Carmen Johnson

VOLUME I

APPLICATION FOR PERMIT TO CONSTRUCT A MIXED WASTE PROCESSING FACILITY AT THE

CUMBERLAND COUNTY SANITARY LANDFILL
ANN STREET, FAYETTEVILLE, NC

AND AN

RDF-FIRED
ENERGY GENERATION FACILITY
ADJACENT TO THE DUPONT FAYETTEVILLE WORKS
BLADEN COUNTY, NC

Submitted By:

BCH 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, NC 27611-7687

October 23, 1992

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Submitted By:

BCH Energy Limited Partnership
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Prepared By:

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Boston, MA 02129

October 23, 1992

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INDEX SYSTEM

Contents:

1

TABLE OF CONTENTS
SECTION 1

1.0 INTRODUCTION

BCH Energy Limited Partnership (BCH) has entered into a long term contract with Cumberland, Bladen and Hoke Counties, North Carolina for the processing, recycling and energy recovery (resource recovery) from municipal solid waste (MSW) generated within the Counties. Two (2) separate locations in the Fayetteville Area will be utilized for the project. The mixed waste processing facility will be located at the Cumberland County Sanitary Landfill at Ann Street, Fayetteville and will incorporate the existing Baling Facility which presently operates under Permit No. 26-03-TP issued October 12, 1989 to Cumberland County. MSW will be processed for the recovery of paper, plastics and metals, removal of grit and other inorganic materials and production of refuse-derived fuel (RDF).

The mixed waste processing facility, referred to as the Materials Recovery Facility (MRF) throughout this document, will produce approximately 188,000 tons per year of RDF which is the principal fuel for the Energy Generation Facility (EGF) component of the project. Other products recovered at the MRF include paper, corrugated (cardboard), ferrous metals, aluminum and plastics. Inorganic fines along with bulky, non-processible wastes will be directed to the existing Cumberland County-operated Ann Street Landfill. Ash residue from the EGF will be landfilled at the Ann Street Landfill in the event that it is not beneficially used in production of portland cement or concrete.

The RDF will be loaded into covered, live bottom trailers for transport to the EGF site which is approximately 20 miles south of Fayetteville located in Bladen County and presently owned by E.I. DuPont DeNemours and Co. The EGF to be constructed on the site from DuPont will include two (2) atmospheric fluidized bed boilers designed to burn 100 percent RDF, supplying steam to be sold to DuPont for electrical power generation and process steam. Excess electricity will be sold to Carolina Power & Light.

1.1 SITE LOCATIONS

The MRF will be located on leased property owned by Cumberland County within the City of Fayetteville. The leased site is adjacent to the Ann Street Sanitary Landfill and includes the existing tipping building and baling plant. The MRF will be constructed as an addition to the existing building. The site lease will run for 21 years. The proposed site limits are indicated on the MRF plans (Section 3).

The EGF will be located on an 11 acre leased site within the DuPont Fayetteville Works in Bladen County. The EGF site is rectangular in shape, flat and has no existing structures (see Site Plan in Section 5).

Details of the waste supply and service agreement, as well as the Ann Street Landfill agreement are included in Volume II of this application document.

1.2 PROJECT DESCRIPTION

Upon completion of MRF construction, the existing Cumberland County baling plant operation will be assumed by BCH. The baling operation will be terminated, but equipment will remain as a backup to the MRF. The MRF will process 60 tons per hour of MSW as fed to it from the existing tipping floor. A front-end loader will feed the MSW onto an apron conveyor system as the first step of the MRF operation. On the feed conveyor system, MSW will be handsorted at the primary picking station for bulky and non-processible wastes, corrugated (cardboard) and paper. MSW will then be processed in a rotary screen (trommel) for bag opening and size separation. Materials over 6-inches in size will be conveyed to a second picking station for recovery of ferrous metals, large aluminum items and plastic containers (HDPE, PET). Materials under 6 inches in size will be conveyed past a magnetic separator for ferrous metals recovery and then to a second rotary screen (trommel) for separation at approximately 2 inches. Materials less than 2 inches in size will be conveyed to roll-off containers for transfer to landfill. Material over 2 inches will be conveyed to an electro-mechanical aluminum can recovery system followed by a third picking station for recovery of plastic containers (HDPE, PET) and any remaining aluminum.

Of the 60 tons per hour of MSW fed to the system, approximately 65-70 percent will be converted to RDF. The RDF will be compacted into covered 100 cubic yard capacity walking floor trailers each carrying a payload of approximately 22 tons for transport to the EGF Site. Paper, cardboard, plastics and aluminum will be baled for market. Ferrous metals will be marketed in loose form.

The EGF site will receive, process and store RDF in preparation for burning in two (2) 124.5 million BTU per hour heat input atmospheric fluidized bed boilers operating in parallel to deliver 650 psig, 750F steam to a single 16.5 MW (gross) steam turbine generator. The steam turbine is a full condensing type with controlled extraction to supply process steam for the DuPont Plant.

Water will be supplied to the EGF from various DuPont supplies.

1.3 ZONING APPROVAL

Letters of Approval have been obtained from Cumberland County for the MRF site and from Bladen County for the EGF site. Copies of both letters are included at the end of Section 1 of this document.

1.4 COMPLIANCE WITH SITING/DESIGN REQUIREMENTS

1.4.1 Surface Water Requirements

The MRF Facility will utilize the existing Cumberland County Baling Facility with a building addition to house the processing/separation equipment. All operations are indoors. Cumberland County has submitted an NPDES Permit Application as part of a Group Application for stormwater discharge associated with the entire site. The BCH operation will meet the requirements of that application by maintaining all solid waste and recovered materials indoors. In addition, a mechanical sweeper will be employed on-site to maintain roadways utilized by truck traffic travelling to and from the facility.

Any liquids generated within the facility building will be collected and discharged to the nearby POTW for treatment prior to discharge. This is currently the method of disposal employed by the Baling Facility.

Receipt and storage of RDF at the EGF Facility will be indoors. Stormwater from the facility will flow into the existing DuPont Fayetteville Works stormwater system.

1.4.2 Groundwater Standards

As indicated previously, all waste material, recovered materials and residuals will be stored indoors prior to processing or transportation to end users or disposal. All water generated within the facility will be collected and discharged to the nearby POTW for treatment. Therefore, there will be no contaminated water discharges which could contaminate groundwater.

RDF hauled to the EGF will be in covered trailers and discharged directly into indoor storage. Therefore, neither surface water nor groundwater contamination can occur at the EGF Facility.

1.4.3 Sedimentation Pollution Control

A Soil Erosion and Sediment Control Plan will be prepared prior to construction of the MRF Addition to the baling plant, as well as the EGF Facility in Bladen County.

1.4.4 Air Pollution Control

The MRF Facility will require an air pollution control permit for the fabric filter and carbon adsorption system proposed for dust and odor control from the processing system. An application has not as yet been prepared, but will be shortly pending final selection of MRF contractor.

The EGF Facility air permit application was filed with the DEM/Air Permits Unit in June 1992. The complete application is included in Sections 6 and 7 of this document.

1.4.5 Site Access Control

As indicated in the MRF Facility Plans (Section 3) and the EGF Facility Plans (Section 5), both facility sites are fenced with controlled access. No uncontrolled access is available at either facility site.

1.4.6 Odor Control

As indicated previously, the MRF Facility will be installed with a dust collection and odor control system to collect dust and control odors from the solid waste processing operation. Ths MRF processing area will be maintained under negative pressure with all air filtered prior to emission to atmosphere.

The EGF Facility will control odors from the RDF unloading and storage areas by drawing combustion air from these areas. Hence, areas where RDF will be handled or stored will be maintained under negative pressure.

1.5 FACILITY DETAILS

1.5.1 Area Served

The project will serve the Counties of Bladen, Cumberland and Hoke which have all entered into a contract with BCH. A copy of the contract is included in Volume II, Section 1 of this Application Document.

1.5.2 Type and Quantity of Waste

The facility will receive and process household and commercial waste from Bladen, Cumberland and Hoke Counties. The facility will not process construction and demolition wastes and only a portion of industrial waste materials.

Minimum waste quantities to be processed on an annual basis are estimated as follows: Bladen County - 18,000 tons, Cumberland County - 150,000 tons and Hoke County - 15,000 tons. These amounts are estimated to be 80 to 90 percent of the actual amounts available.

In the future, the potential exists for Fort Bragg and other nearby counties to participate in the project.

Wastes from Cumberland County are currently delivered to the baling facility which will be converted to the MRF. Wastes from

Bladen and Hoke Counties will be transferred via transfer stations to be installed, owned and operated by those counties. Wastes will be transferred to the MRF via live bottom trailers.

1.5.3 Process Flow Diagram

A process flow diagram for the MRF Facility is included in Section 3 of this document and the process flow diagram for the EGF is included in Section 5 of this document.

1.5.4 Description of Storage Facilities

All incoming wastes will be discharged and stored on the existing baling plant tipping floor. No modifications are planned for the existing tipping floor except for the installation of two (2) feed conveyor systems in Bay 1 of the tipping floor.

The processing area of the MRF, which will be a new addition to the existing building, will house all processing equipment. This MRF area will also serve as storage area for baled paper, baled corrugated, baled plastic and bundled aluminum cans prior to shipment to market. Recovered ferrous metals and bulky aluminum will be stored in roll-off containers prior to shipment to market. RDF product will be compacted directly into transfer trailers as it is produced for shipment to the EGF Facility.

Non-processible materials and process residue/grit will be stored indoors in roll-off containers prior to transfer to the adjacent Ann Street Landfill for disposal.

RDF delivered to the EGF will be discharged directly into covered, walking floor storage bunkers prior to final sizing and feeding to one (1) of two (2) atmospheric fluidized bed combustors.

Ash residue from the combustion system will be pneumatically conveyed to a totally enclosed ash storage bin equipped with a fabric filter dust collector prior to discharge into enclosed trailers for delivery to an end user or transfer to the Ann Street Landfill for disposal.

1.5.5 Separation and Processing, Disposal of Rejects

Non-recyclable materials will be separated from the waste stream at several locations in the process. First, large non-processible objects identified by the front end loader operator will be removed on the tipping floor. Such items include mattresses, box springs etc. These materials will be placed in a roll-off container located on the tipping floor to await disposal in the adjacent landfill.

Non-recyclable materials will also be manually removed at Picking Station No. 1 from the main feed conveyor system. Materials removed at this location will be dropped via chutes into a roll-off container for storage prior to disposal in the adjacent landfill.

Process residue is generated from the minus 2-inch fines resulting from the screening operation. This material will be conveyed to roll-off containers to await disposal at the adjacent landfill.

Combustion ash generated at the EGF will be stored in a totally enclosed bin equipped with a fabric filter dust collector.

Combustion ash will be beneficially used as an additive in the manufacturing of portland cement or in the production of concrete. The ash will be periodically tested to assure that it is non-toxic by subjecting representative composite samples to the TCLP Toxicity Test. Prior experience with atmospheric fluidized bed combustion ash from RDF indicates that it is non-toxic and can be beneficially utilized.

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

Ash and residue disposal is to be provided by Cumberland County in the Ann Street Landfill in accordance with 3.08 of the Resource Recovery Agreement (See Volume II, Section 1).

1.5.6 Surface Water Runoff Control

Surface water runoff at the MRF Facility will be controlled in essentially the same manner as presently controlled at the existing baling facility. BCH Energy will operate and maintain a mechanical sweeper on-site to further assure best management practices are being employed.

All liquid generated within the building will be collected for disposal at the nearby POTW. This is the present mode of wastewater disposal at the existing baling operation.

The EGF Facility will utilize the existing DuPont stormwater system. Due to the nature of the EGF operation and the fact that only RDF will be transported to the facility in enclosed trailers which discharge directly into live bottom bunkers, no waste materials of any type will be outdoors or exposed to stormwater. In addition, due to the processing and separation of the MRF, no free liquids will be contained in the RDF, hence no free liquids will be present requiring disposal.

Sanitary wastes from the EGF site will be disposed via the DuPont sewage treatment system.

1.5.7 Final Product Use

All products shipped from the site will be in covered, live bottom transfer trailers, van trailers or roll-off containers. In the event a final product cannot be marketed due to poor quality or change in market conditions, it will be disposed at the adjacent Ann Street Landfill.

The list of products and the means of removal from the MRF site is as follows:

Product	Form	Vehicle Type
Paper	Baled	Van Trailer
Corrugated	Baled	Van Trailer
Ferrous Metals	Loose	Roll-Off
Aluminum Cans	Baled	Van Trailer
Bulky Aluminum	Loose	Roll-Off
Plastics	Baled	Van Trailer
RDF	Compacted	Live Bottom Trailer

1.5.8 Daily Traffic Flows

Traffic to and from the Ann Street site will increase from current levels due to the transfer of Bladen and Hoke County solid waste to the facility, as well as due to the transportation of recovered materials and RDF from the facility.

Additional truck traffic delivering solid waste to the facility is estimated to be a total of eight (8) transfer trailers per day.

Trucks transporting recyclable products from the facility are estimated to number six (6) per day, while twenty-eight (28) trailer loads of RDF are estimated to leave the facility for delivery to the EGF.

1.5.9 Truck Unloading

Waste arriving at the facility will be discharged onto the existing tipping floor. All vehicles, packer trucks, roll-off trucks, dump trucks and transfer trailers will back into the existing tipping building for unloading. No solid waste will be discharged outside the tipping building.

1.5.10 Operation Arrangements

BCH Energy will assume operations of the existing baling facility upon completion of the MRF construction. The baling systems will be maintained on standby as backup for the MRF operation. Existing Cumberland County employees will be given perference in hiring by BCH for operation of the MRF Facility.

An Operator Training Program will be implemented by the MRF Vendor to properly train all MRF operating personnel.

1.5.11 Personnel

The following is a list of personnel required for MRF Operation and Maintenance:

Position	Number Required
Plant Manager	1
Assistant Plant Manager	1
Transportation Manager	1
Scale Clerk/Secretary	2
Lead Operator	2
Frontend Loader Operator	2
Recovery Personnel	16
Maintenance	3
Maintenance Helper	3
Forklift Operator	2
Truck Driver	4
Total	37

The following personnel are required for the EGF Operation and Maintenance:

Position	Number Required
Plant Manager	1
Secretary	2
Lead Operator	4
Control Room Operator	4
Instrument Technician	1
Maintenance Supervisor	1
Maintenance	4
Maintenance Helper	4
Cleanup Personnel	5
Truck Drivers	6
Total	32

1.5.12 Operation Schedule

The MRF will operate six (6) days per week. Waste will be received during 7 AM and 6 PM Monday through Friday and 7 AM to 4 PM on Saturday. Waste processing will occur on a two (2) shift basis, during the hours of 7 AM to 11 PM.

At the end of the operating day, the entire facility will be swept and maintenance will be performed in preparation for the next operating day.

The EGF will receive RDF six (6) days per week, but will operate seven (7) days per week, twenty-four (24) hours per day.

1.5.13 Special Operating Procedures

During storm conditions, the MRF will continue to operate assuming that waste can be delivered to the facility and assuming RDF trailers can be transported to the EGF Facility.

1.5.14 Nuisance Controls

Noise will be controlled by maintaining all operations indoors and through the monitoring of noise levels from on-site mobile equipment, as well as trucks delivering waste to the MRF and trucks transporting materials from the MRF to market.

Vectors will be controlled through daily cleaning of the facility and periodic inspections by a qualified exterminator.

Particulates and odors will be controlled via maintaining the MRF processing facility under negative pressure and filtering the air through a fabric filter and carbon adsorption system prior to discharge to atmosphere.

1.5.15 Unacceptable Waste Handling

All waste arriving at the facility will be inspected for unacceptable wastes, including hazardous and medical wastes. If such materials are found, they will be isolated from the waste in a designated area to await inspection, identification and proper disposal. The hauler bringing such materials will be notified and will be charged for the proper disposal of such items.

1.5.16 Plans and Specifications

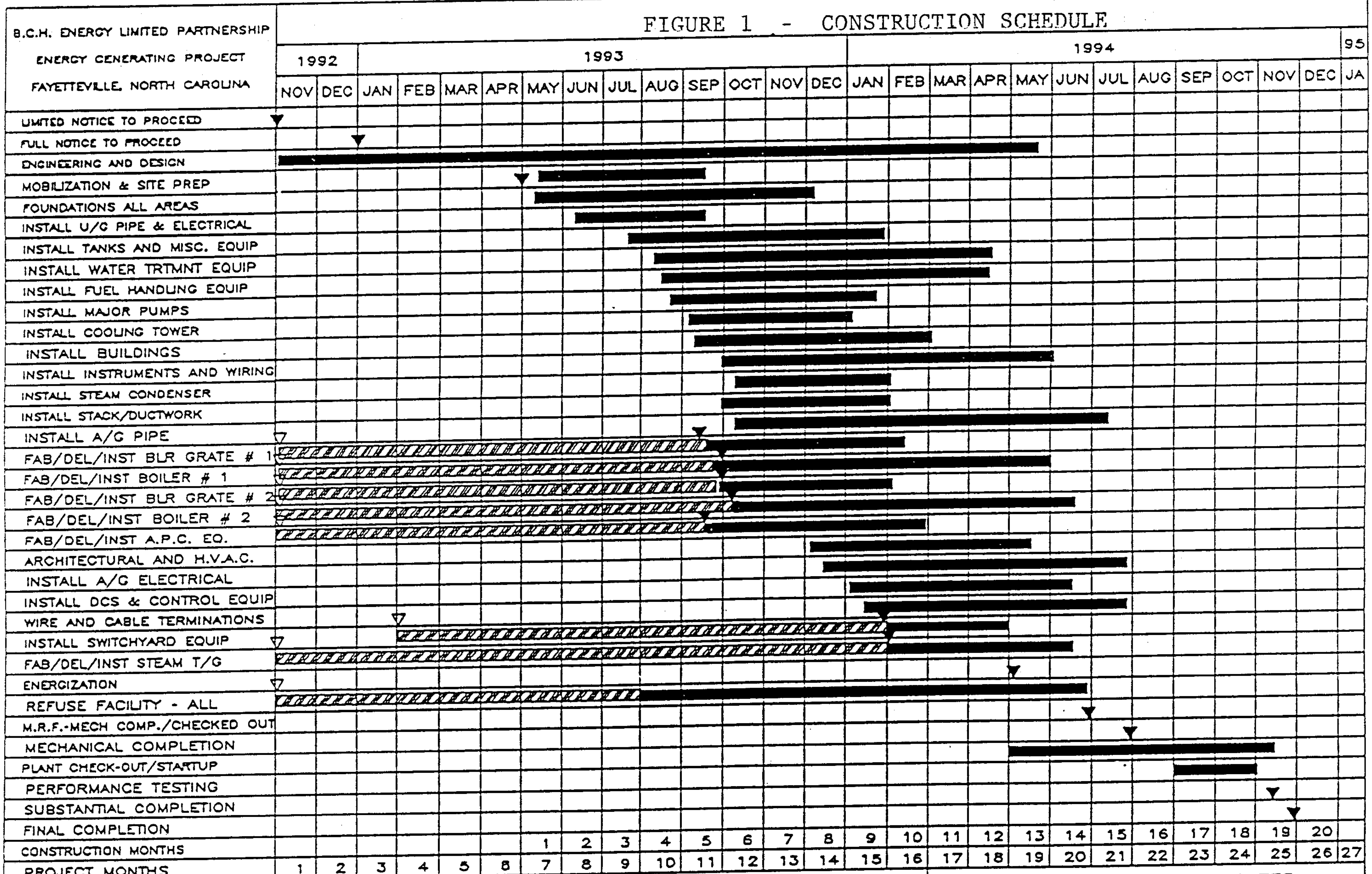
Detailed specifications for the MRF Facility are included in Section 2 of this document, while detailed plans are included in Section 3.

EGF Specifications are included in Section 4, while detailed Plans are included in Section 5.

1.5.17 Draft Operation and Maintenance Manuals

Draft Operations and Maintenance Manuals for both the MRF and EGF are included in Section 8 of this application document.

FIGURE 1 - CONSTRUCTION SCHEDULE



PROJECT MILESTONES

LIMITED NOTICE TO PROCEED................NOV 01, 1992
FULL NOTICE TO PROCEED......................JAN 01, 1993
MOBILIZATION...MAY 01, 1993
DELIVERY OF BOILER # 1........................OCT 01, 1993
DELIVERY OF BOILER # 2........................OCT 15, 1993
DELIVERY OF STEAM T/G........................FEB 01, 1994
MECHANICAL COMPLETION.....................AUG 01, 1994
SUBSTANTIAL COMPLETION....................NOV 15, 1994
PROJECT COMPLETION...........................DEC 01, 1994

SCHEDULE LEGEND

▽ ISSUE PURCH ORDER
▼ MAJOR MILESTONE
INDICATES FAB / DELIVERY OF ITEM
INDICATES INSTALLATION OF ITEM

DATE AND DRAWING NO. R.F.Q. DATES

REV.#	DATE	BY	PROP. #
3A	09/30/92	JSP	M-9243

COUNTY OF CUMBERLAND
OFFICE OF THE COUNTY MANAGER

CLIFFORD G. STRASSENBURG
COUNTY MANAGER

P.O. BOX 1829 • FAYETTEVILLE, NORTH CAROLINA 28302-1829
TELEPHONE: 919-678-7723 • 678-7726
FAX: 919-678-7717

JUANITA PILGRIM
ASSISTANT COUNTY MANAGER

CLIFF SPILLER
ASSISTANT COUNTY MANAGER

October 15, 1992

Mr. Dexter R. Matthews
Chief, Solid Waste Section
Solid Waste Management Division
DEHNE
PO Box 27687
Raleigh, North Carolina 27611-7687

Dear Mr. Matthews:

Reference draft letter dated January 15, 1992 from your office subject "Mixed-Waste Processing Facility Requirements". Paragraph "2)a" of this document requires information from the unit of local government having zoning authority concerning the zoning of the area in which the facility is to be located.

In support of the current application for a permit to construct a materials recovery facility at the existing baling plant facility within the Ann Street Landfill area, I wish to affirm the approved site zoning status of M2-Heavy Industrial and state that the proposed facility is an authorized use for the indicated zoning.

Sincerely,

Clifford G. Strassenburg

CLIFFORD G. STRASSENBURG
County Manager

CGS/md

cc: Larry Carter, CCSWM
Terry Dover, SWS, DEHNR
George Armistead, VEDCO
K. Woodruff & Associates

County of Bladen
State of North Carolina
P.O. Box 1048 · Elizabethtown, North Carolina 28337-1048

Alexis H. Jones
County Manager

Telephone
919 862 6700
FAX 919 862 6767

June 15, 1992

Mr. Richard T. Lasater
DEM/Air Quality/Air Permits Unit
NC Department of Natural Resources and
Community Development
P. O. Box 27687
Raleigh, NC 27611-5317

Dear Mr. Lasater:

With reference to your work on the BCH Energy Corp. RFD-to-Energy Facility project, please be advised that Bladen County does not have any zoning or land use regulations in effect in the area of the DuPont Fayetteville Works where the project will be located. This will certify that the BCH Energy Corp. facility, as planned, meets Bladen County requirements

Sincerely,

Alexis H. Jones
County Manager

AHJ/rba
cc: Mr. Kenneth L. Woodruff
Mr. George Armistead

Post-It™ brand fax transmittal memo 7671

To Ken Woodruff	From Alexis Jones
Co.	Co. Bladen Co.
Dept.	Phone # 919-862-6700
Fax # 215 736-2225	Fax # 919-862-6767

\# of pages ▸ 1

2

MATERIALS RECOVERY FACILITY

1.00 INTRODUCTION

1.01 The purpose of this SECTION is to define the Project Scope and a level of quality 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 will be permitted without the express written consent of the Owner.

1.02 The Materials Recovery Facility (MRF) shall consist of a building and related appurtenances to which Municipal Solid Waste (MSW) is delivered. The MSW is processed at the facility to separate combustibles from non-combustibles utilizing a materials handling system and related materials separating machinery designed for this purpose. The processed combustible products will be trucked from the MRF as refuse derived fuel (RDF) for combustion/incineration in the boiler of an Energy Generating Facility (EGF). The MRF building provided shall include facilities with utilities required to accommodate personnel working at the MRF.

1.03 The Contractor may provide alternative arrangements to the design described in this SECTION provided that the standard of quality and operational flexibility described herein are maintained. Alternatives which enhance reliability and operational flexibility are encouraged.

2.00 DESCRIPTION OF MRF

2.01 The MRF facility will be located at the existing Ann Street Landfill and Baling Station in Fayetteville (Cumberland County) North Carolina. The MRF will receive approximately 270,000 tons/year of municipal solid waste (MSW) from three counties (Balden, Cumberland and Hoke) and through automatic and manual sorting will remove recyclable materials. The remaining combustible materials, estimated at **188,000** tons/year, shall be processed at the MRF into refuse derived fuel (RDF) for incineration and steam production at a remote site to produce up to 15 MW of electrical power as well as up to 100,000 pounds per hour of extracted process steam for the local (and adjacent) Du Pont plant.

2.02 The MRF site at the landfill will be leased from the county, including the existing 45,000 square foot tipping floor and adjoining baling facilities (consisting of two existing Mosley balers and two Mayfran steel belt conveyors). A process sorting line to separate recyclables from the MSW shall be installed in a new addition to the existing building, all as detailed in this specification.

2.03 It is intended that by-pass and residue from the MRF be landfilled at the site, recyclables sold by the MRF and approximately **188,000** tons/year of RDF compacted onto live bottom transfer trailers and transported approximately 20 miles to the Du Pont Plant Site in Balden County, where the EGF is located.

3.0 SITE CONDITIONS

3.01 The MRF site with boundaries are shown on the layout drawings included with the specification. The MRF consists of an addition to the existing waste processing facility.

3.02 For purposes of design, the ambient dry bulb temperatures shall be:

92°F - Maximum
22°F - Minimum

3.03 Design wet bulb temperature shall be 76°F.

3.04 Design for wind shall be in accordance with BOCA Code. Design wind velocity is 90 miles per hour.

3.05 Design for snow loading shall be 20 pounds per square foot in accordance with BOCA Code for snow load. Frost depth is 3 feet.

3.06 Site drainage shall be designed for 100-year storm.

3.07 Seismic design for all buildings, structures and components shall be in accordance with BOCA Code for earthquake loads. Site is located in Seismic Risk Zone 2.

3.08 Site elevation is approximately 150 ft above mean sea level.

3.09 The site arrangement shown on the drawings is conceptual in nature and may be modified by the Contractor to optimize utilization of the facility.

3.10 Borings shall be taken at the site by the Contractor for final design. For bidding purposes, foundation design shall be based on soil loading of 3000 pounds per square foot.

4.00 CODES AND STANDARDS

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

4.02 The governing Codes and Standards shall be those that are in effect at the time the Contract is signed

4.03 All applicable local, state and federal requirements and permit conditions shall be complied with by the Contractor unless specified otherwise. Use of asbestos shall not be permitted for any application.

4.04 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)

- National Solid Waste Management Association (NSWMA)
- Solid Waste Association of North America
- American Society of Civil Engineers (ASCE)
- American National Standards Institute (ANSI)
- a. Dimensional Specifications as applicable
- American Society of Testing and Materials (ASTM)

  a. Material Specifications as applicable
  b. Sampling and Testing Standards as applicable
  c. RDF - ASTM E1126-87

- American Chain Association (ACA)
- American Welding Society (AWS)
- American Water Works Association (AWWA)
- American Iron and Steel Institute (AISI)
- Crane Manufacturers Association of American (CMAA)
- Thermal Insulation Manufacturers Association (TIMA)
- 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)
- Compressed Air and Gas Institute (CAGI)
- Conveyor Equipment Manufacturers Association (CEMA)
- Industrial Gas Cleaning Institute (IGCI)
- Basic National Building Code (BOCA)
- Uniform Building Code (UBC)
- Instrument Society of American (ISA)
- Environmental Protection Agency (EPA)
- Occupational Safety and Health Administration (OSHA)
- State of North Carolina Building Codes
    a. Sanitary Code
    b. Erosion Control Code
    c. State Building Code
    d. 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)

5.00 DESIGN BASIS (See Dwg. D-071-02-M2)

5.01 The MRF addition to the existing facility shall be constructed in a building approximately two stories high. The building shall originate at grade and support materials handling equipment from that elevation. Picking stations and related equipment shall be elevated on steel platforms as required to permit rapid unloading of collectibles.

5.02 The MRF shall be designed with emission controls to ensure that the facility complies with all applicable laws and regulations governing air quality, odor and noise emissions.

5.03 The MRF shall be designed to process a minimum of 60 TPH of MSW (municipal solid waste) delivered by trucks to the MRF, during two ten hour shifts, six days per week.

5.04 Conversion to RDF (refuse derived fuel) is expected to be about 65 percent of the incoming MSW. The MRF shall be capable of processing and delivering to EGF up to 4680 tons/week to meet the requirements of the EGF operating at full capacity.

5.05 Commercial, municipal and private refuse will be accepted at the MRF. Toxic, hazardous and medical wastes are not acceptable wastes and if inadvertently dumped at MRF will be separated and segregated to be removed by a licensed hauler.

5.06 An initial screening of refuse delivered will take place on the existing tipping floor. MRF employees will separate most bulky items, such as furniture, tires, appliances, etc. Front-end loaders (furnished by others) will then push the refuse onto a slow moving pit apron conveyor which will convey the waste from the tipping floor area to the process area.

5.07 The MRF shall be provided with a ventilating system to control dust and odors which maintains the building under a negative pressure. The exhaust of such system to the atmosphere shall comply with the requirements of regulatory agencies having jurisdiction.

5.08 A suitable fire protection system shall be provided in MRF which complies with all local state and federal requirements and other agencies having jurisdiction.

5.09 The MRF design shall include hoists monorails and lifting devices to facilitate servicing items of equipment where experience has shown such equipment to be required.

5.10 The detailed design of the MRF to produce RDF for incineration in the EGF shall comply with requirements listed. The RDF from the MRF will be shredded at the EGF to produce 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 at the EGF 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 and small amounts of metals and glass.

A.	Process Capacity:	60 tons per hour (mininum)
B.	On-Line Availability:	80%
C.	Ferrous Removal:	92%
D.	Glass/Grit Removal:	85%
E.	Electro/Mech Aluminum Recovery:	65%
F.	Plastic Container Recovery	40%

G. Manual Picking Stations:

1. Picking Station No. 1 should be located prior to MSW entry into the primary sizing device (Trommel No. 1) to allow removal of bulky items such as car batteries, undesirable materials and, when market conditions are favorable, corrugated paper and newspapers.

2. Picking Station No. 2 shall be provided for the oversized fraction from the primary sizing device. This picking station shall provide for the separate removal of aluminum, plastic and ferrous materials from the oversize process stream.

3. Picking Station No. 3 shall be provided for the oversized fraction from the secondary sizing device (Trommel No. 2) fraction located after the last electrical/mechanical aluminum separation takes place. This picking station shall provide for separate removal of aluminum and plastic from the oversize process stream.

5.11 The two existing balers and two conveyors at the existing facility are not utilized for the new materials handling/processing system for MSW. This equipment will serve in a standby capacity. However, this equipment must remain operational during the MRF construction period and until the MRF is operational.

6.0 MRF PROCESSING (See Dwg. No. D-071-02-M1)

6.01 Front-end loaders (furnished by others) will place the MSW into an apron conveyor which shall be recessed within the existing MSW tipping floor. This conveyor shall convey the MSW past Picking Station No. 1 where pickers will manually remove large and non-acceptable material , newspaper and cardboard, before screening in Trommel No. 1.

6.02 Trommel No. 1 shall be equipped with suitable blades or spikes to break open plastic bags and remove material which is less than six inches in diameter (minus six inches).

6.03 After leaving the Trommel No. 1, the minus six-inch material will pass under Magnet No. 1 (to remove most of the ferrous metals), then to Trommel No. 2 where material less than 2 inches in diameter will be removed. The 2 inches and smaller material will be separated from the process stream and transported to the landfill (by Others). Trommel No. 2 shall also be equipped with suitable blades or spikes to break open plastic bags.

6.04 Material larger than 2 inches will discharge from Trommel No. 2 to an Eddy Current Separator to recover the aluminum in the stream. The stream then enters Picking Station No. 3 where aluminum and plastic is separated from stream and the remaining combustibles flow to compactors where the RDF is loaded onto 20 ton capacity live bottom trailers.

6.05 The material from Trommel No. 1, which is lager than six inches, will be conveyed to Picking Station No. 2 where plastics and ferrous metal will be separated. The stream from Picking Station No. 2 will pass under Magnet No. 2 to remove ferrous not removed at Picking Station. After passing Magnet No. 2, the stream will join the stream from Picking Station No. 3 which flows to compactors which load RDF onto live bottom trucks for transport to the EGF.

6.06 <u>Picking Station No. 1</u>

A. Products removed from the process stream at Picking Station No. 1 shall be processed as follows:

1. Bulky waste shall be placed into roll-off type bins for removal from the MRF to the land fill via truck.

2. Cardboard shall be conveyed to a baler (BA-3) via a hopper type conveyor for baling.

3. Paper and newsprint shall be conveyed to the same baler (BA-3) via a hopper type conveyor for baling.

4. Baling of newspaper and cardboard will be based on market conditions. Therefore, all equipment downstream of Picking Station No. 1 shall be sized on the basis that none of these materials are removed from the process stream.

5. Baled paper and cardboard will be stored on the floor of the MRF prior to removal from the building by truck.

6.07 Bypass-Reclaim

A. An emergency bypass system shall be provided between Trommel Nos. 1 and 2 to permit continued operation of the plant should Trommel No. 2 be out of service. The emergency bypass system shall have the following features:

1. A flop gate device upstream of Trommel No. 2 to divert process flow on to a separate conveyor (C10).

2. Conveyor C10 shall carry the full process stream back to the existing tipping floor to an elevation where the process stream can be handled by a front-end loader operating on the tipping floor.

3. A separate reclaim hopper, installed below the grade of the existing tipping floor shall be provided for reclaim of by-passed material to Trommel No. 2. Because of this, Trommel No. 2 shall be sized to accept 125% of normal process flow.

6.08 Picking Station No. 2

A. Products removed from the process stream (plus 6" material) at Picking Station No. 2 shall be processed as follows:

1. Aluminum products shall be placed into a roll-off type bin for truck removal from the building.

2. Plastics shall be conveyed to the Plastic Baler (BA-2) for perforation and compaction. Baler No. 2 shall also receive plastic material (+ 2") from Picking Station No. 3. All material entering Baler No. 2 shall first pass through a perforator to facilitate compaction.

3. Baled plastics shall be stored on the floor of the building prior to removal from the site by truck.

6.09 Eddy Current Separator

A. The Eddy Current Separator (EC-1) shall process all + 2" material from Trommel No. 2. EC-1 shall separately remove both aluminum and remaining ferrous material from the process stream.

B. Aluminum shall be normally conveyed to an aluminum can densifier. The chute from EC-1 to the Densifier Conveyor (C-15) shall have a flop gate which will allow aluminum from EC-1 to enter a tote box rather than conveyor, C15.

C. Ferrous material from EC-1 shall be chuted to a separate tote box.

6.10 Picking Station No. 3

A. Products removed from the process stream (+2") at Picking Station No. 3 shall be processed as follows:

1. Aluminum cans will normally be combined with the aluminum cans from EC-1 and conveyed on C15 past an aluminum quality control station.

2. The aluminum quality control station will be a hand picking operation for removal of any non-aluminum cans or material unsuitable for densification.

3. Prior to entry into the aluminum can densifier, all material shall pass over a conveyor head pulley magnet for final separation of ferrous material.

4. The aluminum can densifier shall produce biscuits for stacking and storage on the floor of the building prior to removal from the site by trucks.

5. The aluminum can densifier shall be designed to compress non-aluminum materials including steel cans. To permit this, the aluminum chutes from the Eddy Current Separator and Picking Station No. 3 shall both be provided with flop gates and tote box stations to permit continued operation of the process stream while non-aluminum can material is being densified.

6. Loading of non-aluminum material (and aluminum from the tote boxes) into BA-1 shall be accommodated by inclusion of a bin at the tail end of Conveyor C-15. This bin shall be sized to accept tote box discharge from a fork lift.

6.11 Ferrous Material

A. Ferrous material shall be removed from the process stream:

1. Between Trommel Nos. 1 and 2 by a self-cleaning magnet which conveys its material via conveyor to a roll-off bin.

2. At Picking Station No. 2 which shall feed the same ferrous roll-off bin.

3. By a self-cleaning magnet down stream of Picking Station No. 2 which also feeds the common ferrous roll-off bin.

4. By a head pulley magnet upstream of the aluminum densifier. Ferrous material shall drop into a separate tote box for transfer by fork lift truck to the ferrous roll-off bin described above.

5. As output from the Eddy Current Separator as described above, tote box contents shall be transferred to the ferrous roll-off bin by forklift.

6.12 RDF Removal

A. + 6" material from Picking Station No. 2 and + 2" material from Picking Station No. 3 shall be combined prior to being conveyed to one of two compactors. The compactors shall operate alternatively to permit loading of one RDF trailer at a time. Each compactor shall be designed to load up to 25 tons of RDF into the self-unloading type trailers.

B. RDF shall be compacted prior to being loaded into the trailer.

C. The compactor/trailer interface shall be designed to eliminate spillage of material during the transfer.

6.13 Recyclable Removal

Recyclable products shall be removed in baled and biscuited form as well as in roll-off type bins. Separate loading docks shall be provided to accommodate each type of removal system.

6.14 Fines

Fines removed from Trommel No. 2 shall be conveyed to a roll-off bin on the existing tipping floor for truck removal to the land fill.

6.15 Dust Control

Both Trommels shall be held under negative pressure by means of an induced draft fan and baghouse system. Other dust generating points such as transfer points shall also be connected to the dust control system as required. Dust from the baghouse shall be directed to the fines roll-off bin. Cleaned air from the baghouse shall pass through an activated charcoal type filter for odor control prior to discharge to the atmosphere.

6.16 External to MRF

A. Weighing Station

1. The weigh station shall consist of one fully automated weigh scale and scale house. Trucks will be weighed after loading RDF fuel prior to transport to the EFG. Trucks carrying recycled products shall also be weighed. Scale shall have a gross capacity of 120,000 pounds and be furnished with a 70 foot platform.

2. The weigh station shall be provided with a computer suitable for monitoring and recording truck outflow. NEMA-4 magnetic

card readouts shall be provided for outgoing vehicles. Data to be recorded shall include the following as minimum:

a. Time and Date of Truck Loading
b. Net Weight of RDF or Recycled Product
c. Truck Identification Number
d. Minimum of 30 days of data storage

3. System shall provide a receipt to the trucker. Weigh system provided shall not require the presence of an operator/attendant at the weigh scale/weigh scale house.

B. Truck Scale House

1. One 10' x 10' x 8' (ceiling) scale house shall be provided. The scale house shall be insulated and shall include a wall-mounted air conditioner and heater.

2. Three sides shall contain a window area of at least 12 ft^2 each. One man-door with window shall be provided. The scale house shall include forty inches of countertop with shelves.

7.00 EQUIPMENT TO BE FURNISHED

7.01 The following equipment suppliers are acceptable to the Owner for the type of equipment indicated.

A. Trommels (min. 10' diameter)[(1)] - Triple/S Dynamics, Heil Engineered Systems, American Pulverizer.

B. Steel Apron Conveyors - Mayfran Inc., Rexnord, Hustler Conveyors

C. Rubber Belt Conveyors - Rexnord, Hustler Conveyors, Heil Engineering

D. Can Densifier & Balers - American Baler Company, Selco Corp., Mosley, CP Manufacturing, Bollegraaf

E. Plastic Perforator - Prodeva, CP Manufacturing, Bollegraff

F. Magnets - Eriez Magnetics, Dings Magnetics, Stearns Magnetic

G. Eddy Current Separator - NRT, Eriez Magnetics, Lindemann

H. Compactors - Harris, Amfab, Marathon Equipment

I. Baghouse and Fan (including Activated Charcoal Filter) - Staclean, American Air Filter, Busch

J. Truck Scale - Cardinali, Fairbanks

(1) Drum separator equipment as manufactured by National Recovery Technologies may be used in lieu of trommels.

K. Picking Stations - By Contractor

7.02 Conveyor characteristics shall be as designated below. All conveyors shall be provided with skirting as required. The conveyor numbers shown below correspond to the designations shown on the drawings.

Conveyor Number	Type	Belt Material	Cleated	Variable Speed Drive
C1	Horizontal	Steel	Yes	Yes
C1A	Inclined	Steel	Yes	Yes
C2	Horizontal	Steel	Yes	Yes
C3	Horizontal	Non-Metal	No	Yes
C3A	Horizontal	Non-Metal	No	Yes
C3B	Horizontal/Incline	Steel	Yes	Yes
C4	Inclined	Non-Metal	Yes	No
C4A	Inclined	Non-Metal	Yes	No
C5	Inclined	Steel	Yes	No
C6	Horizontal	Non-Metal	No	No
C7	Horizontal	Non-Metal	No	No
C8	Horizontal	Non-Metal	No	No
C9	Horizontal	Non-Metal	No	No
C10	Inclined	Non-Metal	Yes	No
C10A	Horizontal	Steel	Yes	Yes
C10B	Inclined	Steel	Yes	Yes
C11	Inclined or Horizontal	Metal	No	No
C12	Horizontal or Inclined	Metal	No	No
C12A	Horizontal or Inclined	Non-Metal	No	No
C-13	Chute	Metal	-	-
C-14	Chute	Metal	-	-
C-15	Inclined	Non-Metal	No	Yes
C-16	Horizontal	Non-Metal	No	No
C17	Horizontal	Non-Metal	No	Yes
C18	Horizontal or Inclined	Non-Metal	No	No
C19	Horizontal	Non-Metal	No	No
C20	Horizontal	Non-Metal	No	Yes
C21	Horizontal	Non-Metal	No	No
C22	Horizontal	Non-Metal	No	No

7.03 Contractor's design shall standardize components to the maximum extent possible. Conveyor widths for a type of belting or metal leafs shall be standardized to the extent practicable. Standardization shall include motor types, conveyor components, drive units etc., to reduce maintenance inventory requirements.

7.04 All non-metal conveyor belts shall be equipped with wing type self-cleaning tail pulleys with a minimum diameter of 18 inches.

7.05 No conveyor shall be provided with a drive motor of less than 1 HP.

7.06 Where practical, metal chutes may be substituted for conveyors.

7.07 Flop gates shall be provided with electric position switches for remote indication.

7.08 Multiple types of equipment (e.g. trommels, balers, compactors, etc.) shall be provided by a single manufacturer.

7.09 Separate paper and plastic balers shall be provided. Each of these balers shall be of the horizontal, open end, automatic wire tie type.

8.0 AUXILIARY SYSTEMS

8.01 Compressed Air

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

- Service Air/Automotive Air

B. The compressed air system shall consist of two compressors. 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.

B. 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. An air receiver, 300 gallon minimum, shall also be provided.

C. Controls shall provide for automatic unloading, shutdown, start-up and backup features.

D. The service air header pressure shall be controlled by the receiver pressure which is maintained by the load/no load type compressor regulator.

E. An air header shall be provided to conveniently locate connection points for building equipment maintenance. A gas station type air regulator shall be provided which shall permit selection of air pressure desired.

8.02 Lifting Equipment

A. The plant design shall include providing monorails and lifting devices to service heavy items of equipment such as Trommel screen plate and dust cover sections.

B. A 1-1/2 ton hoist and monorail shall be provided at Picking Station No. 1 to remove bulky items from the process stream.

9.00 BUILDING SERVICES

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

9.02 HVAC Systems

A. The Plant HVAC systems shall be designed to meet the criteria specified in Paragraph 9.03.

B. The MSW processing area shall be ventilated and kept under a slight negative pressure.

C. Roof mounted air conditioning units shall be provided for each picking station. Thermostatically controlled heaters shall be provided in each air conditioning unit to maintain the indicated temperature.

C. A zoned pressurized forced air HVAC system shall be provided to service the office and reception and viewing areas. The system shall allow for adequate make-up air and shall provide for adequate room humidity control. The HVAC unit shall be mounted on the roof of the Building.

D. Electrical equipment rooms and offices shall be pressurized to minimize dust and odor intrusion. Ducted exhaust fans shall be used in toilet areas and locker rooms.

E. Each trommel shall have a ducted exhaust system which shall be connected to a baghouse on the roof.

9.03 HVAC Design Conditions:

Area	Design Basis	
	Summer	Winter
Office, Reception and Viewing	78°F, 50 percent R.H.	70°F
Toilet Areas	Ventilated	70°F (Ventilated)
Locker Rooms	Ventilated	80°F
Switchgear Room	Ventilated	60°F
MSW Processing Area	Ambient Air	Ambient Air
Picking Station Enclosure	78°F	65°F

Minimum Ventilation Requirements

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

9.04 Plumbing

A. Potable Water

1. Potable water required for the plant will be supplied from the existing water service to the site.

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 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 area and in the lunch room.

4. Hose bibs shall be provided around the processing area to allow for hosing down the floor. Provide floor drains around the processing area to drain the area.

B. Sanitary Waste

Sanitary waste will connect to existing sewer line at the site.

C. Roof Drains

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

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

10.00 ELECTRICAL SYSTEM

10.01 General Description

A. The electrical system shall supply the electrical power required for the project. The existing overhead electrical service shall be modified to permit construction of the new building addition, a new pad-mounted transformer and distribution switchgear shall be installed and the existing switchgear shall be re-fed from the new service. Special systems shall include emergency lighting, telephone, computer, grounding, control and instrumentation.

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

10.02 Electric Service

A. The existing electric service shall remain energized but shall be modified by removing the existing poles and overhead feeder cables which will interfere with the new building construction. A temporary pole line with overhead feeders shall be installed to maintain power to the existing transformer. The existing underground high voltage and 480 volt feeders, pad-mounted transformer and temporary pole line shall also be removed after the new service is energized.

B. When the new transformer and switchgear is ready to be energized, the existing high voltage overhead feeder shall be extended to a new pole at which the feeder shall go underground to the new pad-mounted transformer.

C. Secondary feeders shall be installed underground to the new switchboard. The existing switchboard shall be provided with a new feeder from the new switchboard.

10.03 Metering

A. The existing metering system shall be disconnected and removed and all utility company equipment shall be returned.

B. New metering equipment shall be provided at the new service location to measure the amount of the power used by the entire facility.

C. Metering shall conform to the requirements of the local utility company.

10.04 Main Power Transformer

A. The main power transformer shall be a 15 kV class delta primary to 480/277 volt wye secondary oil-filled pad-mounted transformer.

B. The transformer shall be designed for continuous self-cooled operation.

C. The transformer shall be equipped with lightning arrestors and current transformers.

D. The transformer shall meet the requirements of ANSI C57.12.

E. The transformer shall be equipped with the following protective devices:

1. Oil level switch with alarm contact.

3. Building power and motors 3/4 horsepower and up shall be supplied from the 480/277 volt, 3-phase, 4-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.

10.06 Lighting

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

1. Outdoor Facilities:

Stairs and platforms	10 fc
Baghouse area on roof	10 fc
Loading dock	20 fc
Roadway and parking areas	1 fc
Weigh scale	20 fc

2. Indoor Spaces:

MSW processing area	30 fc
Maintenance shop and spare parts	30 fc
Locker rooms, toilets	20 fc
Electrical room	20 fc
Offices	70 fc

B. High pressure sodium type fixtures shall be used throughout the plant, except in the administration area, electrical room and maintenance shop where fluorescent type fixtures shall be used. 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 office area and MSW processing area.

10.07 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.

B. Provide a grounding system for the pad-mounted transformer which complies with the requirements of the local utility company.

C. Provide a ground conductor from the new switchgear to the locations indicated in the NEC Section 250-81 to ground the new service.

10.08 Communications

A. Telephone System

Telephone outlets shall be provided in the office areas and in the new scale house. All outlets shall be wired to a central location for connection to the Owner supplied telephone equipment. Extend the existing phone system from the existing service location to the new service location. 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.

C. Computer System

The Owner will provide a computer system for administrative purposes. The system shall be located in the office area. The Contractor shall provide 1" conduit to outlets in each office space and in the new scalehouse. 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.

10.09 Conduit

A. Underground conduit shall be a minimum of 1 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 shall 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).

10.10 Conductors

A. Single 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. 13.8 kV system - 15 kV, EPR, shielded with 133% insulation level and PVC jacket.

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

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

4. Control systems - 600 volt, Type THHN.

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

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

D. System Segregation and Separation

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

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

3. Control wiring shall 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 shall be run in raceways separate from power and control. A 3-inch minimum separation will be maintained between instrumentation and power raceways.

10.11 Motors

A. Motors 3/4 horsepower and up shall be three-phase, 460 volts, squirrel cage, induction type, supplied from the 480V MCC's or from equipment control panels.

B. Service factor for all motors shall be 1.15.

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

D. 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.

E. 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.

10.12 Heat Tracing

Electric heat tracing shall be furnished on all water and process lines located in the unheated space of the MSW processing area which can freeze. Self-limited heating cable shall be used and controlled by line sensing thermostats. Each system shall have visual or instrument indication of operation.

10.13 Television System

A. The in-plant television system shall provide for the following features. Individual cameras with zoom lenses shall be provided for the following areas:

1. Each Picking Station (three total)

2. Above the MSW reclaim conveyor

3. Above the RDF conveyor which feeds the main compactors

B. Two black and white monitor screens shall be provided, one in the Plant Manager's office and one in the Reception Area, with controls to permit fixed or variable point monitoring for each screen. Provide sequential switcher for automatic camera changing.

10.14 Welding Outlets

Provide six welding outlets, equally spaced, around the inside perimeters of the building.

11.00 INSTRUMENTATION AND CONTROLS

11.01 General

A. A modular, microprocessor-based, Central Control System (CCS) shall be provided for data handling, systems control, monitoring, recording, and alarming necessary for proper operation of the plant from a central control point.

B. The CCS shall control all analog and digital loops except those better suited to local controls or programmable controllers.

C. The CCS shall interface with programmable controllers and local control panels being used for system sequential control and interlocking.

D. For locally controlled systems, a minimum of one system trouble alarm is required. Interface to the CCS is required for alarm.

11.02 Control Hardware

A. Provide the following, separate from the CCS:

- Fire Alarms/Fire Control System

B. Provide programming terminal for Programmable Logic Controllers (PLC). Portable personal computer with vendor specific software packages is preferred.

C. Electronic signals shall be 4-20 MA or 1-5 VAC. Pneumatic signals shall be 3-15 psig.

11.03 MSW Handling System

A. This system shall be designed to operate from the central control panel. 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. Provide belt misalignment switches for conveyors with alarm. Provide loss of speed switch on each driven pulley with alarm.

C. Provide a local emergency stop pushbutton near each conveyor and other major pieces of equipment. Operation of a pushbutton shall stop the associated piece of equipment plus all equipment which feeds the stopped item. Equipment which moves MSW away from the stopped item shall remain in operation.

11.04 Documentation

Provide a functional written description of the control philosophy of all computer controlled systems (DCS, PLC, etc.)

12.00 CIVIL/STRUCTURAL

12.01 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 shall be removed and stockpiled for reuse. After completion, disturbed areas shall be regraded, loamed and seeded.

12.02 Roadways and Parking

A. The site roads, drives, and permanent parking areas shall be constructed as generally shown on the drawings. Access to all doors shall be paved. 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. All roads are to be geometrically designed to accept AASHTO WB-50 semi-trailer truck combinations.

C. Permanent parking areas shall be as designated on the conceptual arrangement drawing. Parking spaces are to be sized 9 feet by 19 feet.

D. Design speed 20 mph.

E. Design Grade:

1. Minimum	0.5 percent
2. Maximum	6.0 percent

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

12.03 Finish Grading and Landscaping

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

B. Minimum graded cross slopes shall be:

Grassed Areas:	4 percent
Paved Areas:	1 percent

12.04 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. Contractor shall be responsible for all foundation/footing design.

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

12.05 Building Structure

A. Superstructure - Structural steel frame of AISC, Type 2 construction with horizontal and vertical bracing systems for lateral stability of the building. Floors shall be of concrete slab, grating and/or checkered plate as required to suit operational and maintenance requirements.

12.06 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. "BOCA Basic National 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

12.07 Loads

A. Dead Loads: floor and roof loads shall include the actual weight of the floor and roof sub-systems, plus allowance for equipment loads and ductwork. The following minimum dead load shall be used.

1. Roof

a.	Roofing and Insulation	15 psf
b.	Metal Deck & Framing	10 psf
c.	Ductwork, Mechanical	15 psf
d.	Concrete Slabs	Self-weight
e.	Air Handling Units & Baghouse	Self-weight

2. <u>Floors</u>

a.	Supported Concrete Slab	Self-weight
b.	Grating - 1-1/4 x 3/16	10 psf
c.	Framing	15 psf
d.	Checkered Plate 3/8" Thick	17 psf
e.	Elec. Conduits, Lights, etc.	10 psf
f.	Ductwork, Mechanical	25 psf

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

1. Roof: A 50 psf general live load. Low roof adjacent to high roof will be designed for snow drifting in accordance with the requirements of BOCA.

2. Office Areas 100 psf

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

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

5. A "phantom" load of 5 kips minimum will be used on all beams in those areas of the facility where exact loadings are unknown at time of design. Beams and girders supporting heavy equipment (equipment weight equal to or greater than 50 kips) shall have minimum phantom load not less than 10% of the equipment load.

6. Equipment Loads: As required.

7. Hoist Girders: According to AISC requirements.

8. MSW Loads

   a. MSW Weight

      (1) 17.5 pcf for volume calculations

      (2) 25 pcf for weight calculations.

9. Loads for retaining walls:

   a. Soil Weight - 120 pcf (minimum)
   b. Horizontal Soil Pressure - 60 psf
   c. Vertical Surcharge - 500 psf
   d. Hydrostatic Loads - The design water table is approximately 6 feet below grade. (To be confirmed by the Contractor.)

10. Wind Loads

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

11. Seismic Design

    Seismic design shall be in accordance with the BOCA Basic Building Code for Zone 2.

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%

12.08 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. Piles: Pile type and capacity to suit geotechnical conditions and design loadings.

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

4. Backfill: Use excavated material to maximum extent, where suitable. Borrow 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: 4000 psi at 28 days

2. Concrete for slabs-on-grade: 4000 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

    1. A325 high strength bolts (marked as such)
    2. E70 welding electrodes

4. Deflection

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

    2. The lateral deflection of the building from wind loading shall be limited to maximum of 0.0025 x height of the structure.

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.

12.09 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 three 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
   Proportions of cement and aggregate
   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 <u>Tests on Structure (Nonconforming Test Results)</u>

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.

13.00 ARCHITECTURAL CRITERIA

13.01 General Description

A. The major architectural aspect of the project is the MRF Building which will be attached to the existing building and will house MSW processing equipment and the administration area which will house the offices, locker rooms, and the lunch room.

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

13.02 Architectural Analysis of BOCA Code

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

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

13.03 Building Materials

A. Exterior

1. Siding - Uninsulated metal panels
2. Roofs - Uninsulated metal panels.

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 - ceramic tile.

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

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

5. Standard floor finish in work areas shall be exposed concrete with a dry shake surface hardener

6. Office area floors shall be vinyl tile.

7. MSW processing floor shall be finished with a suitable material which experience has shown will withstand heavy vehicular traffic expected in the area.

C. Glazing

Windows shall be located in the office area to permit observation of the work area.

D. Doors

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

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

3. Roll-up doors shall be 16' wide by 14' high (min.).

13.04 Functional Layout

The building layout shall emphasize functional relationships of equipment, personnel circulation and access for servicing.

13.05 Synopsis of Required Spaces

A. Space Requirements

Function	Area, Ft^2	Elevation
Plant Manager	200	Mezzanine
Maintenance Superintendent	150	Mezzanine
Reception Area	275	Mezzanine
Lunch Room	175	Mezzanine
Storage Area	300	Ground
Electrical Room	300	Ground

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

B. Special Features

1. The Lunch Room shall be provided with a compact kitchen unit including cabinets, sink, range and refrigerator and space for vending machines.

2. Locker Rooms

a. Men's room contains 3 showers, 1 water closet, 2 urinals, 2 lavatories and 24 pair of half lockers.

b. Women's room contains 3 showers, 3 water closets, 2 lavatories and 24 pair of half lockers.

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

4. Facilities for public viewing of the work area shall be provided. Viewing areas shall be provided from within the office area and from an elevated walkway which is open to MRF processing area. Access to the viewing area shall not require ingress to the processing floor.

13.06 <u>Painting</u>

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.

