

Carolina Energy, Limited Partnership (Carolina) has entered into long term agreements with Lenoir and Pitt Counties for the processing, recycling and energy recovery (resource recovery) from municipal solid waste (MSW) generated within the Counties. A long term contract has been nearly finalized in Wilson County, as well. In addition, negotiations are underway in several other eastern North Carolina including Nash and Edgecombe Counties. Copies of waste supply agreements are included in the Supplemental Information Document which accompanies this Application.

Carolina Energy, Limited Partnership is owned by the following: limited partners are Energy Investors Fund, L.P., Kvaerner Venture, Inc. and QUIXX Corporation. The general partner is Carolina Energy Corp., a subsidiary of VEDCO Energy Corp. Metric/Kvaerner Fayetteville will be the turnkey contractor, and QUIXX Power Services, Inc. will operate the project facilities. Therefore, Carolina participants are substantially identical to the team presently implementing the BCH Energy, L.P. Project in Bladen, Cumberland and Hoke Counties, North Carolina.

1.1 SITE LOCATION

Three (3) separate locations in eastern North Carolina will be utilized and operated by Carolina Energy, L.P. for the project.

1. A Transfer Station/Materials Recovery Facility (MRF) located near the existing Lenoir County Landfill.
2. A Materials Recovery Facility (MRF) and Energy Generation Facility (EGF) located in Wilson County.
3. An Energy Generation Facility (EGF) located adjacent to the DuPont Kinston Works in Lenoir County.

This document describes the third facility, the EGF located adjacent to the DuPont Kinston Works in Lenoir County.

1.2 FACILITY DESCRIPTION

The Carolina Energy, L.P. EGF to be located in Lenoir County, North Carolina will burn approximately 190,000 tons of RDF-3 annually to generate high pressure steam for sale to E.I. DuPont de Nemours & Company (DuPont). The plant is to be constructed on a leased site adjacent to the DuPont Kinston Works, east of the existing DuPont Power House.

The processing of the municipal solid waste (MSW) to produce RDF-3 will occur at off-site locations, at the Lenoir MRF near the Lenoir County Landfill and at the Wilson County MRF. Prepared RDF-3 will be transferred to the steam generating plant in live bottom (walking floor) trailers. Upon receipt, the RDF-3 will be stored in live bottom storage bins which will be maintained under negative pressure. The ventilation air will be used as combustion air for the circulating fluidized bed combustor (CFB). Fuel receiving and storage should not be a source of fugitive air emissions or odors.

A single circulating fluidized bed combustor will burn the RDF-3. This combustor will be manufactured by Kvaerner EnviroPower AB of Sweden. The combustor will be rated at 249 million British Thermal Units (BTU) heat input per hour.

Air pollution emissions will be controlled through the use of state-of-the-art technology and equipment. Acid gases (sulfur dioxide and hydrogen chloride) will be controlled through the addition of pulverized limestone and hydrated lime, nitrogen oxides will be controlled through ammonia or urea injection, heavy metals (mercury) and trace organics will be controlled by activated carbon injection and particulate emissions will be controlled by fabric filters (baghouses).

Emissions from storage bins on-site will be controlled through the installation and operation of fabric filters on the bin vents. Such bins include: pulverized limestone, hydrated lime, activated carbon, sand and flyash.

A pressurized 12,000 gallon aqueous ammonia tank will be maintained on-site for injection into the combustor for control of nitrogen oxides.

A 12,000 propane (LP) tank will be maintained on-site to store startup fuel to for the CFB combustor.

Detailed specifications for the EGF are included in Section 2 of this Application Document, while plans are included in Section 3.

Section 4 contains a copy of Air Permit No. 7737 issued June 6, 1994 for the Facility by the NC DEHNR, Division of Environmental Management, Air Permits Section. Also included is the Air Permit Application Introduction and the Application Forms for reference purposes.

1.3 ZONING APPROVAL

A letter, dated March 9, 1994 prepared by the Lenoir County Manager indicating that the site has no zoning or land use restrictions and certifying that the facility, as planned, meets Lenoir County requirements, is included at the end of Section 1 (page before Tab 2).

1.4 COMPLIANCE WITH SITING/DESIGN REQUIREMENTS

1.4.1 Surface Water Requirements

The EGF will utilize potable water provided by the DuPont Kinston Works. All wastewater (sanitary and boiler blowdown) will be discharged to the existing DuPont Kinston Works wastewater treatment system for treatment prior to discharge. As a result, the EGF requires no discharge permits for process wastewater.

Stormwater from the EGF site will be discharged to the existing DuPont stormwater system.

Prior to construction, the Contractor shall obtain an NPDES Permit for Stormwater Discharge from Construction Activities from NC DEHNR.

1.4.2 Groundwater Standards

All RDF, reagents and ash residues will be stored indoors or in closed bins/containers. All wastewater generated by the facility will be collected and discharged to the existing DuPont Wastewater system.

All raw materials hauled to the facility and ash residues removed from the facility will be in covered or enclosed trailers and discharged directly to or from indoor storage or enclosed bins. Therefore, neither surface water nor groundwater contamination is likely to occur at the Facility.

1.4.3 Sedimentation Pollution Control

Prior to the start of construction, the Contractor shall prepare an application for and obtain Sedimentation and Erosion Control Plan Approval.

1.4.4 Air Pollution Control

The Facility has applied for and obtained an Air Permit from the NC DEHNR, Division of Environmental Management, Air Permits Section.. Air Permit No. 7737 issued June 6, 1994 is included in Section 4 of this document. For reference purposes, the introduction and forms from the original application filed in March 1994 are included.

1.4.5 Site Access Control

As indicated in the EGF Plans (Section 3), the facility site is completely fenced with controlled access. No uncontrolled access is available at the site.

1.4.6 Odor Control

Potential odors from the handling and storage of RDF will be controlled by drawing combustion air from the storage and handling areas. Hence, the storage and handling areas will be maintained under negative pressure.

1.5 FACILITY DETAILS

1.5.1 Area Served

The Carolina Energy, L.P. project will serve the Counties of Pitt, Lenoir and Wilson. Pitt County and Lenoir County have entered into long term contracts with Carolina Energy, L.P. The long term contract with Wilson County is expected to be

finalized in September 1994. Negotiations are underway with Nash and Edgecombe Counties. Copies of Contract Documents are included in the Supplemental Information Document submitted with the Application.

1.5.2 Type and Quantity of Waste

The RDF-to-Energy Facility or EGF to be located adjacent to the DuPont Kinston Works will accept approximately 190,000 tons of RDF-3 annually. The RDF-3 will be produced at the MRF Facilities to be located in Wilson County and Lenoir County. No unprocessed municipal solid waste (MSW) will be accepted by the EGF. All unprocessed MSW will be delivered directly to the MRF Facilities, or to one of several transfer stations expected to serve the Wilson MRF Facility.

1.5.3 Process Flow Diagram

A Process Flow Diagram for the Facility is included in Section 3 (Facility Plans) of this document.

1.5.4 Description of Storage Facilities

RDF delivered to the EGF will be contained in covered or enclosed live bottom (walking floor) trailers. Trailers will be discharged directly into enclosed walking floor storage bunkers prior to feeding to the metering bin and then into the combustor. A total of eight (8) bunkers, each with 225 tons storage capacity shall be maintained. Therefore, total on-site RDF storage is 1800 tons, or approximately three (3) days fuel feed capacity.

Ash residue from the combustion system will be pneumatically conveyed from the boiler ash drop points, mechanical collector and fabric filter system to a totally enclosed ash storage bin equipped with a fabric filter dust collector bin vent. Such ash will be conditioned prior to loading into totally enclosed trailers for transfer to end user or transfer to the designated disposal site. Tramp materials (bottom ash) will be conveyed to a covered container for storage prior to transfer to the designated disposal site.

1.5.5 Disposal of Residues

Flyash generated from the combustion of RDF will be stored in a totally enclosed bin equipped with a fabric filter dust collector as discussed in 1.5.4.

It is anticipated that the flyash will be beneficially used as an additive in the manufacturing of portland cement, in the production of concrete or in the production of asphalt. The ash will be periodically tested for TCLP Toxicity in accordance with Federal and NC DEHNR requirements. Prior experience with the fly ash indicates that it is likely to be non-toxic and suitable for beneficial use. Samples of flyash, typical of this system, have been tested by the NC DOT and found to be suitable for approval as Class F Flyash. Upon startup of the facility, samples will be analyzed and provided to NC DOT for review and approval.

If for any reason the combustion ash can not be beneficially used, it will be disposed at the Cumberland County Ann Street Landfill located in Fayetteville, NC in a Subtitle D lined landfill cell.

Tramp material (bottom ash) will be disposed at the Cumberland County Ann Street Landfill unless approved for beneficial use as a coarse aggregate product.

The Cumberland County Board of Commissioners approved a Resolution on April 18, 1994 authorizing an amendment to the Resource Recovery Agreement with BCH Energy, Limited Partnership to include the disposal of residue and fines from the Carolina Energy, L.P. Project. A copy of the details of this agreement are included in the Supplemental Information Document submitted with this Application.

Prior to startup of the EGF, a Comprehensive Ash Management Plan will be submitted for approval by the NC DEHNR Solid Waste Section.

1.5.6 Surface Water Runoff Control

The EGF will utilize the existing DuPont stormwater system. Due to the nature of the EGF operation and the fact that RDF will be transported to the facility in enclosed trailers, which discharge directly into live bottom bunkers, no waste material will be outdoors or exposed to stormwater. As indicated previously, all materials (sand,

limestone, lime, activated carbon) utilized in the combustion process and air pollution control system are stored in totally enclosed bins and tanks. Ash residues are stored in an enclosed bin and covered containers.

Sanitary wastes and process wastewater will be disposed via the DuPont sewage treatment system.

1.5.7 Final Product Use

As indicated, the primary product is high pressure steam which will be purchased for use by the adjacent DuPont Kinston Works. Flyash, produced as a byproduct of the combustion process, is believed to be suitable for use in the manufacturing of portland cement, concrete or asphalt paving materials. Upon facility startup, appropriate testing will be conducted to gain approvals (NC DEHNR and NC DOT) for beneficial use of the flyash. Tramp material (bottom ash) will also be tested for possible beneficial use as a coarse aggregate substitute.

1.5.8 Daily Traffic Flows

Average daily truck traffic to the site for the delivery of RDF is expected to be 28 tractor trailer loads. Peak delivery if RDF to the facility is expected to be 55 tractor trailers per day. Tractor trailers leaving the site with ash residue are expected to average 5 per day, with a peak of 10 per day. Trucks delivering materials utilized in the process (sand, limestone, lime, activated carbon, ammonia, propane) will average 1 per day.

1.5.9 Truck Unloading

RDF arriving at the facility will be discharged directly into the walking floor storage bunkers. Raw materials (sand, limestone, lime, activated carbon) will be pneumatically conveyed directly from delivery vehicle into storage bins equipped with fabric filter bin vents. Aqueous ammonia and propane will be pumped directly into their respective holding tanks.

1.5.10 Operation Arrangements

Carolina Energy, L.P. will contract with Quixx Power Services, Inc. (Quixx) of Amarillo, Texas to operate the EGF. Quixx will be responsible for the day-to-day operation and maintenance of the facility.

1.5.11 Personnel

It is anticipated that the following personnel will be required to operate the EGF:

Position	No. Required
Chief Facility Operator	1
Assistant Operator	1
Secretary	2
Shift Supervisor	4
Control Room Operator	4
Instrument Technician	1
Maintenance Supervisor	1
Maintenance	4
Maintenance Helper	4
Cleanup Personnel	3
TOTAL	25

1.5.12 Operation Schedule

The EGF will operate 7 days per week, 24 hours per day. RDF will be delivered to the facility 6 days per week on a two shift basis. The combustion system will shut down annually on a scheduled basis for maintenance and inspection. During that approximate two (2) week period, no RDF will be delivered to the facility and no RDF inventory will be maintained. RDF shipments will resume 2 to 3 days prior to scheduled re-start of the system. It is likely that the annual scheduled shutdown will occur during February as this is historically the time of lowest waste generation.

1.5.13 Plans and Specifications

Detailed specifications for the EGF are included in Section 2 of this document, while Section 3 contains the EGF Plans.

1.5.14 Draft Operation and Maintenance Manual

A draft Operation and Maintenance Manual is included as Section 5 of this document. The Standard for the Qualification and Certification of Resource Recovery Facility Operators (ASME QRO-1-1994) is included at the end of Section 5. The Chief Facility Operator and Shift Supervisors will be Certified in accordance with that Standard.

County of Lenoir

Lenoir County Courthouse
Post Office Box 3289
130 South Queen Street
Kinston, NC 28502

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March 9, 1994

Mr. Richard T. Lasater
DEM/Air Quality/Air Permit Unit
North Carolina Department of Environmental
Health and Natural Resources
P. O. Box 27687
Raleigh, North Carolina 27611-5317

RE: Carolina Energy Corp. Project

Dear Mr. Lasater:

With reference to your work on the Carolina Energy Corp., RDF-to-Energy Facility Project (the "Project"), please be advised that Lenoir County does not have any zoning of land use regulations in effect in the area of the DuPont Kinston Works where the Project will be located. This will certify that the Carolina Energy Corp. facility as planned, meets Lenoir County requirements.

Sincerely,

Bob I. Snapp
Lenoir County Manager

cc: Kenneth L. Woodruff
Kenneth L. Woodruff & Associates

George Armistead
VEDCO Energy Corp.

Section 2

SCOPE OF WORK AND DESIGN BASIS FOR THE KINSTON ENERGY GENERATING FACILITY

KINSTON NEW SECTION 2

1.00 INTRODUCTION

1.01 The purpose of this SECTION is to provide general design criteria to the Contractor which must be met in his implementation of the detailed design of the project. No relaxation of the requirements contained in this SECTION shall be permitted without the express written consent of the Owner.

1.02 The Contractor may provide alternatives to the design described in this SECTION provided that the performance specified standards of quality and operational flexibility specified below are maintained. Alternatives which enhance reliability are encouraged. Changes proposed shall be subject to the Owner's review and approval.

1.03 The project consists of two separate facilities located as described in SECTION 0040, Project Summary. One plant is designated as the Wilson County MRF and is covered in SECTION 0055, and the second is an Energy Generation Facility (EGF). This SECTION specifies the design criteria for the EGF.

1.04 The detailed designs proposed by the Bidder shall provide for secondary equipment redundancy in the event of equipment failure to permit plant operation to continue. Designs shall be highly automated and be based on facility operation with minimum of operating personnel from a central control room. Designs proposed shall permit rapid and easy operator exit in the event of serious equipment malfunction.

1.05 The major design objective of the EGF using Refuse Derived Fuel (RDF) is to provide the capability to supply 171,000 lbs/hr of high pressure, superheated steam to Du Pont's Kinston Plant, 24 hours/day, 7 days/week.

2.00 DESCRIPTION OF EGF

2.01 The EGF is located on approximately 10 acres of land in the E.I. Du Pont's industrial facility in Kinston, NC. The purpose of the EGF facility is to provide steam to E. I. Du Pont. Major equipment includes one RDF fired circulating fluidized-bed type steam generator, baghouse ash silo, boiler auxiliaries, RDF receiving and storage equipment, and controls. Approximately 188,000 tons/year of RDF will be delivered to the EGF (from the Wilson County MRF) where it will be used for combustion in the steam generator. Materials handling equipment shall be provided to off-load RDF and convey it to the steam generator fuel feed system. Areas shall be provided for parking of RDF trucks.

3.00 BASIS OF EGF OPERATION

3.01 The EGF will be designed with the objective for a minimum annual capacity factor of 92% for 40 years. It is anticipated that the facility's annual outage shall be for a duration of two weeks (336 hours). Scheduled and unscheduled outages during the remainder of the year are not expected to exceed 360 hours.

3.02 The Steam Sales Contract is with Du Pont and requires the plant to normally run at full capacity 7 days a week, 24 hours per day. The Contractor's design shall recognize this mode of operation and provide technical features to facilitate steady operation at full output while meeting all environmental requirements.

3.03 The Performance Guarantees called for in SECTION 0080 require specified levels of performance under specific operating conditions. The conditions so specified shall be the Guarantee Conditions. The Design Conditions of the plant shall contain sufficient and suitable margins within components and systems such that the ability of the boiler to operate continuously at its Guarantee Conditions shall not be compromised due to deterioration of equipment as it ages. In order to provide for this, all systems shall be designed with margins that shall permit the boiler to operate continuously at 5% above its rated steam pressure and flow. The maximum continuous rating (MCR) for the boiler is 249 x 10^6 Btu/hr.

3.04 All systems involved in the processing of fuel and combustion gas shall recognize the variability in refuse derived fuels (RDF) and be designed to handle such fuel specified under Section 0080, Paragraph 5.00.

3.05 The Contractor shall provide design margins on pollution control equipment to permit full operation of the plant within permit limits in effect at contract signing. The final permits shall be made part of the design specifications.

4.00 SITE CONDITIONS

4.01 The plant site is as shown on the drawings accompanying this specification.

4.02 Design for wind shall be in accordance with NCS Building Code. Design wind velocity is 90 miles per hour.

4.03 Design for snow loading shall be in accordance with NCS Building Code for snow load. Minimum depth of cover for underground piping is 3 feet.

4.04 Site drainage shall be designed in accordance with the NCS Building Code and be based on a 100-year storm.

4.05 Seismic design for all buildings, structures and components shall be in accordance with NCS Building Code for earthquake loads. Site is located in Seismic Risk Zone 0.

4.06 Site elevation is approximately 60 ft above mean sea level.

4.07 The site arrangement shown on the drawings is conceptual in nature and may be modified by the Contractor except that the stack shall be located within a 25 ft radius of the position shown on the Site Plan (Dwg. D-071-030-C2).

4.08 All areas of the site which are not used for some specific function (i.e., equipment, paved areas, structures, etc.) shall be finished graded, loamed and seeded to prevent soil displacement.

4.09 Borings shall be taken at site by the Contractor prior to Contract signing. For bidding purposes, foundation shall be based on soil loading of 3000 pounds per square foot.

4.10 The site is partially wooded. The Contractor is to take reasonable steps to minimize cutting of trees.

4.11 Ambient air temperature range is 92 to 10F. Wet bulb temperature is 76°F (wb).

5.00 CODES AND STANDARDS

5.01 The design, manufacture, erection and start-up of equipment and systems shall be in accordance with governing Codes and Standards.

5.02 The governing Codes and Standards shall be those that are in effect at the time the contract is signed.

5.03 All applicable local, state and federal requirements and permit conditions shall be complied with by the Contractor unless specified otherwise.

5.04 Use of asbestos, fiberglass or other NARF (non-asbestos respiratory fibers) material shall not be permitted for any application.

5.05 The detailed design of each system and equipment specification shall contain reference to the specific code or standard to which the item is designed. In general, the following Codes and Standards shall apply.

- American Society of Mechanical Engineers (ASME)

  a. Boiler and Pressure Vessel Code, Sections I, II, VIII, IX
  b. Power Test Codes, as applicable

- American Society of Civil Engineers (ASCE)

- American National Standards Institute (ANSI)

  a. Code for Power Piping B31.1
  b. Dimensional Specifications as applicable

- American Society of Testing & Materials (ASTM)

  a. Material Specifications as applicable
  b. Sampling and Testing Standards as applicable

- American Boiler Manufacturers Association (ABMA)

- American Chain Association (ACA)

- American Railway Engineering Association (AREA)

- American Welding Society (AWS)

- American Water Works Association (AWWA)

- American Iron and Steel Institute (AISI)

- Crane Manufacturers Association of America (CMAA)

- Thermal Insulation Manufacturers Association (TIMA)

- Tubular Exchanger Manufacturers Association (TEMA)

- Heat Exchanger Institute (HEI)

  a. Standards for Deaerators

- American Petroleum Institute (API)

  a. Std. 613 - Standard for Special Purpose Gear Units

- Hydraulics Institute

  a. Standards for Centrifugal, Rotary, and Reciprocating Pumps

- National Fire Protection Association (NFPA)

  a. National Electrical Code
  b. Fire Protection Codes as appropriate

- Institute of Electric and Electronics Engineers (IEEE)

- National Electrical Manufacturers Association (NEMA)

- National Electrical Safety Code (NESC)
- American Association of State Highway and Transportation Officials (AASHTO)
- Steel Structures Painting Council (SSPC)
- American Institute of Steel Construction (AISC)
- American Concrete Institute (ACI)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- Manufacturers Standardization Society (MSS)
- Metal Building Manufacturers Association (MBMA)
- Pipe Fabrication Institute (PFI)
- Compressed Air and Gas Institute (CAGI)
- Conveyor Equipment Manufacturers Association (CEMA)
- Industrial Gas Cleaning Institute (IGCI)
- Instrument Society of America (ISA)
- Environmental Protection Agency (EPA)
- Occupational Safety and Health Administration (OSHA)
- State of North Carolina Building Codes (NCS)
  a. Sanitary Code
  b. Erosion Control Code
  c. State Building Code
  d. Fuel Gas (Propane) and Plumbing Code
  e. Fire Protection Code
- Factory Mutual System (FM)
  a. Handbook of Industrial Loss Prevention
  b. Factory Mutual Approval Guide

- Underwriters Laboratories Inc. (UL)

  a. UL Products Lists (where not FM listed)

- National Solid Waste Management Association

- Solid Waste Association of North America

6.00 COMBUSTOR/STEAM GENERATOR

6.01 One balanced draft combustor and steam generator (referred to herein as the boiler) shall be provided. The unit shall be designed to combust 249 x 10^6 Btu/hr of RDF fuel as described in SECTION 0080. Superheater outlet conditions are designed to be 645 psia, 710°F.

6.02 The combustor shall be of the circulating fluidized bed type, field erected and designed for balanced draft operation. The combustor shall be capable of burning the range of RDF fuel as specified in SECTION 0080.

6.03 The boiler superheater shall be an integral, two-stage convective type. The superheater outlet temperature control shall be by attemperation between superheater sections. A complete automatic attemperating water spray control system shall be provided.

6.04 A complete digital solid state flame safety system shall be furnished for main fuel and auxiliary firing of propane in the combustor for start-up . System shall supervise and control transient and steady state operation of the combustor in order to prevent a catastrophic accident. Flame safety system shall provide for operator control of the boiler from the control room and shall be incorporated into the DCS.

6.05 Sootblowers shall be provided for maintaining boiler performance. Superheater and convective sections shall be provided with sootblowers. Sootblowers shall be motor driven and shall be automatically and sequentially operated from the control room. Steam supplied from the superheater shall be used as the cleaning medium. Soot blower system shall include all DCS based controls, piping, valves and drains necessary for a complete system. Manufacturer shall be Diamond, Bergman or Copes-Vulcan.

6.06 Environmental Commitments

A. An Air Permit application has been issued by the North Carolina Department of Environment, Health and Natural Resources with the emissions and design limitations described herein. The facility design shall conform to these limitations. The individual guaranteed emission rates are provided in SECTION 0080.

B. Firing Limitations

Fuel	Annual Usage	Burner Max.	Firing Rate/Boiler
RDF	218,124 TPY	By Vendor	249.0 x 10^6 Btu/hr
Propane (Start-up Only)		By Vendor	60.0 x 10^6 Btu/hr (or less)

C. Criteria Emission Limitations

Maximum value of criteria pollutants emitted for the boiler to the atmosphere via stack shall not exceed the values listed in SECTION 0080.

D. Flue Gas Temperature

The temperature of flue gas ahead of the baghouse shall not exceed 300°F.

E. Trace Toxic Emissions

The boiler and flue gas system shall be designed to limit the total trace toxic emissions from the Plant to the N.C. DEHNR Air Permit No. 07737, dated 6/6/94, as attached.

Other restrictions are described in DEHNR Air Permit No. 7737, dated June 6, 1994 which is attached to this SECTION.

6.07 Fuels

A. Main Fuel - Refuse Derived Fuel, 100% Heat Input

B. Ignition & Warm-up - Propane, up to 25% Heat Input

C. Combustor shall be provided with two main fuel feeders, each capable of 100% fuel input rate.

6.08 Performance Fuel

A. The fuel analysis to be used to determine the combustor and steam generator performance guarantee is defined in SECTION 0080.

6.09 Design Fuel

A. The steam generator and its support systems shall be designed to fire fuel with a moisture content within the performance fuel specified in SECTION 0080. The design fuel shall have the same ultimate analysis (dry basis) as the performance fuel except that its moisture content (wet basis) shall range from 20 to 35% (see SECTION 0080).

6.10 Feedwater and Steam Purity

A. Boiler feedwater shall come from the DuPont boiler plant at the following conditions:

Temperature	250°F
Silica	0.1 ppm (max.)
Conductivity	<35 µmho/cm
pH	7 to 10.8
O_2	10 ppb (max.)

B. The purity of steam leaving the superheater shall not exceed:

Total Dissolved Solids, TDS	50 ppb
Sodium, Na	20 ppb
Silica, SiO_2	20 ppb
Cation Conductivity	0.2 µmho/cm

with a boiler water solids content at any level up to and including the limits recommended by the American Boiler Manufacturers Association for the appropriate pressure condition. This criteria shall be met at any operating load.

6.11 Temperature Control

A. The superheater attemperating water spray control system shall be designed to maintain the design steam temperature at all boiler loads down to 80% of the boiler's maximum continuous rating. The outlet temperature below 80% steam flow shall be allowed to drop in accordance with the boiler manufacturer's normal design. Temperature control range shall not be dependent on fuel moisture content.

6.12 Blowdown

A. The steam generator shall be designed for continuous blowdown rates from 0-10%. Performance shall be based upon a continuous blowdown of 0%.

6.13 Water Chemistry

A. Boiler water chemical treatment by Du Pont will consist of an oxygen scavenger injected into the boiler feedwater after the deaerator.

B. Concentration of solids in the boiler drum shall be controlled by continuous blowdown.

C. Water for superheater attemperating spray shall be deaerated, demineralized makeup water from the Du Pont Boiler Plant. As an alternative to the aforementioned, the boiler manufacturer may provide a drum steam condenser and, if necessary, attemperating water injection pumps as a complete desuperheating water system.

D. Boiler pH and scale control shall be by on-site chemical injection which shall be compatible with the DuPont system.

6.14 Turndown

A. RDF burning system shall be capable of providing stable combustion under automatic control with all feeders in service from full capacity to 30% of full boiler output when firing either the design or performance fuels. Emissions may be affected.

B. The automatic control system shall be capable of controlling the boiler with any single fuel feeder out of service. Emissions may be affected. Normal operation shall be with all fuel feeders in service.

6.15 Furnace Design

A. Combustor and steam generator shall be designed to withstand transients of ± 35 in. w.g.

B. The combustor/furnace shall be maintained at a negative draft for all loading conditions.

6.16 Boiler Cleaning

A. The steam generator internal wetted surfaces shall be cleaned prior to operation by chemical cleaning as recommended by the manufacturer and a steam blow. Chemicals for cleaning shall be provided and disposed of by the Contractor.

6.17 Forced Draft And Primary Air Fan

A. The forced draft (total air) and primary air fans shall be designed for the full combustion air requirements of the maximum moisture design fuel including air leakage under the following net operating conditions:

		FD	PAF
1.	Flow	100% MCR	Per Boiler Mfr.
2.	Excess Air	39% (min.)	39% (min.)
3.	Air Leakage	3%	3%

4.	Inlet Air Temp. Range	50° - 100°F	Per Blr. Mfr.
5.	Maximum Fan Speed	1200 RPM	1800 RPM

B. The fans provided shall be specified with the following test block margins above net requirements. Net requirements are defined as volume, temperature and pressure requirements at MCR, when burning the design fuel under the operating conditions shown above.

Volume	-	115%
Static Head	-	132%
Temperature	-	125°F

C. Motor driver shall be sized for test block conditions with 80°F inlet air temperature.

6.18 All piping and tubing and their respective support systems shall be designed in accordance with ANSI B31.1, Power Piping Code and ASME Boiler and Pressure Vessel Code Section I.

6.19 Flame Safety System

A. The flame safety system for the auxiliary burners shall be in accordance with NFPA Standards. The system shall provide for control of the unit from the Central Control Room. The control logic shall be implemented in redundant DCS hardware.

6.20 NO_x Reduction System

The steam generator shall be provided with an ammonia based selective non-catalytic NO_x reduction system. The design of the system is to be by the Contractor to meet the following requirements.:

A. Anhydrous ammonia shall not be used as the system's reagent. Aqueous ammonia (~ 25% solution) shall be the reagent. Ammonia slip shall meet the emissions requirements of SECTION 0080.

B. Content of reagent in the flue gas measured at the location of the CEM equipment shall not exceed guarantee as described in SECTION 0080.

C. The system provided shall be complete to include reagent unloading and transfer facilities, transfer pumps and piping, reagent injection equipment, control, monitoring and recording instrumentation. The ammonia delivery truck area shall be equipped with suitable filling and gas relieving system.

D. The Contractor shall conduct a separate performance test demonstrating the capabilities of the system as required by the air permit.

E. Reagent shall be stored out-of-doors in a single 12,000 gallon tank located in a diked area. The dike shall be provided with an enclosed sump and water quench to reduce the rate of ammonia (if used) evaporation should a spill occur. Piping shall permit the tank to be in service while it is being is filled. Transportation, handling and storage of reagent shall be in conformance with Code of Federal Regulation 29 CFR 1910.111 and ANSI K61.1.

6.21 Safety Valves

A. The steam generator shall be provided with all safety valves as required by the ASME Boiler Code.

B. In addition to code valves, the superheater outlet shall be equipped with a control valve type of "relief valve" to permit relief of steam pressure from the control room. The non-code relief valve shall be provided with double manual isolation and bleed valves to permit removal and repair of the non-code relief valve while the steam generator is in operation.

C. The non-code relief valve vent shall be connected to a silencer which shall keep noise emissions to statutory limits.

6.22 Sand Bed System

A. Sand will be delivered to a storage silo from truck delivery. The silo will be sized for a minimum of 7 days of full load operations.

B. The sand will be delivered to the plant in pneumatic delivery trucks, with the sand being conveyed pneumatically into the storage silo by the delivery vehicle blower and system fill pipe. The silo shall be equipped with a self-cleaning filter to control the release of fugitive dust to the atmosphere.

C. Sand quality shall be:

Silica sand with over 75% silica content.

Size distribution:

Average	-	0.18-0.36 mm
Minimum	-	<1% less than 0.09 mm
Maximum	-	<0.1% larger than 0.7 mm

Agglomeration Temperature - 2200°F (minimum)

D. Sand piping shall be specifically designed for abrasive service with replaceable wearback elbows which are accessible for inspection and replacement.

6.23 Feedwater Control Valve

A three element control system shall be provided to control feedwater flow to the boiler.

6.24 Main Steam Line

A. The main steam line from the boiler outlet to the DuPont boiler plant shall be designed in accordance with Paragraph 20.00 of this SECTION.

B. The steam line shall be above-grade and run on a pipe structure with other utilities to tie into the DuPont main steam header at two locations. The first tie-in shall be on the south side of DuPont's Boiler No. 3. The second tie-in shall be on the north side of the feed to Boiler No. 1. The tie-in points shall be valved and coordinated with DuPont. See the drawings for additional details.

C. The pipe shall be designed for a steam blow prior to final tie-in. Line cleanliness shall be determined by DuPont. Cleanliness standard to be established.

D. Start-up condensate drip pots in the area of the EGF shall drain to the EGF blowdown tank. Disposal of drains near the DuPont plant shall be coordinated with DuPont.

E. The steam flow meter shall be located at the EGF plant and be of the ASME nozzle type. Meter shall be readily accessible for calibration and testing.

F. Warm-up bypass shall be provided around all line isolation valves.

G. Use of expansion joints is not allowed. Tie-in stress analysis shall carry to first DuPont steam line anchor downstream of each tie-in.

H. Line size and insulation thickness shall provide for delivery of steam to DuPont at no less than 600 psia, 700°F.

I. A second meter (orifice type) shall be located at the DuPont end of the steam line. Output signal shall be taken to DuPont's DCS system.

7.00 COOLING WATER SYSTEM (See Dwg. No. D-071-030-F5)

7.01 Equipment requiring water cooling will be served by an existing cooling tower located on the Du Pont site. Supply and return lines to the tower shall be provided as part of the project. Circulating water shall be supplied to the plant from DuPont's existing cooling tower. Available thermal capacity is 50 x 10^6 Btu/hr. The tower design range is 20°F with a 95°F maximum water temperature off of the tower. Other circulating water properties include:

Chlorine	0.15 - 0.25 ppm free
pH	8.5 - 9.2
Conductivity	800 - 2000 µmho/cm
Molybdenum	1.7 - 2.4 ppm

7.02 Equipment Heat Exchangers

Heat exchangers listed below (and others as required) shall be cooled from the circulating water system.

- Air Compressors
- Miscellaneous Lube Oil Coolers
- Draft Fans (if required)
- HVAC Equipment (if required)

7.03 Circulating Water Booster Pumps

The system shall have two (2) 100% capacity booster pumps for increasing the pressure through the circulating water system. The pumps shall be supplied with a 5% flow margin and 10% head margin. The new pumps shall be located indoors at the EGF site.

7.04 Closed Cooling Water System

DuPont's circulating water shall be pumped through one of two 100% capacity heat exchangers to isolate DuPont's water from the plant's closed cooling water system. The closed cooling water system shall consist of two 100% capacity pumps, a suction side storage tank, chemical additive system, and piping to and from individual equipment heat exchangers.

8.00 CONDENSATE/FEEDWATER SYSTEM (See Dwg. D-071-030-F3)

8.01 Feedwater

Feedwater is to be taken from a header in the Du Pont boiler house common to the existing boilers. A feedwater line shall be run on a pipe bridge to the

EGF. Feedwater flow shall be measured using a flow nozzle which complies with the provisions of ASME PTC 6.1.

8.02 Deaerator and Deaerator Storage Tank

A. A new deaerator and storage tank shall be furnished and installed in the existing Du Pont boiler house by the Contractor to replace the existing south deaerator tank which shall be removed by the Contractor. Location shall be as shown in the drawings. The existing north deaerator shall remain in place and shall function as a parallel or backup unit. Contractor shall provide controls to a terminal box near an existing DuPont I/0 cabinet. Final tie-in to DuPont's DCS shall be by others.

B. The new deaerator shall be the direct contact spray atomizing tray-type with separate storage tank. The storage tank shall have minimum operating capacity (between level alarms) of 6000 gallons.

C. Steam supply to the new deaerator shall be supplied from the existing low pressure header in the Du Pont plant. Steam supply to the header is from a controlled turbine extraction. A pegging steam system off the main steam header shall also be installed for use during low load operation.

D. The deaerator shall also be designed to receive vents from Du Pont boiler house feedwater heaters and other equipment located within the Du Pont boiler house.

E. The deaerator design shall comply with the requirements of the ASME Code, Section VIII, Division 1, and HEI standards for deaerators.

F. The deaerator shall reduce feedwater oxygen content to a maximum 0.005 cc per liter over the entire operating range of the unit. Deaeration capacity shall be for 450,000 lb/hr of 60°F makeup water.

G. The deaerator storage tank shall be provided with a steam sparging line for tank heating from the auxiliary steam system supplied from Du Pont.

H. Contractor shall evaluate the need for any support for the new deaerator. Contractor shall provide new supports, if required.

8.03 Boiler Feed Pump

A. Contractor shall furnish and install one new boiler feed pump in the Du Pont boiler house. Pump shall provide 140,000 lbs/hr to twin headers for both the new RDF boiler and the existing Du Pont coal boilers. The new pump shall be designed to operate in parallel with existing pumps and shall closely match the existing pump curves. The

pump may be barrel or horizontally split case multistage type. The pump shall be motor-driven.

B. The feed pump shall be provided with its own independent recirculation system. Recirculated water shall be piped individually to both deaerator storage tanks.

C. If required, pumps shall be cooled from the existing cooling water lines located in the Du Pont boiler house.

D. The new motor-driven boiler feed pump shall require a new motor starter which is to be fed from the existing DuPont system.

9.00 PLANT WATER SYSTEMS

9.01 The plant water systems include the following systems:

A. Boiler Make-up Water System

B. Cooling Water System from Du Pont Cooling Towers

C. Potable Water System

D. Plant Service (Domestic) Water

E. Plant Drains and Waste Water

F. Fire Protection

G. Sanitary Waste Water System

9.02 Potable Water System

A. This system shall provide water for human consumption and sanitary plumbing applications.

B. Water will be provided from a Du Pont interface.

9.03 Boiler Make-up Water System

Boiler make-up water will be supplied by the Contractor to the new deaerator from the existing Du Pont Water Treatment System.

9.04 Service Water System

A. This system will be supplied from the DuPont domestic water system. The system shall distribute service water throughout the plant for wash down of selected areas and non-potable applications such as cooling medium for bottom ash conveyors.

9.05 Plant Drains and Wastewater Treatment

A. All process waste stream which have a potential for oil contamination shall be collected and processed for oil separation prior to discharge to the Du Pont sewer system.

B. Effluent from the blowoff tank system shall discharge directly to the existing Du Pont sewer system.

C. A system of floor drains and sumps shall also be incorporated into the overall design of the plant. The system shall consist of collection troughs, sumps, piping, fittings and valves for gravity drainage of waste water to various collection points for delivery to the Du Pont sewer system via the oil/water separator.

D. Equipment, floor drains, area sumps and storm water from the transformer area shall be collected and pumped through an oil/water separator prior to discharge to Du Pont sewer system

E. The sewer line shall be metered for flow and T.O.C. at its exit from site. Meter shall be provided by Contractor. The line shall be run by the Contractor to the tie-in location shown on the drawings. The tie-in point is approximately 30 ft below grade.

F. Storm runoff from roof drains shall be collected and routed to the Du Pont storm runoff system with no additional treatment.

9.06 Fire Protection System

A. Prior to start of on-site construction, Contractor shall prepare a fire protection plan and obtain approval by the Local Authority. Contractor shall determine the appropriate fire protection requirements to meet the insurability requirements of a plant of this type and shall use NFPA 850 as the definition of good engineering practice. Contractor shall determine the appropriate fire protection measures by contacting several insurers offering policies to plants of this type. Contractor shall consult with Owner to determine the final fire protection package. The system descriptions given below are intended to guide Contractor efforts and represent typical types of systems required by the waste energy plant insurers but do not necessarily describe the complete fire protection system required for this plant.

B. The fire protection system for the EGF shall consist of fire suppression and detection systems. This fire protection system shall include an underground fire water loop, above grade sprinklers, hose stations, portable extinguishers and a zoned fire detection system. This design shall be based on using water from the Du Pont firewater system at the available pressure. No new fire pumps are required for

this plant. Design firewater pressure from the Du Pont system is 60 - 100 psig. A minimum of two tie-in points with the DuPont system shall be required.

C. The fire water loop shall supply firewater on demand to the hydrants and standpipes located at key locations around the EGF and to the water sprinkler systems.

D. A fire hose station standpipe system shall be installed at key areas within the Plant. This system shall include open rack type hose stations equipped with hoses and nozzles suitable for safe and effective use on identified hazards and involved equipment.

E. Excluding the Control Room, fixed fire suppression systems shall be provided for the following areas as specified:

Area	Type
Fuel Storage Bins	Dry Pipe Deluge
Fuel Conveyors	Dry Pipe Deluge
Office Area	Wet Pipe Sprinkler
Control Room	Portable Fire Extinguishers
Electrical Room	Portable Fire Extinguishers

F. A fire detection system shall be furnished to provide smoke detection for key powerhouse building areas as well as the office areas with UV/IR fire detectors to be provided for potentially hazardous locations within the fuel handling area.

G. A fully automatic fire detection, alarm, actuation and signaling system shall be provided in accordance with NFPA 72E with annunciation in the Control Room. Electrical rooms, personnel and other areas shall be equipped with smoke detection. A central fire protection system status panel shall be provided and located in the Control Room. This panel shall have indicator lights for each protected and/or monitored area and shall include audible and visible alarms. The system shall provide an alarm function to the local Fire Department and to the Du Pont Kinston Works Fire Alarm System. An audible and visual site alarm shall also be provided to notify personnel that a fire has been detected.

H. A wet standpipe system shall be installed in all heated buildings in accordance with NFPA-14. The systems shall be designed for Class II service. Hose stations shall be located such that all portions of each story of each building shall be within 20 feet of a nozzle when attached to not more than 75 feet of 1-1/2 inch fire hose. A combination fog spray/solid stream nozzle shall be provided at each hose rack.

I. Portable hand extinguishers shall be provided in accordance with NFPA-10 throughout the buildings to provide protection against small local fire hazards.

J. Office areas shall be provided with wet pipe sprinkler protection in accordance with NFPA-13.

K. The control room shall be provided with portable type hand extinguishers.

L. Cable trays shall not be routed through high risk or high temperature areas. When necessary to do so, provide sprinkler coverage.

9.07 Sanitary Water System

See Paragraph 14.00 of this SECTION.

10.00 RDF RECEIVING/HANDLING SYSTEM (See Dwg. D-071-030-F4)

10.01 General Description

The system described below may be modified by Contractor to best suit the type of system /equipment furnished.

A. The fuel handling system shall be designed to accept either shredded or unshredded RDF from 20 ton/105 cubic yard self-unloading trailers from the Wilson County and Lenoir County MRF's. The trailers will be coordinated to match the EGF receiving system. Fuel transfer interface shall be designed to prevent spillage.

B. The RDF receiving system shall provide for unloading of four walking floor trailers containing shredded RDF from the Wilson County MRF. Trailers shall unload into an enclosed unloading point onto a single conveyor system which shall stock out RDF to the enclosed storage area.

C. The fuel stock-out system shall be variable speed and controlled by the plant DCS. RDF shall be taken to fuel storage area by a conveyor system designed for at least twice the unloading capacity of two RDF trailers.

D. Facilities shall be provided for parking a minimum 9 live-bottom trailers to be maintained at the EGF away from the front of the receiving bays.

E. RDF shall be moved into a single 1800 ton storage facility. Two traveling screw-type reclaimers shall be provided with separate reclaim conveying systems capable of feeding either of the two boiler metering bins.

F The boiler is to be fed by two separate inclined full capacity conveyors.

G. The boiler shall be provided with two separate fuel metering bins which ultimately supply the RDF to the combustor. Each metering bin system shall be sized to provide 100% of fuel to the combustor.

10.02 Design Criteria

A. All fuel equipment to be sized to supply a minimum of 249 x 10^6 Btu/hr to the circulating fluidized bed type steam generator. Sizing of fuel particles to be in accordance with steam generator manufacturer's requirements

B. The entire fuel unloading, conveying and feeding system shall be suitably enclosed and ventilated to control release of fugitive dust and odors. Some combustion air for both boilers shall be drawn from the ventilation system header. Booster fans shall be provided if required.

C. RDF fuel density shall be taken as 15 lb/ft^3 for purpose of sizing the storage facility.

10.03 Other Design Features

A. Fuel receiving handling system design shall be responsive to the following:

1. Must not utilize tipping floor and front-end loaders.

2. Shall utilize a four truck receiving area.

3. Shall utilize a single 1800 ton RDF fuel storage facility and two reclaimers.

4. Space shall be provided on site to store inventory in 9 trailers.

5. All fuel handling areas shall be sprinklered. All or some of the combustion air shall be drawn from the RDF storage area.

6. All controls for the fuel handling system shall be implemented in the EGF Distributed Control System.

7. Provide appropriate fire sensing and hydrocarbon vapor monitors for explosion limit detection.

11.00 FLUE GAS SYSTEM

11.01 General

The combustion gases exiting the circulating fluidized bed boiler economizer shall be ducted through a flue gas cleaning system and to the stack for discharge to the atmosphere. The system shall include a mechanical collector and baghouse, induced draft fan, a stack with internal flue, dampers, ducting, breeching and the necessary supports.

11.02 Mechanical Dust Collector

The mechanical dust collector shall be located immediately downstream of the boiler and provide removal of particulate from the gas stream to reduce particulate loading on the bag house and to protect the ID fan from excessive wear. The unit efficiency shall be at least 45% with the boiler operating at MCR.

11.03 Induced Draft Fan

A. One induced draft fan located downstream of the baghouse shall be provided for the boiler complying with the following design criteria:

Net Flow Conditions

- Boiler operating at MCR
- Design Fuel
- Design Excess Air
- Design Inlet Gas Temperature

Test Block Conditions

- Net flow x 1.20
- Net static head x 1.44
- Net inlet temperature + 25°F
- Maximum speed 1200 RPM

B. Fan drive shall be rated for test block conditions and shall be constant speed. Two speed fan drives are acceptable.

C. Damper control shall be provided and shall be electric (motor) or pneumatic using instrument quality air.

11.04 Baghouse

A. A baghouse shall be provided with a minimum of 31,828 square feet of filter area to further enhance flue gas particulate removal to meet air quality permit requirements. The unit shall be a modular, pulse jet type self-cleaning filter or equivalent design with housing of carbon steel construction designed for ± 35" W.C. Each module shall include a clean air plenum with access features to facilitate inspection and bag removal. The lower section of each module shall be fitted with an ash hopper. The fly ash hopper shall include an access hatch to allow internal inspection and maintenance of the "dirty side" of the module.

B. A by-pass duct, with pneumatically operated damper or poppet valve, shall be provided between the baghouse "dirty gas" inlet manifold and the "clean gas" outlet manifold. This arrangement will permit the baghouse to be bypassed during start-up when the gas temperatures are below the dew point.

C. Capture of sulfur, chlorine and mercury emissions shall be enhanced through the use of a filter bag pre-coat system. The system shall inject dry pulverized hydrated lime and activated carbon into the flue gas stream upstream of the baghouse from metering bins. A storage silo shall be provided for hydrated lime. The silo shall be suitable for at least seven days of full operation without recharging. Delivery to each storage silo shall be by truck. A truck unloading system shall be provided. Activated carbon shall be stored and metered to the flue gas system by a system specifically designed for that purpose. The filter bag precoat system shall maximize the use of reagents.

11.05 Ductwork

A. Ductwork shall be arranged to be self-cleaning as much as possible with a maximum gas velocity of 4000 fpm at net flow conditions. Areas with potential buildup of ash shall be provided with hoppers and be tied to the ash collection system. Hoppers shall be provided with two rod-out ports at each ash system entry point. Hopper access doors shall be padlocked.

B. Ducts shall be insulated and be designed for outdoor service with an internal pressure of + 35" W.C. Expansion joints shall be provided to avoid distortion of equipment due to thermal growth.

C. Ducts shall be provided with access ports and ladders.

D. Expansion joints shall be of fabric and be provided with baffles to protect the fabric from flue gas erosion.

E. Ductwork support system shall include spring supports consistent with good engineering practice.

F. Instrumentation shall be provided in the ductwork to measure and record pressure drop across each piece of dust collecting equipment.

11.06 Stack

A. The stack shall be ground-mounted free-standing design with internal insulated flue. Stack shall be provided with lighting and markings to satisfy local and FAA code requirements. Stack shall be of steel design and constructed in accordance with ASME/ANSI specification STS-1. Flues shall be of a material which experience has shown is suitable for service.

B. Stack height shall be 213 ft above grade. Flue diameter shall be set to achieve 48 ft/sec exit gas velocity at boiler MCR conditions.

C. The stack shall be provided with 360° access platforms, at least five feet wide, handrails and toeplates, ladders to provide access to EPA test ports and gas sampling stations. The foregoing shall adequately allow for maintenance and compliance testing. A davit capable of supporting 500 lb shall be provided to lift test equipment to the test platform. Provide a minimum of two 110V, 20A electrical circuits at the platform.

D. Lightning protection shall be in accordance with NFPA 78.

E. A painters trolley ring shall be provided in accordance with ASME/ANSI STS-1. The imposed load shall be 500 lb, minimum.

11.07 Continuous Emissions Monitoring Equipment

A. Continuous Emissions Monitoring shall be provided to monitor the emissions from the boilers.

B. Continuous Emissions Monitoring (CEM) and recording equipment shall be provided for the following parameters as required by the Air Permit:

- Nitrogen Oxides, expressed as NO_2
- Carbon Monoxide, CO
- Opacity
- Sulfur Dioxide, SO_2

C. All CEM equipment shall meet U.S. EPA performance specifications, be EPA certified, and North Carolina DEHNR requirements.

D. The plant's continuous monitoring (CEM) gas taps shall be located in the stack near the EPA test ports.

E. CEM analysis equipment shall be located in a weatherproof (heated and air conditioned) enclosure suitable for the application at grade elevation . Provide a minimum of two 110V, 20A electrical circuits inside the enclosure.

12.00 ASH AND RESIDUE HANDLING SYSTEMS

12.01 The ash handling system shall be of the vacuum type conveying system used in conjunction with mechanical conveyors. The system provided shall collect and transport fly ash from the mechanical collector and baghouse to a common ash silo.