13.07 <u>Access Platforms</u>

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

Picking Stations
Trommels

B. Picking stations shall be directly accessible from the mezzanine level.

14.00 OWNER SUPPLIED EQUIPMENT AND MATERIALS

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

14.02 <u>Stationary Equipment</u>

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

B. Machine shop tools.

C. Telephone equipment and handsets.

D. Personal and office computers.

14.03 Vehicles

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

- Front-End Loader
- Forklift
- Tractors/Trailers
- Pickup Truck/Service Vehicle
- Roll-Off Container Truck
- Street Sweeper

14.04 Movable Equipment

A. Roll-Off Containers (20 cu. yd. min.)

B. Tote Bins (self-unloading, 1 cu. yd.)

14.05 Test Material

A. All MSW material used for testing and initial operation.

B. Disposal of all materials used during testing.

15.00 SPARE PARTS AND SPECIAL TOOLS

15.01 General Spare Parts

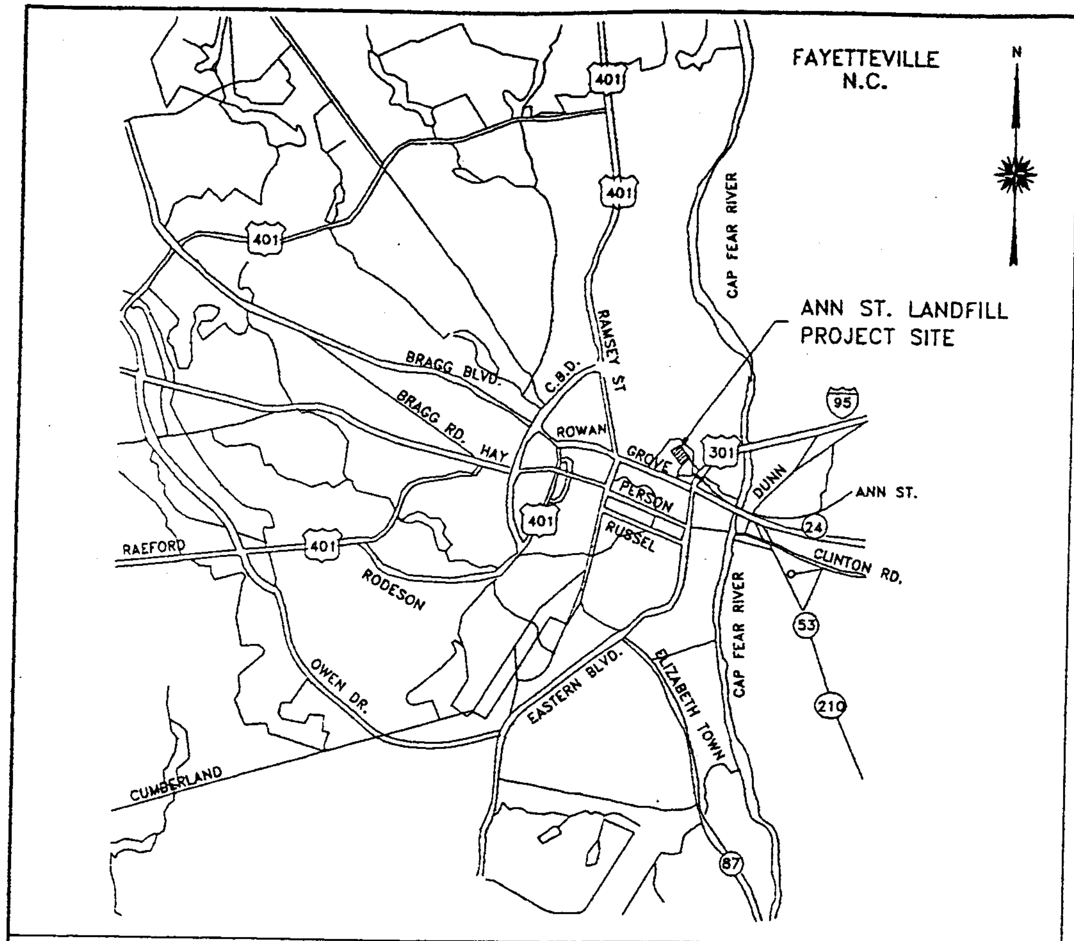
A. The Contractor's procurement specifications shall request the bidders to provide a recommended spare parts list and price sheet with their bid on the equipment. This information shall be provided to the Owner at the time an equipment purchase order is issued. The Owner shall purchase spare parts from 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.

15.02 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.

3



SITE LOCATION PLAN

BCH ENERGY
LIMITED PARTNERSHIP
HOUSTON, TEXAS

MATERIAL RECOVERY FACILITY
ANN STREET LANDFILL

PREPARED BY

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

TRI-MONT DRAWING NO.	TITLE
D-071-02-T1	TITLE SHEET
D-071-02-C1	EXISTING SITE PLAN
D-071-02-C2	EXISTING TOPO PLAN
D-071-02-C3	PROPOSED SITE PLAN
D-071-02-C4	PROPOSED TRAFFIC PATTERN
D-071-02-M1	SCHEMATIC DIAGRAM MATERIALS RECOVERY SYSTEM
D-071-02-M2	MASS FLOW DIAGRAM WITH BULK PAPER SORTING
D-071-02-M3	MASS FLOW DIAGRAM WITHOUT BULK PAPER SORTING
D-071-02-M4	GENERAL ARRANGEMENT PLAN - GROUND FLOOR
D-071-02-M5	GENERAL ARRANGEMENT PLAN - MEZZANINE
D-071-02-M6	ROOF PLAN - VENTILATION
D-071-02-E1	ELECTRICAL ONE LINE DIAGRAM

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/24/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

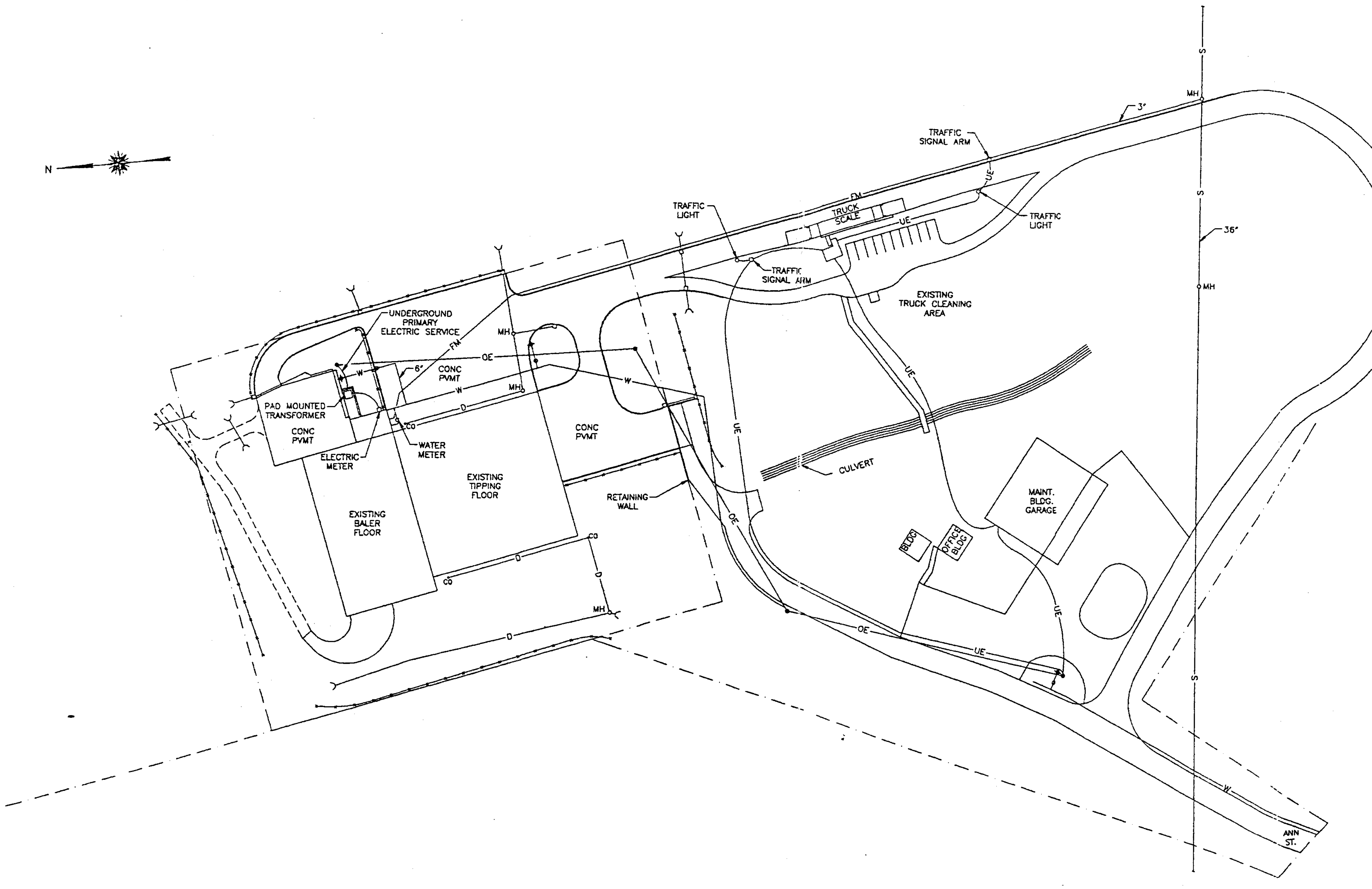
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIAL RECOVERY FACILITY

Title TITLE SHEET

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale	Job No.	Drawing No.	Rev. No.
NONE		D-071-02-T1	B



LEGEND

—FM—	FORCED MAIN SANITARY SEWER
—S—	SANITARY SEWER
—W—	WATER
—UE—	UNDERGROUND ELECTRIC
—OE—	OVERHEAD ELECTRIC
	6' HIGH REFUSE FENCE
	FIRE HYDRANT
	GATE VALVE
—D—	STORM DRAIN
CO	CLEANOUT
	CATCH BASIN
	8"x12" NC DOT CURB
MH	MANHOLE
	ELECTRIC/TELEPHONE POLE
	NEW CONSTRUCTION AREA

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/24/92	FJT
	REVISIONS			

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title

EXISTING
SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/30/92	Approved		
Checked	TOMASZYCKI	6/30/92	Approved		
Approved	G.J. CAHILL	6/30/92	Approved		

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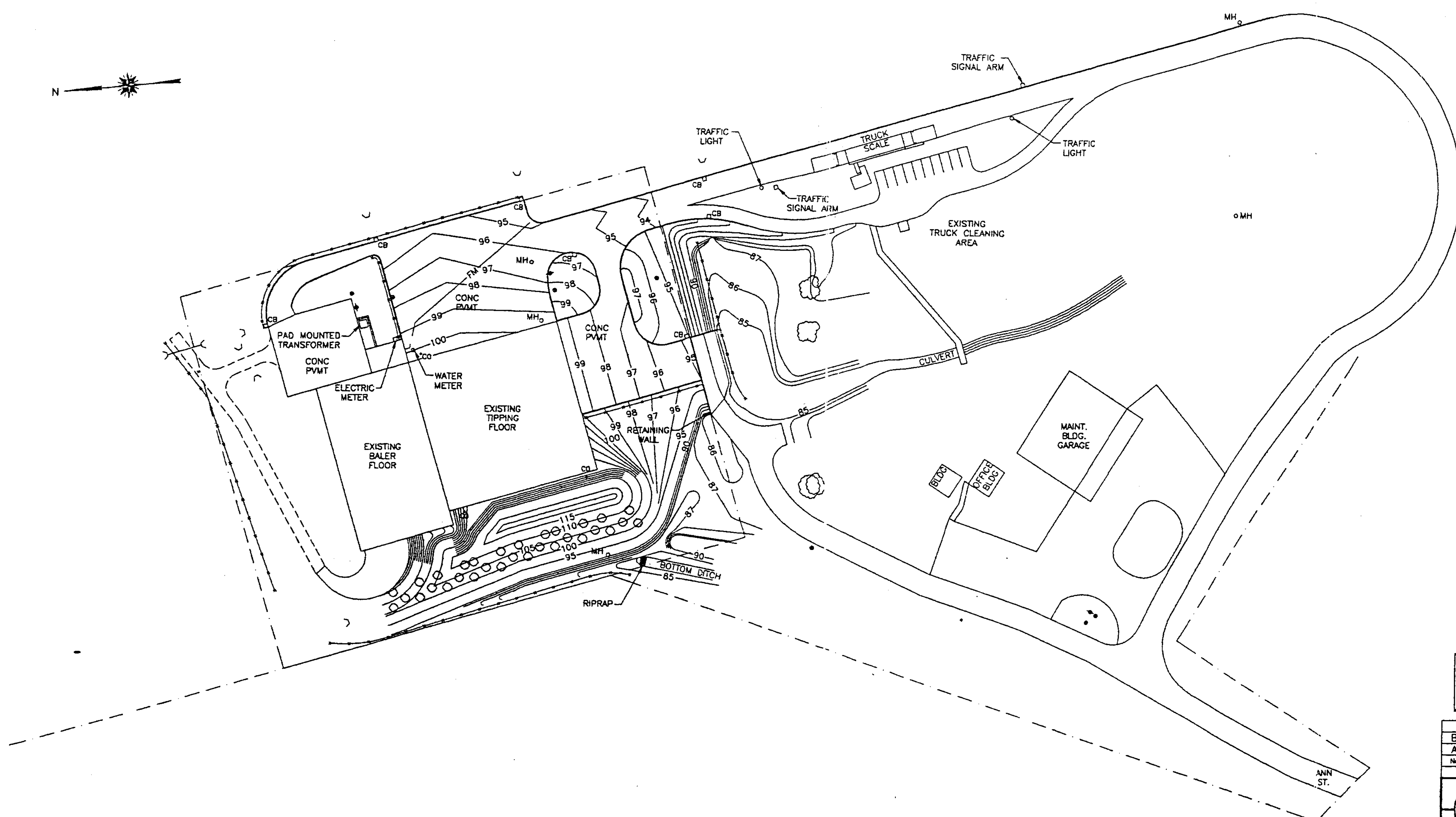

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A	FOR REVIEW	JRT	7/24/92	FJT

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title

EXISTING
TOPO PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/30/92	Approved		
Checked	TOMASZYCKI	6/30/92	Approved		
Approved	G.J. CAHILL	6/30/92	Approved		

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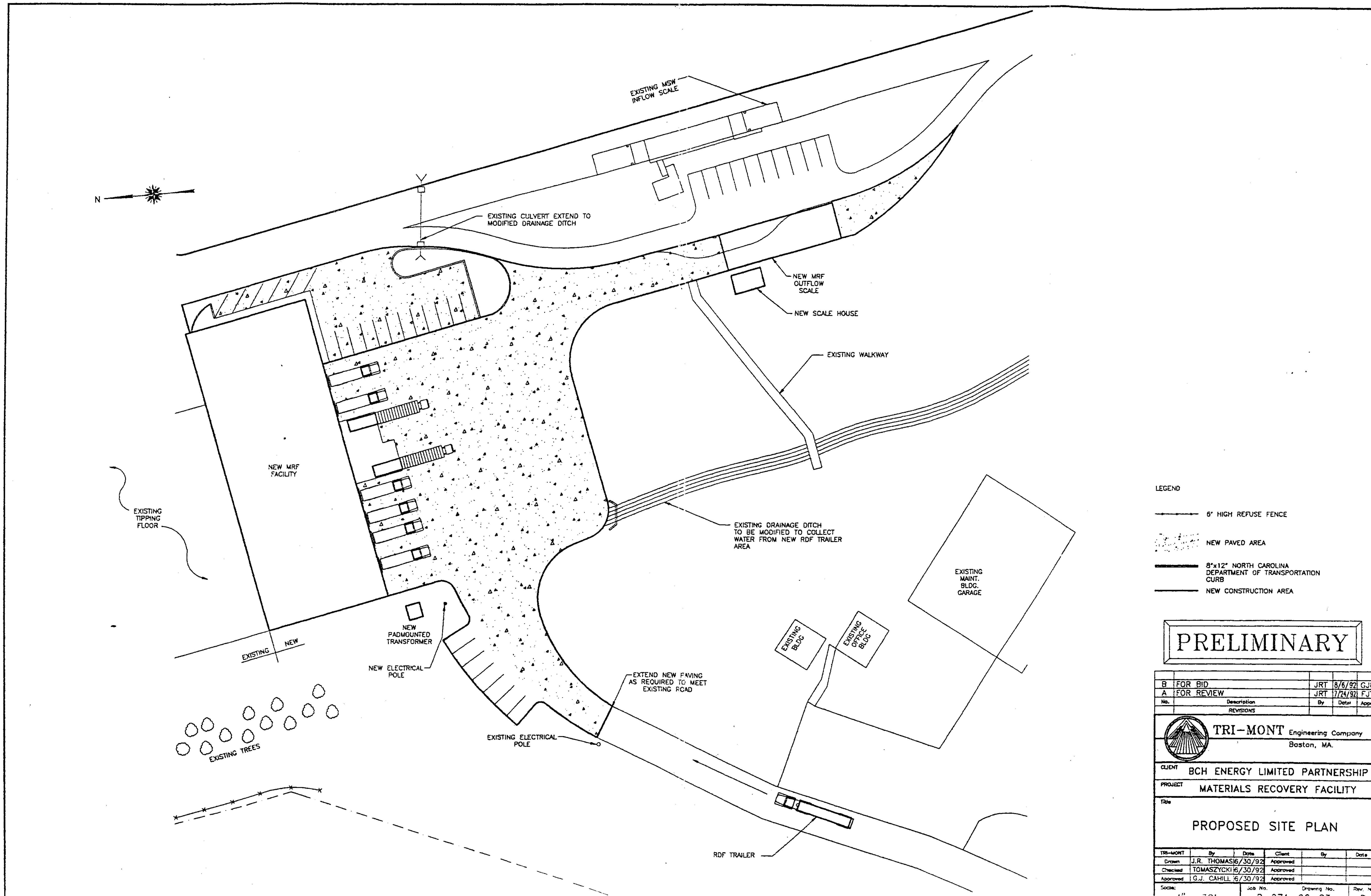

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A	FOR REVIEW	JRT	7/24/92	FJT
	REVISIONS			

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title

PROPOSED SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/30/92	Approved		
Checked	TOMASZYCKI	6/30/92	Approved		
Approved	G.J. CAHILL	6/30/92	Approved		

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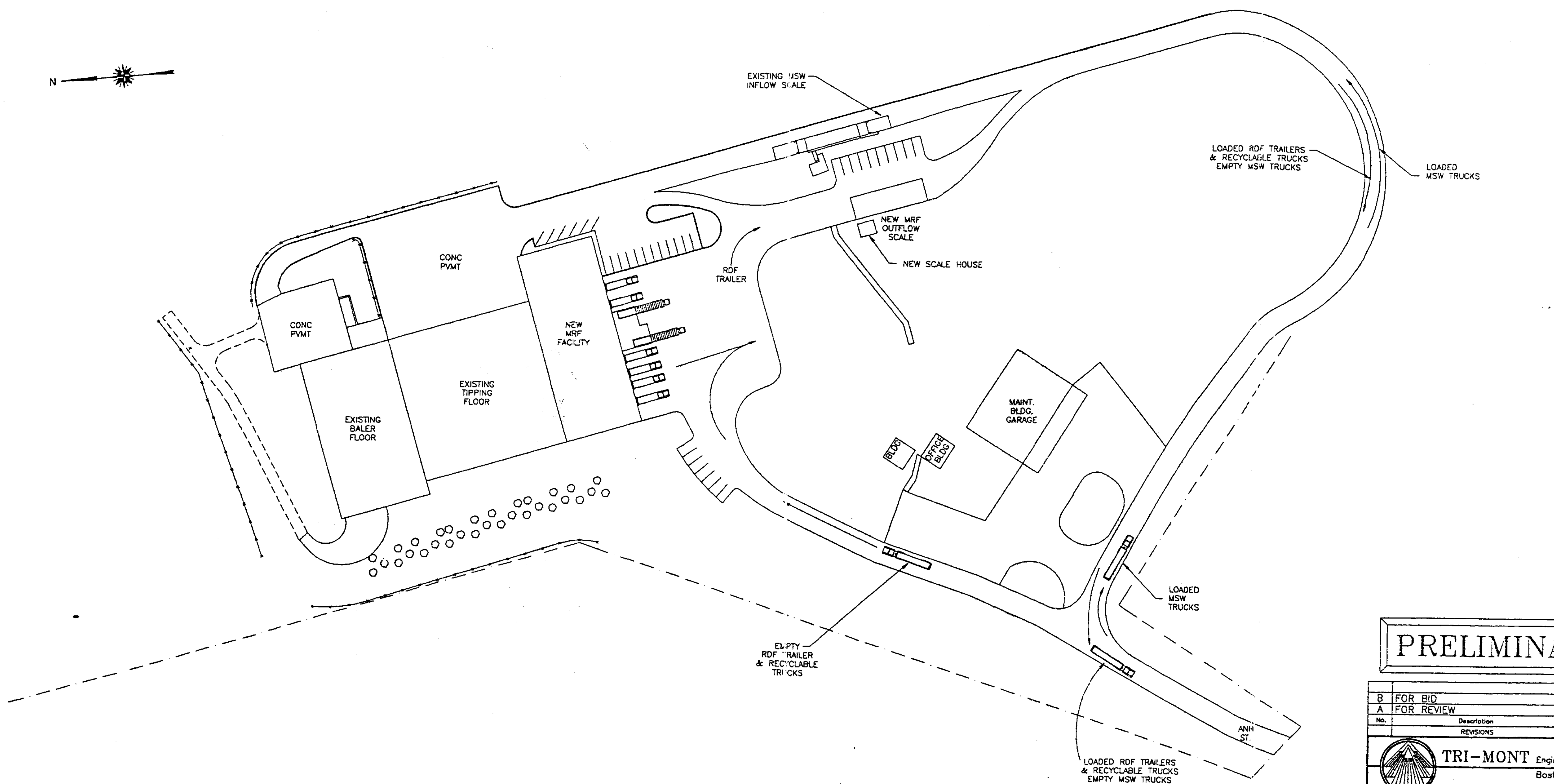

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A	FOR REVIEW	JRT	7/24/92	FJT

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title

PROPOSED TRAFFIC PATTERN

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/30/92	Approved		
Checked	TOMASZYCKI	6/30/92	Approved		
Approved	G/J/ CAHILL	6/30/92	Approved		

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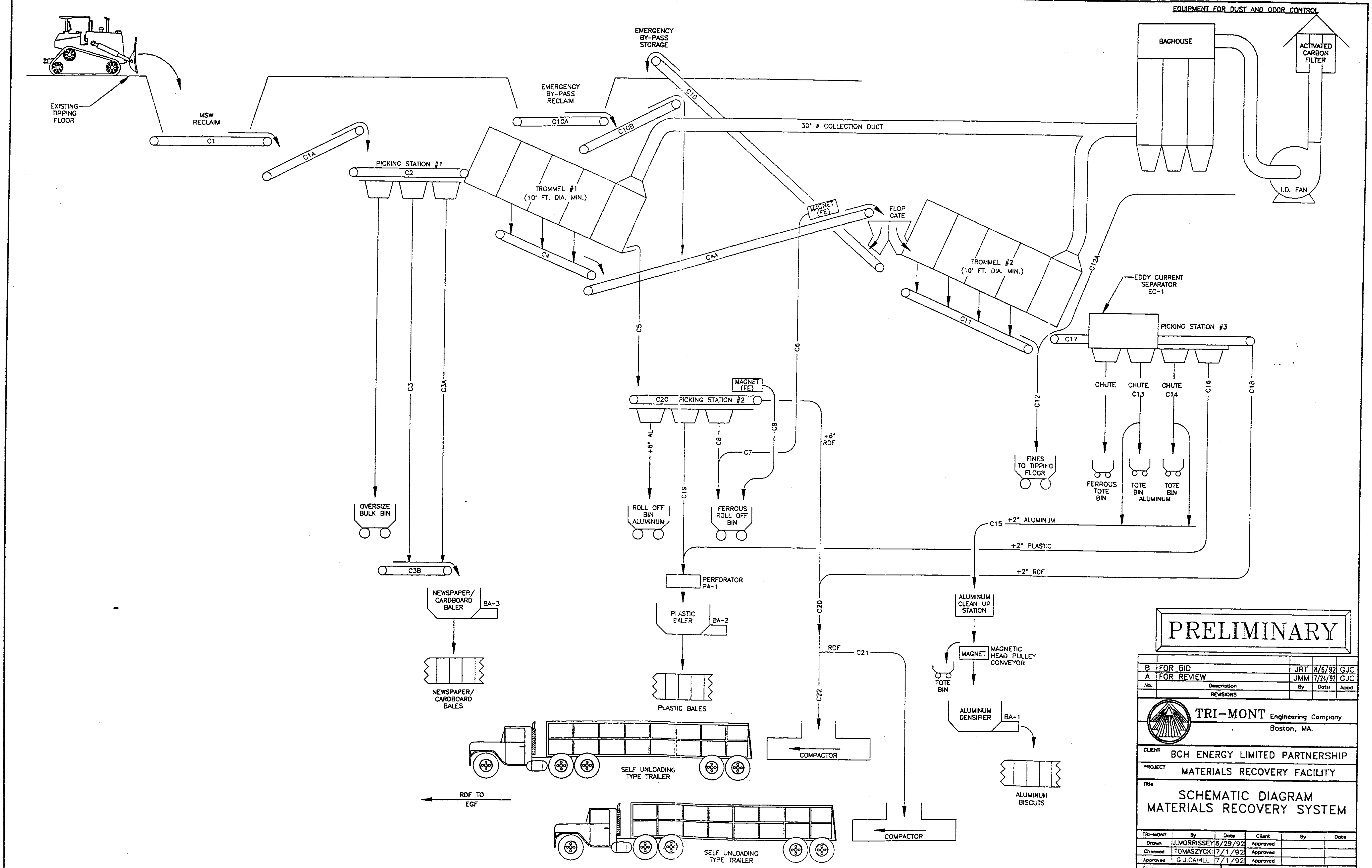

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JMM	7/24/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title SCHEMATIC DIAGRAM MATERIALS RECOVERY SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.MORRISSEY	6/29/92	Approved		
Checked	TOMASZYCKI	7/1/92	Approved		
Approved	G.J.CAHILL	7/1/92	Approved		

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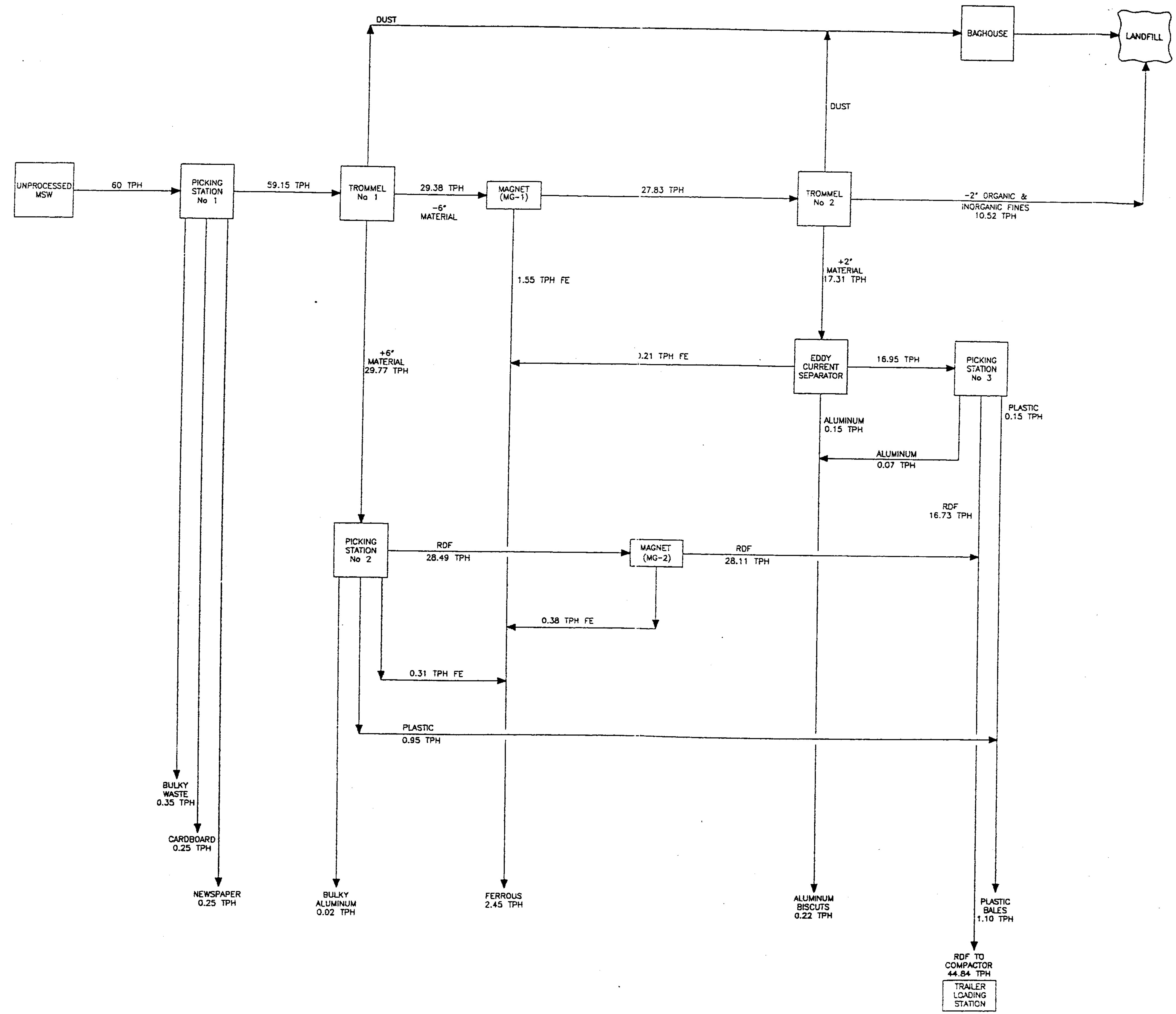

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JMM	7/24/92	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIAL RECOVERY FACILITY

Title MASS FLOW DIAGRAM WITH BULK PAPER SORTING

TRI-MONT	By	Date	Client	By	Date
Drawn	J.MORRISSEY	7/17/92	Approved		
Checked	G.MORIN	7/17/92	Approved		
Approved	G.J. CAHILL	7/17/92	Approved		

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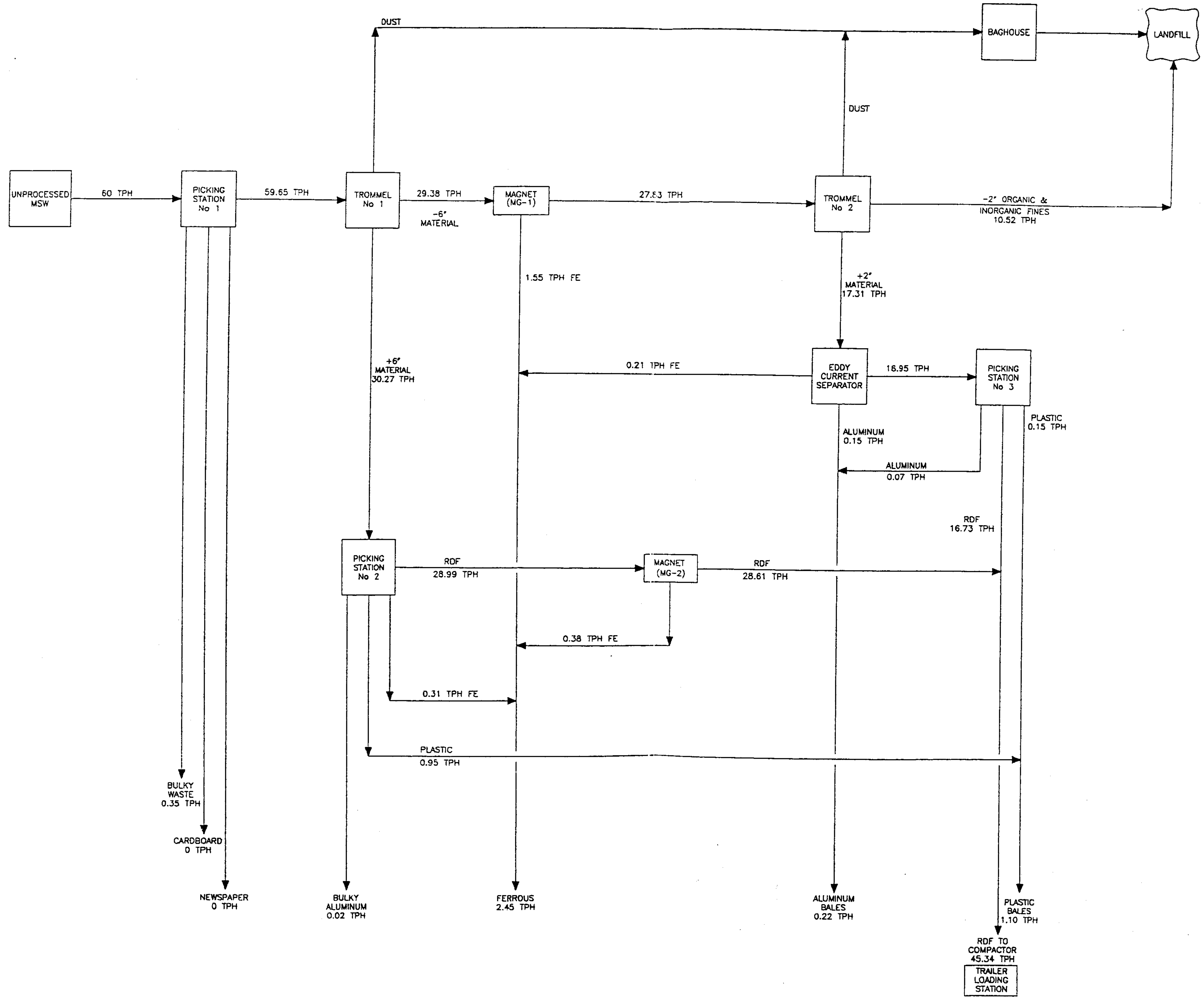

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JMM	7/24/92	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIAL RECOVERY FACILITY

Title MASS FLOW DIAGRAM WITHOUT BULK PAPER SORTING

TRI-MONT	By	Date	Client	By	Date
Drawn	J.MORRISSEY	7/17/92	Approved		
Checked	G.MORIN	7/17/92	Approved		
Approved	G.J. CAHILL	7/17/92	Approved		

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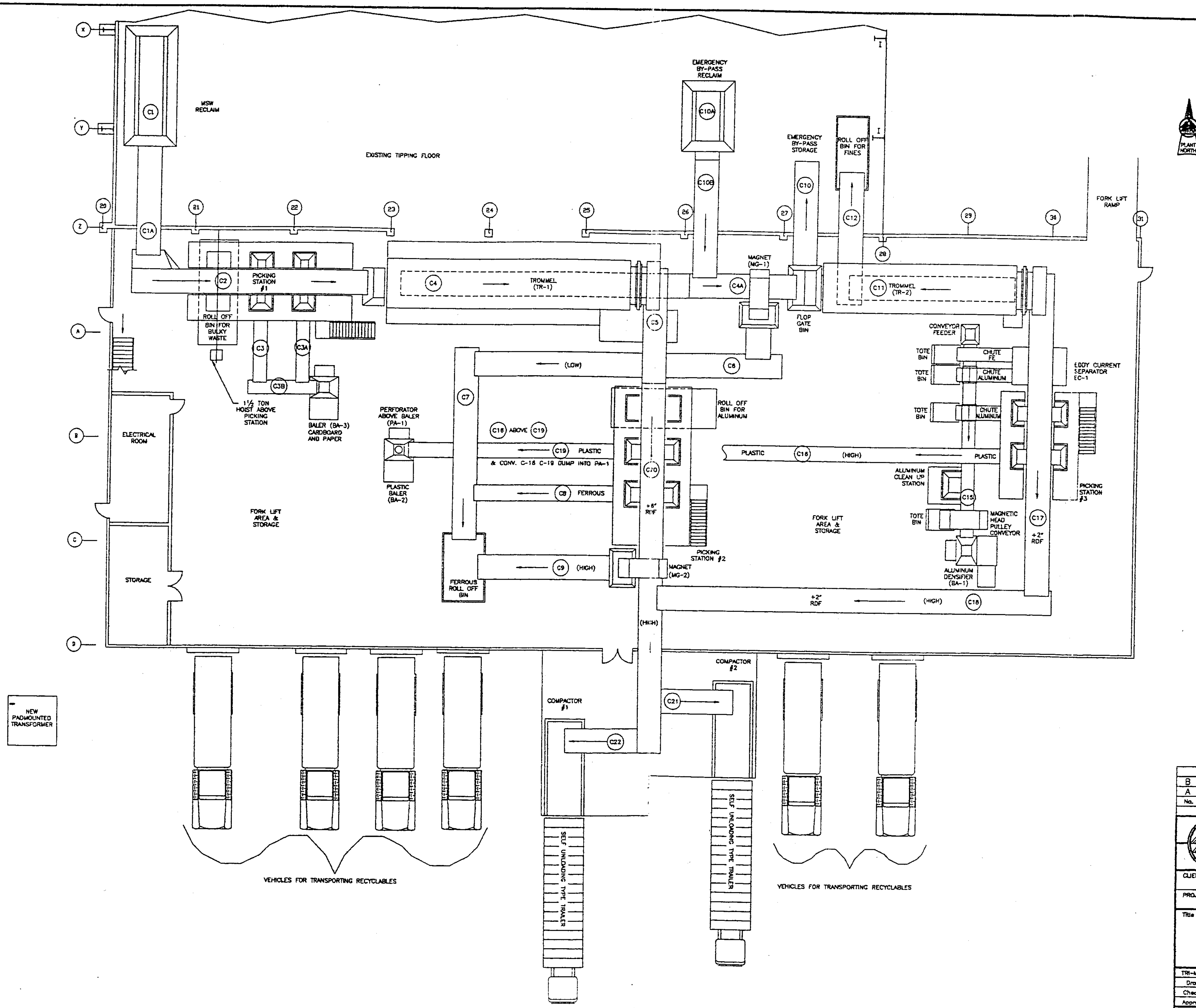

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	J.R.T.	7/24/92	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT: BCH ENERGY LIMITED PARTNERSHIP

PROJECT: MATERIALS RECOVERY FACILITY

Title: GENERAL ARRANGEMENT PLAN-GROUND FLOOR

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/25/92	Approved		
Checked	TOMASZYCKI	6/25/92	Approved		
Approved	G.J. CAHILL	6/25/92	Approved		

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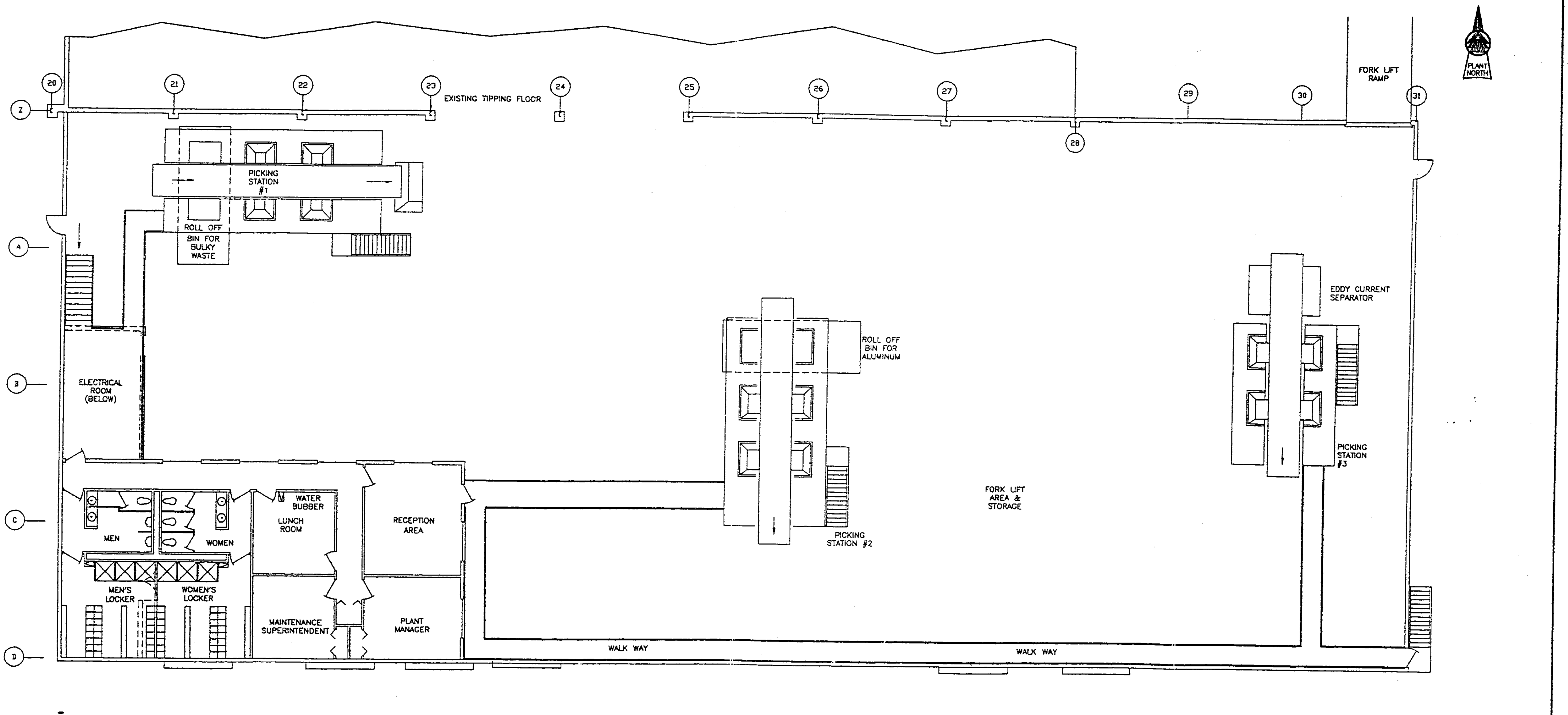

PRELIMINARY

No.	Description	By	Date	Appd
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A	FOR REVIEW	J.R.T.	7/24/92	G.J.C

REVISIONS

TRI–MONT Engineering Company
Boston, MA.

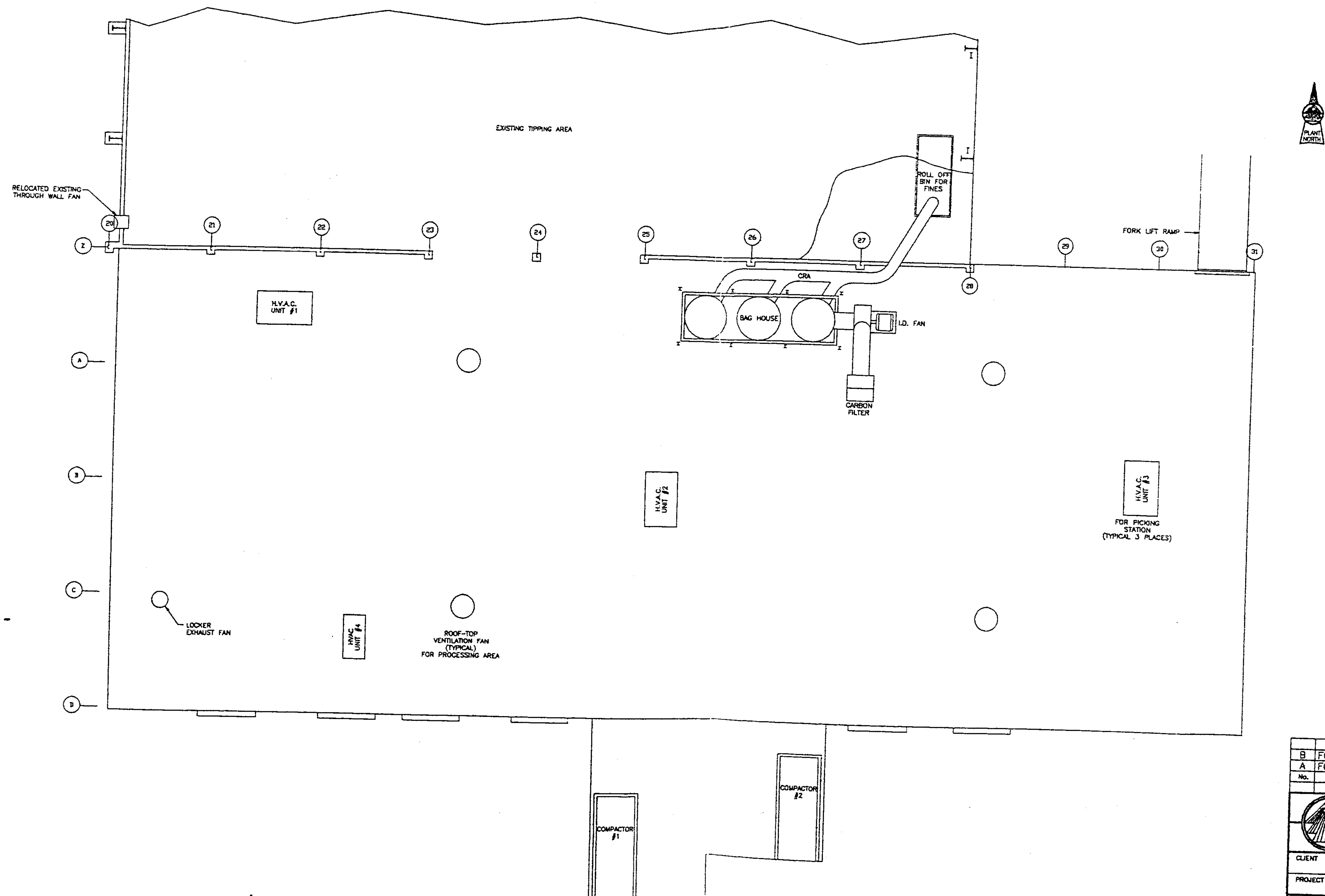
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title GENERAL ARRANGEMENT PLAN MEZZANINE

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/25/92	Approved		
Checked	TOMASZYCKI	6/25/92	Approved		
Approved	G.J. CAHILL	6/25/92	Approved		

Scale: 1/8" = 1' | Job No. | Drawing No. D-071-02-M5 | Rev. No. B



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	J.R.T.	7/24/92	G.J.C

REVISIONS

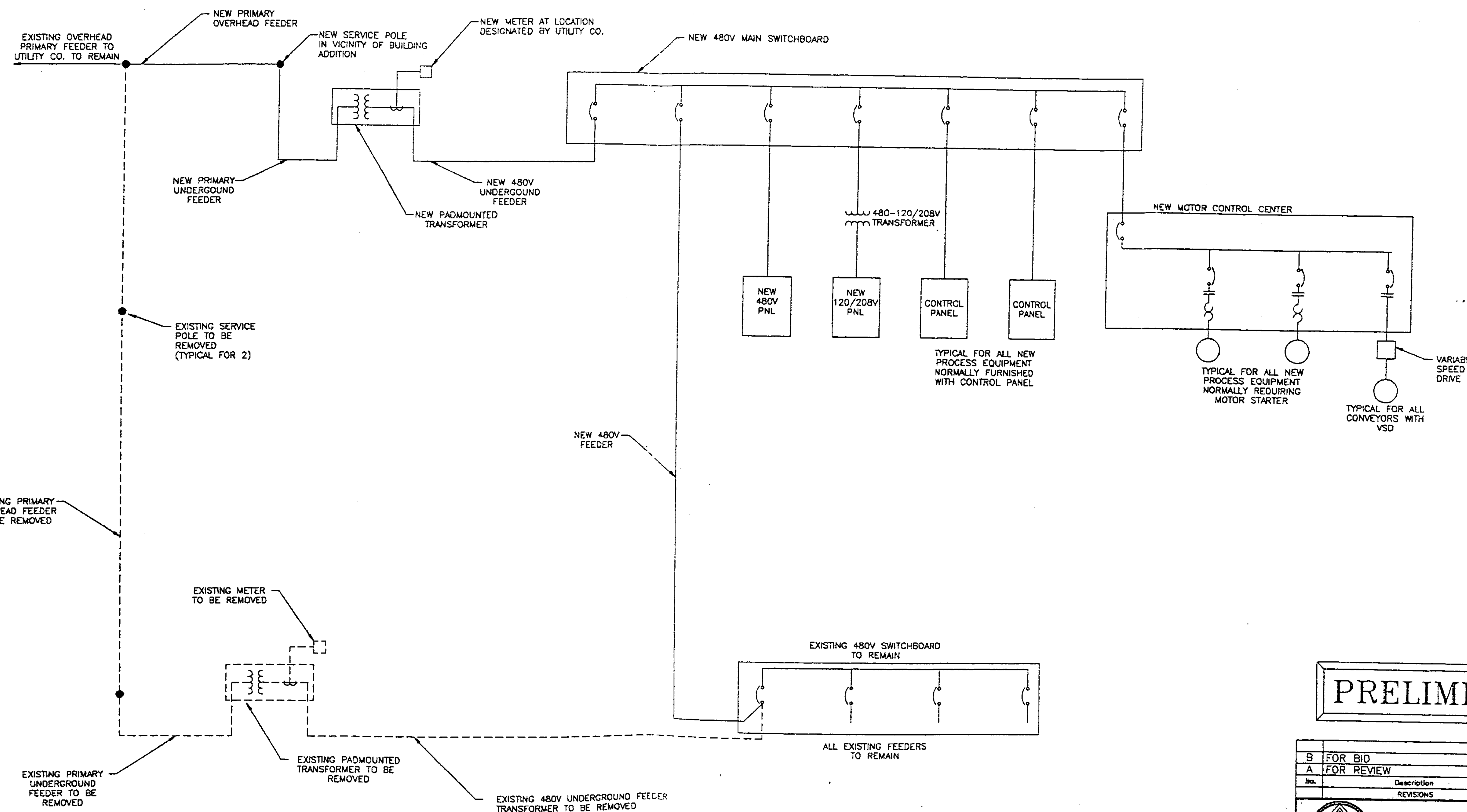
TRI-MONT Engineering Company
Boston, MA.

CLIENT: BCH ENERGY LIMITED PARTNERSHIP

PROJECT: MATERIALS RECOVERY FACILITY

Title: ROOF PLAN VENTILATION

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/25/92	Approved		
Checked	TOMASZYCKI	6/25/92	Approved		
Approved	G.J. CAHILL	6/25/92	Approved		



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/24/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT MATERIALS RECOVERY FACILITY

Title ELECTRICAL ONE LINE DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	7/21/92	Approved		
Checked	TOMASZYCKI	7/21/92	Approved		

4

ENERGY GENERATING FACILITY

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.

1.03 The project consists of two separate facilities located approximately 25 miles from one another all as described in SECTION 0040, Project Summary. One plant is designated as a Material Recovery Facility (MRF) and is covered in SECTION 0055 and the other 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. Designs proposed shall permit rapid and easy operator exit in the event of serious equipment malfunction. Systems, equipment, material handling systems proposed shall have had at least three years operating experience.

1.05 The major design objectives of the EGF using Refuse Derived Fuel (RDF) are to:

A. Provide the capability to supply 0-100,000 lbs/hr of turbine extraction steam at 275 psig, 414°F to Du Pont's Fayetteville Plant, 24 hours/day, 7 days/week.

B. Provide the capability to supply 0 to 11 MW to Du Pont's Fayetteville Plant, 24 hours/day, 7 days/week.

C. Operate in a full condensing mode with excess power delivered to Carolina Power & Light.

2.00 DESCRIPTION OF EGF

2.01 The EFG is located on approximately 11 acres of land in the E.I. Du Pont's industrial facility. The major purpose of the EGF facility is to provide steam and electrical power to E. I. Du Pont. Major equipment includes two RDF fired bubbling fluidized-bed type steam generators, baghouse for each steam generator, one steam turbine generator and associated auxiliaries, boiler water treatment facility, cooling tower, ash silo, controls and all associated electrical components. Approximately 188,000 tons/year of RDF will be delivered to the EGF (from the MRF) where it will be finally processed for combustion in the steam generators. Materials handling

handling equipment shall be provided to off-load RDF and convey it to the steam generators fuel feed system. Areas shall be provided for parking of RDF trucks. Sanitary facilities shall be provided for truck drivers delivering RDF to the EGF.

3.00 BASIS OF EGF OPERATION

3.01 The EGF shall be designed 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 400 hours.

3.02 The Energy 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 turbine-generator 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 turbine-generator to operate continuously at 5% above its rated steam throttle pressure and with its throttle valves wide open (5% OP, VWO).

3.04 In addition to permitting 5% OP, VWO operation, 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

3.05 In the event that neither the electric generation nor the steam available from the EGF is not required by E. I. Du Pont, RDF will continue to be delivered to the EGF as required by contracts between BCH Energy Corporation and Bladen, Cumberland and Hoke Counties. EGF operation shall continue at full firing rate with steam directed to a dump condenser as later described herein.

3.07 The Contractor shall provide design margins on pollution control equipment to permit full operation of the plant within permit limits over its entire life. 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 For purposes of design, the ambient dry bulb temperatures used shall be:

92°F - Maximum
22°F - Minimum

4.03 Design wet bulb temperature shall be 76°F.

4.04 Design for wind shall be in accordance with BOCA Code. Design wind velocity is 90 miles per hour.

4.05 Design for snow loading shall be 20 pounds per square foot in accordance with BOCA Code for snow load. **Minimum depth of cover for underground piping is 3 feet.**

4.06 Site drainage shall be designed for 100-year storm.

4.07 Seismic design for all buildings, structures and components shall be in accordance with BOCA Code for earthquake loads. Site is located in Seismic Risk Zone 2.

4.08 Site elevation is approximately 218 ft above mean sea level.

4.09 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 100 ft radius of the position shown on the Site Plan (Drawing D-071-01-C2).

4.10 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.

4.11 Borings shall be taken at site by the Contractor. For bidding purposes, foundation shall be based on soil loading of 4000 pounds per square foot.

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 will 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 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 Condensers
  b. Standards for Deaerators

- American Petroleum Institute (API)

  a. Std. 613 - Standard for Special Purpose Gear Units
  b. Std. 650 - Welded Steel Tanks for Oil Storage

- 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)
- Cooling Tower Institute (CTI)
- Conveyor Equipment Manufacturers Association (CEMA)
- Industrial Gas Cleaning Institute (IGCI)
- Basic National Building Code (BOCA)
- Uniform Building Code (UBC)
- Instrument Society of America (ISA)
- Environmental Protection Agency (EPA)
- Occupational Safety and Health Administration (OSHA)
- State of North Carolina Building Codes

  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 TURBINE GENERATOR AND AUXILIARIES

6.01 Components

A. The steam turbine generator shall be a multi-valve, double extraction, condensing type unit. One extraction shall be automatic and the other non-automatic. Generator may be coupled to turbine, either directly or by gear reducer.

B. The turbine generator package shall consist of the following as a minimum: steam turbine, stop valve, throttle valves, inlet steam chest, lube oil system, water to air-cooled generator, excitation system, gland seal system, electrohydraulic control system, extraction non-return valves for extraction points, turning gear, exhaust hood diaphragm and exhaust hood spray system for low load operation, insulation blanket and oil purification equipment as required.

C. The turbine generator shall be capable of operation at constant speed in parallel with the Du Pont (utility) system controlling the frequency or isolated from the Utility at 60 Hz.

6.02 General Turbine Design

A. The turbine throttle flow shall be set so that the facility will be turbine limited. Therefore, the maximum design throttle flow shall be set above the MCR rating of the steam generator. The exhaust hood and blading of the turbine shall be sized to permit 1.5" HgA operation.

B. The turbine inlet steam chest shall be designed for maximum boiler pressure corresponding to safety valve set pressure plus accumulations.

C. Steam purity delivered to the turbine shall be limited to 200 ppb of dissolved solids.

D. Turbine shall be arranged for a bottom, axial or top discharge exhaust.

E. The turbine shall be capable of operating without damage at an inlet pressure and temperature in excess of design maximum inlet steam pressure and temperature in accordance with NEMA standards.

F. All parts which are subject to temperature changes shall be designed and supported so as to permit free expansion and contraction in order to minimize distortion or misalignment.

G. The casing shall be horizontally split and supported at the centerline, with flexible supports at the high pressure end.

H. The main horizontal joint shall be steam tight. There shall be no vertical joints with pressures in excess of 100 psig.

I. The rotor shall be of forged construction with wheels keyed to the shaft or forged integrally with shaft, as required by design operating conditions. Dovetailed grooves shall be turned in the wheels to securely hold the individual blades.

J. A grounding device shall be provided between the stationary and rotating parts of the turbine to prevent the flow of shaft currents between the rotor and the bearings.

K. The turbine blading shall be stainless steel and shall be securely and adequately anchored and shall be readily renewable. Welding of blading to wheel disc will not be acceptable in any stage.

L. All diaphragm blading shall be of stainless steel.

6.03 Turbine Trip and Control Valves

A. The unit shall be equipped with a stop valve, which shall include provisions to actuate the main circuit breaker when the valve is closed. On-line testing shall be included to check the trip valve stem movement while the turbine is running. Control solenoid for trip valve to have 125V D.C. coil. Stop valve will isolate the turbine from the boiler during start-up and provide for emergency overspeed trip following loss of electrical load.

B. Vertical support for the valve shall be supplied, if required.

C. A removable corrosion-resistant integral strainer shall be furnished with the stop valve. A temporary fine mesh strainer shall be furnished for use during start-up.

D. All of the valves, valve stems, and valve seats shall be made of corrosion and erosion-resistant materials which have been proven suitable for successful operation and durability in similar applications.

E. Blowdown provisions for cleaning inlet piping shall be provided with the stop valve.

F. The automatic governor controlled steam inlet valves shall be multiple venturi type. Single control valve design shall not be allowed.

6.04 Shaft Sealing

A. The shaft packings shall be of the spring backed labyrinth type. They shall be supported so that their movement relative to the shaft will be minimized.

B. A complete gland evacuation system with gland condenser shall be furnished. The system shall be designed for the complete condensation and removal of all surplus leak-off steam, and under no conditions shall steam be discharged into the turbine room.

6.05 Turbine Governing System

A. A turbine speed control system shall be supplied, which shall automatically regulate the steam flow to the turbine through the governing system. The speed control system shall be furnished with speed/load control adjusting devices. It shall meet NEMA "D" requirements as a minimum. In the event of an instantaneous change from full load (with maximum extraction) to no load, the speed governing system shall prevent any overspeed trip.

B. In addition to the turbine speed control system, a separate quick-acting emergency governor shall be furnished that shall cause steam flow to be shut off to the unit when it reaches approximately 10% overspeed but can be reset when the speed is reduced to approximately normal. The emergency governor shall be of the type which can be tested at no load. One mechanical and one electric overspeed trip shall be provided.

6.06 Bearings

A. All bearings must be split to permit removal of the upper half for inspection without removal of the turbine casing and must be removable without removing the rotor.

B. All main bearings shall be provided with a positive visual check for oil flow through the bearings via sight flow indicators.

C. A double acting tilting pad, multi-segment thrust bearing shall be provided to align and maintain the correct axial relationship between the rotating and the stationary parts.

D. All bearings shall be provided with temperature and vibration monitors which input to the control system.

6.07 Hydraulic and Lubrication System

A. A combined hydraulic and lubricating oil console, skid mounted shall be furnished to provide hydraulic fluid to turbine control and emergency trip system and lubricating oil to the turbine and generator bearings.

B. The hydraulic and lubrication system shall include the following:

1. A full size oil reservoir with minimum three (3) minute retention time and level indicator to alarm at high and low levels. Provisions for draining and cleaning shall be provided. A reservoir heater shall be provided.

2. Twin oil coolers with transfer valve. Each cooler shall have 100% cooling capacity when supplied with 100°F cooling water, which shall have a pressure not-to-exceed 150 psig. Cooler tubing shall be stainless steel.

3. Twin oil filters with transfer valve shall be provided. Filtration level shall be 10 microns (max.).

4. Two full size, 100% system capacity A.C. motor-driven pumps shall be provided so that the main pump has at least one backup. A D.C. emergency pump for coast down will also be supplied.

5. Provisions for remote tripping of lubrication pumps in the event of a fire emergency.

6. A suction strainer on each pump, a bearing pressure regulator, and low bearing pressure alarm and trip switches.

7. Solenoid trip with low oil pressure trip to shut trip and control steam valves when hydraulic pressure is low (and non-return valves when applicable).

8. Provisions for testing backup and D.C. emergency pump via their associated pressure switches.

9. Stainless steel lube oil supply piping between the filter and the turbine.

C. Instrumentation at the lube console shall be included for the following:

1. Temperature indication in and out of oil coolers.

2. Bearing oil pressure indication.

3. Control oil pressure indication.

4. Differential pressure switch for oil filter alarm.

D. The oil console shall be prefabricated, prepiped and prewired to minimize installation time. All piping connections and wiring connections shall terminate on exterior of the console. All wiring connections except for motors shall be made at terminal strips in junction boxes.

6.08 Water Induction Prevention

A. ASME Standard No. TWDPS-1 entitled "Recommended Practices for the Prevention of Water Damage to Steam Turbines used for Electric Power Generation" and specific turbine generator manufacturer's recommendations shall be followed to prevent water from entering the turbine.

B. All drain lines and drain valve ports shall have an inside diameter of not less than one inch to minimize risk of plugging by foreign material.

C. Power actuated valves shall be located in the main steam line drains, turbine drains, extraction line drains and exhaust line drains. Valves shall open automatically on a turbine trip and be remotely operated from the control room. These power actuated valves are to be used for start-up, shutdown and no-load operation. Steam traps in parallel with the power actuated valves in the steam line drains shall provide draining for steady state operation.

D. Drip pots shall be located at all low points of the main steam extraction lines both before and after non-return valves and exhaust lines. The drain lines from these drop pots shall slope continuously to their terminal points and shall run independently to the terminal receiver. Level sensing on the drip pots shall activate the power drain valves on high level. There shall be control room indication of drain valve position.

E. A power-operated block valve shall be installed in series with the superheater attemperating water control valve. The block valve shall provide tight shutoff to prevent water leaking past the control valve and shall provide a backup if the spray control valve fails to close when required.

F. The extraction lines and feedwater heaters shall be designed such that no single failure of equipment results in water entering the turbine. Two independent means of automatically preventing water from entering the turbine from the extraction system shall be provided as follows:

1. An automatic heater drain system that drains directly to the condenser on high level in the heater.

2: Automatic shut-off valves in the extraction steam line between the feedwater heater and the turbine.

G. Lines feeding steam to the steam seal system shall be pitched towards the source of steam.

H. Steam seal lines between the turbine and gland steam condenser shall be pitched towards the condenser.

6.09 Turbine Overspeed Protection

A. An independent emergency overspeed trip device which acts at 10% overspeed closes all steam admission valves and the main turbine stop valve shall be provided.

B. In accordance with turbine generator manufacturer's requirements, the turbine must be protected against the possibility of the high pressure extraction points providing an energy source for the turbine. Every extraction point shall have a power-assisted non-return valve. These valves shall trip closed upon a turbine trip. There shall be two non-return valves in the extraction line feeding the deaerator.

C. To guard against possible overspeed due to circumventing isolation valves via drain lines, the drains shall be routed to the condenser.

6.10 Accessories

A. In addition to those accessories already described above, the following shall be included:

1. Two magnetic speed sensing pickups.

2. Embedded 100 ohm platinum resistance temperature detectors for all main bearings and thrust bearing **(6 RTD minimum).**

3. All special maintenance tools including eyebolts, casing guide pins, jacking bolts, and other tools depending on special turbine construction.

4. Soleplates under turbine and generator.

5 Borescope openings at selected critical stages.

6. An A.C. motor-operated rotor turning gear with manual engagement lever, auto disengage, local start/stop/jog pushbuttons, zero speed sensor, permissive to start oil pressure switch and limit switch for engaged/disengaged position.

7. Vibration probes, cables, proximeters, and monitors mounted on the control panel (shaft sensing at turbine and generator bearings).

8 Local turbine start-up panel with the following instruments:

a. Inlet steam pressure gauge

b. First stage pressure gauge

c. Extraction pressure gauges

d. Extraction temperature gauges

e. Exhaust vacuum gauge

f. Governor oil pressure gauge

g. Bearing oil pressure gauge

h. Electronic digital tachometer indicator

i. Oil pump indicating lights (main, backup, emergency)

B. Lagging for high temperature parts of the turbine and heat retention insulating material.

6.11 <u>Generator Ratings</u>

A.	Rated kW Output	-	By Contractor
B.	Rated kVA	-	By Contractor
C.	Power Factor	-	0.8
D.	Number Poles	-	By T.G. Vendor
E.	Phases	-	3
F.	Hertz	-	60
G.	Voltage	-	13,800
H.	Insulation Class	-	F
I.	Rotor Temperature Rise (°C) (By Resistance)	-	105
J.	Stator Coils Temperature (Rise (°C) (by Detector)	-	90
K.	Excitation Type	-	Brushless
L.	Voltage Regulator Type	-	Static

M. Cooling Medium - Water to Air (TEWAC)

6.12 General Generator Design Criteria

A. The generator shall be a _____ synchronous, _____, air-to-water cooled machine and will include necessary grounding, instrument transformers, surge protection, and excitation equipment. The generator lube oil system will be integrated with the turbine system.

B. The generator shall be of the non-salient pole revolving field type **if it is directly connected to the turbine. If the generator is gear driven, the unit can be salient pole revolving field type.**

C. The telephone influence factors of the generator shall be in accordance with the latest ANSI standards.

D. The deviation factor of the open circuit terminal voltage wave of the generator shall not exceed 10% as defined by ANSI standards.

E. The generator armature shall be capable of operating at 130% of rated armature current for at least one minute, starting from stabilized temperatures at rated conditions.

F. The generator field windings shall be capable of operating at a field voltage of **150%** of rated load field voltage for at least one minute starting from stabilized temperatures at rated conditions.

G. The generator shall be capable of withstanding without mechanical injury, any type of short circuit at its terminals for times not exceeding the short time thermal capabilities, when operating at rated kVA and power factor and 5% over voltage, provided the maximum phase current is limited by external means to a value which does not exceed the maximum phase current obtained from the three-phase fault. In the case of stator windings, the criterion for no injury is that the windings will satisfactorily withstand a normal maintenance high-potential test. There shall also be no visible abnormal deformation or damage to the winding coils and connections resulting from this test.

H. The generator shall be suitable for operation at rated kVA, power factor, and frequency at any voltage not more than 5% above or below rated voltage, but not necessarily in accordance with the standards of performance established for operation at normal rating.

I. The generator shall be capable of operating continuously at full rated load under usual service conditions (altitude not above 3300 ft, as per ANSI standards). The total temperature as determined by any of the methods given in ANSI standards shall not exceed 130°C for the field when operating at full load or below.

J. The generator shall be equipped with integral plate fin surface air coolers with suitable surface area to maintain the generator temperature within the operating range. The coolers shall be of sufficient size and number so that the unit may operate at a minimum of 66% rated kVA with one cooler section out of service. The air coolers shall be arranged in sections and shall be mounted in the generator housing in such a manner as will permit removal of the water box for cleaning of any one section when required without shutting down the generator. Cooler tubing material shall be 90/10 CuNi. The generator shall be capable of operating at a cooling water temperature of 100°F.

6.13 Stator

A. The stator coils shall be **copper and shall be** insulated to eliminate any voids so as to form a long lasting and durable insulation of the stator coils.

B. Insulation of stator core laminations shall be non-aging and of a type which will maintain its insulating properties at high temperatures.

C. Leads from both ends of all phase windings shall be brought out to an accessible location.

6.14 Rotor

A. The generator rotor shall be machined from a solid forging.

B. Suitable fans shall be provided on the rotor to circulate the air used as a cooling medium in the generator.

6.15 Bearings

A. All bearings must be split to permit removal of the upper half for inspections.

B. All bearings shall be provided with a positive visual check point on oil flow through the bearings.

C. Bearings shall be insulated where necessary to prevent the flow of "shaft current."

6.16 Accessories

In addition to those accessories already mentioned in the specifications above, the following shall be included:

A. A 100 ohm platinum bearing temperature detector will be inserted in the lower half of each bearing, to monitor bearing temperatures and actuate alarms or shut downs (**6 RTD minimum**).

B. Platinum resistance type temperature detectors, embedded in the stator windings shall be provided (**12 RTD minimum**).

C. Platinum resistance type temperature detectors in the generator air paths shall be provided (2 RTD minimum).

D. High voltage terminal box with:

1. Three (3) CT's on outgoing lines (one on each phase) for generator differential.

2. Supply of all necessary CT's and PT's for voltage regulator as per manufacturer's recommendations.

3. Three (3) lightning arresters and surge capacitors on the incoming lines. Outgoing lines shall be connected into a neutral bus bar.

4. A transformer shall be wired and installed inside the terminal box with secondaries of transformers brought to terminal strips in a junction box.

5. Two (2) electric space heaters.

6.17 Brushless Excitation System

A. The generator shall include a direct connect brushless exciter overhung on an extension of the generator shaft complete with a rotating fused diode assembly, including a lead assembly that connects the D.C. output to the field windings of the main generator.

B. A full wave 3-phase diode bridge assembly shall be used to rectify the exciter armature output. Parallel fully rated diodes shall be used to provide 100% redundancy.

C. A permanent magnet pilot exciter shall be furnished to provide a power source for the voltage regulator and eliminate the need for field flashing and voltage regulation power transformer.

D. A plate-mounted dual automatic voltage regulator shall be provided.

E. The excitation system shall provide current forcing up to one minute for fault current support to provide 200% of full load current into a 3-phase short circuit.

6.19 Generator Control and Protection Panel

A. Provide one generator control and protection panel with protective relays, metering and controls as indicated below.

B. Generator Protective Relays

All relays shall be utility grade in accordance with ANSI C37.1 standards.

Device 51V	-	Voltage controlled overcurrent relay
Device 87-G1	-	Generator differential
Device 32	-	Generator reverse power
Device 40	-	Loss of field
Device 46	-	Negative sequence overcurrent relay

Device 86-G1	-	Lockout relay
Device 64-G	-	Generator field ground fault
DELETED	-	**DELETED**
Device 86M	-	Lockout relay
DELETED	-	**DELETED**
Device 24	-	**Volts per Hertz Relay**
Device 49G	-	Generator over temperature relay
Device 59G	-	Generator ground fault
DELETED	-	**DELETED**
Device 60	-	**Blown fuse**

C. Generator Metering

All meters shall be 4-1/2 inch square switchboard type, 1% accuracy.

- AC ammeter
- Four position ammeter selector switch, OFF 1-2-3
- AC voltmeter
- Three position voltmeter selector switch
- Megawatt meter
- Megawatt hour meter
- MVAR meter
- Frequency meter 55-65 Hz
- Power factor meter 0.5 leading - 1.0 - 0.5 lagging
- Voltage/VAR control switch
- Synchroscope
- Synchronizing lamps
- Synch selector switch, auto/off/manual
- Generator breaker control switch with indicator lamps
- Generator coolant and stator temperature recorder
- Bus voltmeter
- Generator voltmeter

D. Synchronizing

Provide equipment for both manual and automatic synchronizing.

6.19 Steam Turbine Tests

A. The turbine shall be assembled at the factory and given a one-hour mechanical run test with steam and the following test checks as a minimum:

1. Test of lube oil console.

B. Check auxiliary oil pump operation.

C. Speed governor test; adjustment shall meet IEEE Standard 122.

D. Emergency overspeed governor test; adjustment to +1% of the 10% above nominal mechanical overspeed trip. Run at just under trip speed for 15 minutes prior to testing. The mechanical trip shall be tested three (3) consecutive times with all trip speeds within + 1% of trip speed. The stop trip valve shall be used as part of this test.

E. Stop valve test.

F. Steam seal regulator test, if applicable.

G. Static and dynamic balance of the completed turbine rotor and operation of turbine rotor to 110% of rated speed for at least three minutes.

H. Assembly of turbine.

I. Physical and chemical analysis of major rotating parts.

J. Heat stabilization of rotor shaft .

K. Hydrostatic test of turbine casing. All tests shall be at 1-1/2 times the maximum design pressures.

L. Set all safety devices and calibrate all instruments.

M. Test vibration sensing system on turbine.

N. Check all bearing operating temperatures.

O. Turning gear test.

P. Inspect thrust and journal bearings after tests.

6.20 Generator Tests

A. The generator shall be assembled at the factory and provided with the following tests as a minimum:

1. Mechanical inspection.

2 Mechanical balance and high speed run to 120% of rated speed.

3. Measurement of cold resistance of armature and field windings.

4. Di-electric test.

a. Armature - The standard test voltage shall be 60 Hz alternating voltage whose effective value is 1,000V plus twice the rated voltage of the generator. Test shall be applied for 60 seconds duration.

b. Field - The standard test voltage shall be a 60 Hz alternating voltage whose effective value will be ten times the field rated excitation voltage but not less than 1,500V. The test shall be applied for 60 seconds duration.

5. Excitation System:

   a. D.C. resistance of all winding.
   b. Polarity test.
   c. High potential test of windings at 60 Hz.

6. Voltage Balance

7. Phase Sequence

8. Open Circuit Saturation Curve

9. Rotor Impedance Test

10. Bearing Insulation Resistance

11. Shorted Field Turn Test

7.00 COMBUSTOR/STEAM GENERATOR

7.01 Two balanced draft combustors and steam generators (collectively called the boilers) shall be provided. Each combined unit shall be designed to combust 124.5 x 10^6 Btu/hr of RDF fuel as described in SECTION 0080. Superheater outlet conditions shall be 700 psia, 750°F.

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

7.03 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.

7.04 A complete digital solid state flame safety system shall be furnished for 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.

7.05 Sootblowers shall be provided for maintaining boiler performance. Superheater and convective sections shall be provided with sootblowers. Designs using furnaces shall be provided with wall boxes for future use of rotary wall blower type sootblowers. Sootblowers shall be motor driven and shall be automatically and sequentially operated from the control room. Steam supplied from the boiler drum shall be used as the cleaning medium.

Soot blower system shall include all necessary controls, piping, valves and drains necessary for a complete system.

7.06 Air Preheating

A. All combustion air including primary (i.e. underbed) air and secondary air (i.e. overfire air) shall be preheated. Contractor may make use of recirculation gas, gas-to-air heat exchanger or steam coil air heaters to achieve this goal.

7.07 Environmental Commitments

A. An Air Permit Application has been submitted to the North Carolina Department of Environmental Protection with the emissions and design limitations described below. The facility design shall conform to these limitations. **The individual emission rates are provided in SECTION 0080.**

B. Firing Limitations

Fuel	Annual Usage	Burner Max.	Firing Rate/Boiler
RDF	180,000 TPY	By Vendor	124.5×10^6 Btu/hr
Propane (Start-up Only)	\	By Vendor	30.0×10^6 Btu/hr

C. Continuous Emission Limitations

1. Maximum value of **criteria** pollutants emitted for two boilers to **the atmosphere via stack shall not exceed the following values:**

Pollutants	Emission Rates lb/hr
Sulfur Dioxide	17.43
Nitrogen Dioxide	22.41
Total Suspended Particulates	4.98
Carbon Monoxide	22.41
Lead	0.207
Non-Methane Hydrocarbons	7.50
Ammonia	**4.78**

D. Flue Gas Temperature

The temperature of flue gas leaving the boilers shall not exceed 300°F.

7.08 Fuels

A. Main Fuel - Refuse Derived Fuel, 100% Heat Input
B. Ignition & Warmup - Propane, 25% Heat Input

7.09 Performance Fuel

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

7.10 Design Fuel

A. The steam generator and its support systems shall be designed to fire fuel with a moisture content higher than 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 be 35%.

7.11 Steam Purity

A. The total solids content of steam leaving the steam drum shall not exceed 200 ppb 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.

7.12 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.

7.13 Blowdown

A. The steam generator shall be designed for continuous blowdown rates from 0-10%. Performance shall be based upon a continuous blowdown of 2%. A continuous blowdown heat recovery system shall be provided.

7.14 Water Chemistry

A. Boiler water chemical treatment shall consist of an oxygen scavenger injected into the boiler feedwater after the deaerator and a boiler water treatment program as recommended by the boiler manufacturer.

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. As an alternative to the aforementioned, the boiler manufacturer may provide a drum steam condenser and attemperating water injection pumps as a complete desuperheating water system.

7.15 Turndown

A. RDF burning system shall be capable of providing stable combustion under automatic control with all feeders in service from full capacity to 50% of full boiler output when firing either the design or performance fuels.

B. The automatic control system shall be capable of controlling the boiler with any single fuel feeder out of service.

7.16 Furnace Design

A. Combustor, steam generator, backpass, ductwork and combustion air and flue gas exposed accessories shall be designed to withstand transients of ± 26 in. w.g.

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

7.17 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.

7.18 Forced Draft And Overfire Air Fan(s)

A. The forced draft and overfire air fans (if used) shall be designed for the full combustion air requirements including air leakage under the following operating conditions:

		FD	OFA
1.	Flow	100% MCR	Per Boiler Mfr.
2.	Excess Air	50% (min.)	50% (min.)
3.	Air Leakage	3%	3%
4.	Inlet Air Temp. Range	50° - 100°F	Per Blr. Mfr.
5.	Maximum Fan Speed	1200 RPM	1200 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.

7.19 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.

7.20 Flame Safety System

A. The flame safety system for the auxiliary burners shall be in accordance with NFPA Standards 85D and 85E. The system shall provide for control of the unit from the Central Control Room.

7.21 Combustor

A. Solid fuel will be fed into the lower portion of the combustion chamber of each unit. A design utilizing overbed fuel feeding chutes located in the side walls of the combustion chamber is acceptable. High turbulence in each bubbling bed will cause the fuel to mix quickly and uniformly with the bed material. Natural sand is acceptable for use as the bed material. Limestone shall be added as required to control sulfur emissions.

B. Primary air for each combustor shall be introduced through the fluidizing grid located in the lower portion of the chamber, where the heavier bed material will be fluidized and retained. The upper portion will contain the entrained, less dense material, that will be separated from the bed. Secondary air may be introduced at two levels to ensure complete combustion and reduced NOx emissions.

7.22 Flue Gas Recirculation

A. A flue gas recirculation system may be provided to control fluidized bed combustor bed temperature while maintaining low furnace excess air and high boiler efficiency. If used, the gas will be taken from the baghouse outlet and discharged into the inlet of the primary air fan. The system shall consist of a flue gas recirculation fan, flow control, damper, ducts, expansion joints, and supports.

7.23 NO_x Reduction System

The steam generator shall be provided with an ammonia or urea 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 or urea is acceptable as a reagent.

B. Content of reagent in the flue gas measured at the location of the CEM equipment shall not exceed 10 ppm.

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.

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 10,000 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.

7.24 Combustion Air Control

A. In order to accommodate the full range of moisture content in the design fuel, the design of the combustion air control system shall receive special attention and be provided with the following as a minimum:

1. An over-fire air system using heated combustion air. The design of the system shall permit the adjustment of over-fire air to permit a significant change in the ratio of over-fire air to under-fire air in the combustion process.

2. Fan control systems capable of turndown in response to the range of flue gas flow, consistent with fuel moisture and turndown requirements.

3. The variance of over-fire to under-fire air shall be adjustable with the boiler on line. Instrumentation to effectively monitor the impact of combustion air control shall be provided.

7.25 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 an electromatic type relief valve to permit relief of steam pressure from the control room. The electromatic type relief valve shall be provided with a manual isolation valve to permit removal and repair of the relief valve while the steam generator is in operation.

C. The electromatic type relief valve vent shall be connected to a silencer which shall keep noise emissions to statutory limits.

7.26 Sand Bed System

A. A natural sand delivery system shall be furnished for each boiler combustion chamber. The sand will be used as a bed material and serve to ignite the RFD after it is heated and "fluidized" by jets of combustion air passing upward through it. The sand delivery system for each boiler shall include a sand silo designed for gravity flow with metering equipment, sand conveying piping, and a sand return system. A fluidizing air fan shall be provided as required. The sand silo shall be fitted with a motor-operated fan and vent filter to capture fugitive dust upon filling.

8.00 CIRCULATING WATER SYSTEM

8.01 General

A. The circulating water system shall consist of the cooling tower, circulating water pumps, piping, steam turbine condenser, dump condenser and equipment heat exchangers.

B. The design wet bulb temperature shall be 76°F.

C. Approach temperatures in the steam turbine condenser, cooling tower and closed cooling water heat exchangers shall permit a maximum of 3.0" HgA operating backpressure in the steam turbine at full net electrical output at the design ambient wet bulb temperature.

8.02 Main Steam Turbine Condenser

A. The main steam turbine condenser shall be a one or two-pass shell and tube type specifically designed for steam surface condenser service. This unit shall be designed to condense the steam from the turbine at maximum rated electrical output while maintaining a maximum of 3.0" HgA vacuum. The condenser shall also be designed to accept steam from the bubbling fluidized bed type combustor/steam generator during plant start-up and shut down and during off normal plant operating conditions. Equipment shall be designed and constructed in accordance with the standards of HEI. Performance calculations shall be based on HEI standards and shall use HEI coefficients.

Specific design criteria is as follows:

Tube Material	Type 304 SS (to be verified as suitable for water used)
Tube Diameter	3/4 inch
Tube Thickness	20 BWG gauge or less
Maximum Water Velocity	7.0 FPS
Fouling Factor	85% clean

B. The hot well shall have available volume, sufficient to contain all of the condensate produced in the condenser in a period of 3 minutes under conditions of maximum load. Access to the hot well shall be via a 20" hinged manway.

C. Tube sheets shall be carbon steel and shall be so designed to permit water box removal without disturbing the shell to tube sheet joints.

D. Water boxes shall be carbon steel with epoxy coating. Water boxes shall be of divided type to permit tube cleaning with plant on line. Waterboxes shall be provided with hinged manways (18" min. dia.) for servicing the unit.

E. The water boxes shall be rated for the full shut-off head of the circulating water pumps.

F. The steam inlet expansion joint shall be a suitable type. The joint shall be able to withstand pressures from full vacuum to 15 psig at 200 degrees F maximum temperature.

G. A suitable sized atmospheric relief valve shall be furnished. Valve sizing shall be in accordance with HEI standards for steam surface condensers.

H. Two 110% capacity mechanical, rotary water sealed electric motor-driven vacuum pumps shall be furnished to be used to initially evacuate the turbine and condenser steam space and to maintain design vacuum. The unit shall be a packaged unit with exhaust separator/silencers.

I. Each vacuum pump shall be capable of maintaining the condenser vacuum at 1.5 in. HgA. The hogging capacity of each unit shall be capable of reducing the condenser pressure from atmospheric pressure to 3.0 in. HgA within 1/2 hour.

8.03 Dump Condenser

A. A dump condenser shall be provided to allow dumping steam from the combustor/steam generator in the event the main turbine-generator system condenser is not available. All data provided above shall be applied to this condenser.

B. The dump condenser shall be cooled from the cooling tower and operated at pressure not exceeding 5 psig.

C. The dump condenser system (including cooling tower) shall be sized to accept the full thermal output of both boilers.

8.04 Cooling Tower

A. The cooling tower shall be a counter flow, induced draft type with a minimum of two individual cells. The cooling tower shall be supported by a concrete basin. Cells shall be individually operable.

B. The mechanical draft fans shall be two-speed, adjustable pitch type. Fan blades shall be manually adjustable.

C. Structural members shall be of pressure treated fir or redwood material. Structural fittings shall be corrosion resistant.

D. Drift loss shall be less than 0.005% of the circulating water flow rate up to and including maximum flow rate.

E. Water outfall to the circulating water pumps shall be provided with screens (1/2" x 1/2" size) of a corrosion resistant material.

F. The concrete basin shall extend a minimum of 4 feet beyond the wooden structural members to minimize spillage of water on the ground surrounding the tower.

G. Cooling tower piping shall be so fitted as to permit performance testing in accordance with CTI Code ATC-105.

H. Make-up water supply to the circulating water system shall be from the service water system.

8.05 Equipment Heat Exchangers

A. Heat exchangers listed below shall be cooled by circulating water (directly from the cooling tower).

- Turbine Lube Oil Coolers
- Generator Air Coolers
- Exciter Air Coolers
- Air Compressors

- Miscellaneous Lube Oil Coolers
- Boiler Feed Pumps
- ID Fans (if required)
- HVAC Equipment (if required)

8.06 Circulating Water Pumps

A. The system shall have a minimum of 3-50% capacity electric motor-driven circulating water pumps which take their suction from the cooling tower sump and supply water to the plant condensers and other heat exchangers through a single buried water line. The pumps shall be of the vertical mixed flow design with flooded suction.. The pumps shall be provided with a 5% flow margin and 10% head margin.

B. A low water trip shall be provided to protect the pumps from low water level in the cooling tower basin.

8.07 Circulating Water System Chemical Treatment

A. The circulating water shall be treated by chemical injection to control pH and minimize fouling in the main condenser, dump condenser, equipment heat exchangers and biological growth in the cooling tower.

8.08 Cooling Tower Blowdown

A. Cooling Tower Blowdown shall be discharged directly to the sewer.

9.00 CONDENSATE/FEEDWATER SYSTEM

9.01 Condenser(s) Hotwell

A. The condenser(s) hotwell shall be located above the floor elevation of the plant and serve as the ultimate receiver of all condensate from steam systems throughout the plant. The primary source of condensate will be from the condenser which is located directly over the condenser hotwell. The condenser hotwell shall provide a minimum of three (3) minutes of active storage for the plant with the storage tank providing additional standby storage.

B. Condensate taken from the condensate (demineralized water) storage tank shall enter the cycle via the condenser hotwell for deaeration.

9.02 Condensate Pumps

A. Two, multi-stage 100% capacity condensate pumps shall take suction from the condenser hotwell and deliver condensate to the deaerator. The pumps shall be vertical can type or horizontal type electric motor driven designed specifically for this type of operation. The pumps shall be sized with a 20% flow margin and 44% friction head margin.

B. Net positive suction head (NPSH) available at pump shall be based on the lowest water level available in the condenser hotwell.

C. On high hotwell level, the pumps shall deliver water to the condensate storage tank.

D. The pumps shall take seal water from their discharge and be provided with vents back to the condenser.

9.03 Deaerator and Deaerator Storage Tank

A. The deaerator shall be the direct contact spray atomizing tray-type with separated storage tank. The storage tank shall have minimum operating capacity (between level alarms) equivalent to 5 minutes of feedwater flow at rated conditions.

B. Steam supply to the deaerator shall normally be from an uncontrolled extraction point on the turbine-generator. During low load operation minimum pressure (pegging) auxiliary steam shall be supplied.

C. The deaerator shall also be designed to receive drains from the high pressure feedwater heater.

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

E. The deaerator shall reduce feedwater oxygen content to a maximum 0.005 cc per liter over the entire operating range of the unit.

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

9.04 Boiler Feed Pumps

A. The plant shall be provided with a minimum of three, 100% capacity (plant) high pressure boiler feed pumps. Each boiler feed pump shall supply feedwater through a common header system to the economizer inlet of both boilers. The pumps may be barrel or horizontally split case multistage centrifugal type.

B. Two pumps shall be motor-driven at constant speed for full-load operations. One pump shall be steam turbine driven. The steam source for turbine pump shall be from the main steam system and the turbine pump shall exhaust to the atmosphere. Each pump shall be provided with a 5% flow margin and 10% head margin.

C. Water for desuperheating process steam may be taken from the boiler feed pumps or separate desuperheating water pumps may be provided.

D. Each feed pump shall be provided with its own independent recirculation system. Recirculated water shall be piped individually to the deaerator storage tank.

E. Each boiler feed pump shall be designed to permit maximum continuous flow to the boiler with boiler safety valves fully relieving.

9.05 Feedwater Control Valve

A. The control of feedwater to each boiler shall be in response to its respective three element control system.

9.06 Closed Feedwater Heater

A. The high pressure feedwater heater shall be of the shell and tube type designed to HEI standards. Shell design pressure shall be at least 15% above the 5% OP, VWO steam turbine extraction pressure.

B. The water design (tube side) pressure on each heater shall correspond to the shut-off head of the pump driving the water. Tube side design flow shall have a 5% margin.

C. Tubing material shall be suitable for the steam and water conditions.

9.07 Condensate (Demineralized Water) Storage Tank and Transfer System

A. The condensate (and demineralized water) storage tank shall provide condensate storage for the plant cycle. The condensate storage tank shall be sized to provide condensate requirements for the plant power cycle at design conditions for 24 hours plus the expansion volume to store the contents of the condenser hotwell if it must be emptied for maintenance purposes.

B. The condensate storage tank shall also act as the surge tank for the condensate system by supplying condensate via a direct connection to the condenser on low condenser hot well level and receiving condensate via the condensate pump discharge on high condenser hotwell tank level.

C. The tank, if located outdoors, shall be insulated and provided with a steam sparging unit for freeze protection or equivalent system.

D. The tank shall be suitably lined or manufactured of a material to protect against corrosion.

9.08 Condensate System Operation

A. Condensate system shall supply the deaerator which will maintain a stable level in the deaerator storage tank over the entire range of the plant operation and supply condensate for other services such as turbine exhaust hood spray, gland steam desuperheater, and boiler feed pump seal water.

9.09 Gland Steam Condenser

A. One gland steam condenser shall be provided to condense, deaerate, and reuse gland steam leakage from the main turbine shaft seals. The gland steam condenser shall be a shell and tube type, designed in accordance with HEI standards for heat exchangers.

9.10 Condensate Return System

A. There will be no condensate returns to the EGF from Du Pont.

10.00 PLANT WATER SYSTEMS

10.01 The plant water systems include the following systems:

A. River Water System

B. Circulating Water System (previously described)

C. Potable Water System

D. Make-up Water Treatment

E. Plant Service Water

F. Plant Drains and Waste Water Treatment

G. Fire Protection

10.02 River Water System

A. River water is supplied to the facility from a Du Pont river water line contiguous to the site. River water is used as a make-up supply for the circulating water (cooling water) system, the make-up water treatment system and plant service water system.

B. The river water shall pass through a clarifier and gravity filter prior to use in the facility.

C. The clarifier shall be of the high rate solids contact, such as manufactured by Graver Water, type and have a daily throughput capacity of 820,000 GPD.

D. The river water supply pressure ranges from 55-80 psig.

E. River water quality to the clarifier has the following properties:

Item		
Total Suspended Solids	20	ppm
Total Phosphate	1.6	ppm
Nitrate N.	0.80	ppm
Nitrite N.	<0.20	ppm
BOD	1.0	ppm
pH	7.1	
Silicon Dioxide	0.87	ppm
Manganese	<0.010	ppm
Lead	<0.010	ppm
Sodium	15.7	ppm
Zinc	0.010	ppm
Nickel	<0.010	ppm
Hardness ($CaCO_3$)	72	ppm
Total Alkalinity	26	ppm
Magnesium	1.01	ppm

F. A clarified water storage tank designed to AWWA standards with 250,000 gallon minimum capacity shall be provided to permit continuous plant operations during servicing of the clarifier.

G. The river water supply shall be metered at its entrance to the site. Meter to be supplied by Contractor.

10.03 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.

10.04 Boiler Make-up Water Treatment

A. The source of water to this system will be clarified and filtered water from the river water system.

B. The treatment of make-up water to the power generation cycle shall meet ABMA requirements and shall be accomplished by installation of a two-train demineralizer system with the following outlet characteristics and with 2% continuous blowdown.

pH	8 to 9.5
Silica	<0.6 ppm
Na + K	*
Iron as Fe	<0.025 ppm
Copper as Cu	<0.02 ppm
Conductivity	<40 mho/cm
Total Dissolved Solids	<20 ppm
Total Hardness	<0.2 ppm

*No limit as long as TDS is as specified.

C. Instantaneous Demineralized Water Quantity - 5% of total boilers MCR plus 80,000 lb/hr.

D. Each demineralizer train shall consist of the following components, as a minimum.

   1. Cation Exchanger
   2. Anion Exchanger
   3. Degasifier

E. The cation and anion resin beds shall be sized for a minimum of 8 hours of full-flow service between regenerations. The regeneration cycle shall not take more than 4 hours.

F. Discharge of the anion bed units shall be monitored for media exhaustion and/or silica breakthrough. A local display shall be provided along with alarm signals to the DCS.

G. The regeneration agents shall be hydrochloric acid and 50% liquid caustic soda.

H. The regeneration cycle for the anion and cation units shall be automatic upon receipt of a manual start signal from the plant operator.

I. The degasifier shall be the forced draft gravity type aerator. Each degasifier shall be provided with a single 100% capacity motor-driven clear well pump to repressurize the system downstream of the degasifier.

J. The acid and caustic regeneration equipment shall be supplied by the same manufacturer who supplies the demineralizer. Acid and caustic storage and transfer pumps to the regeneration equipment day tanks may be supplied by a different firm.

K. The acid and caustic storage tanks shall be located indoors in the water treatment area and shall be sized to accept a full truckload of reagent when each tank is half full or 5000 gallon minimum. Both tanks shall be individually diked to collect spills to a pumping sump within the dike where they can be discharged into the neutralizing tank for treatment. The caustic storage tank area shall be heated to prevent crystallization of the solution.

L. Regeneration flows shall be directed to the plant sewer system. High or low pH waste shall be neutralized prior to entry into the plant sewer system while low conductivity waste may be sent directly to the sewer.

M. The neutralization tank(s) shall be sized to accept at least 150% of a single regeneration wash. Controls on the neutralization tank shall permit pH adjustment of water prior to a controlled discharge to the plant sewer.

10.05 Service Water Pumps

Two 100% capacity electric motor-driven centrifugal pumps shall be provided to transfer clarified/filtered water through the make-up water treatment system to the condensate (demineralized water) storage tank.

10.06 Service Water System

A. This system will be supplied from the river water system and provide make-up water to the cooling tower (circulating water system) and distribute service water throughout the plant for wash down of selected areas and non-potable applications.

10.07 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 process sewer system.

B. Boiler and cooling tower blowdown and effluent from the neutralization system shall discharge directly to the existing Du Pont process sewer system.

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

E. The process sewer line shall be metered at its exit from site. Meter shall be provided by Contractor.

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

10.08 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 are not intended to fully describe the fire protection systems 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 required pressure and flow rate. No new fire pumps are required for this plant. Design firewater pressure from the Du Pont system is 60 - 140 psig.

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
Cooling Tower	Dry Pipe
Turbine Lube Oil System Area	Dry Pipe
Fuel Processing Area	Water Monitor
Fuel Storage Bins	Water Sprinkler Deluge
Fuel Conveyors	Water Sprinkler Deluge
Turbine Bearing Area	As Specified by Turbine Vendor
Office Area	Wet Pipe
Control Room	Portable Fire Extinguishers
Electrical Room	Portable Fire Extinguishers
Propane Tank Area	Dry Pipe
Main Transformer	Dry Pipe
Shredder	Dry Deluge & Explosion Suppression

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. 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 City of Fayetteville Fire Department and to the Du Pont Fayetteville Works Fire Alarm System. An audible 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 III 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 turbine generator lube oil tank area, propane tank area and the main transformer shall be served with dry pipe, open spray deluge systems in accordance with NFPA-15.

L. The control room shall be provided with sprinklers in cabinets and portable type hand extinguishers.

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

11.0 RDF RECEIVING/HANDLING SYSTEM (See Dwg. D-071-01-M6)

11.01 <u>General Description</u>

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

1. The fuel handling system receives presorted MSW loaded on 20 ton/105 cubic yard self-unloading trailers from the MRF.

2. The RDF receiving system shall provide for unloading of four walking floor trailers Two trailers shall unload at each of two live bottom parallel fuel tunnels, each approximately 130 ft in length. Each tunnel consists of a walking floor at loading dock height for service access and a second separate system that is somewhat lower. The second walking floor in each tunnel will normally run at a different speed than the first walking floor. All floors will be variable as to speed and direction and shall be tied into the DCS which in turn controls fuel demand. Each of the two tunnels would hold approximately 135 tons of unshred RDF.

3. Facilities shall be provided for parking a minimum of 20 live-bottom trailers to be maintained at the EGF for an additional 400 tons of unshred RDF storage.

4. A hammermill shredder room shall be located at the end of each tunnel, each capable of handling 30 tons per hour of RDF. An apron conveyor with a metering system shall feed the RDF into the shredders. Movement of the RDF through the tunnels into the shredder areas will be controlled by the DCS

5. Shredded RDF shall be moved into two additional walking floor fuel rooms--each about 120 ft long. Shredded RDF in each room would be maintained at a height of about 18 ft providing storage of about 150 tons. Rolls should be employed to prevent bridging or surging as the RDF in each room advances over a pit apron conveyor located perpendicular to the end of the walking floor room for reclaim to the boilers.

6. The boilers are to be fed by two separate inclined conveyors which can reclaim from either of the two shredded RDF storage rooms.

7. Each boiler shall be provided with two separate fuel metering bins which ultimately supply the shredded RDF to the combustors. Each metering bin shall be sized to provide 60% of fuel to the combustor.

11.02 Design Criteria

A. All fuel equipment to be sized to supply 124.5 x 10^6 Btu/hr to each of two (2) bubbling fluidized bed type steam generator units. Sizing of fuel particles to be in accordance with steam generator manufacturer's requirements

B. The entire fuel unloading, processing, conveying and feeding system shall be suitably enclosed and ventilated to control release of fugitive dust and odors. Combustion air for both boilers shall be drawn from the ventilation system header, thus creating a slight negative draft throughout the fuel storage areas. Booster fans shall be provided if required.

11.03 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 two live bottom receiving and transfer tunnels. Two truck unloading positions per tunnel shall be provided.

3. Hammermill or shear shredders provided at Contractor's option.

4. Shall utilize live bottom shredded RDF fuel storage with stacking at a maximum of 27 feet.

5. Space shall be provided on site to store inventory in 20 trailers.

6. All fuel handling areas shall be sprinklered and maintained under negative pressure for odor and emissions control. At a minimum, combustion air should be drawn from all RDF storage areas.

7. Provide separately enclosed shredder areas. Two shredders shall be provided each with a minimum capacity of 30 tons per hour.

8. Controls for the fuel handling system should be tied into the EGF Distributed Control System.

9. Provide closed circuit TV (color) surveillance system for fuel receiving and handling areas with monitors located in the control room.

10. Provide appropriate fire sensing and hydrocarbon vapor monitors.

11. Provide tramp iron magnetic separation.

12. Provide ______ screens with provisions for removal of oversized material from the site via roll-off bins.

12.00 FLUE GAS SYSTEM

12.01 General

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

12.02 Mechanical Dust Collector

A. The mechanical dust collector for each boiler 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 80% with the boiler operating at MCR.

12.03 Induced Draft Fan

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

Net Flow Conditions

- Boiler operating at MCR
- Design Fuel
- Design Excess Air plus 15%
- Design Inlet Gas Temperature plus 25°F

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.

12.04 Baghouse

A. A baghouse shall be provided for each boiler 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 ± 26" 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 **and chlorine** emissions shall be enhanced through the use of a filter bag pre-coat system. The system shall inject dry pulverized lime into the flue gas stream upstream of the baghouse. A **1400 ft^3 storage silo shall be provided for both baghouses.**

12.05 <u>Ductwork</u>

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 $\pm$ 26" 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.

12.06 <u>Stack</u>

A. The stack shall be ground-mounted free-standing design with two internal flues. 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 150 ft above grade. Stack diameter shall be 7.5 feet.

C. The stack shall be provided with 360° access platforms, handrails and toeplates, ladders to provide access to 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.

12.07 Continuous Emissions Monitoring Equipment

A. Continuous Emissions Monitoring shall be provided to monitor the emissions from the flues of each of the two boilers.

B. Continuous Emissions Monitoring (CEM) and recording equipment shall be provided for the following parameters:

- Nitrogen Oxides, expressed as NO_2
- Carbon Monoxide, CO
- Opacity
- Oxygen, O_2
- Sulfur Dioxide, SO_2
- Carbon Dioxide, CO_2
- Ammonia, NH_3

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 equipment (CEM) shall be located in the ductwork between the outlet of the ID fan and the stack

E. Access platforms and ladders shall be provided at the CEM test ports to permit servicing of the CEM and conducting of audits. The platforms shall be enclosed to permit heating during calibration and audit activities.

F. Provide a minimum of two 110V, 20A electrical circuits inside the enclosure.

G. CEM analysis equipment shall be located in a weatherproof enclosure suitable for the application at grade elevation .

13.00 ASH AND RESIDUE HANDLING SYSTEMS

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

13.02 The outlet of the ash hoppers of each boiler 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 a pneumatic conveying system. A means shall be provided in the pneumatic conveying line that will permit the ash to be directed to either the common ash silo or to an ash reinjection port in each fluidized bed combustor.

13.03 The system for collecting and transporting ash from the ash hoppers of each baghouse module shall be identical to the system described above except that no reinjection feature is required.

13.04 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 common ash silo shall provide (for each boiler) four days of fly ash storage capacity based on normal plant operating conditions. An air based system shall be provided to be used in conjunction with conveying equipment for discharge of ash from silo to a enclosed trailer. The ash silo and piping shall be constructed of materials experience has shown to be suitable for intended service.

13.05 Loading of trucks with ash from the silo shall be accomplished within a totally enclosed building. Provision shall be made in the design for loading dry ash into enclosed hopper type cement trailers, via top loading domes. Building shall be designed for drive-through loading with truck doors of 12 feet minimum width. Building floor drains shall be directed to the wastewater treatment system.

13.06 The ash system shall be provided with controls to allow manual operation of the system from either the Central Control Room or from a local control station. Systems loading/storing operations shall be monitored from the Control Room by closed circuit television.

13.07 Residue bed material removal from each fluidized bed combustor shall be accomplished using two automatically operated bed classifiers and drain systems, with each system discharging into a mechanical bed drain conveyor. Each bed classification system shall remove oversize material and discharge it to the drain conveyor for disposal via the ash system. The bed material fines shall be returned to the fluidized bed to maintain the bed mean particle size and minimize bed material consumption. The bed drain conveyor shall discharge to a residue container.

13.08 The ash system shall be designed to have a capacity based on the requirements of the equipment and systems provided by the Contractor plus a reasonable factor of safety.

14.00 AUXILIARY SYSTEMS

14.01 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.

B. 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. Dual air receivers, 300 gallon minimum, shall also be provided.

C. 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.

D. A two-tower desiccant type air dryer, regenerated by electric heat or 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. A separate receiver shall be provided for the instrument air systems.

E. 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.

14.02 <u>Chemical Feed System</u>

A. The design of the chemical feed system shall provide for the use of semi-bulk type equipment in 300 to 400 gallon returnable containers. The containers and transfer pumps shall be provided by the chemical supplier. The Contractor's design of the plant shall provide for the use of this type of equipment in lieu of 55 gallon type drums. All semi-bulk containers shall be located in the water treatment building which permits transfer of the semi-bulk containers to their supplier by use of Owner's forklift vehicle.

B. Chemical feed subsystems shall be supplied that allow controlled injection of chemicals for:

1. Oxygen scavenging in the deaerator storage tank. Injection point shall be the deaerator storage tank outlet.

2. pH control in the feedwater, steam and condensate systems. Injection point shall be in the boiler feed system.

3. Scale control in the boiler cycle. Injection point shall be at the boiler drum.

4. pH control, algae/slime control, dispersant, and inhibitor in the circulating water system.

C. Each subsystem shall, as a minimum, consist of a chemical day tank, mixer and two 100% capacity positive displacement chemical metering pumps, together with sufficient piping, valves, instrumentation and controls for proper operation.

D. All chemical feed units shall be located in a common diked area (a separate area may be provided for the cooling tower) sized to contain 110% of the chemical tank volume. Day tanks shall be sized for 32 hours of injection . Use of 55 gallon drums shall not be permitted.

14.03 <u>Limestone System</u>

A. A limestone system shall be provided to assist in the control of SO_2 emissions. The system design shall be based on adding limestone to the sand bed within the fluidized bed boiler in sufficient quantity to achieve optimum sulfur retention directly in the furnace. The system configuration shall include a storage silo with outlet hopper, airlock feeders and feed chutes. The silo shall be located directly above the fuel conveyors. The limestone shall be fed at a controlled rate directly onto the fuel being carried by each of the two boiler area feed conveyors.

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.

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

14.04 <u>Boiler Blowoff/Blowdown</u>

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 receive drains from the flash tank. The blowoff tank shall be vented to the atmosphere and shall be directed to the waste water system with pH adjusted as required.

C. The boiler continuous blowdown system shall include a flash tank, heat exchanger tank and associated piping.

D. Blowdown from the boiler steam drums will be piped to the flash tank. Vent from the tank will be piped to the deaerator.

E. The continuous blowdown system shall be sized for 0-10% of the boiler MCR flow rate. Continuous blowdown flash tank drain shall be directed to waste via a heat exchanger in the condensate system.

14.05 Propane Storage System

Propane will be used as a start-up fuel for the two steam generators. The plant design shall provide for the outdoor storage of sufficient propane for at least four boiler start-ups. Tanks 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 and shall be sized to provide propane for start-up of both boilers simultaneously.

14.06 Turbine Crane

A. A traveling gantry crane shall be provided that will provide access to the entire turbine generator.

B. Crane lift rating shall exceed 110% of the largest single component lift required for maintenance of the turbine generator. A second hoist (15 ton, min) shall be provided for general maintenance of the turbine.

14.07 Lifting Equipment

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

15.00 BUILDING SERVICES

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

15.02 HVAC Systems

A. The Plant HVAC systems shall be designed to meet the criteria specified in Paragraph 15.03.

B. Wall-mounted ventilator units shall be provided in the ends of the turbine enclosure Additionally, the fans shall be provided with louvers with bird screens. Thermostatically controlled steam heaters shall be provided around the turbine enclosure to provide supplemental, localized heating.

C. 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 on the roof of the administration area of the building.

D. 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.

E. The fuel storage and processing areas and the fuel conveyors shall be ventilated by drawing combustion air from these areas using the combustion air fans.

15.03 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	Ventilated	70°F (Ventilated)
Locker Rooms	Ventilated	80°F
Electronic Equip. Room	Ventilated	70°F
Battery/Switchgear Room	Ventilated	60°F
Maintenance Areas	Ventilated	60°F (Ventilated)
Drivers Lounge	Ventilated	70°F

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

15.04 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 steam heated. Fixtures shall include 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 area and in the vicinity of the control room.

B. Sanitary Waste

Sanitary waste will connect to existing Du Pont sanitary sewer line.

C. Roof Drains

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

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

16.00 ELECTRICAL SYSTEM

16.01 General Description

A. The electrical system shall supply the electrical power required for the project and shall export the excess generated power to the Du Pont Company system. Special systems shall include emergency power for lighting, a direct current system to provide control voltage for switchgear and other equipment having direct current requirements. The installation shall include fire alarm and telephone 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. All work shall conform to the latest edition of the National Electrical Code (NFPA 70).

16.02 Generation

A. The generation system shall be designed to supply ________ electrical power to the Du Pont Plant and shall be capable of operating in parallel with the Carolina Power & Light (CP&L) feed to the Du Pont system. ____________________

B. The generator rated voltage shall be 13.8 kV. A single bus line-up of 13.8 kV generation switchgear shall be provided. The 13.8 kV switchgear shall feed the plant load via 4.16 kV and 480 volt switchgear.

16.03 Generator Control

A. Generator control shall be from the central Control Room.

B. Generator/turbine power loading shall be controlled by an electronic speed/load governing system. The governor shall be capable of controlling speed/load with the generator operating in parallel with the CP&L system feed to the Du Pont system.

C. Generator reactive power loading shall have automatic voltage regulation and manual control.

16.04 Synchronizing Control

A. All circuit breakers which could be closed across power sources, which could be out of synchronism shall have synchronizing control. These circuit breakers shall be the two 24 kV Du Pont feeder breakers (52 D1 and 52 D2), the generator main breaker (52G1) and the facility feeder breakers (52C1B and 52C2B).

B. Synchronizing operation shall be automatic with manual back-up including auto-tracking nullmeter. Synchronizing check relays shall be provided.

16.05 Metering

A. Metering shall be provided to measure the amount of electricity supplied by the facility to Du Pont Company system and the amount of electricity furnished to the facility by Du Pont Company system.

B. Coordinate with the DuPont Company and CP&L to modify the metering in the main incoming 115 kV substation to measure the amount of electricity supplied by CP&L to the DuPont facility and the amount of electricity supplied to CP&L by the DuPont facility.

16.06 Du Pont Electric Interconnection

A. The electrical output of the plant shall be connected to the existing Du Pont system in manhole Nos. 11 and 12. Direct burial cable shall be installed from the take-off structures to the manholes where the new cables shall be spliced to the existing feeder cables. Existing ducts shall be used for the final lengths of run to the manholes.

16.07 Main Power Transformer

A. The main power transformer shall be a 13.8 kV delta to 24 kV wye oil-filled transformer.

B. The transformer shall be designed for continuous self-cooled operation. The transformer shall be equipped with the necessary auxiliary cooling equipment to provide the supplemental forced-cooled kVA ratings. The cooling equipment shall be controlled from winding-temperature indicator-relay.

C. The transformer shall be equipped with lightning arrestors and current transformers.

D. The transformer shall meet the requirements of ANSI C57.12.

E. The transformer shall be equipped with the following protective devices:

1. Oil level switch with alarm contact.

2. Pressure vacuum gauge with alarm contact.

3. Dial type thermometer with alarm contact.

4. Rapid pressure rise relay.

F. **All bushings on both the 13.8 kV and 24 kV sides of the transformer shall be equipped with a power-factor tap to permit power-factor testing when the bushing is mounted on the transformer.**

16.08 Distribution

A System Capacity and Design Criteria

1. The distribution system shall be designed with a sufficient kVA capacity to carry the maximum kVA output of the steam turbine generator, plus the maximum kVA required for station service. Circuit breakers shall have sufficient continuous current capacity and short-circuit capacity for system operation and protection and shall be electrically operated with D.C. close and trip.

2. Optimum design of the 13.8 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, ANSI C37.010 being the basis for 13.8 kV switchgear.

ANSI C37 series standards, ANSI C37.010 being the basis for 13.8 kV switchgear.

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 (13.8 kV, 4.16 kV and 480 volt) must be considered.

c. Under normal* operating conditions, the 13.8 kV and 4.16 kV systems 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.

e. The voltage at the terminals of the steam turbine generator shall fall within the generator manufacturer's stated permissible values (typically 95% to 105% without derating).

f. The main generator will not normally operate in isolated mode, i.e., disconnected from the utility.

g. When the generator is off line (including start-up and shut-down), power for auxiliaries will be supplied by backfeeding the main transformer from the Du Pont system.

*Normal is defined as falling within the following limits:

(1) Full station output, all required auxiliary loads in service, no large motor starting, generation voltage at 95% of nominal rating.

(2) Minimum station output, minimum auxiliary load, no large motors starting, generator voltage at 105% of nominal rating.

B. <u>13.8 kV Switchgear</u>

A single busbar line-up of 13.8 kV switchgear shall be provided. The switchgear shall consist of three (3) 13.8 kV power vacuum circuit breakers, one for the generator, one for the 13.8 kV-4.16 kV transformer, one for the main 13.8 kV-480 kV transformer and a auxiliary compartment for connection of the main power transformer.

C. 4160 Volt System

1. A single 13.8 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 circuit breakers 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 will 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.

D. Low Voltage System

1. A single 13.8 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.

shall be single phase and supplied from the 208/120 volt, 3-phase, 4-wire system.

16.09 Protective Relays

A. Contractor shall provide a fully integrated relay scheme for the protection of the turbine generator, plant switchgear, auxiliary power distribution equipment, step-up transformer and substation 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. The One-Line Diagram and materials specified give requirements for protective relaying. 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 drawout 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.

16.10 D-C System

A. Lead acid batteries shall supply 125 volt D.C. power to operate the 24 kV circuit breakers, the 13.8 kV switchgear, the 4160V switchgear, steam turbine generator emergency lube oil pump(s) (60 minute minimum operation), emergency lighting, Diesel engine start and other loads as required.

B. The DC system shall be located in a ventilated battery room. The battery charging equipment shall be designed to operate in parallel with the batteries.

16.11 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

Switchyard	5 fc
Roadway & parking areas*	1 fc

2. RDF Handling Area

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

3. Electrical Generating Stations (Interior)

Turbine operating floor	30 fc
Below operating floor	10 fc
Control room	50 fc
Office and laboratories	70 fc
Locker rooms, toilets	20 fc
Maintenance shop and spare parts	30 fc

4. Water Treatment Area

Interior areas	30 fc
Outdoor facilities	5 fc

5. Instrument Areas and Boiler Front 30 fc

B. High pressure sodium 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, office area and turbine/generator building.

16.12 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. All equipment enclosures and/or equipment ground buses shall be grounded through the plant's ground loop which shall consist of buried ground wire minimum #4/0 AWG, with driven ground rods located strategically throughout the plant. Taps from the ground loops to individual equipment shall be a minimum #2/0 AWG. Non-current carrying part of electrical equipment shall be grounded from the source by a separate wire to the equipment.

16.13 Lightning Protection

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

16.14 HV Switchyard

A. The HV switchyard shall be located near the turbine building and shall be enclosed by a chain link fence.

B. The switchyard shall contain the main power transformer, _____the 24 kV circuit breakers, 24 kV line disconect switches, instrument transformers, bus and support structures.

C. The switchyard layout shall be such that no conveyor comes within a 50 foot horizontal distance of the switchyard fence.

D Provide an oil containment dike around the main transformer.

E. **The Contractor shall modify the existing Main Incoming 115 kV Substation as follows:**

1. **Furnish and install new 24 kV circuit breaker and 24 kV line disconnect switch on the existing 24 kV tie bus.**

2. **Modify existing control/protection scheme including installing of new relays and instrument transformers, removal of existing devices and wiring changes.**

3. **All work shall be in accordance with DuPont requirements and standards and shall be subject to their review and approval.**

16.15 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.