12.02 The outlet of the boiler ash hopper(s) shall be located at the low point of the vertical flue gas paths. Mechanical screw conveyors shall be provided to collect the flyash from the boiler ash hoppers and mechanical collector ash hoppers and convey the ash to the storage silo.

12.03 The system for collecting and transporting ash from the ash hoppers of each baghouse module shall be similar to the system described above.

12.04 The pneumatic ash transport system shall convey the collected ash from the various collection points to the top of the ash silo where the ash will be discharged into the silo. The conveying air shall be discharged to atmosphere through a self-cleaning fabric filter unit. The ash silo shall provide five days of fly ash storage capacity based on normal plant operating conditions. An air blast system shall be provided to be used in conjunction with conveying equipment for discharge of ash from silo to a closed trailer. The ash silo and piping shall be constructed of materials experience has shown to be suitable for intended service.

12.05 Loading of trucks with ash from the silo shall be accomplished within an enclosed building. Provision shall be made in the design for loading dry ash into a closed trailer. Building shall be designed for drive-through loading. Building floor drains shall be directed to the wastewater treatment system. Platform and stairs shall be provided to allow connection of ash piping and vent for truck load-out. The ash silo structure shall provide space for the future installation of an ash conditioning system as described herein.

12.06 The future ash conditioning system shall be provided in the form of a water based liquid reagent (1% phosphoric acid solution) and mixing pug mill. The ash shall be conditioned prior to loading into trucks. The system shall be designed to add up to 25% reagent by weight to the ash being loaded. Reagent storage shall be suitable for at least seven days of full load operation.

12.07 The ash system shall be provided with controls to allow manual operation of the system and load-out of ash from the central control room and from a local control station. Systems loading/storing operations shall be monitored from the control room by closed circuit television.

12.08 Residue bed material removal from the circulating fluidized bed combustor shall be accomplished using an automatically operated, bed classifier and drain system, discharging into a mechanical bed drain conveyor. The bed classification system shall remove oversize material and discharge it to the drain conveyor for disposal via the bottom ash system.

12.09 A cooling system for bottom ash shall be provided to minimize danger to personnel and damage to equipment. Cooled bed material shall be discharged into a roll-off type container.

13.00 AUXILIARY SYSTEMS

13.01 Compressed Air

A. The compressed air system will supply air to the following systems:

- Baghouse - Pulse Air for Bag Cleaning
- Ash Handling
- Service Air
- Instrument Air

B. The compressed air system shall consist of two compressors which supply both the service air system and instrument air system. Air intakes shall be indoors and shall be equipped with air filter silencer. An aftercooler with moisture trap and appropriate oil and particulate filters shall be provided.

C. Two identical 100%, non-lubricated type, electric motor-driven air compressors shall be provided. Each air compressor shall be sized for the required service but shall have a 20% flow design margin over that calculated at 125 psig minimum discharge pressure. Air receiver, 300 gallon minimum, shall be provided. Air-cooled units are acceptable.

D. Controls for service air piping shall be arranged to allow preferential supply to the instrument air system upstream of the instrument air drier in the event of low air pressure. Controls shall provide for automatic unloading, shutdown, start-up and backup features.

E. A two-tower desiccant type air dryer, regenerated by heat of compression, shall be provided to deliver dry instrument air at -40°F

dew point. An after filter shall be installed downstream of the air dryer to eliminate desiccant carryover into the instrument air system.

F. The service air header pressure shall be controlled by the receiver pressure which is maintained by the load/no load type compressor regulator. An automatic back pressure regulator shall be provided on the service air system to prevent depressurization of the instrument air system by excessive service air use or leakage.

13.02 Heat Trace System

A. A heat trace system shall be furnished where required to prevent freezing of process lines and tanks.

B. Electric heat tracing may be used. Self-limited heating cable shall be used and controlled by line sensing thermostats. Each system shall have visual or instrument indication of operation.

13.03 Limestone (or Dolomite) System

A. Limestone (or Dolomite) will be delivered to a storage silo from trucks. The silo shall be sized for seven days of full-load operation without recharge. The storage site outlet shall be provided with a dense phase conveying system which transports limestone to a surge bin, at the boiler. From the surge bin, limestone is metered into the boiler.

B. The limestone will be delivered to the plant in pneumatic delivery trucks, with the limestone being conveyed pneumatically into the storage silo by the delivery vehicle blower and the system fill pipe. The silo shall be equipped with a self-cleaning filter to control the release of fugitive dust to the atmosphere. Conveyor controls and level indication shall be implemented through the DCS.

C. Controls shall be suitable for the boiler system and equipment being provided by the Contractor.

D. Limestone quality shall be young amorphous with CaCO3 content over 90% by weight.

13.04 Boiler Blowoff/Blowdown

A. A boiler blowoff system shall be supplied to provide a means of removing accumulated solids from the drums and headers of the boiler. The blowoff system shall collect and control steam cycle wastes on a periodic basis.

B. The blowoff tank shall be vented to the atmosphere and shall drain to the waste water system with a drain quench system.

C. The boiler continuous blowdown system shall include a flash tank, vent and associated drain piping to the waste water system with a quench.

D. Blowdown from the boiler steam drum shall be piped to the flash tank.

13.05 Propane Storage System

Propane will be used as a start-up fuel for the steam generator. The plant design shall provide for the outdoor storage of sufficient propane for at least four boiler start-ups (as recommended by the CFB manufacturer) or 12,000 gallon maximum size. Tank shall be designed and constructed in accordance with Section 8 of the ASME Pressure Vessel Code, NFPA 58 and applicable OSHA regulations (1910.110). Vaporization equipment shall be steam or atmospheric type. Tanks shall be located at least 50 feet from any structure.

13.06 Lifting Equipment

The plant design shall include providing monorails and lifting devices to service heavy items of equipment such as fan components and drives, etc. The boiler/combustor design shall provide for a hoist way from the ground elevation to the highest level.

13.07 Chemical Feed Equipment

A chemical feed system for scale control in the boiler cycle shall be provided. Injection point shall be at the boiler drum. The system shall be a prepackaged design and shall not make use of 55 gallon type drums. The system shall be contained in a diked area sized to contain 110% of the storage tank volume.

14.00 BUILDING SERVICES

14.01 Building services include the heating, ventilating, air conditioning and plumbing systems associated with the work.

14.02 HVAC Systems

A. The Plant HVAC systems shall be designed to meet the criteria specified in Paragraph 14.03.

B. A zoned, pressurized, forced air HVAC system shall be provided to service the control room and administrative areas. The control room zone shall allow for adequate make-up air and shall provide for adequate room humidity control. The HVAC units shall be mounted in locations which allow easy access for servicing.

C. Remote work areas requiring heating, ventilation and/or air conditioning shall be serviced by individual units selected to match the specific application. Ducted exhaust fans shall be used in toilet areas and locker rooms. Areas where combustible materials will be stored shall have ducted exhaust fans and air intake grills or louvers. Electrical equipment rooms and offices shall be pressurized to minimize dust and odor intrusion.

14.03 HVAC Design Conditions:

Area	Design Basis	
	Summer	Winter
Control Room	75°F, 50 percent R. H.	70°F
Office, Reception	78°F, 50 percent R.H.	70°F
Toilet Areas	78°F, 50 percent R.H.	70°F
Locker Rooms	78°F, 50 percent R.H.	80°F
Electronic Equip. Room	78°F with Humidity Control	70°F
Battery/Electrical Room	Ventilated	60°F
Maintenance/Equip. Areas	Ventilated	60°F (Ventilated)

Minimum Ventilation Requirements

Plant - to compensate for heat gain
Office - 15 cfm/person
Control Room - 15 cfm/person
Toilets - 40 cfm/water closet or urinal

14.04 Plumbing

A. Potable Water

1. Potable water required for the plant will be supplied from the existing Du Pont utility water lines.

2. Domestic hot and cold water, drains and vents shall be provided for plumbing fixtures. Domestic water heaters shall be electric heated. Fixtures shall include, but not be limited to, water closets, urinals, lavatories, mop receptor, water coolers, floor drains, roof drains, emergency showers and eye washes.

3. Refrigerated water coolers shall be provided in the office and maintenance shop areas and in the vicinity of the control room.

B. Sanitary Waste

Sanitary waste will connect to existing Du Pont sewer line and shall be provided with a comminutor for solids break-up.

C. Roof Drains

1. Roof drains shall be sized on a rainfall rate of 4.0" per hour and in accordance with NCS Plumbing Code.

2. Roof drains and piping sizes shall be in accordance with NCS Plumbing Code.

3. Downspout outlets shall be designed to eliminate ground erosion.

15.00 ELECTRICAL SYSTEM

15.01 General Description

A. The electrical system shall supply the electrical power required for the project from the Du Pont Company existing 12 kV system. Special systems shall include emergency power for lighting and a direct current system for equipment having direct current requirements. The installation shall include fire alarm and communication systems, grounding and lightning protection systems and control and instrumentation wiring.

B. Voltage insulation levels, interrupting capacities, continuous current capacities, circuit protection, and mechanical strengths shall be selected and coordinated in accordance with calculations and the recommendations of IEEE, NEMA, IPCEA, ANSI and NFPA. System protective devices (relays, fuses, breaker trip unit, etc.) shall be selected and coordinated to insure that the interrupter nearest the point of short circuit (or high overload) shall open first and minimize disturbances on the rest of the system.

C. An electrical "Ride-through" feature is required on the power systems. The system is to allow for a one second ride-through or automatic restart of voltage dips of 50% for 20 cycles.

D. All work shall conform to the latest edition of the National Electrical Code (NFPA 70).

15.02 Metering

Metering shall be provided to measure the amount of electricity supplied to the facility from Du Pont Company system on a time of day basis.

15.03 Du Pont Electric Interconnection

A. The EGF shall be fed from two existing Du Pont 12 kV sources located in the CP&L switchyard. Each feed is to be carried above ground in the existing cable way to the pipe bridge connecting the EGF to Du Pont's boiler plant. At that point the feeders will run on the pipe bridge to the EGF.

B. Ground fault coordination with the existing CP&L switchyard breakers shall be by the Contractor.

15.04 Distribution

A System Capacity and Design Criteria

1. The distribution system shall be designed with a sufficient capacity to carry the maximum kVA required for station service. Circuit breakers shall have sufficient continuous current capacity and short-circuit capacity for system operation and protection.

2. Optimum design of the 4.16 kV distribution system as well as power distribution equipment for lower voltage levels must be demonstrated by contractor's calculations submitted to the Owner prior to final selection of equipment. This design shall coordinate selection of switchgear interrupting ratings, voltage ratios and impedances of main and auxiliary transformers, cable sizes and load equipment ratings to meet the following criteria.

   a. Switchgear and circuit interrupting devices at all voltage levels shall have adequate interrupting and close and latch capability for the calculated available three-phase and line-to-ground fault currents. Design shall be in accordance with ANSI C37 series standards.

   b. It shall be possible to start the largest motor on an otherwise fully loaded system without depressing any bus voltage to a level where running motors stall or where motors or driven equipment are at danger of risk of damage. Interaction between the different voltage level systems (4.16 kV and 480 volt) must be considered.

   c. Under normal* operating conditions, 4.16 kV system shall have a voltage spread of no more than 95% to 105% of nominal rating.

d. Under normal* operating conditions, the low voltage systems shall have a voltage spread of no more than 92% to 106% of nominal rating.

*Normal is defined as all required station loads in service; no large motor starting.

B. 4160 Volt System

1. A single 12 kV - 4.16 kV delta-wye transformer shall supply the 4160V switchgear. The transformer shall meet the requirements of ANSI C57.12 and shall be equipped with oil level gauge, pressure vacuum gauge, dial-type thermostat and alarm contacts. Alarms shall be connected to the control room DCS.

2. The 4160 volt switchgear shall consist of a grouped indoor line-up of fused switches and motor starters. Circuit breakers shall be power vacuum breakers, draw-out type, electrically operated with D.C. close and trip. Combination starters shall be complete with full voltage magnetic starter, isolating switch and current limiting power fuses to interrupt the short-circuit current. All components shall be front accessible, facilitating routine inspection and parts replacement. Bus bars shall be copper.

3. Motors 250 horsepower and larger shall be 4160 volts supplied from the 4160 volt metal clad switchgear.

C. Low Voltage System

1. A single 4.16 kV - 480V delta-wye transformer shall supply the 480V system. The transformer shall be equipped with oil level gauge, pressure vacuum gauge, dial-type thermostat and alarm contacts. Alarms shall be connected to the Control Room DCS.

2. The 480 volt switchgear shall be of the indoor metal enclosed type, rated 480 volts, 3 phase, 3 wire, 60 hz with copper bus. The feeder circuit breakers shall be electrically or manually operated power circuit breakers with a current limiting fuse in each pole, draw-out type, with stored energy closing mechanisms, and RMS digital current sensing solid-state microprocessor based trip unit. Provide a minimum of two spaces for additional circuit breakers. Spaces shall be equipped with bus, mounting railing and all other accessories to install breaker.

3. The 480 volt motor control centers shall be of the indoor metal enclosed type for the control of 460 volt, 3 phase, 60 hz motors. Motor starters shall be combination full voltage magnetic type starter and fused switches. Motor starters shall have three

overload devices, one per phase. Each motor control center shall contain as a minimum spaces to add two NEMA size 2 starters and one NEMA size 4 starter. Spaces shall be equipped with bus, mounting railings and all other accessories required to install a starter.

4. Building power and motors 3/4 horsepower up to and including 200 horsepower shall be supplied from the 480 volt, 3-phase, 3-wire system. Small loads, convenience receptacles, incandescent lighting and motors smaller than 3/4 horsepower shall be single phase and supplied from the 208/120 volt, 3-phase, 4-wire system.

15.05 Protective Relays

A. Contractor shall provide a fully integrated relay scheme for the auxiliary power distribution equipment. The relaying scheme shall cause a rapid and coordinated response to electrical and mechanical faults so as to minimize equipment damage while maintaining continuity of service of unaffected systems. Safety of personnel and of the general public, whenever involved, shall be considered of paramount importance in the design.

B. Contractor retains responsibility for final design of a scheme in accordance with recognized standards of good engineering practice for utility systems. The relay scheme will be subject to review and approval by Du Pont Company.

C. All protective relays shall be utility grade, semi-flush mounted on panel fronts with draw-out cases and suitable test switches. In general, protective relays should be provided with targets to facilitate trouble shooting. Auxiliary relays shall have dust covers and generally be mounted in panel interiors.

15.06 D-C System

A. Lead acid batteries shall supply 125 volt D.C. power to operate the main circuit breakers, the 4160V switchgear and emergency lighting.

B. The DC system shall be located in a ventilated battery room. The battery charging equipment shall be fed from the UPS system. Batteries shall function only on loss of AC power. See paragraph 15.11.

15.07 Lighting

A. Illumination levels shall be as follows (footcandle values are minimum required):

1. Outdoor Facilities:

Catwalks, general areas	2 fc
Stairs and platforms	10 fc
Ground level areas including Baghouse, ID & FD fans, bottom ash hopper	10 fc
Roadway & parking areas	1 fc

2. RDF Handling Area

Truck unloading area	10 fc
Conveyors	5 fc
Storage area	10 fc

3. Building Interiors

Control room	50 fc
Office and laboratories	70 fc
Locker rooms, toilets	20 fc
Maintenance shop and spare parts	50 fc
Equipment Areas	50 fc

4. Instrument Areas and Boiler Front 30 fc

B. Metal halide type fixtures shall be used throughout the plant, except in the control room and office areas where fluorescent type fixtures shall be used. Control room lighting shall be provided with a dimming feature. Emergency lighting shall be provided in areas where such lighting may be required on failure of the normal power source. Emergency lighting shall be incandescent. Exit lighting fixtures shall be provided in the control room and office area.

15.08 Grounding

A. Grounding shall be provided to insure safety to personnel and equipment in case of electrical equipment failures and to prevent fires and damage from lightning and/or static electricity and shall be in accordance with IEEE Standard Publications No. 80 and 142. Resistance to ground shall not exceed 1 ohm.

B. The ground system shall consist of a grid of bare, stranded copper cables (#4/0 AWG) buried beneath major buildings and structures and connected to ground rods or wells. Minor structures may use a loop design.

C. System resistance shall be measured with a three terminal "megger" type ground tester which applies AC current to the system and read-out in DC ohms. Two reference ground probes shall be used. Owner shall select location for formal test of ground system. Test results shall be submitted to the Owner within five days.

D. All structural steel, equipment enclosures and/or electrical equipment ground buses shall be grounded through the plant's ground system Taps from the ground system to individual equipment shall be a minimum #2/0 AWG insulated. Non-current carrying part of electrical equipment shall be grounded from the source by a separate wire to the equipment.

E. Cable tray shall be grounded at no more than 50 foot intervals by a continuous ground conductor running the length of the tray. The ground shall connect to the ground wire which shall connect to the ground sysem and to the incoming line end of the ground bus in each switchgear and/or MCC which the tray serves.

F. Conduit runs terminated at tray shall be connected to the tray ground with bare copper conductor (No. 8 AWG min.). Grounding conductors in conduit shall be insulated and shall be terminated on the tray ground. Conduit shall not be considered a grounding conductor except for itself and for lighting fixtures.

G. Ground conductors on power circuits shall be connected to equipment grounds and to the source ground bus.

15.09 Lightning Protection

A. Lightning protection shall be provided in accordance with the requirements of NFPA No. 78 and Du Pont Company.

15.10 Communications

A. Telephone System

Telephone outlets shall be provided in the control room, office areas, conference rooms and in remote buildings. All outlets shall be wired to a central location for connection to the Owner supplied telephone equipment. Provide an empty conduit from Owner's service equipment to telephone company service.

B. Intercom System

In-plant communications shall be provided by radios. Owner will provide and install all radio equipment, including a base station in the control room. Contractor shall provide Owner with DCS manufacturer's recommendations relative to locating the base station.

C. Television System

1. The in-plant television system shall provide individual color cameras with zoom lenses for the following areas:

   Truck Unloading Area (2 required)
   Main Entrance Gate
   Boiler Feed Area

   Provide two additional cameras with illumination for use in fuel handling transfer points. Exact locations to be determined in final design.

   All cameras shall be provided by a single manufacturer.

2. Monitoring of the truck unloading process shall include video recording equipment suitable for taping 12 hours of continuous activity.

3. Three color monitor screens shall be provided in the control room with controls to permit fixed or variable point monitoring for each screen. Provide sequential switcher for automatic camera changing. All monitors shall be mounted in a common console.

D. Computer System

In addition to the computers supplied for plant operations by the Contractor, the Owner will provide a separate computer system for administrative purposes. This system shall be located in the office area in the utility/supply room. The Contractor shall provide 1" conduit to outlets in each office space. This conduit system may be common with the telephone system. Computer cables shall be furnished and installed by the Contractor for connection to the Owner's computer equipment. Provisions for a computer link between the office and plant computers shall be provided by the Contractor.

15.11 UPS System

A. A reliable source of power to instruments and shutdown networks will be furnished as dictated by process control requirements. This power supply will be a static solid-state UPS (uninterruptible power supply) system consisting of a rectifier-invertor unit with battery backup. The UPS system will be located in the battery room and have a capacity of at least 125 percent of the DC load. Batteries shall be sized for 30 minutes of running time upon power failure.

15.12 Conduit and Tray

A. Underground ductbank conduit shall be a minimum of 3 inch PVC.

B. Underground conduit stub-ups will terminate in couplings 1 inch from the floor or foundation on electrical rooms, and 6 inches from grade for motors or other connections. Above-grade conduit will be rigid, hot dipped galvanized steel. Aluminum conduit shall be used in corrosive atmosphere where aluminum is better suited. Above grade conduit will be securely and adequately supported and grouped in a selected portion of the pipe racks. Above grade conduit will be 3/4 inch trade size minimum except that 1/2 inch conduit may be used for short taps to selected equipment and at the back of instrument boards. Flexible conduit will be PVC coated, liquid tight, metal type and suitable for the hazard classification of the area in which it is installed. Flexible conduit will be used to connect vibrating equipment, instrument and motors. Expansion fittings will be installed in long horizontal runs (maximum distance of 150 feet between fittings). Wiring methods in areas classified as hazardous by Article 500 of the NEC including propane storage area shall comply with Articles 501 through 504 of the Code.

C. Cable tray will be used for raceway. Where deemed feasible, all trays shall be aluminum, open rung type installed with all supports and fasteners, recommended by manufacturer and required by code.

D. Cable trays located under fuel conveyors shall be covered on top and open on the bottom.

15.13 Conductors

A. Multistrand insulated copper conductors shall be used throughout except that multi-conductor control and instrumentation cable will be used where practical and economical. Minimum sizes shall be #12 AWG for power, #14 AWG for control and #16 AWG for instrumentation.

B. Insulation

1. 12 kV system - 15 kV, EPR, shielded with 133% insulation level and PVC jacket.

2. 4160 volt system - 5 kV EPP, shielded with 133% insulation level and PVC jacket.

3. Low voltage (600 volt and below) systems for power - 600 volt, Type XHHW.

4. Low voltage systems for lighting - 600 volt, Type THHN.

5. Control systems - 600 volt, Type THHN.

6. Instrumentation systems - Shielded with EPR or XLPE insulation with Hypalon jacket.

C. Equipment Grounding - Insulated (green) grounding conductors will be run with circuit conductors of 4160 volt system and low voltage power and lighting systems.

D. System Segregation and Separation

1. Conductors of different voltage systems will be run in separate raceways.

2. Lighting wiring will be run in raceways separate from low voltage power and control.

3. Control wiring will be run in raceways separate from low voltage power except that control wire for local pushbutton stations at motors can be run in the same raceway as motor power conductors for motors 30 horsepower and smaller.

4. All instrumentation and noise susceptible control circuits will be run in raceways separate from power and control. A 3-inch minimum separation will be maintained between instrumentation and power raceways.

15.14 Motors

A. Motors 250 horsepower and larger shall be 4160 volts squirrel cage induction type, supplied from the 4160 volt metal clad switchgear unit substation.

B. Motors 3/4 horsepower to 200 horsepower inclusive shall be three-phase, 460 volts, squirrel cage, induction type, supplied from the 480V MCC's.

C. Service factor for all motors shall be 1.15.

D. Motors shall be designed and constructed in accordance with ANSI/NEMA MG1.

E. All motors shall be suitable for full voltage (across-the-line) starting. Torque and current characteristics shall be in accordance with NEMA design "B" unless drive requirements dictate higher values.

F. Motor enclosures shall be suitable for the environment in which they are to operate. It shall be the Contractor's responsibility to determine

the location classification and motor enclosure required. All totally enclosed motors shall have at least one threaded drain hole and plug for removal of condensate. Motors for use in hazardous locations shall be totally enclosed, fan-cooled or pipe ventilated, and approved for the locations.

15.15 Boiler and Maintenance Outlets

A. Provide 480V, weatherproof welding outlets, at each of the following locations:

1. Maintenance Shop (three required)
2. Base of the Boiler (one on each side)
3. Mid-Level of the Boiler (one on each side)
4. Steam Drum Level (one one each side)

B. Provide a 110V, 30 amp GFI outlet at each of the above listed boiler maintenance outlets.

C. Provide at least eight 110V, 30 amp GFI outlets in the maintenance shop.

16.00 INSTRUMENTATION AND CONTROLS

16.01 General

A. A modular, microprocessor-based, Distributed Control System (DCS) shall be provided for data handling, systems control, monitoring, recording, operator actions, operator journals, and alarming necessary for proper operation of the plant from a central control room. The DCS shall provide a seamless interface to all processes in the plant independent of which Vendor or Subcontractor provides the process hardware. The DCS CRT's shall be the primary operator interface to the process.

B. Control strategies that need to be defined by various Vendors, Subcontractors, or other suppliers of process equipment shall submit those strategies as functional drawings, logic drawings or ladder diagrams of sufficient detail to allow the DCS vendor or the design engineer to implement these stragegies in the DCS hardware.

C. The DCS shall control all analog and digital loops. Contractor shall minimize use of local controls or programmable controllers.

D. The DCS shall be used for system sequential control and interlocking except as prohibited by an explicit code.

E. All plant parameters in the system shall be monitored, indicated and historized and made available on the control room CRT's via the DCS.

F. If a locally controlled system is required, a serial interface compatible with Bailey equipment shall be provided to the DCS. This interface shall provide all pertinent information relative to the locally controlled system. One status contact or alarm is not acceptable.

G. Local indicating devices (pressure gauges, thermometers, etc.) shall be furnished for local monitoring only if data are not available in the DCS. Use of local indications is to be minimized. The use of test taps and test wells is encouraged.

H. Continuous emissions monitoring, metering and recording shall be provided and shall be subject to the approval of regulatory authorities. This system shall be provided with a communication interface to the DCS.

16.02 Control Hardware

A. General

1. The DCS console equipment shall consist of 19 inch color monitors with minimum resolution of 1024 X 768 pixels, equipped with touch screens and trackball pointing devices. The console shall contain a minimum four (4) CRT's for primary interface activity and at least one additional CRT as a dedicated alarm display. No more than two (2) CRT's shall be driven by one set of display electronics.

2. The operator interface shall be designed so that the use of the QWERTY type keyboard is not required. Standard operator function keyboards are discouraged. The primary interface to the process is the CRT console. An Engineer's CRT of the same hardware as the operator's CRT's shall be provided. It shall be located in the computer room.

3. Any CRT type display that is provided by a vendor other than the DCS vendor shall be as described above and of the same manufacturer. It shall be the responsibility of the Contractor to provide mounting space for additional CRT's in the control room console.

4. The console for CRT mounting shall be designed as a "set down" type console with a work ledge of approximately 12 inches. The console shall provide for the mounting of the CRT'in two rows. The first row shall have a maximum tilt angle of 10 degrees away from the operator. The height of the second row shall be within easy reach of the average operator when in a seated position. The console shall provide for CRT removal from the rear for maintenance access. Withdrawal shall

be rail supported. At least one company, Evan's Consoles of Canada, provides these features.

5. Rack mounted electronic equipment that provide DCS functions shall be located in an air conditioned electronics room adjancent to the control room with access to the control room. UPS equipment shall not be located in the control room or the electronics room. Field termination to the DCS shall be located in the electronics room. Remotely located electronic hardware is discouraged.

6. Field equipment shall be of common manufacturer to the maximum extent. Final drive elements and control valves shall be of one manufacturer. Local indication when used, such as gauges, thermometers, pressure switches and level switches shall be one manufacturer. Power transducers, pressure transmitters, thermocouples, Resistance Temperature Detectors (RTD's) shall be of one manufacturer.

7. The use of temperature transmitters is discouraged. Thermcouple extension leadwire shall be used to direct connect thermocouples to the reference cold junction in the electronics room termination cabinets.

8. Electronic signals shall be 4-20 milliamps or 1-0-1 milliamps. Smart transmitters shall be used where the probable installed accuracy improvement is justified. Digital communication of transmitters with the DCS is allowed. However, transmitters may not be bused onto a single digital communicatoin pair.

9. Pneumatic signals shall be 3-15 psi. The use of current to pneumatic signal transducers is discouraged. When pneumatic final drive components are used, current to pneumatic positioners that are drive-mounted are encouraged as signal conversion devices.

10. The DCS system when accepted as complete shall have 20% installed and implemented spare analog and digital input and outputs of each type of signal.

11. The DCS system shall provide for on-line redundancy in the following subsystems:

    a. Data Highway Cable and Controller Interface to Highway
    b. Operator Display CRT Electronics
    c. Controller Processors for Critical Loops
        - Drum Level
        - Main Steam Pressure
        - Main Steam Temperature

- Air Flow/O2 Trim
- Furnace Draft
- Fuel Flow
- Burner Management and Flame Safety Systems

B. The graphic Control Displays for operator interface shall utilize the following guidelines:

1. Control Display shall be that set of graphic templates on CRT displays that provide the operator with the ability to interface with any loop component available to the system when the loop is in either auto or manual.

2. Control Displays shall provide all information; auto/manual, real time/historical trends, inter-display connectivity, component start/stop, and set point manipulation functions that are required by the operator to manage an interactive combination of loops.

3. The overview display shall provide the plant operator with a hierarchical format of the Control Displays. Any overview that shows process information of over 8 process loops is unacceptable.

4. The touchscreen and trackball shall be the operators primary interface with the process and shall be capable of performing all operating functions. The function keyboard shall be an alternative to the touchscreen and trackball.

5. Tag numbers shall not be used in plant operator Control Displays. Control Displays shall use an English description of the variable or component. Tag numbers shall be used only on engineering displays.

6. The active "poke points" on all displays should be no smaller than 3/4" by 3/4" actual dimensions on the CRT's.

7. The Trend Display shall generate the most recent historical data. Trend displays shall be an integral part of the Control Displays and shall not require changes by the operator. Provide the ability to display four (4) variables concurrently with each variable confined to approximately 1/4 of the CRT screen. Provide the ability to select either Historical or Real Time data for trending. Provide the ability in both the Historical and Real Time modes of displaying instantaneous, uncompressed data updated as close to the scan frequency of the displayed variables as practical. Provide the ability to scroll backward and forward relative to time. Provide both time and variable amplitude grids. Provide display of the digital value of the trended variables. Provide current time display in hours, minutes and seconds to

the most recent trend update. Provide cursor time display in days, hours, minutes and seconds when displaying Historical data during scrolling.

8. Digital data presented on Control Displays shall, in general, not be carried to more than one significant digit past the decimal point. There are some exceptions such as boiler O_2. The update frequency of digital data on control displays shall be adjustable independent of point scan frequency or loop execution frequency.

9. Digital information displayed on Control Displays shall be as large as possible consistent with the design of the display. The largest digital values should be those control process variables and their set points involved in the logical combination of loops that make up the Control Display.

10. Colors for Control Displays shall be limited to a maximum of 16 and shall be chosen for their contrast with video background. Colors can be used to indicate significant meaning but should be enhanced by significant icons or shape changes to aid operators who may have color deficient vision. The number of colors with significant meaning shall be limited to a maximum of eight.

11. Control Displays shall be designed to eliminate the need for group displays.

12. Any requirement to select a loop before initiation of auto/manual transfer or set point change is not acceptable.

13. Individual loop displays shall be relegated to the engineering work station environment.

C. A minimum of 10 custom designed graphic displays shall be provided. Displays shall be approved by the Owner.

D. Major plant systems to be controlled and/or monitored from the DCS are:

- RDF Fuel System
- RDF Metering and Boiler Feed
- Steam Generator and Combustor Systems
  Includes:
  - Soot Blowers
  - Flame Safety System
  - Burner Management System
- Condensate and Feedwater Systems
- Cooling Water System
- Flue Gas Cleaning System

- Ash Handling Systems
- Transformers

16.03 Control Software

A. Alarm Management System

1. A pre-wired alarm annunciation panel shall not be used. A graphic display should be designed to emulate an annunciation panel and shall be displayable on any of the CRT's in the operators console.

2. Alarm presentations shall provide pertinent information in a way that does not require interpretation or searching by the operator.

3. The Alrm Management System shall be applied on a point by point basis with the following definitions in effect.

4. Alarm Definition:

   The deviation of a MONITORED process variable beyond defined limits or a detectable change in the health of the process control system (DCS) equipment that requires IMMEDIATE REMEDIAL ACTION by the operator.

5. Alert Definition:

   The change in any parameter of the process or the control equipment that requires INVESTIGATIVE ACTION by the operator. It may frequently be outside of his immediate control.

6. Advisory Definition:

   The change of state of a process or control system component that is within the EXPECTED RANGE of operating procedures or boundaries. The state change may be the result of opeator or control equipment action.

7. When an alarm occurs it shall generate an audible signal and a display containing the English description of the variable, in the largest practical font. Alarm acknowledge action should require only one step by the operator. The display should appear in the next available large box on the dedicated alarm CRT. The display of an alarm message should not be canceled until the alarm is returned to normal and acknowledged. A flashing display on the CRT makes reading the description of the alarm more difficult.

8. When an alarm is acknowledged it should be moved to an available smaller box on the dedicated alarm CRT. If an alarm returns to normal before it is acknowledged, it need not be moved to a smaller box.

9. When an alarm is acknowledged, the audible signal should be silenced on an individual event basis only. Global silence of multiple alarm events is unacceptable.

10. A minimum use of color significance is strongly recommended. Color should not be used to designate plant area or unit. The alarm description must be complete enough to transmit this knowledge. If color significance is used, it shall indicate alarm status only.

RED	-	In alarm and unacknowledged
YELLOW	-	In alarm and acknowledged
GREEN	-	Returned to normal and unacknowledged

11. When an alert occus, it shall generate an audible signal (significantly different than the alarm audible) and generate a flashing line of information on a current alert display. This is similar to most vendors "current alarm display." Alert acknowledge action can take more than one step to accomplish. Global acknowledgment of multiple alert events is unacceptable. The flashing line of information should not go "steady-on" until acknowledged.

12. If an alert returns to normal before it is acknowledged, its audible signal can be silenced but the information line must continue to flash until acknowledged.

13. When an advisory event occurs, it shall generate a short audible tone that is repeated periodically (1 to 5 minute period) until it is acknowledged. It shall also generate a small dedicated flashing target reserved on every display. Advisories shall be individually acknowledged.

14. The "current alarm" display shall be used to present advisory information to the operator. The information line shall flash until acknowledged. Color to indicate unit and area information is very useful for presentation of advisory information.

15. There is no real requirement for printing of an alarm log. All alarm, alert, or advisory events including all responses of the operator shall be recorded in the historian. Timing tagging of these events shall be of sufficient detail to make post fault diagnostics possible.

16. Printing of an alarm list need not be automatic. It is desirable that alarm summaries be printed (from the history files) only on demand.

17. It shall not be within the unilateral control of the operator to modify or disable any alarm, alert, or advisory function.

18. Two laser or ink jet printers shall be provided.

B. Data Historian

1. The data historian shall provide these basic functions:

   a. Short-term real time historical process data storage plus replay.

   b. Post fault analysis of transient failures.

   c. Long-term historical process data storage plus replay.

   d. The storage of all DCS alarms, alerts, and advisory events.

   e. The storage of all operator actions.

2. The ability to trend instantaneous values shall be provided without averaging, without using large value increments, or any other data compression algorithm.

3. Short-term history shall have the capacity to store all monitored variables that come into or go out of the DCS via field input devices analog or digital as well as information received over serial or parallel communications ports. It shall also have the ability to store system intermediate values, such as the outputs of PID, Lead/Lag, Ratio, Summer, etc. This data must contain all time tag information and be stored at whatever rate that the value is scanned or communicated into or out of the system. The data shall be stored in its raw form without any data compression. This history shall contain a minimum of 72 hours of data and a maximum of 120 hours data. It shall be a circular file first in last out.

4. This history shall have the ability to replay, to the operator's trend display and to the engineer's work station, the most current real time data plus the available short-term history. This history should also have the ability to recognize an "event" initited by a predefined change of state or by operator action. This "event" shall carry with it a definable pre-fault and post-fault period. For example, 1 hour of pre-fault and 2 hours of post-fault. Once the post-fault period is satisfied the system

shall capture the entire data history that defines the "event" and archive this "event" to some permanent media storage reserved for fault "events."

5. Alarms, alerts, and advisory events, and operator actions are by their nature related to fault analysis. The events and actions that have long-term significance shall be stored in the permanent fault "events" file.

6. Long-term history shall also have the ability to store all data collected by the DCS. Long-term history shall provide at least 6 months of storage before it requires archiving. Long-term history shall make intelligent use of available data compression techniques. Long-term history shall be retrievable only on the engineer's workstation. The primary function of this history is to provide the ability to monitor and establish long-term trends for use in statistical process control. Long-term history shall also provide for the accumulation of 31-day billing data.

7. It is unacceptable for process alarm monitoring to be a background function or that this function could be disabled at the operator's discretion.

16.04 Boiler Control

A. The DCS shall control the boiler to safely and efficiently maintain steam pressure and temperature, furnace pressure and feedwater flow to match boiler requirements during start-up, normal operation, emergencies and shutdown.

B. The primary functions of the boiler control system shall be:

1. To maintain desired steam pressure.

2. To maintain drum water level - feedwater control is a three-element control system. Steam flow is continuously balanced with feedwater flow while maintaining the drum level.

3. To provide automatic turndown capability.

4. To maintain optimum excess air - flue gas oxygen shall be measured at the boiler outlet by an oxygen analyzer.

5. To maintain combustion within the safe operating range.

6. To maintain emissions at or below the required levels.

7. To maintain safe operations of the unit.

16.05 RDF Handling System

A. This system shall be designed to operate from the DCS located in the main control room. All conveyors shall have zero speed switches where applicable and be interlocked for safe operation. An automatic start function shall be provided which shall enable the entire system to start with one operator action. Also, an emergency stop system shall enable the operator to shut down the entire system.

B. The status of the RDF handling system shall be monitored in the control room via DCS display and closed circuit television.

C. Provide four belt misalignment switches for each fuel reclaim conveyor with alarm to DCS. Provide actual speed switch on each driven pulley with alarm to DCS.

16.06 RDF Metering and Boiler Feed

The DCS shall control the RDF supply and in-feed conveyor systems. The boiler shall be fed with RDF fuel utilizing both or one of the feeders. The speed of these feeders shall be the primary signal for metering the fuel feed to the boiler. The speed of the feeders shall be adjusted by the boiler combustion control system. Switches shall be provided to alarm on low fuel metering bin level.

16.07 Burner Management System

A. The burner management system shall supervise the main fuel and auxiliary propane gas burners and shall cut off the fuel supplies, or prevent light-off of burners, when safety interlocks are not satisfied.

B. The start-up of the propane gas burners shall be from the Control Room. The system shall provide positive proof of ignition.

16.08 Continuous Emissions Monitoring System

The flue gas monitoring system (CEM) shall be designed to continuously measure and record the products of combustion and particulate level, in accordance with North Carolina CEM Guidelines and federal requirements; provide reports on monitored parameter, based on lbs/MM Btu and ppmvd via the DCS, and alert the plant operator when the measured parameter has a higher than desirable level of concentration.

16.09 Steam and Water Sampling Systems

A. The steam and water sampling shall be designed for sampling to allow detection of undesirable concentrations of contaminants in the steam or water. Automatic or manual adjustments of the chemical feed or blowdown rates can then be made to restore proper purity levels. All

samples shall be piped to a central station for cooling and analysis as required.

B. Minimum sampling shall include the following:

- Steam Drum (above and below water level)
- Superheater Outlet
- Feedwater at Boiler
- Export steam to DuPont

C. Steam to DuPont shall be continually monitored for conductivity. Condensate to DuPont shall be continually monitored for pH and conductivity. Condensate shall be automatically valved to waste if outside of specified limits.

D. Analysis shall provide for automatic control of chemical addition to the boiler system.

16.10 Documentation

Provide a functional written description and logic drawings of the control philosophy of all computer controlled systems.

16.11 Control Room

A. The plant shall be provided with a central Control Room and be provided with glass windows to allow visual observation of the boiler area. The room shall be air conditioned and sound proofed.

B. The Control Room shall house the DCS hardware, electrical board, relay panel, and other control panels not included in the DCS system. Other functions operated from the central Control Room shall include security monitoring, intercom, television monitors and fire alarm/controls. DCS I/0 racks shall be located in the remote electronics room .

C. Layout of the Control Room shall provide for a shift supervisor's office (125 ft^2 minimum).

16.12 DuPont Controls Interface

A. The EGF DCS shall share data with DuPont's Bailey DCS using a data highway type interface run from the EGF to DuPont's control room by the Contractor. Software design of the EGF DCS system shall allow DuPont to access any EGF parameters it may require to operate its plant. DuPont shall modify its software to allow the EGF DCS to access its operating parameters. Contractor shall coordinate its DCS software design with DuPont to allow this type of interface.

B. The EGF will operate in parallel with DuPont's two existing coal-fired boilers (125,000 lb/hr steam capacity each). Normal operation shall be with the EGF boiler at full output with one or both of the DuPont boilers running to meet load swings. The Contractor's Control System shall provide for this method of operation and shall also allow the RDF boiler to follow one or both of the DuPont boilers in response to varying DuPont steam demand. The Contractor's control system shall also allow the EGF boiler to operate on a stand-alone basis responding to DuPont's steam demand.

17.00 CIVIL/STRUCTURAL

17.01 Site Preparation

A. The site shall be cleared and grubbed as necessary for the project facilities, operations and construction as specified herein. Erosion control for storm drainage during the Construction Phase shall be implemented in accordance with an approved erosion and sedimentation plan. Existing top soil around the boiler plant shall be removed and replaced with a gravel course. Areas near the site shall be graded to provide for construction trailers and activities. After completion, these areas shall be regraded, loamed and seeded. Removal of existing trees shall be minimized.

B. Contractor shall coordinate with DuPont for a "dig-safe" identification of underground utilities at the site.

17.02 Roadways and Parking

A. The site access road, site roads and drives, and permanent parking areas shall be constructed as generally shown on the drawings. Access to all doors shall be paved and provided with concrete stoops. Additional roads and parking shall be as required to support construction activities. As a minimum, the following design criteria applies:

B. Flexible and rigid pavements are to be designed for an AASHTO HS20-44 truck loading. The main access road and site roads are to be geometrically designed to accept AASHTO WB-50 semi-trailer truck combinations.

C. The main access road shall be upgraded as shown in the drawings to meet AASHTO HS-20-44 requirements. The road shall be 24 feet wide at a minimum.

D. Permanent parking areas shall be as designated on the conceptual arrangement drawing. Parking spaces are to be sized 9 feet by 18 feet.

E. Design speed 20 mph.

F. Design Grade:

1. Minimum 0.5 percent
2. Maximum 6.0 percent

G. Traffic markings, guardrails and signs shall be provided for proper traffic flow, control and safety.

H. Concrete strip(s) for support of cranked-down dolly wheels shall be provided.

17.03 Perimeter Fence

A. The plant area shall be enclosed by an industrial quality 8 foot high galvanized chain link fence. The site's main entrance way shall have a motorized gate which shall be controlled from the control room. An audio communication link between the gate and the control room shall be provided.

B. Other fence gates shall be hinged and provided with locks.

17.04 Finish Grading and Landscaping

A. All unpaved areas in the plant area and access road shall be finish graded, loamed and seeded.

B. Minimum graded cross slopes shall be:

Grassed Areas: 4 percent
Paved Areas: 1 percent

17.05 Foundation Investigation

A. The determination of soil classification and design bearing capacity shall be the responsibility of the Contractor. Contractor shall carry out soil borings/excavations as required prior to final contract signing. Contractor shall be responsible for all foundation/footing design.

B. Reports of Contractor's soils data shall be provided to the Owner for verification.

17.06 Control/Administration Building

A. Foundations - slab on grade to meet floor loads and geotechnical conditions.

B. Structure shall be clear span rigid frame type with pitched roof. Manufacturer's standard architectural components (windows, personnel doors, roll-up doors, etc.) may be used. Design shall comply with MBMA "Recommended Design Practices Manual."

C. Doors to permit entry of large vehicles for servicing.

17.07 Utility Structure

A. A galvanized steel utility bridge and/or sleepers shall be provided to run steam, water, power and control lines between the EGF and the DuPont boiler plant.

B. The structure shall run above-grade with loops and bends as required to promote steam line flexibility. Elevations and clearances at rail and road crossings shall meet or exceed applicable standards.

C. DuPont shall review and approve the general arrangement of the utility structure.

17.08 Codes and Criteria:

A. Codes and Standards: Design loads shall conform to the requirements of the following references except where exceeded by other provisions of this basis of design:

1. N.C.S. Building Code

2. Loss Prevention Data, Factory Mutual System

3. Occupational Safety and Health Act (OSHA)

B. Structural Analysis, design procedure, allowable stresses and load factors shall be based on the following Codes and Specifications:

1. Reinforced Concrete

"Building Code Requirements for Reinforced Concrete (ACI 318)" of the American Concrete Institute.

2. Structural and Miscellaneous Steel

"Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction (AISC).

3. Concrete Masonry

"Building Code Requirements for Concrete Masonry Structures" (ACI 531) of the American Concrete Institute

17.09 Loads

A. Dead Loads: floor and roof loads shall include the actual weight of the floor and roof sub-systems, plus allowance for mechanical piping, equipment loads and ductwork.

1. Roof

a.	Roofing and Insulation	Actual
b.	Metal Deck & Framing	Actual
c.	Piping, Mechanical	10 psf*
d.	Concrete Slabs	Self-weight

* To be verified.

2. Floors

a.	Supported Concrete Slab	Self-weight
b.	Grating - 1-1/4 x 3/16	10 psf
c.	Framing	Actual
d.	Checkered Plate 3/8" Thick	17 psf
e.	Elec. Conduits, Lights, etc.	10 psf
f.	Piping, Mechanical	20 psf

3. Platforms

a.	Grating (1-1/4" x 3/16")	10 psf
b.	Framing	Actual
c.	Checkered Plate (3/8")	17 psf
d.	Electrical, Piping, etc.	15 psg

B. Live Loads: The following minimum unit live loads shall be used for the specific areas:

1. Roof: A 20 psf general live load. Low roof adjacent to high roof will be designed in accordance with the requirements of the N.C. Building Code.

2. Stairways, Office Areas and Platforms 100 psf

3. Ground Floor Slab, Forklift Truck 250 psf or 5 Tons

4. Electrical Room - As required for transformer and/or switchgear equipment or for battery storage.

5. RDF Fuel Gallery 100 psf

6. Walkways 100 psf

7. Equipment Loads: As required.

8. RDF Fuel Loads

   a. RDF Fuel Weight

      (1) 15 pcf (compacted) for volume calculations

      (2) 13 pcf (uncompacted) for volume calculations

      (3) 25 pcf for weight calculations. In addition, check RDF fuel metering bin filled with water and use 33% increase in allowable stresses for this load case.)

9. Loads for underground structures and retaining walls:

   a. Soil Weight - 120 pcf (minimum)
   b. Horizontal Soil Pressure - 60 psf
   c. Vertical Surcharge - 120 psf, minimum
   d. Hydrostatic Loads - The design water table is 10 feet below grade.

10. Wind Loads

    Wind loads shall be based upon N.C. Building Code for basic wind speed of 90 mph, 50 year mean recurrence.

11. Seismic Design

    Seismic design shall be in accordance with the N.C.Building Code for Zone 0.

12. Impact loads (as percentage of static loads)

    a. Light machinery shaft or motor driven, 20%.
    b. Reciprocating machinery or power driven limit, 50%
    c. Hangers for floor, etc., 33%

17.10 Construction Materials

A. Soils

1. Soil Borings: The taking of borings and preparation of project geotechnical report will be the Contractor's responsibility prior to final negotiation of lump-sum contract price.

2. Spread Footings: allowable maximum soil pressure - to suit geotechnical conditions as confirmed.

3. Backfill: Use excavated material to maximum extent, where suitable. Backfill material to be free from debris, roots, wood, refuse, cinders, coal, frozen materials and petroleum contamination. Maximum size shall be 2".

B. Reinforced Concrete

1. Concrete strength of slabs, footings and wall foundations: 3000 psi at 28 days

2. Concrete for slabs-on-grade: 3000 psi at 28 days

C. Structural Steel

1. Type A36 unless unusual loads warrant a higher strength steel to be used.

2. Design according to AISC Code, simple framing (Type 2 Construction)

3. Connections

a. A325 high strength bolts (marked as such)
b. E70 welding electrodes

4. Deflection

a. Girts shall be designed to resist wind forces with a maximum deflection of 1/240 of the span

b. The lateral deflection of the building from wind loading shall be limited to follow the recommendations of AISC, "Serviceability design considerations for low rise buildings."

5. Grating Floors: 1-1/4" x 3/16" bearing bar grating, galvanized

6. Checkered Plate Floor: 3/8" thick multi-grip floorplate, galvanized.

D. Miscellaneous and Embedded Metals: Mild steel shapes and plates as required (galvanize for exterior service).

E. Waterproofing: Waterproof all below grade concrete pits.

17.11 Concrete Testing

A. The Contractor shall retain an independent testing laboratory to perform field testing of concrete as follows:

1. As the work progresses, concrete shall be sampled in accordance with ASTM C172.
2. Slump tests shall be made according to ASTM C143.
3. Air content of concrete made with normal weight aggregates that have low water absorption shall be tested according to ASTM C173.

B. Compression Tests

1. Compression test specimens shall be made and cured according to ASTM C 31. Each test shall consist of one set of laboratory cured cylinders. A set shall consist of six cylinders. The minimum number of tests shall be one for each 50 cubic yards of concrete for each class or one for each 5000 square feet of surface area for slabs or walls. At least one test per day shall be made of each class of concrete used that day.
2. Cylinders shall be tested one at 7 days, two at 28 days, and one at 56 days, if required.
3. The strength level of the concrete will be considered satisfactory so long as the averages of any three consecutive strength test results of cylinders equal or exceed the specified strength f'c, and no individual strength test result falls below the specified strength f'c by more than 15%.
4. Reports on the cylinder tests shall be made to the Owner and shall show:

Dates placed and tested
Name of job
Mix design
Initial quantity of water and water added at the site
Slump
Air content

Admixtures
Location of concrete in the building
Design compressive strength in pounds per square inch and class
Tested compressive strength in pounds per square inch
Atmospheric and concrete temperature at time of sampling

5. In all cases where the strength of the cylinders shown by these tests for any portion of the structure falls below the required compressive strengths specified, the Owner shall have the right to order a change in the mix for the remaining portion of the structure.

C Tests on Structure (Nonconforming Test Results)

1. If concrete cylinders' strength fall below specified requirements, the Owner may require cores to be secured and compression tests of the concrete in question to be performed in accordance with ACI 318.

2. In the event test data develops a concern for the structural safety of a portion of the structure, the Owner may direct a load test to be made. A load test shall not be made until that portion of the structures to be subject to load is at least 56 days old. Shoring and centering shall have been removed at least 30 days prior to the test. Load tests shall be conducted in accordance with ACI 318.

3. Tests required due to nonconformance shall be conducted by an independent laboratory retained by the Owner but paid for by the Contractor.

18.00 ARCHITECTURAL CRITERIA

18.01 General Description

A. The major architectural aspect of the project is the Control and Administration Building which will accommodate the control room, electrical room, maintenance areas, and offices.

B. Other structures such as Equipment Building, Maintenance/Warehouse Building, and Structures associated with the fuel handling system may be separate from the main structure.

C. The exterior treatment of all structures is to be of consistent design and shall blend as harmoniously as possible with the environs. Exterior and interior treatment details and color schemes shall be subject to Owner's approval.

18.02 Architectural Analysis of Standard Building Code

A. The Standard Building Code shall be used to conduct an architectural analysis of the structures relative to the following features:

1. Means of Egrèss
2. Interior Stairways
3. Access to Roofs
4. Smoke-proof Enclosures
5. Exterior Stairways
6. Exit Signs

18.03 Building Materials

A. Exterior

1. Siding - Insulated sandwich metal panels (heated buildings)

   Metal Panels (unheated buildings)

2. Roofs - Insulated sandwich metal panels (heated buildings)

   Metal Panels (unheated buildings)

3. U-Factors - Shall comply with ASHRAE Standard and be provided as follows:

Concrete Walls	U	=	0.67 Btu/hrft^2°F
Insulated Metal Siding	U	=	0.27 Btu/hrft^2°F
Roof with Ceilings	U	=	0.15 Btu/hrft^2°F
Roof without Ceilings	U	=	0.2 Btu/hrft^2°F

B. Interior Finishes

1. Interior Walls - concrete masonry block, except steel stud/gypsum partition may be used within the office area.

2. Walls and floors of toilets, showers and locker rooms - dry wall with ceramic tile finsih.

3. Ceilings - suspended acoustic tile ceilings in all employee facility rooms, except for toilet areas which shall have plaster ceilings. Showers shall have ceramic tile finish.

4. Concrete block, gypsum wall board and concrete walls shall be sealed and painted.

5. Standard floor finish in work areas shall be exposed concrete.

6. Control room floor shall be vinyl composition tile.

7. The control room/administration building floor shall be vinyl tile finish with a 4-inch high cove base.

C. Glazing

Glazing shall be non-operable. Windows shall be located in the the office area on all levels. Placement and number of windows shall be approved by the Owner.

D. Doors

1. Personnel doors in industrial areas will be hollow metal in metal door frames (3' x 7' size).

2. Control room doors shall be hollow metal double door in metal frame (6' x 7' size).

3. Interior office area doors shall be solid core wood in pressed metal frames (3' x 7' size).

4. Roll-up doors shall be motor operated and be 12' wide by 14' high (min.).

E. Entrance Ways

All building access ways including stairways to grade shall be provided with concrete stoops or aprons.

18.04 Synopsis of Required Spaces

A. Space Requirements

Function	Area, Ft^2
Plant Manager	225
Operations Superintendent	169
Bookkeeping/Reception Area	135
Maintenance Superintendent	169
Envir./Chemist	169 (In Equip. Bldg.)
Safety/Training	169
Engineer	169
Control Room	350
Lunch Room	400
Utility/Supply Room	210
Shift Supervisor	125 (At Control Room)

Parts Storage/Maintenance Shop	1400
Electrical/Instrument Shop	400
Locker Rooms	See Below

The above space requirements of the proposed facility are minimums only and shall be sized by Contractor to suit operational requirements. Arrangement plant to be approved by Owner.

B. Special Features

1. The Lunch Room shall be provided with a compact kitchen unit including upper and lower cabinets, double sink, refrigerator, icemaker, microwave oven and utilities for at least four vending machines.

2. Locker Rooms

   a. Men's room contains 2 showers, 2 water closets, 2 urinals, 2 lavatories and 30 pair of half lockers and bench(es).

   b. Women's room contains 1 shower, 3 water closets, 2 lavatories and 12 pair of half lockers and bench(es).

   c. Both locker rooms shall be provided with mirrors and other accessories for a complete facility.

3. All office area doors shall be provided with locks.

18.05 Painting

A. Contractor shall supply structural steel, ducts and exposed steel plate cleaned of scale, rust, and foreign matter, in line with good commercial practice, and given one shop coat of paint or commercial primer before shipment. Equipment supplied by the Contractor shall be shipped with the vendor's standard prime paint coat, and/or vendor's standard finish coat. Exterior exposed structural steel, uninsulated ducts, exposed steel plate, and vendor prime coated equipment shall be cleaned and finish painted with two-mil dry film thickness of an alkyd enamel paint after assembly and erection. Building interior offices shall be finish painted. Contractor shall clean and paint areas of vendor finish coated equipment affected by field weldments and/or assembly.

B. Building siding and roofing shall be supplied with shop-applied baked-on paint coat.

C. Uninsulated piping with a surface temperature below 140°F shall be finish painted.

18.06 Access Platforms

Contractor shall furnish and install galvanized steel grating, access platforms, stairs, and ladders in accordance with the requirements of the Occupational Safety and Health Administration requirements. Structural steel framing for platforms shall be painted structural steel. Access will be provided to the following areas as a minimum.

Steam Drums
Water Columns
Safety Valves
Main Steam, Water, and Continuous Blowdown Valves
Sootblowers
Boiler Access Doors and Observation Windows
Economizer
Fuel Feeders and Chutes
Conveyor Idlers and Drives
Chimney Test Ports
CEM Equipment Areas

Other items requiring access for routine maintenance shall be provided with access walkways/stairs/platforms as required.

19.00 ACOUSTIC CRITERIA

19.01 Plant

A. The noise level at the plant shall be controlled so that worker exposure complies with the noise regulations of Occupational Safety and Health Administration (OSHA). Where practical, the noise in areas where workers spend the most time shall be limited to an A-weighted level of 85 dB(A). The basic approach to this design goal shall be the purchase of quiet equipment and, where required, the use of noise control treatments such as barriers, enclosures, sound absorption, silencers and acoustic lagging.

B. The noise level in areas such as the control room, offices and conference rooms shall be limited to a design goal of 55 dBA (A) or less depending on the work function requirements therein. These spaces shall be isolated from station equipment areas by walls, doors and windows having the required transmission loss to achieve the design goal. As a minimum, partitions shall achieve a Sound Transmission Class (STC) of not less than 46, limiting Sound Transmission Loss (TL) to not less than 50 dB at 2000 Hz. Acoustic noise traps shall be used in the ventilating and air conditioning ductwork serving these areas, if necessary.

19.02 Control Measures

A. The noise control measures required to achieve the design goals for the plant shall include as a minimum, but not limited to the following:

1. Quiet transformers and/or transformer barriers tuned to 120 Hz.

2. Blowdown mutes (silencers) for steam safety and relief valves.

B. The surrounding areas nearest the plant shall be shielded from excess noise as required by providing a sound barrier at the ground level.

20.00 PIPING SYSTEMS

20.01 Piping systems including pipe, flanges, bolting, gaskets, valves, relief devices and fittings.shall be designed in accordance with the Power Piping Code, ANSI B31.1.

20.02 All piping systems shall be designed for inherent flexibility. The use of expansion joints shall be avoided.

20.03 Piping loads on equipment shall be determined and verified not to exceed manufacturer's allowable load specifications.

20.04 Main Steam and Feedwater Systems

A. For piping in these systems 2-1/2 inch diameter and larger, the following analysis shall be performed using computer techniques:

1. Thermal flexibility analysis.

2. Dead weight analysis which defines support points, loads and deflections.

3. Transient analysis for the following:

a. Seismic analysis using the equivalent static type analysis with accelerations dictated by applicable codes.

b. Safety valve discharge transient loading analysis.

4. Stress summaries for the above to satisfy code requirements.

B. For piping in these systems 2 inch diameter and smaller, either computer techniques or code approved manual techniques shall be used to assure adequate flexibility and support.

C. NDE inspection of welds on this piping shall conform to ANSI B31.1.

20.05 Piping Systems with Temperature Greater than 250°F

A. Piping in these systems 2-1/2 inch diameter and larger, shall have the following analysis performed using computer techniques:

1. Thermal flexibility analysis.

2. Dead weight analysis which defines support points, loads and deflections.

3. Stress summaries for the above to satisfy Code requirements.

B. For piping in these systems 2 inch diameter and smaller either computer analysis using techniques or Code approved manual techniques shall be performed to assure adequate flexibility and support.

20.06 Piping Systems with Temperature Less than 250°F

Piping in these systems shall be analyzed using either computer techniques or Code approved manual techniques to assure adequate flexibility and support.

20.07 Pressure Boundary

The pressure integrity of all piping systems shall be designed in accordance with the appropriate Code with a minimum design allowance of 1/16 inch on wall thickness. Extra wall thickness shall be provided for such lines as flashing condensate returns or, as needed, for sound attenuation after pressure reducing stations.

20.08 Pipe Sizing

Pipe sizes shall be determined primarily on the basis of allowable pressure drop for the service, but the following velocity limits shall apply:

Water Other Than Boiler Feed

6" NPS and above	15 ft/sec.
4" NPS and below	10 ft/sec.

Boiler Feed

Suction	7 ft/sec
Discharge	15 ft/sec.

Steam

Dry or Superheated	200 ft/sec.
Wet	100 ft/sec.

20.09 End Connections

Pipe line run size should not necessarily match equipment connections. Outlets from vessels that are below the water line should be at least 25 percent larger in diameter than the pipe line to reduce pipe inlet losses and air or vapor entrainment. Inlets to heat exchangers may be enlarged to reduce impingement velocities and obtain better distribution. Where pump suction connections are smaller than the line, eccentric reducer (with off-set below the centerline of pump connection) shall be used to avoid an air pocket at the inlet connection.

20.10 Valves

A. Valve body materials shall comply with the pressure temperature class for each system. Where stainless steel is used for stems, discs and seat facings material shall be AISI Type 410, 420 or ASTM A182, Grade F6a. Use of cast iron valves is discouraged for use in any application.

B. Valve bodies and bonnets shall be suitable to support valve operators (handwheel, gear, motor or pneumatic) with the valve in any position, without external support.

C. Globe and gate valves shall be of the outside screw and yoke design with backseating construction. Globe valves of the T-pattern type are preferred. Check valves shall be of the swing or stop check type.

D. Use of reduced size ports is discouraged.

E. Gear operators shall be provided for globe and gate valves over 12-inch size.

F. Each valve shall be assigend a unique valve number by the Contractor and have a permanent stamped metal tag bearing the valve number securely attached to the valve.

20.11 Installation Guidelines

A. Pipe in storage shall have ends plugged or capped and shall be stored off the ground. Prior to fabrication in the shop or field, scale or any foreign material shall be blown or swabbed from the interior of the pipe. After fabrication, all open ends shall again be plugged, capped or otherwise sealed. All loose filings, slag, sand, dirt, oil, grease, or

other foreign substances shall be removed from the interior and exterior surfaces of all pipe or pipe fabrication prior to installation.

B. Lines shall be run level or pitched to conform to local requirements, providing one or, if necessary, two or more low spots in each line with provisions at the low point, or points, for draining the line. Vent valves, with provision for locking and sealing closed, shall be installed in high points of pipe lines where necessary to prevent air pockets.

C. Routing for piping runs indicated schematically or diagrammatically on piping drawings shall be reviewed by Contractor in conjunction with existing field conditions and requirements of all other systems, equipment and services to be installed.

D. Piping which is indicated schematically or diagrammatically on piping arrangement drawings shall be installed with proper allowances for insulation, headroom, equipment, removal and venting or drainage as necessary by first class piping practice.

E. Changes in direction of pipe lines shall be made only with fittings. Changes in line size shall be made only with fittings. Miter fittings, face or flush bushings, or street elbows shall not be used.

F. Use of different wall thickness for same size pipe in any particular piping system shall not be allowed.

G. Socket welding and threaded connections on pipe lines shall be made by forged outlet fittings. Fittings shall be of sufficient weight to satisfy reinforcement requirements and pressure temperature ratings compatible with pipe to which it is to be attached. Holes in pipe headers made for these connections shall be drilled to same size as fitting inside diameter. All burrs shall be removed and threaded fittings shall be retapped after welding.

H. Flanged or welding nozzles, branch connections, welding outlets, adapters and taps shall be true and faced at right angles to axis of pipe to insure accurate fit. Connections shall not extend inside pipe.

I. All pipe shall be cut to exact measurement and installed without springing or forcing. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or building elements with piping connections or piping supports.

J. Valves shall be installed in accordance with drawings. Where orientation is not indicated, install valves with stems horizontal on vertical runs or extending vertically upward on horizontal pipe runs. All valves shall be installed in accessible locations for operation as well as for removal, repair or replacement.

K. Full lenths of pipe shall be used where length between fittings is less than the mill random lengths of pipe. Extra joints shall be avoided.

L. Piping shall be accurately installed. All vertical piping shall be installed plumb, unless designed otherwise.

M. Use of welded connections shall be maximized.

20.12 Welding and Workmanship

A. Welding ground returns must be placed on the material being welded and closely adjacent to the arc.

B. Where possible, all welding shall be carried out in the down-hand position.

C. Manual welding shall be done by the shielded or inert-gas metal arc process, except for carbon steel pipe sizes 2" or smaller (outside diameter) where oxyacetylene gas welding may be used.

D. Approved automatic or semi-automatic processes may also be used. Cracks of any size are prohibited. Projections of weld metal into the pipe bore shall not exceed 1/16" for 8" or smaller, or 1/8" for larger pipe.

E. Backing rings shall not be used.

F. Electrode material for welding carbon steel pipe shall be equal to AWS A5.1, latest edition, Class E6010 for dc, E6011 for ac or dc. When the thickness of a butt weld or the throat of a fillet weld exceeds 1/2", filler metals producing low hydrogen deposits shall be used. However, cellulose or rutile type coated electrodes may be used for root passes regardless of wall thickness or throat dimension.

G. Use of slip-on flanges is discouraged. Slip-on flanges, where used, shall be positioned so that the distance from the face of the flange to the pipe end shall approximate the nominal pipe wall thickness plus 1/8". The interior seal weld shall be applied so that the flange does not require refacing. The maximum out of alignment of flanges from the required position shall be 1/32" measured across the diameter.

H. Weld end preparation for all field weld pipe joints shall be in accordance with ANSI B16.25 or Contractor's qualified procedure.

I. All welding on metal piping shall be performed in accordance with a procedure specification which has been qualified in accordance with Section IX of ASME Boiler and Pressure Vessel Code.

J. All welding operators on metal piping shall be qualified in accordance with Performance Qualification Specification prescribed by Section IX of ASME Boiler and Pressure Vessel Code.

20.13 Pipe Supports

A. Supports shall be constructed to permit movement of the pipe as may be caused by thermal expansion, contraction or other causes and to prevent damage by frost action.

B. Support components shall be connected to support steel, bolted, to or embedded in concrete or masonry. Bolt holes shall be drilled, not burned. Support components shall be attached where they will not damage other construction either during or after installation. Wall brackets shall not be used on metal wall panels.

C. Support points shall be selected on the basis of proper location and spacing for optimum load distribution and weight balance, taking into consideration available structures. Spacing shall be limited so as to prevent excessive sag, bending and shear stresses in the piping and to keep within the allowable structure loading limitations.

D. Insulated pipelines shall be supported on pipe supports sized to fit the outside diameter of the pipe and insulation. Protection saddles where used shall be of commercial manufacture fabricated of curved steel plate.

E. Spacing Horizontal Piping(Maximum)

Pipe Size (Inches)	Maximum Spacing (Feet)
1/2 and 3/4	5
1	7
1-1/2	9
2	10
2-1/2	11
3	12
4	14
6	17
8	22
10	28
12	32

F. Where multiple runs of pipe use common supports, the smallest diameter shall govern the maximum span between bents except that pipes 6" and larger may be fitted with brackets to support smaller pipes which have a diameter not greater than one-fourth that of the supporting pipe.

20.14 Non-Destructive Examination

A. Contractor shall make use of non-destructive examination procedures as described in Section V of the ASME Boiler and Pressure Vessel Code.

B. Inspection personnel shall have specific experience in the types of tests required. Use of an outside inspection agency is not required but is preferred. Contractor shall submit the qualifications of the inspection personnel to the Owner for approval.

C. Intensity of inspection shall be as follows:

Visual Inspection (VT)	-	All welds
Magnetic Particle (PT)	-	Per B31.1
Liquid Penetrant (PT)	-	Per B31.1
Radiography (RT)	-	All main steam and feedwater welds, per B31.1 mandatory NDE.
Ultrasonic (UT)	-	Selected applications
Leak Testing (LT)	-	Per B31.1
Initial Services Testing	-	All piping

D. Limitations on imperfection for all examinations shall meet the requirements in ANSI B31.1.

E. Contractor, at his expense, shall cut out, repair and retest by radiography all welds shown defective by non-destructive examination and/or hydrostatic (LT) test.

20.15 Leak Testing

A. Pressure shall be applied to the systems prior to application of insulation or backfilling. Pressure shall be maintained while all joints are thoroughly examined for leaks. All leaks shall be promptly repaired and the system retested.

B. All pneumatic instruments shall be isolated, the instrument lines shall be pressurized to instrument air supply pressure and "soap" leak checked.

C. Other than instrument piping, pneumatic testing shall not be used except with consent of the Owner.

D. Hydrostatic testing on new and existing piping systems that the Contractor has installed or modified shall be done in accordance with ANSI B31.1 Owner's representative shall be notified of field hydrostatic tests in advance.

20.16 Pre-operational System Cleaning

A. Prior to placing in operation, the piping systems shall be cleaned as follows:

1. Main steam line from boiler to Du Pont shall be cleaned via steam blow. Temporary piping shall be installed if necessary to safely discharge the steam to the atmosphere The required steam pressure for steam blow shall be calculated such that the steam blow "cleaning force" momentum exceeds the steam momentum developed at MCR. Impact targets shall be provided for assessment of cleaning effectiveness. The boiler manufacturer's recommended procedure shall be followed for performance of the steam blow and Du Pont's acceptance criteria shall be used for determining acceptable cleanliness. A steam quench/silencing device shall be mounted on the exhaust of the temporary steam blow piping. Contractor shall prepare calculations to demonstrate the adequacy of his temporary steam blow piping and suitability of steam blow conditions to meet the above requirements. Calculations shall be submitted to the Owner at least 60 days prior to initial steam blow.

2. Pre-boiler piping shall be cleaned via a hot alkaline flush and passivated in accordance with boiler manufacturer's recommended procedure. Temporary piping shall be installed as necessary to allow circulation through the feedwater system and bypassing such equipment as boiler feed pumps, deaerator and feedwater heaters. Provisions shall be made for Environmental Protection Agency approved off-site disposal of wastes by the Contractor.

3. All other steam and water piping systems shall be cleaned by flushing with clean water until all foreign matter is eliminated. Temporary flushing connections and piping shall be installed as necessary. Velocity of flushing water shall not be less than 10 feet per second. Recirculation through a temporary strainer (openings not more than .034 in.) is permitted on large lines where flushing water requirements would exceed 100 gpm.

4. Air system piping shall be cleaned by air blow to the atmosphere with minimum air pressure of 75 psig.

21.00 INSULATION SYSTEMS

21.01 Insulation shall be provided to conserve heat energy, provide personnel protection from hot surfaces and prevent nuisance water condensation on cold surfaces.

21.02 All hot parts shall be covered with calcium silicate of a suitable thickness. To avoid deformation, calcium silicate shall be used on piping or equipment which would be readily walked on. Flat surfaces, cylindrical surfaces and irregular surfaces shall be lagged with aluminum or stainless steel, properly sealed. Irregular surfaces located indoors shall be enclosed with preformed aluminum jackets. Equipment and valves requiring frequent access for maintenance shall be provided with easily removable and reusable blanket insulation and lagging systems. Mineral wool shall not be used except on flat surfaces (e.g. ductwork, boiler surfaces, fans, etc.) or as covered removable blankets.

21.03 Insulation thickness shall be dictated by system temperature, economic sensitivity to energy loss and outside lagging temperature limitation. Surface temperature of lagging or insulation shall not be more than 45°F above ambient temperature. Ambient temperature shall be measured at least 3 feet from the insulated surface.

21.04 Insulation for personnel protection shall extend from the floor or grating level to an elevation eight feet above this level.

21.05 All parts where the exposed surface temperature shall be below the expected dew point temperature and the resulting condensation would be a nuisance, shall be insulated with polyurethane of suitable thickness and covered with vapor barrier jacketing.

21.06 Underground steam or hot water lines shall use foamglass type insulation with a sealed bitumastic outer jacket.

21.07 Asbestos materials shall not be used in any insulation system.

22.00 OWNER SUPPLIED EQUIPMENT AND MATERIALS

22.01 The Owner shall be responsible for purchasing, delivering and installing the following items of equipment, materials and services.

22.02 Stationary Equipment

A. Office furniture consisting of desks, chairs, file cabinets, book cases, etc.

B. Laboratory furniture, equipment and supplies not part of the permanent installation.

C. Machine shop tools.

D. Telephone equipment and handsets.

E. Personal and office computers.

F. Vending Machines

22.03 Vehicles

A. Representative vehicles may include the following as dictated by the facility design.

- Forklift
- Tractors/Trailers
- Pickup Truck

22.04 Fuel

A. All RDF fuel used for testing and initial operation.

B. Propane required during startup shall be purchased by the Owner.

22.05 Ash Disposal

A. All ash resulting from the combustion of the RDF fuel will be disposed of by the Owner.

22.06 Chemicals

A. Owner will provide chemicals required for start-up, initial operation and testing not including initial cleaning of boiler and piping systems.

23.00 SPARE PARTS AND SPECIAL TOOLS

23.01 General Spare Parts

A. The Contractor's procurement specifications shall request each Vendor to provide a recommended spare parts list with specific model numbers and exploded views of parts as well as a price sheet with its bid on the equipment. This information shall be provided to the Owner at the time an equipment purchase order is issued. The Owner shall purchase spare parts from the Contractor's equipment supplier. Owner shall receive and place into storage all spare parts received. Contractor shall provide adequate and secure storage area for spares.

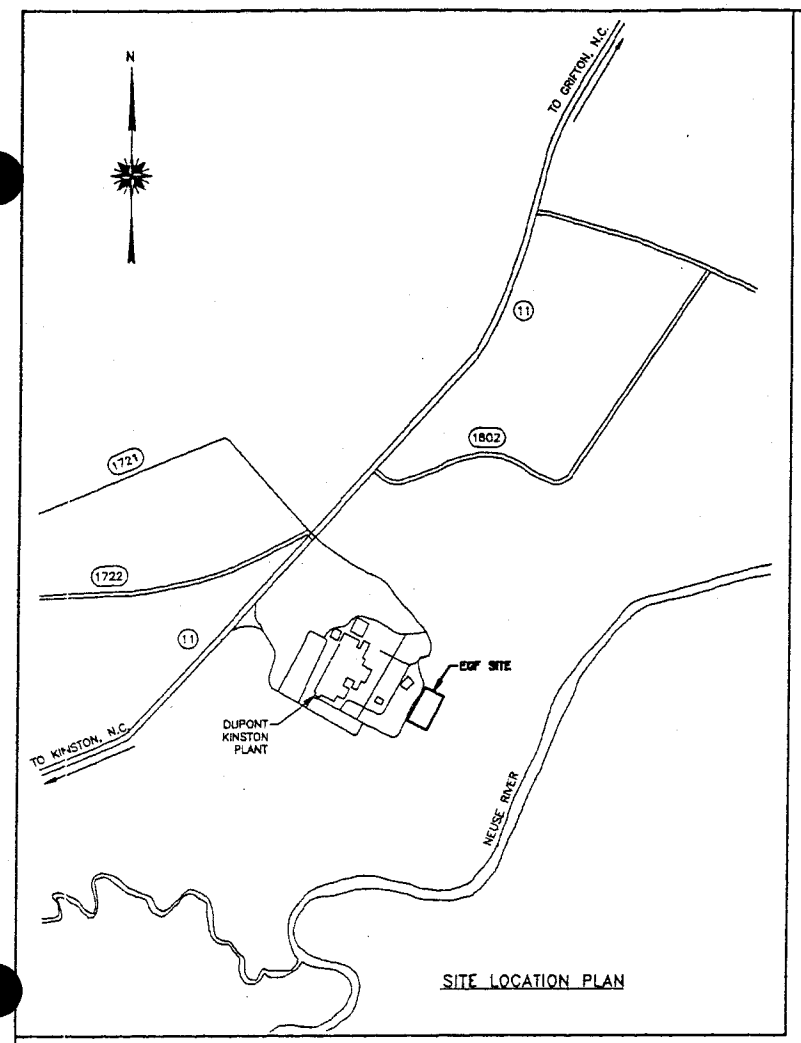
B. The Contractor shall be responsible for cost for resupply, delivery and installation of Owner's spare parts used during testing and start-up of the plant. All Owner supplied spares may not be available prior to Substantial Completion.

23.02 Special Tools

A. The Contractor's procurement specifications shall require equipment suppliers to provide any special tools, equipment or lifting devices

required to install, test, clean, or maintain the equipment. These items shall be supplied by the Contractor and be turned over to the Owner upon Substantial Completion. Special tools shall be in good working order.

Section 3



SITE LOCATION PLAN

VEDCO ENERGY CORPORATION
HOUSTON, TEXAS

ENERGY GENERATION FACILITY

PROJECT AT

KINSTON, NORTH CAROLINA

PREPARED BY

TRI-MONT ENGINEERING COMPANY
THE SCHRAFFT CENTER, SUITE 208
529 MAIN ST.
BOSTON, MA 02129

TRI-MONT DRAWING NO.	TITLE
D-071-030-T1	TITLE SHEET & INDEX
D-071-030-C1	AREA PLAN & ACCESS ROAD
D-071-030-C2	SITE PLAN
D-071-030-C3	DUPONT FACILITIES PLAN
D-071-030-E1	DUPONT ELECTRICAL ONE LINE DIAGRAM
D-071-030-E2	EGF ONE LINE DIAGRAM
D-071-030-B1	GUARANTEED HEAT BALANCE FULL BOILER OUTPUT
D-071-030-B2	INTERFACE DIAGRAM
D-071-030-F1	PIPING & INSTRUMENTATION DIAGRAM, SYMBOLS
D-071-030-F2	PIPING & INSTRUMENTATION DIAGRAM, FEEDWATER, STEAM & CONDENSATE SYSTEM
D-071-030-F3	PIPING & INSTRUMENTATION DIAGRAM, DUPONT CONDENSATE & FEEDWATER SYSTEM
D-071-030-F4	PIPING & INSTRUMENTATION DIAGRAM, RDF HANDLING & FUEL FEED SYSTEM
D-071-030-F5	PIPING & INSTRUMENTATION DIAGRAM, WATER SERVICE SYSTEMS
D-071-030-F6	PIPING & INSTRUMENTATION DIAGRAM, WASTE WATER SYSTEM
D-071-030-F7	PIPING & INSTRUMENTATION DIAGRAM, COMPRESSED AIR SYSTEM
D-071-030-F8	PIPING & INSTRUMENTATION DIAGRAM, MISCELLANEOUS SYSTEMS
D-071-030-F9	PIPING & INSTRUMENTATION DIAGRAM, FLUE GAS SYSTEM
D-071-030-S1	FLOOR PLANS, OFFICE/CONTROL BUILDING & EQUIPMENT BUILDING

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	FOR BID	C.U.	7/11/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

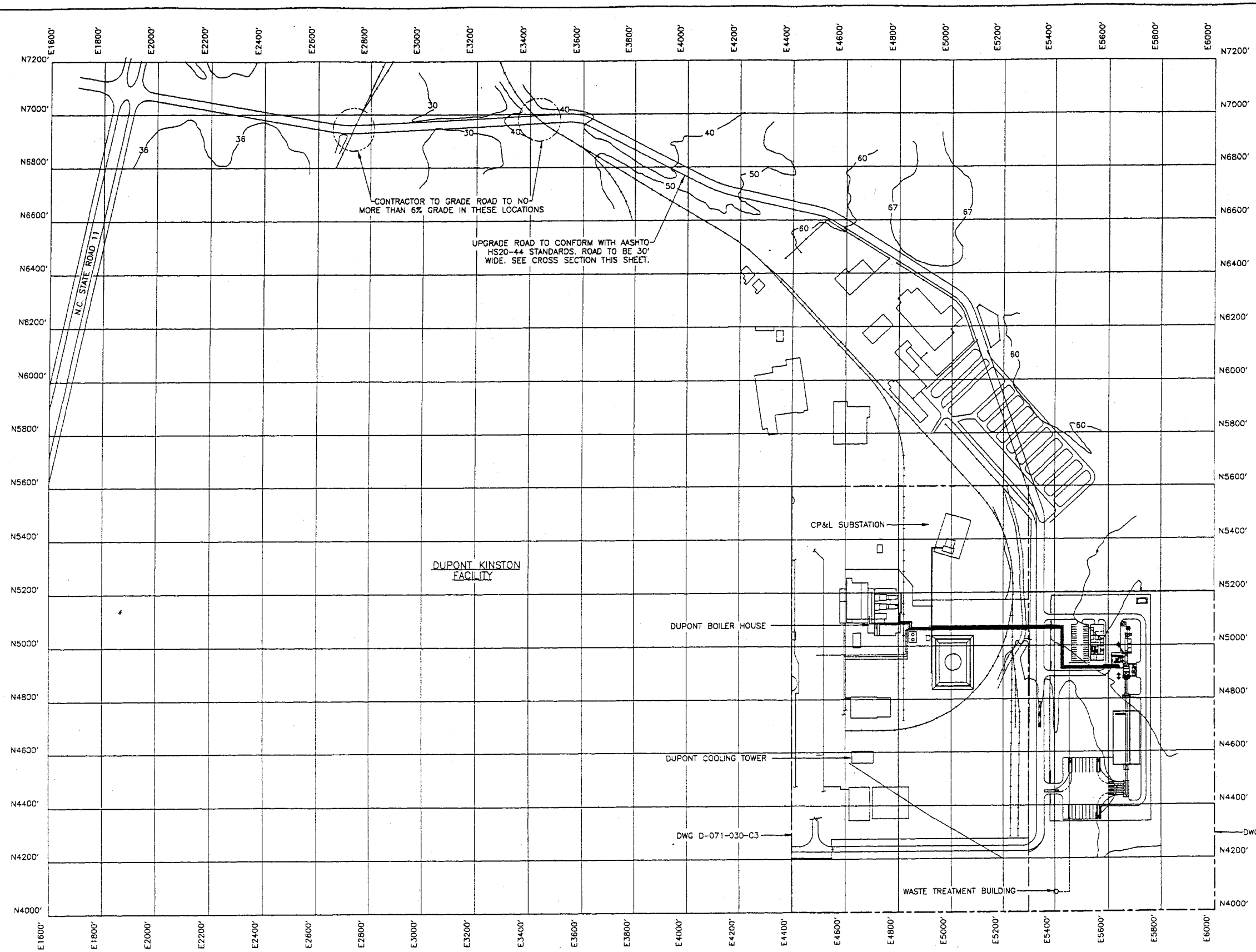
PROJECT: KINSTON EGF

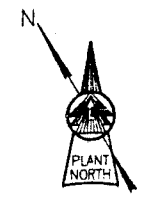
Title: TITLE SHEET & INDEX

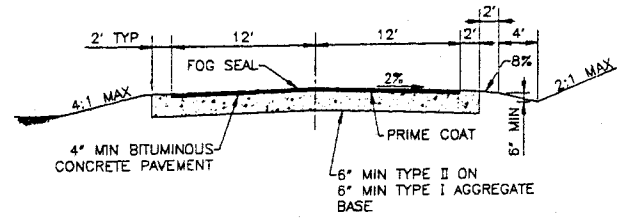
TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/16/93	Approved		
Checked	G.J. CAHILL	11/16/93	Approved		
Approved	G.J. CAHILL	11/16/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-T1	D

11/18/94







PAVEMENT CROSS SECTION DETAIL

1. ELEVATIONS ARE APPROXIMATE. CONTRACTOR TO VERIFY ELEVATIONS.

0 100 200 300 400 500 600 700 800

SCALE: 1"=200'

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	ADDENDUM NO. 1	HC	8/5/94	GJC
B	FOR BID	C.U.	7/11/94	GJC
A	FOR REVIEW	HC	5/13/94	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: AREA PLAN & ACCESS ROAD

TRI-MONT	By	Date	Client	By	Date
Drawn	H. CLEMENS	12/3/94	Approved		
Checked	G.J. MORIN	5/6/94	Approved		
Approved	G.J. CAHILL	5/6/94	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1" = 200'		D-071-030-C1	D

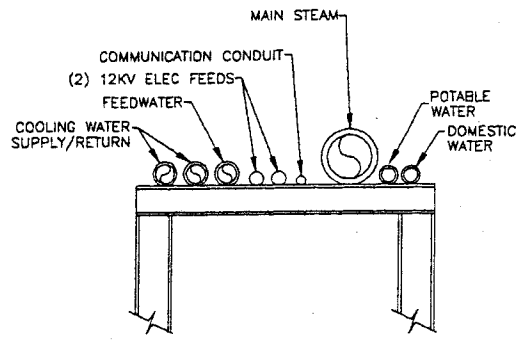
11/14/94

N5200'
N5000'
N4800'
N4600'
N4400'
N4200'
E6000'
E5800'
E5600'
E5400'
E5300'

PROPANE TANK
CHIMNEY
LIME & ACTIVATED CARBON SILOS
CFB BOILER
RECLAIM CONVEYORS
NH_3 TANK
ASH LOADOUT ENCLOSURE
EQUIPMENT BUILDING
SAND & LIMESTONE SILOS
FUEL STORAGE BLDG
CONTROL & ADMINISTRATION BUILDING
PIPE SUPPORT BRIDGE
PARKING
64 (EXISTING GRADE)
66
60
NEW STEAM LINE & OTHER UTILITIES
PIPE SUPPORT BRIDGE
CB
MAIN GATE
8" SD
30" SD
CB
NEW SEWER LINE
SEWER WEIR W/T.O.C. MONITOR
LOADED RDF TRUCK
A
A
E

MATCH LINE DWG D-071-030-C3

N
PLANT NORTH



A–A
PIPE BRIDGE CROSS SECTION
NOT TO SCALE

0 50 100 150
SCALE: 1"=40'

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
G	CONTRACT AWARD	H.C.	11/23/94	GJC
F	ADDENDUM NO.2	C.U.	8/30/94	GJC
E	ADDENDUM NO.1	HC	8/5/94	GJC
D	FOR BID	C.U.	7/11/94	GJC
C	REV PLANT ARRGT	HC	5/13/94	GJC
B	FOR AIR PERMIT	MIR	3/18/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI–MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1"=40'		D-071-030-C2	G

11/15/94

11/14/94

FIRE WATER: 2 INDEPENDENT UNDERGROUND FEEDS TO ROF PLANT.
COOLING WATER: UNDERGROUND TO FUEL OIL TANK AREA, PIPE BRIDGE TO ROF PLANT.

N4200' N4400' N4600' N4800' N5000' N5200' N5400' N5600'

E4400' E4600' E4800' E5000' E5200' E5300'

POTABLE WATER
FIRE PROTECTION TIE-IN #1
12"FP
10"FP
~45°
COOLING WATER SUPPLY AND RETURN TIE-INS
COOLING WATER LINES 42"
POWER PLANT
REFRIGERATION BUILDING
COOLING TOWER
COOLING WATER SUPPLY AND RETURN LINES
FUTURE DUMP CONDENSER (OPTION)
POTABLE WATER TIE-IN #1
HP STEAM TIE-IN #1
FEEDWATER TIE-INS
NEW DEAERATING HEATER 3RD FLR
NEW BOILER FEED PUMP 1ST FLR
DOMESTIC WATER TIE-IN #1
DUPONT KINSTON FACILITY
HP STEAM TIE-IN #2
6" FIRE PROTECTION
FIRE PROTECTION TIE-IN #2
FUEL OIL TANKS
NEW STEAM LINE & OTHER UTILITIES
EXISTING OUTDOOR CABLE TRAY
NEW ELECTRICAL SERVICE
PIPE BRIDGE
SUBSTATION
F.O. STORAGE TANK
2 UNDERGROUND FIRE PROTECTION LINES

MATCH LINE
DWG D-071-030-C2

N

PLANT NORTH

SCALE: 1"=60'

0 50 100 200

PRELIMINARY

No.	Description	By	Date	Appd
B	CONTRACT AWARD	HC	11/23/94	GJC
A	FOR REVIEW	HC	5/13/94	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

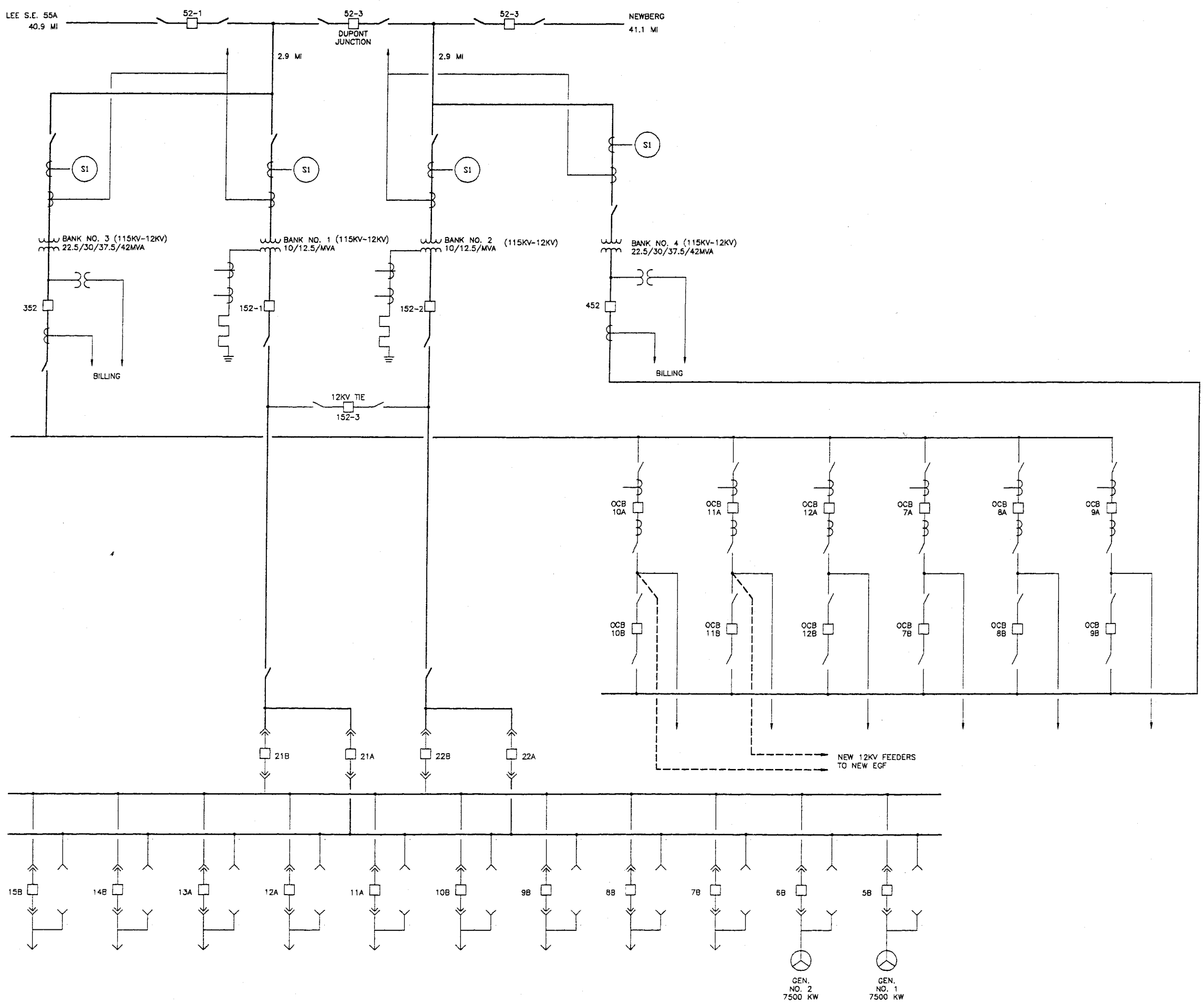
CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: DUPONT FACILITIES PLAN

Tri-MONT	By	Date	Client	By	Date
Drawn	H. CLEMENS	5/3/94	Approved		
Checked	G.J. MORIN	5/6/94	Approved		
Approved	G.J. CAHILL	5/6/94	Approved		

Scale: 1"=60' | Job No. D-071-030-C3 | Drawing No. | Rev. No. B



NOTES:
1. DIAGRAM IS BASED UPON DUPONT DRAWING NUMBER W 501177 DATED 2/7/74.
2. DIAGRAM IS FOR INFORMATION ONLY. REFER TO DUPONT DRAWINGS FOR CONSTRUCTION.

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
C	CONTRACT AWARD	HC	11/23/94	GJC
B	FOR BID	HC	7/15/94	GJC
A	FOR REVIEW	HC	5/13/94	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

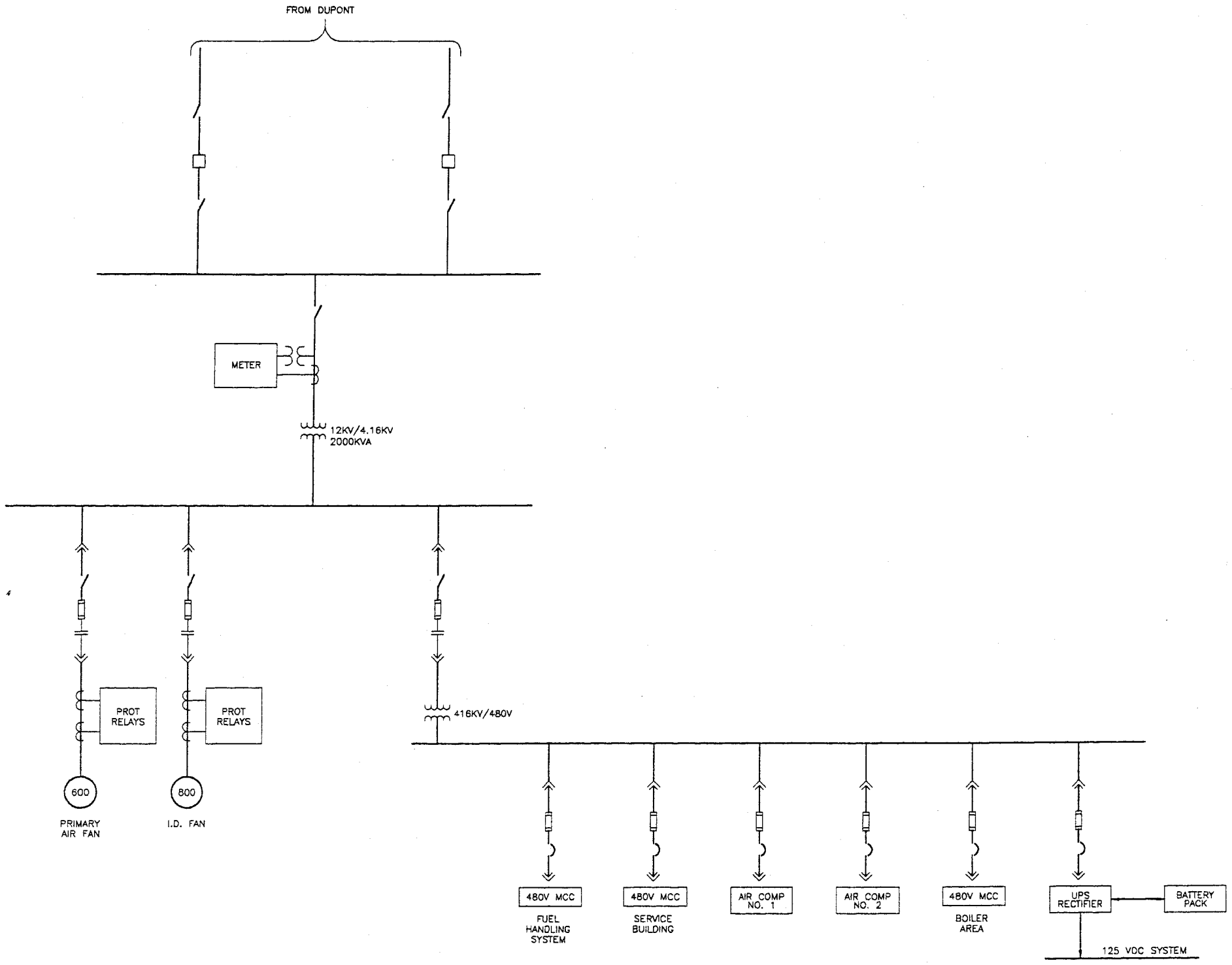
PROJECT: KINSTON EGF

Title: DUPONT ELECTRICAL ONE LINE DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	H. CLEMENS	4/29/94	Approved		
Checked	G.J. MORIN	5/6/94	Approved		
Approved	G.J. CAHILL	5/6/94	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-E1	C

11/14/94



PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	ADDENDUM NO. 1	HC	8/5/94	GJC
B	FOR BID	HC	7/15/94	GJC
A	FOR REVIEW	HC	5/13/94	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

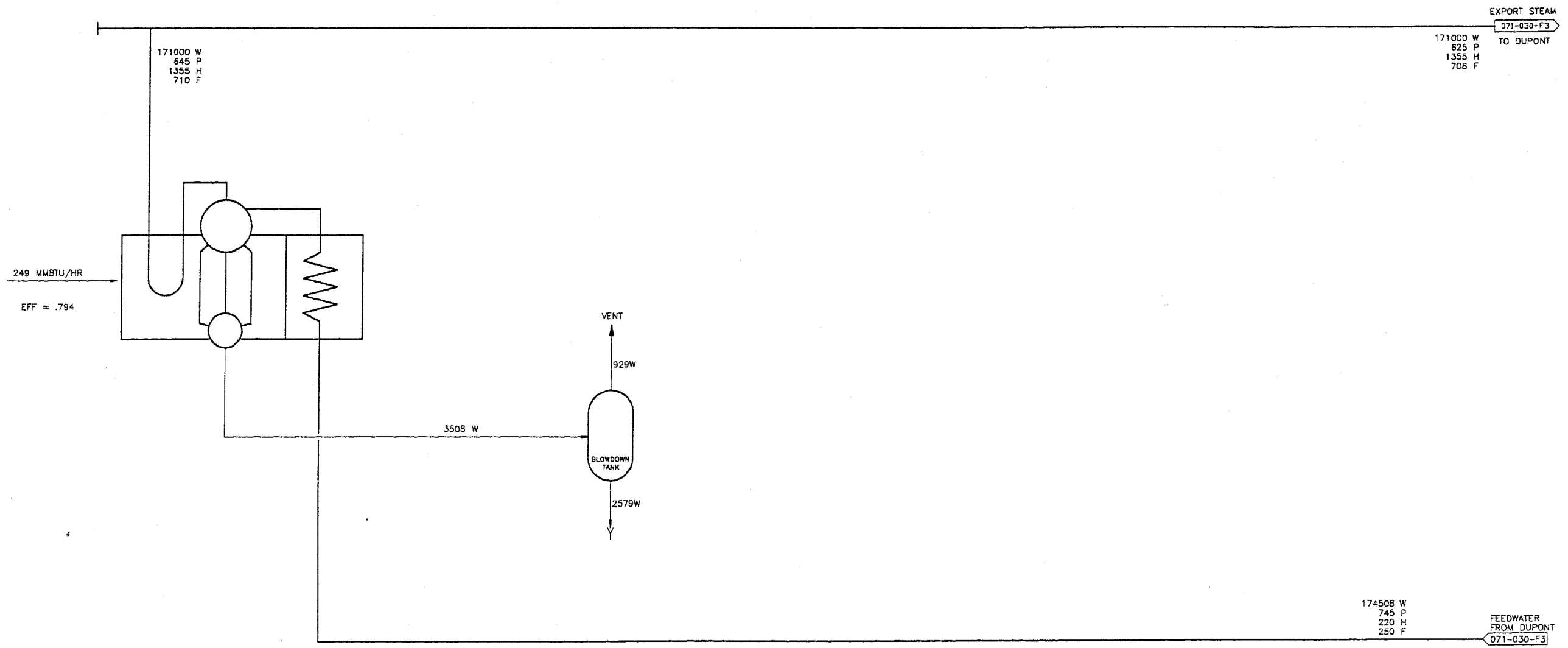
PROJECT: KINSTON EGF

Title: EGF
ONE LINE DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	H. CLEMENS	5/2/94	Approved		
Checked	G.J. MORIN	5/6/94	Approved		
Approved	G.J. CAHILL	5/6/94	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-E2	D

11/14/94



PRELIMINARY

LEGEND

W=LB/HR

P=PSIA

H=BTU/LB

F=DEGREES F

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P

PROJECT: KINSTON EGF

Title: GUARANTEED HEAT BALANCE
FULL BOILER OUTPUT

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE

Job No.