C. Television System

1. The in-plant television system shall provide for the following features. Individual cameras shall be provided for the following areas:

Fuel Trailer Entrance Gate	Truck Unloading Area
Main Entrance Gate	Boiler Grate
Fuel Handling Area (Two Panning Units)	Ash Silo
Boiler Feed Area	Sand Silos

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

3. Four 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.

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. A link to the Du Pont boiler plant for data only shall be provided.

16.16 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 capacity will be at least 125 percent of the D.C.S. load and sized for 30 minutes of running time upon power failure.

16.17 Electric Heat Tracing

A. Electric heat tracing shall be furnished as required to prevent freezing for process lines and caustic storage tank. Self-limiting heating cable shall be used and controlled by line sensing thermostats. Each system shall have visual or instrument indication of operation. Mineral insulated heat trace cable shall be used on high temperature process lines.

16.18 Conduit and Tray

A. Underground conduit will be a minimum of 1 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.

16.19 Conductors

A. Single 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. 24 kV system - 25 kV, EP shielded with 133% insulation level and PVC jacket.

2. 13.8 kV system - 15 kV, EPR, shielded with 133% insulation level and PVC jacket.

3. 4160 volt system - 5 kV EPP, shielded with 133% insulation level and PVC jacket.

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

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

6. Control systems - 600 volt, Type THHN.

7. 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.

16.20 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.

16.21 Welding Outlets

A. Provide welding outlets in the following location:

1. Maintenance Shop

2. Base of each Boiler
3. Mid-Level of each Boiler
4. Steam Drum Level

17.00 INSTRUMENTATION AND CONTROLS

17.01 General

A. A modular, microprocessor-based, Distributed Control System (DCS) shall be provided for data handling, systems control, monitoring, recording, and alarming necessary for proper operation of the plant from a Central Control Room. The DCS shall be the main operator interface with the plant.

B. The DCS shall control all analog and digital loops except those better suited to local controls or programmable controllers.

C. The DCS shall interface with local controls and programmable controllers being used for system sequential control and interlocking.

D. All required plant parameters shall be monitored and indicated in the Central Control Room to facilitate control of the plant. Analog meters shall be provided for key parameters.

E. For locally controlled systems, a minimum of one system trouble alarm is required. Interfaces to the DCS are preferable.

F. Local indicating devices (pressure gauges, thermometers, etc.) shall be furnished for local monitoring of selected plant parameters. Use of local only indications at remote process areas is to be minimized.

G. Continuous emissions monitoring, metering and recording shall be provided and shall be subject to the approval of regulatory authorities.

17.02 Control Hardware

A. General

1. The DCS equipment consisting of control panels, electronic rack, color CRT's, operator's keyboards, printer and input/output racks shall be supplied by a Bailey INFI-90 or engineer approved equal.

2. Final control elements (drives and valves) programmable controllers and local instruments shall be supplied by a single manufacturer for each element type, (e.g. a single manufacturer shall supply all control valves).

3. Remote rack mount all vendor's electronics and access panels for systems which are controlled by vendor's electronics. Interface with the DCS for operator access to the process.

4. Provide the following, separate from the DCS:

   - Fire Alarms/Fire Control System
   - Turbine Trip Pushbutton(s)
   - Visual Indications as required by Codes.

5. The following equipment shall be provided with 100% backup:

   - Data Highway Cable and Controller/Interface
   - Operator Interface
   - Printer/Logger
   - Electronics for Critical Loops including:

     o Drum Level
     o Main Steam Pressure
     o Main Steam Temperature
     o Air Flow/O_2 Trim
     o Furnace Draft
     o Fuel Flow
     o T-G Water Induction Prevention

6. Provide programming terminal for Programmable Logic Controllers (PLC). Portable personal computer with vendor specific software packages is preferred.

7. Electronic signals shall be 4-20 MA or 1-5 VAC. Pneumatic signals shall be 3-15 psig.

8. The DCS system shall be provided with a minimum of 20% spare input output points.

B. The operator's console shall have two CRT type operator consoles each with its own keyboard. Each operator interface shall be redundant to the other. A third CRT shall be provided for use by the plant engineer.

C. The displays available shall include:

1. Overviews: Provides an overall impression of plant operation and of alarm conditions.

2. Groups: Provides detailed information on a group of measurements, contact status, or loops. This group display shall show control loops by a pictorial representation of the fascia of a panel-mounted controller with bar-graph indications of measured value and set-point. The keyboard gives the operator access to at least all the facilities available on the fascia of a conventional single-loop controller.

3. Details - Provides detailed information on a single measurement, contact or loop. Detail displays shall repeat the fascia type representation from the group display and shall add tabulated data on all the parameters associated with the point; such as, scaling, alarm settings and control term settings.

4. Trends: Provides time related trend of a measurement.

5. Summaries: To list all current alarms.

D. A minimum of 20 graphic displays shall be provided.

E. 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
- Condensate and Feedwater Systems
- Demineralizer System (Alarms from Local Panel)
- Circulating Water System
- Turbine/Generator System
- Extraction Steam and Feedwater Heater System
- Flue Gas Cleaning System
- Ash Handling Systems
- Plant Heat Rate
- Transformers

17.03 Boiler Control

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

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

1. To maintain desired steam throttle 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 controller.

5. To maintain combustion within the safe operating range.

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

7. To provide a plant master control for:

   - o Boiler following turbine mode of operation
   - o Turbine following boiler mode of operation
   - o Boiler only mode of operation

8. To maintain safe operations of the unit.

17.04 Turbine Generator Control

A. The primary functions of the turbine control system shall be:

1. Speed/Load Control - Maintain turbine speed by adjusting steam inlet control valves in response to load demands.

2. Overspeed Protection - Closes inlet control and/or stop valves upon detection of turbine overspeed by the redundant speed sensors.

3. Turbine Monitoring - Bearing vibration level, shaft voltage and current shall be monitored and the operator alerted upon detection of abnormal condition.

4. Auxiliary Equipment Control - Bearing lubrication system, hydraulic control power unit and turning gear shall be monitored and controlled in accordance with turbine manufacturer's standards.

5. Water Induction Protection

17.05 Generator Control:

A. The primary function of the generator control system shall be:

1. Automatic synchronization

2. Automatic voltage regulation

3. Protective relaying system to provide protection against stator short circuit, external fault, loss of excitation, motoring, unbalanced faults, and low frequency.

4. Net power output and net reactance shall be displayed in the control room.

17.06 Water Treatment

A. Water treatment shall be controlled from a local control panel supplied by the water treatment manufacturer. A programmable controller shall be provided to carry out all system automatic sequences. At minimum, trouble alarm signals to the main DCS shall be provided.

B. Production of makeup water shall be manually initiated, based upon a low level signal from the condensate storage tank. A high condensate storage tank level shall automatically cease operation of the demineralizer system.

C. The regeneration and neutralization cycles of the makeup water treatment system shall be manually initiated by the operator and then proceed to completion automatically.

D. Neutralization shall be controlled by continuous pH monitoring of the waste in the holding tank and automatic administration of caustic as required. Acid addition, if required, shall be by manual control. Dump of neutralized waste shall be operator initiated.

17.07 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 loss of speed switch on each driven pulley with alarm to DCS.

17.08 RDF Metering and Boiler Feed

A. The DCS shall control the supplying RDF and the in-feed conveyor system. The boiler shall be fed with RDF fuel utilizing 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.

17.09 Burner Management System

A. The burner management system shall supervise the 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 local at the burner platform with a release from the Control Room. After a burner is on, the gas combustion shall be controlled from the central Control Room.

17.10 Continuous Emissions Monitoring System

A. 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.

17.11 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
- Deaerator Storage Tank Outlet
- Condensate at Deaerator
- Condensate Pump Discharge
- Circulating Water (at condenser inlet and outlet)

C. Analysis shall provide for automatic control of chemical addition to the boiler, feedwater and condensate systems.

17.12 Trending and Data Recording Capability

The DCS shall provide for the following capabilities:

- Trending: 2 hour maximum; frequency 0.5 sec.
- Tracking Upsets: historical, all points over the past 24 hours: frequency 1 sec. (maximum of 10% of total points) to 6 min. averages.
- Shift Reports: historical, all points over the past 8 hours; frequency 3 min. average; high and low values.
- Daily Reports: three-day minimum; 6 min. average (min.); 40% of total points.

- Monthly Reports: 6-month minimum; hourly averages; 15% of total points.

- Calculating Capability: Totalization, averaging, heat rate, efficiency, etc.

- Corrections: Ability to enter manual values for "bad data" for up to three days.

- Archiving: Ability to interface with tape drive for future archive of data to tape.

17.13 Documentation

Provide a functional written description of the control philosophy of all computer controlled systems (DCS, PLC, etc.)

17.14 Control Room

A. The plant shall be provided with a central Control Room which shall preferably be located on the turbine level and be provided with glass windows to allow visual observation of the steam turbine generator especially during shutdown with the turbine enclosure removed. The room shall be air conditioned, sound proofed.

B. The Control Room shall house the DCS hardware, turbine panel, electrical board, relay panel, soot blower 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.

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

18.00 CIVIL/STRUCTURAL

18.01 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 power house shall be removed and replaced with a gravel course. Areas near the power house shall be graded to provide for construction trailers and activities. After completion, these areas shall be regraded, loamed and seeded.

18.02 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. 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 have a 30-foot paved width and site roads 24-foot paved width.

D. Permanent parking areas shall be as designated on the conceptual arrangement drawing. Parking spaces are to be sized 10 feet by 20 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. Trailer stands shall be provided with concrete pads for support of cranked-down dolly wheels.

18.03 Perimeter Fence

A. The plant area shall be enclosed by an industrial quality 7 feet high galvanized chain link fence. RDF receiving area shall be fenced separately from the EGF plant. The site entrance way shall have a motorized gate which shall be controlled from the Control Room. An audio communication link to the Control Room shall be provided.

18.04 Finish Grading and Landscaping

A. All unpaved areas in the plant area and access road shall be finish graded, loamed and seeded or covered with a river run gravel comparable to that used by Du Pont as a cover material.

B. Minimum graded cross slopes shall be:

Grassed Areas:	4 percent
Paved Areas:	1 percent

18.05 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. Contractor shall be responsible for all foundation/footing design.

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

18.06 General Description

A. Power Plant Buildings (Turbine and Administration)

1. Superstructure - Structural steel frame of AISC, Type 2 construction with horizontal and vertical bracing systems for lateral stability of the building. Floors shall be of concrete slab, grating and/or checkered plate as required to suit operational and maintenance requirements.

2. The turbine generator shall be supported on a reinforced concrete pedestal founded on mat isolated from the surrounding superstructure and foundations.

3. An overhead crane shall traverse the length of the turbine floor. Crane shall be sized to hoist the largest turbine generator components (exclusive of the stator).

4. The turbine may be housed in a removable type enclosure (Kelly Klosure or engineer approved equal) which allows routine servicing of the turbine without removal.

B. Demineralized Water Tank and Clarified Water Tank

1. Vendor furnished and field erected.

2. Foundations - in accordance with tank vendor recommendations and as required to suit geotechnical conditions.

C. Switchyard

1. Structures and equipment

2. Foundations - sized to accommodate vendor requirements, and as required to suit geotechnical conditions.

3. Provide main power transformer with spill containment system. Sump pump-out system shall deactivate if liquid loss alarm is received.

4. Enclose with chain link fence and equipment gate.

D. Pre-Engineered Buildings (Water Treatment and Other Buildings)

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

2. 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."

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

18.07 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. "BOCA Basic National 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

18.08 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. The following minimum dead load shall be used.

1. Roof

a.	Roofing and Insulation	15 psf
b.	Metal Deck & Framing	10 psf
c.	Piping, Mechanical	15 psf
d.	Concrete Slabs	Self-weight

2. Floors

a.	Supported Concrete Slab	Self-weight
b.	Grating - 1-1/4 x 3/16	10 psf
c.	Framing	15 psf
d.	Checkered Plate 3/8" Thick	17 psf
e.	Elec. Conduits, Lights, etc.	10 psf
f.	Piping, Mechanical	25 psf

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

1. Roof: A 50 psf general live load. Low roof adjacent to high roof will be designed for snow drifting in accordance with the requirements of BOCA.

2. Stairways — 100 psf

   Office Areas and Platforms — 100 psf

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

4. Operating Floor

   a. Turbine Deck, Forklift Truck — 250 psf or 5 Tons

   b. Boiler House - Concrete Area — 250 psf
      Grating Area — 150 psf

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

6. RDF Fuel Gallery — 100 psf

7. Walkways — 60 psf

8. HVAC Fan Room & Control Room — 150 psf

9. A "phantom" load of 5 kips minimum will be used on all beams in those areas of the Power Plant Buildings where exact loadings are unknown at time of design. Beams and girders supporting heavy equipment (equipment weight equal to or greater than 50 kips) shall have minimum phantom load not less than 10% of the equipment load (exclusive of boiler loads).

10. Equipment Loads: As required.

11. Crane Girders: According to AISC requirements.

12. Live Load Reduction: All columns below one story below the roof level may have their uniform live load reduced by 20%.

13. RDF Fuel Loads

    a. RDF Fuel Weight

        (1) 17.5 pcf for volume calculations

        (2) 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.)

14. Loads for underground structures and retaining walls:

    a. Soil Weight - 120 pcf (minimum)
    b. Horizontal Soil Pressure - 60 psf
    c. Vertical Surcharge - 500 psf
    d. Hydrostatic Loads - The design water table is approximately 20 feet below grade. (To be confirmed by the Contractor.)

15. Wind Loads

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

16. Seismic Design

    Seismic design shall be in accordance with the BOCA Basic Building Code for Zone 2.

17. 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%

18.09 <u>Construction Materials</u>

A. <u>Soils</u>

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. Piles: Pile type and capacity to suit geotechnical conditions and design loadings.

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

4. 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 maximum of 0.0025 x height of the structure.

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.

18.10 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 three 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
   Proportions of cement and aggregate
   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.

19.00 ARCHITECTURAL CRITERIA

19.01 General Description

A. The major architectural aspect of the project is the Turbine Administration Building which will accommodate the major power plant equipment, control room and computer room. The Water Treatment Building will be separate from the turbine structure.

B. Other structures such as a Pump Houses, 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.

19.02 Architectural Analysis of BOCA Code

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

1. Means of Egress
2. Interior Stairways
3. Access to Roofs
4. Smoke-proof Enclosures
5. Exterior Stairways

6. Exit Signs

19.03 Building Materials

A. Exterior

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

   Metal Panels (unheated buildings)

2. Roofs - Loose laid elastomeric sheet with ten pounds per sq ft of stone ballast on substrate of either concrete slab or a 2" perlite board on metal deck.

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

Concrete Walls	U	=	0.67 Btu/hr. ft^2 ^{o}F
Insulated Metal Siding	U	=	0.27 Btu/hr ft^2 ^{o}F
Roof with Ceilings	U	=	0.15 Btu/hr ft^2 ^{o}F
Roof without Ceilings	U	=	0.2 Btu/hr ft^2 ^{o}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 - ceramic tile.

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

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

5. Standard floor finish in work areas shall be exposed concrete with a dry shake surface hardener

6. Control room floor shall be vinyl composition tile on raised access flooring.

7. Office area floors shall be vinyl tile.

C. Glazing

Glazing shall be operable. Windows shall be located in the Turbine Enclosure at the operating floor level and in the office area on all levels.

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 16' wide by 14' high (min.).

19.04 Functional Layout

Each building layout shall emphasize functional relationships of equipment, personnel circulation and access for servicing.

The major plant levels are designated as follows and shall provide the following functions:

Ground Level

Turbine Generator Auxiliaries
Administrative Areas and Locker Rooms
Maintenance Areas
Lunch Room

Operating Level

Control Room
Computer Room
Turbine Generator
Boiler Operating Front

19.05 Synopsis of Required Spaces

A. Space Requirements

Function	Area, Ft^2
Plant Manager	300
Operations Superintendent	240
Reception Area	270
Bookkeeping	168

Conference Room	240
Maintenance Superintendent	168
Lunch Room	240
Utility/Supply Room	210
Shift Supervisor	125 (At Control Room)
Water Treatment Laboratory	125
Service/Maintenance Shop	1100

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

B. Special Features

1. The Lunch Room shall be provided with a compact kitchen unit including cabinets, sink, range and refrigerator and utilities for at least six vending machines.

2. Locker Rooms

   a. Men's room contains 3 showers, 1 water closets, 2 urinals, 2 lavatories and 21 pair of half lockers.

   b. Women's room contains 3 shower, 3 water closet, 2 lavatory and 21 pair of half lockers.

3. A single water closet toilet room shall be located adjacent to the control room containing water closet, urinal and lavatory.

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

5. Drivers lounge shall be provided with space and utilities for at least six vending machines.

19.06 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.

19.07 Access Platforms

Contractor shall furnish and install galvanized steel access platforms, stairs, and ladders in accordance with the requirements of the Occupational Safety and Health Administration requirements. 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
Cooling Tower Fans and Drives
Chimney Test Ports
CEM Equipment Areas

20.00 ACOUSTIC CRITERIA

20.01 Plant Interior

A. The noise level inside 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.

20.02 Plant Exterior

A. The outdoor noise associated with normal operation of the plant shall be controlled so that the resulting increase in broadband noise level at the property line shall not be more than 15 dBA above the ambient noise level.

20.03 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.

3. Selecting quiet equipment including roof-mounted vent fans and air-cooled chillers for the ventilating and air conditioning systems.

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

21.00 PIPING SYSTEMS

21.01 Piping systems shall be designed in accordance with the Power Piping Code, ANSI B31.1.

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

21.03 Piping loads on equipment shall be determined and verified not to exceed manufacturer's allowables.

21.04 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 BOCA.

b. Safety valve discharge transient loading analysis.

c. Turbine trip analysis using the equivalent static type analysis with maximum forces dictated by the characteristics of the turbine trip valve closing time.

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. Welds on this piping shall be 100% radiographic inspected.

21.05 <u>Piping Systems with Temperature Greater than 250°F</u>

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.

21.06 <u>Piping Systems with Temperature Less than 250°F</u>

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

21.07 <u>Pressure Boundary</u>

A. The pressure integrity of all piping systems shall be designed in accordance with the 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.

21.08 <u>Preoperational System Cleaning</u>

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

1. Main steam line from boiler to turbine stop valve shall be cleaned via steam blow. Temporary piping shall be installed from the

top of the turbine stop valve 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 the turbine manufacturer'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. Preboiler piping shall be cleaned via a hot alkaline flush in accordance with boiler manufacturer's recommended procedure. Temporary piping shall be installed as necessary to allow circulation through the condensate system and 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.

5. Lube oil piping shall be flushed with clean No. 2 fuel oil until all foreign matter is eliminated. Flushing velocity shall not be less than 10 ft/sec. The oil shall be recirculated through a temporary strainer (openings less than .034 in.) Turbine manufacturer's special instructions for lubricating oil system cleaning shall be complied with.

21.09 <u>Pipe Sizing</u>

A. 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.

21.10 End Connections

A. 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.

22.00 INSULATION SYSTEMS

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

22.02 All hot parts shall be covered with mineral wool, fiberglass or 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.

22.03 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 exceed 130°F at an ambient temperature of 100°F.

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

22.05 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 fiberglass or polyurethane of suitable thickness and covered with vapor barrier jacketing.

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

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

23.00 OWNER SUPPLIED EQUIPMENT AND MATERIALS

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

23.02 <u>Stationary Equipment</u>

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

23.03 <u>Vehicles</u>

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

- Forklift
- Tractors/Trailers
- Pickup Truck

23.04 <u>Fuel</u>

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

B. Propane required during startup shall be purchased by the Owner and charged to the Contractor as a reimbursable expense.

23.05 Ash Disposal

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

23.06 Chemicals

A. Owner will purchase chemicals required for start-up, initial operation and testing and charge to Contractor as a reimbursable expense.

24.00 SPARE PARTS AND SPECIAL TOOLS

24.01 General Spare Parts

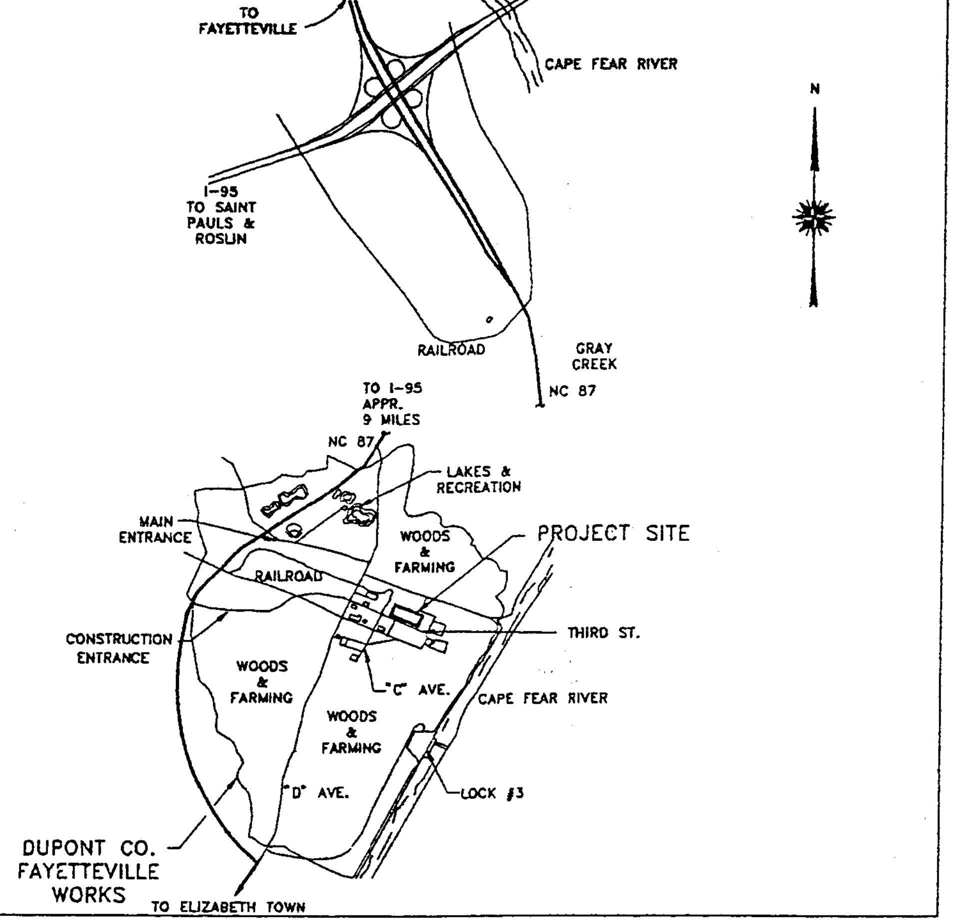
A. The Contractor's procurement specifications shall request the bidders to provide a recommended spare parts list and price sheet with their bid on the equipment. This information shall be provided to the Owner at the time an equipment purchase order is issued. The Owner shall purchase spare parts from 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.

24.02 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.

5



SITE LOCATION PLAN

BCH ENERGY
LIMITED PARTNERSHIP
HOUSTON, TEXAS

ENERGY GENERATION FACILITY
PROJECT
AT
FAYETTEVILLE, 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-071-01-T1	TITLE SHEET
D-071-01-C1	AREA SITE PLAN AND EXISTING UNDERGROUND UTILITY ROUTING
D-071-01-C2	SITE PLAN
D-071-01-C3	SITE ELEVATION
D-071-01-E1	MAIN ELECTRICAL ONE LINE DIAGRAM
D-071-01-E2	4160V SYSTEM ONE LINE DIAGRAM
D-071-01-E3	480V AND 120V SYSTEM ONE LINE DIAGRAM
D-071-01-M1	EQUIPMENT ARRANGEMENT PLANS, STEAM TURBINE BUILDING AND DRIVERS LOUNGE
D-071-01-M2	HEAT BALANCE DIAGRAM, ZERO STEAM EXTRACTION CASE
D-071-01-M3	HEAT BALANCE DIAGRAM, 80,000 LBS/HR STEAM EXTRACTION CASE
D-071-01-M4	WATER BALANCE
D-071-01-M5	PIPING & SCHEMATIC DIAGRAM SYMBOLS
D-071-01-M6	SCHEMATIC DIAGRAM RDF HANDLING AND FUEL FEED SYSTEM
D-071-01-M7	SCHEMATIC DIAGRAM COMBUSTION AIR AND FLUE GAS SYSTEM
D-071-01-M8	PIPING & INSTRUMENTATION DIAGRAM STEAM SYSTEMS
D-071-01-M9	PIPING & INSTRUMENTATION DIAGRAM CONDENSATE & FEEDWATER SYSTEM
D-071-01-M10	PIPING & INSTRUMENTATION DIAGRAM WATER TREATMENT SYSTEM
D-071-01-M11	PIPING & INSTRUMENTATION DIAGRAM CIRC./ COOLING WATER SYSTEM
D-071-01-M12	PIPING & INSTRUMENTATION DIAGRAM WATER SYSTEMS
D-071-01-M13	PIPING & INSTRUMENTATION DIAGRAM COMPRESSED AIR SYSTEM
D-071-01-M14	PIPING & INSTRUMENTATION DIAGRAM WASTE WATER SYSTEM
D-071-01-M15	PIPING & INSTRUMENTATION DIAGRAM MISCELLANEOUS SYSTEMS

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/15/92	GJC

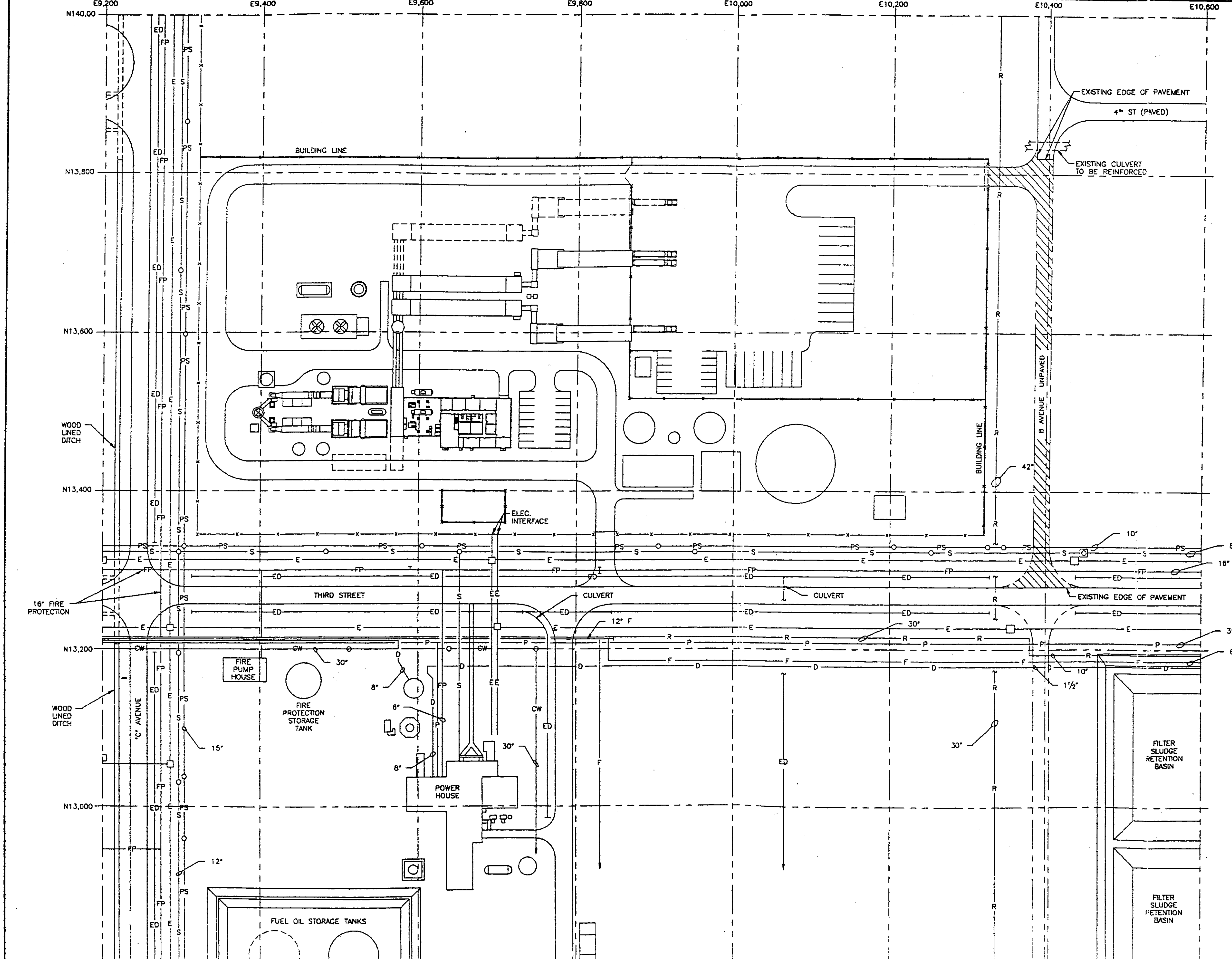
REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP
PROJECT ENERGY GENERATION FACILITY
Title TITLE SHEET

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	8/15/92	Approved		

Scale	Job No.	Drawing No.	Rev. No
NONE		D-071-01-T1	B



LEGEND

EXISTING UTILITY LINES WITH TIE-IN (SEE NOTE #1)

- — R — RIVER WATER
- — P — POTABLE WATER
- — FP — FIRE PROTECTION
- — S — SANITARY SEWER
- — PS — PROCESS SEWER
- — ED — EARTH DITCH
- — E — ELECTRIC

EXISTING UTILITY LINES & STRUCTURES TO REMAIN "AS IS"

- — D — DEMINERALIZED WATER
- — F — FILTERED WATER
- — CW — COOLING WATER
- □ ELECTRIC MANHOLE
- o SEWER MANHOLE
- — X — FENCE

NEW WORK

- — x — NEW FENCE
- UNPAVED OFFSITE ROAD TO BE PAVED UNDER THIS CONTRACT

NOTES:

1. UTILITY TIE-IN SHALL BE LOCATED AT DISCRETION OF OF CONTRACTOR, SUBJECT TO DUPONT'S APPROVAL.
2. ELECTRICAL TIE-IN SHALL BE AT LOCATION INDICATED.

PRELIMINARY

No.	Description	By	Date	Apvd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC
	REVISIONS			

TRI-MONT Engineering Company
Boston, MA.

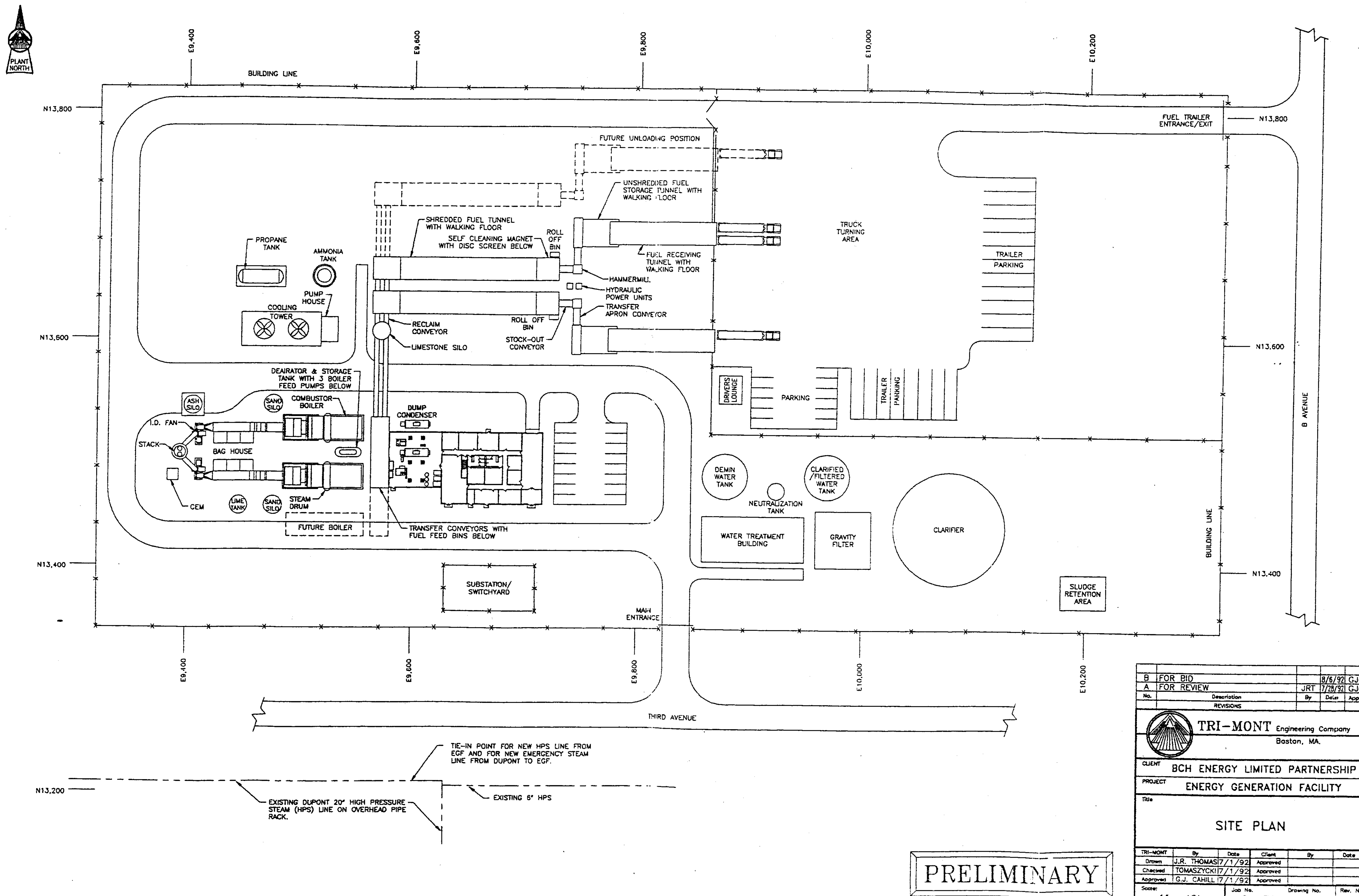
CLIENT: BCH ENERGY LIMITED PARTNERSHIP

PROJECT: ENERGY GENERATION FACILITY

Title: AREA SITE PLAN AND EXISTING UNDERGROUND UTILITY ROUTING

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/23/92	Approved		
Checked	TOMASZYCKI	6/23/92	Approved		
Approved	G.J. CAHILL	6/22/92	Approved		

Scale	Job No.	Drawing No.	Rev. No.
1" = 60'		D-071-01-C1	B



No.	Description	By	Date	Appd
B	FOR BID		8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

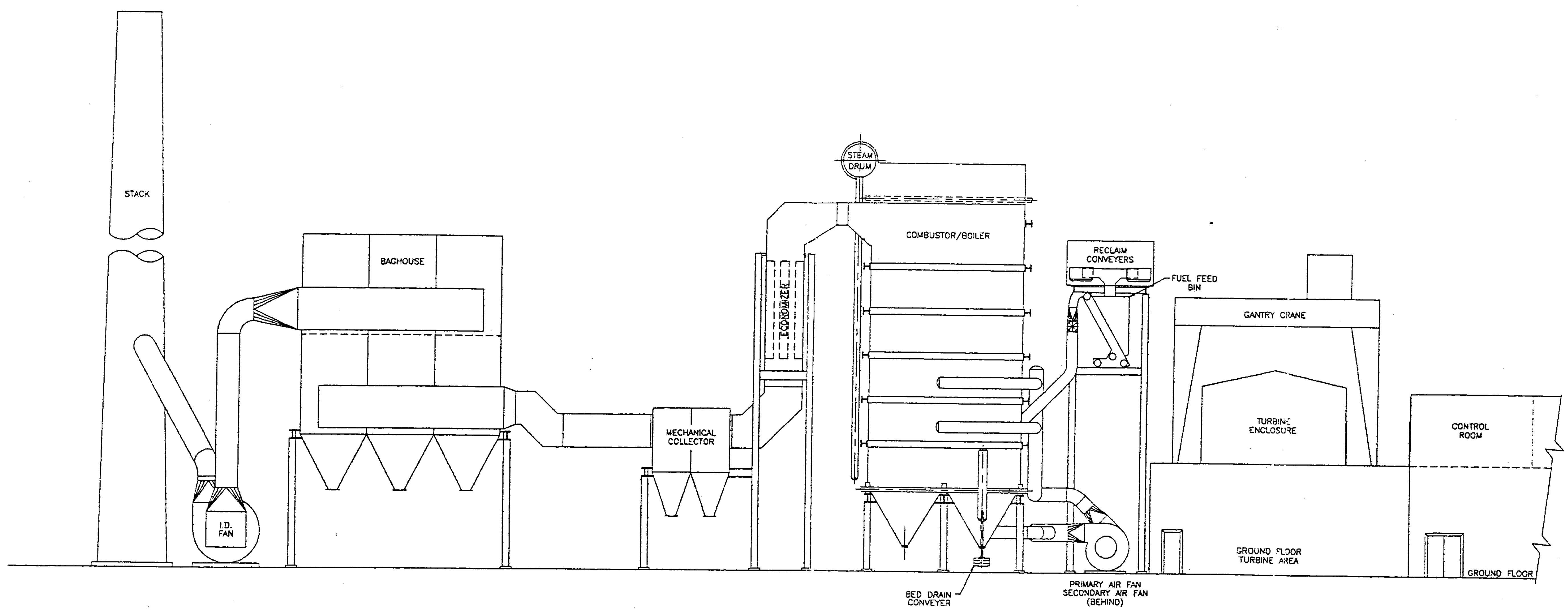
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title SITE PLAN

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	7/1/92	Approved		
Checked	TOMASZYCKI	7/1/92	Approved		
Approved	G.J. CAHILL	7/1/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1" = 40'		D-071-01-C2	B



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	6/8/92	GJC
A	FOR REVIEW	JMM	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

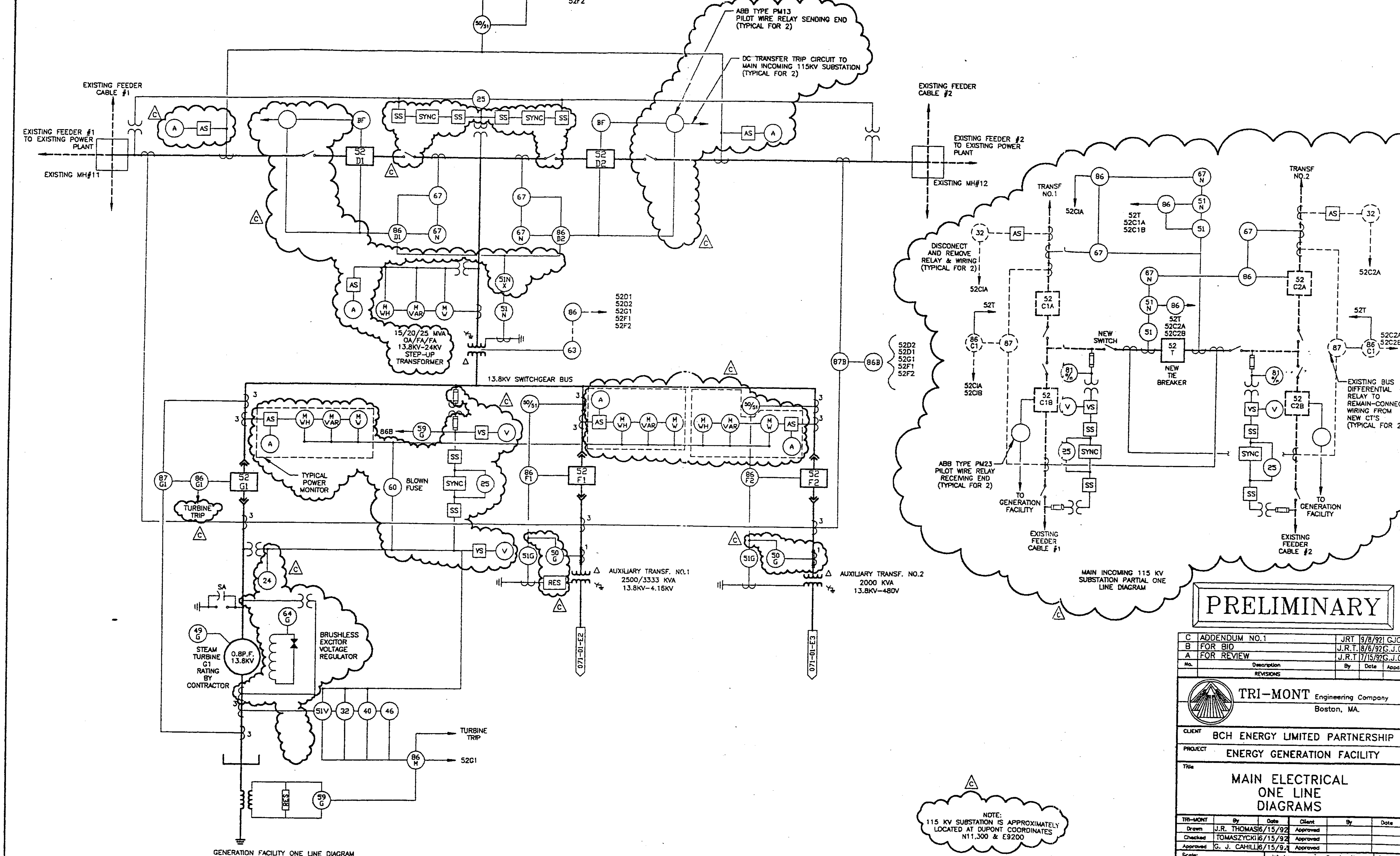
PROJECT ENERGY GENERATION FACILITY

Title

SITE ELEVATION

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
1"=10'		D-071-01-C3	B



PRELIMINARY

No.	Description	By	Date	Appd
C	ADDENDUM NO.1	JRT	9/8/92	GJC
B	FOR BID	J.R.T.	8/6/92	G.J.C.
A	FOR REVIEW	J.R.T.	7/15/92	G.J.C.

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

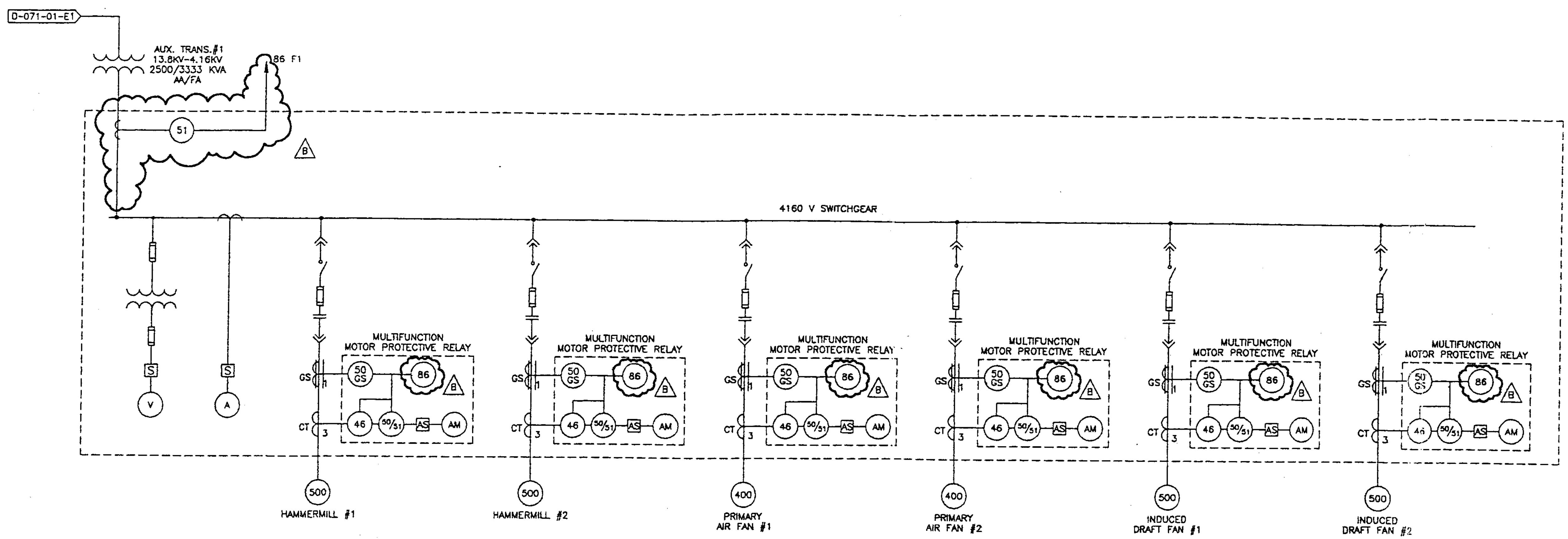
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title MAIN ELECTRICAL ONE LINE DIAGRAMS

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G. J. CAHILL	6/15/92	Approved		

Scale	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-E1	C



NOTE:
MOTOR HORSEPOWER IS ASSUMED TO BE 250 H.P. OR LARGER.
IF DESIGN REQUIRES A MOTOR OF LESS THAN 250 H.P. IT SHALL BE SUPPLIED FROM THE 480V-SYSTEM.

PRELIMINARY

No.	Description	By	Date	Appd
C	ADDENDUM NO.1	JRT	9/8/92	GJC
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/15/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

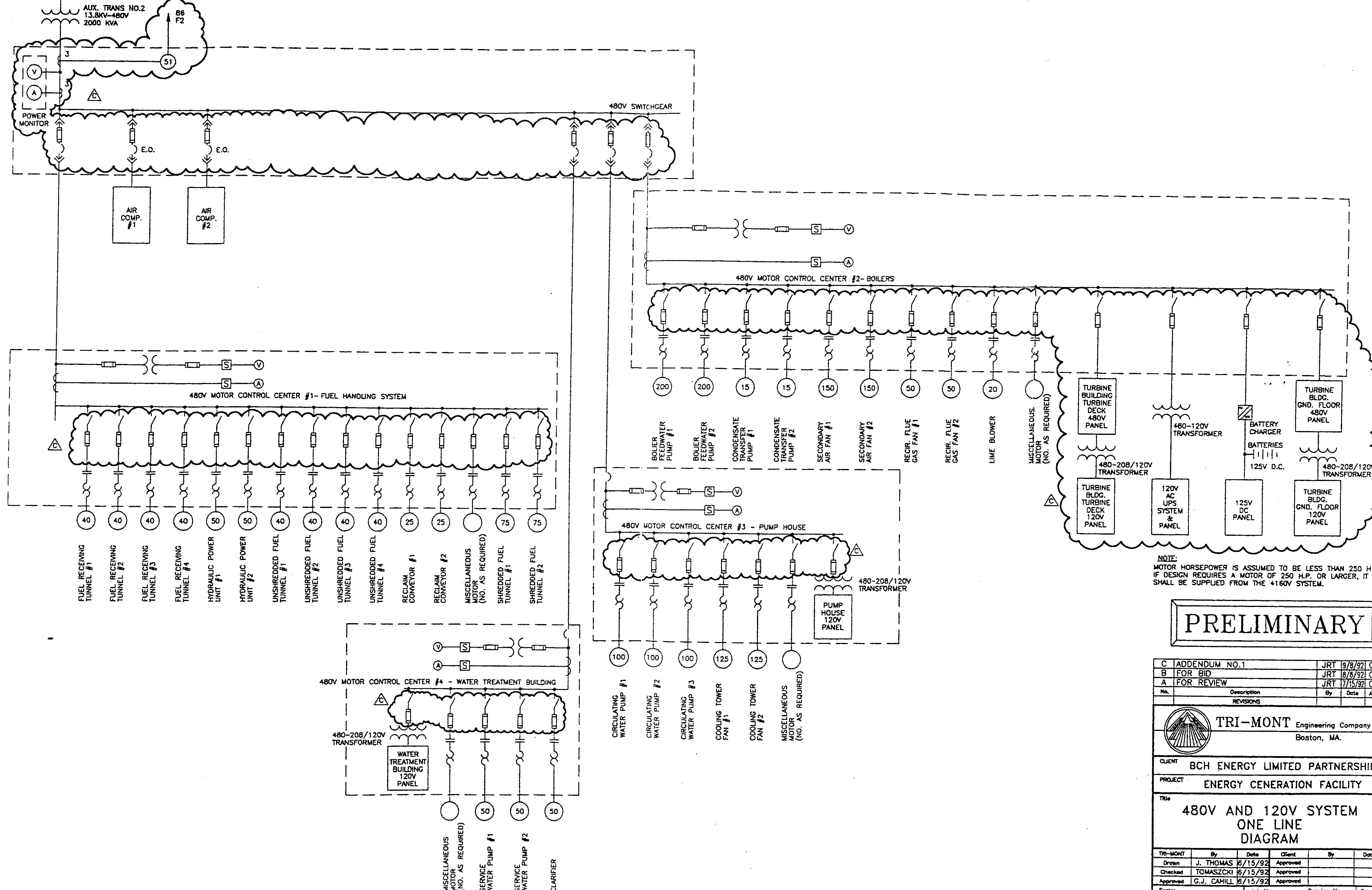
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title
4160V SYSTEM
ONE LINE
DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-E2	C



NOTE:
MOTOR HORSEPOWER IS ASSUMED TO BE LESS THAN 250 H.P. IF DESIGN REQUIRES A MOTOR OF 250 H.P. OR LARGER, IT SHALL BE SUPPLIED FROM THE 4160V SYSTEM.

PRELIMINARY

No.	Description	By	Date	Appd
C	ADDENDUM NO.1	JRT	9/8/92	GJC
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/15/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

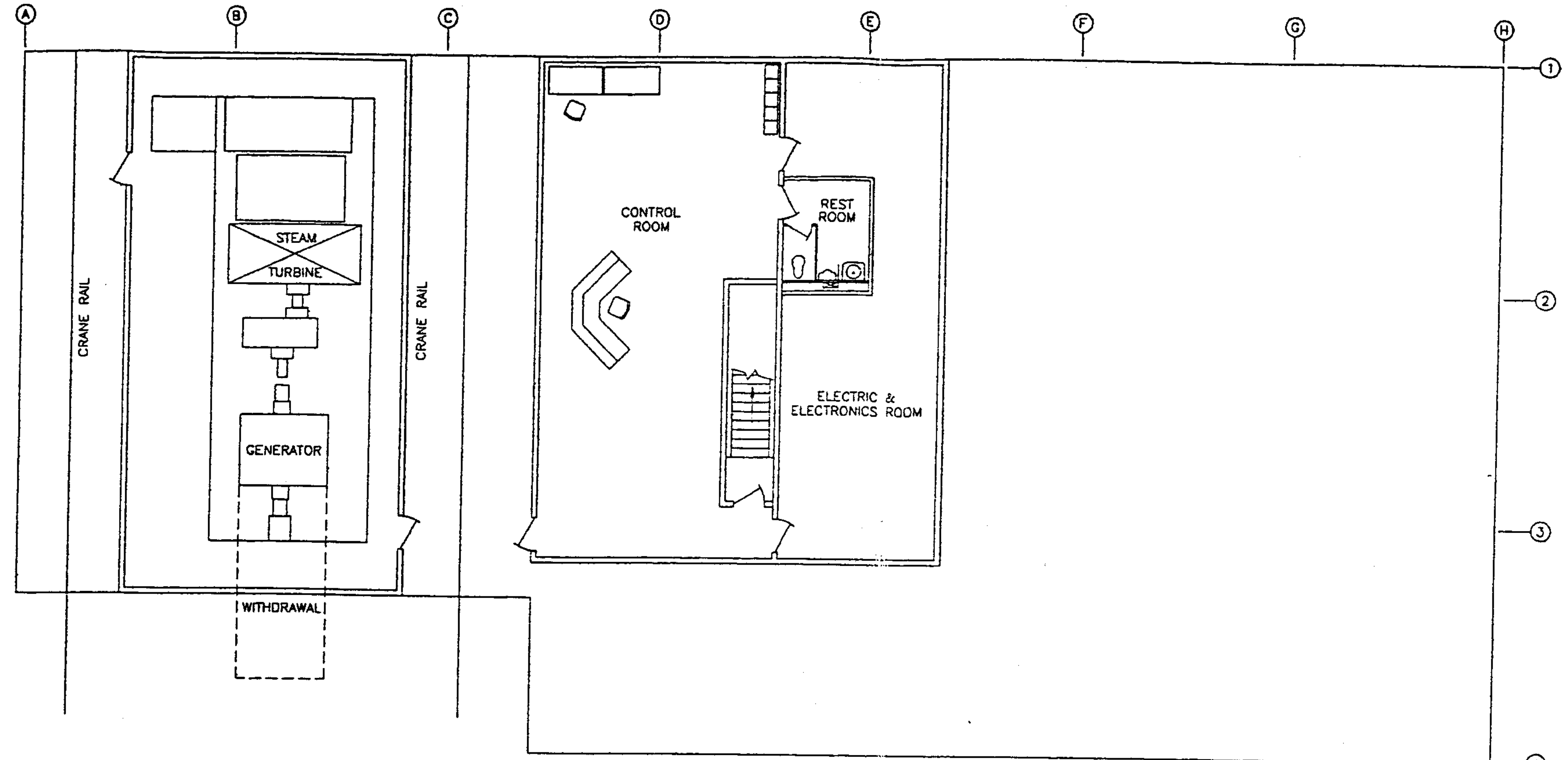
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

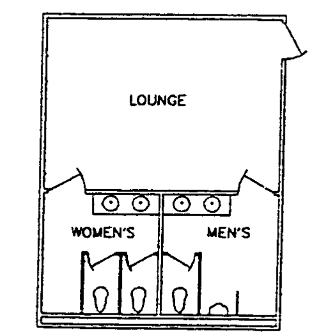
Title 480V AND 120V SYSTEM ONE LINE DIAGRAM

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

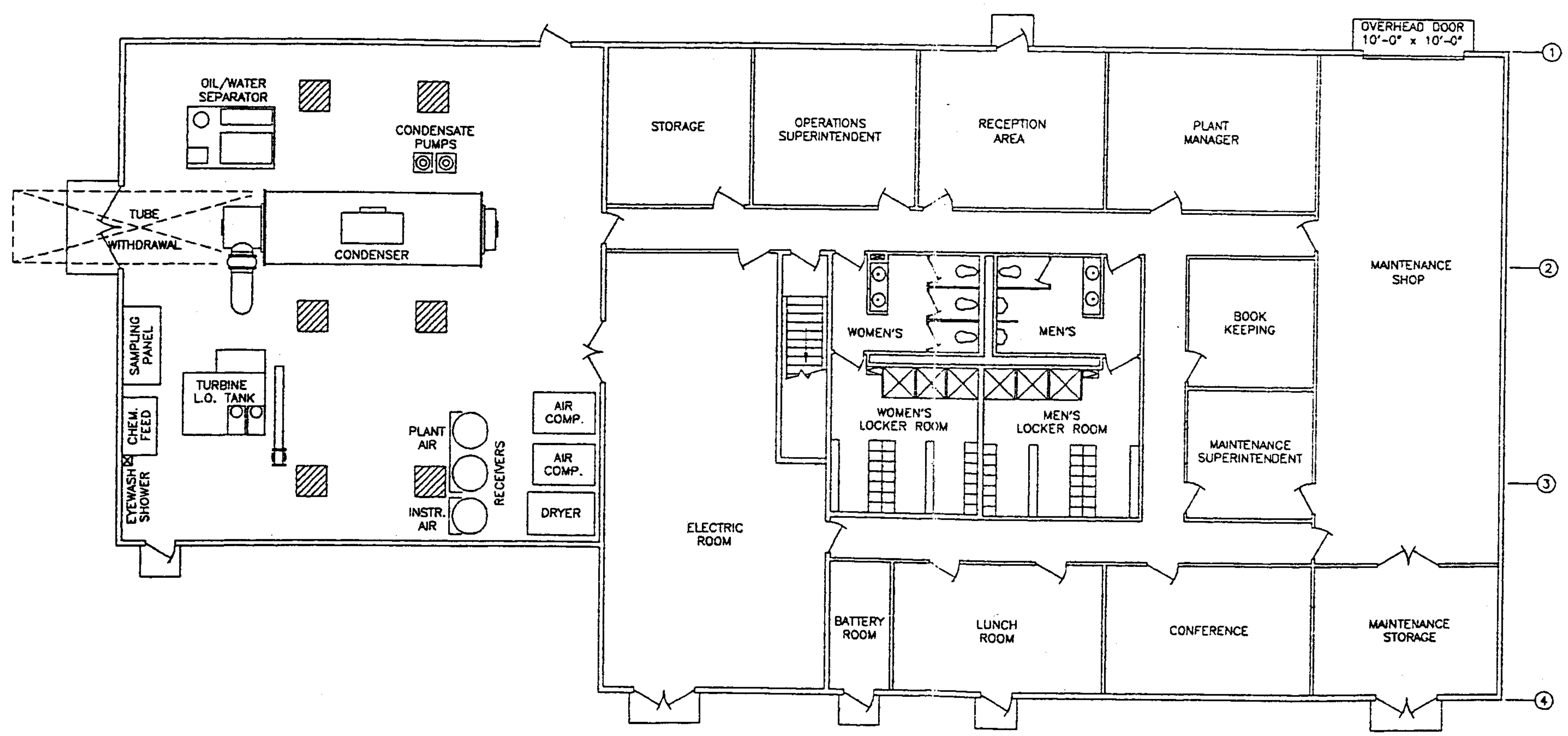
Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-E3	C



ROOF PLAN



DRIVERS LOUNGE



GROUND FLOOR PLAN
STEAM TURBINE BUILDING

PLANT NORTH

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

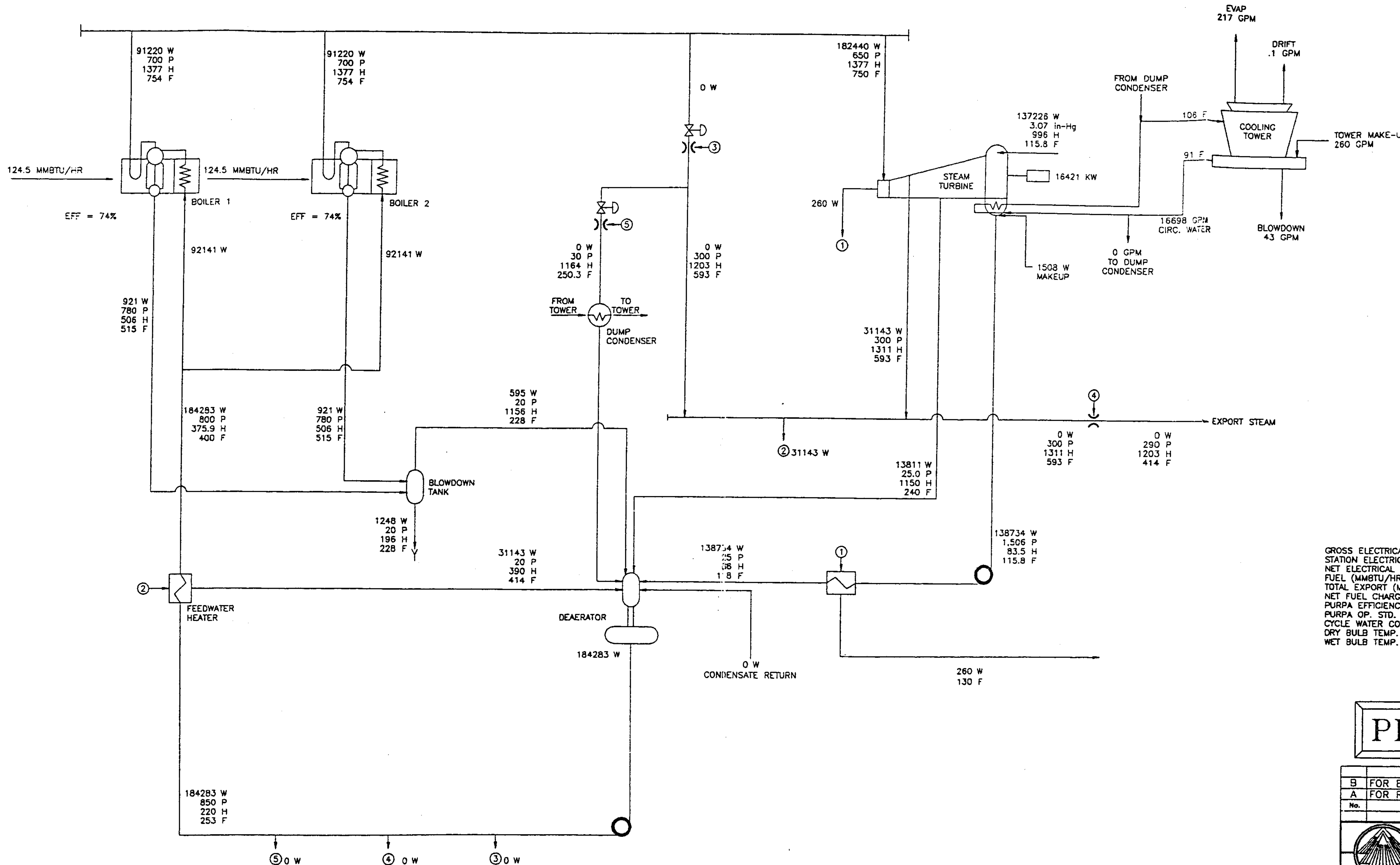
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title
EQUIPMENT ARRANGEMENT PLANS
STEAM TURBINE BUILDING
AND DRIVERS LOUNGE

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J.CAHILL	6/15/92	Approved		

Scale: 1/8" = 1'-0" | Job No. | Drawing No. D-071-01-M1 | Rev. No. B



GROSS ELECTRICAL (KW)	16421
STATION ELECTRICAL (KW)	3500
NET ELECTRICAL (KW)	12921
FUEL (MMBTU/HR, HHV)	249
TOTAL EXPORT (MMBTU/HR)	0
NET FUEL CHARGE TO POWER (BTU/KW, HHV)	19271
PURPA EFFICIENCY (%)	18
PURPA OP. STD. (%)	N/A
CYCLE WATER CONSUMPTION (GPM)	264
DRY BULB TEMP. (F)	100
WET BULB TEMP. (F)	76

LEGEND
W=LB/HR
P=PSIA
H=BTU/LB
F=DEGREES F

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/15/92	GJC

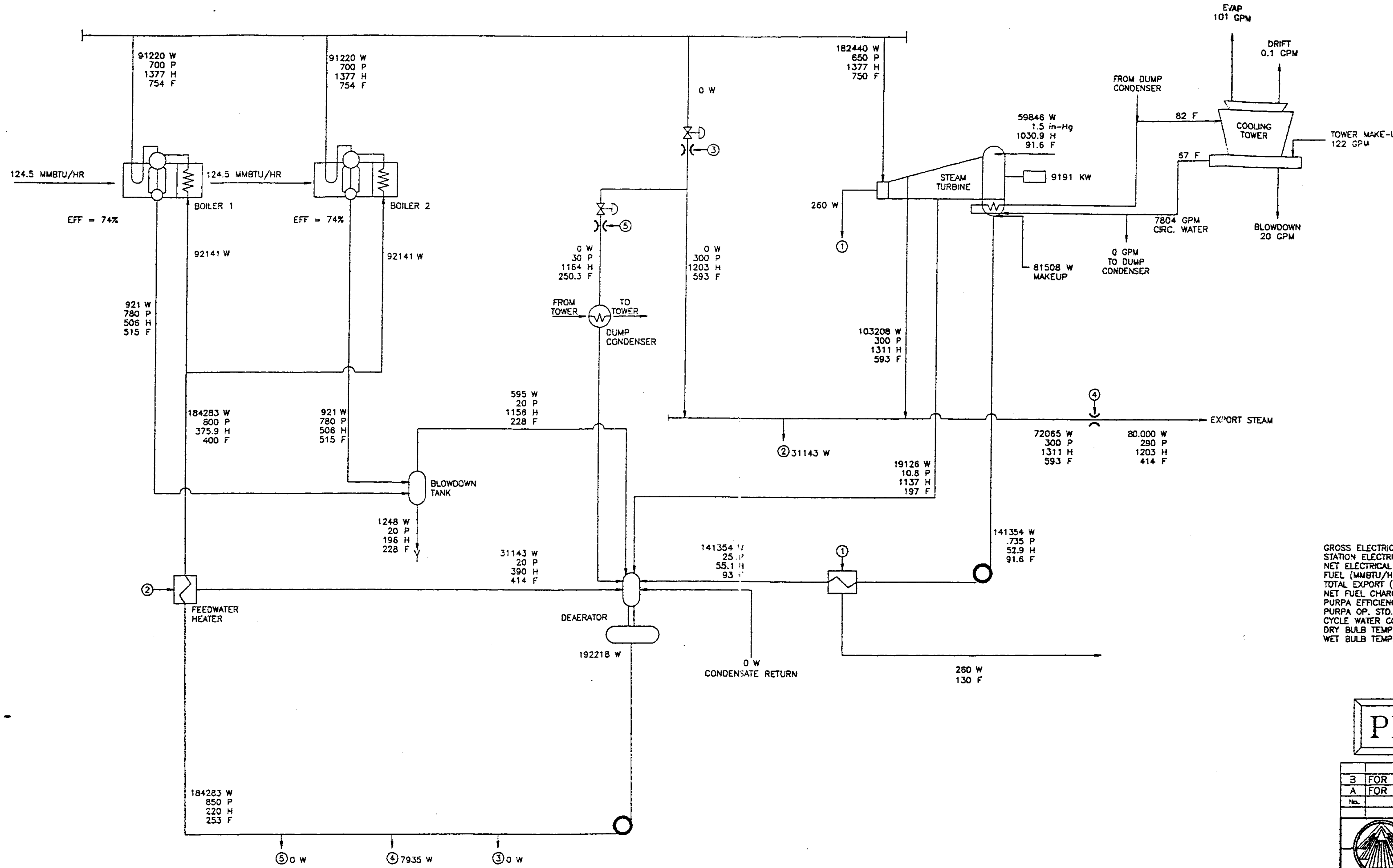
REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP
PROJECT ENERGY GENERATION FACILITY
Title HEAT BALANCE DIAGRAM, ZERO STEAM EXTRACTION CASE

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	G. MORIN	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale: NONE | Job No. | Drawing No. D-071-01-M2 | Rev. No. B



GROSS ELECTRICAL (KW)	9191
STATION ELECTRICAL (KW)	3500
NET ELECTRICAL (KW)	5691
FUEL (MMBTU/HR, HHV)	249.0
TOTAL EXPORT (MMBTU/HR)	96
NET FUEL CHARGE TO POWER (BTU/KW, HHV)	26884
PURPA EFFICIENCY (%)	27
PURPA OP. STD. (%)	83
CYCLE WATER CONSUMPTION (GPM)	285
DRY BULB TEMP. (F)	20
WET BULB TEMP. (F)	15

LEGEND

W=LB/HR

P=PSIA

H=BTU/LB

F=DEGREES F

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JMM	8/6/92	GJC
A	FOR REVIEW	JRT	7/15/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

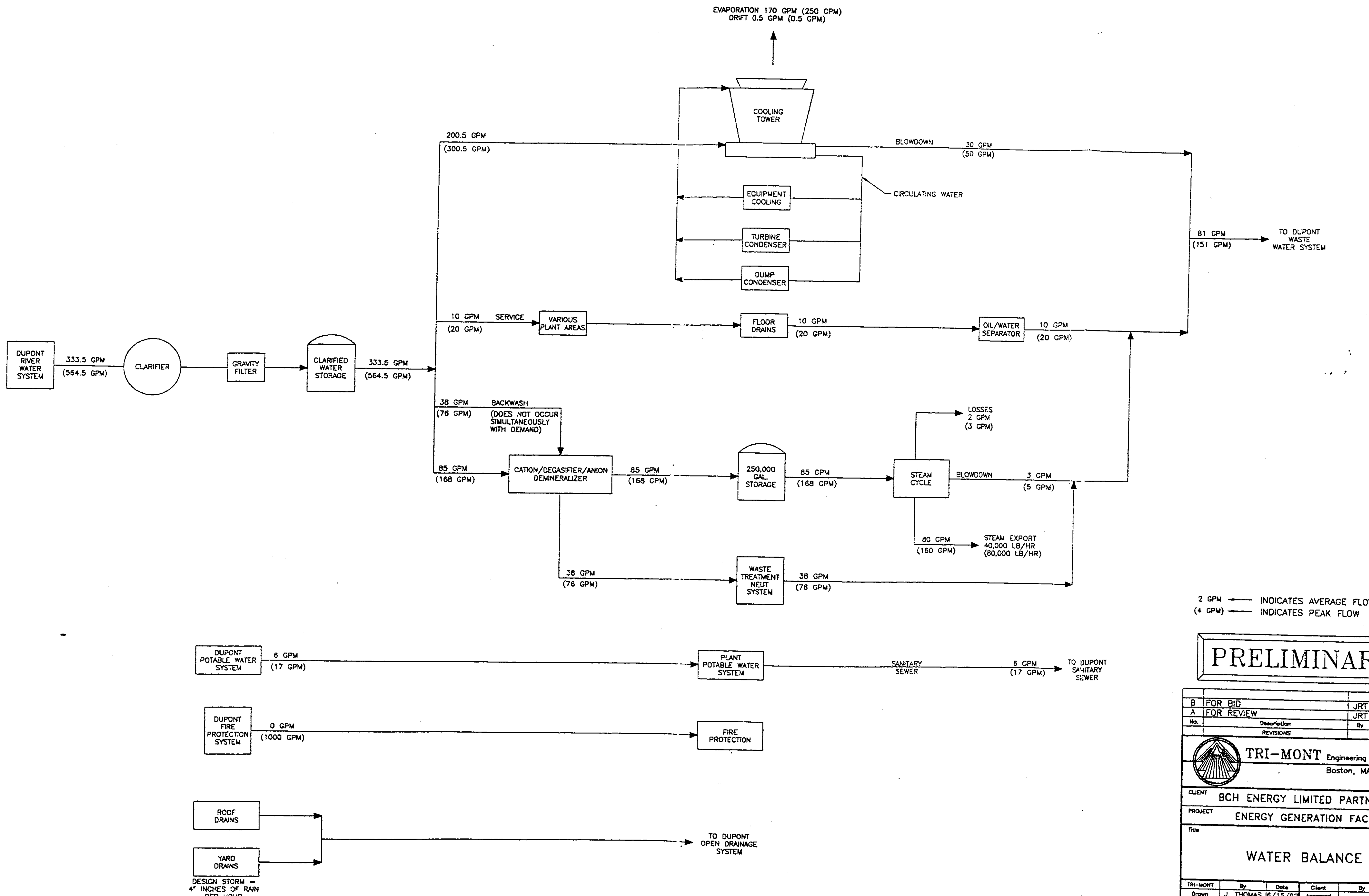
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title HEAT BALANCE DIAGRAM, 80,000 lbs/hr STEAM EXTRACTION CASE

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	G. MORIN	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale: NONE | Job No. | Drawing No. D-071-01-M3 | Rev. No. B



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	G.J.C
A	FOR REVIEW	JRT	7/15/92	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

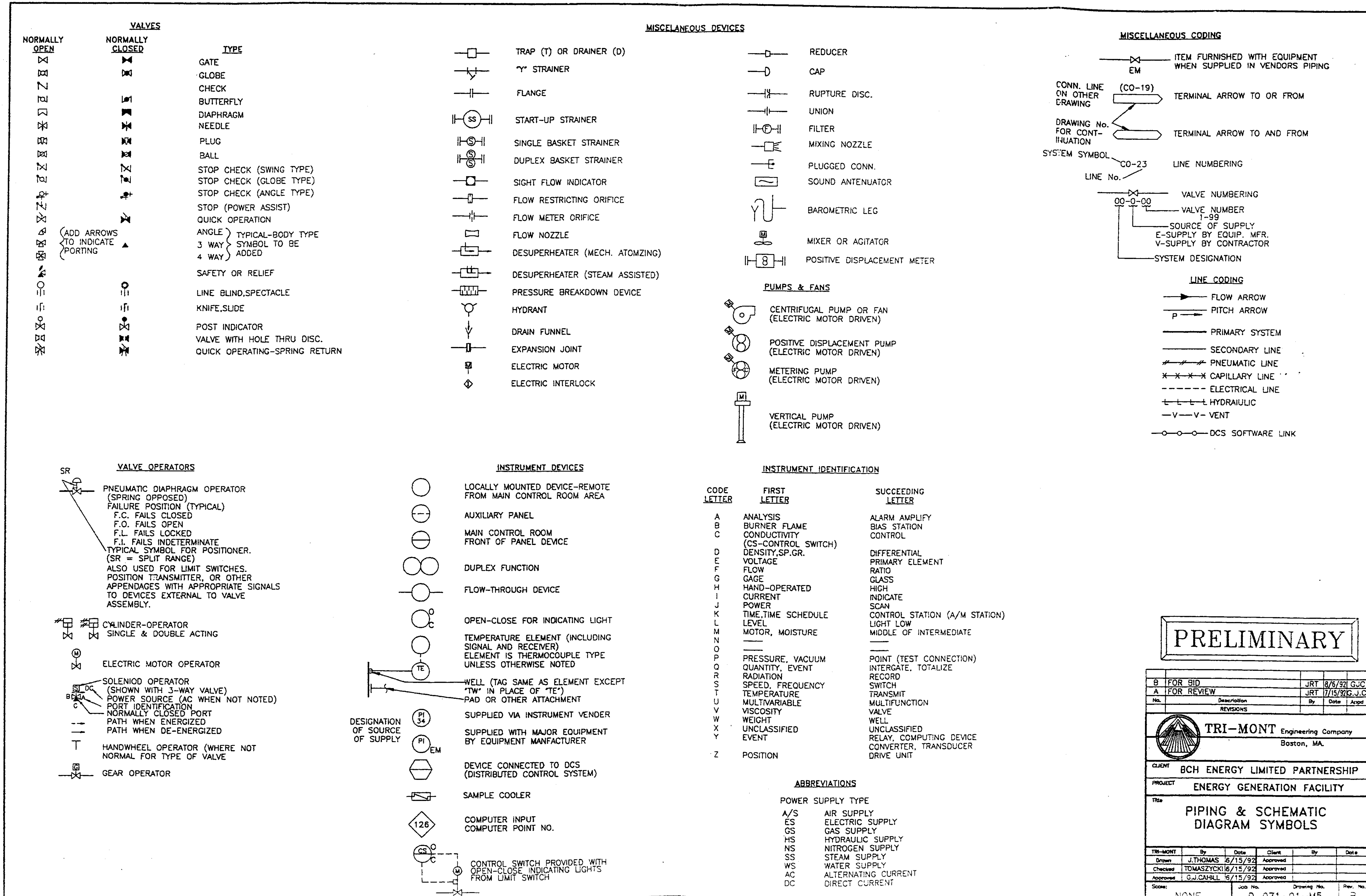
PROJECT ENERGY GENERATION FACILITY

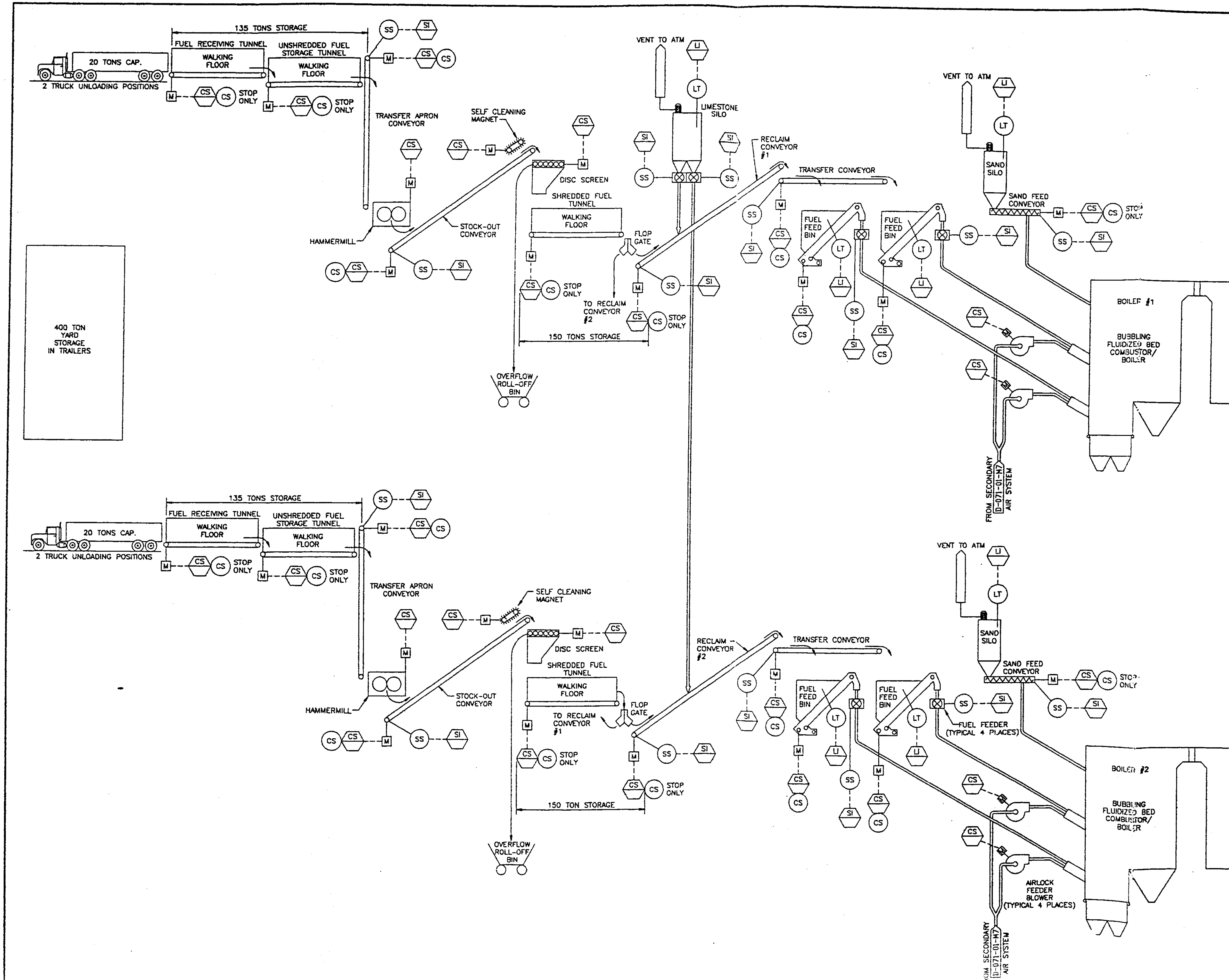
Title

WATER BALANCE

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	G.MORIN	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M4	B


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
MISCELANEOUS 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
ELECTRIC INTERLOCK
REDUCER
CAP
RUPTURE DISC.
UNION
FILTER
MIXING NOZZLE
PLUGGED CONN.
SOUND ANTENUATOR
BAROMETRIC LEG
MIXER OR AGITATOR
POSITIVE DISPLACEMENT METER
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)
MISCELLANEOUS CODING
ITEM FURNISHED WITH EQUIPMENT WHEN SUPPLIED IN VENDORS PIPING
EM
CONN. LINE ON OTHER DRAWING
(CO-19)
TERMINAL ARROW TO OR FROM
DRAWING No. FOR CONTINUATION
TERMINAL ARROW TO AND FROM
SYSTEM SYMBOL
CO-23
LINE NUMBERING
LINE No.
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
HYDRAIULIC
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)
POWER SOURCE (AC WHEN NOT NOTED)
PORT IDENTIFICATION
NORMALLY CLOSED PORT
PATH WHEN ENERGIZED
PATH WHEN DE-ENERGIZED
S DC
B A
C
HANDWHEEL OPERATOR (WHERE NOT NORMAL FOR TYPE OF VALVE
G
GEAR OPERATOR
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
OPEN-CLOSE FOR INDICATING LIGHT
O
C
TEMPERATURE ELEMENT (INCLUDING SIGNAL AND RECEIVER) ELEMENT IS THERMOCOUPLE TYPE UNLESS OTHERWISE NOTED
TE
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
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
B | FOR BID | JRT | 8/6/92 | GJC
A | FOR REVIEW | JRT | 7/15/92 | G.J.C
No. | Description | By | Date | Appd
REVISIONS
TRI-MONT Engineering Company
Boston, MA.
CLIENT BCH ENERGY LIMITED PARTNERSHIP
PROJECT ENERGY GENERATION FACILITY
Title PIPING & SCHEMATIC DIAGRAM SYMBOLS
TRI-MONT | By | Date | Client | By | Date
Drawn | J.THOMAS | 6/15/92 | Approved
Checked | TOMASZYCKI | 6/15/92 | Approved
Approved | G.J.CAHILL | 6/15/92 | Approved
Scale: NONE | Job No. | Drawing No. D-071-01-M5 | Rev. No. 3



RDF STORAGE BURN RATE SUMMARY

FUEL HTG VALUE	RDF BURN RATE	FUEL STORED IN TUNNEL	OPERATING HOURS
5500 BTU/LB	22.7 T/H	570 T	25.1 HOURS
6500 BTU/LB	19.2 T/H	570 T	29.7 HOURS

RDF BURN RATE AND STORAGE HOURS ARE BASED ON BOTH BOILERS OPERATING AT FULL CAPACITY. TRAILER STORAGE NOT INCLUDED

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	J.R.T.	8/6/92	G.J.C
A	FOR REVIEW	J.R.T.	7/28/92	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

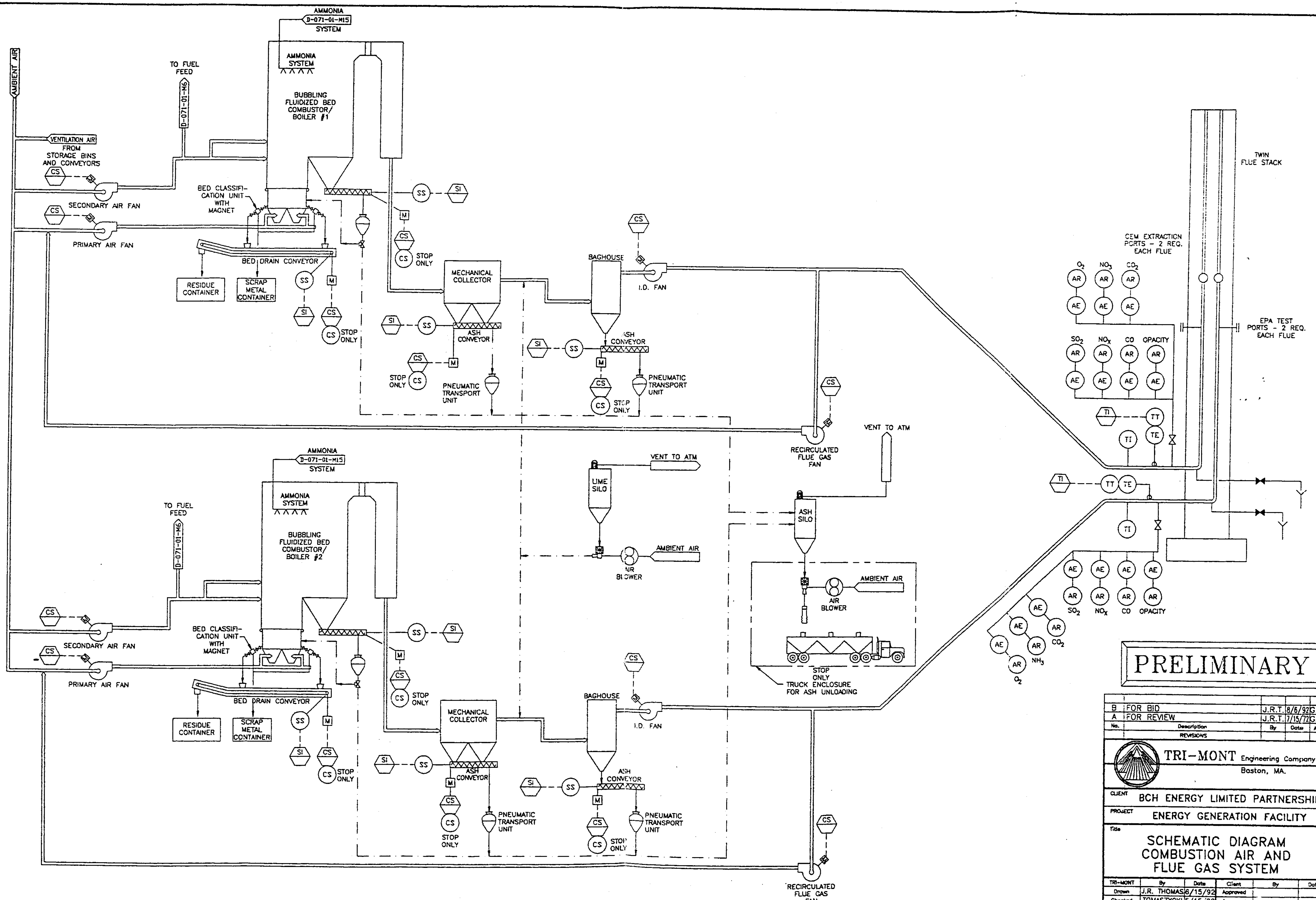
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title SCHEMATIC DIAGRAM
RDF HANDLING
AND FUEL FEED SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	8/15/92	Approved		

Scale	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M6	B



No.	Description	By	Date	Appd
B	FOR BID	J.R.T.	8/6/92	G.J.C
A	FOR REVIEW	J.R.T.	7/15/72	G.J.C

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

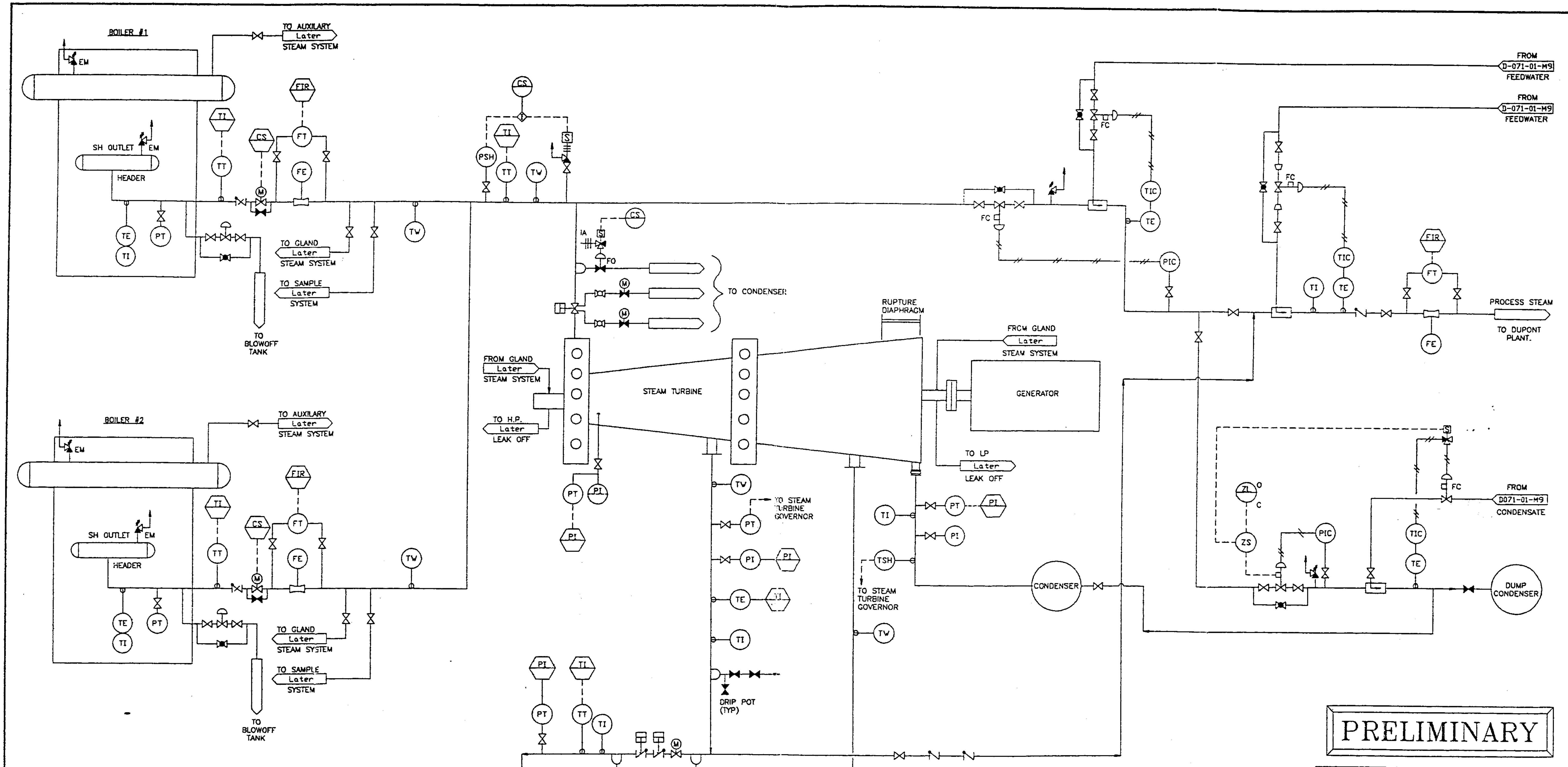
CLIENT: BCH ENERGY LIMITED PARTNERSHIP

PROJECT: ENERGY GENERATION FACILITY

Title: SCHEMATIC DIAGRAM COMBUSTION AIR AND FLUE GAS SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	5/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M7	B



No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title PIPING & INSTRUMENTATION DIAGRAM STEAM SYSTEMS

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J.CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
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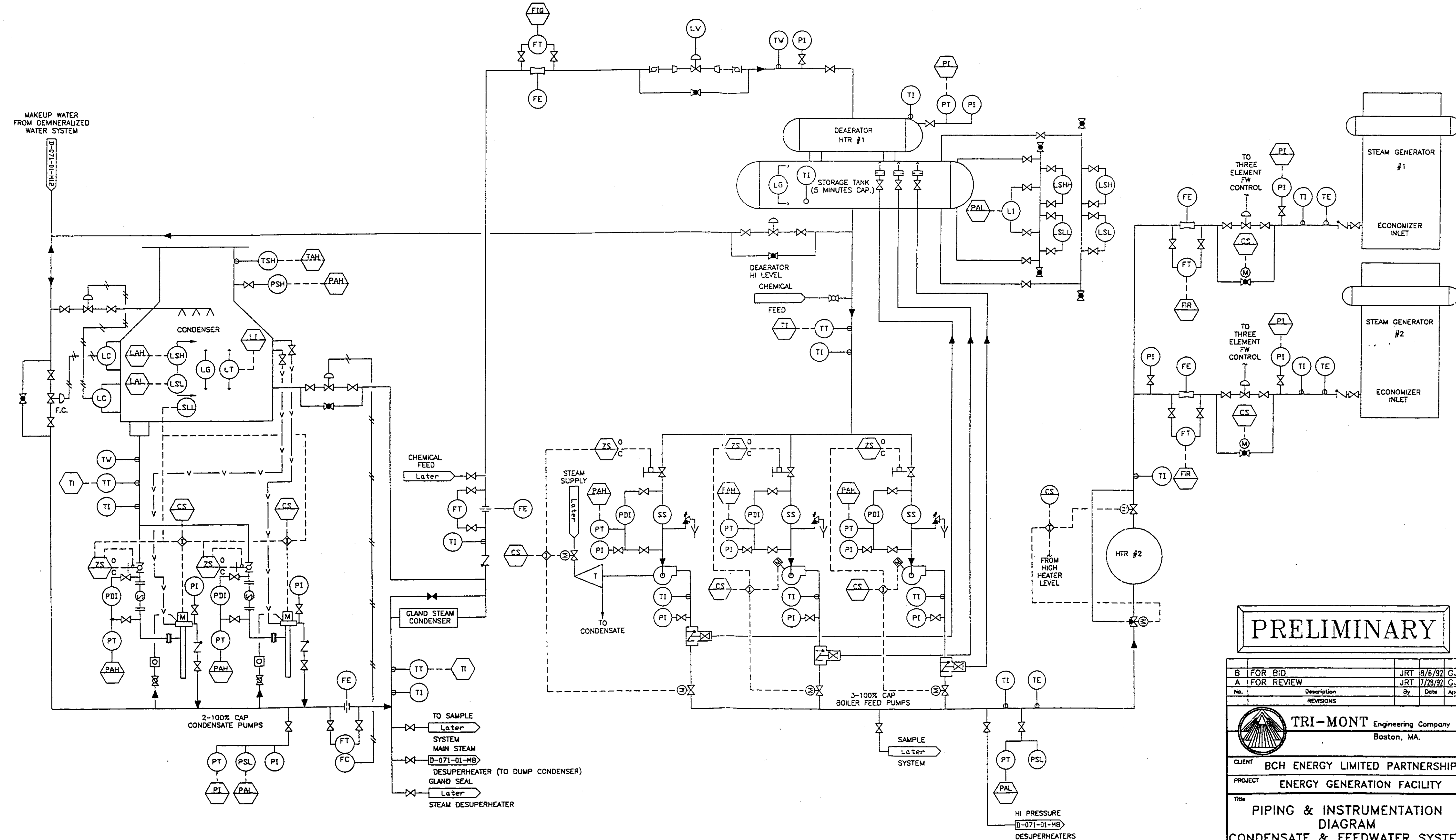

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title
PIPING & INSTRUMENTATION DIAGRAM
CONDENSATE & FEEDWATER SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
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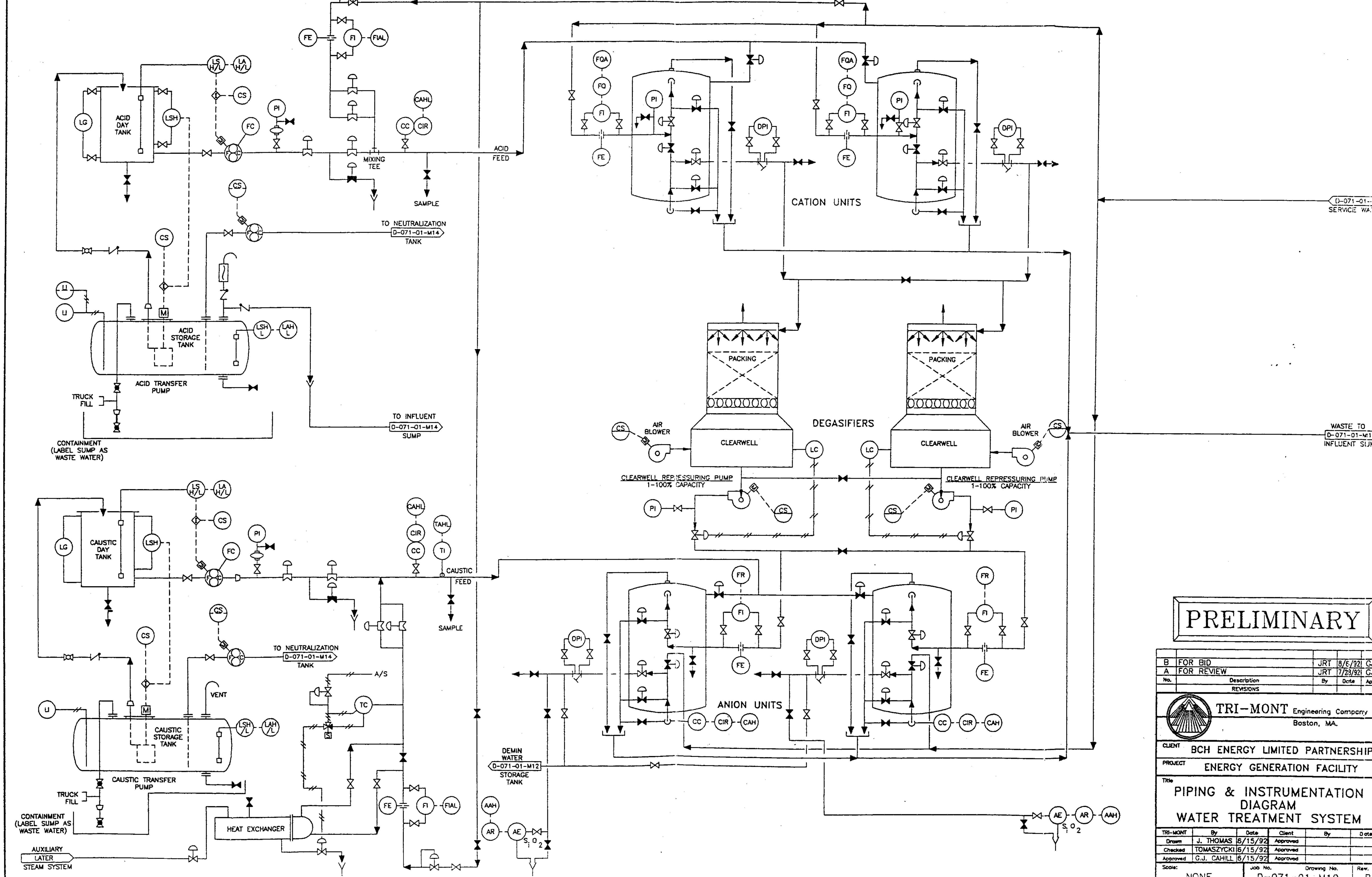
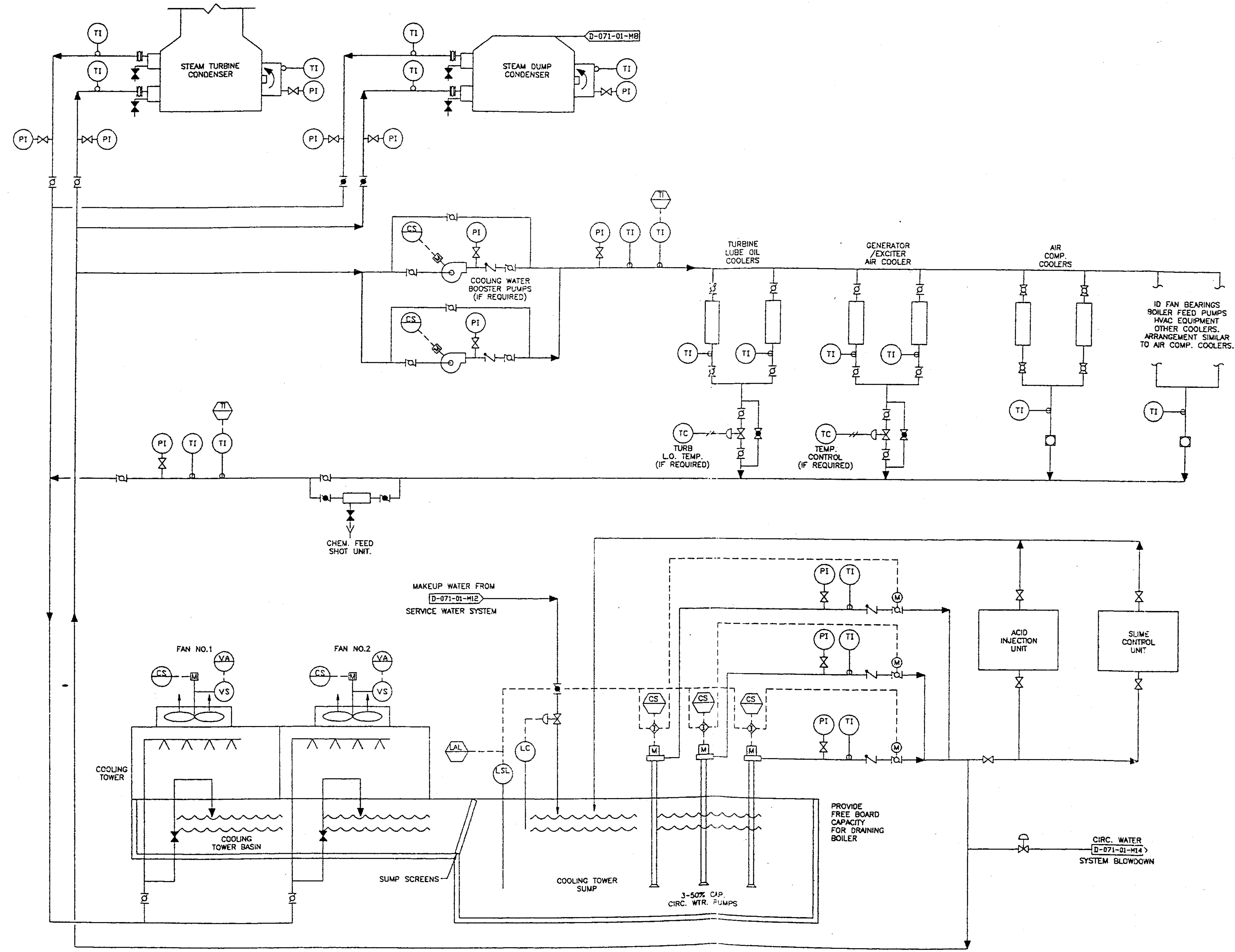

PRELIMINARY
B FOR BID JRT 8/6/92 GJC
A FOR REVIEW JRT 7/23/92 GJC
No. Description By Date Appd
REVISIONS
TRI-MONT Engineering Company
Boston, MA.
CLIENT BCH ENERGY LIMITED PARTNERSHIP
PROJECT ENERGY GENERATION FACILITY
Title PIPING & INSTRUMENTATION DIAGRAM
WATER TREATMENT SYSTEM
TRI-MONT By Date Client By Date
Drawn J. THOMAS 6/15/92 Approved
Checked TOMASZYCKI 6/15/92 Approved
Approved G.J. CAHILL 6/15/92 Approved
Scale: NONE
Job No. Drawing No. D-071-01-M10
Rev. No. B
ACID DAY TANK
ACID STORAGE TANK
ACID TRANSFER PUMP
TRUCK FILL
CONTAINMENT (LABEL SUMP AS WASTE WATER)
MIXING TEE
ACID FEED
SAMPLE
TO NEUTRALIZATION D-071-01-M14 TANK
TO INFLUENT D-071-01-M14 SUMP
CAUSTIC DAY TANK
CAUSTIC STORAGE TANK
CAUSTIC TRANSFER PUMP
VENT
A/S
HEAT EXCHANGER
AUXILIARY LATER STEAM SYSTEM
CAUSTIC FEED
DEMIN WATER D-071-01-M12 STORAGE TANK
CATION UNITS
DEGASIFIERS
PACKING
CLEARWELL
AIR BLOWER
CLEARWELL REPRESSURING PUMP 1-100% CAPACITY
ANION UNITS
D-071-01-M12 SERVICE WATER
WASTE TO D-071-01-M14 INFLUENT SUMP
FE
FI
FIAL
FQA
FQ
PI
DPI
LG
LSH
LS H/L
LA H/L
LSH L
LAH L
CS
FC
CC
CIR
CAHL
CAH
TAHL
TI
TC
LC
FR
LI
AE
AR
AAH
S_iO_2



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/29/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

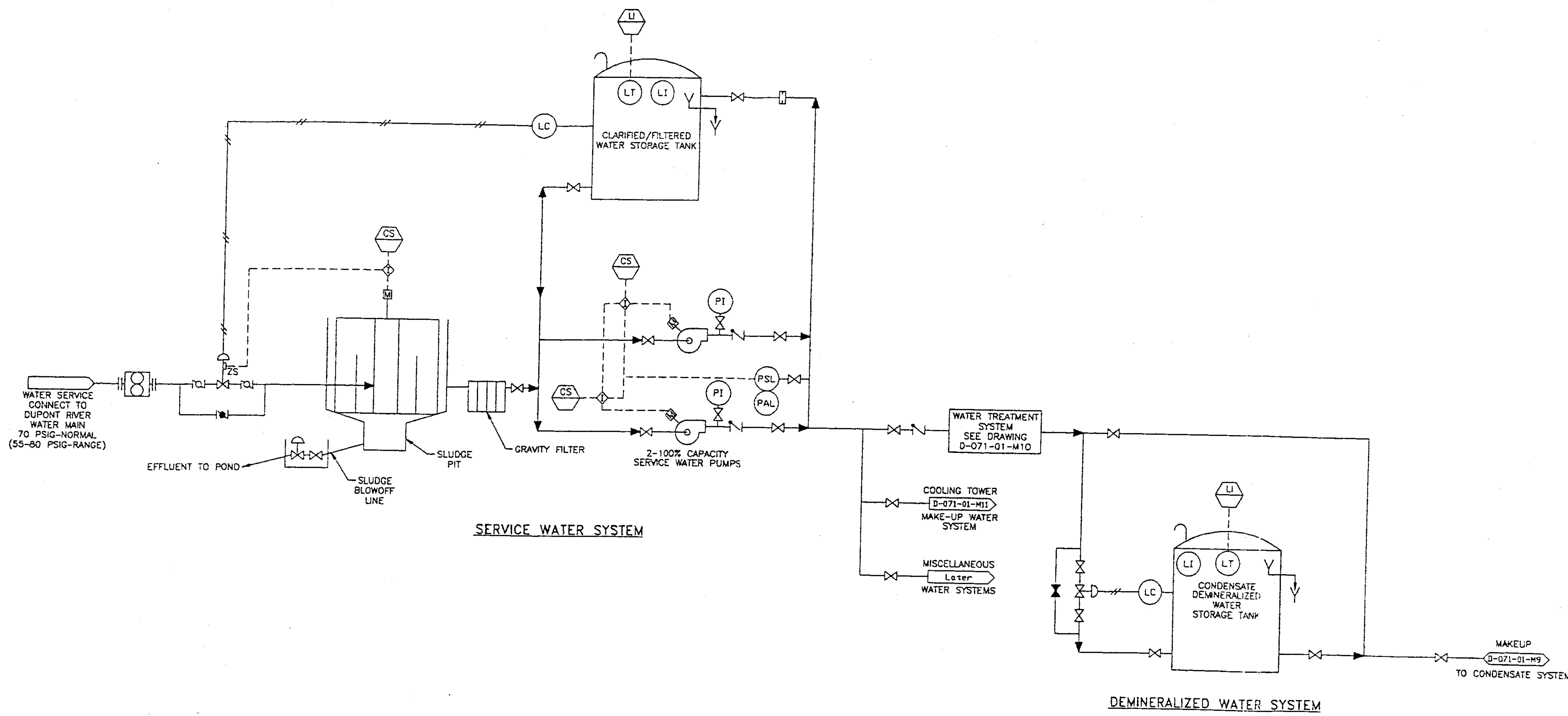
CLIENT BCH ENERGY LIMITED PARTNERSHIP

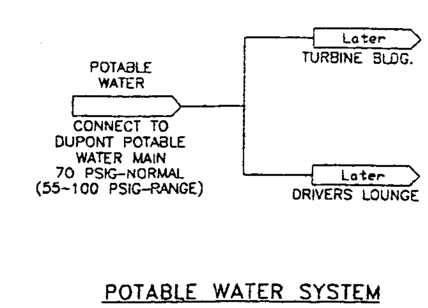
PROJECT ENERGY GENERATION FACILITY

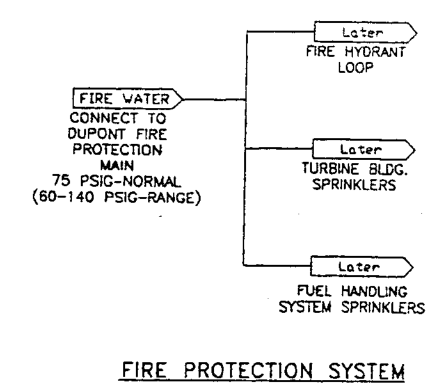
Title
PIPING & INSTRUMENTATION DIAGRAM CIRC./COOLING WATER SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	TOMASZYCKI	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M11	B







PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/23/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

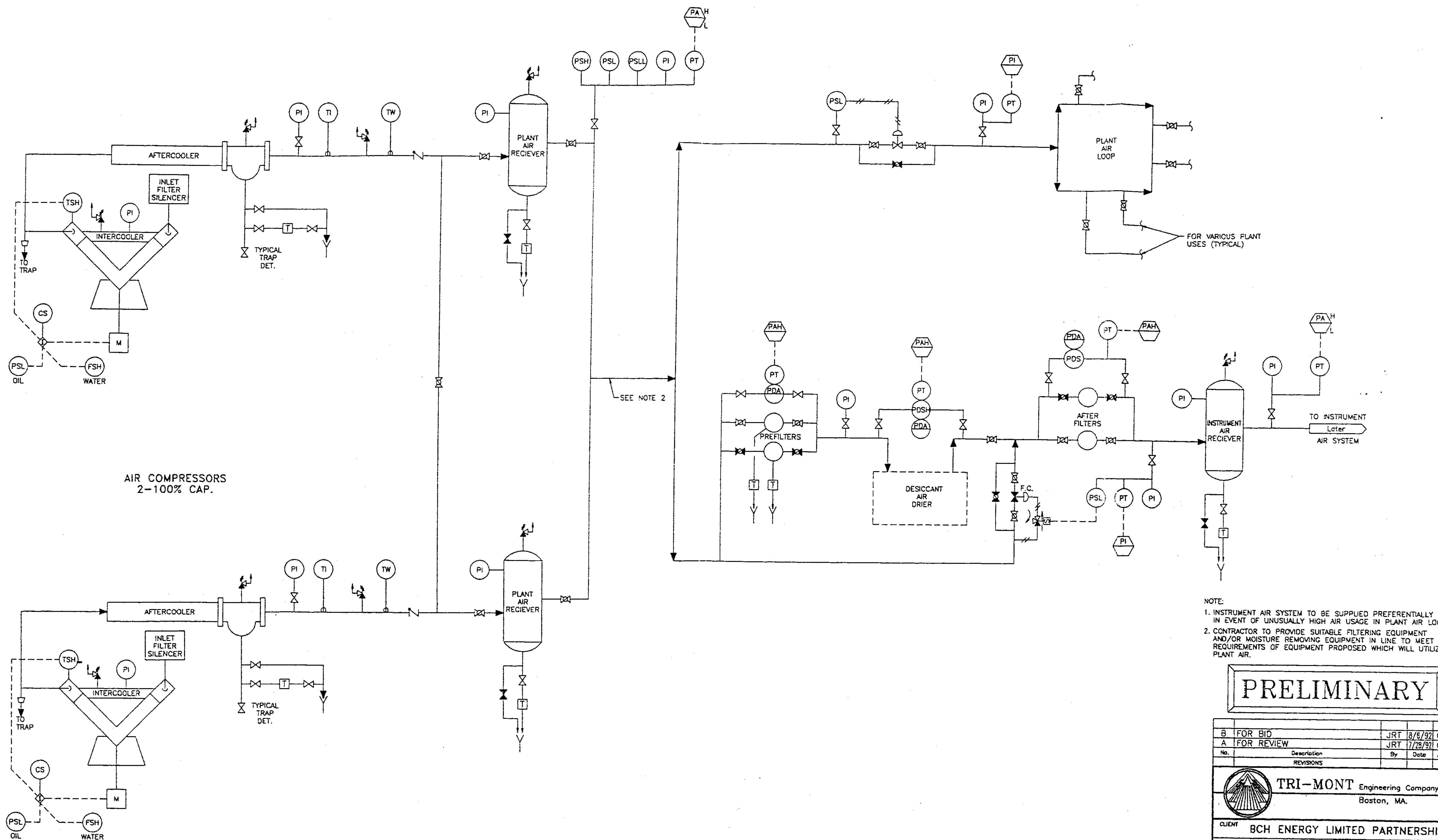
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title
PIPING & INSTRUMENTATION DIAGRAM
WATER SERVICE SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J.R. THOMAS	6/15/92	Approved		
Checked	B. LEVINE	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M12	B



NOTE:

1. INSTRUMENT AIR SYSTEM TO BE SUPPLIED PREFERENTIALLY IN EVENT OF UNUSUALLY HIGH AIR USAGE IN PLANT AIR LOOP.
2. CONTRACTOR TO PROVIDE SUITABLE FILTERING EQUIPMENT AND/OR MOISTURE REMOVING EQUIPMENT IN LINE TO MEET REQUIREMENTS OF EQUIPMENT PROPOSED WHICH WILL UTILIZE PLANT AIR.