Drawing No. D-071-030-B1

Rev. No. E

11/18/94

SUPPLY FROM HOST

VEDCO FACILITY

RETURN TO HOST

FUEL:
RDF: 250 X 10^6 BTU/HR
PROPANE: 62 X 10^6 BTU/HR

CHEMICALS:
LIMESTONE
HYDRATED LIME
ACTIVATED CARBON
AMMONIA
SAND

ASH

FROM DUPONT

TO/FROM OFFSITE

TO DUPONT

BOILER PLANT & AUXILIARY

BOILER FEEDWATER — 350 GPM (400 GPM)

FE — 345 GPM (375 GPM) — FE — HIGH PRESSURE STEAM TO DUPONT

5 GPM (7 GPM)

5 GPM (7 GPM) — MIXING COOLER — 10 GPM (14 GPM) — 30 GPM (51 GPM) — FE (WEIR) — PROCESS SEWER

DOMESTIC WATER SUPPLY — 30 GPM (59 GPM)

0 GPM (2 GPM) — NH^3 WET SUMP — 0 GPM (2 GPM)

15 GPM (20 GPM) — ASH COOLING — 15 GPM (20 GPM)

10 GPM (15 GPM) — HOSE BIBS — 10 GPM (15 GPM)

MAKEUP 0 GPM (15 GPM)

CIRCULATING WATER SUPPLY — 2000 GPM (3000 GPM)

CLOSED LOOP EQUIPMENT COOLING WATER 20 DEG F RANGE — 2000 GPM (3000 GPM) — 2000 GPM (3000 GPM) — COOLING WATER RETURN

POTABLE WATER — 10 GPM (15 GPM)

PLANT POTABLE WATER SYSTEM — 10 GPM (15 GPM)

DRAINS — OIL/WATER SEPARATOR — 10 GPM (20 GPM)

PLANT FIRE PROTECTION SYSTEM — 0 GPM (2000 GPM)

FIRE PROTECTION

STORM/ROOF DRAINS — 0 GPM (3000 GPM) — OPEN DRAINAGE SYSTEM

METER

(2) 12KV FEEDS — 1500 KW (2000 KW)

BOILER PLANT ELECTRICAL SYSTEM

2 GPM —— INDICATES AVERAGE FLOW
(4 GPM) —— INDICATES PEAK FLOW

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	GENERAL REVISIONS	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: INTERFACE DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G. MORIN	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE | Job No. D-071-030-B2 | Drawing No. | Rev. No. E

11/18/94

VALVES

NORMALLY OPEN	NORMALLY CLOSED	TYPE
		GATE
		GLOBE
		CHECK
		BUTTERFLY
		DIAPHRAGM
		NEEDLE
		PLUG
		BALL
		STOP CHECK (SWING TYPE)
		STOP CHECK (GLOBE TYPE)
		STOP CHECK (ANGLE TYPE)
		STOP (POWER ASSIST)
		QUICK OPERATION
ADD ARROWS TO INDICATE PORTING		ANGLE, 3 WAY, 4 WAY — TYPICAL-BODY TYPE SYMBOL TO BE ADDED
		SAFETY OR RELIEF
		LINE BLIND, SPECTACLE
		KNIFE, SLIDE
		POST INDICATOR
		VALVE WITH HOLE THRU DISC.
		QUICK OPERATING-SPRING RETURN
		DAMPER

MISCELLANEOUS DEVICES

- TRAP (T) OR DRAINER (D)
- "Y" STRAINER
- FLANGE
- START-UP STRAINER (SS)
- SINGLE BASKET STRAINER
- DUPLEX BASKET STRAINER
- SIGHT FLOW INDICATOR
- FLOW RESTRICTING ORIFICE
- FLOW METER ORIFICE
- FLOW NOZZLE
- DESUPERHEATER (MECH. ATOMZING)
- DESUPERHEATER (STEAM ASSISTED)
- PRESSURE BREAKDOWN DEVICE
- HYDRANT
- DRAIN FUNNEL
- EXPANSION JOINT
- ELECTRIC MOTOR (M)
- ELECTRIC INTERLOCK
- REDUCER
- CAP
- RUPTURE DISC.
- UNION
- FILTER (F)
- MIXING NOZZLE
- PLUGGED CONN.
- SOUND ANTENUATOR
- BAROMETRIC LEG
- MIXER OR AGITATOR (M)
- POSITIVE DISPLACEMENT METER (8)

PUMPS & FANS

- CENTRIFUGAL PUMP OR FAN (ELECTRIC MOTOR DRIVEN)
- POSITIVE DISPLACEMENT PUMP (ELECTRIC MOTOR DRIVEN)
- METERING PUMP (ELECTRIC MOTOR DRIVEN)
- VERTICAL PUMP (ELECTRIC MOTOR DRIVEN) (M)

MISCELLANEOUS CODING

- EM — ITEM FURNISHED WITH EQUIPMENT WHEN SUPPLIED IN VENDORS PIPING
- CONN. LINE ON OTHER DRAWING (CO-19) — TERMINAL ARROW TO OR FROM
- DRAWING No. FOR CONT-INUATION — TERMINAL ARROW TO AND FROM
- SYSTEM SYMBOL CO-23 / LINE No. — LINE NUMBERING
- VALVE NUMBERING 00-0-00
  - VALVE NUMBER 1-99
  - SOURCE OF SUPPLY: E-SUPPLY BY EQUIP. MFR., V-SUPPLY BY CONTRACTOR
  - SYSTEM DESIGNATION

LINE CODING

- FLOW ARROW
- P — PITCH ARROW
- PRIMARY SYSTEM
- SECONDARY LINE
- PNEUMATIC LINE
- CAPILLARY LINE
- ELECTRICAL LINE
- HYDRAULIC
- V — V — VENT
- DCS SOFTWARE LINK

VALVE OPERATORS

- SR — PNEUMATIC DIAPHRAGM OPERATOR (SPRING OPPOSED)
  FAILURE POSITION (TYPICAL)
  F.C. FAILS CLOSED
  F.O. FAILS OPEN
  F.L. FAILS LOCKED
  F.I. FAILS INDETERMINATE
  TYPICAL SYMBOL FOR POSITIONER. (SR = SPLIT RANGE)
  ALSO USED FOR LIMIT SWITCHES. POSITION TRANSMITTER, OR OTHER APPENDAGES WITH APPROPRIATE SIGNALS TO DEVICES EXTERNAL TO VALVE ASSEMBLY.
- CYLINDER-OPERATOR SINGLE & DOUBLE ACTING
- (M) ELECTRIC MOTOR OPERATOR
- SOLENIOD OPERATOR (SHOWN WITH 3-WAY VALVE)
  DC — POWER SOURCE (AC WHEN NOT NOTED)
  B, A, C — PORT IDENTIFICATION
  NORMALLY CLOSED PORT
  PATH WHEN ENERGIZED
  PATH WHEN DE-ENERGIZED
- HANDWHEEL OPERATOR (WHERE NOT NORMAL FOR TYPE OF VALVE)
- GEAR OPERATOR (G)

INSTRUMENT DEVICES

- LOCALLY MOUNTED DEVICE-REMOTE FROM MAIN CONTROL ROOM AREA
- AUXILIARY PANEL
- MAIN CONTROL ROOM FRONT OF PANEL DEVICE
- DUPLEX FUNCTION
- FLOW-THROUGH DEVICE
- O / C — OPEN-CLOSE FOR INDICATING LIGHT
- TE — TEMPERATURE ELEMENT (INCLUDING SIGNAL AND RECEIVER) ELEMENT IS THERMOCOUPLE TYPE UNLESS OTHERWISE NOTED
- WELL (TAG SAME AS ELEMENT EXCEPT "TW" IN PLACE OF "TE") PAD OR OTHER ATTACHMENT
- DESIGNATION OF SOURCE OF SUPPLY
  - PI 34 — SUPPLIED VIA INSTRUMENT VENDER
  - PI EM — SUPPLIED WITH MAJOR EQUIPMENT BY EQUIPMENT MANFACTURER
- DEVICE CONNECTED TO DCS (DISTRIBUTED CONTROL SYSTEM)
- SAMPLE COOLER
- 126 — COMPUTER INPUT COMPUTER POINT NO.
- CS — O / C — (M) CONTROL SWITCH PROVIDED WITH OPEN-CLOSE INDICATING LIGHTS FROM LIMIT SWITCH

INSTRUMENT IDENTIFICATION

CODE LETTER	FIRST LETTER	SUCCEEDING LETTER
A	ANALYSIS	ALARM AMPLIFY
B	BURNER FLAME	BIAS STATION
C	CONDUCTIVITY (CS-CONTROL SWITCH)	CONTROL
D	DENSITY, SP.GR.	DIFFERENTIAL
E	VOLTAGE	PRIMARY ELEMENT
F	FLOW	RATIO
G	GAGE	GLASS
H	HAND-OPERATED	HIGH
I	CURRENT	INDICATE
J	POWER	SCAN
K	TIME, TIME SCHEDULE	CONTROL STATION (A/M STATION)
L	LEVEL	LIGHT LOW
M	MOTOR, MOISTURE	MIDDLE OF INTERMEDIATE
N	——	——
O	——	——
P	PRESSURE, VACUUM	POINT (TEST CONNECTION)
Q	QUANTITY, EVENT	INTERGATE, TOTALIZE
R	RADIATION	RECORD
S	SPEED, FREQUENCY	SWITCH
T	TEMPERATURE	TRANSMIT
U	MULTIVARIABLE	MULTIFUNCTION
V	VISCOSITY	VALVE
W	WEIGHT	WELL
X	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT	RELAY, COMPUTING DEVICE CONVERTER, TRANSDUCER
Z	POSITION	DRIVE UNIT

ABBREVIATIONS

POWER SUPPLY TYPE

A/S	AIR SUPPLY
ES	ELECTRIC SUPPLY
GS	GAS SUPPLY
HS	HYDRAULIC SUPPLY
NS	NITROGEN SUPPLY
SS	STEAM SUPPLY
WS	WATER SUPPLY
AC	ALTERNATING CURRENT
DC	DIRECT CURRENT

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	FOR BID	HC	7/15/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

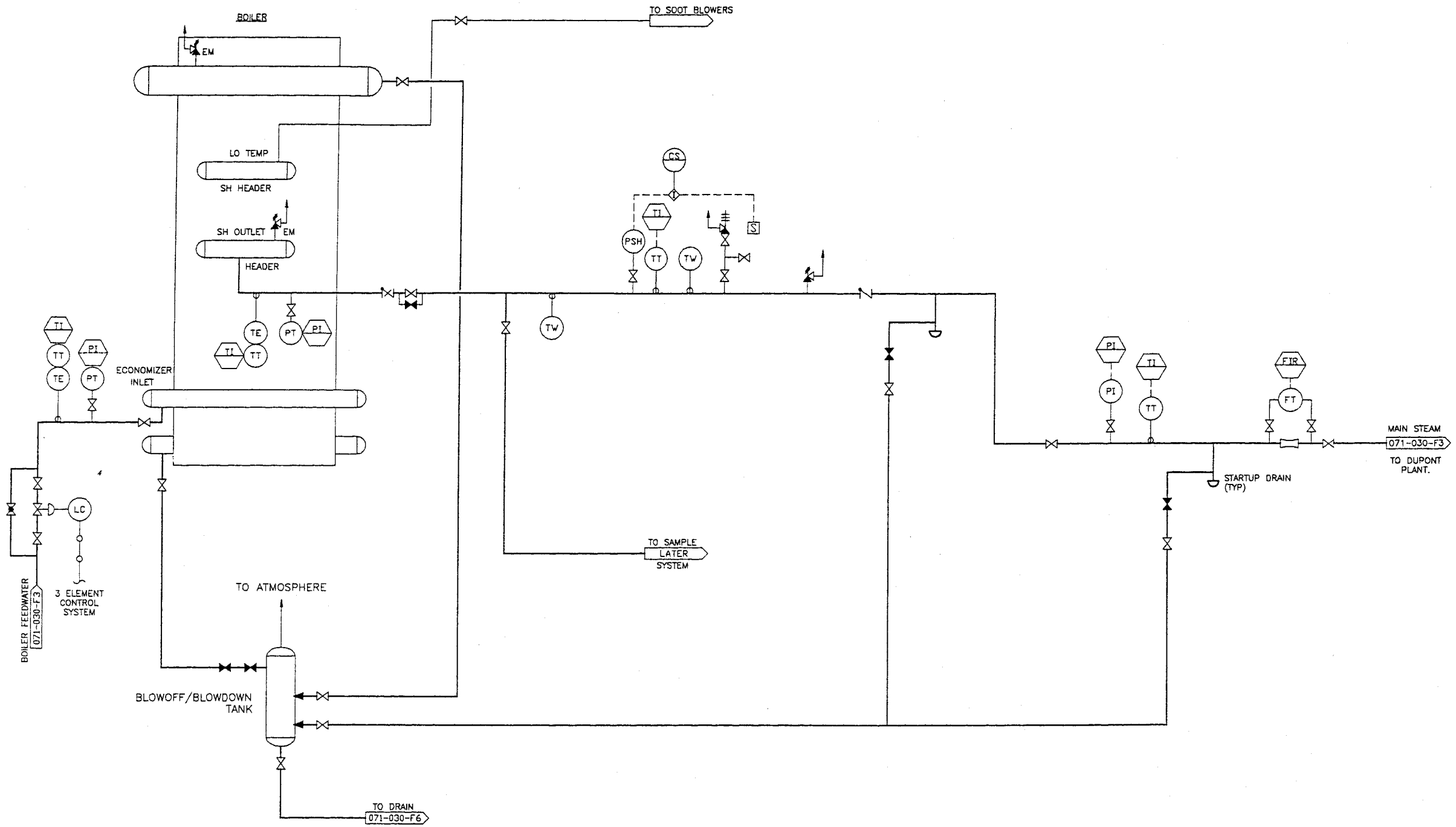
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM SYMBOLS

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE | Job No. | Drawing No. D-071-030-F1 | Rev. No. D

11/14/94



PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

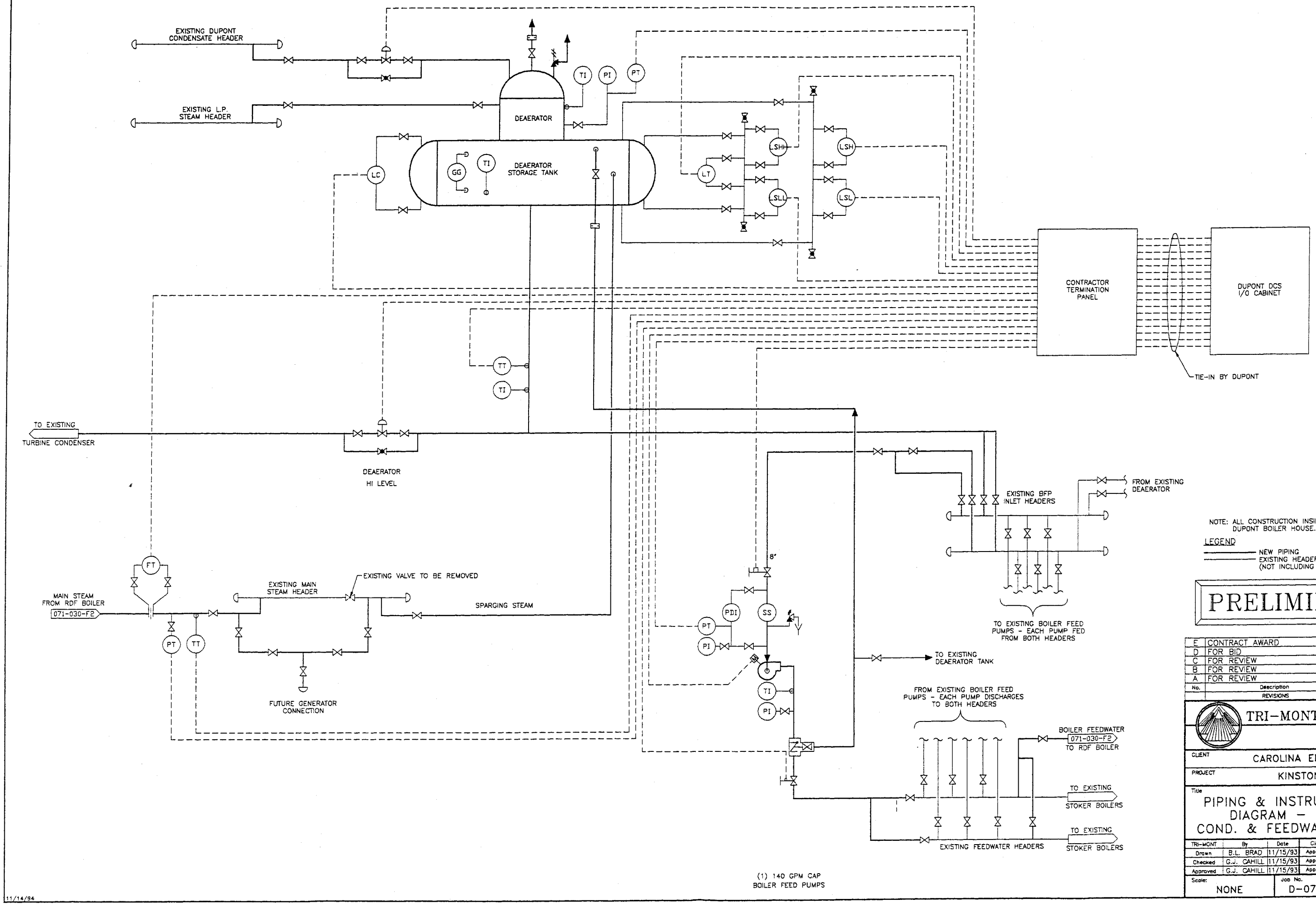
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM – FEEDWATER, STEAM & CONDENSATE SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L.BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE | Job No. | Drawing No. D-071-030-F2 | Rev. No. E

11/14/94



NOTE: ALL CONSTRUCTION INSIDE EXISTING DUPONT BOILER HOUSE.

LEGEND

——— NEW PIPING
——— EXISTING HEADERS/PIPES (NOT INCLUDING INSTRUMENTATION)

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

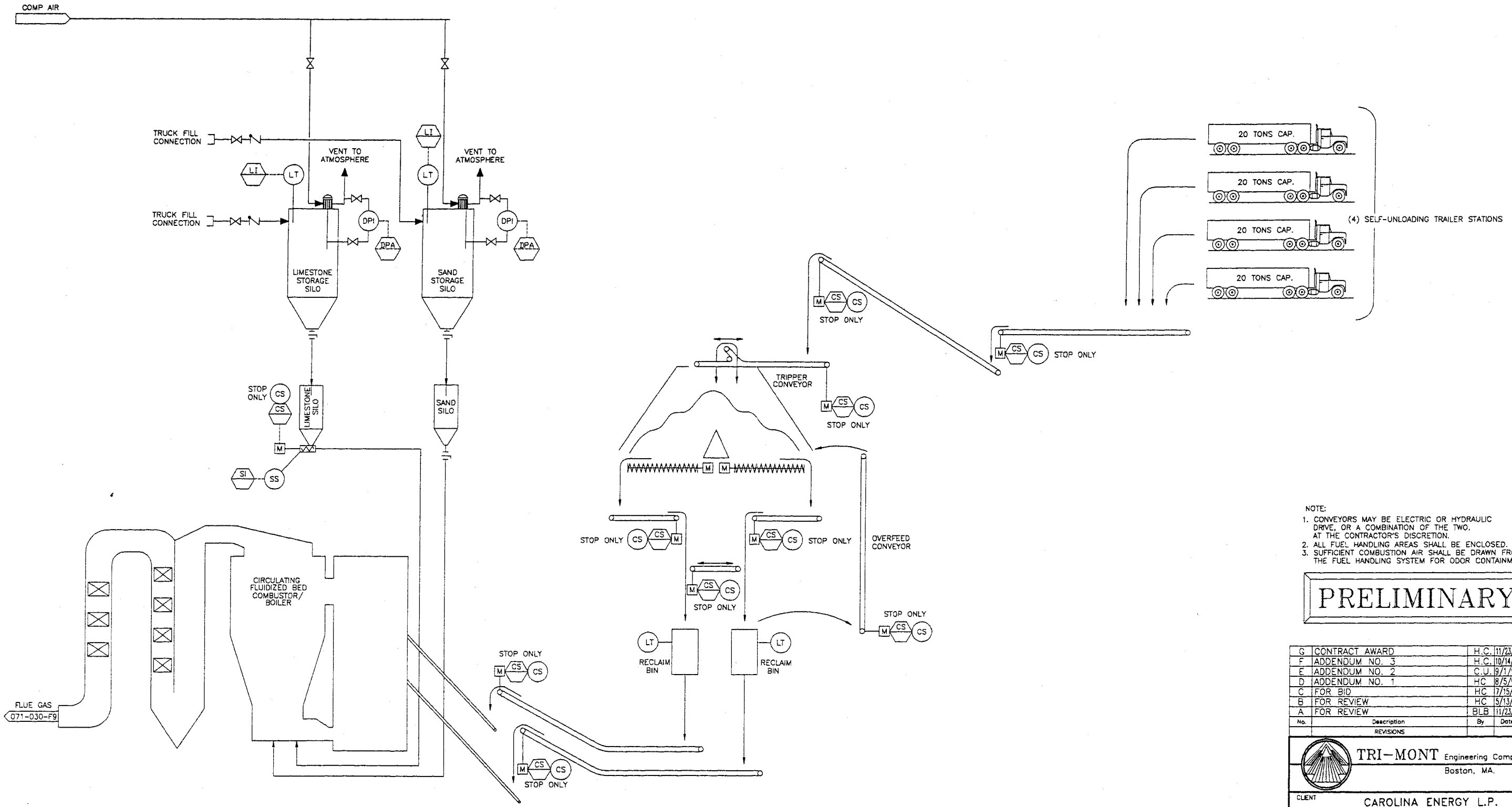
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM – DUPONT COND. & FEEDWATER SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE | Job No. | Drawing No. D-071-030-F3 | Rev. No. E

11/14/94



NOTE:
1. CONVEYORS MAY BE ELECTRIC OR HYDRAULIC DRIVE, OR A COMBINATION OF THE TWO. AT THE CONTRACTOR'S DISCRETION.
2. ALL FUEL HANDLING AREAS SHALL BE ENCLOSED.
3. SUFFICIENT COMBUSTION AIR SHALL BE DRAWN FROM THE FUEL HANDLING SYSTEM FOR ODOR CONTAINMENT.

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
G	CONTRACT AWARD	H.C.	11/23/94	GJC
F	ADDENDUM NO. 3	H.C.	10/14/94	GJC
E	ADDENDUM NO. 2	C.U.	9/1/94	GJC
D	ADDENDUM NO. 1	HC	8/5/94	GJC
C	FOR BID	HC	7/15/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

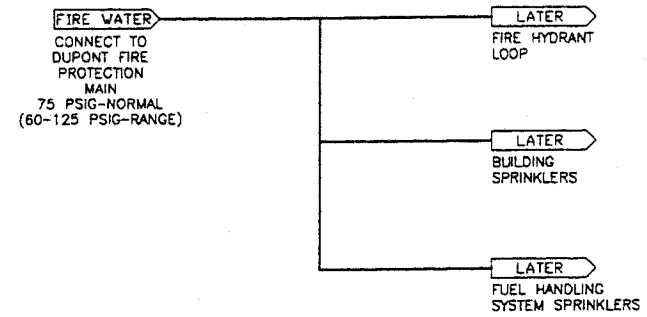
Title: PIPING & INST. DIAGRAM RDF HANDLING & FUEL FEED SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

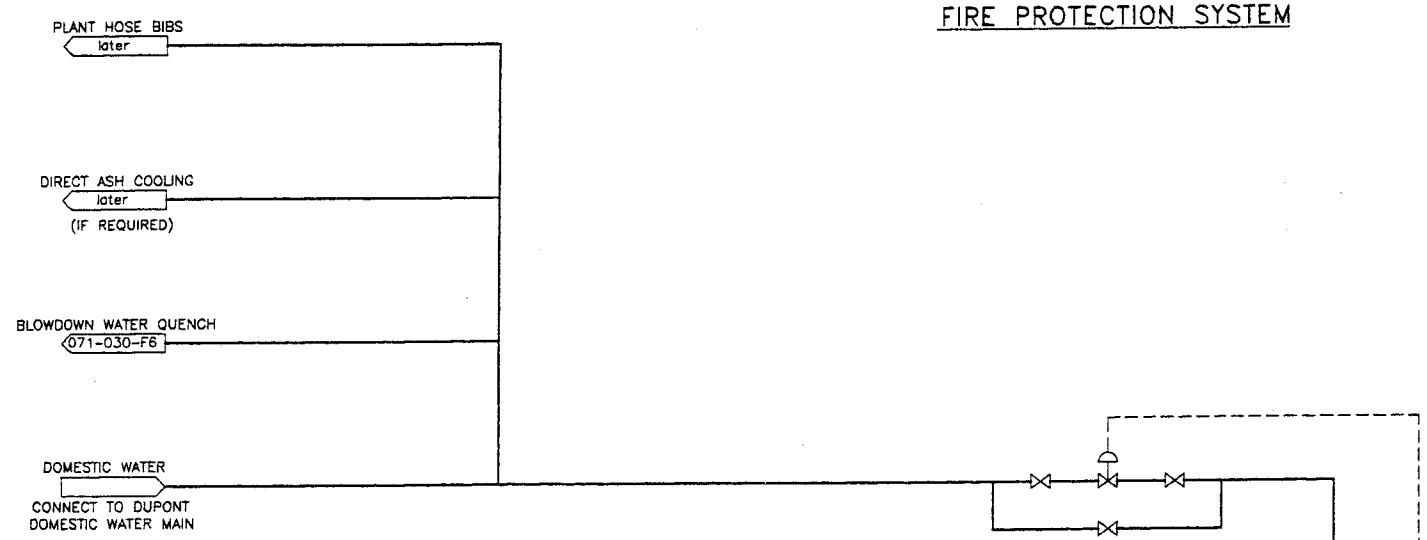
Scale:	Job No.	Drawing No.	Rev. No.
NONE	D-071-030-F4		G

11/14/94

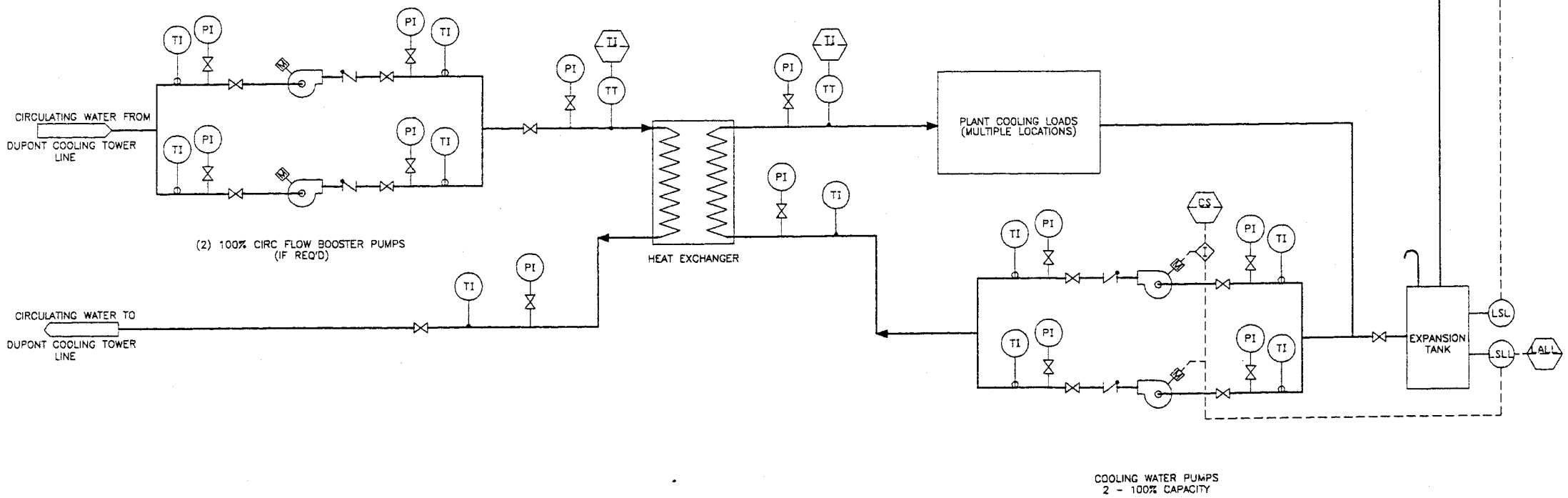
POTABLE WATER SYSTEM



FIRE PROTECTION SYSTEM



DOMESTIC WATER SYSTEM



PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

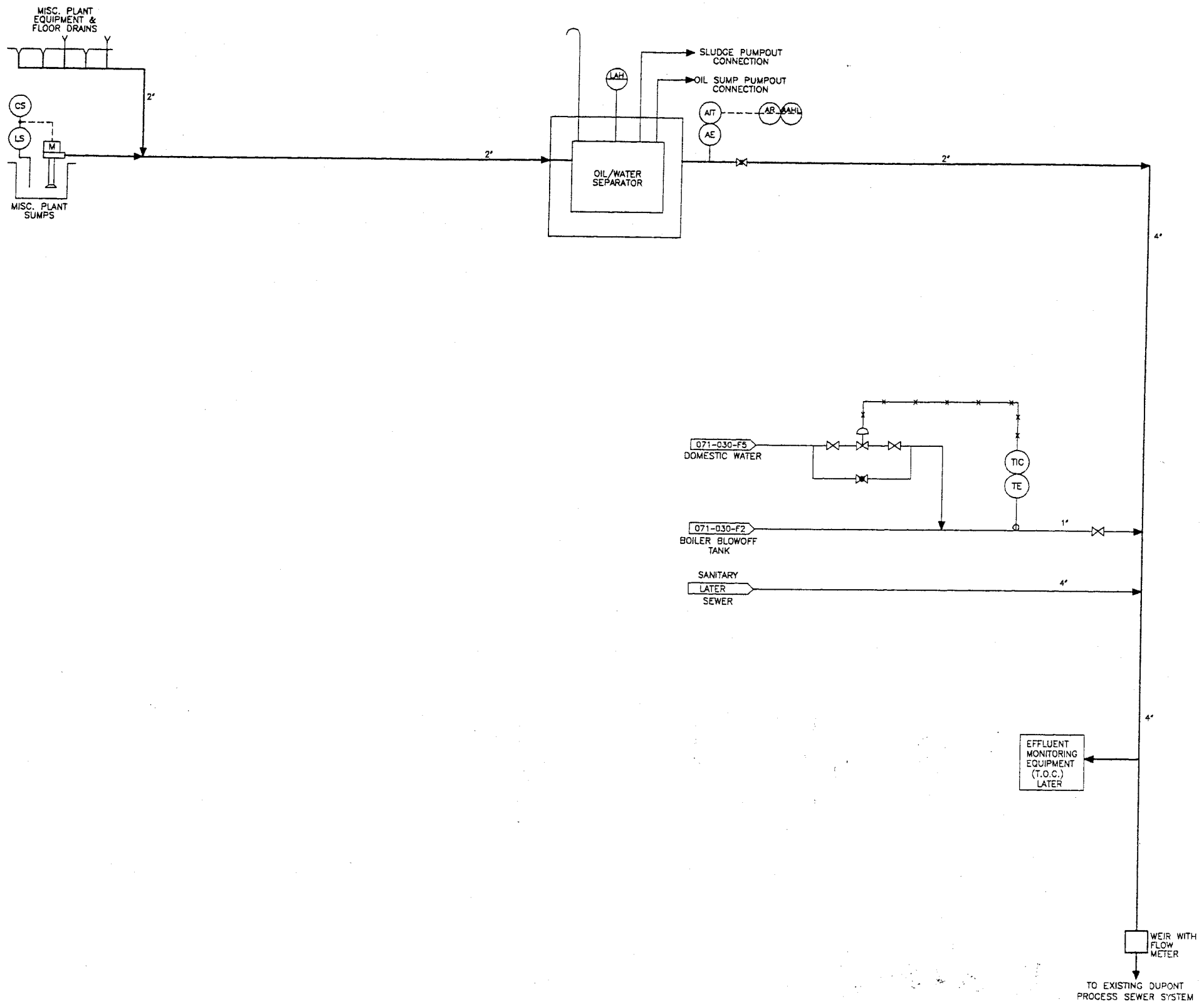
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM WATER SERVICE SYSTEMS

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE	D-071-030-F5		E

11/14/94



PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

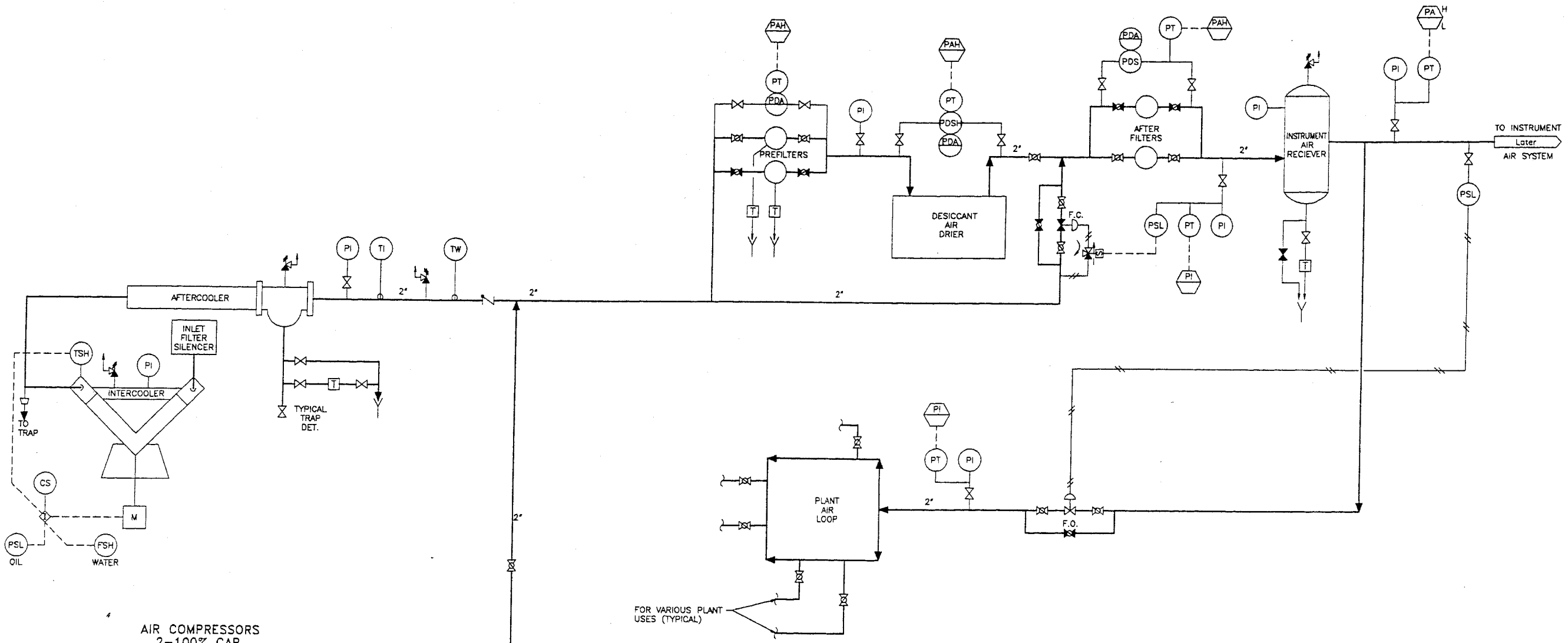
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM WASTE WATER SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-F6	E

11/14/94



NOTE:

1. INSTRUMENT AIR SYSTEM TO BE SUPPLIED PREFERENTIALLY IN EVENT OF UNUSUALLY HIGH AIR USAGE IN PLANT AIR LOOP.

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	FOR BID	HC	7/15/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

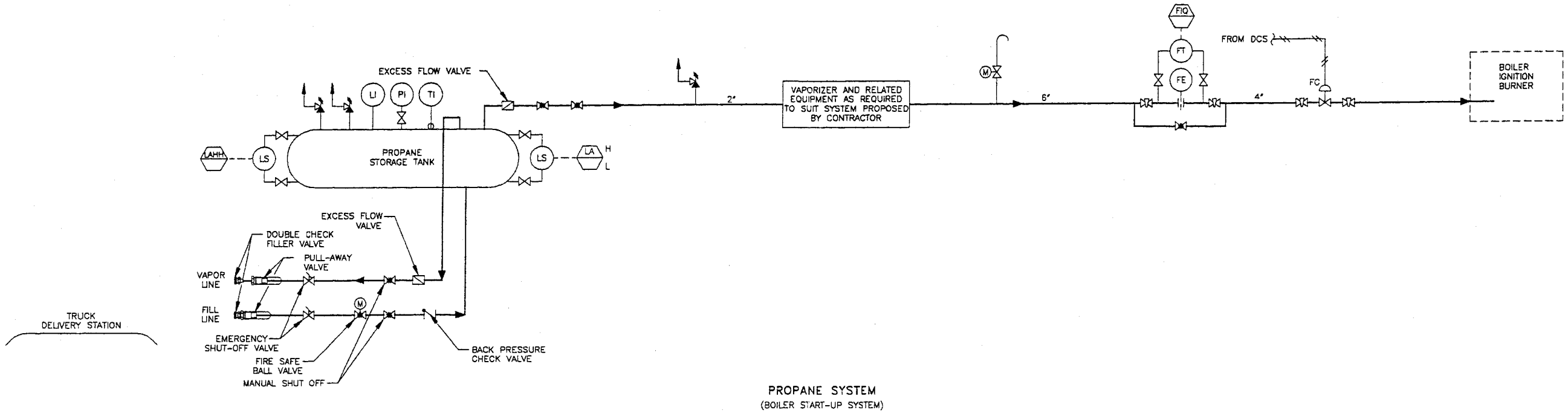
PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM COMPRESSED AIR SYSTEM

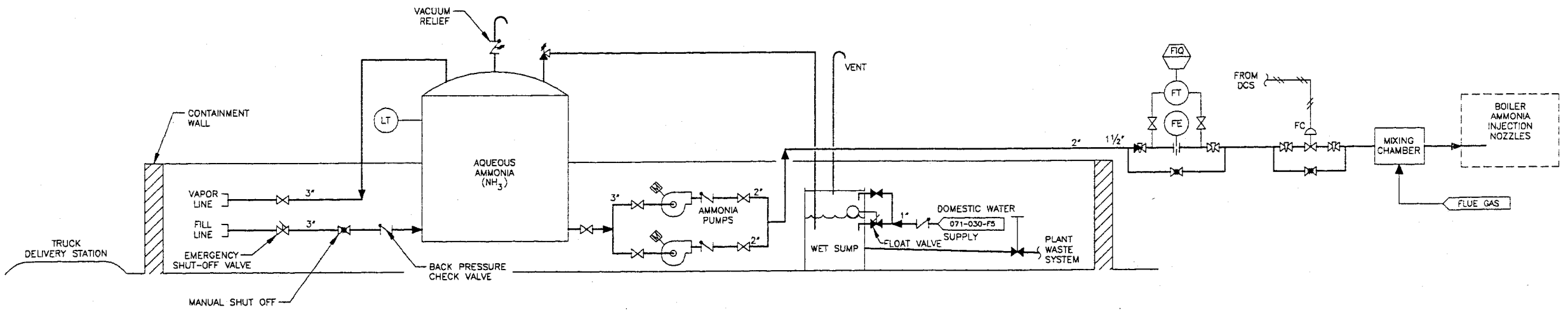
TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-F7	D

11/14/94



PROPANE SYSTEM
(BOILER START-UP SYSTEM)



AQUEOUS AMMONIA SYSTEM
(FOR NO_X CONTROL)

11/14/94

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
D	CONTRACT AWARD	HC	11/23/94	GJC
C	FOR BID	HC	7/15/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

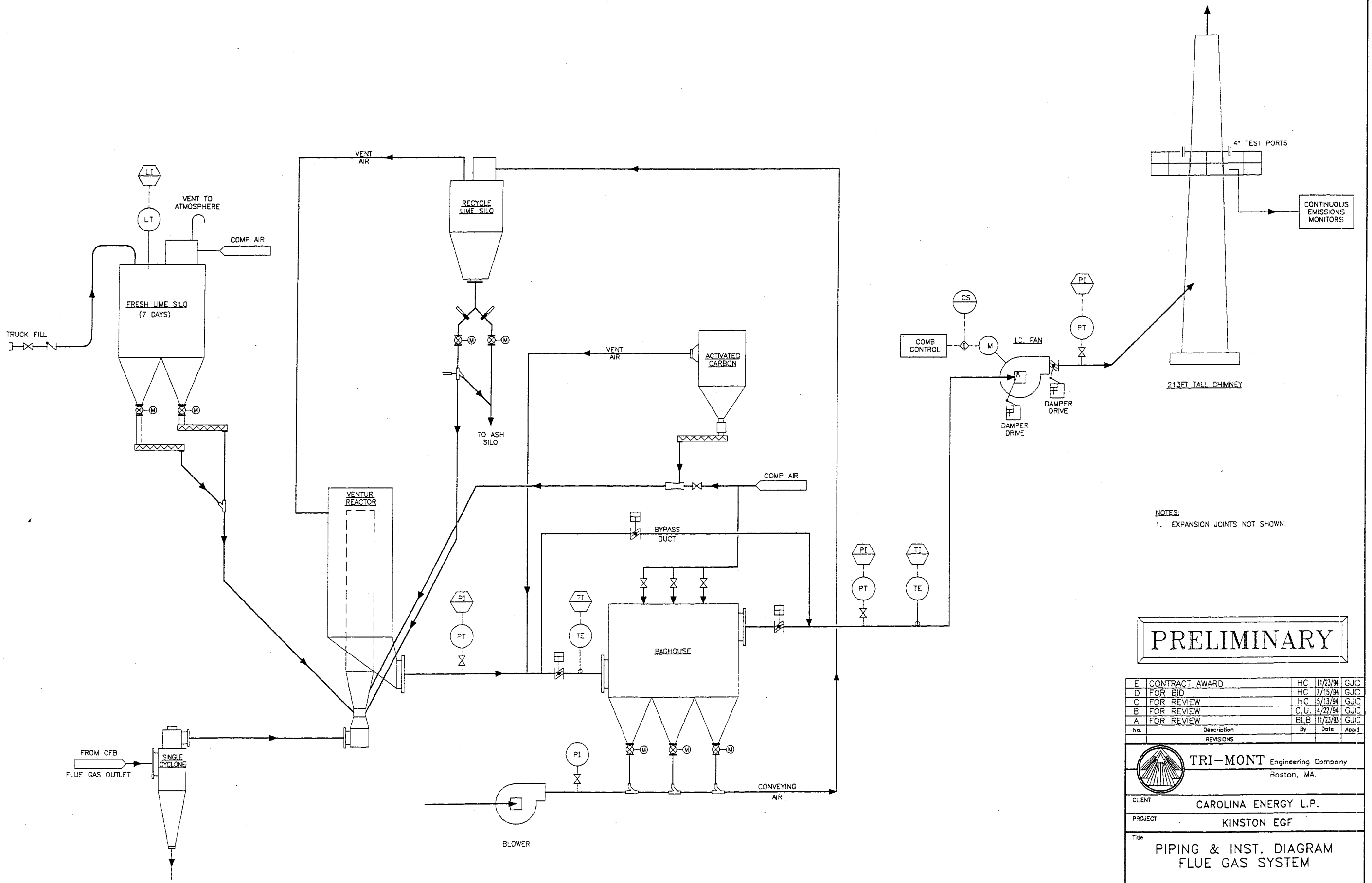
CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: PIPING & INSTRUMENTATION DIAGRAM MISCELLANEOUS SYSTEMS

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale: NONE | Job No. D-071-030-F8 | Drawing No. | Rev. No. D



NOTES:

1. EXPANSION JOINTS NOT SHOWN.

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	FOR BID	HC	7/15/94	GJC
C	FOR REVIEW	HC	5/13/94	GJC
B	FOR REVIEW	C.U.	4/22/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

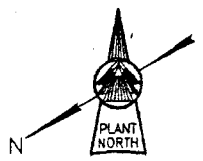
PROJECT: KINSTON EGF

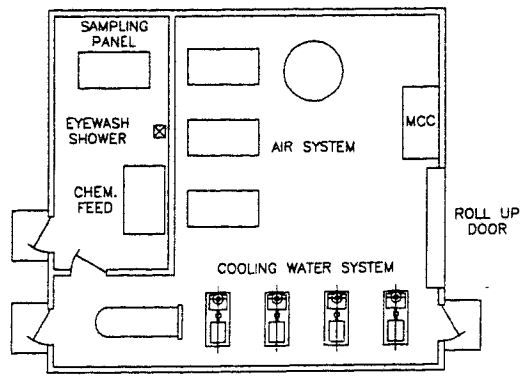
Title: PIPING & INST. DIAGRAM FLUE GAS SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

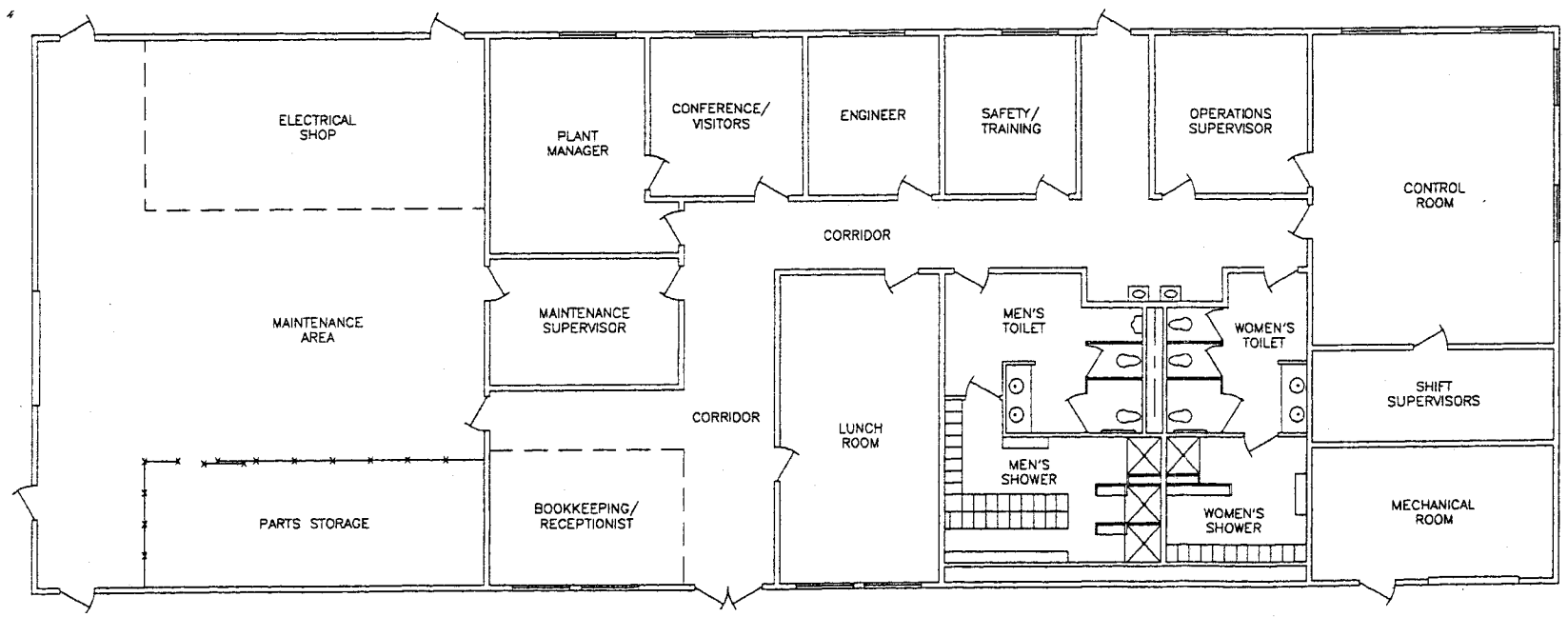
Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-030-F9	E

11/17/94

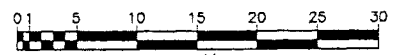




EQUIPMENT BUILDING



GROUND FLOOR PLAN
OFFICE/CONTROL BUILDING



PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
E	CONTRACT AWARD	HC	11/23/94	GJC
D	ADDENDUM NO. 1	HC	8/5/94	GJC
C	FOR BID	CU	7/11/94	GJC
B	FOR REVIEW	HC	5/13/94	GJC
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: CAROLINA ENERGY L.P.