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/29/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

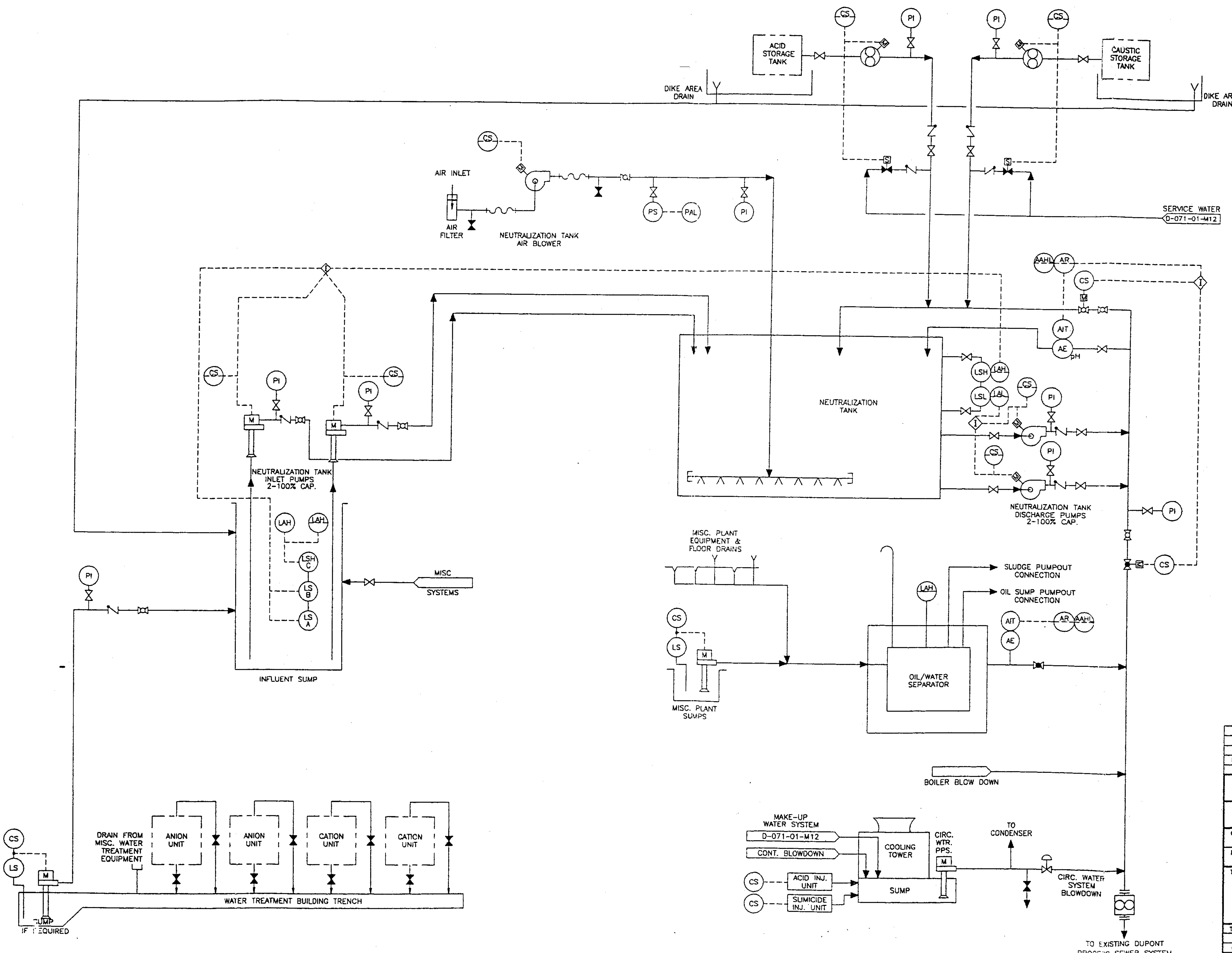
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title
PIPING & INSTRUMENTATION DIAGRAM
COMPRESSED AIR SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/15/92	Approved		
Checked	B. LEVINE	6/15/92	Approved		
Approved	G.J. CAHILL	6/15/92	Approved		

Scale: NONE | Job No. | Drawing No. D-071-01-M13 | Rev. No B



PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/23/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

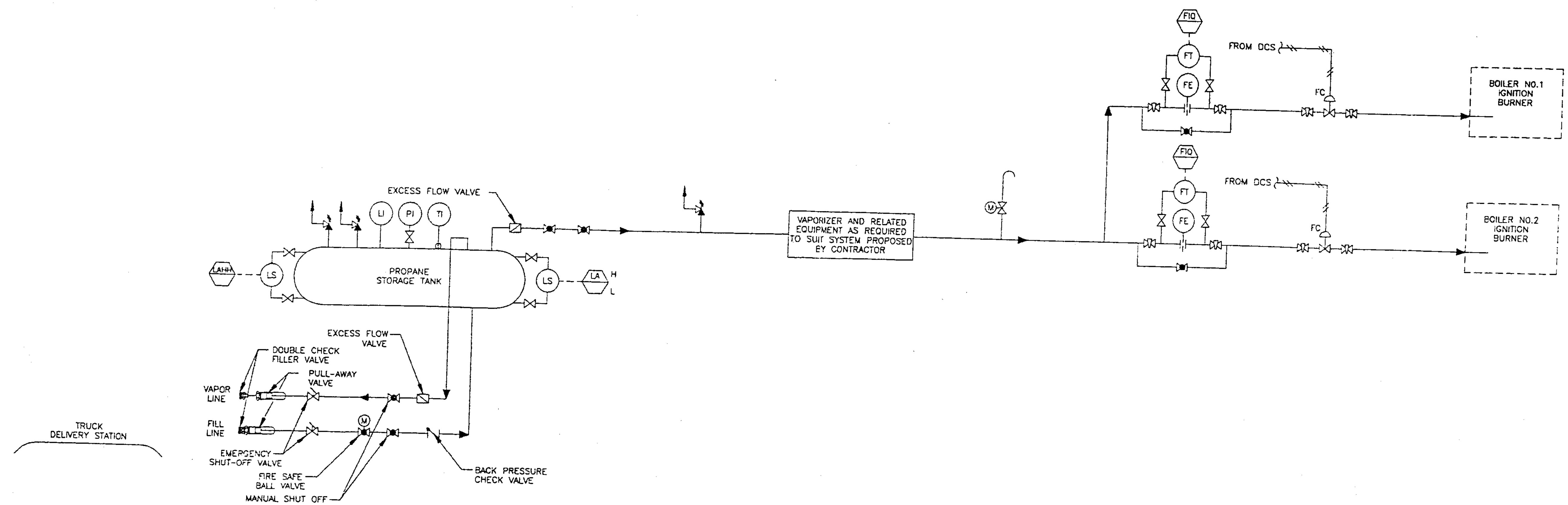
CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

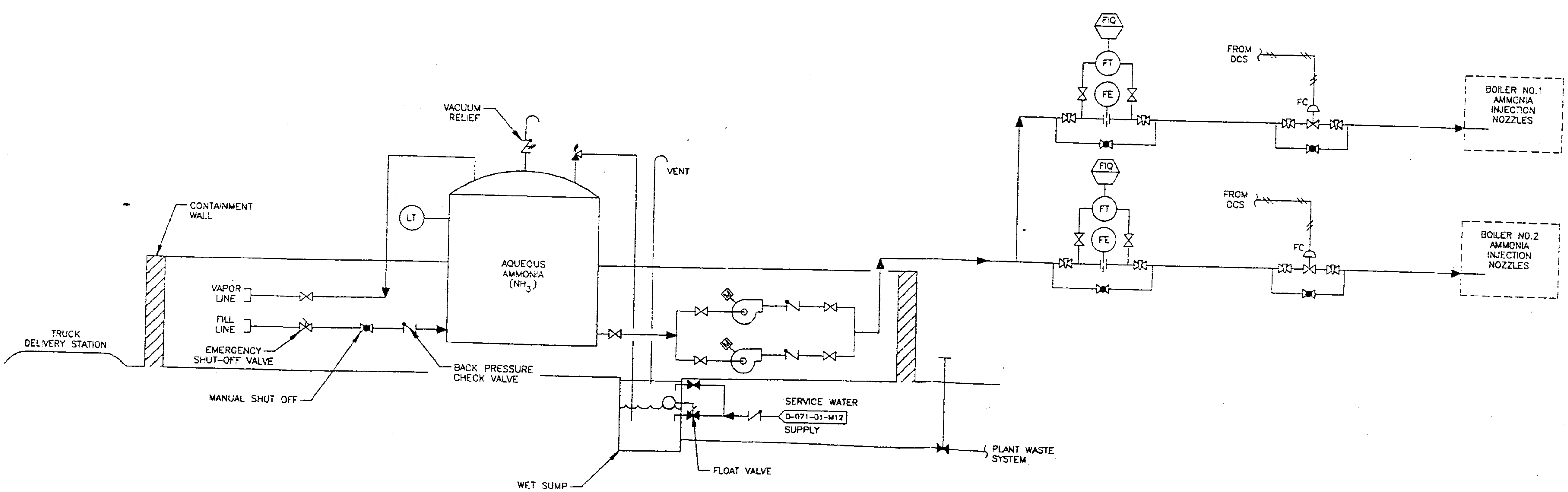
Title PIPING & INSTRUMENTATION DIAGRAM WASTE WATER SYSTEM

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	5/15/92	Approved		
Checked	TOMASZYCKI	5/15/92	Approved		
Approved	G.J. CAHILL	5/15/92	Approved		

Scale:	Job No.	Drawing No.	Rev. No.
NONE		D-071-01-M14	B



PROPANE SYSTEM
(BOILER START-UP SYSTEM)



AQUEOUS AMMONIA SYSTEM
(FOR NO_X CONTROL)

PRELIMINARY

No.	Description	By	Date	Appd
B	FOR BID	JRT	8/6/92	GJC
A	FOR REVIEW	JRT	7/28/92	GJC

REVISIONS

TRI-MONT Engineering Company
Boston, MA.

CLIENT BCH ENERGY LIMITED PARTNERSHIP

PROJECT ENERGY GENERATION FACILITY

Title PIPING & INSTRUMENTATION DIAGRAM MISCELLANEOUS SYSTEMS

TRI-MONT	By	Date	Client	By	Date
Drawn	J. THOMAS	6/25/92	Approved		
Checked	TOMASZYCKI	6/25/92	Approved		
Approved	G. J. CAHILL	6/25/92	Approved		

Scale: NONE | Job No. | Drawing No. D-071-01-M15 | Rev. No. B

6

Alexis H. Jones
County Manager

County of Bladen
State of North Carolina
P.O. Box 1048 · Elizabethtown, North Carolina 28337-1048

Telephone
919 862-6700
FAX 919 862-6767

June 15, 1992

Mr. Richard T. Lasater
DEM/Air Quality/Air Permits Unit
NC Department of Natural Resources and
Community Development
P. O. Box 27687
Raleigh, NC 27611-5317

Dear Mr. Lasater:

With reference to your work on the BCH Energy Corp. RFD-to-Energy Facility project, please be advised that Bladen County does not have any zoning or land use regulations in effect in the area of the DuPont Fayetteville Works where the project will be located. This will certify that the BCH Energy Corp. facility, as planned, meets Bladen County requirements

Sincerely,

Alexis H. Jones
County Manager

AHJ/rba
cc: Mr. Kenneth L. Woodruff
Mr. George Armistead

Post-It™ brand fax transmittal memo 7671	# of pages ▸ 1
To Ken Woodruff	From Ire Jones
Co.	Co. Bladen C.
Dept.	Phone # 919-862-6700
Fax # 215 736-2225	Fax # 919-862-6767

AIR PERMIT APPLICATION
FOR
BCH ENERGY CORP.
RDF-TO-ENERGY FACILITY

Bladen County, North Carolina

JUNE 17, 1992

Submitted To:

**North Carolina Department of Environment,
Health and Natural Resources
DEM/Air Quality/Air Permits Unit
Raleigh, North Carolina 27611-7687**

INTRODUCTION

BACKGROUND

BCH Energy Corp. (BCH) plans to construct and operate a plant in Bladen County, North Carolina to burn Refuse Derived Fuel (RDF-3) and generate steam by the process for sale to E.I. DuPont de Nemours & Company (DuPont). BCH proposes to burn approximately 190,000 tons of RDF-3 annually, generating approximately 692,000 tons of steam per year. The plant is to be constructed on a 10.9 acre site to the east of Highway 87 South adjacent to DuPont Fayetteville Works in Bladen County.

PROCESS DESCRIPTION

The proposed steam generation plant will burn refuse-derived fuel (RDF-3) processed by BCH Energy Corp. from municipal waste collected from Bladen, Cumberland and Hoke Counties, North Carolina at the present site of the Ann Street Landfill, located in Fayetteville, Cumberland County.

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 BCH's 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 RDF-3 will be received in a building equipped with 'walking floors,' with ventilation directly into the combustion units; consequently, fugitive air pollutant emissions should not occur. The RDF-3 will be moved from the building to two covered metering bins by covered conveyors. According to BCH's construction plan, the covered conveyors will be under negative pressure caused by the ventilation of the storage building. Ventilation air will be used as combustion air for the fluid bed combustors. Therefore, the conveyors should not be a source of fugitive air pollutant emissions.

Upon reaching the convered metering bins, the RDF-3 will then be fed via a screw conveyor to the combustion units. These metering bins will also be under negative pressure and should not be a source of fugitive air pollutant emissions. Consequently, because the fuel feed system is under negative pressure and enclosed all the way from the receiving/storage shed to the combustion units, no emissions directly to the atmosphere are expected from the fuel receiving, handling and feed system.

Two (2) identical fluidized bed combustors will be used to burn the RDF-3. These combustors will be manufactured by Energy Products of Idaho, Outokumpu EcoEnergy, Kvanerner Generator or Ebara/Zurn. Each combustor will have a rated capacity of 95,000 tons of RDF-3 per year. The combustor boilers will be rated at 124.5 million British Thermal Units (BTU) per hour heat input each.

To control sulfur dioxide (SO2) emissions, powdered limestone will be fed, via a separate pneumatic feedline, into each combustor. Aqueous ammonia or urea will be injected into the vapor space above the fluidized bed to control nitrogen oxide (NOx) emissions. Final determination of aqueous ammonia or urea depends upon selection of the SNCR system vendor.

The fluidized bed combustor boilers will create steam for sale to E.I. DuPont de Nemours & Company. Each of the boilers is to have a rated capacity of 96 million BTU per hour, and 85,000 pounds of steam per hour. Each boiler will consist of a superheater, an evaporator and an economizer.

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

Several storage bins and tanks will be installed on the site, four (4) of which will have particulate and/or toxic air pollutant emissions. A description of the storage bins and tanks that will be on-site emission sources 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 1400 cubic foot (ft3), 45 foot tall storage bin, and fed into the fluidized bed combustors 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 two feet. The emission point will be at the top of the baghouse or about 52 feet above the ground. Particulate emissions from this storage bin will only occur during pneumatic loading of limestone into the bin (approximately 150 hours per year) and not while the limestone is being fed into the combustors.

Aqueous Ammonia/Urea Storage Tank

The aqueous ammonia or urea used to control NOx emissions will be stored in a 12,000 gallon capacity above ground storage tank and fed into the fluidized bed combustors on a continuous basis. Storage tank emissions will only occur after loading of ammonia/urea into the tank (upon hose disconnect, approximately 24 hours per year), and not while the ammonia/urea is being fed into the combustors. Hose connections are estimated to be about 10 feet above ground. Loading will require about twenty minutes, approximately 72 times a year.

Hydrated Lime Storage Bin

The hydrated lime used to control HCl emissions will be stored in a 1400 cubic foot, 45 foot tall storage bin and fed into the fluidized bed combustors 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 two feet. The emission point will be at the top of the baghouse or about 52 feet above the ground. Particulate emissions from this storage bin will only occur during pneumatic loading of hydrated lime into the bin (approximately 38 hours per year) and not while the lime is being fed into the combustors. Loading will require about one-half hour, approximately 76 times a year.

Ash Storage Bin

Combustion ash will be collected from the fabric filters (baghouses) located in the process stream on a continuous basis. The ash will be stored in a 220 cubic yard capacity, 50 foot tall storage bin. The storage bin will be fitted with its own fabric filter (baghouse) approximately three feet square by seven feet tall, with an approximate outlet diameter of two feet. The emission point will be at the top of the baghouse or about 57 feet above the ground. Particulate emissions from this storage bin will occur continuously. The ash collected from the combustion process is to be sold to a concrete or portland cement manufacturer.

Sand Bin

A 1400 cubic foot capacity sand bin will be installed for bed media make-up sand. This bin will be equipped with a fabric filter (baghouse). Particulate emissions will only occur during pneumatic loading of sand into the bin.

Propane Tank

A 12,000 gallon capacity above ground propane tank will be installed to store startup fuel for the fluid bed combustors. Emissions will only occur after filling of the tank (upon hose disconnect, approximately 6 hours per year), and not while propane is being fed to the combustors. Filling will require 20 to 30 minutes, approximately 12 times per year.

CONTROL TECHNOLOGY

The BCH Energy Corp. Facility will release the following constituents to the air:

- o Particulates
- o Organics
- o Sulfur Dioxide
- o Nitrogen Oxides
- o Carbon Monoxide

Particulate Matter

Based on estimates provided by fluid bed combustion system suppliers, the average particulate emissions from the BCH Facility will be 10.6 mg per cubic meter, amounting to not more than 21.81 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 32.85 tons per year. Since this category of pollutants is incorporated in the toxic air pollutants regulated by the North Carolina Department of Environmental Management, Toxic Air Pollutant Modelling and

Analysis was conducted for the BCH Energy Corp. Facility. A complete report prepared by ENSR Consulting and Engineering is included with 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 BCH Facility will be less than 7 percent of uncontrolled emissions, or 20 ppmv, amounting to not more than 76.34 tons per year. Compliance will be demonstrated by the use of continuous emissions monitoring equipment. 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 98.16 tons per year. Compliance will be demonstrated by continuous emissions monitoring of effluent gases. Aqueous ammonia or urea injection will be used to control NOx emissions.

Carbon Monoxide

The average CO emissions from the BCH Facility will be less than 60 ppmv, amounting to not more than 98.16 tons per year. Compliance will be demonstrated by continuous emissions monitoring of effluent gases.

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.): BCH Energy Corporation — Date: June 17, 1992
2. Site Location (St./Rd./Hwy.): Highway 87 South — City: Fayetteville — Zip Code: 28302 — County: Bladen
   Latitude: 34°50'44" N — Longitude: 78°50'12" — SIC Code: 4953
3. Mailing Address (P. O. Box/St./Rd./Hwy.): 11757 Katy Freeway, Suite 820
   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 atmospheric fluid bed combustors to generate steam and electricity.

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 Fluid Bed Combustor-Unit #1	FB-1	Fabric Filter	FF-1
RDF-Fired Fluid Bed Combustor-Unit #2	FB-2	Fabric Filter	FF-2
Powdered Lime Storage Bin	PL	Fabric Filter	FF-3
Hydrated Lime Storage Bin	HL	Fabric Filter	FF-4
Ammonia/Urea Tank Vent	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/Yea
8. Name and address of engineering firm that prepared application or plans:
   Kenneth L. Woodruff & Associates (Project Coordinator)
   P.O. Box 42, Morrisville, PA 19067
9. Signature of responsible person or company official:
   George Armistead — Date June 17, 199

Signer's Name (TYPE OR PRINT): George H. Armistead — Title: President — Phone with Area Code: 713-558-4300

FORM AQ-22

APPLICATION INSTRUCTIONS

THIS APPLICATION IS NOT COMPLETE UNLESS ALL REQUIRED INFORMATION IS SUBMITTED

1. PRINT OR TYPE ONLY. FOR ASSISTANCE, Call the Air Quality Section at (919) 733-3340 or the appropriate field office listed below:

Asheville (704) 251-6208
59 Woodfin Place
Asheville, NC 28802

Mooresville (704) 663-1699
919 North Main Street
Mooresville, NC 28115

Washington (919) 946-6481
1424 Carolina Avenue
Washington, NC 27889

Winston-Salem (919) 761-2351
8025 North Point Blvd., Suite 100
Winston-Salem, NC 27106

Fayetteville (919) 486-1541
Wachovia Building, Suite 714
Fayetteville, NC 28301

Raleigh (919) 733-2314
Post Office Box 27687
Raleigh, NC 27611

Wilmington (919) 256-4161
7225 Wrightsville Avenue
Wilmington, NC 28403

2. Submit TWO (2) copies of the application, engineering drawings, specifications, other supporting data and documents to your local field office or to:

N.C. DIVISION OF ENVIRONMENTAL MANAGEMENT
AIR QUALITY SECTION
AIR PERMITS BRANCH
POST OFFICE BOX 27687
RALEIGH, NORTH CAROLINA 27611-7687

3. ALL APPLICANTS MUST COMPLETE FORMS "A" AND "D". Submit ONLY those forms that apply.

IF APPLICATION IS MADE FOR:	COMPLETE THE FOLLOWING FORMS: "A"	"B"	"C"	"D"	"E"	"F"
General Process	X	X	X	X		
(Boiler	X	X	X	X)		
Incinerator	X		X	X		X
Woodworking Operations	X	X	X	X		
Painting, Finishing, Spray Booths, or Printing Operations	X		X	X	X	
Air Pollution Control Device	X	X	X	X		
Concrete or Asphalt Batch Plant	X	X	X	X		

"A" GENERAL INFORMATION
"B" GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES
"C" AIR POLLUTION CONTROL DEVICE
"D" AREA DIAGRAM
"E" HYDROCARBON EMISSION SOURCES
"F" INCINERATOR

4. The application MUST BE SIGNED on Form "A" item 9 by a RESPONSIBLE INDIVIDUAL of the Company.
5. Because the application is not ideally suited for every conceivable operation, applicants are encouraged to submit additional information when needed to complete the application and to provide adequate explanation of the operations.
6. Address compliance with applicable regulations under NEW SOURCE PERFORMANCE STANDARDS, NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS, and PREVENTION OF SIGNIFICANT DETERIORATION in the comments section on Form "A".

•••• CHECKLIST ••••

DOES YOUR APPLICATION CONTAIN THE FOLLOWING?

A. Signature by a Company Official.
B. Pollutants and Emission Rates Before and After Control.
C. Process Flow Diagram(s).
D. Weight Rate of Materials Entering each Process.
E. Completion of Form "E" if Solvents, Paints, Finishing Materials, or any Volatile Organic Compounds are Used.
F. Description of Emission Source(s) and Air Control Device(s) (Make, Model No., Efficiency, Design Criteria, etc.)
G. Completion of Forms "A" and "D".

•••TABLE OF EMISSION ESTIMATION METHOD CODES•••

CODE	
0	Not applicable. Emissions are known to be zero.
1	Emissions based on source testing.
2	Emissions based on material balance using engineering expertise and knowledge of process.
3	Emissions calculated using emission factors from EPA publication No. AP-42 COMPILATION OF AIR POLLUTION EMISSION FACTORS.
4	Judgement.
5	Emissions calculated using a special emission factor differing from that in AP-42. Specify reference in comments below.
(6)	Other. Specify in comments below.

COMMENTS:

Emissions based on pilot plant testing of RDF-3 by Energy Products of Idaho and source testing in Tacoma, Washington. Both units are atmospheric fluid bed units with similar emissions control equipment.

B

GENERAL DATA FOR PROCESSES OR FUEL BURNING SOURCES

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 - Units #1 and #2 (FB-1 & FB-2)

2. Description of Process or Fuel Burning Source Including Air Control Device:
Two (2) 124.5 mm BTU/Hour heat input atmospheric fluid bed combustors fired with RDF-3. Emissions control includes lime injection, ammonia/urea injection, hydrated lime injection, fabric filter.

3. Permit Application is made for (CHECK ONE ONLY):
XX New Source ( ) Existing Source ( ) Modification – Last Permit No. ______
Commence Construction Date January, 19 93 Operation Date September, 19 94

4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year

5. Air Contaminants Emitted: (Each Unit)	Maximum Actual Emissions Before Control (lb/hr)	After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates (TOTAL)	498	2.49		Fabric Filter	99.5
Sulfur Dioxide	135.9	8.72		Limestone Injection	93
Nitrogen Dioxide	28.0	11.21		Ammonia/Urea Injection	60
Carbon Monoxide	37.4	11.21		Combustion Control	70
Hydrocarbons (VOC)		3.75		Combustion Control	
Lead		0.105		Fabric Filter	
PM-10	498	2.49		Fabric Filter	99.5
Other (HCl)	116.4	4.73		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	Actual	Max. Requested Permit Input Rates (lb/hr)
A.			
B.			
C.			
D.			
E.			
F.			
.			
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 (specify) Atmospheric Fluidized Bed (2 Units)

11. Is collected flyash reinjected? (X) NO ( ) YES Percent Reinjected ______ %
Combustion Air: Percent Excess Air 40 % ( ) Natural ( ) Induced
Specify method and schedule of tube cleaning:
( ) Lancing ( ) Tube Blowing (X) Other Steam Sootblowers Schedule Once/Day

12. Boiler Horsepower Rating (Each Unit) 95 million BTU/Hour Boiler Steam Flow (lb/hr) (Each Unit) 85,000 (Each Unit) (Maximum)

13. Fuel Burning Source Heat Input: Maximum 124.5 Each Unit Million BTU/hr Average 120 Million BTU/hr

14. Fuel Data: Primary Fuel Type(s) (specify) RDF-3
Standby Fuel Type(s) (specify) Propane (Startup Fuel)

FUEL TYPE	FUEL USAGE (Each Unit) 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) 655	(gal/hr) 555	(gal/yr) 55,000	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 22,650	lb/hour 21,500	ton/year 94,000	0.3	12	5500 - 6500

15. If a combination of fuels is used, specify the maximum BTU/hr heat input for each: No Combination
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 (X) 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 and Cooling Tower Blowdown will be discharged to the adjacent DuPont Plant Wastewater System.

Solid Waste - Combustion Ash to be landfilled and/or beneficially used as an additive to concrete or in the manufacturing ofPortland Cement.

DATA FOR PROCESSES OR FUEL BURNING SOURCES — *continued*

20. Stack or Emission Point Data: (Single Stack Vents both Boilers)

Height Above Ground (ft.)	Inside Area (sq. ft.)	Gas Temperature (Deg. F)	Direction of Exit (up, down or horizontal)
150	44.18	300	UP
Volumetric Flow Rate (ACFM) 127,000	Velocity (ft./sec.) 47.92	Are sampling ports available? ( ) No (X) Yes	Is rain cap or other obstruction over stack? (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 asphalt, fuel receiving, storage and handling system to be under negative pressure. All storage bins/silos are equipped with bin vent fabric filters.

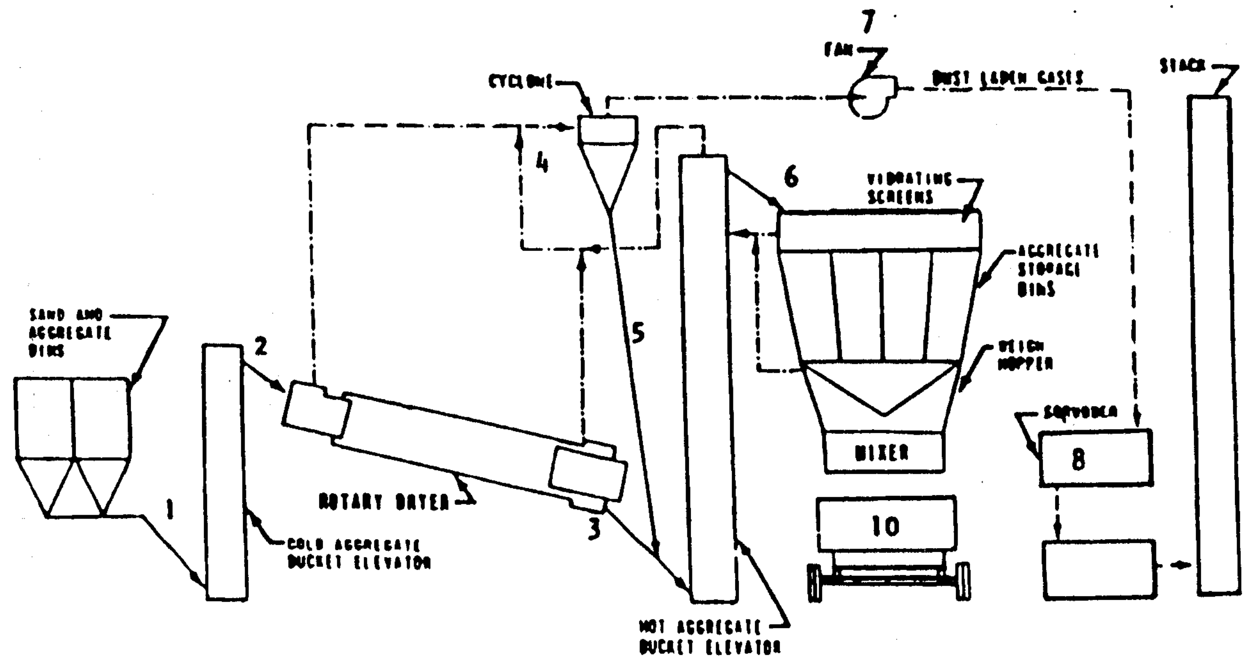
SEE FACILITY DRAWINGS

INSTRUCTIONS

FLOW DIAGRAM FOR PROCESSES OR FUEL BURNING SOURCES INCLUDING AIR CONTROL DEVICES

Draw a complete flow diagram of the process or fuel burning source including air control device(s). Indicate all equipment, mass flow of material, location of direct heating, inlet and outlet temperatures, and air flow rates. Give flow rates for water used either as cooling or as scrubbing. Indicate pollutant collected and emissions exhausted to the atmosphere. If a solvent or a mix of solvents, inks, paints or other volatile liquid mixes are used, complete the Hydrocarbon Emission Sources Form "E". All materials entering this process should appear in item 8, page 1.

FOR EXAMPLE:



Flow diagram of a typical hot-mix asphalt paving batch plant.

1. Rock, gravel, sand, fines, etc. – 200,000 lbs/hr or 100 tons/hr.
2. Rock, gravel, sand, fines, etc. – 200,000 lbs/hr or 100 tons/hr.
3. Dry aggregate – 199,000 lbs/hr or 99.50 tons/hr.
4. 30,000 CFM @ 180° F; 1,000 lbs/hr particulate entering cyclone; 80% cyclone efficiency.
5. 800 lbs/hr returned to dry aggregate.
6. Dry aggregate entering vibrating screens – 199,800 lbs/hr.
7. 30,000 CFM @ 180° F; particulates to scrubber – 200 lbs/hr.
8. Water 200 GPM; scrubber efficiency – 90%.
9. 28,000 CFM @ 140° F; particulate emissions to atmosphere – 20 lbs/hr.
10. Asphalt production 219, 800 lbs/hr or 109.9 tons/hr.

C

AIR POLLUTION CONTROL DEVICE

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 Filters FF-1 & FF-2

2. If there are several devices in series, list each unit in series starting at the emission source.
   (1) Limestone Injection (2) Ammonia/Urea ~~Injection~~ (3) Hydrated Lime ~~Injection~~ XXXXXXXX Fabric Filter

3. Indicate Emission Source and ID No. that Control Device(s) is installed on:
   RDF-Fired Fluid Bed Combustors (Units FB-1 & FB-2)

4. Narrative Description of Control Device(s):
   Pulsed Jet Baghouse (2 units, 1 for each combustion system)

Manufacturer	Model Name	Model Number
Procedair, Staclean or Equal		

5. Estimated Cost of Control Device: $500,000
   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 January, 1993 Operation Date September, 1994

Emission Parameters:	PART.	SO_2	NO_x	CO	VOC	LEAD	OTHER	OTHER
Pollutant(s) Controlled	(X)	(X)	(X)	(X)	(X)	(X)	HCl	
Emission Rate Before Control (lb/hr) =	498	135.9	28.0	37.4			116.4	
Emission Rate After Control (lb/hr) =	2.49	8.72	11.21	11.21	3.75	0.105	4.73	
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) =	63,500	-	63,500
Temperature (Deg. F) =	300	-	300
Cam Velocity (ft./sec.) =	2.53	-	-
Pressure Drop (in. H_2O) =	4	-	-
Moisture (%) =	10.56	-	10.56

9. Describe Ultimate Disposal of Collected Materials:
   Collected ash will be beneficially used as an additive in the manufacturing of concrete or portland cement.

10. Stack or Emission Point Data: (stack with two (2) flues)

Height Above Ground (ft.)	Inside Area (sq. ft.)	Direction of Exit (up, down, or horizontal)	Are there obstructions over the stack?
150	44.18	UP	(X) No ( ) Yes, (specify)

Is scaffolding available for sources testing? ( ) No (X) Yes

Are sampling ports available? ( ) No (X) Yes

Comments:
Two (2) identical systems installed. Data presented for a single system.

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

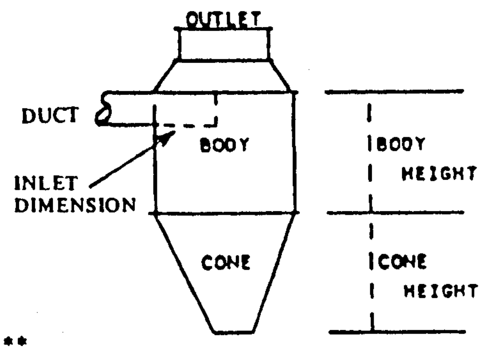
A process flow diagram must be attached If cyclone is routed to another cyclone or other equipment, show sketch of entire system.

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) *** Each Unit (FF-1 & FF-2)

Efficiency (%)	Volumetric Flow Rate (ACFM)	Filter Surface Area (sq. ft.)	Air-to-Filter Area Ratio (ft./min.)	Pressure Drop (in. H_2O)
99.5	63,500	15,914	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
3	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 ______

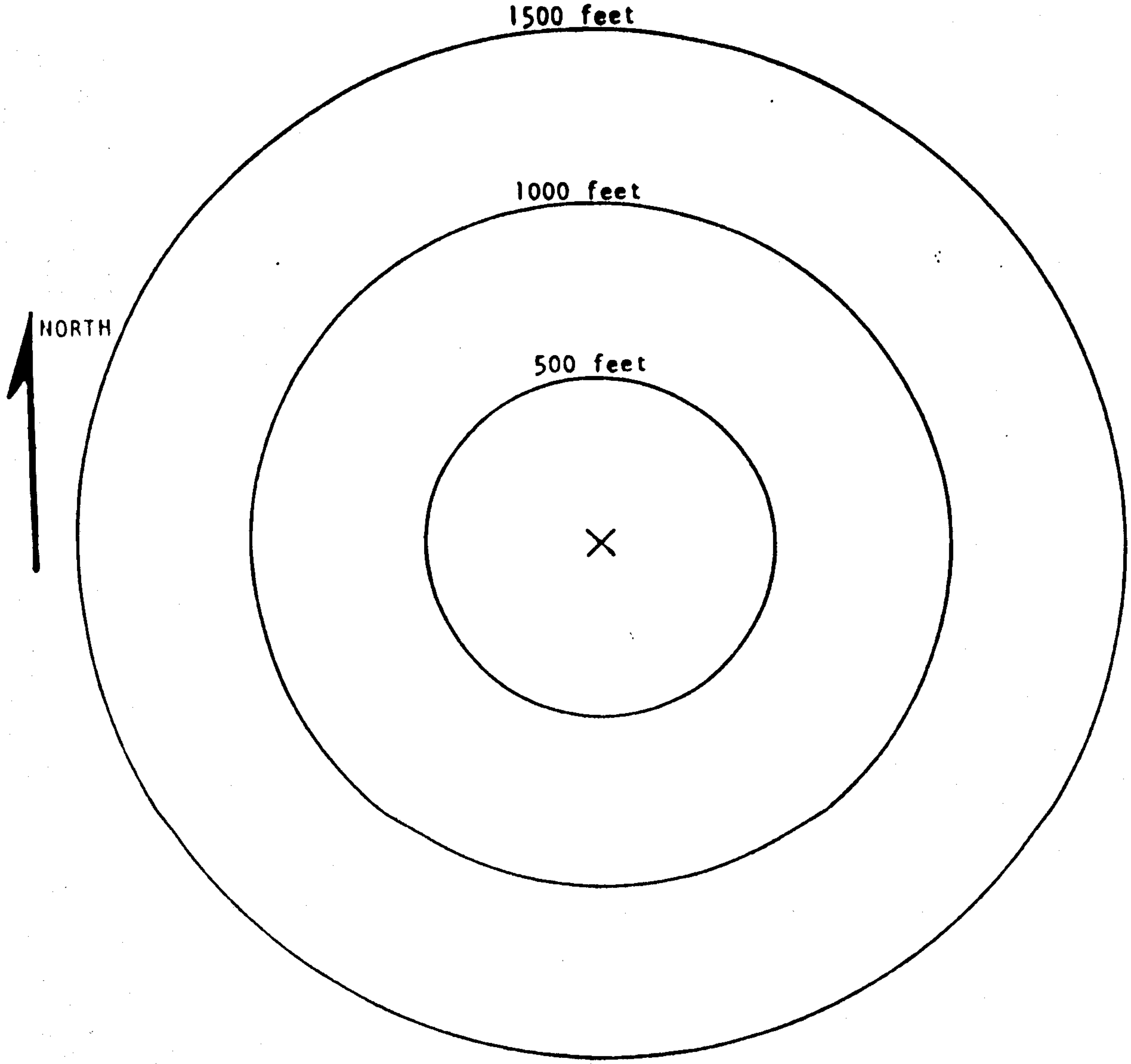
Combustion Chamber Dimensions (ft.): ______ Length ______ Diameter

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	CODE	DESCRIPTION
1. Indicate location and type of building by the use of small numbered circles with the decription below.	(1)	
	(2)	
2. Show roads as lines representing the road edges. Indicate street names and highway numbers.	(3)	
	(4)	
	(5)	
3. Show wooded or cleared area by approximate boundary lines and the words "woods", "cleared", "cornfield", etc.	(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 Lime 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 January, 1993 Operation Date September, 1994

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)	After Control (lb/hr)	Emission Estimate Method*	Control Device**	Control Efficiency %
Particulates	11.14	0.0557	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. No. Batches per Day 1

8. Process Name Powdered Lime Storage Bin

Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Actual	Max. Requested Permit Input Rates (lb/hr)
A. Powdered Limestone	100,000	44,000	100,000
B.			
C.			
D.			
E.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	44,000	100,000

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

B

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 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	3.14	70	DOWN
Volumetric Flow Rate (ACFM) 650	Velocity (ft./sec.) 3.45	Are sampling ports available? (X) No ( ) Yes	Is rain cap or other obstruction over stack? ( ) 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

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-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 Lime Storage Bin (PL)

4. Narrative Description of Control Device(s):
   Bin Vent with Fabric Filter

   Manufacturer: Staclean of equal
   Model Name: ______
   Model Number: ______

5. Estimated Cost of Control Device: $ 25,000

   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 January, 1993 Operation Date September, 1994

7. Emission Parameters:

	PART.	SO_2	NO_x	CO	VOC	LEAD	OTHER	OTHER
Pollutant(s) Controlled	(X)	( )	( )	( )	( )	( )		
Emission Rate Before Control (lb/hr) =	11.14							
Emission Rate After Control (lb/hr) =	0.0557							
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.) =			-
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	3.14	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

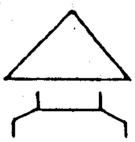
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_20)	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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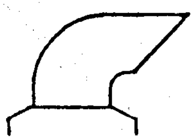
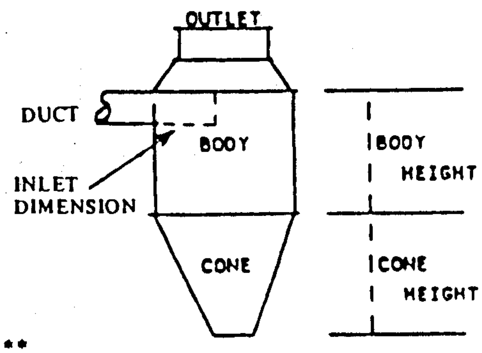


( )

SKETCH OTHER CONFIGURATION ON DIAGRAM Below



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_20)	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_20)
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
[illegible]mum Burner Rating ([illegible]llion 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 January, 1993 Operation Date September, 1994

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	11.14	0.0557	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 Hour No. Batches per Day 0.5

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	44,000	100,000
B.			
C.			
D.			
E.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	100,000	44,000	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 particulate matter is discharged back into the storage bin.

B

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	3.14	70	DOWN
Volumetric Flow Rate (ACFM) 650	Velocity (ft./sec.) 3.45	Are sampling ports available? (X) No ( ) Yes	Is rain cap or other obstruction over stack? ( ) 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

23. Comments

AIR POLLUTION CONTROL DEVICE

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: $ 25,000
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 January, 1993 Operation Date September, 1994

Emission Parameters:

	PART.	SO_2	NO_x	CO	VOC	LEAD	OTHER	OTHER
Pollutant(s) Controlled	(X)	( )	( )	( )	( )	( )		
Emission Rate Before Control (lb/hr) =	11.14							
Emission Rate After Control (lb/hr) =	0.0557							
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.) =			3.45
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	3.14	DOWN	Rain Cap

Is scaffolding available for sources testing? ( ) No (X) Yes
Are sampling ports available? (X) No ( ) Yes

11. Comments:

C

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.

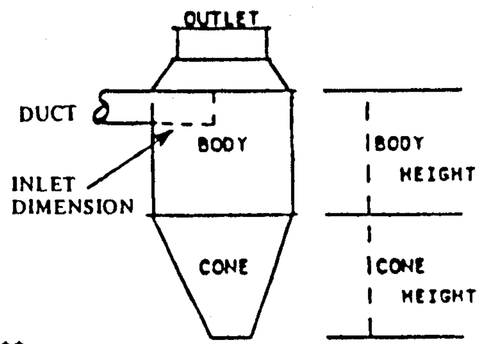
CYCLONE DIAGRAM

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):
   Ash Storage Bin Vent (AS)

2. Description of Process or Fuel Burning Source Including Air Control Device:
   Combustion Ash Storage soli 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 January, 19 93 Operation Date September, 19 94

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	11.14	0.0557	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 storage bins.

B

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	3.14	210	DOWN
Volumetric Flow Rate (ACFM) 650	Velocity (ft./sec.) 3.45	Are sampling ports available? (XX) No ( ) Yes	Is rain cap or other obstruction over stack? ( ) No (XX) 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

C

AIR POLLUTION CONTROL DEVICE

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 of equal — Model Name: ______ — Model Number: ______

5. Estimated Cost of Control Device: $ 25,000
   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 January, 19 93 Operation Date September, 1994

7. Emission Parameters:

	PART.	SO_2	NO_x	CO	VOC	LEAD	OTHER	OTHER
Pollutant(s) Controlled	XX	( )	( )	( )	( )	( )		
Emission Rate Before Control (lb/hr) =	11.14							
Emission Rate After Control (lb/hr) =	0.0557							
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) =	210	-	210
Velocity (ft./sec.) =			3.45
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	3.14	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

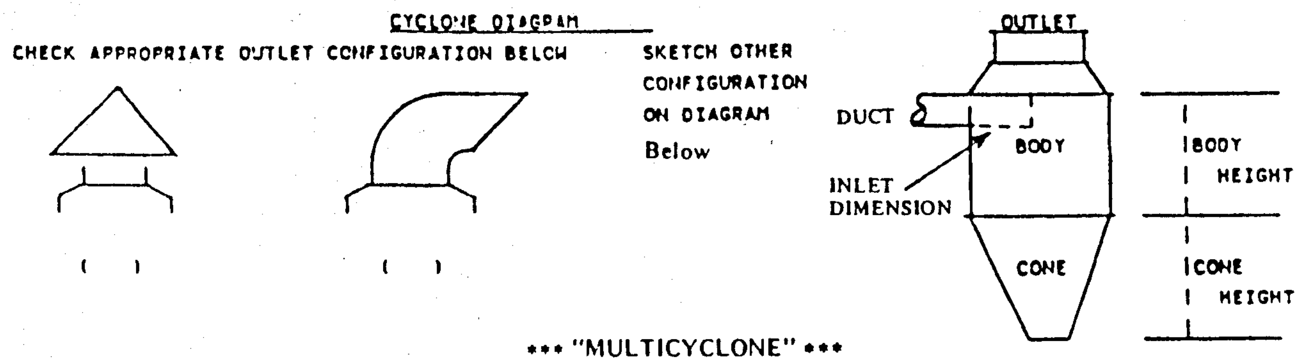
12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_20)	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.



13. *** "MULTICYCLONE" ***

Efficiency (%)	Volumetric Flow Rate (ACFM)	No. of Cones	Pressure Drop (In. H_20)	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_20)
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 Vent (SS)
2. Description of Process or Fuel Burning Source Including Air Control Device:
   Sand storage soli 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 January, 1993 Operation Date September, 1994
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	11.14	0.0557	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 No. Batches per Day 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	44,000	100,000
B.			
C.			
D.			
E.			
F.			
TOTAL WEIGHT ENTERING PROCESS	100,000	44,000	100,000

*DO NOT LIST ANY VOLATILE HYDROCARBONS, USE HYDROCARBON EMISSION SOURCES FORM "E"

DATA FOR PROCESSES OR FUEL BURNING SOURCES – *continued*

B

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 matter is discharged back into the storage bin.

B

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	3.14	70	DOWN
Volumetric Flow Rate (ACFM) 650	Velocity (ft./sec.) 3.45	Are sampling ports available? (X) No ( ) Yes	Is rain cap or other obstruction over stack? ( ) 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

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-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: Staclean or equal
   Model Name: ______
   Model Number: ______

5. Estimated Cost of Control Device $ 25,000
   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 January, 1993 Operation Date September, 1994

7. Emission Parameters:

	PART.	SO_2	NO_x	CO	VOC	LEAD	OTHER	OTHER
Pollutant(s) Controlled	(X)	( )	( )	( )	( )	( )		
Emission Rate Before Control (lb/hr) =	11.14							
Emission Rate After Control (lb/hr) =	0.0557							
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.) =			3.45
Pressure Drop (in. H_2O) =	4		
Moisture (%) =	7	-	7

9. Describe Ultimate Disposal of Collected Materials:
   Discharged back into storage silo

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	3.14	DOWN	Rain Cap

Is scaffolding available for sources testing? ( ) No (X) Yes

Are sampling ports available? (X) No ( ) Yes

Comments:

C

SUPPLEMENTAL DATA FOR AIR CONTROL DEVICES

12. *** "CYCLONE" (MECHANICAL SEPARATORS) ***

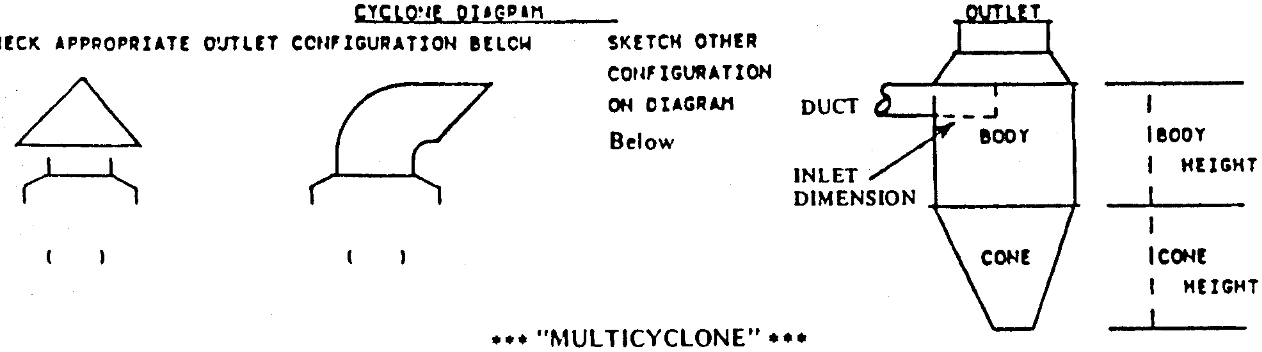
Efficiency (%)	Volumetric Flow Rate (ACFM)	Pressure Drop (in. H_2O)	Baffles or Louvers (specify)	Position in Series # ______ of ______ Units	
Cyclone Dimensions (inches) Inlet Outlet		Cyclone Body Diameter (inches)	Cyclone Body Height (ft.)	Cyclone Cone Height (ft.)	
Wet Spray ( ) No ( ) Yes	No. of Nozzles	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/Urea Tank (AT)

2. Description of Process or Fuel Burning Source Including Air Control Device:
   Aqueous Ammonia/Urea 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 January, 19 93 Operation Date September, 19 94

4. Maximum Source Operation: 24 Hours/Day 7 Days/Week 52 Weeks/Year

5. Air Contaminants Emitted:	Maximum Actual Emissions Before Control (lb/hr)	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/Urea	.0831	.0831	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 No. Batches per Day 0.2 (Avg.)

8. Process Name Ammonia/Urea Storage Tank (12,000 gallon tank) Materials Entering Process*: (Include In-process Solid Fuels)	Input Rates (lb/hr) Design	Actual	Max. Requested Permit Input Rates (lb/hr)
A. Ammonia (100%)	100,000	50,000	100,000
B. Urea (100%)	100,000	50,000	100,000
C.			
D. NOTE: Tank to be used for aqueous			
E. ammonia or urea, depending on			
F. NOx control SNCR system selected			
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(XX) 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	70	UP
Volumetric Flow Rate (ACFM) 0.12	Velocity (ft./sec.) 0.01	Are sampling ports available? (X) No ( ) Yes	Is rain cap or other obstruction over stack? (X) 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):

Aqueous Ammonia or Urea will be stored in a 12,000 gallon tank for injection into the combustors for NOx control. Emissions will only occur after loading of the tank, upon hose disconnect, approximately 24 hours per year. Hose connections are approximately 10 feet above ground. Loading will require 20-30 minutes, approximately 72 times per year.

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):
   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 January, 19 93 Operation Date September, 19 94
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)	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)	0.424	0.424	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 No. Batches per Day 0.05 Avg.
8. Process Name Propane Storage Tank
   Materials Entering Process*: (12,000 gallon tank)
   (Include In-process Solid Fuels)

Materials Entering Process	Input Rates (lb/hr) Design	Actual	Max. Requested Permit Input Rates (lb/hr)
A. Propane	51,000	51,000	51,000
B.			
C. NOTE: Emissions occur only under			
D. disconnect of hose after filling,			
E. approximately 12 times per year.			
F.			
G.			
TOTAL WEIGHT ENTERING PROCESS	51,000	51,000	51,000

*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

B

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	70	UP
Volumetric Flow Rate (ACFM) 0.72	Velocity (ft./sec.) 0.06	Are sampling ports available? (X) No ( ) Yes	Is rain cap or other obstruction over stack? (X) 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 a Startup Fuel for the Fluid Bed Combustors. Emissions will only Occur after loading of the tank, upon hose disconnect, approximately 6 hours per year. Hose connections are approximately 10 feet above ground. Loading will require 20-30 minutes, approximately 12 times per year.

23. Comments.

7

BCH Energy Corporation

Fayetteville, NC

Revised Toxic Air Pollutant Modeling Analysis for the Fayetteville RDF-to-Energy Facility

ENSR Consulting and Engineering

July 1992

Document Number 6104-002-500

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This report presents the results of a dispersion model analysis of Toxic Air Pollutant emissions from the Fayetteville RDF-to-Energy Facility. This document has been revised from an earlier submission due to a revision of the site plan which resulted in the relocation of the main stack approximately 420 feet to the west of its original position, changes in the design of the combustor unit structures, and minor changes in the position of the support structures. The analyses were performed in accordance with North Carolina Department of Environmental Management (NCDEM) procedures and the modeling protocol previously approved by NCDEM. The results of the revised analyses show that the maximum predicted impacts of the all Toxic Air Pollutants which the facility emits above state-specified threshold limits are below the Acceptable Ambient Levels (AALs) as defined by NCDEM, and are comparable to those presented in the previous version of this document.

1.0 INTRODUCTION

1.1 Project Description

BCH Energy Corporation (BCH) plans to construct and operate a plant in Bladen County, NC to burn refuse-derived fuel (RDF-3) and generate steam for cogeneration of electricity for sale to E.I. DuPont de Nemours and Company (DuPont). BCH proposes to burn approximately 190,000 tons of RDF-3 annually. The plant is to be constructed at the DuPont facility in Bladen County, north of the existing DuPont Power House (Figure 1-1). DuPont currently burns heavy fuel oil to generate steam and electricity for plant needs. Installation of the BCH facility will significantly reduce the amount of fuel oil burned at the DuPont facility.

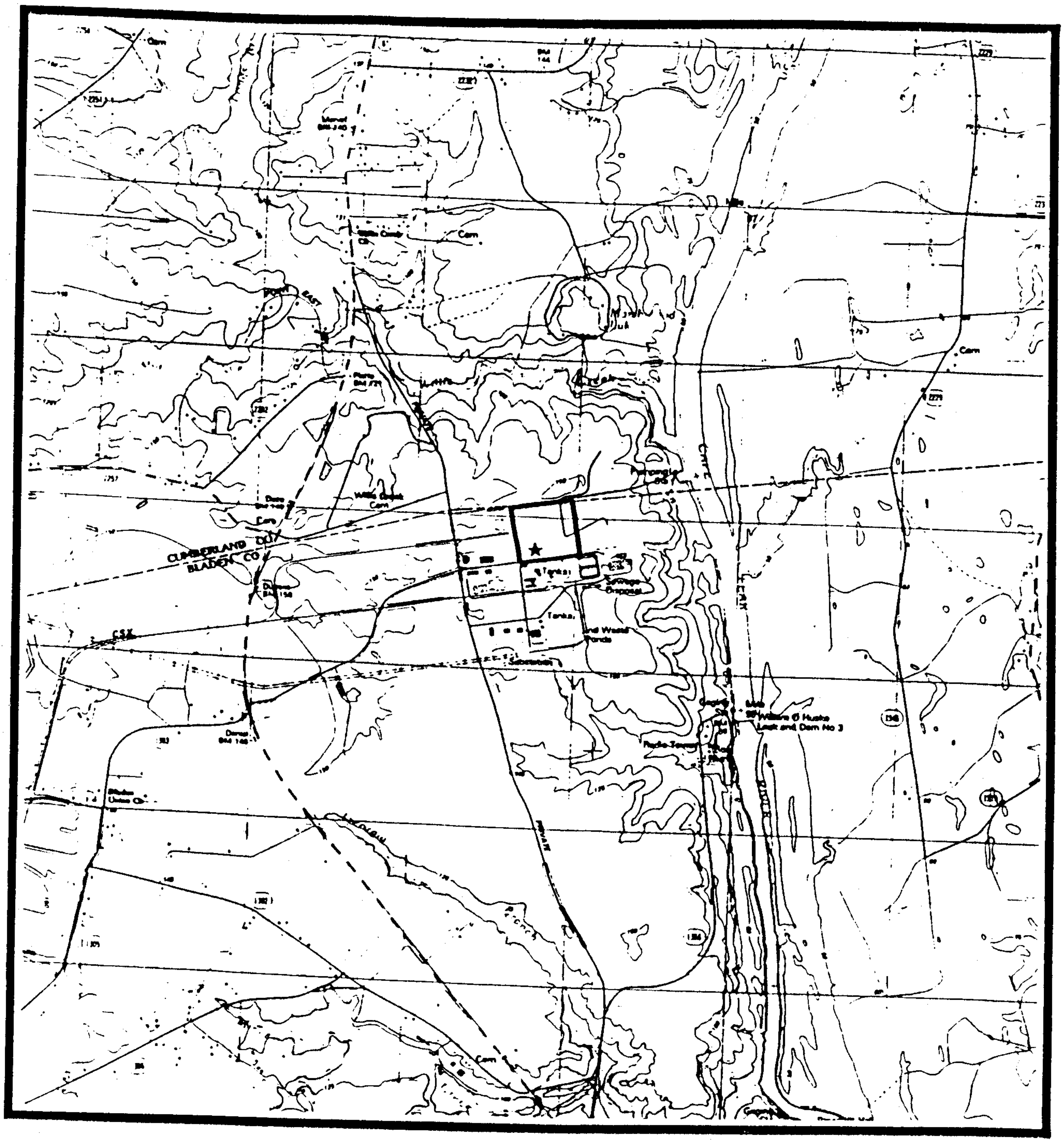
1.2 Regulatory Requirements

In accordance with North Carolina Permit Requirements for Toxic Air Pollutants (15A NCAC 2H .0610), facilities with emission rates of toxic air pollutants (TAPs) greater than the threshold values established in 15A NCAC 2H.0610(h), must obtain a permit from the North Carolina Division of Environmental Management (NCDEM). Table 1-1 lists the regulated TAPs expected to be emitted from the proposed facility in quantities greater than their applicable thresholds. To obtain this permit, an applicant must demonstrate, through the use of dispersion models (15A NCAC .1106), that emissions of TAPs will not result in concentrations which exceed the Acceptable Ambient Concentration Levels (AALs), also shown in Table 1-1. A complete list of all TAPs expected to be emitted from the proposed facility and the applicable threshold values are listed on NC Form 2, contained in Appendix A.

The proposed facility will not require a permit under the Prevention of Significant Deterioration Program (PSD), it is one of the 28 listed source categories and emissions of regulated pollutants are less than 100 tons per year (Table 1-2).

1.3 Report Content

This report documents the modeling analyses used to determine ambient concentrations of those TAPs which the proposed facility will emit in amounts greater than their threshold values. All modeling procedures followed the guidelines presented in Guidelines for Evaluating the Air Quality Impacts of Toxic Pollutants in North Carolina (NCDEM 1990). This document contains the following items:



Source: U.S.G.S 7.5 minute series(topographic) quad of Duart, North Carolina

0 .5 1 mile

0 .5 1 kilometer

Stack Location ★

——— Fenceline

N

M920561

Figure 1-1

Location of the Proposed Facility

TABLE 1-1

Acceptable Ambient Concentration Levels for Pollutants Emmitted in Amounts Above the NCDEM Thresholds

Pollutant(1)	Acceptable Ambient Concentration Levels (mg/m^3)(2)			
	Annual	24-hour	1-hour	15-minute
Ammonia	--	--	--	2.7
Arsenic and compounds	2.3×10^{-7}	--	--	--
Benzene	1.2×10^{-4}	--	--	--
Beryllium	4.1×10^{-6}	--	--	--
Cadmium	5.5×10^{-6}	--	--	--
Chromium (VI)	8.3×10^{-8}	--	--	--
Formaldehyde	--	--	--	0.15
Hydrogen chloride	--	--	--	0.7
Hydrogen fluoride	--	0.03	--	0.25
Lead	--	1.5×10^{-3}(3)		
Mercury (aryl and inorganic compounds)	--	6.0×10^{-4}	--	--
Mercury vapor	--	6.0×10^{-4}	--	--
Nickel metal	--	6.0×10^{-3}	--	--
Vinyl chloride	3.8×10^{-4}	--	--	--

(1) Source: Energy Products of Idaho.
(2) Source: North Carolina Administrative Code 15A NCAC.1104(a).
(3) Value represents the 3-month National Ambient Air Quality Standard for lead.

TABLE 1-2

Estimated Maximum Criteria Pollutant Emission Rates[1]

Pollutant	Emission Rates[2]	
	lbs/hr	tpy[3]
Sulfur dioxide	17.43	76.34
Nitrogen dioxide	22.41	98.16
Total suspended particulates	4.98	21.81
Carbon monoxide	22.41	98.16
Lead	2.07×10^{-1}	0.91
Non-methane hydrocarbons	7.50	32.85

(1) The PSD regulations define a major source as one which annually emits 100 tons or more of any regulated pollutant.
(2) Source: Energy Products of Idaho.
(3) Based on 8,760 hours of operation.

- A general discussion of plant processes and the types and locations of the emission sources proposed for the facility. Appendix B contains a revised plot plan which clearly shows the locations of all property boundaries, stack locations, and building dimensions, the direction of true north, a scale and notations of UTM coordinates

- A discussion of the Good Engineering Practice stack height and cavity analyses;

- A list of all models and inputs used in the analysis;

- A list of receptor locations, including terrain elevations;

- Results of dispersion model analyses, and

- Floppy diskettes containing all model input and output files.

Appendix A contains NCDEM Forms 1, 2, 3, 4, 5, and S6 for the screening modeling analysis and Form R6 for the refined analysis.

All analyses were completed as stated in An Air Quality Modeling Protocol for the Fayetteville RDF-to-Energy Facility (ENSR 1992), which was approved by the NCDEM on March 3, 1992 (NCDEM 1992a). The letter confirming this approval was contained in Appendix D of the previous version of this report (ENSR 1992a)

2.0 SOURCE DESCRIPTION

2.1 Facility Description

The proposed steam cogeneration plant will burn refuse-derived fuel (RDF-3) processed by BCH Energy Corp. from municipal waste collected in Bladen, Cumberland, and Hoke Counties. The processing of municipal solid waste (MSW) will occur off-site, at the Ann Street Landfill Facility in Fayetteville, Cumberland County. Processed MSW will be transferred to the steam generating plant site in live bottom transfer trailers. Upon receipt, the material will be shredded to meet the necessary size specifications of RDF-3. RDF-3 as defined by ASTM designation E1126-87 is shredded fuel derived from municipal solid waste that has been processed to remove metal, 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 BCH's 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 is plastics, other organic materials, some trace metals and glass.

2.1.1 Process and Control Equipment

The RDF-3 will be stored in a building with ventilation directly into the combustion units, consequently, fugitive air pollutant emissions should not occur from the storage building. The RDF-3 will be moved from the storage building to covered metering bins by covered conveyor. According to BCH's construction plan, the covered conveyors will be under negative pressure caused by the ventilation of the storage building. Therefore, the conveyors should not be a source of fugitive air pollutant emissions.

Upon reaching the covered metering bins, the RDF-3 will then be fed via a screw conveyor through a pneumatic feedline to the combustion units. These metering bins will also be under negative pressure and will not be a source of fugitive air pollutant emissions. Consequently, because the fuel feed system is under negative pressure and enclosed from the storage enclosure to the combustion units, no emissions to the atmosphere are expected from the fuel feed system.

Two identical fluidized bed conveyors will be used to burn the RDF-3. These combustors will be manufactured by Energy Products of Idaho (EPI), Outokumpu Eco Energy, or Kvaerner Generator. Each combustor will have a rated capacity of 95,000 tons of RDF-3 per year. The combustors will be rated at 124.5 million British Thermal Units (MMBtu) per hour heat input each. To control sulfur dioxide (SO_2) emissions, powdered limestone will be fed into the combustor via a separate pneumatic feedline. Aqueous ammonia or urea will be injected into the vapor space above the fluidized bed to control nitrogen oxide (NO_x) emissions. The exhaust gas emissions from the fluidized bed combustors will pass through the boiler units to create steam. Two identical waste-heat boilers will be used to process steam. Each of the boilers is to have a rated capacity of 96 MMBtu/hr, and 85,000 pounds of steam per hour. Each boiler will consist of a superheater, an evaporator and an economizer. 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.

2.1.2 Storage Bins and Tanks

There will be several storage bins and tanks on the site, four of which will have particulate and/or toxic air pollutant emissions. A description of the storage tanks and bins that will be on-site emission sources follows.

Powdered Limestone Storage Bin

As discussed previously, powdered limestone will be injected to control SO_2 emissions. The powdered limestone will be stored in a 1,400 cubic foot (ft^3), 45-foot tall storage bin, and fed into the fluidized bed combustors 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 two feet. The emission point will be at the top of the baghouse, or about 52 feet above the ground. Particulate emissions from this storage bin will only occur during pneumatic loading of limestone into the bin (approximately 150 hours per year), and not while the limestone is being fed into the combustors.

Aqueous Ammonia/Urea Storage Tank

The aqueous ammonia or urea used to control NO_x emissions will be stored in a 12,000-gallon above-ground storage tank, and fed into the fluidized bed combustors on a continuous basis. Storage tank emissions will only occur after loading of ammonia/urea into the tank (upon hose disconnect, approximately 24 hours per year), and not while the ammonia/urea is being fed into the combustors. 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 HCl emissions will be stored in a 1,400 ft^3, 45 foot tall storage tank and fed into the gas stream prior to fabric filters on a continuous basis. The storage bin will be fitted with a fabric filter (baghouse), approximately three feet square by seven feet tall, wit an approximate outlet diameter of two feet. The emission point will be at the top of the baghouse, or about 52 feet above the ground. Particulate emissions from this source will only occur during pneumatic loading of hydrated lime into the tank (approximately 38 hours per year), and not while the lime is being fed into the combustors. Loading will require about one-half hour, approximately 76 times a year.

Ash Storage Bin

Combustion ash will be collected from the fabric filters (baghouses) located in the process stream on a continuous basis. The ash will be stored in a 2,800 ft^3, 50 foot tall storage bin. The storage bin will be fitted with its own fabric filter (baghouse), approximately three feet square by seven feet tall, with an approximate outlet diameter of two feet. The emission point will be at the top of the baghouse, or about 57 feet above the ground. Particulate emissions from this storage bin will occur continuously. The ash collected from the combustion process is to be sold to a cement manufacturer. Unloading will require about one-half hour, approximately 1,360 times a year.

2.2 Operating Characteristics and Emission Rates

Table 2-1 lists the exit characteristics and TAP emission rates for the main stack at the proposed facility. These operating characteristics represent 100% load operation. Table 2-2 lists the emission characteristics of the storage tanks/bins and Table 2-3 lists their TAP emission rates.

TABLE 2-1

Main Stack Operating Characteristics and TAP Emission Rates

Operating Characteristics(1)	
Stack height	150 feet
Stack base elevation	145 feet
Exit temperature	300°F
Exit velocity	2875 ft/min
Stack inner diameter	7.5 feet
Stack UTM Coordinates	697.690 km E, 3857.760 km N

TAP Emission Rates(1)

Pollutant	lbs/hr	tons/year(2)	Pollutant	lbs/hr	tons/year(2)
Ammonia	4.78	20.94	Mercury (aryl and inorganic compounds)	6.85×10^{-2}	0.30
Arsenic and compounds	1.25×10^{-3}	5.48×10^{-3}	Mercury vapor	1.37×10^{-2}	6.00×10^{-2}
Benzene	2.35×10^{-3}	1.03×10^{-2}	Methyl chloroform	2.35×10^{-3}	1.03×10^{-2}
Benzo(a)pyrene	4.64×10^{-7}	2.03×10^{-6}	Methylene chloride	2.35×10^{-3}	1.03×10^{-2}
Beryllium	1.17×10^{-3}	5.12×10^{-3}	Methyl ethyl ketone	4.72×10^{-3}	2.07×10^{-2}
Cadmium	1.97×10^{-4}	8.63×10^{-4}	Methyl isobutyl ketone	4.72×10^{-3}	2.07×10^{-2}
Carbon disulfide	4.72×10^{-3}	2.07×10^{-2}	Nickel metal	6.47×10^{-2}	2.83×10^{-1}
Carbon tetrachloride	2.35×10^{-3}	1.03×10^{-2}	Perchloroethylene	2.35×10^{-3}	1.03×10^{-2}
Chlorobenzene	2.35×10^{-3}	1.03×10^{-2}	Polychlorinated biphynels	4.53×10^{-5}	1.98×10^{-4}
Chloroform	2.35×10^{-3}	1.03×10^{-2}	Styrene	2.35×10^{-3}	1.03×10^{-2}
Chromium (total)	9.02×10^{-2}	3.95×10^{-1}	Tetrachlorodibenzo-p-dioxin (TCDD)	4.72×10^{-6}	2.07×10^{-5}
Ethylene dichloride	2.35×10^{-3}	1.03×10^{-2}	Toluene	2.35×10^{-3}	1.03×10^{-2}
Formaldehyde	2.56×10^{-1}	1.12	Trichlorofluoromethane	3.39×10^{-3}	1.48×10^{-2}
Hexachlorodibenzo-p-dioxin (HCDD)	2.72×10^{-7}	1.19×10^{-6}	Trichlorotrifluoroethane	5.02×10^{-3}	2.20×10^{-2}
Hydrogen chloride	9.46	41.43	Vinyl chloride	4.72×10^{-3}	2.07×10^{-2}
Hydrogen fluoride	0.50	2.19	Vinylidene chloride	2.35×10^{-3}	1.03×10^{-2}
Manganese and compounds	8.15×10^{-3}	3.57×10^{-2}	Xylene	2.35×10^{-3}	1.03×10^{-2}

(1) Source: Energy Products of Idaho.
(2) Tons per year figure based on 8,760 hours of operation.

TABLE 2-2

Operating Characteristics of Storage Bins and Tanks[1]

Source Name	UTMs (km E, km N)	Vent Height (ft)	Vent Diameter (ft)	Exit Temperature (°F)	Exit Velocity (ft/min)
Powdered Limestone Storage Bin	697.739, 3857.805	52	2	70	207
Hydrated Lime Storage Bin	697.715, 3857.763	52	2	70	207
Ammonia/Urea Storage Tank	697.768, 3857.804	10	0.5	70	0.01[2]
Ash Storage Bin	697.714, 3857.810	57	2	210	207

(1) Data supplied by Mr. K. Woodruff.
(2) Per NCDEM guidance, a value of 0.3 ft/s was used in the modeling, since the actual exit velocity was less than 0.01 m/s (0.3 ft/s).

TABLE 2-3

TAP Emission Rates for the Storage Bins and Tanks

	Powdered Lime Storage Bin		Hydrated Lime Storage Bin		Ammonia Storage Tank		Ash Storage Bin	
	lb/hr	tons/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
Ammonia	--	--	--	--	8.31×10^{-2}	0.36	--	--
Arsenic	1.1×10^{-7}	4.82×10^{-7}	1.51×10^{-7}	6.61×10^{-7}	--	--	2.24×10^{-5}	9.81×10^{-5}
Beryllium	--	--	--	--	--	--	3.36×10^{-7}	1.47×10^{-6}
Cadmium	3.90×10^{-9}	1.71×10^{-8}	5.30×10^{-9}	2.32×10^{-8}	--	--	1.12×10^{-5}	5.04×10^{-5}
Chromium (total)	1.23×10^{-6}	5.39×10^{-6}	1.66×10^{-6}	7.27×10^{-6}	--	--	1.25×10^{-4}	5.48×10^{-4}
Lead	1.00×10^{-6}	4.38×10^{-6}	1.36×10^{-6}	5.96×10^{-6}	--	--	--	--
Manganese	1.23×10^{-4}	5.38×10^{-4}	1.66×10^{-4}	7.27×10^{-4}	--	--	--	--
Mercury (oxides and chlorides)	4.46×10^{-9}	1.95×10^{-3}	--	--	--	--	--	--
Nickel metal	2.23×10^{-6}	9.76×10^{-6}	3.03×10^{-6}	1.33×10^{-5}	--	--	1.37×10^{-6}	6.00×10^{-6}

(1) Data provided by Mr. K. Woodruff.

3.0 SCREENING MODELING ANALYSIS

3.1 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was conducted to determine which stacks at the proposed facility will be influenced by building wake effects. This analysis included all structures within the lesser of 5L (where L is the lesser of structure height or maximum projected width) or one-half mile of the stack. The procedures and methodologies described in Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (USEPA 1985) were used.

The results of the GEP analysis are shown in Table 3-1. These results show that:

- The controlling structure for the main stack and the storage tank vents is the main structure housing the two combustion units and ancillary equipment;

- The GEP formula stack height for all sources is 140 feet, thus the main stack is greater than GEP formula stack height.

- All storage tank vents are influenced by building downwash.

3.2 Cavity Analysis

A cavity analysis was performed using the EPA SCREEN model (USEPA 1988) to determine if the potential for source plumes to be entrained in cavity regions existed. All the structures identified in the GEP analysis were included in the cavity analysis. The largest cavities calculated were attributable to the two combustion unit structures, which created a maximum cavity length of 213 feet and a cavity height of 101 feet. The main stack, with a height of 150 feet, was above this cavity. Of the remaining sources, only the cavity attributable to the hydrated lime storage tank extends off fenced property. Cavity concentrations were calculated for this source and are discussed in Section 3-4. The results of this analysis show that none of the maximum cavity concentrations exceeded the applicable AALs.

TABLE 3-1

Results of the GEP Stack Height Analysis

Description	Dimensions (ft)				Calculated Dimensions (ft)		Sources Within 5L[3]
	Height	Width	Length	Projected Width[1]	GEP Stack Height	5L[2]	
Incinerator Structure 1	56.0	30.0	125.0	128.5	140.0	280.0	All Sources
Incinerator Structure 2	56.0	30.0	125.0	128.5	140.0	280.0	All Sources
Powdered Lime Storage Bin	45.0	6.3	6.3	8.9	58.4	44.5	PL
Hydrated Lime Storage Bin	45.0	6.3	6.3	8.9	58.4	44.5	No Sources
Ammonia Storage Tank	9.0	9.0	22.5	24.2	22.5	45.0	AT
Ash Storage Bin	50.0	20.0	20.0	28.3	92.5	141.5	AS

(1) Maximum projected width.
(2) Maximum sphere of influence.
(3) MS = Main Stack; PL = Powdered Lime Storage Bin; HL = Hydrated Lime Storage Bin; AT = Ammonia Storage Tank; AS = Ash Storage Bin.

3.3 Land Use Classification

The selection of urban or rural dispersion coefficients for use in dispersion modeling will follow the guidance described in Guideline on Air Quality Models (Revised) (USEPA 1986). Land use within a three kilometer radius of the facility was examined and classified using the land use identification methods of Auer (1978) and United States Geological Survey (USGS) topographic maps. Less than 50 percent of the land within this area was identified as having heavy or medium industrial, commercial, or multi-family residential uses (Figure 3-1), thus the land use was classified as rural for modeling purposes. USGS topographic maps encompassing a three-mile radius of the proposed facility were contained in Appendix C of the previous version of this report.

3.4 Modeling Analysis

3.4.1 Simple Terrain

EPA SCREEN was used to estimate the maximum ground level concentrations of TAPs caused by point sources at the facility in areas where the terrain within three miles of the facility does not exceed the height of the main facility stack. The model options recommended in Section 3.3.1.1 of the NCDEM TAP modeling guidelines (NCDEM 1990) were used in the analysis. Table 3-2 lists the receptor locations and elevations used in the screening analysis.

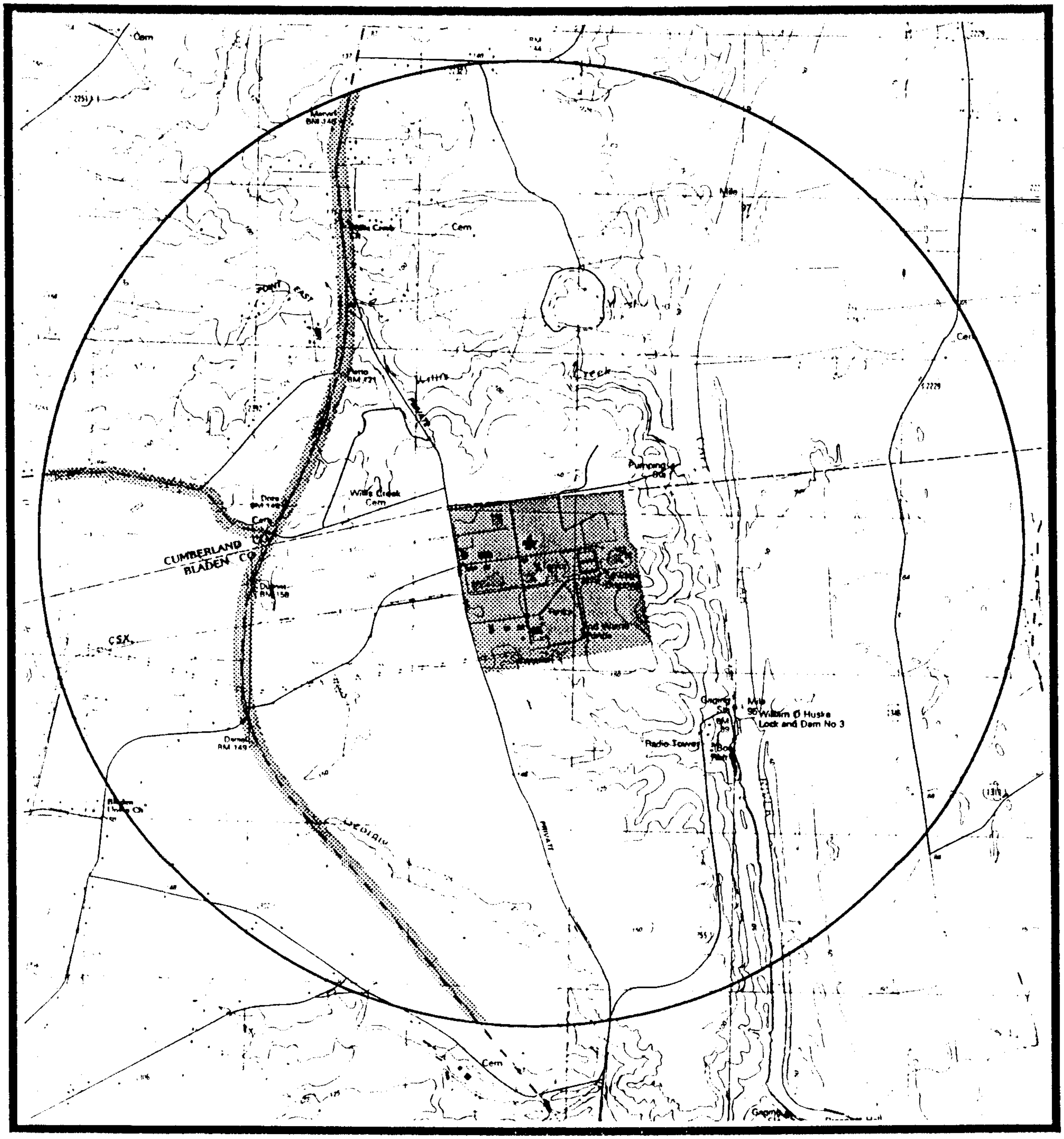
One-hour averages were calculated by SCREEN. Annual and 24-hour concentrations were calculated by multiplying the one-hour concentration by scale factors of 0.038 and 0.4 respectively, as discussed in Section 3.1 of NCDEM 1990. Fifteen-minute concentrations were conservatively calculated using one-hour emission rates.

3.4.2 Complex Terrain

Only one stack at the proposed facility, that associated with the Ammonia Storage Tank, had terrain features which exceeded stack top located within 20 kilometers. EPA SCREEN was run for this stack and the final stable plume height (Hf) was determined. The critical terrain feature height (2fc) was calculated using the stack base elevation, as follows:

$$Zfc = (Hb + Hf) - 33 = 156 \text{ feet}$$

The distance to the nearest terrain feature with the height of Zfc (2,296 feet) was measured and the Ammonia Storage Tank Vent was modeled using this height. The one-hour concentration of 4.4×10^{-4} mg/m^3 which resulted was less than the 15-minute AAL of 2.70.



Source: U.S.G.S 7.5 minute series(topographic) quad of
Duart, North Carolina

0 .5 1 mile

0 .5 1 kilometer

Urban Areas

Stack Location ★

N

Figure 3-1

M920561

Land Use Within Three Kilometers of the Proposed Facility

TABLE 3-2

Receptor Locations and Heights Included in the Screening Model Analysis

Distance (m)	Height (ft msl)	Distance (m)	Height (ft msl)	Distance (m)	Height (ft msl)
23(1)	145	1400	150	12000	175
49(2)	145	1600	155	14000	200
53(2)	145	1800	155	16000	194
54(3)	145	2000	150	18000	217
69(4)	145	2250	150	20000	220
73(5)	145	2500	155		
100	145	2750	155		
200	145	3000	160		
300	150	3500	160		
400	150	4000	160		
500	150	4500	165		
600	160	5000	160		
700	155	6000	167		
800	155	7000	173		
900	150	8000	177		
1000	150	9000	176		
1200	150	10000	175		

(1) Distance measured from the main facility stack.
(2) Distance measured from the hydrated lime bin.
(3) Distance measured from the ash storage bin.
(4) Distance measured from the powdered lime bin.
(5) Distance measured from the ammonia storage tank.

3.5 Comparison with AALs

Table 3-3 lists the cavity concentrations attributable to the hydrated lime storage tank. None of these concentrations exceed the applicable AAL's.

The one-hour maximum concentrations predicted by SCREEN for simple terrain for all sources at the facility were scaled, summed, and compared to the appropriate AAL for each pollutant and averaging period. All concentrations for Chromium VI are based on the assumption that only ten percent of the total chromium emitted from each source is emitted as Chromium VI. Chromium VI is not a stable compound at normal atmospheric temperature and pressure and readily converts to Chromium III in the environment. An EPA-sponsored stack test at the Baltimore RESCO resource recovery facility (RRF) did not detect hexavalent chromium at the inlet to the control train and hexavalent chromium has not been detected at other RRFs. The detection limit for Chromium VI typically ranges from 1 to 20 percent of measured total chromium. For the purposes of this study, 10 percent of total chromium was assumed to be emitted as Chromium VI. This percentage has previously been accepted by regulatory agencies, including the State of New Jersey.

The 15-minute and 24-hour results, shown in Tables 3-4 and 3-5, show that all predicted concentrations were less than the AALs. No 15-minute impacts exceeded 90 percent of the appropriate AALs, thus there was no need to remodel these pollutants using refined techniques. The annual concentration of 1.83×10^{-7} mg/m^3 for Chromium VI shown in Table 3-6, exceeds the AAL of 8.3×10^{-8} mg/m^3, thus chromium was remodeled using refined techniques, as discussed in the following section.

TABLE 3-3

Cavity Concentrations - Hydrated Lime Storage Tank

Pollutant	Cavity Concentration (mg/m^3)	AAL (mg/m^3)	Does Cavity Concentration Exceed AAL? (Y/N)
Arsenic	7.41×10^{-10}	2.3×10^{-7}	No
Cadmium	2.60×10^{-11}	5.5×10^{-6}	No
Chromium VI	8.13×10^{-10} (1)	8.3×10^{-8}	No
Nickel	1.57×10^{-7} (2)	6.0×10^{-3} (2)	No
Lead	7.00×10^{-8} (2)	1.5×10^{-3} (2)	No

(1) Assumes 10% of total chromium is emitted as Chromium VI.
(2) Twenty-four hour concentration, all others are annual concentrations.

TABLE 3-4

Facility Maximum 15-Minute Concentrations
Using EPA SCREEN

Pollutant	Facility Maximum 15-Minute Concentration (mg/m^3)$^{(1)}$	15-Minute AAL (mg/m^3)	Does Facility Exceed AAL? (Yes/No)
Ammonia	0.02	2.70	No
Formaldehyde	1.13×10^{-4}	0.15	No
Hydrogen chloride	4.17×10^{-3}	0.70	No
Hydrogen fluoride	2.21×10^{-4}	0.25	No

(1) One-hour emission rates used as a conservative estimate of the 15-minute emission rate.

TABLE 3-5

Facility Maximum 24-Hour Concentrations
Using EPA SCREEN

Pollutant	Facility Maximum 24-hour Concentration (mg/m^3)	24-hour AAL (mg/m^3)	Does Facility Exceed AAL? (Yes/No)
Hydrogen fluoride	8.84×10^{-5}	0.03	No
Mercury (aryl & inorganic)	1.38×10^{-5}	6.0×10^{-4}	No
Mercury vapor	2.42×10^{-6}	6.0×10^{-4}	No
Nickel metal	1.20×10^{-5}	6.0×10^{-3}	No
Lead	3.66×10^{-5}	1.5×10^{-3} (1)	No

(1) Value represents the 3-month National Ambient Air Quality Standard (NAAQS) for lead.

TABLE 3-6

Facility Maximum Annual Concentrations
Using EPA SCREEN

Pollutant	Facility Maximum Annual Concentration (mg/m^3)	Annual AAL (mg/m^3)	Does Facility Exceed AAL? (Yes/No)
Arsenic	8.62×10^{-8}	2.3×10^{-7}	No
Benzene	3.95×10^{-8}	1.2×10^{-4}	No
Beryllium	2.06×10^{-8}	4.1×10^{-6}	No
Cadmium	3.54×10^{-8}	5.5×10^{-6}	No
Chromium VI	1.83×10^{-7} (1)	8.3×10^{-8}	Yes
Vinyl chloride	7.90×10^{-8}	3.8×10^{-4}	No

(1) Assumes 10% of total chromium is emitted as Chromium VI.

4.0 REFINED MODELING ANALYSIS

4.1 Modeling Techniques

Based on the screening model results presented in Section 3.0, refined modeling was required for chromium in order to more realistically estimate ground level concentrations of these pollutants attributable to the proposed facility. No terrain features within a 20 kilometer radius of the facility are greater than the proposed stack height of 150 feet, therefore complex terrain modeling was not required. The long term version of the EPA Industrial Source Complex (ISCLT) model was used since Chromium VI has only an annual AAL.

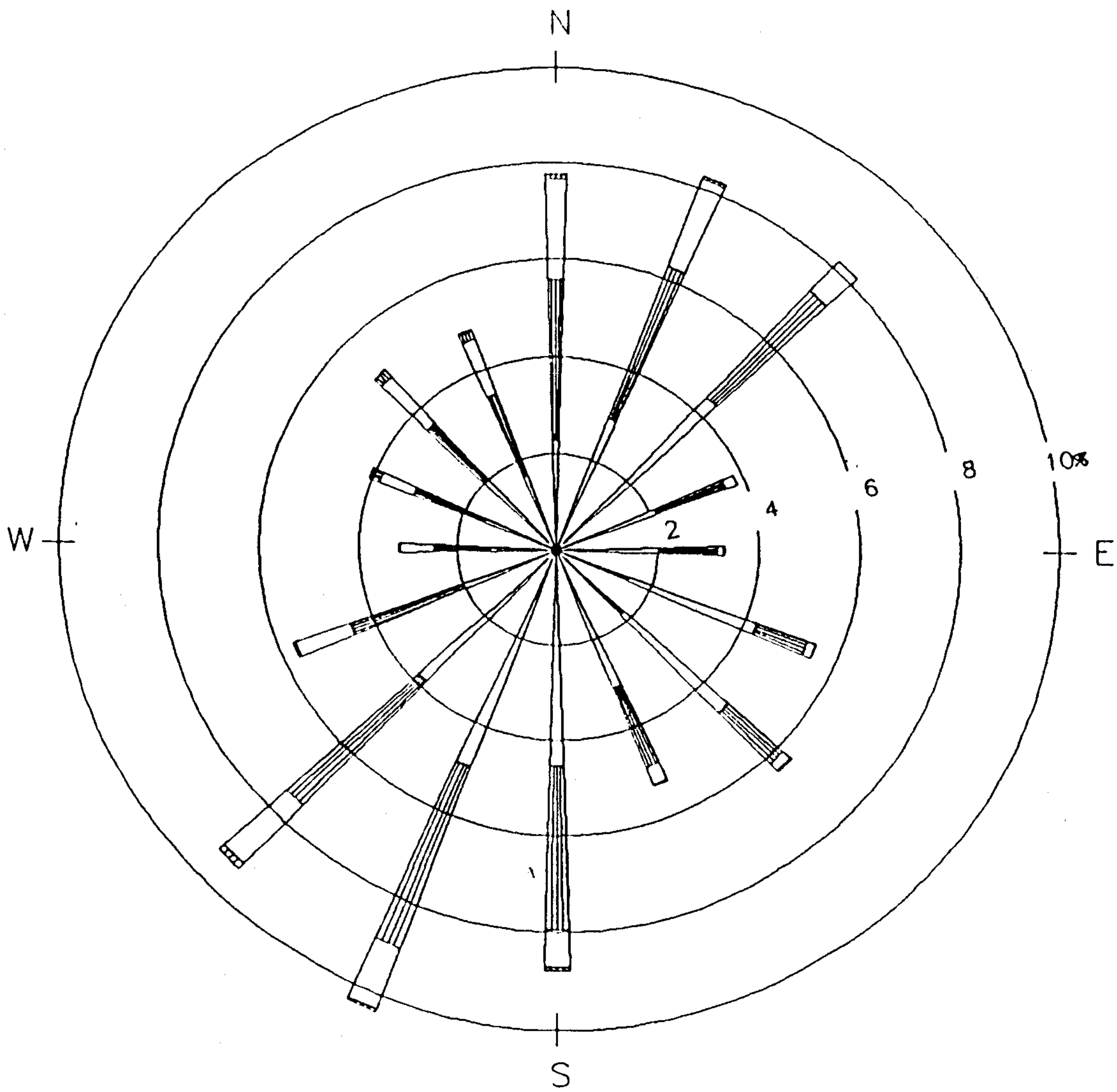
4.1.1 Model Inputs

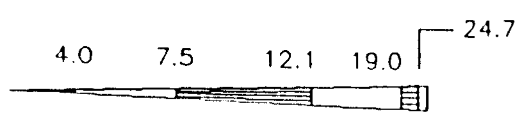
4.1.1.1 Meteorological Data

The meteorological data used in the refined analysis consisted of annual STAR summary for Raleigh-Durham, NC for the year 1989. Figure 4-1 depicts the annual windrose created using this data set. Since the maximum concentration of Chromium VI resulting from this modeling were less than 70 percent of the appropriate AAL, no further meteorological data was required.

4.1.1.2 Receptor Grid Arrays

The position of the first ring of the polar receptor grid was determined by running EPA SCREEN for each stack for each combination of atmospheric stability and windspeed. The smallest distance to the highest concentration for all combinations was 53 meters. This distance was used as the position of the first ring, with eight more distances calculated using the scale factors presented in Section 4.2.1.2.1 of NCDEM, 1990. This calculation resulted in rings being placed at distances of 69, 95, 122, 159, 207, 223, 360, and 477 meters. To insure that the location of the maximum annual concentration was included, additional rings were added at distances of 600, 800, 1000, 1500, 2000, 3000, 4000, and 5000 meters. Thirty-six receptors were placed at 10° intervals around each ring and receptors were placed along each 10° interval of the property line. The locations of four churches within approximately five kilometers of the proposed facility were identified and receptors placed there. Receptors from the rings which lay inside the property boundary were excluded from the analysis. Each receptor was assigned the maximum terrain elevation in the vicinity of the receptor, i.e., the area bounded by one-half the distance between adjacent rings. Table 4-1 lists the receptor locations and elevations used in the analysis.





WIND SPEED CLASS BOUNDARIES
(MILES/HOUR)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING.
EXAMPLE – WIND IS BLOWING FROM THE NORTH 7.8 PERCENT OF THE TIME.

WINDROSE

Raleigh–Durham, NC
PERIOD: 1989

Figure 4-1

Windrose for Raleigh-Durham, NC (1989)

TABLE 4-1

Receptors Used in the Refined Modeling Analysis

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
122	22	145	159	22	145	207	22	145	223	22	145
360	22	150	477	22	150	600	22	150	800	22	145
1000	22	140	1500	22	120	2000	22	140	3000	22	110
4000	22	80	5000	22	80	159	45	145	207	45	145
223	45	145	360	45	145	477	45	150	600	45	145
800	45	145	1000	45	140	1500	45	70	2000	45	75
3000	45	80	4000	45	85	5000	45	75	223	67	145
360	67	145	477	67	145	600	67	145	800	67	145
1000	67	110	1500	67	60	2000	67	75	3000	67	80
4000	67	90	5000	67	90	207	90	145	223	90	150
360	90	150	477	90	150	600	90	160	800	90	160
1000	90	135	1500	90	55	2000	90	80	3000	90	80
4000	90	85	5000	90	95	95	112	145	122	112	145
159	112	145	207	112	145	223	112	150	360	112	150
477	112	150	600	112	150	800	112	150	1000	112	140
1500	112	75	2000	112	75	3000	112	80	4000	112	85
5000	112	90	69	135	145	95	135	145	122	135	145
159	135	145	207	135	145	223	135	145	360	135	150
477	135	155	600	135	150	800	135	150	1000	135	150
1500	135	140	2000	135	85	3000	135	75	4000	135	80
5000	135	85	69	157	145	95	157	145	122	157	145
159	157	145	207	157	150	223	157	150	360	157	150
477	157	155	600	157	160	800	157	150	1000	157	150
1500	157	145	2000	157	145	3000	157	150	4000	157	135
5000	157	140	69	180	145	95	180	145	122	180	145
159	180	145	207	180	150	223	180	150	360	180	150
477	180	150	600	180	150	800	180	150	1000	180	150
1500	180	146	2000	180	155	3000	180	155	4000	180	145
5000	180	145	53	202	145	69	202	145	95	202	145
122	202	145	159	202	145	207	202	145	223	202	145
360	202	145	477	202	150	600	202	150	800	202	150
1000	202	150	1500	202	145	2000	202	145	3000	202	145
4000	202	145	5000	202	155	53	202	145	69	225	145
95	225	145	122	225	145	159	225	145	207	225	145
223	225	145	360	225	145	477	225	150	600	225	150
800	225	150	1000	225	150	1500	225	155	2000	225	155
3000	225	150	4000	225	150	5000	225	155	53	247	145
69	247	145	95	247	145	122	247	145	159	247	145
207	247	145	223	247	145	360	247	150	477	247	150
600	247	150	800	247	150	1000	247	150	1500	247	155
2000	247	145	3000	247	160	4000	247	155	5000	247	155
53	270	145	69	270	145	95	270	145	122	270	145

TABLE 4-1

Receptors Used in the Refined Modeling Analysis (continued)

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
159	270	145	207	270	145	223	270	145	360	270	150
477	270	150	600	270	150	800	270	150	1000	270	150
1500	270	158	2000	270	150	3000	270	165	4000	270	157
5000	270	160	53	292	145	69	292	145	95	292	145
122	292	145	159	292	145	207	292	145	223	292	145
360	292	150	477	292	150	600	292	150	800	292	145
1000	292	145	1500	292	150	2000	292	150	3000	292	156
4000	292	160	5000	292	160	53	315	145	69	315	145
95	315	145	122	315	145	159	315	145	207	315	145
223	315	145	360	315	150	477	315	150	600	315	150
800	315	145	1000	315	145	1500	315	130	2000	315	140
3000	315	150	4000	315	155	5000	315	170	53	337	145
69	337	145	95	337	145	122	337	145	159	337	145
207	337	145	223	337	145	360	337	150	477	337	150
600	337	150	800	337	145	1000	337	125	1500	337	135
2000	337	140	3000	337	155	4000	337	165	5000	337	165
122	360	145	159	360	145	207	360	145	223	360	145
360	360	150	477	360	145	600	360	145	800	360	145
1000	360	135	1500	360	145	2000	360	140	3000	360	150
4000	360	165	5000	360	160	2400	337	130(1)	3600	270	165(1)
3700	247	165(1)	5000	45	75(1)						

(1) Sensitive receptors located at nearby churches.

4.1.1.3 Model Options

The model options used with ISCLT are shown in Table 4-2. Per a discussion with Jim Roller of NCDEM on April 30, 1992, version 3.4 of ISCLT (dated 891127), would be acceptable for use in the refined model analyses (NCDEM 1992b).

4.2 Comparison with AALs

The facility maximum predicted annual concentration of Chromium VI is shown in Table 4-3. Because this predicted concentration was less than 70 percent of the applicable AAL, no further modeling was performed.

TABLE 4-2

ISCLT Model Options

Model Options
Rural, Pasquill-Gifford Dispersion Coefficients
Final Plume Rise
Default Wind Speed Profile Exponents
Default Vertical Potential Temperature Lapse Rates
Anemometer Height of 6.1 meters (Raleigh-Durham)
Calm Wind Adjustment
Terrain Cutoff
No Pollutant Decay

TABLE 4-3

Facility Maximum Annual Concentrations Using ISCLT

Pollutant	Facility Maximum Concentration (mg/m^3)/Location (m, °)	Annual AAL (mg/m^3)	Facility Concentration as a Percent of the AAL	Does Facility Exceed AALC?
Chromium VI	3.0×10^{-8}(1)/(2000 m, 180°)	8.3×10^{-8}	36	No

(1) Assumes ten percent of all chromium is emitted as Chromium VI.

5.0 CONCLUSIONS

This report presents the results of a dispersion model analysis of Toxic Air Pollutant emissions from the Fayetteville RDF-to-Energy Facility. The analyses were performed in accordance with North Carolina Department of Environmental Management (NCDEM) procedures and a modeling protocol approved by NCDEM. The results of the analyses show that the facility maximum predicted impacts of the all Toxic Air Pollutants which the facility emits above state-specified threshold limits, are below the Acceptable Ambient Levels (AAL) as defined by NCDEM.

6.0 REFERENCES

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USEPA 1985. Guideline for the Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) - Revised. EPA-450/4-80-023R, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

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APPENDIX A

NORTH CAROLINA TOXIC AIR POLLUTANT ANALYSIS FORMS

NC FORM 1 - GEP Analysis Results

Facility Name: Fayetteville RDF-to-Energy
Date: July 10, 1992

Structure	Height (m)	Width (m)	Length (m)	GEP (m)	Region of Influence (5L)[2] (m)	Sources Within 5L[1]
Incinerator Structure #1	17.06	9.14	38.10	42.67	85.34	MS
Incinerator Structure #2	17.06	9.14	38.10	42.67	85.34	All Sources
Powdered Lime Storage Bin	13.72	1.92	1.92	17.80	13.56	PL
Hydrated Lime Storage Bin	13.72	1.92	1.92	17.80	13.56	No Sources
Ammonia Tank	2.74	2.74	6.86	6.86	13.72	AT
Ash Storage Bin	15.24	6.10	6.10	28.19	43.13	AS

(1) Stack ID: MS = Main Stack
PL = Powdered Lime Storage Bin Vent
HL = Hydrated Lime Storage Bin Vent
AT = Ammonia Tank Vent
AS = Ash Storage Bin Vent

(2) Where L is the lesser of height or maximum projected width.

NC Form 2 Toxic Air .ant Emission Rates
All Analyses (page 1 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID(1)	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Ammonia	5	MS	1.20	0.17	4.78	---	—	—	41,880	—
Arsenic and compounds	9	MS	—	—	1.25×10^{-3}	---	—	—	11.0	0.016
Benzene	12	MS	---	---	2.35×10^{-3}	---	—	—	20.6	8.1
Benzo(a)pyrene(2)	14	MS	---	---	4.64×10^{-7}	---	—	—	4.06×10^{-3}	2.2
Beryllium	16	MS	---	---	1.17×10^{-3}	---	—	—	10.2	0.28
Cadmium	23	MS	—	---	1.97×10^{-4}	---	—	—	1.7	0.37
Carbon disulfide(2)	27	MS	—	---	4.72×10^{-3}	---	0.11	3.9	41.4	—
Carbon tetrachloride(2)	28	MS	—	---	2.35×10^{-3}	---	—	—	20.6	460
Chlorobenzene(2)	30	MS	—	---	2.35×10^{-3}	—	0.06	46	20.6	—
Chloroform(2)	31	MS	—	—	2.35×10^{-3}	---	—	—	20.6	290
Chromium (total)	32	MS	—	---	9.02×10^{-2}	---	—	—	790.2	5.6×10^{-3}
Ethylene dichloride(2)	46	MS	—	—	2.35×10^{-3}	---	—	—	20.6	260
Formaldehyde	51	MS	0.064	0.010	2.56×10^{-1}	---	—	—	2,240	–
HCDD(2)	53	MS	—	--	2.72×10^{-7}	---	—	—	2.38×10^{-3}	5.1×10^{-3}
Hydrogen chloride	57	MS	2.37	4.5×10^{-2}	9.46	---	—	—	82860	—
Hydrogen fluoride	59	MS	—	---	0.50	---	12.00	0.63	4380	1.6×10^{-2}
Lead	--	MS	---	---	2.07×10^{-1}	---	---	—	1820	---
Manganese(2)	63	MS	---	---	8.15×10^{-3}	---	0.20	0.63	71.4	---
Mercury (aryl and inorganic)	67	MS	---	---	6.85×10^{-2}	---	1.64	1.3×10^{-2}	600	---
Mercury vapor	68	MS	---	---	1.37×10^{-2}	---	0.33	1.3×10^{-2}	120	---
Methyl chloroform(2)	69	MS	5.88×10^{-4}	16	2.35×10^{-3}	---	0.06	250	20.6	---

NC Form 2 Toxic Air P[illegible]ant Emission Rates

All Analyses (page 2 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID(1)	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Methylene chloride(2)	70	MS	---	---	2.35×10^{-3}	---	---	---	20.6	1600
Methyl ethyl ketone(2)	71	MS	1.18×10^{-3}	5.6	4.72×10^{-3}	---	0.11	78	41.4	---
Methyl isobutyl ketone(2)	72	MS	1.18×10^{-3}	1.9	4.72×10^{-3}	---	0.11	52	41.4	---
Nickel metal	75	MS	---	---	6.47×10^{-2}	---	1.13	0.13	566	---
Perchloroethylene(2)	82	MS	---	---	2.35×10^{-3}	---	---	---	20.6	13000
Polychlorinated biphynels(2)	86	MS	---	---	4.53×10^{-5}	---	---	---	0.4	5.6
Styrene(2)	92	MS	5.88×10^{-4}	2.7	2.35×10^{-3}	---	0.06	27	20.6	---
TCDD(2)	94	MS	---	---	4.72×10^{-6}	---	---	---	0.04	2.0×10^{-4}
Toluene(2)	98	MS	5.88×10^{-4}	3.6	2.35×10^{-3}	---	0.06	98	20.6	---
Trichlorofluoromethane(2)	101	MS	---	---	3.39×10^{-3}	140	---	---	29.6	---
1,1,2-Trichloro-1,2,2-trifluoroethane(2)	102	MS	1.26×10^{-3}	60	5.02×10^{-3}	---	---	---	44.0	---
Vinyl chloride	103	MS	---	---	4.72×10^{-3}	---	---	---	41.4	26
Vinylidene chloride(2)	104	MS	---	---	2.35×10^{-3}	---	0.06	2.5	20.6	---
Xylenes(2)	105	MS	5.88×10^{-4}	4.1	2.35×10^{-3}	---	0.06	57	20.6	---
Arsenic	9	PL	---	---	1.10×10^{-7}	---	---	---	4.8×10^{-7}	0.016
Cadmium	23	PL	---	---	3.90×10^{-9}	---	---	---	1.7×10^{-8}	0.37
Chromium (total)	32	PL	---	---	1.23×10^{-6}	---	---	---	5.4×10^{-6}	5.6×10^{-3}
Lead	--	PL	---	---	1.00×10^{-6}	---	---	---	4.4×10^{-6}	---
Manganese(2)	63	PL	---	---	1.23×10^{-4}	---	2.95×10^{-3}	0.63	5.4×10^{-4}	---

NC Form 2 Toxic Air P[illegible]ant Emission Rates
All Analyses (page 3 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID	Emission Rates: pounds/15 min. (a)	pounds/15 min. (b)	pounds/hour (a)	pounds/hour (b)	pounds/24 hour (a)	pounds/24 hour (b)	pounds/year (a)	pounds/year (b)
Mercury (aryl and inorganic)	67	PL	---	---	4.46×10^{-9}	---	1.07×10^{-7}	1.3×10^{-2}	3.91×10^{-5}	---
Nickel	75	PL	---	---	2.23×10^{-6}	---	5.35×10^{-5}	0.13	9.8×10^{-6}	---
Arsenic	9	HL	---	---	1.51×10^{-7}	---	---	---	6.6×10^{-7}	0.016
Cadmium	23	HL	---	---	5.30×10^{-9}	---	---	---	2.3×10^{-8}	0.37
Chromium (total)	32	HL	---	---	1.66×10^{-6}	---	---	---	7.3×10^{-6}	5.6×10^{-3}
Lead	--	HL	---	---	1.36×10^{-6}	---	---	---	6.0×10^{-6}	---
Manganese(2)	63	HL	---	---	1.66×10^{-4}	---	3.98×10^{-3}	0.63	7.3×10^{-4}	---
Nickel	75	HL	---	---	3.03×10^{-6}	---	7.27×10^{-5}	1.3×10^{-2}	1.3×10^{-4}	---
Ammonia	5	AT	0.02	0.17	8.31×10^{-2}	---	---	---	0.4	---
Arsenic	9	AS	---	---	2.24×10^{-5}	---	---	---	9.8×10^{-5}	0.016
Beryllium	16	AS	---	---	3.36×10^{-7}	---	---	---	1.5×10^{-6}	0.28
Cadmium	23	AS	---	---	1.12×10^{-5}	---	---	---	4.9×10^{-5}	0.37
Chromium (total)	32	AS	---	---	1.25×10^{-4}	---	---	---	5.5×10^{-4}	5.6×10^{-3}
Nickel	75	AS	---	---	1.37×10^{-6}	---	3.29×10^{-5}	1.3×10^{-2}	6.0×10^{-6}	---

a Emitted from this source.
b State threshold limit.
(1) Stack ID: MS = Main Stack
PL = Powdered Lime Storage Bin Vent
HL = Hydrated Lime Storage Bin Vent
AT = Ammonia Tank Vent
AS = Ash Storage Bin Vent
(2) Sources which had emission rates of this TAP which combine with other sources to form a facility-wide emission rate which is less than the appliicable threshold limit. These sources and TAPs were not included in the dispersion modeling analysis.

NC Form 3. Toxic Air Pollutant Emissions Parameters
All Analyses

Facility Name: Fayetteville RDF-to-Energy
Date: July 9, 1992

Stack I.D.(1)		MS	PL	HL	AT	AS
Stack height (meters)[a]		45.72	15.8	15.8	3.05	17.40
Stack diameter (meters)		2.29	0.61	0.61	0.50	0.61
Stack temperature (Kelvin)		421.90	294.30	294.30	294.30	372.00
Stack exit velocity (m/s)		14.61	1.10	1.10	0.01	1.10
Building height (meters)		(2)	17.07	17.07	17.07	17.07
Building width (meters)		(2)	9.14	9.14	9.14	9.14
Building length (meters)		(2)	38.10	38.10	38.10	18.10
UTM Coordinates (kilometers)	Horizontal (E)	697.690	697.739	697.715	697.768	697.714
	Vertical (N)	3857.760	3857.805	3857.804	3857.804	3857.810
Stack base elev. above MSL[b] (ft)		145	145	145	145	145

Stack Number(1)	Source Description	Stack Direction[c]
MS	Main Stack	Vertical
PL	Powdered Lime Storage Bin	Vertical
HL	Hydrated Lime Storage Bin	Vertical
AT	Ammonia Storage Tank	Vertical
AB	Ash Storage Bin	Vertical

a Above ground level.
b MSL = mean sea level.
c Stack direction - Hor. = horizontal and Ver. = vertical

(1) Stack ID: MS = Main Stack
PL = Powdered Lime Storage Bin Vent
HL = Hydrated Lime Storage Bin Vent
AT = Ammonia Tank Vent
AS = Ash Storage Bin Vent
(2) Main stack is GEP.

NC Form 4. Toxic Air Pollutant Emissions Parameters
All Analyses

Facility Name: Fayetteville RDF-to-Energy
Date: 5/18/92

IDENTIFICATION OF ATMOSPHERIC DISPERSION MODEL USED
Model used for annual effects: EPA Screen (V88300)
Model used for quarterly effects: EPA Screen (V88300)
Model used for short term effects: EPA Screen (V88300) (15 min., 1 hr., 8 hr., 24 hr.)
Model used for refined analyses: ISCLT dated 90008.

IDENTIFICATION OF METEOROLOGICAL DATA SETS[a]
Surface Data Weather Station: Raleigh - Durham, North Carolina
Surface Data Weather Year(s): 1989
Upper Air Data Weather Station: Greensboro, North Carolina
Upper Air Weather Year(s): 1989

a Only needs to be completed for refined modeling analysis.

NC Form 5. Complex Terrain Modeling Variables

Facility Name: Fayetteville RDF-to-Energy
Date: July 10, 1992

Stack I.D.[1]	Final Plume Rise (Hf) (m)	Stack Base Height (Hb) (ft)	Critical Terrain Height (Zfc) (ft)	Distance to Zfc (m)
AT	3.5	145	156	700

(1) Stack ID: AT=Ammonia Storage Tank

NC Form S6. Toxic Air Pollutant Model Results
Screening Analysis (Page 1 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: July 10, 1992

Maximum Modeled Concentration

Pollutant	Stack ID[1]	Averaging Period	Simple Terrain (mg/m^3)	Cavity[2] (mg/m^3)	Complex Terrain[3] (mg/m^3)		AAL (mg/m^3)	Shows Compliance (Y/N)
					Complex	Simple		
Ammonia[4]	MS	15-minute	2.11×10^{-3}	--	--	--	--	--
	AT	15-minute	0.02	--	--	--	--	--
Ammonia Total	Total	15-minute	0.02	--	4.37×10^{-4}	--	2.7	Y
Arsenic and compounds	MS	Annual	2.10×10^{-8}	--	--	--	--	--
	PL	Annual	4.03×10^{-10}	--	--	--	--	--
	HL	Annual	5.55×10^{-10}	7.41×10^{-10}	--	--	--	--
	AS	Annual	6.42×10^{-8}	--	--	--	--	--
Arsenic Total	Total	Annual	8.62×10^{-8}	7.41×10^{-10}	--	--	2.3×10^{-7}	Y
Benzene	MS	Annual	3.95×10^{-8}	--	--	--	--	--
Benzene Total	Total	Annual	3.95×10^{-8}	--	--	--	1.2×10^{-4}	Y
Beryllium	MS	Annual	1.96×10^{-8}	--	--	--	--	--
	AS	Annual	9.65×10^{-10}	--	--	--	--	--
Beryllium Total	Total	Annual	2.06×10^{-8}	--	--	--	4.1×10^{-6}	Y
Cadmium	MS	Annual	3.29×10^{-9}	--	--	--	--	--
	PL	Annual	1.41×10^{-11}	--	--	--	--	--
	HL	Annual	1.95×10^{-11}	2.60×10^{-11}	--	--	--	--
	AS	Annual	3.21×10^{-8}	--	--	--	--	--
Cadmium Total	Total	Annual	3.54×10^{-8}	2.60×10^{-11}	--	--	5.5×10^{-6}	Y

NC Form S6. Toxic Air Pollutant Model Results
Screening Analysis (Page 2 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: July 10, 1992

Maximum Modeled Concentration

Pollutant	Stack ID[1]	Averaging Period	Simple Terrain (mg/m^3)	Cavity[2] (mg/m^3)	Complex Terrain[3] (mg/m^3)		AAL (mg/m^3)	Shows Compliance (Y/N)
					Complex	Simple		
Chromium VI[5]	MS	Annual	1.46×10^{-7}	--	--	--	--	--
	PL	Annual	4.45×10^{-10}	--	--	--	--	--
	HL	Annual	6.12×10^{-10}	8.13×10^{-10}	--	--	--	--
	AS	Annual	3.60×10^{-8}	--	--	--	--	--
Chromium VI Total	Total	Annual	1.83×10^{-7}	8.13×10^{-10}	--	--	8.3×10^{-8}	N
Formaldehyde[4]	MS	15-minute	1.13×10^{-4}	--	--	--	--	--
Formaldehyde Total	Total	15-minute	1.13×10^{-4}	--	--	--	0.15	Y
Hydrogen Chloride[4]	MS	15-minute	4.17×10^{-3}	--	--	--	--	--
Hydrogen Chloride Total	Total	15-minute	4.17×10^{-3}	--	--	--	0.70	Y
Hydrogen Fluoride[4]	MS	15-minute	2.21×10^{-4}	--	--	--	--	--
Hydrogen Fluoride Total	Total	15-minute	2.21×10^{-4}	--	--	--	0.25	Y
Hydrogen Fluoride[4]	MS	24-hour	8.84×10^{-5}					
Hydrogen Fluoride Total	Total	24-hour	8.84×10^{-5}	--	--	--	0.03	Y
Lead	MS	24-hour	3.65×10^{-5}	--	--	--	--	--
	PL	24-hour	3.80×10^{-8}	--	--	--	--	--
	HL	24-hour	5.28×10^{-8}	7.00×10^{-8}	--	--	--	--
Lead Total	Total	24-hour	3.66×10^{-5}	7.00×10^{-8}	--	--	1.5×10^{-3}[6]	Y

NC Form S6. Toxic Air Pollutant Model Results
Screening Analysis (Page 3 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: July 10, 1992

Maximum Modeled Concentration

Pollutant	Stack ID(1)	Averaging Period	Simple Terrain (mg/m^3)	Cavity(2) (mg/m^3)	Complex Terrain(3) (mg/m^3)		AAL (mg/m^3)	Shows Compliance (Y/N)
					Complex	Simple		
Mercury (aryl and inorganic)	MS	24-hour	1.21×10^{-5}	--	--	--	--	--
	PL	24-hour	1.70×10^{-6}	--	--	--	--	--
Mercury Total	Total	24-hour	1.38×10^{-5}	--	--	--	6.0×10^{-4}	Y
Mercury Vapor	MS	24-hour	2.42×10^{-6}	--	--	--	--	--
Mercury Vapor Total	Total	24-hour	2.42×10^{-6}	--	--	--	6.0×10^{-4}	Y
Nickel Metal	MS	24-hour	1.14×10^{-5}	--	--	--	--	--
	PL	24-hour	8.48×10^{-8}	--	--	--	--	--
	HL	24-hour	1.18×10^{-7}	1.57×10^{-7}	--	--	--	--
	AS	24-hour	4.16×10^{-7}	--	--	--	--	--
Nickel Metal Total	Total	24-hour	1.20×10^{-5}	1.57×10^{-7}	--	--	6.0×10^{-3}	Y
Vinyl Chloride	MS	Annual	7.90×10^{-8}	--	--	--	--	--
Vinyl Chloride Total	Total	Annual	7.90×10^{-8}	--	--	--	3.8×10^{-4}	Y

(1) Stack ID: MS=Main Stack; PL=Powdered Lime Storage Bin Vent; HL=Hydrated Lime Storage Bin Vent; AT=Ammonia Storage Tank; AS=Ash Storage Bin Vent.
(2) Only the cavity attributable to the Hydrated Lime Storage Bin extended off the property, thus only the concentrations caused by this source were reported.
(3) Complex terrain screening applicable to Ammonia Storage Tank only.
(4) One-hour emission rate used to calculate a 15-minute average.
(5) Assumes 10% of total chromium is emitted as Chromium VI.
(6) Value represents the three-month National Ambient Air Quality Standard for lead.