PROJECT: KINSTON EGF

Title: FLOOR PLANS-OFFICE/CONTROL BUILDING & EQUIPMENT BUILDING

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/17/93	Approved		
Checked	G.J. CAHILL	11/17/93	Approved		
Approved	G.J. CAHILL	11/17/93	Approved		

Scale: 1/8"=1'-0"
Job No. Drawing No. D-071-030-S1
Rev. No. E

11/18/94

Section 4

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Environmental Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
A. Preston Howard, Jr., P.E., Director

AIR QUALITY SECTION
June 6, 1994

Mr. George H. Armistead
President
Carolina Energy, L. P.
11757 Katy Freeway, Suite 1420
Houston, Texas 77079

Dear Mr. Armistead:

SUBJECT: Air Permit No. 7737
Carolina Energy, L. P.
Kinston, North Carolina
Lenoir County

In accordance with your completed application received April 18, 1994, we are forwarding herewith Permit No. 7737 to Carolina Energy, L. P., Kinston, North Carolina for the construction and operation of air emission sources or air cleaning devices and appurtenances.

If any parts, requirements, or limitations contained in this Permit are unacceptable to you, you have the right to request a formal adjudicatory hearing within thirty (30) days following receipt of this Permit, identifying the specific issues to be contested. This hearing request must be in the form of a written petition, conforming to the G.S. 150B-23 of the North Carolina General Statutes, and filed with the Office of Administrative Hearings, Post Office Drawer 27447, Raleigh, North Carolina 27611-7447. The form for requesting a formal adjudicatory hearing may be obtained upon request from the Director of the Division of Environmental Management. Unless a request for a hearing is made pursuant to G.S. 150B-23, this Air Permit shall be final and binding.

You may request modification of your Air Permit through informal means pursuant to G.S. 150B-22. This request must be submitted in writing to the Director and must identify the specific provisions or issues for which the modification is sought. Please note that the permit will become final and binding regardless of a request for informal modification unless a request for a hearing is also made under G.S. 150B-23.

Unless exempted by a condition of this Permit or the regulations, construction of new air pollution sources or air cleaning devices, or modifications to the sources contained in this Permit must be covered under a Permit issued by this Division prior to construction. Failure to do so is a violation of General Statute 143-215.108 and may subject the Permittee to civil or criminal penalties contained in General Statute 143-215.114A.

This Permit shall be effective from June 6, 1994 until May 31, 1999, is nontransferable to future owners and operators, and shall be subject to the conditions and limitations as specified therein.

Should you have any questions concerning this matter, please contact Mr. Booker Pullen at (919) 733-3340, extension 321.

Sincerely,

Laura S. Butler, P.E.

for A. Preston Howard, Jr., P.E.

Enclosure

cc: Mr. Jim Mulligan
Ms. Jewell Harper
Ms. Shannon Vogel

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION

DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL MANAGEMENT

AIR PERMIT NO. 7737

Issue Date: June 6, 1994 Effective Date: June 6, 1994

Expiration Date: May 31, 1999 Replaces Permit: N/A

To construct and operate air emission source(s) or air cleaning device(s), and for the discharge of the associated air contaminants into the atmosphere. In accordance with the provisions of Article 21B of Chapter 143, General Statutes of North Carolina as amended, and other applicable Laws, Rules and Regulations,

Carolina Energy, L. P.
Highway 11 North
Lenoir County, North Carolina

is hereby authorized to construct and operate air emission sources or air cleaning devices and appurtenances consisting of:

NSPS 1. one circulating fluidized bed, RDF-3 (refuse derived fuel)/propane-fired municipal solid waste combustor (597.6 tons per day, maximum permitted RDF-3 firing capacity, 249 million Btu per hour maximum permitted heat input rate, ID No. CFB-1) equipped with a superheater, evaporator, economizer, an aqueous ammonia injection denox system, lime injection and one bagfilter with 31,828 square feet of filter area (ID No. FF-1),

2. an odorous emission reduction system wherein ventilation collected in the RDF handling areas is used as makeup air for the combustor,

3. one bagfilter (170 square feet of filter area, ID No. FF-3) installed on the Powdered Lime Storage Bin vent (ID No. PL),

4. one bagfilter (170 square feet of filter area, ID No. FF-4) installed on the Hydrated Lime Storage Bin vent (ID No. HL),

5. one bagfilter (170 square feet of filter area, ID No. FF-5) installed on the Ash Storage Bin vent (ID No. AS),

6. one bagfilter (170 square feet of filter area, ID No. FF-6) installed on a Sand Storage Bin vent (ID No. SS),

7. one 12,000 gallons capacity aqueous Ammonia Storage Tank (ID No. AT) ,

8. one bagfilter (170 square feet of filter area, ID No. FF-7) installed on the Activated Carbon Silo vent (ID No. AC), and

NSPS 9. one propane storage tank (12,000 gallon capacity, ID No. PT),

in accordance with the completed application (APP018268) received April 18, 1994 including all plans, specifications, previous applications, and other supporting data, all of which are filed with the Department of Environment, Health, and Natural Resources and are incorporated as part of this Permit.

This Permit is subject to the following specified conditions and limitations including any TESTING, REPORTING, OR MONITORING REQUIREMENTS:

A. SPECIFIC CONDITIONS AND LIMITATIONS

1. Any air emission sources or control devices authorized to construct and operate above must be operated and maintained in accordance with the provisions contained herein. The Permittee shall comply with applicable Environmental Management Commission Regulations, including Title 15A North Carolina Administrative Code (NCAC), Subchapter 2D .0408, .0515, .0521, .0522, .0524 (a) (56) [Subpart Db], .0524 (a) (57) [Subpart Kb], .0524 (a) (66) [Subpart Ea], .1100, and Subchapter 2H .0610.

2. As required by 15A NCAC 2D .0521 "Control of Visible Emissions", visible emissions from the bagfilters (ID Nos. FF-3, FF-4, FF-5, FF-6, FF-7), established after July 1, 1971, shall not be more than 20 percent opacity when averaged over a six-minute period, except that six-minute periods averaging not more than 87 percent opacity may occur not more than once in any hour nor more than four (4) times in any 24-hour period. However, sources which must comply with 15A NCAC 2D .0524 "New Source Performance Standards" or .0525 "National Emission Standards for Hazardous Air Pollutants" must comply with applicable visible emissions requirements contained therein.

3. NOTIFICATION REQUIREMENT - This permit may be revoked unless the emission sources (ID Nos. FF-1, FF-3, FF-4, FF-5, FF-6, and FF-7,) and appurtenances are constructed in accordance with the approved plans, specifications, and other supporting data. Within fifteen (15) days after start-up of the new or modified facilities, the Permittee shall provide written notice of the start-up to the Regional Supervisor, Division of Environmental Management. If the proposed operational date of June 30, 1995 is not met, a revised permit is not needed. However, within fifteen (15) days after the proposed operational date is not met, the Permittee shall notify in writing the Regional Supervisor of the new proposed operational date. Any existing equipment being replaced is permitted to operate in compliance until the replacement equipment is operational.

4. RECORD KEEPING REQUIREMENT - Particulate emissions from the emission sources shall be controlled by bagfilters. The bagfilters (ID Nos. FF-1, FF-3, FF-4, FF-5, FF-6, and FF-7) shall be equipped with a device to continuously measure the differential pressure drop across fabric filter. The device shall be installed in an accessible location and shall be maintained by the Permittee such that it is in proper working order at all times. An annual internal inspection shall be conducted on the bagfilter by the Permittee to insure structural integrity such that optimum control efficiency is achieved. The results of this inspection, and any maintenance performed on the bagfilter, shall be recorded in a log book which shall be kept on site and made available to the DEM upon request.

5. 15A NCAC 2D .0524 "NEW SOURCE PERFORMANCE STANDARDS" - For the combustor (ID No. CFB-1), the Permittee shall comply with all applicable provisions, including the notification, testing, reporting, record keeping, and monitoring requirements contained in Environmental Management Commission Standard 15A NCAC 2D .0524, "New Source Performance Standards" (NSPS) as promulgated in 40 CFR 60, **Subpart Db**, including Subpart A "General Provisions."

(a) NSPS REPORTING REQUIREMENTS - In addition to any other notification requirements to the Environmental Protection Agency (EPA), the Permittee is required to NOTIFY the Regional Supervisor, Division of Environmental Management, in WRITING, of the following:

(i) the date construction (40 CFR 60.7) or reconstruction (40 CFR 60.15) of an affected facility is commenced, postmarked no later than thirty (30) days after such date;

(ii) the anticipated date of initial start-up of an affected facility, postmarked not more than sixty (60) days nor less than thirty (30) days prior to such date; and

(iii) the actual date of initial start-up of an affected facility, postmarked within fifteen (15) days after such date;

(b) NSPS EMISSIONS LIMITATIONS - As required by 15A NCAC 2D .0524, the following Permit limits shall not be exceeded:

AFFECTED FACILITY	POLLUTANT	EMISSION LIMIT
Combustor (ID No. CFB-1)	Particulate	0.10 lb/million Btu (heat input)
Combustor (ID No. CFB-1)	Nitrogen Oxide	0.30 lb/million Btu (heat input)
Combustor (ID No. CFB-1)/ Fabric filter (ID No. FF-1)	Opacity	20 percent opacity (six-minute average) except for one six-minute period per hour of not more than 27 percent opacity.

(c) NSPS PERFORMANCE TESTING - As required by 15A NCAC 2D .0524, the following performance tests shall be conducted:

AFFECTED FACILITY	POLLUTANT	TEST METHOD
Combustor (ID No. CFB-1)	Particulate	5, 5B or 17
Combustor (ID No. CFB-1)\ Fabric filter (ID No. FF-1)	Opacity	9
Combustor (ID No. CFB-1)	Nitrogen Oxides	7, 7A, 7E or other approved ref. methods

(i) All performance tests shall be conducted in accordance with EPA Reference Methods, contained in 40 CFR 60, Appendix A.

(ii) The EPA Administrator retains the exclusive right to approve equivalent and alternative test methods, continuous monitoring procedures, and reporting requirements.

(iii) Within (60) days after achieving the maximum production rate at which the facility will be operated, but not later than 180 days after the initial start-up of the affected facility, the Permittee shall conduct the required performance test(s) and submit a written report of the test(s) to the Regional Supervisor, Division of Environmental Management.

(iv) The source shall be responsible for ensuring, within the limits of practicality, that the equipment or process being tested is operated at or near its maximum normal production rate or at a lesser rate if specified by the Director or his delegate.

(v) All associated testing costs are the responsibility of the Permittee.

6. 15A NCAC 2D .0524 "NEW SOURCE PERFORMANCE STANDARDS" - For the combustor (ID No. CFB-1), the Permittee shall comply with all applicable provisions, including the notification, testing, reporting, record keeping, and monitoring requirements contained in Environmental Management Commission Standard 15A NCAC 2D .0524, "New Source Performance Standards" (NSPS) as promulgated in 40 CFR 60, **Subpart Ea**, including Subpart A "General Provisions."

(a) NSPS REPORTING REQUIREMENTS - In addition to any other notification requirements to the Environmental Protection Agency (EPA), the Permittee is required to NOTIFY the Regional Supervisor, Division of Environmental Management, in WRITING, of the following:

(i) the date construction (40 CFR 60.7) or reconstruction (40 CFR 60.15) of an affected facility is commenced, postmarked no later than thirty (30) days after such date;

(ii) the anticipated date of initial start-up of an affected facility, postmarked not more than sixty (60) days nor less than thirty (30) days prior to such date; and

(iii) the actual date of initial start-up of an affected facility, postmarked within fifteen (15) days after such date;

(b) NSPS EMISSIONS LIMITATIONS - As required by 15A NCAC 2D .0524, the following Permit limits shall not be exceeded:

AFFECTED FACILITY	POLLUTANT	EMISSION LIMIT
Combustor (ID No. CFB-1)	Dioxin/Furan	12 grains per billion dry standard cubic feet, corrected to 7 percent oxygen (dry basis)
Combustor (ID No. CFB-1)	Sulfur Dioxide	30 parts per million by volume, corrected to 7 percent oxygen (dry basis) or 20 percent of the potential sulfur dioxide emission rate (80 percent reduction by weight or volume), whichever is less stringent.
Combustor (ID No. CFB-1)	Nitrogen Oxide	180 parts per million by volume, corrected to 7 percent oxygen (dry basis).
Combustor (ID No. CFB-1)	Hydrogen Chloride	5 percent of the potential hydrogen chloride emission rate (95 percent reduction by weight or volume) or 25 parts per million by volume, corrected to 7 percent oxygen (dry basis), whichever is less stringent.
Combustor (ID No. CFB-1)	Carbon Monoxide	100 parts per million by volume, corrected to 7 percent oxygen (dry basis).

6. (b) Cont'd.

AFFECTED FACILITY	POLLUTANT	EMISSION LIMIT
Combustor (ID No. CFB-1) Fabric filter (ID No. FF-1)	Opacity	10 percent opacity (six-minute average)
Combustor (ID No. CFB-1)	Particulate	34 milligrams per dry standard cubic meter (0.015 grains per dry standard cubic foot), corrected to 7 percent oxygen (dry basis).

(c) NSPS PERFORMANCE TESTING - As required by 15A NCAC 2D .0524, the following performance tests shall be conducted:

AFFECTED FACILITY	POLLUTANT	TEST METHOD
Combustor (ID No. CFB-1)	Dioxin/Furan	23
Combustor (ID No. CFB-1)	Sulfur Dioxide	19
Combustor (ID No. CFB-1)	Nitrogen Oxide	19
Combustor (ID No. CFB-1)	Hydrogen Chloride	26
Combustor (ID No. CFB-1)	Carbon Monoxide	10 or 10 B
Combustor (ID No. CFB-1)/ Fabric filter (FF-1)	Opacity	9
Combustor (ID No. CFB-1)	Particulate	5

(i) All performance tests shall be conducted in accordance with EPA Reference Methods, contained in 40 CFR 60, Appendix A.

(ii) The EPA Administrator retains the exclusive right to approve equivalent and alternative test methods, continuous monitoring procedures, and reporting requirements.

(iii) Within (60) days after achieving the maximum production rate at which the facility will be operated, but not later than 180 days after the initial start-up of the affected facility, the Permittee shall conduct the required performance test(s) and submit a written report of the test(s) to the Regional Supervisor, Division of Environmental Management.

6. (c) NSPS PERFORMANCE TESTING, Cont'd.

(iv) The source shall be responsible for ensuring, within the limits of practicality, that the equipment or process being tested is operated at or near its maximum normal production rate or at a lesser rate if specified by the Director or his delegate.

(v) All associated testing costs are the responsibility of the Permittee.

7. 15A NCAC 2D .0524 "NEW SOURCE PERFORMANCE STANDARDS" - For the propane storage tank (ID No. PT), the Permittee shall comply with all applicable provisions, including the notification, reporting, and record keeping requirements contained in Environmental Management Commission Standard 15A NCAC 2D .0524, "New Source Performance Standards" (NSPS) as promulgated in 40 CFR 60, **Subpart Kb**, including Subpart A "General Provisions."

(a) The owner or operator of the propane storage tank (ID No. PT) shall keep readily accessible records showing the dimension of the storage vessel and an analysis showing the capacity of the storage vessel.

8. As requested by the Permittee, the following restrictions shall apply to the five storage bins at the facility.

(a) The Ash Bin (ID No. AS) shall be allowed to operate continuously.

(b) The remaining four (4) storage bins shall be allowed to be filled simultaneously in pairs, however, the Powdered Lime Storage Bin (ID No. PL) and the Hydrated Lime Storage Bin (ID No. HL) shall not be filled simultaneously.

(c) At no time shall more than three (3) of the five (5) storage bins be filled at the same time.

9. TESTING PROTOCOL - At least forty-five (45) days prior to performing any required emissions testing, the Permittee must submit a testing protocol to the Regional Supervisor, Division of Environmental Management for review and approval. All testing protocols must be approved by the DEM prior to performing such tests.

10. TESTING NOTIFICATION REQUIREMENT - To afford the Regional Supervisor, Division of Environmental Management the opportunity to have an observer present, the Permittee shall provide the Regional Office, in writing, at least fifteen (15) days notice of any required performance test(s).

11. TOXIC AIR POLLUTANT EMISSIONS LIMITATION AND REPORTING REQUIREMENT - Pursuant to 15A NCAC 2D .1100 and in accordance with the approved application for an air toxic compliance demonstration, the following permit limits shall not be exceeded:

11. cont'd

EMISSION SOURCE(S)	TOXIC AIR POLLUTANT	EMISSION LIMIT(S)
RDF-3 Combustor, (ID No. CFB-1), Ammonia Storage Tank, (ID No. AT)	ammonia	1.22 lbs/15 min
RDF-3 Combustor, (ID No. CFB-1), Powdered Lime Bin, (ID No. PL) Hydrated Lime Bin, (ID No. HL), Ash Storage Bin, (ID No. AS)	arsenic & compounds	11.2 lbs/yr
RDF-3 Combustor, (ID No. CFB-1),	benzene	20.0 lbs/yr
RDF-3 Combustor, (ID No. CFB-1) Ash Storage Bin, (ID No. AS)	beryllium & compounds	10.2 lbs/yr
RDF-3 Combustor, (ID No. CFB-1) Powdered Lime Bin, (ID No. PL), Hydrated Lime Bin, (ID No. HL) Ash Storage Bin, (ID No. AS)	cadmium	2.5 lbs/yr
RDF-3 Combustor, (ID No. CFB-1)	carbon disulfide	13.2 lbs/day
RDF-3 Combustor, (ID No. CFB-1) Powdered Lime Bin, (ID No. PL), Hydrated Lime Bin, (ID No. HL), Ash Storage Bin, (ID No. AS)	chromium VI	79.1 lbs/yr
RDF-3 Combustor, (ID No. CFB-1),	formaldehyde	0.064 lbs/15 min
RDF-3 Combustor, (ID No. CFB-1),	hydrogen chloride	2.37 lbs/15 min

11. cont'd

EMISSION SOURCE(S)	TOXIC AIR POLLUTANT	EMISSION LIMIT(S)
RDF-3 Combustor, (ID No. CFB-1)	hydrogen fluoride	12.0 lbs/day 0.125 lbs/15 min
RDF-3 Combustor, (ID No. CFB-1) Powdered Lime Bin, (ID No. PL), Hydrated Lime Bin, (ID No. HL),	manganese	6.49 lbs/day
RDF-3 Combustor, (ID No. CFB-1),	mercury (aryl & inorganic compounds)	1.65 lbs/day
RDF-3 Combustor, (ID No. CFB-1),	mercury vapor	0.33 lbs/day
RDF-3 Combustor, (ID No. CFB-1) Powered Lime Bin, (ID No. PL) Hydrated Lime Bin, (ID No. HL) Ash Storage Bin, (ID No. AS)	nickel metal	1.55 lbs/day
RDF-3 Combustor, (ID No. CFB-1)	tetrachloro-dibenzo-p-dioxin	0.04 lbs/yr
RDF-3 Combustor, (ID No. CFB-1),	vinyl chloride	42.0 lbs/yr

(a) To ensure compliance with the above limits, the following restrictions shall apply:

(i) the maximum permitted RDF-3 firing rate shall be less than 597.6 tons per day.

(b) For compliance purposes, within thirty (30) days after each calendar year quarter the following shall be reported to the Regional Supervisor, Division of Environmental Management:

(i) the charge rate of RDF-3 into the combustor (ID No. CFB-1) in pounds per hour for the previous months of that year.

12. This facility shall be operated and maintained in such a manner that any listed toxic air pollutant(s) emitted from the facility, including fugitive emissions, will not exceed those levels specified in 15A NCAC 2H .0610(h) unless an application is submitted that demonstrates compliance with 15A NCAC 2D .1100. The Permittee shall maintain records of the process operational information as necessary to determine that the toxic air pollutant(s) emissions are below the levels in 15A NCAC 2H .0610(h).

TOXIC AIR POLLUTANT	MODELING EXEMPTION EMISSION RATE
benzo (a) pyrene	2.2 lb/yr
carbon tetrachloride	460.0 lb/yr
chlorobenzene	46 lb/day
chloroform	290 lb/yr
ethylene dichloride	260 lb/yr
hexachlorodibenzo-p-dioxin	0.0051 lb/yr
methyl chloroform	250.0 lb/day 16.0 lb/15 min
methylene chloride	1600 lb/yr
methyl ethyl ketone	78 lb/day 5.6 lb/15 min
methyl isobutyl ketone	52 lb/day 1.9 lb/15 min
perchloroethylene	13000 lb/yr
polychlorinated biphenyls	5.6 lb/yr
styrene	2.7 lb/hr
toluene	98 lb/day 3.6 lb/15 min
trichlorofluoro-methane	140 lb/hr
1, 1, 2-trichlor-1,2, 2-trifluoroethane	60 lb/15 min
vinylidene chloride	2.5 lb/day
xylene	57 lb/day 4.1 lb/15 min

13. CONTINUOUS MONITORING REQUIREMENT - For the combustor (ID No. CFB-1), continuous emissions monitors for opacity, sulfur dioxide, nitrogen oxides, and carbon monoxide emissions shall be installed, calibrated, maintained, tested, and operated in accordance with 40 CFR Part 60, Appendix B "Performance Specifications" and Appendix F "Quality Assurance Procedures".

14. RECORD KEEPING REQUIREMENT - The Permittee shall retain records of all information resulting from monitoring activities and information indicating operating parameters as specified in this permit for a minimum of two (2) years from the date of recording.

15. NOTIFICATION REQUIREMENT - As required by 15A NCAC 2D .0535, or for sources applicable to 15A NCAC 2D .0524 or .0525, when particulate, odorous, and visible emissions exceed Environmental Management Regulations for more than four (4) hours, the Regional Supervisor, Division of Environmental Management, shall be notified as promptly as possible, but in no case later than twenty-four (24) hours or on the next working day of becoming aware of the occurrence. Such notice shall specify the facility name and location, the nature and cause of the excess emission, the time when first observed, the expected duration, and the estimated rate of emissions. This reporting requirement does not allow the operation of the facility in excess of Environmental Management Commission Regulations.

B. GENERAL CONDITIONS AND LIMITATIONS

1. REPORTS, TEST DATA, MONITORING DATA, NOTIFICATIONS, AND REQUESTS FOR RENEWAL shall be submitted to the:

Regional Supervisor
North Carolina Division of Environmental Management
Washington Regional Office
1421 Carolina Avenue
Washington, North Carolina 27889
(919) 946-6481

2. PERMIT RENEWAL REQUIREMENT - The Permittee shall request permit extension by letter. The letter should include the permit number, the appropriate renewal fee, description of any modifications, and should be sent to and must be received by the Regional Supervisor, Division of Environmental Management at least ninety (90) days prior to the expiration date of this permit.

3. ANNUAL FEE PAYMENT - The Permittee must pay the annual administering and compliance fee or submit a certification for exemption within thirty (30) days after being billed by the Division. Failure to timely pay the fee or submit a certification of exemption in accordance with 15A NCAC 2H .0609 (m) will cause the Division to initiate action to revoke the permit.

4. EQUIPMENT RELOCATION - A new air permit shall be obtained by the Permittee prior to establishing, building, erecting, using, or operating the emission sources or air cleaning equipment at a site or location not specified in this permit.

5. REPORTING REQUIREMENT - Any of the following that would result in previously unpermitted, new, or increased emissions must be reported to the Regional Supervisor, Division of Environmental Management:

   (a) changes in the information submitted in the application regarding facility emissions;

   (b) changes that modify equipment or processes of existing permitted facilities; or

   (c) changes in the quantity or quality of materials processed.

   If appropriate, modifications to the permit may then be made by the Division of Environmental Management to reflect any necessary changes in the permit conditions. In no case are any new or increased emissions allowed that will cause a violation of the emission limitations specified herein.

6. This permit is subject to revocation or modification by this Division upon a determination that information contained in the application or presented in the support thereof is incorrect, conditions under which this permit was granted have changed, or violations of conditions contained in this permit have occurred. The facility shall be properly operated and maintained at all times in a manner that will effect an overall reduction in air pollution. Unless otherwise specified by this permit, no emission source may be operated without the concurrent operation of its associated air cleaning device(s) and appurtenances.

7. This permit is nontransferable by the Permittee. Future owners and operators must obtain a new air permit from the Division of Environmental Management.

8. This issuance of this permit in no way absolves the Permittee of liability for any potential civil penalties which may be assessed for violations of State law which have occurred prior to the effective date of this permit.

9. This permit does not relieve the Permittee of the responsibility of complying with all applicable requirements of any Federal, State, or Local water quality or land quality control authority.

10. Reports on the operation and maintenance of the facility shall be submitted by the Permittee to the Regional Supervisor, Division of Environmental Management at such intervals and in such of form and detail as may be required in such by the Division. Information required in such reports may include, but is not limited to, process weight rates, firing rates, hours of operation, and preventive maintenance schedules.

11. A violation of any term or condition of this permit shall subject the Permittee to enforcement pursuant to North Carolina General Statute 143-215.114A, including assessment of civil penalties.

12. Pursuant to North Carolina General Statute 143-215.3 (a) (2), no person shall refuse entry or access to any authorized representative of the Division of Environmental Management who requests entry or access for purposes of inspection, and who presents appropriate credentials, nor shall any person obstruct, hamper, or interfere with any such representative while in the process of carrying out his official duties. Refusal of entry or access may constitute grounds for permit revocation and assessment of civil penalties.

Permit issued this the 6th day of June 1994.

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION

Laura S. Dufley, P.E.

A. Preston Howard, Jr., P.E., Director
Division of Environmental Management
By Authority of the Environmental Management Commission

for

Air Permit No. 7737

AIR PERMIT APPLICATION
FOR
CAROLINA ENERGY, L.P.
RDF-TO-ENERGY FACILITY

LENOIR COUNTY, NORTH CAROLINA

MARCH 25, 1994

Submitted To:

North Carolina Department of Environment,
Health and Natural Resources
DEM/Air Quality/Air Permits Unit
Raleigh, North Carolina 27611-7687

Prepared By:

Kenneth L. Woodruff & Associates
Resource Recovery Consultants
P.O. Box 42
Morrisville, Pennsylvania 19067-0042
215-736-2194

INTRODUCTION

BACKGROUND

Carolina Energy, L.P. plans to construct and operate a plant in Lenoir County, North Carolina to burn Refuse Derived Fuel (RDF-3) to generate high pressure steam for sale to E.I. DuPont de Nemours & Company (DuPont). Carolina Energy proposes to burn approximately 190,000 tons of RDF-3 annually. The plant is to be constructed adjacent to the DuPont facility near Kinston in Lenoir County, east of the existing DuPont Power House. DuPont currently burns coal, fuel oil and natural gas to generate steam and electricity for plant needs. Installation of the Carolina Energy facility will reduce the amount of fossil fuel burned at the DuPont Kinston facility.

PROCESS DESCRIPTION

The proposed steam generation plant will burn refuse-derived fuel (RDF-3) processed by Carolina Energy, L.P. from municipal waste collected from Pitt and Lenoir Counties. The processing of municipal solid waste (MSW) will occur at off-site locations in each of the two counties. Processed MSW will be transferred to the steam generating plant in live bottom trailers. Upon receipt, the material will be shredded to meet the necessary RDF size requirements.

Definition of Refuse-Derived Fuel (RDF-3)

RDF-3 as defined by ASTM designation E 1126-87, is a

shredded fuel derived from municipal solid waste that has been processed to remove metals, glass and other inorganics for recycling, and which has a particle size such that 95% (by weight) will pass through a 2-inch square mesh screen. It is estimated that the RDF-3 to be used in the Carolina Energy steam generation process will consist of approximately 65% (by weight) paper and paper products, approximately 20% (by weight) moisture and approximately 0% (by weight) gaseous waste, liquid waste, semi-liquid waste, and pathological waste. The balance consists of plastics, other organic materials, small amounts of metals and glass.

Process and Control Equipment

The processed MSW will be received in enclosed buildings equipped with 'walking floors,' ventilated to the combustion unit; consequently, fugitive air pollutant emissions should not occur from the receiving operation. Processed MSW will be conveyed to enclosed shredders and then conveyed to enclosed storage equipped with walking floors. A covered conveyor system feeds a metering bin which in turn feeds the single circulating fluid bed (CFB) combustor. According to Carolina Energy's construction plan, all receiving, storage, shredding and conveying systems will be enclosed and maintained under negative pressure. Ventilation air will be used as combustion air for the circulating fluid bed combustor. Therefore, fuel receiving, processing and storage should not be a source of fugitive air pollutant emissions.

A single circulating fluidized bed combustor will be used to

burn the RDF-3. This combustor will be manufactured by Kvaerner EnviroPower AB of Sweden. The combustor will have a rated capacity of 190,000 tons of RDF-3 per year based on a higher heating value (HHV) of 5750 BTU's per pound. The combustor boilers will be rated at 249 million British Thermal Units (BTU) per hour heat input each.

The CFB boiler will create steam for sale to E.I. DuPont de Nemours & Company. The boiler is to have a rated capacity of 197 million BTU per hour, and 176,000 pounds of steam per hour. The boiler will consist of a superheater, an evaporator and an economizer.

To control sulfur dioxide (SO2) emissions, powdered limestone will be fed, via a separate pneumatic feedline, into the combustor. Aqueous ammonia will be injected into the combustor to control nitrogen oxide (NOx) emissions.

Hydrated lime will then be injected into the process stream to control acid gas emissions, primarily hydrochloric acid (HCl). Fabric filters (baghouses) will be used to control the particulate emissions. The remaining exhaust gas emissions will be vented through the process stack.

STORAGE BINS AND TANKS

Storage Bins and Tanks

Several storage bins and tanks will be installed on the site five (5) of which will have particulate and/or toxic air

pollutant emissions. A description of each of these units follows.

Powdered Limestone Storage Bin

As discussed previously, powdered limestone will be injected to control SO2 emissions. The powdered limestone will be stored in a 1,400 cubic foot, 45-foot tall storage bin, and fed into the fluidized bed combustor on a continuous basis. The storage bin will be fitted with a fabric filter (baghouse), approximately three feet square by seven feet tall, with an approximate outlet diameter of 0.25 feet. The emission point will be at the top of the baghouse, located approximately 52 feet above the ground. Particulate emissions from this storage bin will only occur during pneumatic loading of limestone into the bin (one half-hour 300 times per year or approximately 150 hours per year), and not while the limestone is being fed into the combustor.

Sand Silo

Sand is utilized as the bed media for the CFB combustor. Make-up sand is to be stored in a 1,400 cubic foot, 45-foot tall storage silo and fed into the combustor on a continuous basis. The sand silo will be fitted with a fabric filter (baghouse), approximately three feet square by seven feet tall, with an approximate outlet diameter of 0.25 feet. The emission point for the silo will be at the top of the baghouse, located approximately 52 feet above the ground. Particulate emissions

will only occur during pneumatic loading of the sand into the silo (one half-hour 300 times per year or approximately 150 hours per year).

Aqueous Ammonia Storage Tank

The aqueous ammonia used to control NOx emissions will be stored in a 12,000-gallon above-ground storage tank, and fed into the fluidized bed combustor on a continuous basis. Storage tank emissions will occur after loading of aqueous ammonia into the tank (upon hose disconnect, approximately 24 hours per year), and not while the aqueous ammonia is being fed into the combustor. Hose connections are estimated to be about 10 feet above ground. Loading will require about 20 minutes, approximately 72 times a year.

Hydrated Lime Storage Bin

The hydrated lime used to control Hydrogen Chloride emissions will be stored in a 1,400 cubic foot, 45-foot tall storage bin and fed into the flue gas cleaning system on a continuous basis. The storage bin will be fitted with a fabric filter (baghouse), approximately three feet square by seven feet tall, with an approximate outlet diameter of 0.25 feet. The emission point will be at the top of the baghouse, approximately 52 feet above the ground. Particulate emissions from the storage bin will occur during pneumatic loading of hydrated lime into the bin (approximately one-half hour 76 times per year or 38 hours per year), and not while the lime is being fed into the flue gas system.

Ash Storage Bin

Combustion ash will be collected from the multi-cyclones and fabric filters (baghouses) located in the process exhaust stream on a continuous basis. The ash will be stored in a 4,000 cubic foot, 50 foot tall storage bin. The bin will be fitted with its own fabric filter (baghouse) aproximately three feet square by seven feet tall, with an approximate outlet diameter of 0.25 feet. The emission point will be at the top of the baghouse, located approximately 57 feet above the ground. Particulate emissions from the bin will occur continuously, since the ash will be continuously removed when the combustor is operating. The ash collected from the combustion process will be sold to a concrete or asphalt manufacturer.

Propane Tank

A 12,000 gallon capacity above-ground propane tank will be installed to store start-up fuel for the fluid bed combustor. Emissions will only occur after filling of the tank (upon hose disconnect, approxmiately 6 hours per year), and not while propane is being fed to the combustor. Filling will require 20 to 30 minutes, approximately 12 times per year.

CONTROL TECHNOLOGY

The Carolina Energy, L.P. Facility will release the following contaminants to the air:

- o Particulate Matter
- o Organics
- o Sulfur Dioxide
- o Nitrogen Oxides
- o Carbon Monoxide

Particulate Matter

Based on estimates provided by the CFB combustion system supplier, the average particulate emissions from the Carolina Energy, L.P. Facility will be 10.6 mg per cubic meter, amounting to not more than 21.9 tons per year. Compliance for opacity will be demonstrated by continuous emissions monitoring. Fabric filters (baghouses) will be used to control particulate emissions.

Organics

Volatile Organic Compounds expressed as non-methane hydrocarbons will be limited to 32.8 tons per year. Since this category of pollutants is incorporated in the toxic air pollutants regulated by the North Carolina Department of Environmental, Health and Natural Resources, Division of Environmental Management, Toxic Air Pollution Modeling and Analysis has been conducted for the Carolina Energy, L.P. Facility. A complete report on air toxics, as well as criteria pollutant modeling is included as Section 3 of this application document. Compliance will be demonstrated through periodic stack testing as required under North Carolina Regulations and

US EPA New Source Performance Standards for Municipal Waste Combustors.

Sulfur Dioxide

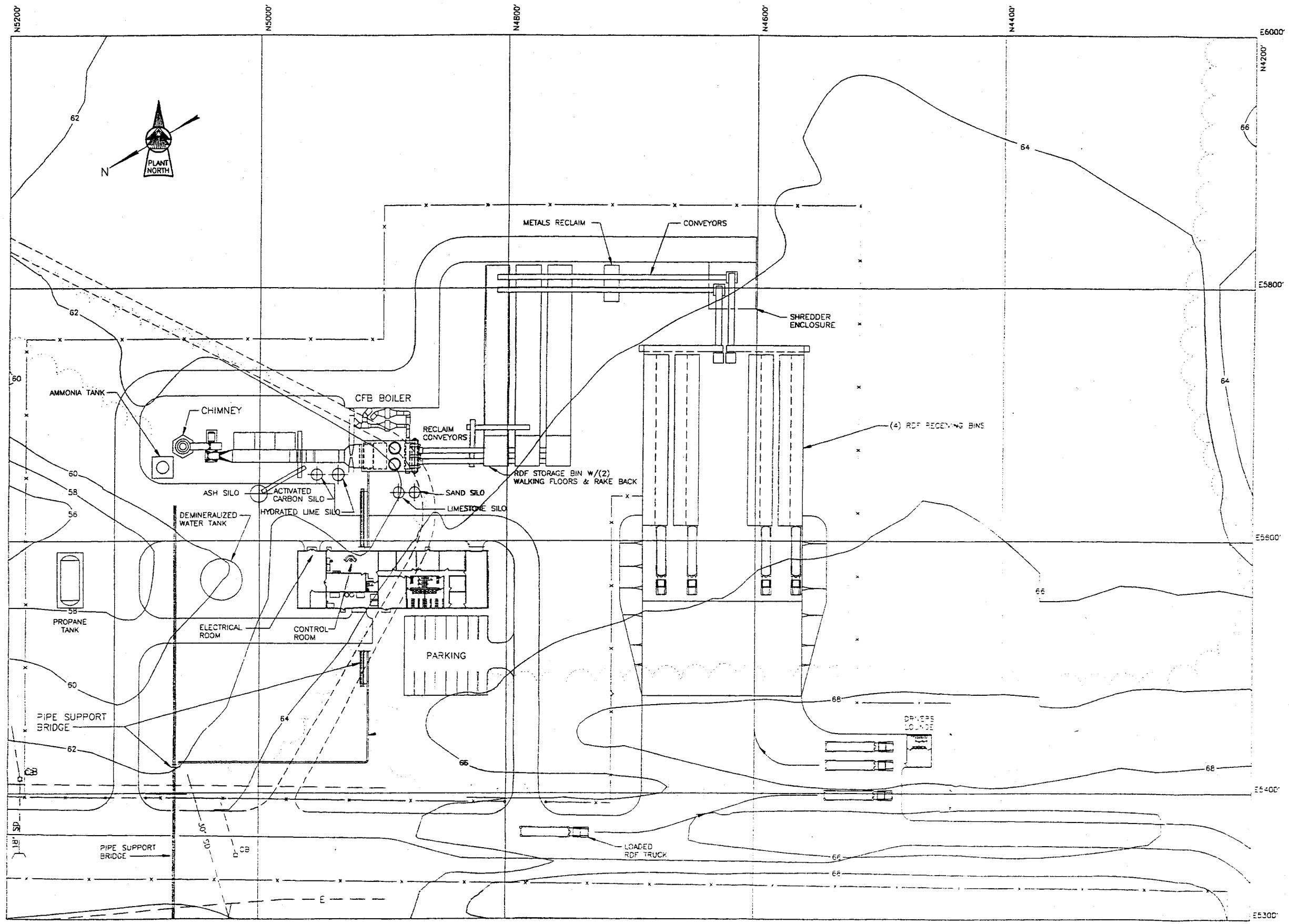
Based on emissions estimates, average sulfur dioxide emissions from the Carolina Energy, L.P. will be less than 7 percent of potential uncontrolled emissions, or 20 ppmv, amounting to not more than 76.2 tons per year. Compliance with the emissions limitations will be demonstrated by the use of continuous emissions monitoring of the effluent gas. Dry limestone (pulverized to minus 10 mesh) and hydrated lime injection will be used to control sulfur dioxide emissions.

Nitrogen Oxides

Average emissions of NOx will be less than 36 ppmv amounting to not more than 98.1 tons per year. Compliance will be demonstrated by continuous emissions monitoring of effluent gases. Aqueous ammonia injection will be used to control NOx emissions.

Carbon Monoxide

The average CO emissions from the Carolina Energy, L.P. Facility will be less than 60 ppmv, amounting to not more than 98.1 tons per year. Compliance will be demonstrated by continuous emissions monitoring of effluent gases.



0 50 100 150

SCALE: 1"=40'

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
B	FOR AIR PERMIT	G.J.	11/15/93	G.J.C.
A	FOR REVIEW	B.L.B.	11/15/93	G.J.C.

TRI-MONT Engineering Company
Boston, MA.

CLIENT: VEDCO ENERGY CORPORATION

PROJECT: KINSTON CONCEPT DESIGN

Title: SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1"=40'	D-071-03	C-2	B

4/5/94

11/24/93

AREA PLAN AND EXISTING UNDERGROUND UTILITIES

Tri-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	8/27/92	approved		
Checked	G.J. CAHILL	8/27/92	approved		
approved	G.J. CAHILL	8/27/92	approved		

Scale: 1"=60' | Job No. D-071-03-C1 | Drawing No. | Rev. No. B

Title

PROJECT KINSTON CONCEPT DESIGN

CLIENT VEDCO ENERGY CORPORATION

Tri-MONT Engineering Company
Boston, MA.

No.	Description	By	Date	Appd
	REVISIONS			
B	FOR REVIEW	BLB	11/23/93	GJC
A	FOR REVIEW	JRT	8/27/92	GJC

PRELIMINARY

SCALE: 1"=60'

0 50 100 200

PIPE BRIDGE CROSS-SECTION
N.T.S.

- STEAM SUPPLY
- ELECTRICAL CONDUIT
- DEMINERALIZED WATER
- SERVICE WATER
- SERVICE WATER

E64000' E65000' E65200' E65400' E65800' E66000'
N4200' N4400' N4600' N4800' N5000' N5200' N5400' N5600'

BAGHOUSE
PIPE SUPPORT BRIDGE
CP & L SUB-STATION
GRAVEL ROAD
P. WATER
MONITORING WELL
MONITORING WELL
PAVED ROAD
PIPE SUPPORT BRIDGE
NEW STEAM LINE
PARKING
LOADED RDF TRUCK
EMPTY RDF TRUCK
DRIVERS LOUNGE
RDF STORAGE BIN W/ (2) WALKING FLOORS & RAKE BACK
CFB BOILER
CHIMNEY
RECLAIM CONVEYORS
CONVEYORS
SHREDDER ENCLOSURE
(8) RDF RECEIVING BINS
F.O. STORAGE TANK
EL 70'
EL 65.8'
PLANT NORTH
N

N4700'
N5000'
N4800'
N4600'
N4400'
E6000'
N4200'
E5800'
E5600'
E5400'
E5300'

PLANT NORTH

(8) RDF RECEIVING BINS

SHREDDER ENCLOSURE

CONVEYORS

CFB BOILER

CHIMNEY

RECLAIM CONVEYORS

AMMONIA TANK

ASH SILO

HYDRATED LIME SILO

SAND SILO

RDF STORAGE BIN W/ (2) WALKING FLOORS & RAKE BACK

DRIVERS LOUNGE

DEMINERALIZED WATER TANK

LIMESTONE SILO

PARKING

PROPANE TANK

CONTROL ROOM

ELECTRICAL ROOM

EMPTY RDF TRUCK

LOADED RDF TRUCK

PIPE SUPPORT BRIDGE

CB

50'

11/24/93

0 50 100 150

SCALE: 1"=40'

PRELIMINARY

No.	Description	By	Date	Appd
	REVISIONS			
A	FOR REVIEW	BLB	11/23/93	GJC

TRI-MONT Engineering Company
Boston, MA.

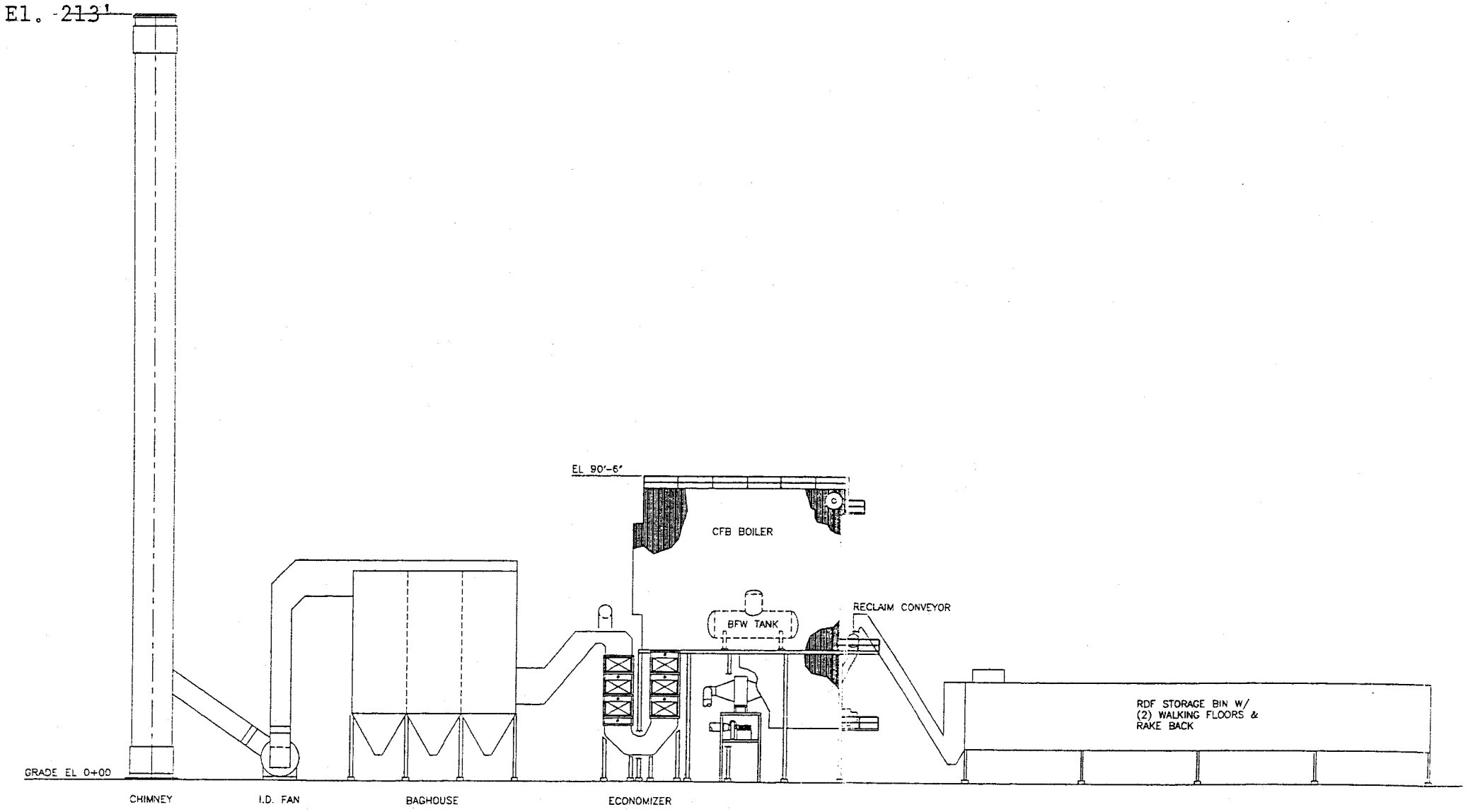
CLIENT: VEDCO ENERGY CORPORATION

PROJECT: KINSTON CONCEPT DESIGN

Title: SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/15/93	Approved		
Checked	G.J. CAHILL	11/15/93	Approved		
Approved	G.J. CAHILL	11/15/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1"=40'	D-071-03-C2		A



ELEVATION LOOKING NORTH

0 10 20 40 60 80

SCALE: 1"=20'

No.	Description	By	Date	Appd
	REVISIONS			
A	FOR REVIEW	BLB	11/29/93	GJC

TRI-MONT Engineering Company
Boston, MA.

CLIENT: VEDCO ENERGY CORPORATION

PROJECT: KINSTON CONCEPT DESIGN

Title: CFB BOILER ELEVATION

TRI-MONT	By	Date	Client	By	Date
Drawn	B.L. BRAD	11/29/93	Approved		
Checked	G.J. CAHILL	11/29/93	Approved		
Approved	G.J. CAHILL	11/29/93	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1"=20'	D-071-03-M21		A

11/29/93

North Carolina Department of Environment, Health, and Natural Resources

Environmental Management Commission

AIR PERMIT APPLICATION

A

page 1 of 1

GENERAL INFORMATION

INSTRUCTIONS ON BACK

*To construct and operate Air Emission Sources and Control Devices in accordance with N. C. General Statutes Chapter 143, Article 21.

PLEASE TYPE OR PRINT. ATTACH APPROPRIATE EMISSION SOURCE AND CONTROL DEVICE FORMS FOR EACH SOURCE LISTED IN ITEM 6 BELOW.

1. Facility Name (Company, Establishment, Town, Etc.): Carolina Energy, L.P. — Date: 3/21/94 Revised 4/14/94

2. Site Location (St./Rd./Hwy.): Highway 11 North — City: Kinston — Zip Code: 28502 — County: Lenoir

Latitude: 35 19'41" — Longitude: 77 28'25" — SIC Code: 4953/4961

3. Mailing Address (P. O. Box/St./Rd./Hwy.): 11757 Katy Freeway, Suite 1420

City: Houston — State: TX — Zip Code: 77079 — Phone with Area Code: 713-558-4300

4. Applicant Technical Contact: Kenneth L. Woodruff — Title: Consultant — Phone with Area Code: 215-736-2194

FOR DEM USE ONLY
DATE RECEIVED:
PERMIT NUMBER: _____
DATE ISSUED: _____

5. Description of operation conducted at above facility:
Combustion of RDF-3 using a single circulating fluid bed (CFB) combustor to generate high pressure steam.

6. List each EMISSION SOURCE and CONTROL DEVICE for which application is made. Assign an ID NUMBER to each emission source and control device which uniquely identifies that source. Attach appropriate emission source and control device forms for each.

EMISSION SOURCE	ID NO.	CONTROL DEVICE	ID NO.
RDF-Fired CFB Combustor	CFB-1	Fabric Filter	FF-1
Powdered Limestone Bin	PL	Fabric Filter	FF-3
Hydrated Lime Bin	HL	Fabric Filter	FF-4
Ammonia Tank	AT	None	
Ash Storage Bin Vent	AS	Fabric Filter	FF-5
Sand Silo Vent	SS	Fabric Filter	FF-6
Propane Tank	PT	None	
Activated Carbon Silo Vent	AC	Fabric Filter	FF-7

USE SEPARATE SHEET(S) IF NEEDED

7. Maximum facility operation: 24 Hours/Day — 7 Days/Week — 52 Weeks/Year

8. Name and address of engineering firm that prepared application or plans: Kenneth L. Woodruff & Associates
P.O. Box 42, Morrisville, PA 19067-0042

9. Signature of responsible person or company official:

Signer's Name (TYPE OR PRINT): George H. Armistead, Jr. — Title: Chairman and CEO — Date: April 14, 1994 — Phone with Area Code: 713-558-4300

VEDCO Energy Corp., General Partner

FORM AQ-22

North Carolina Department of Environment, Health, and Natural Resources

Environmental Management Commission

AIR PERMIT APPLICATION

A

page 1 of 1

GENERAL INFORMATION

INSTRUCTIONS ON BACK

*To construct and operate Air Emission Sources and Control Devices in accordance with N. C. General Statutes Chapter 143, Article 21.

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2. Site Location (St./Rd./Hwy.): Highway 11 North — City: Kinston — Zip Code: 28502 — County: Lenoir

Latitude: 35 19'41" — Longitude: 77 28'25" — SIC Code: 4953/4961

3. Mailing Address (P. O. Box/St./Rd./Hwy.): 11757 Katy Freeway, Suite 1420

City: Houston — State: TX — Zip Code: 77079 — Phone with Area Code: 713-558-4300

4. Applicant Technical Contact: Kenneth L. Woodruff — Title: Consultant — Phone with Area Code: 215-736-2194

FOR DEM USE ONLY
DATE RECEIVED:
PERMIT NUMBER: _____
DATE ISSUED: _____

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Combustion of RDF-3 using a single circulating fluid bed (CFB) combustor to generate high pressure steam.

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EMISSION SOURCE	ID NO.	CONTROL DEVICE	ID NO.
RDF-Fired CFB Combustor	CFB-1	Fabric Filter	FF-1
Powdered Limestone Bin	PL	Fabric Filter	FF-3
Hydrated Lime Bin	HL	Fabric Filter	FF-4
Ammonia Tank	AT	None	
Ash Storage Bin Vent	AS	Fabric Filter	FF-5
Sand Silo Vent	SS	Fabric Filter	FF-6
Propane Tank	PT	None	

USE SEPARATE SHEET(S) IF NEEDED

7. Maximum facility operation: 24 Hours/Day — 7 Days/Week — 52 Weeks/Year

8. Name and address of engineering firm that prepared application or plans: Kenneth L. Woodruff & Associates
P.O. Box 42, Morrisville, PA 19067-0042

9. Signature of responsible person or company official:

George H. Armistead, Jr. — Date: March 21, 1994

Signer's Name (TYPE OR PRINT) — Title — Phone with Area Code

George H. Armistead, Jr. — Chairman and CEO — 713-558-4300
VEDCO Energy Corp., General Partner

FORM AQ-22

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   RDF-Fired Fluid Bed Combustor (CFB-1)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   One (1) 249 mm BTU/hour heat input circulating fluid bed combustor fired with RDF-3. Emissions control includes limestone injection, ammonia injection, hydrated lime injection, fabric filter.
3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 1996
4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates, Total	1000	5.0	6	Fabric Filter	99.5
Sulfur Dioxide	272	17.4	6	Limestone Injection	93
Nitrogen Dioxide	56	22.4	6	Ammonia Injection	60
Carbon Monoxide	75	22.4	6	Combustion Control	70
Hydrocarbons (VOC)		7.5	6	Combustion Control	
Lead		0.21	6	Fabric Filter	
PM-10	1000	5.0	6	Fabric Filter	99.5
Other (HCl)	233	9.48	6	Lime Injection	96

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   ( ) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   (X) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: ( ) Continuous ( ) Batch – Normal Batch Time _____ No. Batches per Day _____
8. Process Name _____

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A.			
B.			
C.			
D.			
E.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS			

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

9. Type of Fuel Burning Source:
(X) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
(X) Other (specifiy) Circulating Fluidized Bed

11. Is collected flyash reinjected? ( ) NO (X) YES Percent Reinjected _____ %
Combustion Air: Percent Excess Air 40 % ( ) Natural (X) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing (X) Other Steam Sootblowers Schedule Once/day

12. Boiler Horsepower Rating 197 mm BTU/Hr. Boiler Steam Flow (lb/hr) 176,000

13. Fuel Burning Source Heat Input: Maximum 249 Million BTU/hr Average 240 Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) RDF-3
Standby Fuel Type(s) (specify) Propane (Startup Fuel Only)

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Propane (Startup Fuel) #4 Fuel Oil	(gal/hr) 1400	(gal/hr) 1100	(gal/yr) 110,000	0.014 #/1000 gal	0.44 #/1000 gal	(BTU/gal) 91,600
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
RDF-3 Other	lb./hour 49,800	lb./hour 47,400	ton/yr. 190,000	0.3	12	5000-6000

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No ( ) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
Liquid Wastes - Boiler Blowdown will be discharged to the adjacent DuPont Facility Wastewater System. Solid Waste - Combustion Ash (Flyash) will be beneficially used as an additive to concrete or in the manufacturing of Portland Cement. Tramp material (bottom ash) will be landfilled.

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
213	44.18	300	UP
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
127,000	47.92	( ) No (X) Yes	(X) No ( ) Yes, (specify)

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. MS – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

(X) Opacity Monitor (X) SO2 Monitor (X) NOx Monitor (X) Other CO

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE ATTACHED DRAWINGS

23. Comments:

No storage piles, haul roads to be paved with bituminous concrete (asphalt), fuel receiving, storage and handling systems to be under negative pressure.

All storage bins/silos are equipped with bin vent fabric filters.

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-1)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) Limestone Injection into CFB (2) Ammonia Injection (3) Hydrated Lime Injection ~~XXXXXXXXX~~ Fabric Filter
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   RDF-Fired Circulating Fluid Bed Combustor (CFB-1)
4. Narrative Description of Control Device(s):
   Pulsed Jet Baghouse

Manufacturer	Model Name	Model Number
Procedair, Staclean, Flakt or Equal		

5. Estimated Cost of Control Device: $ 1,100,000
   Period of Time Control Device is Estimated to be Adequate: 20 Years with periodic maintenance and bag replacement
6. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 19 96
7. Emission Parameters:

Pollutant(s) Controlled	PART. (X)	SO_2 (X)	NO_x (X)	CO (X)	VOC (X)	LEAD (X)	OTHER HCl	OTHER
Emission Rate Before Control (lb/hr) =	1000	272	56	75			233	
Emission Rate After Control (lb/hr) =	5	17.4	22.4	22.4	7.5	0.21	9.48	
Removal Efficiency Percent (%) =	99.5	93	60	70			96	

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   _____ 0-1 _____ 1-10 _____ 10-25 _____ 25-50 _____ 50-100 _____ Over 100
8. Gas Conditions at Control Device:

	INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM) =	127,000	-	127,000
Temperature (Deg. F) =	300	-	300
Velocity (ft./sec.) =	2.53	-	-
Pressure Drop (in. H_2O) =	4	-	-
Moisture (%) =	10.56	-	10.56

9. Describe Ultimate Disposal of Collected Materials:
   Collected flyash will be beneficially used as an additive in the manufacturing of concrete or portland cement. Tramp material (bottom ash) will be landfilled.
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? (X) No ( ) Yes, (specify)
213	44.18	UP	

   Is scaffolding available for sources testing? ( ) No (X) Yes
   Are sampling ports available? ( ) No (X) Yes
   Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

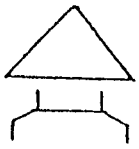
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

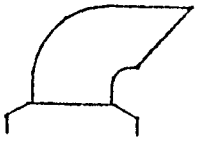
A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

CYCLONE DIAGRAM

CHECK APPROPRIATE OUTLET CONFIGURATION BELOW

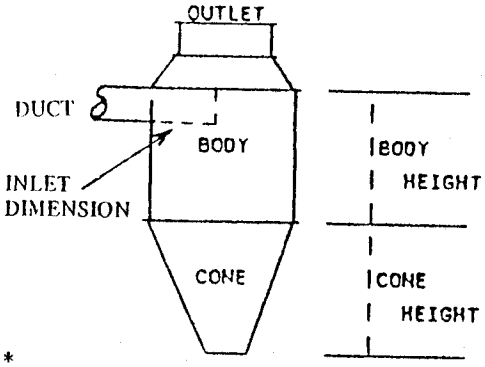


( )



( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) *** (FF-1)

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	127,000	31,828	4.1 to 1	4

TYPE OF FILTER
(X) Fabric Filter (BAGHOUSE)
( ) Packed Bed ( ) Mat Filter
( ) Panel Filter
( ) Other ____

FILTER MATERIAL (to be selected)
(X) Fiberglass ( ) Nylon
(X) Nomex ( ) Teflon
( ) Wool ( ) Dacron
( ) Cotton ( ) Orlon
(X) Other Ryton

BAG CLEANING
( ) Mechanical ( ) Sonic
( ) Reverse Flow (X) Air Pulse
( ) Simple Bag Collapse ( ) Ringed Bag Collapse
( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
6	10 seconds	300	N/A

15. N/A *** "AFTERBURNER" (FUME INCINERATOR) ***

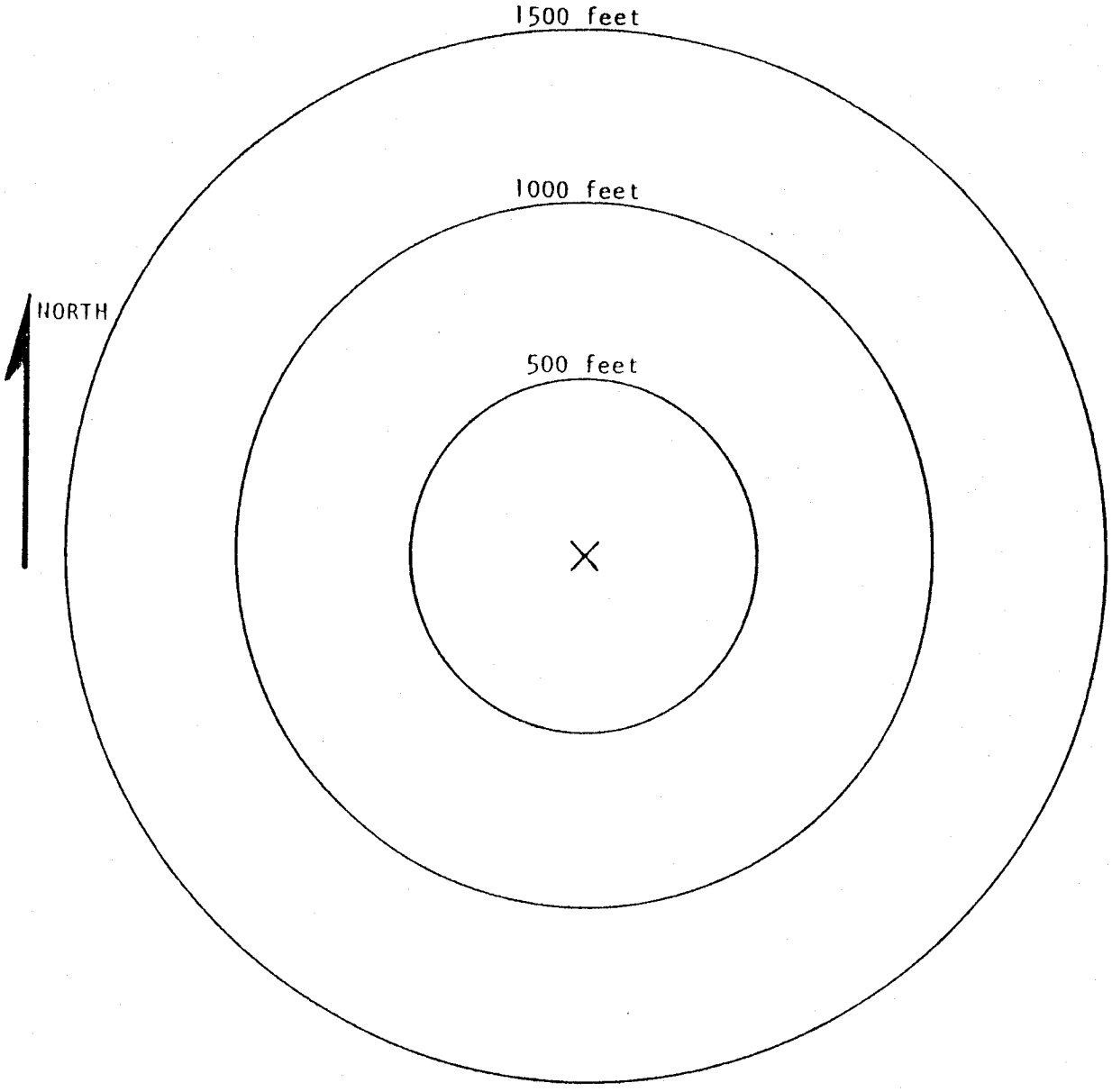
Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

SEE ATTACHED DRAWINGS
AND SITE PLAN
AREA DIAGRAM

D

Show all surrounding buildings and roads within 1500 feet of the equipment covered by this application. Attach a site diagram identifying each emission source location(s), property boundaries and building (structure) dimensions (height, width, and length).



INSTRUCTIONS

1. Indicate location and type of building by the use of small numbered circles with the decription below.
2. Show roads as lines representing the road edges. Indicate street names and highway numbers.
3. Show wooded or cleared area by approximate boundary lines and the words "woods", "cleared", "cornfield", etc.

CODE	DESCRIPTION
(1)	
(2)	
(3)	
(4)	
(5)	
(6)	
(7)	
(8)	
(9)	
(10)	

Example:

(1) Church
(2) Residence

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Powdered Limestone Storage Bin (PL)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Powdered Limestone Storage Bin Vent with Fabric Filter
3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 19 96
4. Maximum Source Operation: (Storing Material) 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	10	0.05	2	Fabric Filter	99.5
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (_____)					

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (XX) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 0.5 Hr. (filling) No. Batches per Day Max. 1
8. Process Name Powdered Limestone Storage Bin

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Powdered Limestone	100,000	45,000	100,000
B.			
C. NOTE: Emissions occur only during the time			
D. of bin filling, estimated to be			
E. 150 hours per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	45,000	100,000

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
Collected particulates are discharged back into storage bin.

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
52	0.2	70 (Ambient)	DOWN
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
650	55.2	(X) No ( ) Yes	( ) No (X) Yes, (specify) Rain Cap

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. PL – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE FACILITY DRAWINGS

Comments:

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-3)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) _____ (2) _____ (3) _____ TOTAL UNITS _____
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   Powdered Limestone Storage Bin (PL)
4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

Manufacturer	Model Name	Model Number
Staclean or Equal		

5. Estimated Cost of Control Device
   $ 28,000
   Period of Time Control Device is Estimated to be Adequate:
   20 Years with periodic maintenance
6. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 19 96
7. Emission Parameters:

Pollutant(s) Controlled		PART. (X)	SO_2 ( )	NO_x ( )	CO ( )	VOC ( )	LEAD ( )	OTHER	OTHER
Emission Rate Before Control (lb/hr)	=	10							
Emission Rate After Control (lb/hr)	=	0.05							
Removal Efficiency Percent (%)	=	99.5							

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   _____ 0-1 _____ 1-10 _____ 10-25 _____ 25-50 _____ 50-100 _____ Over 100
8. Gas Conditions at Control Device:

		INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM)	=	650		650
Temperature (Deg. F)	=	70 (Ambient)		70
Velocity (ft./sec.)	=			55.2
Pressure Drop (in. H_2O)	=	4		4
Moisture (%)	=	7		7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage bin
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? (X) No ( ) Yes, (specify)
52	0.2	Down	Rain Cap

   Is scaffolding available for sources testing? ( ) No (X) Yes
   Are sampling ports available? (X) No ( ) Yes
   Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

C

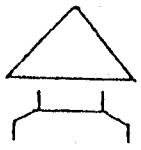
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

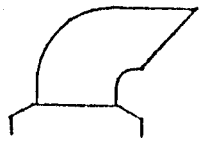
A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

CYCLONE DIAGRAM

CHECK APPROPRIATE OUTLET CONFIGURATION BELOW

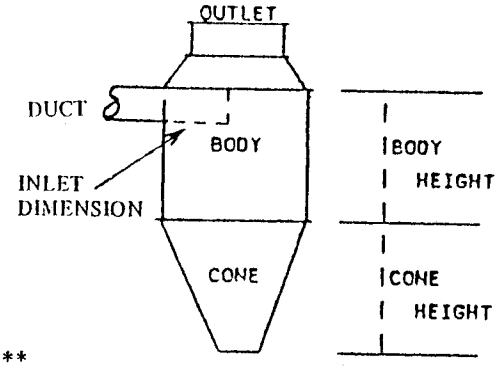


( )



( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	650	170	3.75 to 1	4

TYPE OF FILTER
- (X) Fabric Filter (BAGHOUSE)
- ( ) Packed Bed ( ) Mat Filter
- ( ) Panel Filter
- ( ) Other ____

FILTER MATERIAL
- ( ) Fiberglass ( ) Nylon
- ( ) Nomex ( ) Teflon
- ( ) Wool ( ) Dacron
- ( ) Cotton ( ) Orlon
- (X) Other Polyester

BAG CLEANING
- ( ) Mechanical ( ) Sonic
- ( ) Reverse Flow (X) Air Pulse
- ( ) Simple Bag Collapse ( ) Ringed Bag Collapse
- ( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
1		70 (Ambient)	

15. *** "AFTERBURNER" (FUME INCINERATOR) ***

Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Hydrated Lime Storage Bin (HL)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Hydrated Lime Storage Bin Vent with Fabric Filter
3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 1996
4. Maximum Source Operation: (Storing Material) 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	10	0.05	2	Fabric Filter	99.5
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (_____)					

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 0.5 Hr. (filling) No. Batches per Day Max. 1
8. Process Name Hydrated Lime Storage Bin

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Hydrated Lime	100,000	45,000	100,000
B.			
C. NOTE: Emissions occur only during bin			
D. filling estimated to be 38 hours			
E. per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	45,000	100,000

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____Million BTU/hr Average _____Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	FUEL USAGE Max. Actual	FUEL USAGE Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
Collected particulate matter is discharged back into the storage bin.

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
52	0.2	70 (Ambient)	DOWN
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
650	55.2	(X) No ( ) Yes	( ) No (X) Yes, (specify) Rain Cap

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. HL — Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:
( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE FACILITY DRAWINGS

Comments:

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-4)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) ..... (2) ..... (3) ..... TOTAL UNITS .....
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   Hydrated Lime Storage Bin (HL)
4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

Manufacturer	Model Name	Model Number
Staclean or Equal		

5. Estimated Cost of Control Device
   $ 28,000
   Period of Time Control Device is Estimated to be Adequate:
   20 Years
6. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. .....
   Commence Construction Date October, 19 94 Operation Date January, 19 96
7. Emission Parameters:

Pollutant(s) Controlled	PART. (X)	SO_2 ( )	NO_x ( )	CO ( )	VOC ( )	LEAD ( )	OTHER	OTHER
Emission Rate Before Control (lb/hr) =	10							
Emission Rate After Control (lb/hr) =	0.05							
Removal Efficiency Percent (%) =	99.5							

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   ..... 0-1 ..... 1-10 ..... 10-25 ..... 25-50 ..... 50-100 ..... Over 100
8. Gas Conditions at Control Device:

	INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM) =	650	-	650
Temperature (Deg. F) =	70 (Ambient)	-	70
Velocity (ft./sec.) =		-	55.2
Pressure Drop (in. H_2O) =	4	-	4
Moisture (%) =	7	-	7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage bin
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? ( ) No (X) Yes, (specify)
52	0.2	DOWN	Rain Cap

   Is scaffolding available for sources testing? ( ) No (X) Yes
   Are sampling ports available? (X) No ( ) Yes
   Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

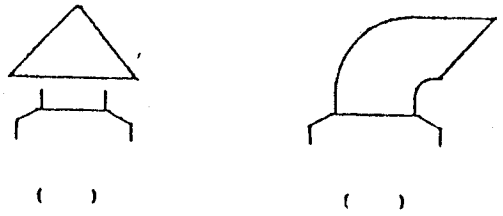
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

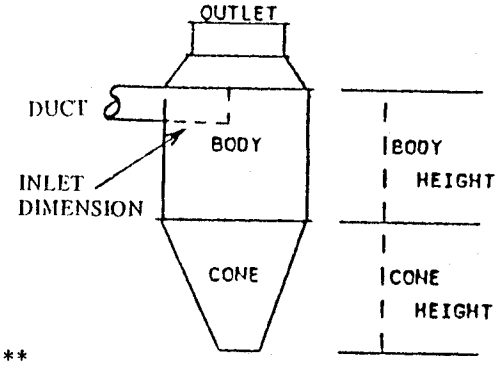
CYCLONE DIAGRAM

CHECK APPROPRIATE OUTLET CONFIGURATION BELOW



( ) ( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	650	170	3.75 to 1	4

TYPE OF FILTER
(X) Fabric Filter (BAGHOUSE)
( ) Packed Bed ( ) Mat Filter
( ) Panel Filter
( ) Other ____

FILTER MATERIAL
( ) Fiberglass ( ) Nylon
( ) Nomex ( ) Teflon
( ) Wool ( ) Dacron
( ) Cotton ( ) Orlon
(X) Other Polyester

BAG CLEANING
( ) Mechanical ( ) Sonic
( ) Reverse Flow (X) Air Pulse
( ) Simple Bag Collapse ( ) Ringed Bag Collapse
( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
1		70	

15. *** "AFTERBURNER" (FUME INCINERATOR) ***

Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):

Ammonia Tank (AT)

2. Description of Process or Fuel Burning Source Including Air Control Device:

Aqueous Ammonia Storage Tank

(12,000 gallon capacity)

3. Permit Application is made for (CHECK ONE ONLY):

(X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____

Commence Construction Date October, 1994 Operation Date January, 1996

4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year

5. Air Contaminants Emitted:

	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates					
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (Ammonia)	0.83	0.83	2	NONE	-

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE

**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:

CHECK ONE

(X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)

( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)

( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)

7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 0.5 hour (filling tank) No. Batches per Day Max. 1

8. Process Name Ammonia Tank

Materials Entering Process*: (12,000 gallons)

(Include In-process Solid Fuels)

	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Ammonia	100,000	50,000	100,000
B.			
C.			
D.			
E.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	50,000	100,000

DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
NONE

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
10	0.05	70 (Ambient)	UP
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
0.03	0.01	(X) No ( ) Yes	( ) No ( ) Yes, (specify)

Is scaffolding available for source testing?
(X) No ( ) Yes

Stack ID No. AT – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

23. Comments:

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Ash Storage Bin Vent (AS)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Combustion Ash Storage Silo Bin Vent with Fabric Filter
3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 19 96
4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	10	0.05	2	Fabric Filter	99.5
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (_____)					

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: (X) Continuous ( ) Batch – Normal Batch Time _____ No. Batches per Day _____
8. Process Name Combustion Ash

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Combustion Ash	7500	6500	7500
B.			
C.			
D.			
E.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	7500	6500	7500

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
Collected particulate matter is discharged back into the storage bin.

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
57	0.2	210	DOWN
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
650	55.2	(X) No ( ) Yes	( ) No (X) Yes, (specify) Rain Cap

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. AS – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE FACILITY DRAWINGS

23. Comments:

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-5)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) ..... (2) ..... (3) ..... TOTAL UNITS .....
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   Ash Storage Bin Vent (AS)
4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

   Manufacturer: Staclean or Equal
   Model Name:
   Model Number:
5. Estimated Cost of Control Device
   $ 28,000
   Period of Time Control Device is Estimated to be Adequate:
   20 Years
6. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. .....
   Commence Construction Date October, 1994 Operation Date January, 1996
7. Emission Parameters:

Pollutant(s) Controlled	PART. (X)	SO_2 ( )	NO_x ( )	CO ( )	VOC ( )	LEAD ( )	OTHER	OTHER
Emission Rate Before Control (lb/hr) =	10							
Emission Rate After Control (lb/hr) =	0.05							
Removal Efficiency Percent (%) =	99.0							

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   ..... 0-1 ..... 1-10 ..... 10-25 ..... 25-50 ..... 50-100 ..... Over 100
8. Gas Conditions at Control Device:

	INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM) =	650		650
Temperature (Deg. F) =	210		210
Velocity (ft./sec.) =			55.2
Pressure Drop (in. H_2O) =	4		4
Moisture (%) =	7		7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage bin
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? ( ) No (X) Yes, (specify)
57	0.2	DOWN	Rain Cap

   Is scaffolding available for sources testing? ( ) No (X) Yes
   Are sampling ports available? (X) No ( ) Yes

   Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

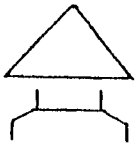
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

CYCLONE DIAGRAM

CHECK APPROPRIATE OUTLET CONFIGURATION BELOW



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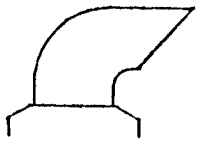
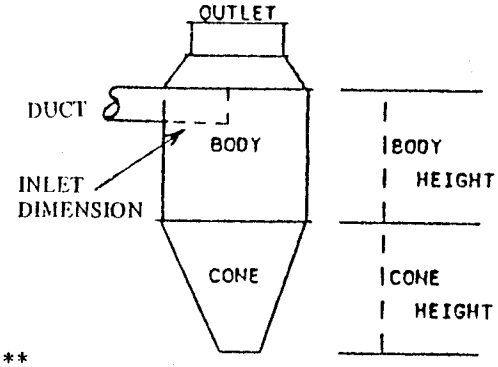


( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	650	170	3.75 to 1	4

TYPE OF FILTER
(X) Fabric Filter (BAGHOUSE)
( ) Packed Bed ( ) Mat Filter
( ) Panel Filter
( ) Other ____

FILTER MATERIAL
( ) Fiberglass ( ) Nylon
(X) Nomex ( ) Teflon
( ) Wool ( ) Dacron
( ) Cotton ( ) Orlon
( ) Other ____

BAG CLEANING
( ) Mechanical ( ) Sonic
( ) Reverse Flow (X) Air Pulse
( ) Simple Bag Collapse ( ) Ringed Bag Collapse
( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
1		210	

15. *** "AFTERBURNER" (FUME INCINERATOR) ***

Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Sand Silo Bin Vent (SS)

2. Description of Process or Fuel Burning Source Including Air Control Device:
   Sand Storage Bin Vent with Fabric Filter

3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 1994 Operation Date January, 1996

4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year

5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	10	0.05	2	Fabric Filter	99.5
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (_____)					

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)

7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 0.5 (Filling) No. Batches per Day Max. 1

8. Process Name Sand Storage Silo

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Sand	100,000	45,000	100,000
B.			
C. NOTE: Emissions occur only during the			
D. time of bin filling, estimated to			
E. be 150 times per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	45,000	100,000

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES -- *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	FUEL USAGE Max. Actual	FUEL USAGE Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
Collected particulate matter is discharged back into the storage bin.

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
52	0.2	70 (Ambient)	DOWN
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
650	55.2	(X) No ( ) Yes	( ) No (X) Yes, (specify) Rain Cap

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. SS – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE FACILITY DRAWINGS

Comments:

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-6)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) _____ (2) _____ (3) _____ TOTAL UNITS _____
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   Sand Silo Bin Vent (SS)
4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

Manufacturer	Model Name	Model Number
Staclean or Equal		

5. Estimated Cost of Control Device: $ 28,000
   Period of Time Control Device is Estimated to be Adequate: 20 Years
6. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 1994 Operation Date January, 1996
7. Emission Parameters:

Pollutant(s) Controlled	PART. (X)	SO_2 ( )	NO_x ( )	CO ( )	VOC ( )	LEAD ( )	OTHER	OTHER
Emission Rate Before Control (lb/hr) =	10							
Emission Rate After Control (lb/hr) =	0.05							
Removal Efficiency Percent (%) =	99.5							

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   _____ 0-1 _____ 1-10 _____ 10-25 _____ 25-50 _____ 50-100 _____ Over 100
8. Gas Conditions at Control Device:

	INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM) =	650		650
Temperature (Deg. F) =	70		70
Velocity (ft./sec.) =			55.2
Pressure Drop (in. H_2O) =	4		
Moisture (%) =	7		7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage bin.
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? ( ) No (X) Yes, (specify)
52	0.2	DOWN	Rain Cap

   Is scaffolding available for sources testing? ( ) No (X) Yes
   Are sampling ports available? (X) No ( ) Yes
   Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

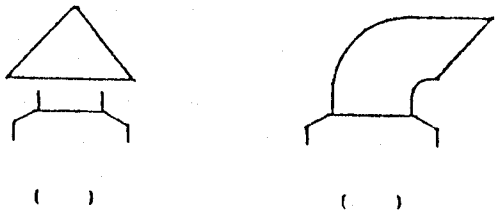
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

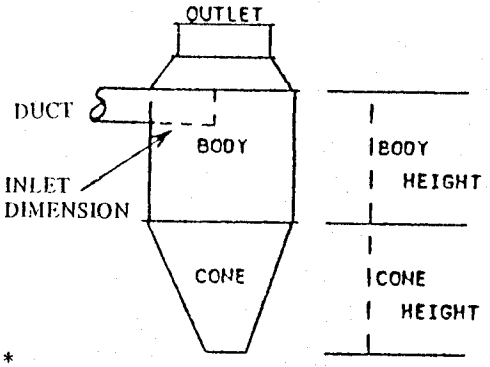
CYCLONE DIAGRAM

CHECK APPROPRIATE OUTLET CONFIGURATION BELOW



( ) ( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	650	170	3.75 to 1	4

TYPE OF FILTER
(X) Fabric Filter (BAGHOUSE)
( ) Packed Bed ( ) Mat Filter
( ) Panel Filter
( ) Other ____

FILTER MATERIAL
( ) Fiberglass ( ) Nylon
( ) Nomex ( ) Teflon
( ) Wool ( ) Dacron
( ) Cotton ( ) Orlon
(X) Other Polyester

BAG CLEANING
( ) Mechanical ( ) Sonic
( ) Reverse Flow (X) Air Pulse
( ) Simple Bag Collapse ( ) Ringed Bag Collapse
( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
1		70	

15. *** "AFTERBURNER" (FUME INCINERATOR) ***

Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Propane Storage Tank (PT)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Propane Storage Tank (12,000 gallons)
3. Permit Application is made for (CHECK ONE ONLY):
   (X) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 1994 Operation Date January, 1996
4. Maximum Source Operation: (Propane Storage) 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates					
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (Propane)	0.42	0.42	2	NONE	

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 0.5 Hr. (filling) No. Batches per Day Max. 1
8. Process Name Propane Storage Tank
   Materials Entering Process*: (12,000 gallon tank)
   (Include In-process Solid Fuels)

	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Propane	60,000	51,000	60,000
B.			
C. NOTE: Emissions occur only upon disconnect			
D. of hose after filling approximately			
E. 12 times per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	60,000	51,000	60,000

DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

19. Describe any liquid or solid wastes generated and method of disposal:
NONE

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
10	0.2		UP
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
0.7	0.06	(X) No ( ) Yes	(XX) No ( ) Yes, (specify)

Is scaffolding available for source testing?
(X) No ( ) Yes

Stack ID No. PT – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

Propane will be stored in a 12,000 gallon tank to be used for startup fuel for the combustor. Emissions will occur only after filling the pressurized tank, upon hose disconnect.

23. Comments:

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

B

NOTE: DO NOT USE THIS FORM FOR INCINERATORS, USE FORM "F".

PLEASE TYPE OR PRINT. ATTACH TO THE GENERAL INFORMATION FORM "A". IF APPLICABLE, ATTACH AIR POLLUTION CONTROL DEVICE FORM "C". USE SEPARATE FORM FOR EACH SOURCE.

1. Emission Source and ID NO. (FROM GENERAL INFORMATION FORM "A", ITEM 6):
   Activated Carbon Silo (AC)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Activated Carbon Storage Silo Bin Vent with Fabric Filter
3. Permit Application is made for (CHECK ONE ONLY):
   ( ) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 19 94 Operation Date January, 1996
4. Maximum Source Operation: (Storing Material) 24 Hours/Day 7 Days/Week 52 Weeks/Year
5. Air Contaminants Emitted:

Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	Maximum Actual Emissions After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	10	0.05	2	Fabric Filter	99.5
Sulfur Dioxide					
Nitrogen Dioxide					
Carbon Monoxide					
Hydrocarbons (VOC)					
Lead					
PM-10					
Other (_____)					

*REFER TO BACK OF GENERAL INFORMATION FORM "A" FOR EMISSION ESTIMATION CODE
**ATTACH AIR CONTROL DEVICE FORM "C"

6. Type of Source:
   CHECK ONE
   (X) A GENERAL PROCESS – Source not covered by B and C below. (Complete items 7, 8, 18 through 22)
   ( ) B GENERAL PROCESS WITH IN-PROCESS FUEL – Source where products of combustion contact materials heated. (Complete items 7, 8, 9, 13, 14, 18 through 22)
   ( ) C FUEL BURNING SOURCE (boilers, etc.) – Source where products of combustion are for the primary purpose of producing heat or power by indirect heat transfer. (Complete items 9 through 22)
7. Process Operation: ( ) Continuous (X) Batch – Normal Batch Time 1 Hr. (filling) No. Batches per Day Max. 1
8. Process Name Activated Carbon Silo

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Input Rates (lb/hr) Actual	Max. Requested Permit Input Rates (lb/hr)
A. Activated Carbon	50,000	45,000	50,000
B.			
C. NOTE: Emissions occur only during bin			
D. filling estimated to be 40 hours			
E. per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	50,000	45,000	50,000

DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

9. Type of Fuel Burning Source:
( ) Industrial Boiler ( ) Institutional/Residential Boiler ( ) Electric Utility Boiler ( ) Process Burner(s)
( ) Other _____ Make and Model No. _____

10. Type of Solid Fuel Burning Equipment Used:
( ) Hand Fired ( ) Overfeed Stoker ( ) Pulverized
( ) Spreader Stoker ( ) Traveling Grate ( ) Wet Bed
( ) Underfeed Stoker ( ) Shaking Grate ( ) Dry Bed
( ) Other (specifiy) _____

11. Is collected flyash reinjected? ( ) NO ( ) YES Percent Reinjected _____%
Combustion Air: Percent Excess Air _____% ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing ( ) Other _____ Schedule _____

12. Boiler Horsepower Rating _____ Boiler Steam Flow (lb/hr) _____

13. Fuel Burning Source Heat Input: Maximum _____ Million BTU/hr Average _____ Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) _____
Standby Fuel Type(s) (specify) _____

FUEL TYPE	FUEL USAGE Max. Design	Max. Actual	Annual	Max. % Sulfur	Max. % Ash	BTU Value
#6 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#5 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
#4 Fuel Oil	(gal/hr)	(gal/hr)	(gal/yr)			(BTU/gal)
Coal	(lb/hr)	(lb/hr)	(ton/yr)			(BTU/lb)
Wood	(lb/hr dry)	(lb/hr dry)	(ton/yr dry)			(BTU/lb) 8,000
Other						

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each:
Fuel Oil _____ Coal _____ Wood _____ Other _____

16. Total maximum heat input in million BTU/hr of all indirect fired fuel burning sources within property boundaries excluding that indicated above:
Fuel Oil _____ Coal _____ Wood _____ Other _____

17. Total No. of indirect fired fuel burning sources within property boundaries:
Fuel Oil _____ Coal _____ Wood _____ Other _____

18. Are there any fugitive emissions (storage piles, product handling, haul roads, etc.)? No (X) Yes ( ) If yes, please describe in comments below, the type, size, estimated emissions and control measures.

Describe any liquid or solid wastes generated and method of disposal:
Collected particulate metter is discharged back into the storage silo.

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

20. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
52	0.2	70 (Ambient)	DOWN
Volumetric Flow Rate (ACFM)	**Velocity (ft./sec.)**	**Are sampling ports available?**	**Is rain cap or other obstruction over stack?**
650	55.2	(X) No ( ) Yes	( ) No (X) Yes, (specify) Rain Cap

Is scaffolding available for source testing?
( ) No (X) Yes

Stack ID No. AC – Sources with a common stack will have the same stack number.

21. Indicate monitoring and recording instruments installed on stack:

( ) Opacity Monitor ( ) SO2 Monitor ( ) NOx Monitor ( ) Other NONE

22. Attach or sketch a flow diagram of the process or fuel burning source. Include air control device(s). (SEE INSTRUCTIONS ON BACK OF THIS PAGE):

SEE FACILITY DRAWINGS

Comments:

AIR POLLUTION CONTROL DEVICE

C

PLEASE TYPE OR PRINT. ATTACH TO GENERAL INFORMATION FORM "A". SUPPLY DESIGN DATA, SPECIFICATIONS, AND AVAILABLE ENGINEERING DRAWINGS.

1. Air Control Device and ID No. (FROM GENERAL INFORMATION FORM "A", ITEM 6)
   Fabric Filter (FF-7)
2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) _____ (2) _____ (3) _____ TOTAL UNITS _____
3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   Activated Carbon Silo (AC)
4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

Manufacturer	Model Name	Model Number
Staclean or Equal		

5. Estimated Cost of Control Device
   $ 28,000
   Period of Time Control Device is Estimated to be Adequate:
   20 Years
6. Permit Application is made for (CHECK ONE ONLY):
   ( ) New Source ( ) Existing Source ( ) Modification – Last Permit No. _____
   Commence Construction Date October, 1994 Operation Date January, 1996
7. Emission Parameters:

Pollutant(s) Controlled	PART. (X)	SO_2 ( )	NO_x ( )	CO ( )	VOC ( )	LEAD ( )	OTHER _____	OTHER _____
Emission Rate Before Control (lb/hr) =	10							
Emission Rate After Control (lb/hr) =	0.05							
Removal Efficiency Percent (%) =	99.5							

   Particle Size Distribution of Particulates Entering Control Device (% Micron):
   _____ 0-1 _____ 1-10 _____ 10-25 _____ 25-50 _____ 50-100 _____ Over 100
8. Gas Conditions at Control Device:

	INLET	INTERMEDIATE LOCATIONS	OUTLET
Flow Rate (ACFM) =	650	-	650
Temperature (Deg. F) =	70 (Ambient)	-	70
Velocity (ft./sec.) =		-	55.2
Pressure Drop (in. H_2O) =	4	-	4
Moisture (%) =	7	-	7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage bin
10. Stack or Emission Point Data:

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack? ( ) No (X) Yes, (specify)
52	0.2	DOWN	Rain Cap

Is scaffolding available for sources testing?
( ) No (X) Yes

Are sampling ports available?
(X) No ( ) Yes

11. Comments:

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

C

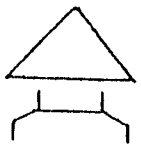
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ____ of ____ Units
Cyclone Dimensions (inches) Inlet / Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)
Wet Spray ( ) No ( ) Yes	No. of Nozzles	Liquid Used (specify)	Flow Rate (GPM)	Makeup Rate (GPM) / % Recirculated

A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

CYCLONE DIAGRAM

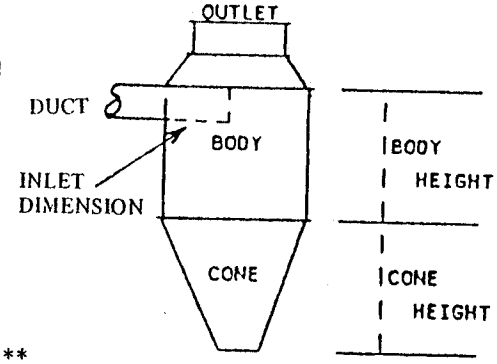
CHECK APPROPRIATE OUTLET CONFIGURATION BELOW



( )

( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_2O)	Position in Series # ____ of ____ Units
Louvers ( ) No ( ) Yes	Inlet Dimension of Individual Cyclone (inches)	Outlet Dimension of Individual Cyclone (inches)	Individual Cyclone Diameter (inches)	Inlet Temperature (Deg. F)

14. *** "FILTRATION" (BAGHOUSE) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	650	170	3.75 to 1	4

TYPE OF FILTER
(X) Fabric Filter (BAGHOUSE)
( ) Packed Bed ( ) Mat Filter
( ) Panel Filter
( ) Other ____

FILTER MATERIAL
( ) Fiberglass ( ) Nylon
( ) Nomex ( ) Teflon
( ) Wool ( ) Dacron
( ) Cotton ( ) Orlon
(X) Other Polyester

BAG CLEANING
( ) Mechanical ( ) Sonic
( ) Reverse Flow (X) Air Pulse
( ) Simple Bag Collapse ( ) Ringed Bag Collapse
( ) Other ____

No. of Compartments	Time Between Cleaning (mins./hr.)	Inlet Temperature (Deg. F)	Position in Series # ____ of ____ Units
1		70 (AMBIENT)	

15. *** "AFTERBURNER" (FUME INCINERATOR) ***

Type of Afterburner: ( ) Direct Flame ( ) Catalytic ( ) Other ____	Efficiency (%)	Volumetric Flow Rate (CFM)	Position in Series # ____ of ____ Units
Maximum Burner Rating (Million BTU/hr)	Combustion Chamber Temp. (Deg. F)	Retention Time (sec.)	Fuel Type ____ Usage ____

Combustion Chamber Dimensions (ft.): ____ Length ____ Diameter

Section 5

OPERATION AND MAINTENANCE MANUAL

FOR THE

CAROLINA ENERGY L.P.

RDF-TO-ENERGY FACILITY

LENOIR COUNTY, NORTH CAROLINA

DRAFT JUNE 1994

NOTE: This draft O&M Manual is for a typical fluidized bed combustion system and is not site or vendor specific for the proposed Lenoir County Facility.

INTRODUCTION:

This manual has been prepared to serve as a guide in the understanding of the operation and maintenance of the Energy Generation Facility (EGF) and to provide assistance in operator training and familiarization.

This manual consists of the following sections:

1. Circulating Fluid Bed Boiler Description
2. Technical Data
3. Safety Precautions and Preparation for Operation
4. Operation
5. Maintenance

The entire facility is composed of many components manufactured by vendors other than the fluid bed manufacturer. This manual does not include details of the operation, maintenance and safety precautions of these components: the appropriate vendor data which will be presented in other volumes of the manual should be consulted in conjunction with the information contained in this volume of the manual.

1.0 Description:

1.1 The Boiler System:

The circulating fluid bed boiler system is used to produce superheated steam for driving a steam turbine generator and also process steam for use within the Du Pont Plant, by burning RDF-3 in a fluidized bed consisting of a mixture of RDF-3, RDF-3 ash, sand and limestone. The system consists of a circulating fluidized bed boiler supported by fuel and limestone feed systems, a balanced draft combustion air supply, a waste gas filtration system, a bed ash removal system and an instrumentation and control system. Sand is also provided for bed inventory control.

The design data for the complete plant including the boiler is given in Section 2.

1.2 The Fluidized Bed Combustor:

Fluidized bed combustion is used to accomplish the combustion of the RDF-3 in a manner that minimizes the emissions of pollutants such as oxides of nitrogen, oxides of sulfur, carbon monoxide, unburned hydrocarbons and solid particulate matter. The Circulating Fluidized Bed System incorporates the traditional combustion techniques of ensuring sufficient time, temperature and turbulence to complete combustion.

The turbulent nature of the circulating fluidized bed permits the oxidation of the fuel to occur at a temperature substantially lower than is traditional. The low temperature of combustion results in minimal formation of oxides of nitrogen and essentially eliminates slagging from the ash in the fuel.

The combustion advantages described above apply independently of the bed material. In the case of fuels containing little or no sulfur, sand may be used as the bed material. Where it is necessary to control sulfur emissions, limestone is used as bed material. The limestone reacts with the sulfur released from the fuel in the following steps:

A. Calcination of limestone

$$CaCo_3 \longrightarrow CaO + CO_2$$

B. Sulfation reaction

$$CaO + SO_2 + 1/2\ O_2 \rightarrow CaSO_4$$

The product, $CaSO_4$ is an inert substance known as gypsum.

The limestone is continuously reacted and therefore,it is necessary to continuously feed limestone with the fuel. The sulfation reaction requires that there is always an excess amount of limestone present. The amount of excess limestone that is required is dependent on a number of factors, such as the amount of sulfur in the fuel, the bed temperature and the physical and chemical characteristics of the limestone.

The particles within the fluidized bed are subject to abrasion by particle - particle contact occurring because of the solids circulation set up by the passage of gas bubbles within the bed. As these particles reduce in size, they will become small enough to be elutriated with the gas stream and collected by the baghouse. Those particles that do not readily abrade remain in the bed and must be periodically removed by the ash drain system.

The principle of the circulating fluidized bed system can be explained by examining the relationship between differential pressure and superficial gas velocity for a bed of particles (Figure 1). For a bubbling bed the log of differential pressure is approximately proportional to the log of gas velocity. As the gas velocity increases beyond the minimum fluidization velocity, the particles begin to expand and become fluidized and a distinct bed level is visible in the fluid bed. The differential pressure remains almost constant until the bed material begins to elutriate at the entrainment velocity of the bubbling bed. The degree of turbulent mixing continues to increase between the minimum and the entrainment velocity.

Beyond the entrainment velocity, the particles are carried out of the combustor and a continuous process is maintained by circulating the same amount of particles to the bottom of the reactor. The entrainment velocity marks the transition from a bubbling bed to a circulating bed. Beyond this velocity, the differential pressure becomes a function of velocity and solids recirculation rate.

The Kvaerner circulating fluidized bed system operates in the region between that of a bubbling bed and that of a circulating fluidized bed. This fluidization regime is characterized by high turbulence, solids backmixing, and the absence of a defined bed level. The entrained material with an average size range of 100 to 300 microns is separated by a cyclone or cyclones and returned to the bed by means of a non-mechanical valve or loopseal. Fuel is fed into the returning flow of solids and thence to the lower combustion chamber and primary air is introduced through the lower grid. because of the turbulence in the circulating bed, the fuel mixes quickly and uniformly with the bed material, rapidly gaining heat. Although there is no definite fixed bed depth, the density of the bed varies throughout the combustion chamber, with the higher density at the lower level where the fuel is introduced. Secondary air is introduced at various levels to (1) ensure solids circulation, (2) provide staged combustion air for NO_x reduction and (3) supply air for continuous fines combustion in the upper part of the combustion chamber. The fuel and limestone are stored in silos adjacent to the boiler house and are supplied directly to the fluidized bed combustor by variable speed controllers. Combustion air is supplied by the primary air fan to the fluidized bed to suspend the fuel and limestone in a fluidized state. The fuel burned in this fluidized state generates heat for the combustion chamber water wall steam and water circuits and the resulting steam is used to drive the steam turbine and generate electrical energy.

The combustion product gases, drawn from the boiler by the induced draft fan, are cleaned by the hot cyclone and the baghouse filter and discharged to atmosphere through the stack. The circulating fuel and limestone are collected by the hot cyclone and recycled back to the fluidized bed to maximize combustion efficiency and enhance limestone utilization.

The spent bed material is removed from the bed during operation. It is drawn through the ash cooler inlet pipe, cooled in the ash cooler and transported to the ash storage silo.

Engineering flow diagrams which show the flow of material through the operating fluidized bed system are illustrated in the following figures: Fuel, Limestone and Ash System Fig. 2, Air and Flue Gas System Fig. 3, Water and Steam System Fig. 4 and Gas Burner System Fig. 5.

1.3 Circulating Fluidized Bed Boiler:

This unit is a natural circulation, circulating fluidized bed steam generator and shown in figure 6. It consists of a primary air windbox and air distribution grid, a combustion chamber, hot cyclones, a superheater, an evaprorator and an ecomomizer. A steam drum to separate the steam from the water is located above the combustor and convection enclosure.

The fuel feed system consists of a gravimetric feeder which meters the fuel into the fuel feed rotary valve. RDF-3 is then fed into the combustion chamber via the solids return non-mechanical valve. Primary combustion air enters through the air distribution grid which supports the bed material. Secondary air enters through the upper and lower secondary air nozzles in the lower combustion chamber.

The fluidized bed consists of limestone, sand and fuel and their products, suspended and constantly mixed above the air distribution grid. The fluidizing air is forced through the nozzles in the grid by the primary air fan system. Combustion of the fuel raises the temperature of the bed and heat is transferred to the heat transfer surfaces to raise steam. SO_2 is captured by the calcium oxide produced from the heated limestone. By modulation of the fuel air ratio, the temperature of the combustion chamber is controlled. Variation of this ratio allows for a wide range of load change capability while keeping the bed temperature within the range for optimum sulfur capture.

Flue gases and very fine particles rise through the upper combustion chamber and flow into the cyclones at the rear wall of the combustion chamber. The gases flow upward through the cyclone outlet and pass through the superheater, evaporator and economizer. From there the gases travel out of the boiler and into the baghouse.

A burner is located in the combustion air duct upstream of the windbox. This provides sufficient heat to the incoming air during start-up to increase the temperature of the primary air to approximately $600^{o}F$.

Start-up burners are located in the lower combustion chamber provide heat at start-up to bring temperatures in the combustion chamber to fuel ignition temperature.

Limestone is fed to the bed through two openings: one in the back wall and one in the non-mechanical solids return valve.

Bottom ash is discharged through drain outlet pipes and valves to the water cooled bottom ash screw conveyor. The bottom ash is cooled as it passes through the conveyor and transported by means of a pneumatic conveyor to the ash silo.

A more detailed description of the operating components of the steam generator is given in subsequent sections of this manual.

1.3.1 Water and Steam Flow:

The water/steam circuit consists of the following.

a. Economizer
b. Steam drum
c. Downcomers
d. Evaporator
e. Combustion chamber water walls
f. Convection chamber water walls
g. Superheater

The economizer is located in the flue gas stream between the evaporator and the baghouse. Flue gas flows through the economized from top to bottom. The feedwater enters at the bottom header, flows up through the tubes to the top header from which it is directed to the steam drum by riser tubes.

The steam generating circuitry consists of the economizer tubes, the evaporator tubes, the convection chamber and the combustion chamber water walls. The saturated steam collected in the steam drum is directed to the superheat tubes where the required degree of superheat is provided by the transfer of heat from the flue gas to the superheater banks.

Downcomers direct the water in the steam drum to the evaporator, the enclosure water walls and the combustor water walls inlet headers. The heated steam water mixture is collected in the outlet headers and returned to the steam drum via riser pipes.

1.3.2 Air and Gas Flow:

The Kvaerner boiler is a balanced draft unit, utilizing an induced draft fan to maintain a neutral draft at the top of the combustion chamber. There are two main sources of combustion air: Primary Air and Secondary Air. Boiler room air is drawn into the system through the primary and secondary air inlet ducts, which take the warm inlet air through screened inlets at approximately 75 foot elevation. Each inlet duct has a venturi section to measure the air flow rate.

The primary air fan provides the air for fluidization, the fuel combustion, the non-mechanical seal and limestone transportation. Approximately 85% of the primary air flows into the system through the windbox. This air can be heated by a duct burner that is located just upstream of the windbox. From the windbox the air enters the combustion chamber, at increased velocity through the air distribution grid. The balance of the air enters through the limestone feed and the non-mechanical seal. Primary air flow is modulated by the primary air fan inlet damper.

The secondary air fan provides air to the start-up burner, upper and lower secondary air nozzles and fuel feeding. Flow is controlled by the secondary air fan inlet damper and the start-up burner damper and the upper secondary air damper.

Within the combustion chamber, primary and secondary air mix with the fuel and limestone to facilitate combustion and sulfur capture. Gases of combustion along with elutriated fines then flow upward through the upper combustion chamber and into the cyclones, where the fine solid particles are separated from the flue gas and returned to the lower combustion chamber. The flue gas and remaining fines are then pulled through the boiler convection sections for heat transfer and through the baghouse for final particulate control. Gases exiting the baghouse are drawn through a control damper by the induced draft fan and then sent up the stack to atmosphere. Instrumentation is provided throughout the system as required to provide control for oxygen level, pressures and flows.

1.3.3 Economizer:

The economizer is of the plain tube horizontal serpentine type arranged in banks. The economizer cools the flue gas as it flows from the evaporator to the baghouse. The flue gas flows downward across the tube surface and the water is in counter flowing inside the tubes from bottom to top. The inlet and outlet headers have the necessary connections for venting, draining, feed stop and feed check valves. The economizer is enclosed in a gastight steel casing.

1.3.4 Evaporator:

The evaporator is of the plain tube horizontal serpentine type of similar arrangement to the economizer. The lower inlet header is fed by downcomers from the steam drum and the steam water mixture is returned to the drum by means of riser tubes.

The evaporator is located in the convection enclosure which is of membrane construction and located immediately after the cyclones. The convection enclosure is also fed by downcomers from the steam drum.

1.3.5 Superheater:

The primary superheater is of the plain tube horizontal serpentine type arranged in two banks welded to inlet and outlet headers. The secondary superheater is a single bank plain tube horizontal serpentine type.

Both the primary and secondary superheaters are located in the convection cage which is of membrane construction. The convection cage receives water from the steam drum supplied by downcomers.

1.3.6 Desuperheater:

A desuperheater station is located between the primary and secondary superheaters. The desuperheater is of the venturi spray type capable of controlling the final steam temperature to within +/- 10^{o}F. The spray venturi is mounted in the superheater piping and the temperature controllers are positioned at a sufficient distance to ensure satisfactory operation. Spray water will be supplied from a separate connection to the feedwater system.

1.3.7 Steam Drum:

The steam drum is located above the convection enclosure. The steam drum serves as a water reservoir for the steam generating circuits. The drum contains steam separating equipment and internal piping for distribution of chemicals to the water, for distribution of feedwater entering the drum and for blowdown of the water to reduce solids concentration.

Figure 6 shows the arrangement of the steam drum internal components. An internal baffle extending almost the full length of the shell forms a chamber above the waterwall risers. The steam/water mixture entering the drum in this chamber pass through the steam separators where the first stage of steam separation is accomplished. As the steam/water mixture enters the drum through the risers, the water wall upper headers and tubes, this baffle slows the flow and directs it to the bottom of the drum.

The separated steam flows out through the top of the baffle arrangement and passes through the demister where the final separation of the moisture in the steam is accomplished as the steam comes in contact with the perforated plates in the assembly. Steam enters the demisters at low velocity and makes several abrupt changes in direction of flow. This causes the entrained moisture to adhere to the large surface area presented by the plates. The water film then drains by gravity to the lower part of the drum. The separated steam flows through the dry pan and leaves the drum through the steam pipe at the top.

1.4 Fuel System:

A fuel feed system is provided to supply the RDF-3 to the combustor. The system consists of a surge bin and slide gate valve, a gravimetric feeder and a rotary valve mounted on top of the non-mechanical seal. RDF is fed by gravity from the surge bin to the feeder and can be shut off by the slide gate. The feeder is electrically driven and controls the rate at which the RDF is supplied in response to the boiler master signal. The function of the rotary valve is to isolate the positive pressure and heat of the combustor from the fuel feed system. The feed point at the solids return non-mechanical valves has been selected to obtain good fuel feed distribution by mixing the fuel with the solids returning from the cyclones.

1.5 Limestone Feed System:

The limestone feed system consists of a storage silo, a slide gate to shut off the supply and a volumetric feeder which controls the flow of limestone to the combustor. The limestone falls by gravity to a splitter which feeds it pneumatically to the combustor at two locations.

1.6 Sand Feed System:

The sand feed system consists of a storage silo and a slide gate. The sand falls by gravity to the combustor. The sand feed is used to maintain the solids inventory within the combustor. Sand is added to the combustor when the primary air pressure drop falls below a predetermined set point and it is done manually.

1.7 Non-mechanical Valve (Loopseal):

1.7.1 Principle of operation:

The loopseal is a non-mechanical seal that isolates the cyclones (negative pressure) and the lower combustion chamber (positive pressure). The principle of the loopseal is virtually identical to the trap on the common sink drain. The positive pressure in the combustion chamber is not sufficient to push the bed material over the loopseal down leg and the negative pressure of the cyclones is not sufficient to draw the bed from the combustor. An adequate seal is developed to isolate the two systems.

1.7.2 Air Supply and Control:

The lopseal is supplied with air lances that fluidize the accumulated particles and thereby promote flow to the combustion chamber. The air is provided by the primary air fan through the loopseal air control manifold and control rack. Valves are set at the time of initial system start-up to provide the correct flow rate to each lance. Each lance also has a check valve and air flow rotometer, all mounted at the loopseal air control manifold.

1.8 Bed Material Removal System:

The spent bed material removal system extracts and cools the bad material at a rate required to maintain the proper bed material inventory. The system consists of a dome valve, water cooled screw conveyor and pneumatic transport system to convey the ash to the storage silo.

1.9 Gas Burner System:

The boiler gas burner system consists of a duct burner and start-up burners. The system is described in detail in section 1.12-J.

1.10 Sootblower System:

The superheater, the evaporator and the economizer banks are fitted with sootblowers. They are of the fixed position type, having 360^{o} rotation. Steam is used as the blowing medium. In the event that flyash particulate buildup occurs of the gas side of the generating tubes during operation, the sootblower sequence is initiated by the operator to dislodge and remove the particulates.

The sootblower system is supplied complete with all piping, valves and instrumentation required for it to function automatically through its control circuits.

1.11 Operating Philosophy:

Because the Circulating Fluid Bed (CFB) does not have a fixed bed depth, turndowns of sufficient magnitude are possible to quickly follow plant load demand, while maintaining the process temperatures and pressures within the acceptable operating parameters.

from the standpoint of combustion stability and NO_x emission levels, the maximum theoretical bed temperature variation is from 1200°F to 1750°F. However, the optimum range of bed temperature for SO_2 capture is much more stringent, 1500_oF to 1550_oF. Outside the optimum range significant increases in limestone feed rated (Ca/S ratio) are required to maintain emission levels within acceptable limits. For units burning low sulfur fuels where a high Ca/S ratio can still result in acceptable limestone feed rates and not more than 80% SO_2 reduction is required, a wider variation in bed temperature, 1450°F to 1650°F, is acceptable. For units burning high sulfur fuel, the bed temperature should remain within the optimum range for SO_2 capture, or for more flexibility in rate of load change, within the temperature range 1400°F to 1600°F required for economic limestone usage. This is accomplished by the design of the Kvaerner Boiler.

Typically, a fluidized bed unit utilizes limestone as the predominant bed material, with smaller amount of fuel, sand, ash and impurities (e.g. rocks) present. Fresh limestone enters the combustion chamber and, in the presence of operating temperatures, calcines (gases liberated), then absorbs SO_2 from the burning fuel which sulfates the limestone (converts limestone to gypsum). During the calcined stage, the limestone is physically weak and can be easily decrepitated into finer particles which would then be carried out of the bed (elutriated) by the furnace draft. With a fuel sulfur content of about 2.5% or greater, sufficient SO_2 is produced during combustion that the limestone from the decrepitation and elutriation (limestone attrition) is balanced by the flowrate required for sulfur capture. A low fuel sulfur content on the other hand can lead to loss of limestone through attrition, which must be compensated for by either increased limestone feed to maintain bed inventory or, sand can be used to make up the balance.

1.12 Overview of Controls and Instrumentation:

The control and instrument system is shown symbolically by figures 3, 4, 5 and 6. The following is a description of the operation of the combustion control system and the safety interlock system that is necessary for proper operation of the boiler.

1.12.1 Combustion Control System:

The combustion control system is composed of the following TBD analog feedback control loops.

A. Boiler master demand

The purpose of the control loop is to develop a control signal representing the required boiler response to achieve a balance of the boiler heat input to the process load. the required boiler energy output is composed of the actual steam flow plus the degree of offset in the energy balance due to the change in output steam pressure from set point.

The boiler total steam flow at design conditions of pressure and temperature represents the boiler load to process and therefore is utilized to develop the Btu requirement of the fuel input requirement of fuel input requirement prior to a measured steam pressure variation from set point. Many factors affect the relationship between the boiler Btu output and fuel input and hence cause the steam pressure to vary from set point.

B. RDF-3 Feed Control

The purpose of this loop is to maintain fuel flow to the bed in balance with load demand and air flow and to prevent bed temperature from exceeding minimum and maximum temperature limits. To accomplish this objective, measurements of air flow, boiler master demand, bed temperature and fuel flow are compared and the resulting signal is used to modulate the fuel feeder speed.

The boiler master demand is the primary set point of the fuel flow proportional plus integral controller. However, if the measured air flow signal is of a lower value than the bed master demand signal, a low signal selector selects the measured air flow signal as the set point, thereby preventing excessive fuel flow versus air flow.

Any average bed temperature excursion beyond either high or low temperature limits will cause an immediate inverse proportional change to the fuel flow set point signal. The fuel mass flow rate signal is developed from the measurement of weight and speed signals from the gravimetric feeder.

D. Limestone Feed Control

The function of this loop is to supply sufficient limestone to the bed to maintain the sulfur dioxide emission below allowable limits.

This is accomplished by the controller which utilizes measurements of fuel flow, limestone flow, and SO_2 content of the stack gases.

Measured fuel flow, which represents the rate at which sulfur is being introduced into the bed, is used as a ratio for the set point for the limestone controller. The stack SO_2 signal is used to trim the limestone feed command signal.

E. Lower Combustion Chamber Temperature Control

The purpose of this loop is to maintain bed temperature at its prescribed value based on load demand. Three thermocouples are located in the lower combustion chamber to monitor temperature and each has a corresponding temperature transmitter. Signals from the three elements are averaged to produce an input signal to the bed temperature controller, air flow control loop, and to a high/low temperature alarm in the control circuit.

Two thermocouples are located in the upper combustion chamber which provide input signals for the control system for hi/low alarms.

Output signals from the bed temperature controllers are input into the secondary air control loop, which modulates secondary air flow for temperature control.

F. Lower Combustion Chamber Pressure Control

The purpose of this loop is to maintain the proper bed inventory. The amount of bed material in the unit is measured by the pressure present in the lower combustion chamber, which is accomplished by two pressure taps. These values are averaged.

It this average value is above the operator established set point, ash is admitted to the ash cooler for removal. The rate of removal from the ash cooler is controlled by the speed of the ash removal screws, which is also controlled by the lower combustion chamber pressure.

When the pressure in the lower combustion chamber returns to the predetermined level, the ash screw speed is reduced and ash introduction to the cooler is halted.

If the average value is below the operator established set point, sand is admitted to the bed.

G. Feedwater Control

This loop is designed to supply feedwater to the boiler at a rate to replace the steam flow output and maintain the water level in the steam drum at the desired value. Measured steam flow is the major contributor to the set point for this control loop and this is trimmed by the error between the drum level set point and its measured value. A feedback of the measured feedwater flow completes this loop. This scheme is referred to as "three element feedwater control".

H. Combustor draft control

The purpose of this loop is to maintain the furnace pressure within a narrow band about the set point and prevent damage due to excessive furnace pressure excursions. Measured furnace draft is compared to the set point and the error drives the controller to position the induced draft fan inlet control vanes. A measurement of the combustion air flow from the primary and secondary fans provides a dynamically compensated feed forward signal for this loop.

I. Burner Controls

1 System Operation Philosophy

The burner system is comprised of two independent subsystems, duct burner system and start-up burner system. In order to initiate any of the burners, the following purge procedure must be performed.

All the main interlocks must be proven to initiate a purge and a purge credit, of four volume changes, must be established to maintain a furnace ready condition. Following a furnace ready condition, the start-up burner and the duct burner may be brought on line. If the start-up burner or duct burner fails to light off, an additional purge of one volume change is required before a retry. The interlock and purge logic is shown on Figure (Later).

The purge time for four volume changes is _____ minutes. This was calculated with a primary air flow of _____ACFM and a secondary air flow of _____ ACFM. The total volume from the combustion chamber to the stack is _____ cu.ft.

The time for one volume change is _____ minutes.

2. Duct Burner Controls

This loop controls the operation of the duct burner.

The duct burner is located in the primary air ducting before the windbox plenum. The burner is gas fired and designed for operation within a process air duct. The burner rating is _____ MMBtu/hr with an igniter rating of _____ KBtu/hr. The gas flow to this single burner is automatically modulated to maintain the desired windbox inlet temperature. A high temperature switch is provided to override the gas flow controller and trip the burner on high outlet air temperature. The burner may be started or locked out from either a local control panel or the control room.

The main gas train contains a pressure regulator, pressure indicator, flow transmitter, low gas pressure switch, two safety shut-off valves with vent valve, safety valve test points, modulating valve with low fire position switch and high pressure switch. The igniter gas train contains a separate gas pressure regulator, pressure indicator, two safety shut-off valves with vent valves and safety valve test points. The igniter is of the intermittent type and thus a single flame scanner is used for detecting either the pilot or main flame. The flame scanner is a Honeywell type C7012 with flame relay R4075. An observation port is provided to permit visual inspection of the pilot and main burner flames.

The burner management system, logic diagrams, monitors and interlocks gas pressure, furnace ready condition, flame failure, local and control room STOP/ON/START stations, control valve low fire position, igniter valves and igniter and main gas valve position.

The duct burner will be the first burner to start up in a start-up, sequence following a furnace purge. The OFF/ON/START switch must be ON at both the control room and the local station. A start is initiated at either location by switching to START and releasing back to ON. The duct burner must be proven in the low fire position before a start is allowed. The burner will then start on request if the remaining burner management interlocks are satisfied. Once a start is initiated, the igniter train is energized and a flame must be proven within 10 seconds. On proof of igniter flame, the main gas train is energized and 10 seconds later the igniter train is de-energized to prove main flame. Following proof of main flame, the burner is released to the combustion control system. The firing rate is trimmed to maintain the burner outlet air temperature at the desired set point.

Excess combustion air is maintained at all firing rates; therefore the control system modulates the gas flow to adjust the firing rate.

3. Start-Up Burner Controls

This loop controls the operation of the start-up burners.

The retractable start-up burners are located in the combustion chamber front and rear walls. The burner is gas fired with automatic controls for modulating the combustion air damper and gas flow control valves. The burners are rated at 40 MMBtu/hr each and the igniter rating is 1.25 MMBtu/hr. Combustion air is furnished from the secondary air fan, via a separate circuit. A flexible metallic hose with a quick release coupling and automatic shutoff, connects the burner to the main gas train.

The main gas train contains a pressure regulator, pressure indicator, flow transmitter, low pressure switch, two safety shutoff valves with vent valve, safety valve test points, modulating valve with low fire position switch and high pressure switch. The igniter gas train contains a separate gas pressure regulator, pressure indicator, two safety shutoff valves with vent valve, safety valve test points. The igniter is of the intermittent type and thus a single flame scanner is used for detecting either the pilot or main flame. The flame scanner is a Honeywell type C7012 with flame relay R4075. An observation port is provided to permit visual inspection of the pilot and main burner flames.

The burner management system, logic diagrams, monitors and interlocks gas pressure, gun in place, burner position, furnace ready condition, flame failure, local and control room STOP/ON/START stations, control valve low fire position, igniter valves and igniter and main gas valves position.

The start-up burner will be second following the duct burner in a start-up sequence. The OFF/ON/START switch must be ON at both the control room and the local station. A start is initiated at either location by switching to START and releasing back to ON. The start-up burners must be positioned and proven in the low fire position before a start is allowed. The burner will then start on request if the remaining burner management interlocks are satisfied. Once a start is initiated, the burner is inserted, the igniter train is energized and a flame must be proven within 10 seconds. On proof of igniter flame, the main gas train is energized and 10 seconds later the igniter train is de-energized to prove main flame.

Following proof of main flame, the burner is released to the combustion control system. The operator establishes the firing rate at a master set point station. The combustion control system uses cross limited air and fuel flow controllers to ensure excess air conditions are maintained at all firing rates.

J. Sootblower Controls

The sootblower loop provides for an automatic system which warms up and drains the system, operates the blowers, then shuts the system down, leaving the atmosphere drain valve open.

The signal to start sootblower sequence is initiated by the operator at the main control room via the computer console. This action opens the system warmup valve allowing a low rate of steam flow to circulate through the system. The atmospheric drain remains open during this warmup period.

After six minutes, the main sootblower steam admission valve opens and the atmospheric valve closes. The system remains in this position for four minutes during which time it is intended that all condensate is expelled form the system and the steam becomes dry. The condensate travels to the high pressure drain system via the steam trap.

At ten minutes, the timer for sootblower #1 makes for 8 seconds, initiating operation of the blower, provided that the local selector switch is in the "on" position. The blower completes its cycle operating through its internal limit switch.

The sootblowers are interlocked to prevent operation of more than one blower simultaneously.

The remaining blowers will then operate in sequence provided that their respective local selector switches are properly positioned, after a lag time of approximately 30 seconds.

When all of the blowers have operated, the sequence directs all valves back to the starting position, closing the warmup valve, main sootblower steam admission valve and opening the drain valve.

1.12.2 Safety Interlock System:

The following binary logic interlocks are provided to insure the proper sequence and timing of equipment operation and prevent operation that could damage the equipment.

A. Induced Draft Fan Control

The following permissives are required for the ID fan to operate:

Low fan inlet pressure
Open boiler path from baghouse
ID fan inlet damper closed
The stop switch not initiated
The start switch is initiated

B. Primary Air Fan Control

The following permissives are required for the PA fan to operate:

Primary air fan inlet vanes closed
The stop switch not initiated
The start switch is initiated

C. Secondary Air Fan Control

The following permissives are required for the PA fan to operate:

Secondary air fan inlet vanes closed
ID fan running
The stop switch not initiated
The start switch is initiated

D. Boiler Purge Control

A boiler purge is required if 1. the unit is being started from cold, or 2. MFT occurs and the bed temperature is less than 1400^{o}F.

ID fan running
Primary air fan running
Secondary air fan running
Main fuel trip reset
Instrument air pressure greater than minimum **(TBD)**
Flue gas temperature less than 1830^{o}F
Primary air flow greater than minimum **(TBD)**
Start-up burner gas safety shutoff valve closed
Total air flow greater than purge requirement **(TBD)**

E. Fuel Master Trip (MFT)

A master fuel trip will occur when the unit is in operation, and the primary air fan is in operation, any one of the following conditions occur:

Bed temperature less than 1200^{O}F
Drum pressure higher than maximum **(TBD)**
Drum level less than minimum **(TBD)**
Furnace pressure higher than maximum **(TBD)**
MFT switch is initiated

The MFT is reset by initiating the MFT reset switch.

It is necessary to re-purge the boiler and start up the boiler by satisfying all interlocks after the cause of the MFT has been identified and rectified.

F. Fuel Feeder Control

The following permissives are required for the RDF-3 feeder to run:

The stop switch is not initiated
The start switch is initiated
Bed temperature is over 1000^{O}F
Fuel feeder internal trip is not initiated
Feeder is in remote operation (local panel)
Rotary valve is in operation
Primary air fan is in operation
No MFT exists

G. Fuel Rotary Valve Control

The following permissives are required for the rotary valve to run:

The stop switch is not initiated
The start switch is initiated
Valve speed is greater than minimum setting

H. Limestone Feeder

The following permissives are required for the limestone feeder to run:

The stop switch is not initiated
The start switch is initiated
Local panel on auto
Primary air fan is running
Limestone rotary valve running
No inverter fault exists

I. Limestone Rotary Valve

The following permissives are required for the limestone rotary valve to run:

The stop switch is not initiated
The start switch is initiated
Valve speed is greater than minimum setting

J. Ash Cooler Control

The following permissives are required for the ash cooler to run:

Primary air fan running
Primary air pressure must be more than **(TBD)**
Cooling water flow to screw feeder more than **(TBD)**
Start button energized
Stop button not energized
Dome valve opened

1.13 Auxiliary Equipment:

The following equipment is an integral component of the fluidized bed boiler system. The manufacturer's instructions for the installation, operation and maintenance of this equipment are contained in subsequent volumes of this manual. The vendors manuals are indexed under the following tabulated system.

Note: in the following list, the specific manufacturer's of the equipment will be added to this manual at a later date when actual vendors have been selected.

	Item Supplied By
1.13.1 Water and Steam Flow	
Safety Relief Valves	
Superheater	
Boiler	
Feedwater Control Valve	
Combustion Chamber	Kvaerner
Superheater	Kvaerner
Evaporator	Kvaerner
Economizer	Kvaerner
Water and Steam Hand Valves	
Water column Assemblies	

Item Supplied By

1.13.2 Air and Gas Flow

Primary Air Control Inlet Vanes
Secondary Air Control Inlet Vanes
Induced Draft Fan Dampers

1.13.3 Expansion Joints

Expansion Joints

1.13.4 Fuel Feed Equipment

Gravimetric Feeder
Fuel Rotary valve

1.13.5 Limestone Feed System

Limestone Volumetric Feeder
Limestone Rotary valve

1.13.6 Burner system

Burner System

1.13.7 Sootblower System

Sootblowers

1.13.8 Variable Speed Drives

Variable Speed Drives

2.0 TECHNICAL DATA:

This complete section will be added when the final design of the boiler has been finalized.

3.0 SAFETY PRECAUTIONS AND PREPARATION FOR OPERATION

3.1 Safety Precautions:

The following instructions are some of the general precautions which apply when placing a boiler into operation. They are intended to supplement the experience and judgment of those in charge of operation and cannot cover all precautions which should be observed. It is incumbent upon the owner to provide boiler operators fully qualified and where required licensed in the art and science of boiler operation.

The manufacturer has complied with ASME boiler code pertaining to the design and fabrication of the boiler. A newly erected boiler, prior to being placed in operation, must be carefully inspected to assure that all component parts are properly assembled.

It is the purchaser's responsibility to see that the unit has been inspected and approved by his insurance inspector.

All auxiliary equipment must be in first class operating condition and suitable for operation at design conditions and operated inn accordance with the manufacturer's recommendations and instructions.

2.1.1 Start-Up Checklist - Initial Operation:

When preparing a new unit for service, it is important to ensure that the following are done as required:

A. The drum level gage glasses must be checked and installed in accordance with the drawings prior to preliminary operation. When the water level in the drum is lowered below the lowest visible point of the gage glass, all water should drain out of the glass. Any time a repair or change is made to the gage glass, this should be checked.

B. Blowdown lines from the water column and gage glasses must be properly piped and drain valves closed. The gage glasses must be properly illuminated and clearly visible to the operator from the operating floor.

C. All vent, drain and blowdown lines must be readily accessible and properly piped to a blowdown tank or other safe location so as not to endanger the operator at any time.

D. Valves that are located between the steam drum and the water column must be in the full open position and locked.

E. All safety valve gags and hydrostatic test plugs must be removed and the valves must be in proper operating condition. Discharge pipes and drains must be arranged and supported in accordance with the safety valve manufacturer's recommendations.

F. drum internals must be properly installed in accordance with drawings to assure that there will not be any steam bypassing the internals.

G. All test connections deemed necessary must be installed.

H. Ensure that the ductwork is clean and free from foreign matter.

2.1.2 Start-up Checklist - Subsequent operation

In addition to the above, the following items should be thoroughly checked each time the steam generator is placed into operation:

A. All necessary operating instruments, both permanent and temporary, must be installed, operating properly and correctly calibrated.

B. All areas must be sufficiently illuminated.

C. No hazardous walkways, ladders or stairways should be used. Provide substantial walkways and platforms where needed.

D. Air and gas passages must be free from obstruction and the unit capable of being thoroughly purged by the circulation of air through the unit.

E. The source of feedwater must be ample and uninterrupted once the unit is in operation.

F. An ample fuel and limestone supply should be available.

G. All access and observation openings must be closed after it is ascertained that no one is inside the unit.

H. Drum manway openings must be closed and properly made up.

I. Check rotation of all motors.

J. Ensure operation of all valves.

When it is assured that the above precautions are fully understood and have been complied with, then and only then, should subsequent operations such as "Drying Out", "Boiling Out", "Initial Starting" and "Normal Starting" be initiated.

3.2 Hydrostatic Test:

The boiler shall be subjected to a hydrostatic test when erection of the pressure parts is complete. A hydrostatic test shall also be made upon the completion of each general overhaul or repair affecting any pressure part of the unit, or at other times when it is desirable to inspect for leaks.

CAUTION

THE BOILER TO BE HYDROSTATICALLY TESTED SHALL BE FILLED WITH TREATED WATER.

If the unit is not to be placed into service after the test, treatment shall be with hydrazine in the range of 200 to 300 ppm plus sufficient ammonia or morpholine to raise the pH to 10. If the unit is to be placed into service within a short time using the test water, the treatment may be as for normal operation. It is strongly recommended that the unit be filled from the demineralized water or condensate system for the test.

Refer to the Contract Section to determine the quantity of water required for the hydrostatic test.

Insurance Company regulations, ASME and other codes and inspection requirements, usually specify that the unit shall be subjected to a hydrostatic test pressure of one and one half times the design pressure. This is the initial hydrostatic test to be applied upon completion of erection of the new installation and prior to initial operation of the unit.

Before applying a hydrostatic test on the unit, make a thorough internal and external inspection to be absolutely sure that:

A. All foreign matter and tools have been removed.

B. No one is inside the unit.

C. Two pressure gages have been correctly calibrated by dead weight tests and are connected properly with valves open, on the drum outlet piping.

D. Any part not designed to withstand the hydrostatic test pressure needs to be properly isolated or blanked off from such pressure. Telltale drains should be left open outside the boundaries of the hydrostatic test to check for isolation valve leaks.

E. All safety valves are blanked of gagged if the hydrostatic test pressure is near or will exceed the lifting pressure of any safety valve.

F. All valves operate freely and seat properly.

When the foregoing have been checked carefully:

A. Verify that drum manways are properly closed.

B. Close stop and check valves, all drain and blowdown valves, and valves to any gages or other integral equipment not designed to withstand the hydrostatic test pressure.

C. Open vents on the highest points of each component part of the unit.

D. Be sure that the water will not freeze during the test and that the unit will not be subjected to freezing conditions following the hydrostatic test.

E. Check that only authorized personnel are in the vicinity of the unit to be tested.

F. Do not apply gags to safety valves until 80 to 90% of the set point pressure is obtained. Conversely, remove them again when the test pressure has been reduced to 80 to 90% of the set point pressure. This procedure protects the seating surfaces of the valve and prevents excessive pressure on the valve stem. **REFER TO SAFETY VALVE MANUFACTURER'S INSTRUCTIONS.**

Start filling the boiler with water, which should be relatively close in temperature to that of the pressure parts. The final temperature of the drum metal and water should be at least 90°F before applying the hydrostatic test pressure. All pressure parts must be at a temperature of not less than 70°F.

CAUTION

THE MINIMUM METAL AND WATER TEMPERATURE OF 70°F MUST BE OBSERVED IN INSURE THAT HYDROSTATIC TESTING IS PERFORMED ABOVE THE BRITTLE TO DUCTILE TRANSITION TEMPERATURE OF THE METAL.

To obtain this hydrostatic test temperature, the following procedures are recommended (items A or B).

A. **IF THE DUCT BURNER SYSTEM IS NOT FUNCTIONING (AS MAY BE THE CASE FOR INITIAL HYDROSTATIC TESTING), ANY ONE OF THE FOLLOWING METHODS (1), (2) OR (3) IS RECOMMENDED.**

1. Fill and circulate the water, heated from an external source to obtain the recommended minimum temperature.

2. If available from another source (another unit at jobsite), connect a saturated steam supply to the drum blowdown or chemical feed line to heat the water and drum shell. Start out with the drum at normal operating level and heat the water to a temperature 5°F to 10°F above the desired temperature so that subsequent water addition does not lower the final temperature below the recommended minimum.

3. Use small oil and/or gas burners to raise the temperature to that recommended. **The burner flame must be kept away from the boiler tubes.**

4. Proceed to fill and pressurize as in method B.

B. **IF THE DUCT BURNER SYSTEM IS FUNCTIONING, THE FOLLOWING METHOD IS RECOMMENDED:**

1. After filling the boiler to normal water level, fire the duct burner to raise the drum temperature to 5 to 10°F above the recommended temperature. Extinguish fires and continue to fill the boiler.

2. Inspect the drains and manways for leaks as the boiler fills. Close the high point vents when water issues from them.

3. Raise the pressure to the intended figure slowly to avoid shock. The recommended rate of pressure increase should not exceed 50 psi per minute.

4. At 80 to 90% of the safety valve popping pressure, install the safety valve gags hand tight. Continue to raise pressure to the desired value.

5. Continue raising pressure until the required pressure is reached. Then reduce the pressure slowly and thoroughly inspect the boiler for leaks only at the operating or design pressure. When the inspection is completed, release the pressure slowly, open vents and drains. All drainable portions of the unit not intended to contain water during operation must be drained.

6. If during initial hydrostatic test, temporary manway gaskets were used, they are to be replaced with proper gaskets before refilling the unit for operation.

7. Remove blanks or gags from the safety valves after the test has been completed and pressure has been reduced to below the operating pressure.

3.3 Curing of Refractory:

It is recommended that an outside contractor such as Cooperheat be used for the refractory cure, to prevent possible refractory problems from occurring during normal boiler operation.

The selected refractory vendor's recommendations and refractory curing rates must be strictly adhered too.

Actual curing rates and recommendations will be provided later.

3.4 Boiling-Out:

2.4.1 General:

Oils and grease are put on boiler parts for the purpose of providing protection during fabrication and storage of tubes and other pressure parts for extended periods of time. Boiling-out is the process of chemically cleaning for the removal of the oil and grease, usually with a strong alkaline solution.

The presence of even fairly thin films of oil or grease or their decomposition products on the boiler heating surfaces will seriously retard heat transfer. This film acts as a dangerous heat insulating film and retards the rapid transmission of heat from the metals to the boiler water. The resultant increase in metal temperatures may be sufficient to cause overheating and blistering of the boiler tubes and ultimate failure at high loads.

Oils and other organics can lead to foaming of the water in the drum, leading to impure steam.

During the boil-out process, the gage glasses may become badly discolored and permanently etched. Thus replacement kits for all gage glasses should be readily available before the start of boil-out. Restore the inoperable gage glass to its original condition after boil out and chemical cleaning and before the next filling of the boiler with treated water. The gage glass manufacturer's instructions should be consulted for the identification and ordering of kits, and the replacement procedure.

Where a feedwater consultant has been retained, it is recommended that his advice on chemical dosages be obtained. However, where this service has not been solicited, the use of one of the several proven procedures listed herein is suggested.

The chemicals should be dissolved in water before adding to the boiler and should never be added to the boiler in solid form. In handling caustic materials care should be exercised to avoid contact with the eyes, skin, or clothing. When mixing this material, it is important that goggles, rubber gloves and cotton clothing be employed. **REFER TO THE CHEMICAL MANUFACTURER'S SAFETY INSTRUCTIONS.**

The chemical solutions should not be added to the boiler in high concentrations through the regular chemical feed system since these high concentrations may plug the chemical feed piping and valves.

If the boil-out chemicals must be injected to the boiler drum through the chemical feed system, the concentration should be reduced to five (5) percent solution in a mixing tank ahead of the chemical feed pump suction and the pump and chemical lines flushed thoroughly after pumping is completed.

3.4.2 Recommended Chemicals for Boiling-Out:

Alkaline chemicals such as soda ash and caustic soda are commonly used for boiling out a unit since these agents possess the ability to saponify the oil and greases and form a soap compound that is easily removed by high pressure blowdown during the boiling-out process and after completion of boil-out, by flushing with a high pressure hose using cold water.

In recent years, phosphate has been used as an agent to provide thorough cleansing of internal boiler surfaces. Both trisodium phosphate and disodium phosphate, accompanied by either caustic soda or soda ash, have been used. In this connection, an embrittlement inhibitor has been used in the boiling-out solution with a commercial "wetting agent".

It is known that inter-crystalline cracking (caustic embrittlement) has been caused by the caustic soda used during the relatively short boiling-out period. The alkaline concentrations developed in the boiler water during boiling-out are quite high in comparison to standard boiler water concentrations. It is safer practice therefore, to add to the boiler water an adequate concentration of an embrittlement inhibitor. Sodium nitrate is the preferred agent for this purpose.

For the most effective removal of oil from boiler metal surfaces, it is recommended that a "wetting agent" be incorporated in the boil-out mixture. These agents increase the "wetting power" of the water by reducing the surface tension and therefore reduce the adherent characteristics of oils and greases to a minimum. The combination of a "wetting agent" along with the regular boil-out chemicals will therefore break down the oil-sludge bond and remove the oil and grease from the metal surfaces.

The following chemical dosages are all solutions that have proven successful on many installations and will clean a boiler satisfactorily. The proportions of each chemical should be accurately weighed before being placed in the mixing tank.

A. When a basic phosphate boil-out of a steam generator is desired, trisodium phosphate should be obtained in its crystalline form. In addition soda ash should be used along with sodium nitrate and a wetting agent. Sodium nitrate is employed to inhibit caustic embrittlement. The wetting agent is used to assist in complete removal of oils and greases from the surfaces of the metals to be cleaned.

The chemical charge should consist of the following proportions:

Trisodium Phosphate (crystalline)	5.24 lb per 1000 lb water
Soda Ash	1.00 lb per 1000 lb water
Sodium Nitrate	0.15 lb per 1000 lb water
Wetting agent	0.10 lb per 1000 lb water

Refer to the contract section, Section 2 to determine the amount of water required to fill the boiler.

If trisodium phosphate is not obtainable, it is permissible to substitute disodium phosphate (anhydrous); however, the weight of this chemical should be based on: 2.5 lb per 1000 lb water.

B. There are many commercial wetting agents that may be used in connection with boiling-out. A partial list of those recommended are given below with the names of their manufacturer.

Aerosol (OS)	American Cyanamid Co.
Merpol C	EI duPont de Nemours
Tergitol #4	Carbon & Carbon Chem.

Tergitol #7	Carbon & CarbonChem.
Igepon T	General Analine & Film
Artic Syntex T	Colgate Palmolive-Peet
Cominol	Commonwealth Color & Chemical
Santomerse D	Monsanto Chemical Co.
Nacconal NR	National Chemical Co.
Orvus AB	Procter & Gamble
Kreelon	Wyandotte Chemical Co.

Note: The following procedure is based on the assumption that TSP solution (Na_3PO_4-$12H_2O$) will be used. If alternate boil-out chemicals are used, it is expected that no significant change to this procedure is required. Nevertheless, the owner is requested to submit a list of actual chemicals used for Kvaerner review and approval.

3.4.3 Preparations for Boiling-Out:

Prior to boil-out, the items previously outlined under "Safety Precautions" and "Curing of Refractory" must be consulted and followed.

A careful cleaning and inspection of the interior and exterior surfaces of the boiler and auxiliaries should be made for the purpose of removing all scrap metal, borings, wood, tools rags and other miscellaneous materials. It is very important that these materials be removed before boil-out, otherwise, foreign matter in the interior of the boiler sections is likely to interfere with the operation of blowdown valves and future operation of the boiler.

No attempt should be made to set safety valves when the boiler contain water of high chemical concentration such as that used for boiling-out purposes. The safety valves should be set when the boiler contains water of approximately normal concentration during the initial start-up phase.

Normally, the cyclone and loopseal refractory cure will have been accomplished prior to boil-out. For the initial start-up or for start-up after repairs to the refractory, the boil-out may coincide with curing the refractory in the windbox and combustion chamber.

For the initial boil-out, it is simplest to utilize the duct burner as the sole source of heat for boil-out. In this case, it is not necessary to have bed material in place. For subsequent boil-outs it is permissible to fire the boiler with the bed material in place if desired.

Chemical injection should be carried out only when main feedwater is flowing. Injection must be completed well in advance of reaching the desired drum level so that chemicals in the boiler feed pipe will be flushed out during the final stage of the boiler fill cycle.

A. Open drum vent valve so that air can be expelled as the boiler is being filled. Filling the unit should be accomplished using feedwater pumping and piping system normally used for boiler operation. This will have the advantage of flushing out the piping and auxiliaries ahead of the boiler.

B. Open the boiler feedwater check valve and the start-up vent valve. Close the main steam stop valves. The boiler feedwater stop valves should be closed to protect the feedwater control valves. Boiler feedwater flow control by-pass valve should be throttled as required to control flow to the boiler.

C. Mix the boiler chemicals into a "pumpable" solution and inject them into the boiler feedline at the economizer drain connection.

D. Raise the water level so that it is just visible in the bottom of the lower gage glass.

E. When the desired steam drum level is reached, close the boiler feedwater flow control by-pass valve, but remember that this valve must be throttled open whenever water is added to the boiler.

NOTE:

AT THIS POINT, ALL STEAM DRUM VALVES WITH EXCEPTION OF INSTRUMENT CONNECTIONS AND VENTS SHOULD BE CLOSED.

3.4.4 Boiling-Out Procedure:

A. Start the boiler in accordance with section 4.1 or 4.2 up through starting the duct burner. All heat for boil-out will be supplied by the duct burner only.

B. Establish stable firing at the low duct burner firing rate. After establishing a stable duct burner firing at low fire, increase firing rate within these limits:

1. Increase air temperature no faster than 200^{o}F per hour.

2. Increase the temperature of the water in the drum no faster than 100^{o}F per hour as described in section 4.2.1

C. Close the steam drum vent valve when boiler pressure reaches 15 psig.

D. Continue to fire the duct burner until the steam drum pressure reaches 250 psig. Then fire as necessary to maintain a steam drum pressure of approximately 170 psig for at least 8 hours.

E. The boiler feed pump must be kept available for operation should makeup water be required.

F. Raise the water level to approximately 2 inches from the top of the upper gage glass and fire as required to maintain 170 psig drum pressure.

G. When the high water level and drum pressure of 170 psig +/- 50 psig has been reached, shut off the duct burner.

H. First blow down the economizer through the economizer drain valve. This should be a long easy blow for the purpose of pulling the solution from the drum back through the economizer to clean it. Blow for approximately 30 minutes. If the blow goes dry due to lowered drum level then stop blowing, refill the drum, reheat the water, stop firing and continue.

CAUTION

DO NOT FIRE THE BURNER AT ANY TIME DURING A BLOW.

I. In sequence blow down the evaporator , each of the four water wall headers and the enclosure wall headers. It is recommended that when blowing down these lines, the root valve be opened first and closed last. The second valve in line should be used to control flow.

J. A cooled sample from the drum should be checked for phosphate, pH, Silica and Total alkalinity and a record kept of the chemical concentrations.

K. If the water in the steam drum falls below 2 inches from the bottom of the gage glass refill the steam drum and fire the duct burner to maintain 17o psig +/- 50 psig.

L. Repeat steps H and J once every 4 hours for at least 24 hours until all signs of oil have disappeared from the cooled boiler water sample except that the economizer and the evaporator blows can now be done similar to the boiler headers. Repeat step K as required.

M. Cool, drain the boiler and thoroughly rinse the boiler to remove the alkaline material. When the boiler is finally drained, the steam drum should be inspected and any sediment removed. If any foreign matter is found in a header, it can be removed by hand or flushed by a high pressure water hose. In addition to checking for sediment, inspection should assure that the metal internal surfaces are free from oil adherence.

After the drum and headers have all been cleaned and inspected, the unit can be closed. New manway gaskets should be installed on the drum and inspection nipple caps or tube cut for cleaning and inspection should be replaced. The unit should be filled with either demineralized water or condensate and subjected to a hydrostatic test at the normal operating pressure. The unit should be drained to normal operating drum level.

NOTE:

TO PROTECT THE SUPERHEATER, THE SUPERHEATER WILL BE BACKFILLED WITH DEMINERALIZED WATER THROUGH A TEMPORARY HOSE. THIS WILL BE DONE WHEN THE WATER LEVEL IN THE DRUM REACHES THE BOTTOM OF THE DRUM LEVEL GLASS. BACKFILLING OF THE SUPERHEATER WILL CONTINUE UNTIL A RISE IN THE LEVEL OF THE STEAM DRUM IS OBSERVED.

The backfilling of the superheater will insure that none of the water, chemistry or deposits from the boiler will carry over into the superheater. As the water in the superheater warms during boil-out, it will boil and expand generating a flow from the superheater into the steam drum.

4.0 OPERATION:

4.1 Initial System Start-Up - New Boiler:

4.1.1 General:

A. General Information:

The operator should be thoroughly familiar with the function and controls of the boiler,components, and auxiliary equipment before operating the unit. The information given in this section is not intended to be a detailed procedure for operation of the steam boiler but is meant to serve as a guide together with the instructions of the auxiliary equipment manufacturers and with knowledge derived from initial unit operation in developing a detailed operation procedure.

The operator should be aware of the limitations imposed on the various parts of the boiler and its auxiliaries and be alert to the actual operating conditions during start-up.

B. Boiler Operating Limits:

The boiler can be operated at a maximum continuous rating (MCR) of 176,000 lb/hr, 700 psig and 750^{o}F at the boiler outlet with feedwater entering the economized at 250^{o}F.

4.1.2 Procedure for the Initial Charging of Bed Material into the Combustor:

The initial bed material will be sand. The sand storage silo is filled with sand from a pneumatic delivery truck. The slide gate valve is opened and the sand will be fed by gravity into the combustor. The amount of sand delivered to the combustor can be monitored by the bed pressure transmitters. Sufficient bed inventory has been established when the bed pressure has reached 36 inches wc.

NOTE:

BED MATERIAL MUST BE ADDED ONLY WHEN THE PRIMARY AND SECONDARY AIR FANS ARE OPERATING.

4.1.3 Filling the Boiler:

In filling the boiler for start-up certain precautions should be taken to protect the boiler pressure parts. First, a high quality water must be used to minimize waterside corrosion and deposits. Second, the temperature of the water should be regulated to match the temperature of the boiler metal to prevent thermal stresses. High temperature differentials always cause thermal stresses in the pressure parts and , if severe, will limit the life of the pressure parts. High temperature differentials also distort the pressure parts enough to break studs, lugs and other attachments.

A third precaution taken during filling operation is the use of the start-up vent to displace all air with water. This reduces oxygen corrosion and assures that all boiler tubes are filled with water.

A fourth precaution is to establish the correct water level before firing begins. The water level rises with temperature: therefore, only one inch of water is required in the gage glass except with certain special designs that may require a starting level higher in the gage glass to fill all circulating tubes exposed to the hot flue gases.

See also Section 4.2.2

4.1.4 General Precautions:

There are **FIVE** critical precautions that the operator must observe and exercise during all phases of operation of this unit.

A. FURNACE PRESSURE LIMITS:

Exposure to excessive negative or positive furnace pressure can result in serious damage to the unit and auxiliary equipment. The following controls should be in service and operable prior to start-up for control of and for protection against excessive furnace pressure or draft.

1. The upper combustion chamber draft should be monitored constantly and automatically controlled to between 0.0 to - 0.5 inches wc.

2. The Master Fuel Trip (MFT) should be set at +/- 2 inches wc pressure in the upper combustion chamber.

NOTE:

The above pressure limits are based on Kvarener supplied equipment only and do not take into account effects of equipment supplied by others on either the inlet or outlet end of the boiler.

On any MFT (except low low drum level) when fans trip:
a. Boiler master control transfer to manual.

b. Fuel feeder trips.

c. Start-up burner trips.

d. Limestone feeder trips.

e. Primary and secondary air fan inlet dampers move to minimum flow.

f. Duct burner trips (if operating).

3. The operator should not allow the furnace draft to exceed - 2.0 "wc.

4. On loss of primary and secondary air fans and the ID fan, the collapsed bed can generate combustibles. Access doors should be left closed. Air flow should be slowly reestablished to purge out combustibles from the unit.

B. DRUM WATER LEVEL:

Water level is indicated in the gage glass. The normal drum water level is 4 inches below the center line of the drum. The alarms are set at 5.5 inches below and 4 inches above normal water level and trips are set at 7 inches below and 4 inches above normal water level.

NOTE

A low low drum water level condition initiates a master fuel trip (MFT).

To protect the drum from undue thermal stress, the metal temperature differential between the top and bottom of the drum should not exceed 200^{O}F. **Never add cold water to a hot drum.**

C. SAFETY VALVE ADJUSTMENT:

All safety valves are set at the valve manufacturer but should be rechecked under actual operating conditions as the boiler is brought up to pressure during initial operation.

If a safety valve does not pop at the pressure stamped on its nameplate or reseat properly, the valve should be readjusted. In some localities, it is required that only certain authorized persons may change or adjust the safety valve settings or that changes in safety valve settings be witnessed by authorized persons. It is advisable to consult boiler insurance codes before changing the setting of safety valves.

It is recommended that checking and adjusting safety valve settings during initial operation be performed by the valve manufacturer service engineer.

D. EXCESS AIR REQUIREMENT:

Care should be exercised to insure that the proper fuel-air ratio for good combustion is maintained. The design performance calculations were made for an excess air requirement of 25% at MCR load. This corresponds to an O_2 measurement of approximately 4%. Higher than normal excess air should be maintained for the first 150 hours of boiler operation to ensure an oxidizing atmosphere for the tube surfaces. The O_2 value should be at least 6%.

With experience, it will be possible to reduce excess air, to approximately 3.5%.

CAUTION

OPERATION WITH INSUFFICIENT EXCESS AIR CAN BE DETRIMENTAL FROM THE STANDPOINT OF GOOD COMBUSTION AND SAFE OPERATION OF THE UNIT.

E. BED TEMPERATURE LIMITS:

Normal operating bed temperature is 1560^{o}F +/- **(TBD)**. This temperature should be monitored during operation and attempts should be made to operate at this level.

Maximum temperature of the bed is 1800^{o}F. Do **NOT** allow the temperature to exceed this value.

NOTE:

The high bed temperature alarm point is (_____). A main fuel trip is automatically initiated at 1800^{o}F.

Minimum temperature of the bed is 1200^{o}F. Do **NOT** allow the temperature to drop below this value.

NOTE:

The low bed temperature alarm point is (_____). A master fuel trip is automatically initiated at 1200^{o}F.

4.1.5 Operational Procedures:

The following precautionary steps must be taken to insure reliable operation of the boiler:

A. Sootblowers should be run at intervals dictated by particulate deposit accumulation on the gas side of the tubes. As accumulations occur, the differential pressure reaches (_____) across the superheater, or (_____) across the evaporator, or (_____) across the economizer, sootblower operation must be initiated.

B. It is recommended that the convection surfaces be inspected for particulate deposit accumulation each time the boiler is taken out of service. The surfaces should be cleaned accordingly before boiler restart if any particulate accumulation is detected.

C. To prevent plugging, rusting and oxidation and faulty operation of equipment, air used on the boiler for operating purposes, whether for sealing, aspirating or atomization, should be free from dirt, oil and water.

D. All high and low furnace pressure safety interlocks should be checked for proper values and correct switching action and be in service before starting the induced draft fan.

E. The automatic furnace draft control equipment should be checked and ready for service before starting the induced draft fan.

F. Oxygen (O_2) is monitored continuously during operation of the boiler by a permanently installed unit in the flue gas duct. O_2 levels should not fall below 3.5%. The oxygen analyzer must be checked and calibrated monthly, or sooner if the stack mounted O_2 analyzer is not in agreement.

G. It is strongly recommended that the reliability of all drum level indicators be checked at least once per shift. This would include all gage glasses, remote level indicators and level recorders. This can be done by changing drum level and observing the response of all indicators and gage glasses.

H. Thermowells are provided throughout the boiler and temperatures are indicated on the recorders. Be sure that thermocouples are installed in the thermowells provided for operating and testing purposes.

4.1.6 Start-up Procedures:

The operating sequence recommended in insure safe and proper start-up is given below. Modifications may be necessary as subsequent operating experiences dictates. Follow the manufacturers' instructions contained in other volumes of this manual for operating the auxiliary equipment.

NOTE:

A general equipment walkdown of the equipment and associated auxiliaries should be checked by at least two people to verify that the equipment and the auxiliaries are ready for start-up, including the following:

A. Fuel Feed System

1. Fuel rotary valve
2. Fuel feeder
3. Fuel silo inventory

B. Limestone Feed System

1. Limestone rotary valve
2. Limestone feeder
3. Limestone silo inventory
4. Limestone piping system

C. Sand Feed System

1. Sand outlet valve
2. Sand silo inventory

D. Ash Removal System

1. Ash dome valve
2. Ash cooler water cooled screw
3. Ash transport system

E. Burner system

1. All valves and switches
2. Start-up burner
3. Duct burner

F. Feedwater Supply System

1. Feedwater control valve

G. Sootblower system

1. All piping
2. Superheater blowers
3. Evaporator blowers
4. Economizer blowers

H. Turbine
Later

I. Baghouse
Later

J. Fans

1. Primary air fan
2. Secondary air fan
3. Induced draft fan

K. Air Compressor
Later

L. Operation of the Pressure Tap Purge System:

The pressure tap purge system should be put into operation. Close the two valves on the differential pressure transmitter and adjust the two differential pressure regulators until there is a low flow of air through the pressure probes into the bed.

When a steady flow has been established, the manifold valves can be opened again to activate the transmitter. Periodically the pressure taps should be manually purged with a blast of high pressure instrument air. The frequency of this purging must be established by experience. Always close the valves to protect the transmitter and the differential pressure regulators when the high pressure purge is being performed.

M. Make sure that the test gags and/or plugs are removed form all safety valves.

N. Check availability of utility services, power, ignition and main fuel and suitability of treated feedwater.

O. Check operation of all valves and dampers.

P. Close all access doors and observation ports after it is proven that no one is inside the boiler. Release all safety tags on equipment to be placed in service.

4.2 System Start-up:

4.2.1 Valve Positions:

Place the boiler's vent, drain and instrument valves in the following positions. This list assumes that the boiler is empty.

Valve No.	Valve Description	Position
	Feedwater S/O	open
	FW Control Valve	N/A
	Feedwater S/O	open
	FW Bypass S/O	closed
	Feedwater Check	N/A
	Feedwater S/O	open
	FW Group Drain	closed
	FW Drain Blowdown	closed
	Main Stm. N/R	closed
	Sootblower Press. gage S/O	open
	Start-up vent S/O	open
	S/U Vent Motoriz.	open during filling
	Air vent S/O	open during filling
	Safety relief	
	Safety relief	
	Sootblower S/O	closed
	Stm. Pres. Ind.S/O	open
	Stm. Drm. Level Transmitter S/O	open
	Stm. Drm Level Transmitter S/O	open
	Stm Drum water column S/O	open
	Stm Drum water column S/O	open
	Water Col. Drn.	closed
	FW Press Gage S/O	open
	Stm Drum Pressure gage S/O	open
	FW Press. Gage Drain	closed
	Stm Drum Pressure Gage Drain	closed
	Level Trans S/O	open
	Level Trans S/O	open
	Water Column S/O	open
	Water Column S/O	open
	Water Col. Drain	closed
	Sample Cooler S/O	closed
	Sootblr. Trap B/P	closed
	Steam Trap	N/A
	Sootblr. Trap B/P	closed
	Sootblr. Drain	closed

Valve No.	Valve Description	Position
	Sootblr. Trap Bypass	closed
	Ecomomizer Blow down Stop	closed
	Ecomomizer Blow down Stop	closed
	Steam Drum Blow down Stop	closed
	Steam Drum Blow down Stop	closed
	Steam Drum Blow down Stop	closed
	Comb. Chamber water wall	closed
	Water Wall B/D	closed
	Fr. Wall Hdr.	closed
	Fr. Wall Hdr.	closed
	Side Wall Hdr.	closed
	Side Wall Hdr.	closed
	Cage Wall Hdr.	closed
	Cage Wall Hdr.	closed
	Cage Wall Hdr.	closed
	Cage Wall Hdr.	closed
	Sootblowing Stm. Admission	closed
	Gage glass S/O	open
	Gage glass S/O	open
	Gage glass S/O	open
	Gage glass S/O	open
	Wtr. Col. Drain	open
	Wtr. Col. Drain	closed
	St. Trap Is. V/V	open
	St. Trap Is. V/V	open
	Sootblr. Trap	open
	Pres. Trans. S/O	open
	Sootblr. Warmup	closed
	Superheater vent	open
	Superheater vent	open
	SH Safety V/V	open during filling
	SH Safety V/V	open during filling

4.2.2 System Start-up:

1. Fill the boiler by admitting water via main feed control valve to the economizer using water form the regular feedwater source. The temperature of the water should not be more than 100^{o}F above or 30^{o}F below the temperature of the pressure parts.

Continue filling the boiler until water in the steam drum is just visible in the bottom part of the gage glass. Operate the water column and gage glass blowdown valves to assure the water returns promptly in the gage glass when the valves are closed.

2. Check that the drum level indicators are operating in the control room and that they compare accurately with the local gage glass readings.

3. Check that all pressure and draft gages are calibrated and functioning properly.

4. Check all safety interlocks for proper operation.

5. Verify that the drum level is visible in the gage glass. Close the start-up vent valve.

The following operating sequence is recommended to insure a safe and proper start-up. Modifications may be necessary as subsequent operating experience dictates. Follow the manufacturers' instructions for operating all auxiliary equipment, e.g. baghouse, start-up burner, etc.

4.2.3 Preparation for Boiler Purge:

Immediately prior to each start-up and prior to starting after a master fuel trip (MFT) the boiler must be purged (except the special procedure for hot restart). The dampers should be placed in the following positions in preparation for a purge:

1. Primary and secondary inlet fan dampers and ID fan inlet dampers are closed.

2. Put all manual-auto stations in the manual mode.

4.2.4 Purging the Boiler:

Purge the boiler in accordance with the following procedure:

1. Check that the fuel supply valves to the start-up burner are closed.

2. Start the ID fan.

3. Start the primary air fan.

4. Start the secondary air fan.

5. Open the ID, primary and secondary inlet dampers to establish at least 40% of boiler full load air flow. Furnace must be kept within **(TBD)** to avoid tripping the fans.

6. Place the ID fan on automatic control to maintain furnace draft at a slight negative pressure (-0.5" to -1.0" wc).

7. Adjust primary and secondary air fan dampers to maintain flow of at least **(TBD)** ACFM through the boiler.

8. Place the primary air fan on automatic control to maintain an air flow of **(TBD)** ACFM.

9. Place the secondary air fan on automatic control to maintain an air flow of **(TBD)** ACFM.

10. Push the "Purge On" button and purge the unit for **(TBD)**

4.2.5 Warming the Unit:

CAUTION

PRIOR TO THE LIGHT OFF THERE MUST BE AN INVENTORY IN THE BED EQUAL TO _____ AND THE UNIT MUST HAVE BEEN PURGED.

NOTE:

To protect the drum from undue thermal stress, the metal temperature between the top and bottom of the drum should not exceed 200°F.

1. Start the duct burner on low fire condition. Maintain low fire condition until the lower combustion chamber temperature stabilizes, then increase the duct burner firing rate so as to increase the air temperature no faster than 200°F per hour.

2. Start the start-up burner on low fire. Maintain low fire condition until the lower combustion chamber temperature stabilizes.

3. Heat Up Rate: it is necessary to regulate the rate at which the boiler is heated to prevent excessive thermal stress. The maximum allowable drum heat up rate is 100°F per hour.

This boiler is not equipped with drum metal thermocouples. It is therefore necessary to estimate the drum metal temperatures by a combination of the following methods.

a. Thermocouple temperature measurements:

Thermocouples are located in two wall tubes of the combustion chamber. These thermocouples will provide an indication of the water temperature entering the drum. The temperatures will lead the drum water temperature during heat up and lag it during cool down.

b. Drum pressure measurement:

Range psig	Maximum Allowable Rate of Change psig/min
0-100	1.2
100-200	0.8
200-300	0.5
300-400	0.4
400-500	0.3
500- operating	0.25

It is also necessary to regulate the rate at which the primary air is heated by the duct burner because an excessively fast heat up rate may distort the grid or damage the plenum refractory lining.

Heat the bed material and raise the drum pressure to 25 psig. Firing should be regulated to increase boiler pressure part temperature at 100^{o}F/hr.

4. During heating of the unit, the drum level will rise. Maintain the drum level within the range using the continuous blowdown valve and feedwater control valve.

5. During heating of the unit, care must be taken to ensure that damage is not done to the refractory lining in the cyclones and combustion chamber. Modulate burners so that the temperature rise in the cyclone inlet does not exceed 200^{o}F/hr.

NOTE:

Reduce burner firing rate if water hammer results at the high firing rate.

4.2.6 Start-Up:

1. Close the air vents and start-up vent. The cold start-up should take about 2 hours to reach 25 psig.

2. After achieving approximately 25 psig in the drum recheck the drum water gage glass operation by a short blowdown. Maintain visible water level in the gage glass.

Water level in the drum will rise due to swelling of water in the system. Blow down the drum as required by opening the steam continuous blowdown valve.

If the boiler water silica or solids content is above the recommended limit, the drum water should be blown down using the steam drum continuous blowdown valve until the recommended limit is reached.

NOTE:

When starting the unit with a fresh bed of limestone, there will be a considerable rise in bed temperature after approximately one hour. This rise is due to completion of the calcination of the limestone and the operator must be prepared to adjust (reduce) the fuel feed rate accordingly. It is recommended that for first fire sand be used as the bed material to avoid this complication.

3. The following procedures are the steps to be taken to start-up the unit.

a. Continue heating the boiler using the duct burner until the windbox temperature reached 600°F, then modulate the burner to maintain this temperature.

b. Continue heating the boiler using the start-up burner until the bed temperature reaches 1000°F, at which time fuel feed may begin. Maintain heat in the combustor with the start-up burner until fuel ignition is established, extinguish the start-up burner when the combustor temperature reaches 1200°F.

c. Start the fuel feed when the combustor temperature reaches 1000°F at a rate of approximately 2500 lb/hr.

d. When the combustor temperature stabilizes at 1450°F, take the duct burner out of service.

e. View the bed through the observation ports to confirm that the fuel is burning in the bad and that the bed is properly circulating.

f. Place the air flow on automatic control and adjust the fuel feed as required to maintain 1450°F bed temperature.

g. Vent steam through the start-up vent as required so that the rate of temperature rise in the drum does not exceed 100°F/hr.

h. Place drum level on automatic.

i. Place fuel feed, limestone feed and ash systems on automatic.

4.3 Hot Restart of the Boiler:

The boiler can be shut down for short periods of time and held in the hot condition. When the boiler is to be hot "slumped". the fuel feed should be stopped. When the O_2 starts to increase , the air flow to the combustor should be stopped to minimize heat loss. This O_2 increase indicates that most of the fuel has been burned and the bed can be slumped without the formation of clinkers material in the bed. The fans are then stopped. All valves and air control dampers are closed so that a minimum amount of heat is lost. No fire is maintained or introduced into the furnace: therefore, the pressure in the steam drum will decrease. The bed material forms a good insulator and helps to minimize the heat losses within the boiler so that the boiler can be restarted without the use of the start-up burners, provided the bed temperature remains above 1200°F.

CAUTION:

THERE MUST BE BED INVENTORY PRESENT IN THE UNIT BEFORE INITIATING ANY START-UP SEQUENCE.

NOTE:

A hot condition is one in which the average bed temperature is above 1200°F. If the average bed temperature is below 1200°F, follow the procedure described for a cold start-up, Section 4.2.5. The average bed temperature of the slumped bed must be read from the lower set of bed thermocouples. If the bed temperature does not rise within 5 minutes of starting the fuel feed, fuel ignition has not occurred. The fuel feed must be stopped, the unit purged and started following the normal start-up procedure in Section 4.1.6.

4.4 Normal Operation:

4.4.1 Firing:

1. The primary technique for changing boiler load involves varying the fuel feed rate and the corresponding air flow rate. Bed temperature may be varied between 1400°F and 1650°F to permit small increments of change within a short period of time. However, after obtaining the desired steam rate, bed temperature should be reestablished at 1560°F and boiler load held steady by adjusting the feed rate. In all cases, make sure that air flow tracks fuel flow, either manually or automatically, to maintain a set excess O_2 value < 3.5%.

2. The SO_2 emissions from the boiler should be monitored at all times. The limestone feed rate must be adjusted, either manually or automatically, to maintain an SO_2 emission level at the stack that is in compliance with the local regulations. Also, the SO_2 value should not be allowed to be less than 75% of the standard value for a long period of time since this contributed to inefficient operation of the unit and results in excessive limestone usage.

NO_x emissions are inherently low within the bed in the operating temperature range of 1450°F to 1650°F. NO_x emissions are increased as bed temperature is increased.

3. Periodically inspect the bed for proper fluidization and circulation. This is accomplished by observing the bed through ports, checking temperatures throughout the system to ascertain that they are consistent with one another and finally by monitoring pressure within the lower combustion chamber.

If it is concluded that a portion of the bed is not properly fluidized, increase the primary air flow and ash removal rate temporarily. If this increase does not provide improved fluidization, it may be necessary to shut down the boiler and inspect for pluggage of the air grid nozzles, clinkers in the bed, or rock accumulation. This operational problem within the system does not mean that the unit must be shut down as soon as it is detected. The condition should be monitored and the operator can decide whether a shut down is necessary having assessed this problem over a period of time.

4. Continuously monitor the gas side pressure differential through the superheaters, evaporator and economizer. Use the sootblowers in good time to remove any buildup that might have accumulated.

5. Periodically inspect the fuel and limestone feed system for pluggage.

6. Continuously monitor the fluidized bed material inventory and maintain it at its normal value by adding sand or extracting bed material.

7. Continuously monitor the air distribution grid pressure differential. If this differential decreases significantly, check instrumentation for proper operation and the sensing lines for pluggage. If instrumentation is operating properly, shut down the boiler and inspect the air distribution grid.

8. Periodically check the ash cooler and ash removal system for blockage or plugging.

4.4.2 Water Chemistry and Steam Purity:

1. Assure that the desired boiler water solids concentration and chemistry are maintained. Improper boiler water can lead to fouling or corrosion of the internal surfaces, reducing the efficiency of the unit and possibly resulting in tubes becoming overheated which can lead to tube failure.

2. Large quantities of solids from the injection of water treatment chemicals to the feedwater before the economizer should be avoided.

3. Oxygen content and pH of the feedwater must be strictly controlled.

4. Assure that moisture carryover from the drum is within permitted limits. For operation within the design conditions, the steam separation equipment will keep solids carryover within acceptable limits. Moisture carried over can include solids and other impurities which may deposit in the superheater.

5. If solids carryover is being caused by excessive boiler water solids concentration, this may be controlled by adjustment of the steam drum continuous blowdown valves in the continuous blowdown system.

6. The required frequency of blowoff should be determined by monitoring the boiler water chemistry.

CAUTION:

Drain valves on the lower waterwall headers should not be used for blowdown purposes when the unit is in operation. Improper use of these valves may interrupt WATER CIRCULATION AND BURN OUT TUBES.

4.5 Normal Shutdown:

1. Reduce the fuel and air input to reduce boiler load to 50%. Normal bed temperature should be maintained. During shutdown, do not exceed a maximum temperature differential of 200^{o}F between the top and bottom of the drum.

2. Shut off the fuel feeder, shut off the limestone feeder and shut off the bed material extraction (if in use).

3. Check and maintain drum level near the upper limit of the gage glass during shutdown.

4. Continue fluidizing the bed to purge and cool the entire system at a maximum rate of 100°F/hr on the pressure parts. Use the start-up burner or duct burner to obtain the required rate of temperature decline.

5. Continue air flow through the unit until the desired system temperatures are reached.

6. Close the primary and secondary air fan inlet dampers. The dampers should be closed slowly permitting the ID fan automatic damper control to maintain the furnace draft between -0.5 and 1.0 inched wc. After both fan inlet control dampers are completely closed, shut down all fans

7. Continue to operate all ash removal systems until their respective hoppers are empty. Close the bed drain dome valve and continue to operate the ash cooler until the bed drain pipe and cooler are empty.

8. Open all vents when the drum pressure has decreased to approximately 25 psig. Temperature of the boiler water should not exceed 250°F if the unit is to be drained. Draining the unit when there is still a small amount of pressure on the unit is preferred as the residual heat will assist in drying the internal surfaces.

9. Idle boilers should not be allowed to remain partially filled with water for any appreciable length of time. Fill them completely with deaerated alkaline water into which hydrazine has been added for protection against corrosion. If the outage will amount to several weeks or months, or should weather prohibit filling the unit, drain and dry the unit placing shallow pans of unslaked lime or several pans of silica gel in the drum to absorb moisture and maintain the internal surfaces in a dry condition. When the unit is to be out of service for several days or longer, all ash, soot deposits and bed material should be removed since moisture will be absorbed by these materials causing corrosion.

4.6 Off Normal Operation:

The following list contains situations that are considered off normal and that if allowed to continue, will trip the unit. The trip will occur on either two ways, by the MFT, or by the interlock system.

4.6.1 High or Low Primary Air Fan Discharge Pressure:

1. Check electric motor

2. Check fan rpm

3. Check inlet damper for actual position versus position indicated by the control system

4. Check for, primary air flow to fuel feeder relative to set point

5. Check primary air screened inlet for blockage

5. Check all bearings for overheating

4.6.2 High or Low Secondary Air Fan Discharge Pressure:

1. Check electric motor

2. Check fan rpm

3. Check inlet damper for actual position versus position indicated by the control system

4. Check for, primary air flow to fuel feeder relative to set point

5. Check primary air screened inlet for blockage

6. Check all bearings for overheating

4.6.3 Duct or Start-up Burner Flame Failure:

Follow manufacturer's operation instructions contained in another volume of this manual to remedy the malfunction

4.6.4 High or Low Bed Temperature:

1. Check thermocouples and associated instrumentation for proper operation

2. Check fuel feed rate

3. Check for proper operation of all fans and blowers

4. Check for proper boiler water level

4.6.5 High or Low Natural Gas Pressure:

1. Check all regulators for proper operation

NOTE:

High or low gas pressure will cause the burners to be inoperative.

4.6.6.High or Low Furnace Pressure:

1. Check pressure taps for plugging

2. Check pressure transmitters and associated instrumentation for proper operation

3. Check for proper operation of all fans

4. Check differential pressure across air distribution grid and bed

5. Check for proper operation of the limestone feeder

6. Check for proper operation of the ash cooler

4.6.7.High or Low Drum Pressure:

1. Check for proper operation of the drum level instrumentation

2. Check feedwater pump

3. Check for proper operation of the feedwater control valve

4. Check operation of steam flow transmitter

5. Check all bearings for overheating

4.6.8. High or Low Final Superheat Temperature:

1. Check desuperheater spray water control system

2. Check cleanliness of superheater

4.6.9 Ash Cooler Failure:

1. Check for proper cooling water flow

2. Check for pluggage and rectify as necessary

3. Check motor drive

4. Check all bearings for overheating

4.7 Emergency Situations:

4.7.1 Types of Emergencies:

1. Loss of Service of Essential Equipment:

The loss of service of the following equipment will initiate an immediate automatic boiler shut-down in accordance with the emergency shut-down procedure (refer to paragraph 4.7.2)

a. Primary air fan not running

b. Secondary air fan not running

c. Induced draft fan not running

d. Low or high drum level

e. High or low furnace pressure

f. Instrument air pressure less than 55 psig

g. Control system power failure

h. High or low bed temperature (trips the fuel feeders)

2. Sudden Loss of Drum Water Level:

If the cause is known and immediately correctable, prior to the water level in the drum reaching the minimum allowable operating level, reestablish drum level to its normal operating level and continue boiler operation.

If the cause is not known and **immediately correctable** and the water level in the drum drops below the minimum allowable operating level (this situation could be the result of a tube failure), initiate an immediate shut-down in accordance with the emergency shut-sown procedure.

3. Gradual Loss of Drum Water Level:

If , at any time, it is impossible to maintain normal drum level, the load on the unit should be reduced and the cause of the difficultly corrected. If it is impossible to maintain normal drum level at the reduced load, then the unit must be taken out of service in accordance with the normal shut-down procedure, until the trouble is remedied.

4. Excessive Bed Temperature:

If the bed temperature cannot be maintained below $1700^{o}F$, an immediate decrease in the fuel feed rate must be implemented. This reduces the bed temperature rapidly to minimize bed tube exposure to high temperatures and also to prevent agglomeration and sintering of the bed material. Fuel feed may be increased when the bed temperature decreases to $1650^{o}F$. If the bed temperature cannot be controlled using this procedure, the boiler must be shut down and the cause rectified.

4.7.2 Emergency Shut-Down Procedure:

1. Waterside Failure:

CAUTION

WET BED MATERIAL CAN SOLIDIFY AND COULD CAUSE TUBE METAL CORROSION IN THE UNIT. THE BED MATERIAL SHOULD BE REMOVED AS QUICKLY AS POSSIBLE IN THESE SITUATIONS.

A. Drum level can be maintained

Remove the unit form service immediately by following the Normal Shut-Down Procedure. Remove bed material during the shut-down as quickly as possible from the bed.

B. Sudden Loss of Drum Level:

NOTE:

This procedure should also be followed in the case of loss of feedwater supply.

1. An automatic MFT will occur on low low drum level and the primary and secondary fans will go the minimum flow conditions.

2. Sufficiently cool the unit to allow the bed material removal and unit inspection.

2. Air or gas Side Failures:

This procedure should be followed in the case of primary and/or induced draft fan mechanical failure when the motor continues to run.

a. An MFT activated by low primary air flow on fan failure shuts off the fuel feed, limestone feed and bed material extraction (if operating).

b. Fans and drives will be interlocked to stop in the sequence below.

INDUCED DRAFT FAN MOTOR
SECONDARY AIR FAN MOTOR
PRIMARY AIR FAN MOTOR

A trip of the ID fan will trip the secondary air fan

c. Maintain drum level and feedwater supply.

d. Following control of the emergency situation, use the normal shut-down procedure. in Section 4.5. After correcting the reason for the emergency shut-down, normal or hot restart, as applicable can be initiated.

MAINTENANCE:

The purpose of this section is to provide general guide lines for inspection and maintenance on the equipment supplied by Kvaerner. Some of the equipment supplied be Kvaerner is manufactured by others and therefore has recommended maintenance procedures that are included in that manufacturer's equipment manual that is included in another volume of this manual. This manufacturer's maintenance procedures should be read before performing maintenance on that piece of equipment.

5.1 Maintenance Safety Precautions:

1. Always work in pairs

2. Always wear the correct protective clothing including hard hat, gloves, goggles etc. as necessary

3. Open any access door carefully to prevent hot dust, ash or other materials from falling on you.

4. Make sure that there is no combustibles or inert gas inside confined spaces.

4. Make certain there is enough air to breathe, open sufficient mandoors, handholes etc. to provide circulation of air, also provide fans force air into the unit.

5. Make sure that you can get in and out of the access door quickly and easily.

6. Ensure that there is solid, safe footing available inside the equipment.

7. Provide adequate temporary barriers at all openings where maintenance personnel could fall.

8. Use only approved safety type of lights and flashlights when inspecting and working on the boiler.

9. Follow your company's safety and lockout procedure when entering the boiler.

10. Ensure that the equipment is locked out at the motor control center.

11. Always inform the maintenance supervisor or designated person that you are entering the boiler and follow your company's standard procedure to ensure that either equipment is not started or that the door is closed while you are inside.

12. Always use new gaskets for gasketed closures.

5.2 Protection of the Boiler Pressure Parts.

The protection of the boiler pressure parts will depend upon the length of time the boiler is to be taken out of service. For simple routine annual maintenance and inspections, when the idle boiler is not drained, provision should be made for a nitrogen to be admitted to the area above the water level in the drum and possibly also the superheater. The nitrogen blanket should be maintained at 3 to 5 psig during the layup period.

During idle periods, the boiler must be protected against freezing conditions by intermittently firing the duct burner.

If the boiler is drained for the inspection period, this should be done during shut-down when the boiler is hot, to ensure that the pressure parts are dry. Place several pans of slaked lime or silica gel in the steam drum to absorb moisture and maintain the internal surfaces in a dry condition.

5.3 Boiler Internal Inspection:

a. Inspect each air distribution grid nozzle for pluggage and clean out as necessary.

b. Inspect ash drains, fuel feed, limestone feed, solids return openings, secondary air nozzles and all other openings for signs of erosion or pluggage.

c. Inspect the refractory lining for excessive wear or cracking. Patch and repair any parts that require attention.

d. Inspect the cyclone refractory for erosion or damage.

e. Inspect all water wall tube surfaces for leaks or signs of erosion.

f. Thoroughly inspect the general condition of all thermocouples and pressure taps and repair as necessary for reliable operation.

g. From this internal inspection of the combustor develop the repair list and perform the required repairs as necessary.

h. Check the steam drum for accumulation of foreign matter and broken hardware.

i. Inspect the tightness of all bolted equipment inside the drum.

5.3.3 Other Equipment

a. Check the duct burner refractory lining and repair as necessary.

b. Check windbox floor for accumulation of bed material due to back flow through the grid plate air nozzles. Remove material as necessary.

c. Check all pressure sensing lines for pluggage and clean as necessary.

d. Carefully inspect the burner systems for any damage and carry out any maintenance repairs in accordance with the manufacturers recommendations.

e. Combustion control equipment and other control equipment such as feedwater regulators and steam temperature controllers should be kept in optimum adjustment at all times. Efficiency depends upon the proper functioning of this equipment.

f. Check all fuel, limestone and sand feed piping for pluggage, erosion, overheating, etc. Repair as necessary.

g. All valve and packing leaks should be repaired to help prevent forced outages.

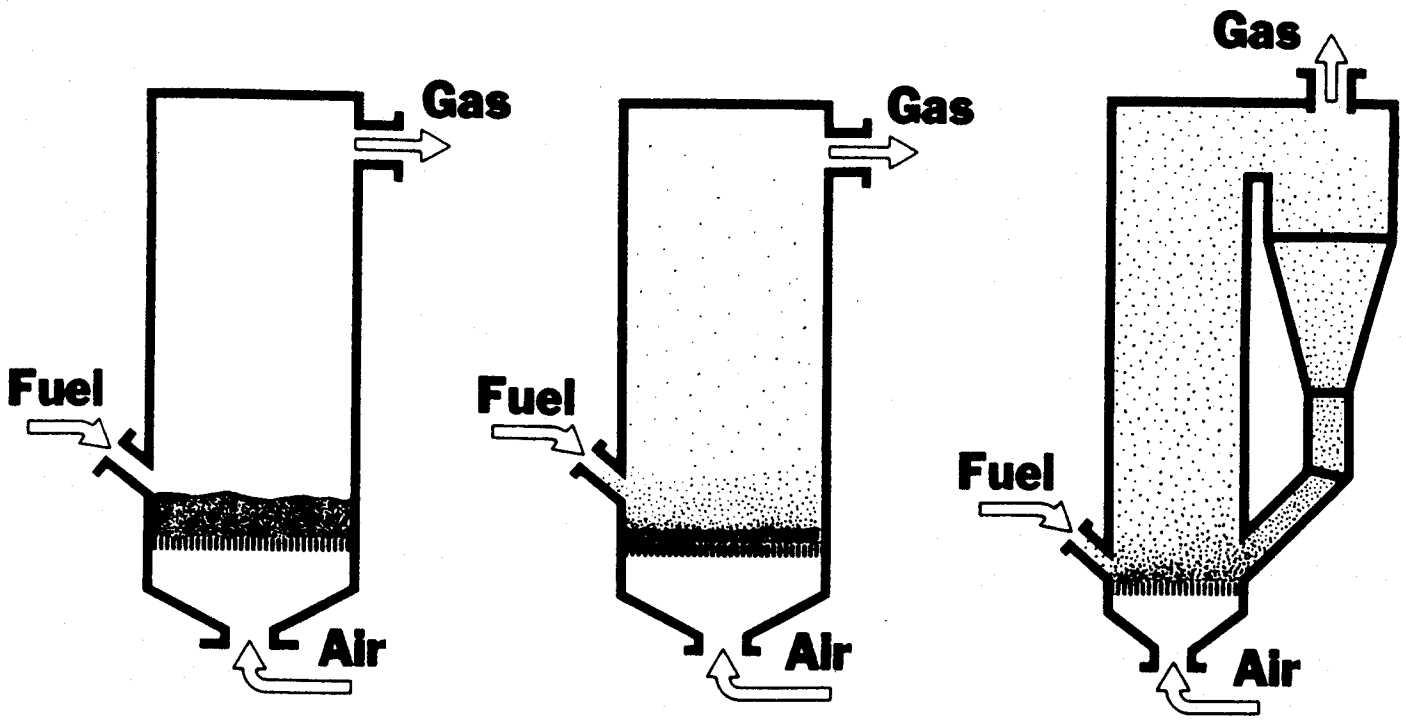
h. Thoroughly inspect all fans, dampers motors, bearings and drives. Lubricate the motor bearings according to the manufacturer's recommendations. Check motors for abnormal vibration frequency.

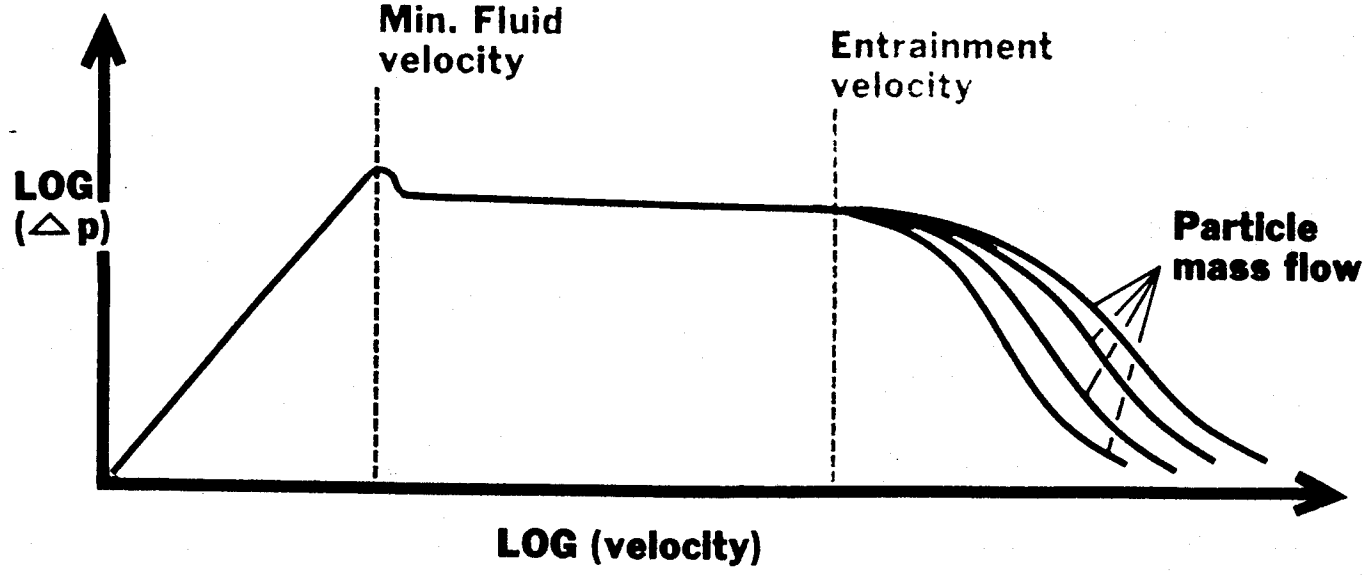
i. Check the secondary air system including the nozzles and dampers.

j. Check the sootblowers according to the manufacturer's requirements.

k. Check superheater surface for general integrity, possible erosion, corrosion, etc. If there are any excessive accumulations of fly ash clean these areas as necessary.

l. Check evaporator and economizer surfaces for general integrity, possible erosion, corrosion, etc. If there are any excessive accumulations of fly ash clean these areas as necessary.





PRESSURE DROP VERSUS GAS VELOCITY

Figure 1: Pressure Drop Versus Gas Velocity

Note: These drawings will be provided when the final version of the O&M manua is produced.

Figure 2, 3, 4 and 5: Engineering Flow Diagrams

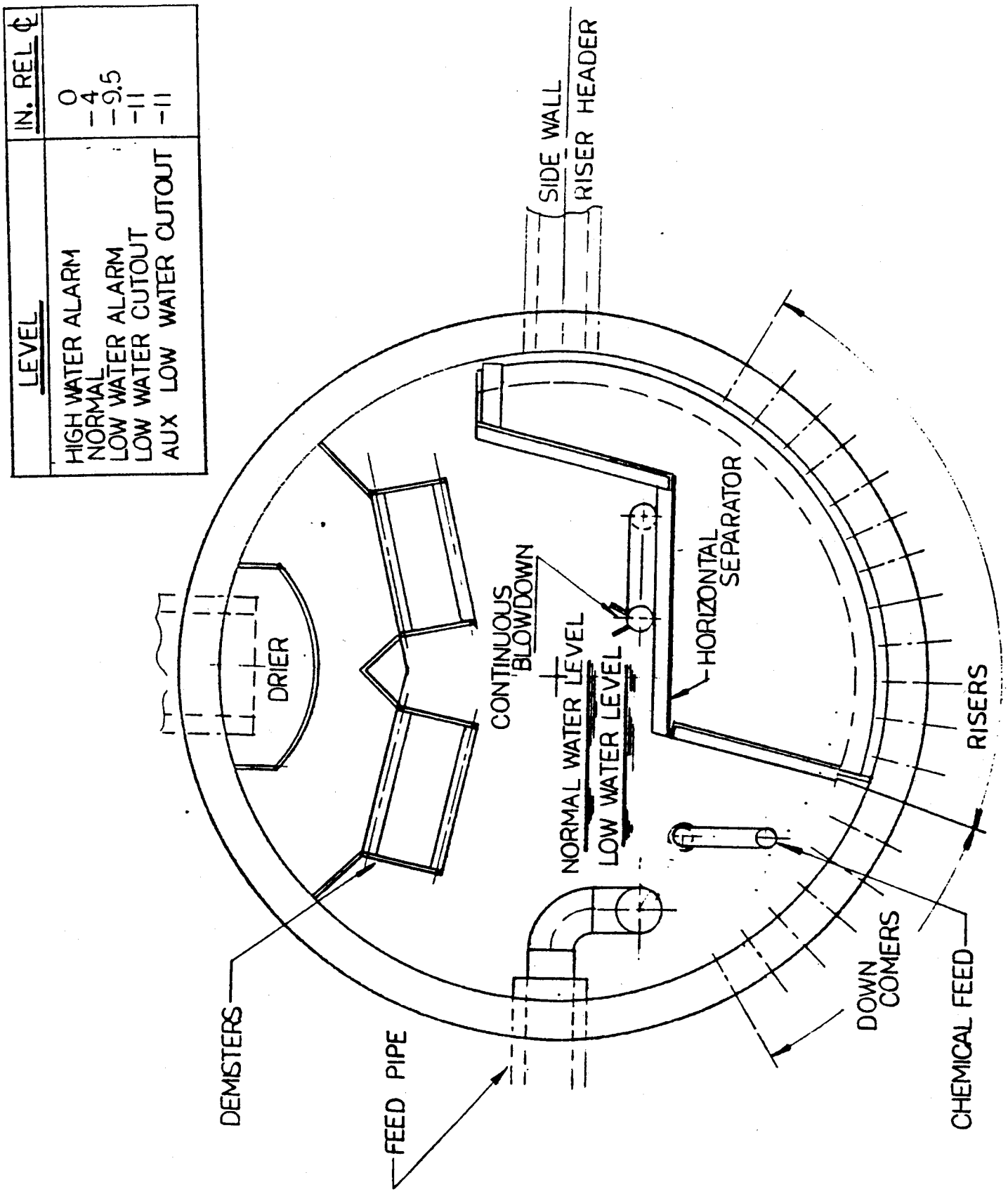


Figure 6: Arrangement of Drum Internals

STANDARD FOR THE QUALIFICATION AND CERTIFICATION OF RESOURCE RECOVERY FACILITY OPERATORS

SECTION 1 — INTRODUCTION

1.1 Scope and Purpose

1.1.1 Scope. This Standard covers the qualification and certification of operators of a resource recovery facility processing municipal solid waste.

1.1.2 Exclusions. This Standard does not cover facilities exclusively processing the following:

(a) hazardous waste as defined by the U.S. Environmental Protection Agency;

(b) pathological waste;

(c) sewage sludges;

(d) industrial waste exclusively from a manufacturing process; e.g., chemical waste, petroleum refinery bottoms, sander dust, etc.

This Standard also does not cover facilities with input capacities less than 1 ton per hr.

1.1.3 Purpose. This Standard provides requirements to be used in certifying operators of resource recovery facilities. These requirements recognize the knowledge, training, and experience in the physical operation of a facility needed to comply with the facility's operating permits and related environmental criteria.

This Standard does not cover the certification or validation of plant operating procedures, operating practices, facility performance, nor compliance with permit requirements.

1.2 Definitions

municipal solid waste — solid waste generated from households, residential, and commercial establishments

resource recovery facility — that portion of a solid waste management system, with materials separation as applicable, utilizing combustion processes aimed at volume reduction and reclaiming materials or energy from municipal solid waste

solid waste — unwanted or discarded materials including solid, liquid, semi-solid, or contained gaseous materials

SECTION 2 — DUTIES AND QUALIFICATIONS

2.1 Duties

This paragraph establishes the essential duties and responsibilities of the positions of chief facility operator and shift supervisor of a resource recovery facility for the purpose of identifying plant personnel to whom this Standard applies.

2.1.1 Chief Facility Operator. The chief facility operator is in direct charge and control of the operation of a resource recovery facility and is responsible for overall on-site supervision, technical direction, management, and performance of the facility including, but not limited to, the following:

(a) overall operation, maintenance, and performance of the facility;

(b) operating in accordance with established facility policies and procedures;

(c) assuring facility personnel are qualified and certified as required and trained when applicable federal, state, and local environmental regulations, or plant technology, plant policies, or plant procedures are changed;

(d) assuring facility operation is consistent with applicable federal, state, and local environmental requirements;

(e) communicating with regulatory agencies;

(f) assuring policies and procedures for proper and safe plant operations are formulated and updated periodically.

2.1.2 Shift Supervisor. The shift supervisor is in direct charge and control of the operation of a resource recovery facility during an assigned shift including, but not limited to, the following:

(a) supervising, training, and monitoring performance of personnel during an assigned shift;

(b) maintaining records of facility operations, including operational changes and abnormalities, and reports to chief facility operator;

(c) authorizing issuance of work orders for equipment repair and maintenance;

(d) assuring the facility is operated consistent with

applicable federal, state, and local environmental requirements;

(e) monitoring operations in accordance with established facility policies and procedures;

(f) undertaking actions to correct upsets or emergencies;

(g) assuring a safe workplace;

(h) communicating operational status of plant with the relieving shift supervisor at shift turnover.

2.2 Qualifications

This paragraph establishes the qualifications which shall be met by a chief facility operator or a shift supervisor prior to receiving provisional certification or operator certification under this Standard.

2.2.1 Provisional Certification. The qualifications for provisional certification of a chief facility operator or a shift supervisor of a resource recovery facility are as follows:

(a) high school diploma or equivalent (GED, or associates degree or higher);

(b) 5 years of experience in general industry, industrial process, or power plant operations. Completion of a baccalaurate degree in physical science or engineering, or 60 credits of course work in the following subjects, from an institute accredited to issue baccalaureate degrees, may be substituted for up to 2 years of experience:

(1) advanced mathematics;

(2) chemistry;

(3) fluid dynamics;

(4) thermodynamics;

(5) materials science;

(6) combustion theory;

(7) environmental, mechanical, civil, chemical, or electrical engineering.

(c) an understanding of resource recovery facility operations adequate to pass a general examination, which covers the body of knowledge listed in para. 3.1. An applicant may retake this examination as frequently as it is offered.

2.2.2 Operator Certification. The qualifications for operator certification of a chief facility operator or a shift supervisor of a resource recovery facility are as follows:

(a) hold a valid provisional certificate;

(b) document 6 months of satisfactory employment at the level of chief facility operator or shift supervisor in that resource recovery facility.

(c) have an understanding of the resource recovery facility operations adequate to pass a site-specific examination which covers a detailed body of knowledge specific to that resource recovery facility which shall include, but not be limited to, an understanding of control room operations and boiler or turbine operations and applicable federal, state, and local environmental requirements. A candidate may retake this examination only after documentation of an additional 6 months of employment at the level of chief facility operator or shift supervisor in the resource recovery facility for which the certificate would be valid. This examination is covered in para. 3.2.

2.3 Transfer of Certification

This paragraph establishes the qualifications by which a certification may be transferred to another facility.

2.3.1 Provisional Certification. Provisional certificates are transferable between facilities.

2.3.2 Transfer of Operator Certification. The holder of a current operator certification for a resource recovery facility may transfer such certification to another facility of similar technology provided that the holder demonstrates employment at the first facility which is satisfactory and has not been interrupted for more than 6 months (cumulative) during the period for which the certificate was valid. To transfer an operator certification to a resource recovery facility of dissimilar technology, the requirements of paras. 2.2.2(b) and (c) shall be met for the new facility.

2.4 Renewal of Provisional Certification

Certification shall be renewed subject to the following requirements:

2.4.1 Renewal of Provisional Certification. Provisional certification shall be renewed subject to the following requirements:

(a) Employment. A provisional certification shall be renewed upon demonstration of satisfactory employment in the management, operation, or maintenance of a resource recovery facility for at least 3 of the last 5 years.

2.4.2 Renewal of Operator Certification. Operator certification shall be renewed subject to the following requirements:

(a) Employment. A certified chief facility operator or shift supervisor shall demonstrate at least 18 months of the last 3 years of satisfactory employment at the resource recovery facility in the applicable level of chief facility operator or shift supervisor.

(b) Demonstration of Knowledge. The certified chief facility operator or shift supervisor shall demonstrate

knowledge of operations required to comply with any revisions to applicable federal, state, and local environmental requirements currently applicable to the resource recovery facility for which the certificate would be valid, as well as adequate knowledge of operations related to any significant technical or design modification currently in use in the resource recovery facility.

2.5 Expiration of Certification

Operator certification shall be renewed subject to the following requirements.

2.5.1 An expired provisional certification shall not be renewed.

2.5.2 An expired operator certification shall not be renewed.

SECTION 3 — TESTING REQUIREMENTS AND PROCEDURES

3.1 General Examination for Provisional Certification

The general examination shall be a 3 hr examination made up of not less than 100 nor more than 150 questions. The examination shall be structured as a closed book, multiple choice, written examination in three areas divided as follows:

Subject matter covering, but not limited to:

(a) 25% of the questions on solid waste collection, transfer, and management:

(1) municipal solid waste composition;

(2) collection techniques;

(3) seasonal industrial, and legislative impact on the character of refuse;

(4) the impact on the character of the refuse due to composting, source reduction, and recycling;

(5) land fills;

(6) ash disposal;

(7) environmental regulations and requirements.

(b) 25% of the questions on theory:

(1) chemistry;

(2) thermodynamics;

(3) combustion;

(4) mechanical and electrical operation and technology;

(5) air pollution control technology;

(6) air emission stack monitoring.

(c) 50% of the questions on the operation of a resource recovery facility:

(1) material handling equipment;

(2) boiler operations;

(3) generator and turbine operations;

(4) control room operations;

(5) general operations and maintenance procedures and techniques;

(6) continuous emission monitors and their calibrations;

(7) ash handling and disposal operations; and

(8) worker safety.

The general examination questions for provisional certification shall be based on the provisional certification guidelines contained in Section A2 of Appendix A.

A candidate must achieve at least a 70% grade overall and at least 50% in each of the above categories.

3.2 Site-Specific Examination for Operator Certification

3.2.1 Oral Examination. The site-specific examination shall be an oral examination administered, whenever possible, at the resource recovery facility site, and shall be based on a knowledge of the operational, preventive maintenance, and safety procedures and practices of the facility.

3.2.2 Subject Matter. The subject matter of the site-specific examination for chief facility operator and shift supervisor shall differ based on the requirements for basic and detailed knowledge as delineated in Appendix A, covering the following areas:

(a) refuse and ash handling;

(b) combustion processing;

(c) steam cycle;

(d) electrical;

(e) environmental controls;

(f) safety;

(g) administrative policy (chief facility operator only).

3.2.3 Grading of Examination. The grading of the site-specific examination shall be as follows.

(a) The site-specific examination shall be graded and a written record made by each member of a board of examiners.

(b) Oral questions and answers shall be recorded electronically.

(c) The board of examiners shall evaluate candidates for operator certification using the following criteria:

(1) technical knowledge;

(2) ability to solve problems;

(3) understanding of integrated plant operations.

(d) A candidate's answers shall be graded on a pass/fail basis according to ASME guidelines.

(e) All members of the board of examiners must pass the applicant if certification is to be granted.