TABLE NC Form R6

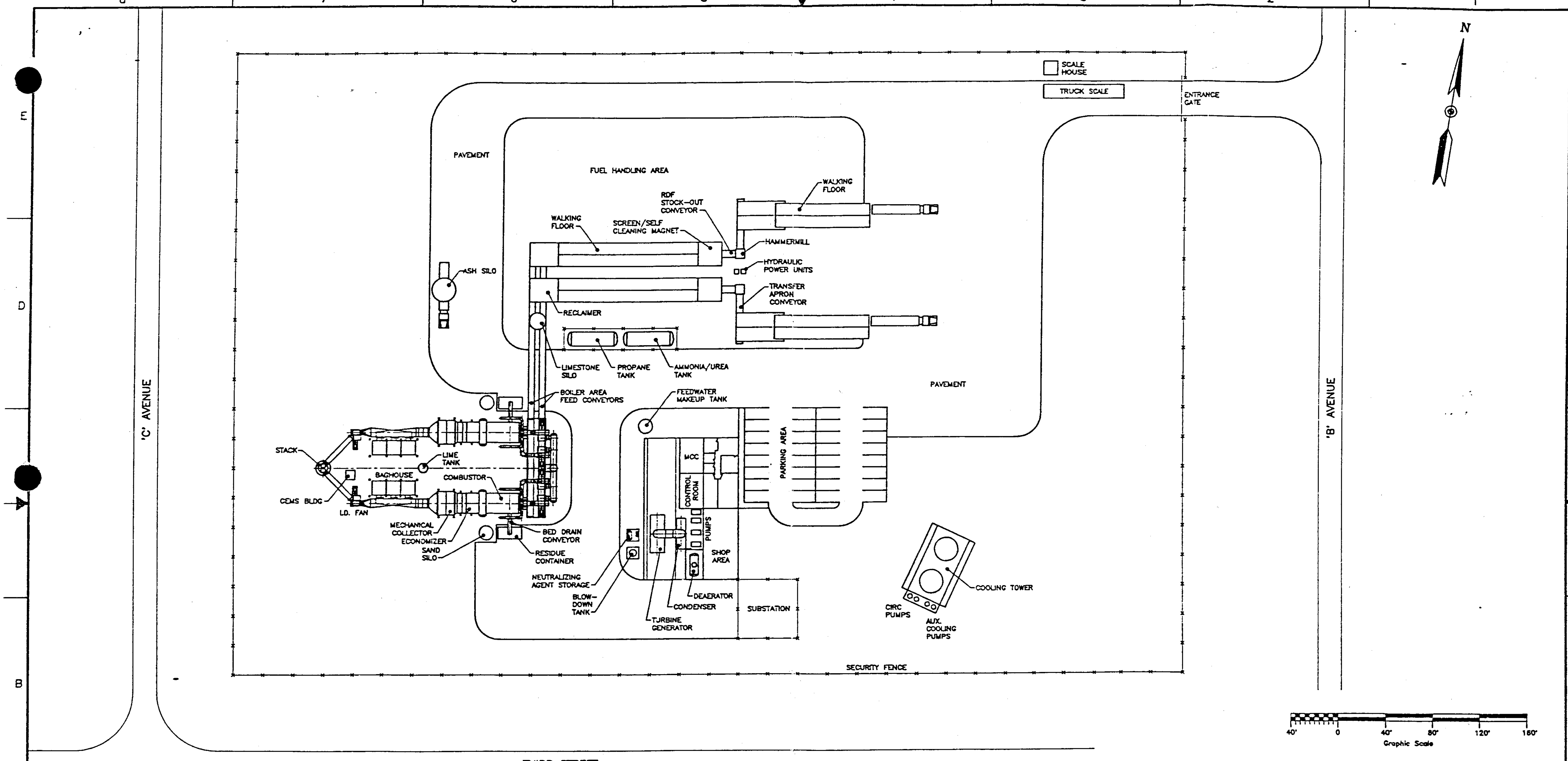
Toxic Air Polutant Model Results
Refined Analysis

Pollutant	Averaging Period	Maximum Modeled Concentration (mg/m^3) Year: 1989 Concentration	Location (m, °)	AAL (mg/m^3)
Chromium VI[1]	Annual	3.01×10^{-8}	(2000 m, 180°)	8.3×10^{-8}

(1) Assumes that ten percent of total chromium is emitted as chromium VI.

APPENDIX B

FACILITY PLOT PLAN



ZONE	REV	DESCRIPTION	DATE	DRAWN	CHKD	APPD
	B	REVISED FOR AIR PERMIT APPLICATION	6/16/92	JKM	JKM	[illegible]
	A	ISSUED FOR CLIENT COMMENTS	6/10/92	JKM	JKM	[illegible]

REVISIONS

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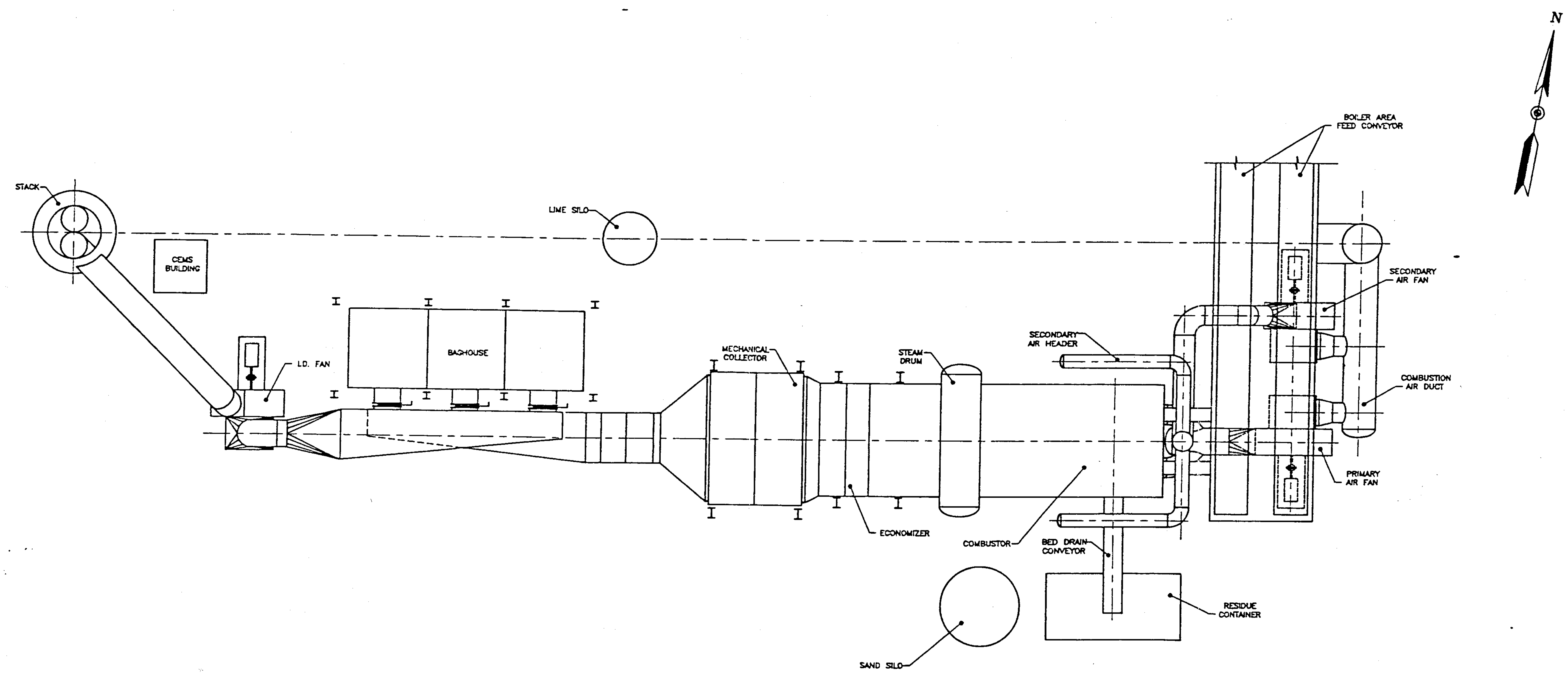
OUTOKUMPU ECOENERGY, INC.

BCH ENERGY CORPORATION
FAYETTEVILLE, NORTH CAROLINA

SITE PLAN

	BY	DATE
DRAWN	JKM	5/27/92
CHECKED	JKM	6/16/92
APPROVED	[illegible]	6/16/92
APPROVED		
SCALE	1" = 40'	

D | PROJECT NO. 12001C | REFERENCE DRAWING NO. | DRAWING NO. C-03-001 | SHEET 1 | REV. B



ZONE	REV	DESCRIPTION	DATE	DRAWN	CHKD	APPD
	B	REVISED FOR AIR PERMIT APPLICATION	6/16/92	JKM	JKM	RWM
	A	ISSUED FOR CLIENT COMMENTS	6/11/92	JKM	JKM	RWM

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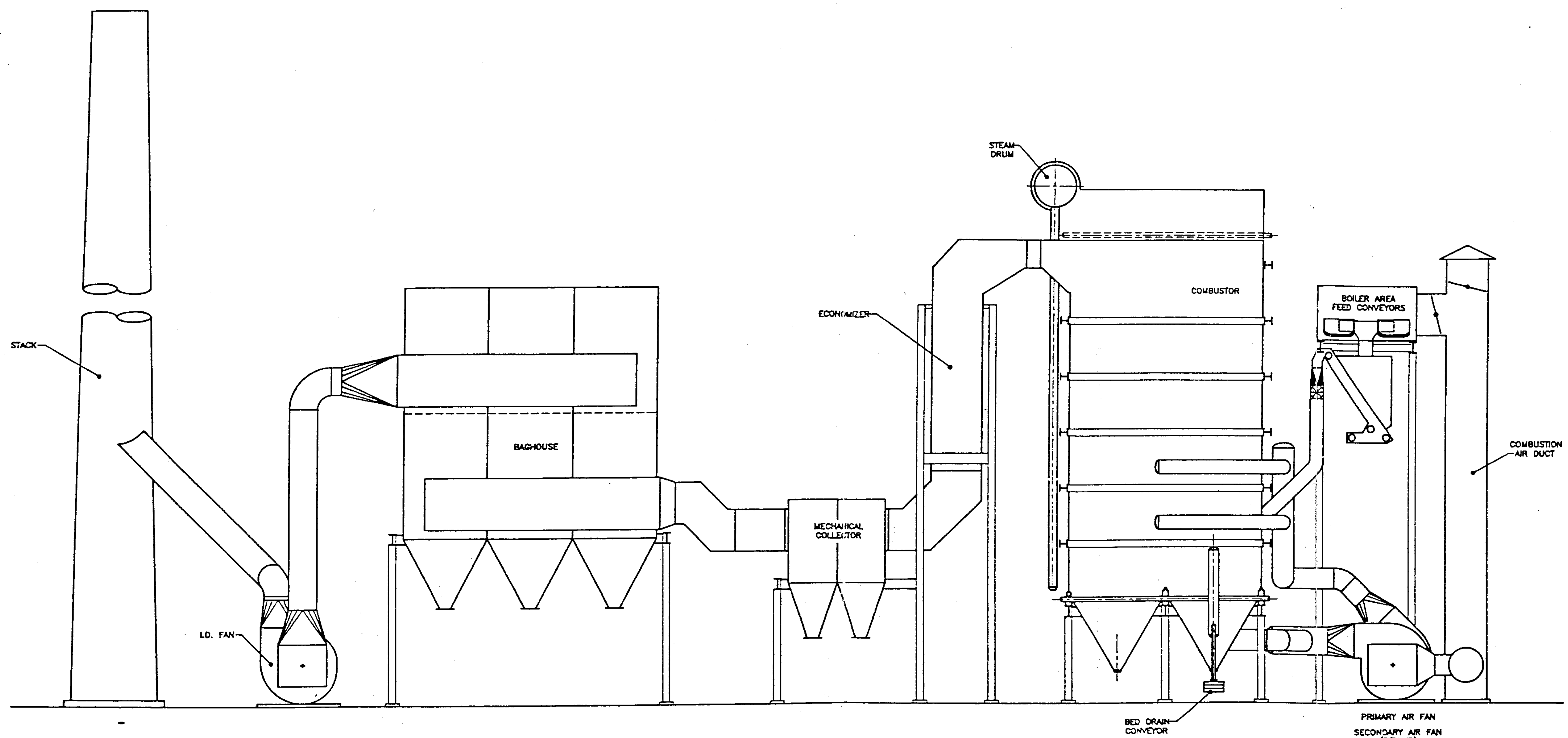
FAYETTEVILLE, NORTH CAROLINA

GENERAL ARRANGEMENT
COMBUSTION TRAIN – PLAN

	BY	DATE
DRAWN	JKM	6/3/92
CHECKED	JKM	6/16/92
APPROVED	RWM	6/16/92
APPROVED		

SCALE 1/8" = 1'-0"

D | PROJECT NO. 12001C | REFERENCE DRAWING NO. | DRAWING NO. M-11-001 | SHEET 1 | REV. B



ZONE	REV	DESCRIPTION	DATE	DRAWN	CHKD	APPD
	B	REVISED FOR AIR PERMIT APPLICATION	6/16/92	JKM	JKM	RWM
	A	ISSUED FOR CLIENT COMMENTS	6/11/92	JKM	JKM	RWM

REVISIONS

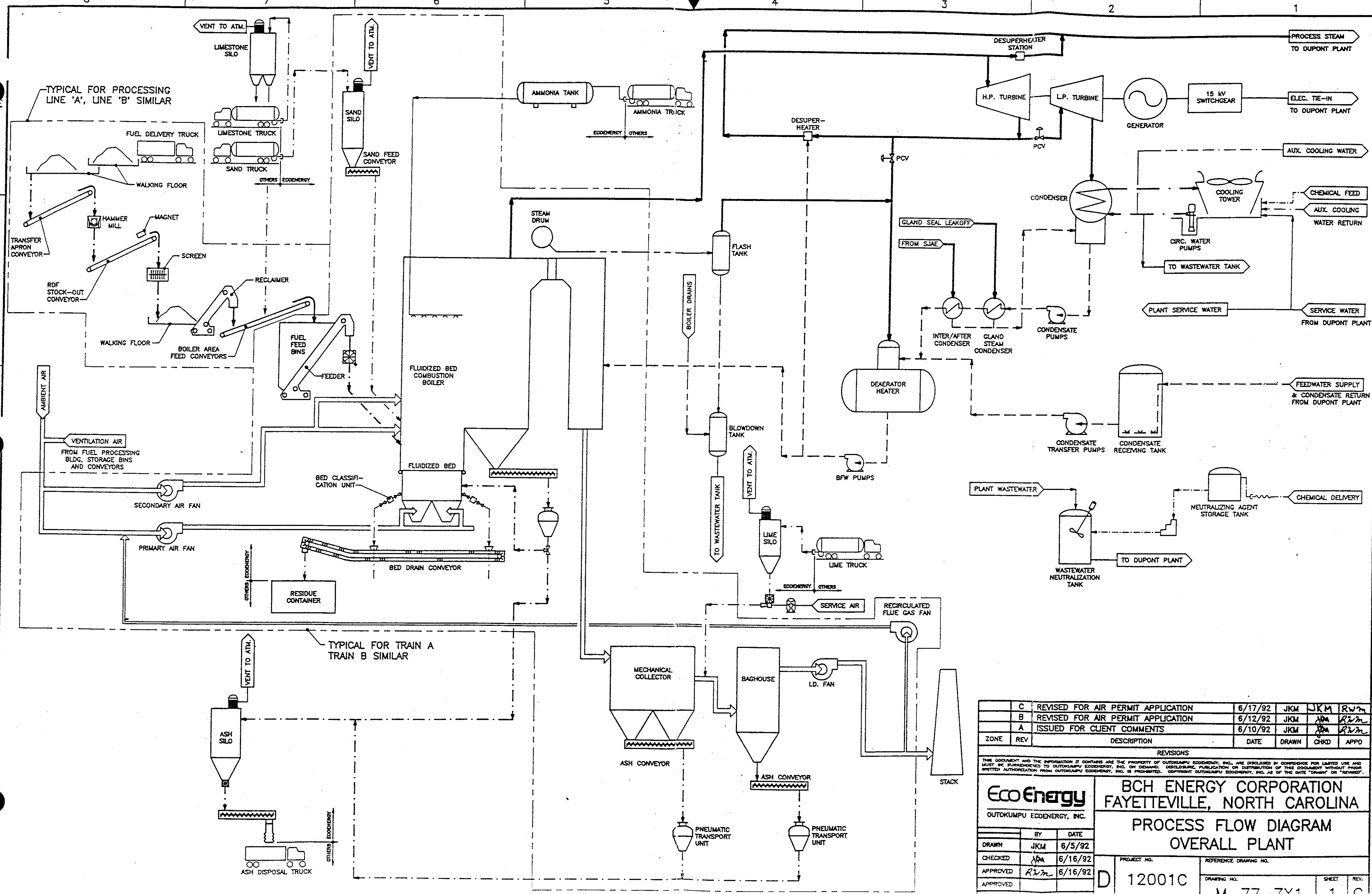
EcoEnergy
OUTOKUMPU ECOENERGY, INC.

BCH ENERGY CORPORATION
FAYETTEVILLE, NORTH CAROLINA

GENERAL ARRANGEMENT
COMBUSTION TRAIN – ELEVATION

	BY	DATE
DRAWN	JKM	6/3/92
CHECKED	JKM	6/16/92
APPROVED	RWM	6/16/92
APPROVED		
SCALE:	1/8" = 1'-0"	

D
PROJECT NO. 12001C
REFERENCE DRAWING NO.
DRAWING NO. M-12-001
SHEET 1
REV. B


TYPICAL FOR PROCESSING LINE 'A', LINE 'B' SIMILAR
VENT TO ATM.
LIMESTONE SILO
LIMESTONE TRUCK
SAND TRUCK
OTHERS
ECOENERGY
FUEL DELIVERY TRUCK
WALKING FLOOR
TRANSFER APRON CONVEYOR
HAMMER MILL
MAGNET
SCREEN
RDF STOCK-OUT CONVEYOR
RECLAIMER
WALKING FLOOR
BOILER AREA FEED CONVEYORS
SAND SILO
SAND FEED CONVEYOR
FUEL FEED BINS
FEEDER
AMMONIA TANK
AMMONIA TRUCK
STEAM DRUM
FLUIDIZED BED COMBUSTION BOILER
FLUIDIZED BED
BED CLASSIFICATION UNIT
BED DRAIN CONVEYOR
RESIDUE CONTAINER
AMBIENT AIR
VENTILATION AIR
FROM FUEL PROCESSING BLDG, STORAGE BINS AND CONVEYORS
SECONDARY AIR FAN
PRIMARY AIR FAN
TYPICAL FOR TRAIN A
TRAIN B SIMILAR
ASH SILO
ASH DISPOSAL TRUCK
DESUPERHEATER STATION
PROCESS STEAM
TO DUPONT PLANT
H.P. TURBINE
L.P. TURBINE
GENERATOR
15 kV SWITCHGEAR
ELEC. TIE-IN
TO DUPONT PLANT
DESUPER-HEATER
PCV
PCV
AUX. COOLING WATER
CONDENSER
COOLING TOWER
CHEMICAL FEED
AUX. COOLING
WATER RETURN
GLAND SEAL LEAKOFF
FROM SJAE
CIRC. WATER PUMPS
TO WASTEWATER TANK
PLANT SERVICE WATER
SERVICE WATER
FROM DUPONT PLANT
INTER/AFTER CONDENSER
GLAND STEAM CONDENSER
CONDENSATE PUMPS
FLASH TANK
BOILER DRAINS
DEAERATOR HEATER
FEEDWATER SUPPLY
& CONDENSATE RETURN FROM DUPONT PLANT
BLOWDOWN TANK
CONDENSATE TRANSFER PUMPS
CONDENSATE RECEIVING TANK
BFW PUMPS
TO WASTEWATER TANK
VENT TO ATM.
LIME SILO
LIME TRUCK
SERVICE AIR
PLANT WASTEWATER
NEUTRALIZING AGENT STORAGE TANK
CHEMICAL DELIVERY
WASTEWATER NEUTRALIZATION TANK
TO DUPONT PLANT
RECIRCULATED FLUE GAS FAN
MECHANICAL COLLECTOR
BAGHOUSE
I.D. FAN
ASH CONVEYOR
ASH CONVEYOR
STACK
PNEUMATIC TRANSPORT UNIT
PNEUMATIC TRANSPORT UNIT
C REVISED FOR AIR PERMIT APPLICATION 6/17/92 JKM
B REVISED FOR AIR PERMIT APPLICATION 6/12/92 JKM
A ISSUED FOR CLIENT COMMENTS 6/10/92 JKM
ZONE REV DESCRIPTION DATE DRAWN CHKD APPD
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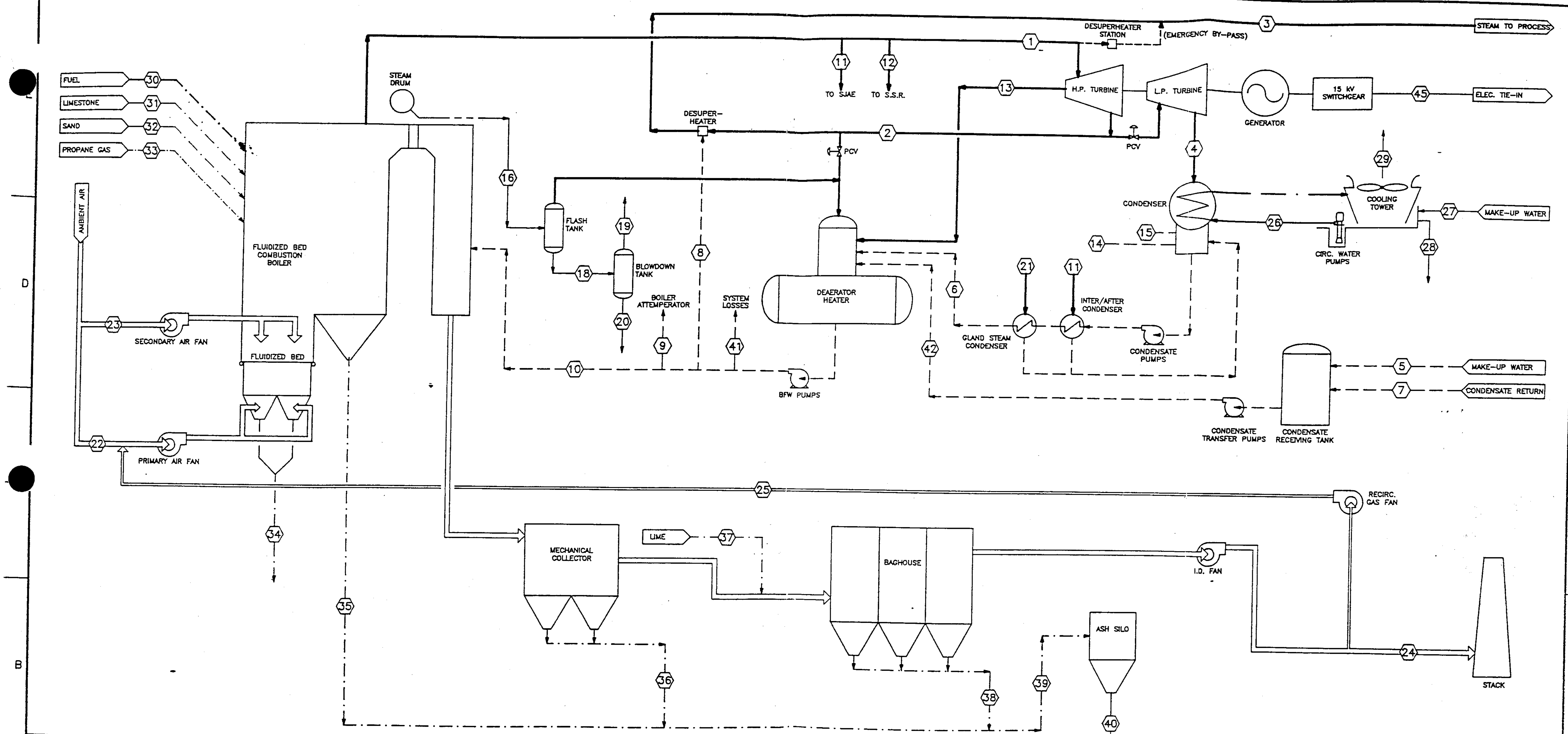
BCH ENERGY CORPORATION
FAYETTEVILLE, NORTH CAROLINA
PROCESS FLOW DIAGRAM
OVERALL PLANT
BY DATE
DRAWN JKM 6/5/92
CHECKED 6/16/92
APPROVED 6/16/92
APPROVED
SCALE: NONE
D
PROJECT NO. 12001C
REFERENCE DRAWING NO.
DRAWING NO. M-77-ZX1
SHEET 1
REV. C



DESIGN CONDITIONS

STREAM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DESCRIPTION	THROTTLE STEAM	EXTRACTION STEAM	PROCESS STEAM	CONDENSER STEAM	MAKE-UP WATER	CONDENSATE FLOW	CONDENSATE RETURN	PROCESS DESUPERHEATER	BOILER ATTEMPERATOR	FEEDWATER FLOW	STEAM TO SJAE	STEAM TO S.S.R.	H.P. STEAM LEAKAGE	DRAINS FROM L.P. SEALS	DRAINS FROM S.S.R.
FLOW RATE (LB/HR)	158,985	49,935	40,000	105,550	33,767	108,450	10,000	3,989	1,500	163,622	600	2,300	3,500	1,500	600
ENTHALPY (BTU/LB)	1377.0	1311.2	1202.6	1006.9	43.0	95.1	148.0	222.2	222.2	222.2	1377.0	1377.0	1347.5	1377.0	1377.0
PRESSURE (PSIG)	650	260	260	3.5" HgA	–	20	–	780	780	780	650	650	–	–	–
TEMPERATURE °F	750	–	–	–	75	127	106	252	252	252	750	750	–	–	–

STREAM NUMBER	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
DESCRIPTION	BLOWDOWN FLOW	FLASH STEAM TO DEAERATOR	DRAINS TO BLOWDOWN TANK	VENT STEAM	BLOWDOWN TO WASTE	L.P. STEAM TO G.S.C.	PRIMARY AIR FLOW	SECONDARY AIR FLOW	FLUE GAS FLOW	RECIRC. GAS FLOW	CIRC. WATER	C.T. MAKE-UP WATER	C.T. BLOWDOWN	C.T. DRIFT/ EVAP. LOSSES	FUEL FLOW
FLOW RATE (LB/HR)	3,238	970	2,267	100	2,167	200	109,000	148,650	287,430	(INTERMITTENT)	10,500 GPM	252 GPM	82 GPM	170 GPM	45,275
ENTHALPY (BTU/LB)	503.5	1164.7	221.0	1151.0	180.0	1377.0	–	–	–	–	–	–	–	–	–
PRESSURE (PSIG)	750	15	15	ATMOS	ATMOS	–	56" WG	12" WG	2" WG	10" WG	50	–	–	–	–
TEMPERATURE °F	513	252	252	212	212	–	80	80	350	350	83	75	105	105	80

STREAM NUMBER	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
DESCRIPTION	LIMESTONE FLOW	BED SAND FLOW	PROPANE GAS FLOW	FBC ASH DRAIN	BOILER HOPPER ASH	MECHANICAL COLLECTOR ASH	LIME INJECTION	BAGHOUSE ASH	ASH TO ASH SILO	MAXIMUM ASH FLOW	SYSTEM LOSSES	COND. RETURN TO DEAERATOR			ELECTRICAL OUTPUT (GROSS)
FLOW RATE (LB/HR)	980	(INTERMITTENT)	(START-UP)	(INTERMITTENT)	128	4,395	196	1,877	6,400	28,000 TPY	1,500	43,767			12.1 MW
ENTHALPY (BTU/LB)	–	–	–	–	–	–	–	–	–	–	222.2	67.0			
PRESSURE (PSIG)	–	–	60	–	–	–	–	–	–	–	780	20			
TEMPERATURE °F	80	80	80	–	–	–	80	–	–	–	252	82			

PERFORMANCE FUEL	% BY WEIGHT
CARBON	33.70
HYDROGEN	4.67
NITROGEN	0.56
OXYGEN	22.92
SULFUR	0.25
ASH	12.38
MOISTURE	25.00
CHLORINE	0.53
TOTAL	100.00
HHU(BTU/LB)	5,500

ZONE	REV	DESCRIPTION	DATE	DRAWN	CHKD	APPD
	A	ISSUED FOR AIR PERMIT APPLICATION	6/16/92	JKM	JKM	RHC

REVISIONS

EcoEnergy

OUTOKUMPU ECOENERGY, INC.

BCH ENERGY CORPORATION
FAYETTEVILLE, NORTH CAROLINA

HEAT & MASS BALANCE 40,000# TO PROCESS

	BY	DATE
DRAWN	JKM	6/16/92
CHECKED	JKM	6/17/92
APPROVED	RHC	6/17/92
APPROVED		

SCALE: NONE

D | PROJECT NO. 12001C | REFERENCE DRAWING NO. | DRAWING NO. M-71-ZX2 | SHEET 1 | REV. A

APPENDIX D

NCDEM CORRESPONDENCE

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Environmental Management
512 North Salisbury Street • Raleigh, North Carolina 27604

James G. Martin, Governor
William W. Cobey, Jr., Secretary

George T. Everett, Ph.D.
Director

Regional Offices

Asheville
[illegible]

Fayetteville
[illegible]

Mooresville
[illegible]

Raleigh
[illegible]

Washington
[illegible]

Wilmington
[illegible]

Winston-Salem
919/896-7007

Division of Environmental Management
Air Quality Division
March 3, 1992

Mr. Kenneth L. Woodruff
Resource Recovery Consultant
182 Walton Drive
P.O. Box 42
Morrisville, PA 19067

Dear Mr. Woodruff:

Subject: Dispersion Modeling Protocol - BCH Energy Corporation
Bladen County, NC

The Division of Environmental Management (DEM) has reviewed the dispersion modeling protocol for the proposed construction of the refuse-derived fuel (RDF-3) plant to provide power for the DuPont facility in Bladen County, NC. This construction will trigger the North Carolina toxics review requirements for the entire facility. The following questions and comments were generated as a result of this review:

1) The protocol submitted does not adequately address Prevention of Significant Deterioration (PSD) air quality dispersion modeling. Per discussion with Mr. Richard Lassiter of NCDEM, a meeting was held to discuss this issue and he was informed that the facility would not trigger PSD requirements. If PSD is not triggered, provide supporting documentation (i.e. SO2 and NOX emission estimates, limits proposed, controls, etc.) in the final analysis. If PSD is triggered, you will have to revise and expand the modeling protocol to address the PSD modeling issues as identified in the New Source PSD Workshop manual.

2) Toxic emissions from the entire facility should be evaluated for comparison to the appropriate acceptable ambient levels; i.e. in addition to the process identified, all toxics vented to the atmosphere should be included in the analysis, e.g. natural gas, wood, additional fuel oil operations, as well as any fugitive emissions other than those already identified. In addition, the final analysis should contain a list of <u>all</u> toxics emitted with these toxics compared against their

P.O. Box 29535, Raleigh, North Carolina 27626-0535 Telephone 919-733-7015 / Pollution Prevention Pays

respective deminimus levels. Refer to North Carolina Administrative Code (NCAC) 15A 2H .0610 "Permit Requirements for Toxic Air Pollutants".

3) In your final analysis, provide a USGS map which covers a three mile radius surrounding the facility for terrain evaluation.

4) In your GEP analysis, structures which are not identified as the dominant structures (i.e. less than maximum GEP) but close to the plant property boundaries with region of influence extending to the emission source(s) should be evaluated for possible cavity impacts off property.

5) If multiple stacks need to be modeled and are similar, consider merging stacks in the SCREEN modeling. Refer to page 5 of the toxic guidelines for further details.

6) In your SCREEN modeling, include discrete receptors at critical or sensitive locations (i.e. churches, hospitals, schools, etc) and at roads, railroad tracks, rivers, etc. which traverse your property.

7) If refined modeling is required, use Raleigh surface data and Greensboro upper air data in place of the Wilmington/Charleston data.

With these additions and corrections, the modeling plan is approved. The modeling plan approval is valid for only 90 days. Additionally, this letter approves only the modeling plan and not any data submitted. This data will be reviewed upon receipt of the complete application.

If you have any questions or comments, please contact me at (919) 733-3340.

Sincerely,

Charles Buckler

Charles Buckler
Meteorologist

cc: Ken Smack

CB/cb
bchrdf.let

KENNETH L. WOODRUFF
RESOURCE RECOVERY CONSULTANT
182 WALTON DRIVE, P.O. BOX 42, MORRISVILLE, PA 19067
215-736-2194

May 26, 1992

Mr. Charles Buckler
Meteorologist
Division of Environmental Management
Air Quality Division
Department of Environment, Health
and Natural Resources
512 North Salisbury Street
Raleigh, NC 27604

Re: BCH Energy Corporation, Bladen County, NC,
Dispersion Modelling Protocol

Dear Mr. Buckler:

We are in receipt of your letter dated March 3, 1992 regarding modelling plan approval. It is our understanding that the modelling plan approval is valid up to June 3, 1992.

We respectfully request a 30 day extension of the approval to July 3, 1992 to permit us to complete preparation and filing of the complete permit application.

We sincerely appreciate your cooperation in this matter.

Sincerely,

Kenneth L. Woodruff

KLW/ktw

OK'D 6/1/92
Mon. will follow
letter to extension
authorizing

ENSR

ENSR Consulting
and Engineering

Somerset Executive Square I
One Executive Drive
Somerset, NJ 08873
(908) 560-7323
(908) 560-1688/FAX

September 21, 1992

BY FAX

Mr. Jim Roller
North Carolina Dept. of Environment, Health, and Natural Resources
Division of Environmental Management
Air Quality Section
P.O. Box 27687
Raleigh, NC 27611-7687

Re: Additional Information Required for Review of the Toxic Air Pollutant Modeling Analysis for the Fayetteville RDF-to-Energy Facility

Dear Mr. Roller:

In a telephone call on September 15, 1992, you requested some additional information required for the review of the toxic air pollutant modeling analysis for the Fayetteville RDF-to-Energy Facility. This letter serves to document my responses to some of your questions, which I gave during a September 17 telephone call and to supply you with the updated summary table of facility-wide toxic emissions which you requested. The information supplied is discussed below.

- <u>Plot Plan Measurement Scale Used in the GEP Analysis</u> - As you stated in our telephone conversation, the plot plan provided states that the scale in use is one inch equals 40 feet, but that the graphical scale depicted on the drawing indicates that one inch equals 80 feet. This plot plan is a 50 percent reduction of the original, thus the doubling of the measurement on the graphical scale. The graphical scale measurement of one inch equals 80 feet was the value used in the GEP analysis, so as to account for the photoreduction of the plot plan.

- <u>Breathing Losses from Facility Storage Tanks and Bins</u> - Since the materials stored in the facility's bins and tanks are not volatile in nature, the emission rates modeled represent only working losses, those occurring during material delivery or drawdown.

- <u>Summary Table of Toxic Emission Rates</u> - Enclosed as an attachment to this letter is a table summarizing the total facility-wide emission rates of all air toxics. This table should serve as an addendum to NC Form 2 supplied with the modeling analysis document. This list contains emission rates for all the toxics emitted from the facility, both above and below the emission rate thresholds listed in 15A NCAC 2H.0610(h).

ENSR

No other air toxics will be emitted from the facility. I have also enclosed an updated version of page 3 of NC Form S6 and Table 3-6 from the modeling analysis. During my compilation of data for the summary table you requested, I noticed that the modeling results for TCDD had inadvertently been omitted.

If you have any further questions on the modeling analysis or source inputs, please let me know.

Sincerely,

Carol M. Broccoli

Carol M. Broccoli
Meteorologist

Ref No. 6104-002-810

Enclosures

cc: M. Dennis
K. Woodruff
Project File

NC Form S6. Toxic Air Pollutant Model Results
Screening Analysis (Page 3 of 3)

Facility Name: Fayetteville RDF-to-Energy
Date: September 21, 1992

Maximum Modeled Concentration

Pollutant	Stack ID(1)	Averaging Period	Simple Terrain (mg/m^3)	Cavity(2) (mg/m^3)	Complex Terrain(3) (mg/m^3)		AAL (mg/m^3)	Shows Compliance (Y/N)
					Complex	Simple		
Mercury (aryl and inorganic)	MS	24-hour	1.21×10^{-5}	–	–	–	–	–
	PL	24-hour	1.70×10^{-6}	–	–	–	–	–
Mercury Total	Total	24-hour	1.38×10^{-5}	–	–	–	6.0×10^{-4}	Y
Mercury Vapor	MS	24-hour	2.42×10^{-6}	–	–	–	–	–
Mercury Vapor Total	Total	24-hour	2.42×10^{-6}	–	–	–	6.0×10^{-4}	Y
Nickel Metal	MS	24-hour	1.14×10^{-5}	–	–	–	–	–
	PL	24-hour	8.48×10^{-8}	–	–	–	–	–
	HL	24-hour	1.18×10^{-7}	1.57×10^{-7}	–	–	–	–
	AS	24-hour	4.16×10^{-7}	–	–	–	–	–
Nickel Metal Total	Total	24-hour	1.20×10^{-5}	1.57×10^{-7}	–	–	6.0×10^{-3}	Y
TCDD	MS	Annual	7.9×10^{-11}	–	–	–	–	–
TCDD Total	Total	Annual	7.9×10^{-11}	–	–	–	3.0×10^{-9}	Y
Vinyl Chloride	MS	Annual	7.90×10^{-8}	–	–	–	–	–
Vinyl Chloride Total	Total	Annual	7.90×10^{-8}	–	–	–	3.8×10^{-4}	Y

(1) Stack ID: MS = Main Stack; PL = Powdered Lime Storage Bin Vent; HL = Hydrated Lime Storage Bin Vent; AT = Ammonia Storage Tank; AS = Ash Storage Bin Vent.
(2) Only the cavity attributable to the Hydrated Lime Storage Bin extended off the property, thus only the concentrations caused by this source were reported.
(3) Complex terrain screening applicable to Ammonia Storage Tank only.
(4) One-hour emission rate used to calculate a 15-minute average.
(5) Assumes 10% of total chromium is emitted as Chromium VI.
(6) Value represents the three-month National Ambient Air Quality Standard for lead.

(Addendur C Form 2)
All Analyse age 1 of 2)

Facility Name: Fayetteville RDF-to-Energy
Date: September 21, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Ammonia	5	All Sources	1.22	0.17	4.86	—	—	—	41,880.4	—
Arsenic and compounds	9	All Sources	—	—	1.27×10^{-3}	—	—	—	11.0	0.016
Benzene	12	All Sources	—	—	2.35×10^{-3}	—	—	—	20.6	8.1
Benzo(a)pyrene	14	All Sources	—	—	4.64×10^{-7}	—	—	—	4.06×10^{-3}	2.2
Beryllium	16	All Sources	—	—	1.17×10^{-3}	—	—	—	10.2	0.28
Cadmium	23	All Sources	—	—	2.08×10^{-4}	—	—	—	1.7	0.37
Carbon disulfide	27	All Sources	—	—	4.72×10^{-3}	—	0.11	3.9	41.4	—
Carbon tetrachloride	28	All Sources	—	—	2.35×10^{-3}	—	—	—	20.6	460
Chlorobenzene	30	All Sources	—	—	2.35×10^{-3}	—	0.06	46	20.6	—
Chloroform	31	All Sources	—	—	2.35×10^{-3}	—	—	—	20.6	290
Chromium (total)	32	All Sources	—	—	9.03×10^{-2}	—	—	—	790.2	5.6×10^{-3}
Ethylene dichloride	46	All Sources	—	—	2.35×10^{-3}	—	—	—	20.6	260
Formaldehyde	51	All Sources	0.064	0.010	2.56×10^{-1}	—	—	—	2,240	–
HCDD	53	All Sources	—	–	2.72×10^{-7}	—	—	—	2.38×10^{-3}	5.1×10^{-3}
Hydrogen chloride	57	All Sources	2.37	4.5×10^{-2}	9.46	—	—	—	82860	—
Hydrogen fluoride	59	All Sources	0.13	1.6×10^{-2}	0.50	—	12.00	0.63	4380	—
Lead	–	All Sources	—	—	2.07×10^{-1}	—	—	—	1820	—
Manganese	63	All Sources	—	—	9.05×10^{-3}	—	0.21	0.63	71.4	—
Mercury (aryl and inorganic)	67	All Sources	—	—	6.85×10^{-2}	—	1.64	1.3×10^{-2}	600	—
Mercury vapor	68	All Sources	—	—	1.37×10^{-2}	—	0.33	1.3×10^{-2}	120	—
Methyl chloroform	69	All Sources	5.88×10^{-4}	16	2.35×10^{-3}	—	0.06	250	20.6	—

Facility Name: Fayetteville RDF-to-Energy
Date: September 21, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Methylene chloride	70	All Sources	---	---	2.35×10^{-3}	---	---	---	20.6	1600
Methyl ethyl ketone	71	All Sources	1.18×10^{-3}	5.6	4.72×10^{-3}	---	0.11	78	41.4	---
Methyl isobutyl ketone	72	All Sources	1.18×10^{-3}	1.9	4.72×10^{-3}	---	0.11	52	41.4	---
Nickel metal	75	All Sources	---	---	6.47×10^{-2}	---	1.13	0.13	566	---
Perchloroethylene	82	All Sources	---	---	2.35×10^{-3}	---	---	---	20.6	13000
Polychlorinated biphynels	86	All Sources	---	---	4.53×10^{-5}	---	---	---	0.4	5.6
Styrene	92	All Sources	5.88×10^{-4}	2.7	2.35×10^{-3}	---	0.06	27	20.6	---
TCDD	94	All Sources	---	---	4.72×10^{-6}	---	---	---	0.04	2.0×10^{-4}
Toluene	98	All Sources	5.88×10^{-4}	3.6	2.35×10^{-3}	---	0.06	98	20.6	---
Trichlorofluoromethane	101	All Sources	---	---	3.39×10^{-3}	140	---	---	29.6	---
1,1,2-Trichloro-1,2,2-trifluoroethane	102	All Sources	1.26×10^{-3}	60	5.02×10^{-3}	---	---	---	44.0	---
Vinyl chloride	103	All Sources	---	---	4.72×10^{-3}	---	---	---	41.4	26
Vinylidene chloride	104	All Sources	---	---	2.35×10^{-3}	---	0.06	2.5	20.6	---
Xylenes	105	All Sources	5.88×10^{-4}	4.1	2.35×10^{-3}	---	0.06	57	20.6	---

(1) Emission rates represent the total from all sources at the proposed facility. No other toxics listed in 15A NCAC 2H.0610(h) are emitted from the proposed facility.

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID[1]	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Ammonia	5	MS	1.20	0.17	4.78	---	---	---	41,880	---
Arsenic and compounds	9	MS	---	---	1.25×10^{-3}	---	---	---	11.0	0.016
Benzene	12	MS	---	---	2.35×10^{-3}	---	---	---	20.6	8.1
Benzo(a)pyrene[2]	14	MS	---	---	4.64×10^{-7}	---	---	---	4.06×10^{-3}	2.2
Beryllium	16	MS	---	---	1.17×10^{-3}	---	---	---	10.2	0.28
Cadmium	23	MS	---	---	1.97×10^{-4}	---	---	---	1.7	0.37
Carbon disulfide[2]	27	MS	---	---	4.72×10^{-3}	---	0.11	3.9	41.4	---
Carbon tetrachloride[2]	28	MS	---	---	2.35×10^{-3}	---	---	---	20.6	460
Chlorobenzene[2]	30	MS	---	---	2.35×10^{-3}	---	0.06	46	20.6	---
Chloroform[2]	31	MS	---	---	2.35×10^{-3}	---	---	---	20.6	290
Chromium (total)	32	MS	---	---	9.02×10^{-2}	---	---	---	790.2	5.6×10^{-3}
Ethylene dichloride[2]	46	MS	---	---	2.35×10^{-3}	---	---	---	20.6	260
Formaldehyde	51	MS	0.064	0.010	2.56×10^{-1}	---	---	---	2,240	--
HCDD[2]	53	MS	---	--	2.72×10^{-7}	---	---	---	2.38×10^{-3}	5.1×10^{-3}
Hydrogen chloride	57	MS	2.37	4.5×10^{-2}	9.46	---	---	---	82860	---
Hydrogen fluoride	59	MS	0.13	1.6×10^{-2}	0.50	---	12.00	0.63	4380	---
Lead	--	MS	---	---	2.07×10^{-1}	---	---	---	1820	---
Manganese[2]	63	MS	---	---	8.15×10^{-3}	---	0.20	0.63	71.4	---
Mercury (aryl and inorganic)	67	MS	---	---	6.85×10^{-2}	---	1.64	1.3×10^{-2}	600	---
Mercury vapor	68	MS	---	---	1.37×10^{-2}	---	0.33	1.3×10^{-2}	120	---
Methyl chloroform[2]	69	MS	5.88×10^{-4}	16	2.35×10^{-3}	---	0.06	250	20.6	---

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID[1]	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Methylene chloride[2]	70	MS	---	---	2.35×10^{-3}	---	---	---	20.6	1600
Methyl ethyl ketone[2]	71	MS	1.18×10^{-3}	5.6	4.72×10^{-3}	---	0.11	78	41.4	---
Methyl isobutyl ketone[2]	72	MS	1.18×10^{-3}	1.9	4.72×10^{-3}	---	0.11	52	41.4	---
Nickel metal	75	MS	---	---	6.47×10^{-2}	---	1.13	0.13	566	---
Perchloroethylene[2]	82	MS	---	---	2.35×10^{-3}	---	---	---	20.6	13000
Polychlorinated biphynels[2]	86	MS	---	---	4.53×10^{-5}	---	---	---	0.4	5.6
Styrene[2]	92	MS	5.88×10^{-4}	2.7	2.35×10^{-3}	---	0.06	27	20.6	---
TCDD[2]	94	MS	---	---	4.72×10^{-6}	---	---	---	0.04	2.0×10^{-4}
Toluene[2]	98	MS	5.88×10^{-4}	3.6	2.35×10^{-3}	---	0.06	98	20.6	---
Trichlorofluoromethane[2]	101	MS	---	---	3.39×10^{-3}	140	---	---	29.6	---
1,1,2-Trichloro-1,2,2-trifluoroethane[2]	102	MS	1.26×10^{-3}	60	5.02×10^{-3}	---	---	---	44.0	---
Vinyl chloride	103	MS	---	---	4.72×10^{-3}	---	---	---	41.4	26
Vinylidene chloride[2]	104	MS	---	---	2.35×10^{-3}	---	0.06	2.5	20.6	---
Xylenes[2]	105	MS	5.88×10^{-4}	4.1	2.35×10^{-3}	---	0.06	57	20.6	---
Arsenic	9	PL	---	---	1.10×10^{-7}	---	---	---	4.8×10^{-7}	0.016
Cadmium	23	PL	---	---	3.90×10^{-9}	---	---	---	1.7×10^{-8}	0.37
Chromium (total)	32	PL	---	---	1.23×10^{-6}	---	---	---	5.4×10^{-6}	5.6×10^{-3}
Lead	--	PL	---	---	1.00×10^{-6}	---	---	---	4.4×10^{-6}	---
Manganese[2]	63	PL	---	---	1.23×10^{-4}	---	2.95×10^{-3}	0.63	5.4×10^{-4}	---

Facility Name: Fayetteville RDF-to-Energy
Date: June 1, 1992
Method for Emission Calculation: Data supplied by Energy Products of Idaho

Pollutant	NC Toxic ID No.	Stack ID	Emission Rates							
			pounds/15 min.		pounds/hour		pounds/24 hour		pounds/year	
			(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Mercury (aryl and inorganic)	67	PL	---	---	4.46×10^{-9}	---	1.07×10^{-7}	1.3×10^{-2}	3.91×10^{-5}	---
Nickel	75	PL	---	---	2.23×10^{-6}	---	5.35×10^{-5}	0.13	9.8×10^{-6}	---
Arsenic	9	HL	---	---	1.51×10^{-7}	---	---	---	6.6×10^{-7}	0.016
Cadmium	23	HL	---	---	5.30×10^{-9}	---	---	---	2.3×10^{-8}	0.37
Chromium (total)	32	HL	---	---	1.66×10^{-6}	---	---	---	7.3×10^{-6}	5.6×10^{-3}
Lead	--	HL	---	---	1.36×10^{-6}	---	---	---	6.0×10^{-6}	---
Manganese(2)	63	HL	---	---	1.66×10^{-4}	---	3.98×10^{-3}	0.63	7.3×10^{-4}	---
Nickel	75	HL	---	---	3.03×10^{-6}	---	7.27×10^{-5}	0.13	1.3×10^{-4}	---
Ammonia	5	AT	0.02	0.17	8.31×10^{-2}	---	---	---	0.4	---
Arsenic	9	AS	---	---	2.24×10^{-5}	---	---	---	9.8×10^{-5}	0.016
Beryllium	16	AS	---	---	3.36×10^{-7}	---	---	---	1.5×10^{-6}	0.28
Cadmium	23	AS	---	---	1.12×10^{-5}	---	---	---	4.9×10^{-5}	0.37
Chromium (total)	32	AS	---	---	1.25×10^{-4}	---	---	---	5.5×10^{-4}	5.6×10^{-3}
Nickel	75	AS	---	---	1.37×10^{-6}	---	3.29×10^{-5}	0.13	6.0×10^{-6}	---

a Emitted from this source.
b State threshold limit.
(1) Stack ID: MS = Main Stack
PL = Powdered Lime Storage Bin Vent
HL = Hydrated Lime Storage Bin Vent
AT = Ammonia Tank Vent
AS = Ash Storage Bin Vent
(2) Sources which had emission rates of this TAP which combine with other sources to form a facility-wide emission rate which is less than the applilcable threshold limit. These sources and TAPs were not included in the dispersion modeling analysis.

TABLE 3-6

Facility Maximum Annual Concentrations
Using EPA SCREEN

Pollutant	Facility Maximum Annual Concentration (mg/m^3)	Annual AAL (mg/m^3)	Does Facility Exceed AAL? (Yes/No)
Arsenic	8.62×10^{-8}	2.3×10^{-7}	No
Benzene	3.95×10^{-8}	1.2×10^{-4}	No
Beryllium	2.06×10^{-8}	4.1×10^{-6}	No
Cadmium	3.54×10^{-8}	5.5×10^{-6}	No
Chromium VI	1.83×10^{-7}(1)	8.3×10^{-8}	Yes
TCDD	7.9×10^{-11}	3.0×10^{-9}	No
Vinyl chloride	7.90×10^{-8}	3.8×10^{-4}	No

(1) Assumes 10% of total chromium is emitted as Chromium VI.

KENNETH L. WOODRUFF & ASSOCIATES
RESOURCE RECOVERY CONSULTANTS
182 WALTON DRIVE, P.O. BOX 42
MORRISVILLE, PA 19067
(215) 736-2194

August 14, 1992

Mr. Richard T. Lasater
Environmental Engineer
DEM/Air Quality/Air Permits Unit
North Carolina DEHNR
512 North Salisbury Street, Room 825E
Raleigh, NC 27604

Re: Air Permit Application, BCH Energy Corporation, Bladen County, Application No. APP015123

Dear Mr. Lasater:

As a result of the meeting of July 27, 1992 held in your office with Charles Buckler, we are pleased to submit three (3) copies of the results of the Criteria Pollutant Modelling Study prepared for the BCH Energy Project.

Also, enclosed please find a diskette which contains the screening and refined modelling for criteria pollutants.

Should you or Mr. Buckler have any questions or require additional information, please do not hesitate to call.

Very truly yours,

K. L. Woodruff

Kenneth L. Woodruff

KLW/ktw

Enclosures

cc: G. Armistead

ENSR

ENSR Consulting
and Engineering

Somerset Executive Square I
One Executive Drive
Somerset, NJ 08873
(908) 560-7323
(908) 560-1688/FAX

August 13, 1992

Mr. Kenneth L. Woodruff and Associates
182 Walton Drive
Morrisville, PA 19067

Re: Criteria Pollutant Modeling for the Fayetteville RDF-to-Energy Facility

Dear Ken:

Per the request of the North Carolina Department of Environmental Management (NCDEM), criteria pollutant emissions from the proposed Fayetteville Refuse-Derived Fuel (RDF)-to-Energy Facility were modeled to assess ambient impacts. A brief discussion of the modeling methodology and results follows.

Screening Modeling Analysis

The Industrial Source Complex Short-Term model (ISCST2) was used in its screening mode to estimate the worst-case ground level impacts from the facility. Because there are no terrain features which exceed the heights of the proposed sources within three miles of the facility, complex terrain modeling was not required. An assumed set of meteorological conditions representing the range of possible dispersion conditions, as recommended by NCDEM, was used as input to the model. These meteorological conditions, and the ISC2 technical options used in the analysis are shown in Table 1. Tables 2 and 3 list the operating characteristics and pollutant emission rates used in the analysis; Table 4 lists the receptor locations and elevations modeled. All input data were identical to those used in the screening analyses for toxic air pollutants previously prepared for the facility (ENSR 1992a, ENSR 1992b). In the analysis for total suspended particulates, in which multiple sources were modeled, all sources were conservatively co-located at the location of the facility's main stack.

The one-hour impacts computed by ISCST2 were multiplied by scaling factors to convert to the averaging periods of concern for each pollutant. Per NCDEM guidance, these scaling factors are: 0.9 for the three-hour averaging period, 0.75 for the eight-hour averaging period, 0.4 for the 24-hour averaging period, and 0.038 for an annual average.

Table 5 summarizes the results of the ISCST2 screening analysis for criteria pollutants. This table lists the maximum predicted impact for each pollutant and averaging period. A comparison of these impacts with the applicable significant levels is also provided. The results of the modeling showed:

- the maximum one-hour impact for stack-only emissions occurred at a location 600 m downwind of the main stack under A stability, with a windspeed of 3 m/s, and a mixing height of 960 m,

- the maximum combined one-hour TSP impact attributable to the stack and storage bins occurred at a distance 100 m downwind of the main stack under D stability, with a windspeed of 1 m/s and a mixing height of 320 m,

- the maximum predicted 24-hour TSP impact approaches its SIL, and

- all other predicted impacts are well below the applicable SILs.

Refined Modeling Analysis

A refined modeling analysis was performed to more accurately predict the magnitude and spatial distribution of pollutant impacts attributable to the Fayetteville RDF-to-Energy facility. Per a telephone conversation with Mr. Jim Roller of NCDEM, modeling using one year of meteorological data would be acceptable if all impacts from the facility were less than significant, otherwise the use of five consecutive years of data would be required. The data used consisted of surface data from Raleigh-Durham, NC and mixing height data from Greensboro, NC for the year 1989, which had been used in the air toxics analysis. These data were processed using the standard EPA meteorological preprocessor to create data suitable for use with ISCST2 in its sequential mode.

A total of 715 receptors were modeled in the analysis. These receptors were chosen based on the results of the screening analysis and were placed to insure the representation of the maximum short- and long-term impacts. The receptor array consisted of a polar grid centered on the location of the proposed facility's main stack, with 36 radials spaced every ten degrees and rings placed at distances of 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000, 3000, 3500, 4000, and 5000 meters. Each receptor was assigned the maximum terrain elevation in the vicinity of the receptor, i.e., the area bounded by one-half the distance between adjacent rings and radials. Receptors in this grid which were located within the facility's fenceline were eliminated from the analysis, and the grid augmented by 36 receptors placed along the facility fenceline. Table 6 lists the receptor locations and elevations used in the analysis.

ENSR

The results of the refined analysis are shown in Table 7. Also shown in this table are the applicable SILs and Prevention of Significant Deterioration (PSD) Class II increments. All predicted impacts are less than these levels. Maximum impacts range from less than one percent of the SIL for CO to 42 percent of the SIL for TSP.

Conclusions

Refined dispersion modeling of the criteria pollutant emissions from the proposed Fayetteville RDF-to-Energy Facility shows that all short- and long-term criteria pollutant impacts are less than the applicable SILs and the federal PSD Class II increments. Thus, operation of the proposed facility will not cause or significantly contribute to an exceedance of any applicable air quality standards and no additional dispersion modeling is required.

References

ENSR 1992a. Toxic Air Pollutant Modeling Analysis for the Fayetteville RDF-to-Energy Facility. ENSR Document No. 6104-002-400, June 1992.

ENSR 1992b. Revised Toxic Air Pollutant Modeling Analysis for the Fayetteville RDF-to-Energy Facility. ENSR Document No. 6104-002-500, July 1992.

Enclosed are two diskettes which contain input and output files for both the screening and refined analyses and copies of the screening and refined meteorological data files for submission to NCDEM. If there are any questions or comments on the results of this analysis, please let me know.

Sincerely,

Michael G. Dennis
Senior Project Manager

Reference No. 6104-002-600(432)

Attachments
cc: C. Broccoli
File 6104-002

TABLE 1

Meteorological Conditions and Model Options Used in the ISCST2 Screening Analysis

Meteorological Conditions[1]	
Stability Class	**Wind Speed (m/s)**
A	1.0, 2.0, 3.0
B	1.0, 2.0, 3.0, 4.0, 5.0
C	1.0, 2.0, 3.0, 4.0, 5.0, 8.0, 10.0
D	1.0, 2.0, 3.0, 4.0, 5.0, 8.0, 10.0, 15.0, 20.0
E	1.0, 2.0, 3.0, 4.0, 5.0
F	1.0, 2.0, 3.0, 4.0

Model Options

- Rural (Pasquil-Gifford) dispersion coefficients
- Regulatory default option
- Final plume rise
- Buoyancy-induced dispersion
- Default wind speed profile exponents
- Default vertical potential temperature lapse rates
- Calm wind adjustment
- Terrain cutoff
- No pollutant decay

(1) As required by NCDEM, ambient temperature was set to 293 K and wind direction set along the line of receptors. Mixing heights were set to 320 times the wind speed (in meters) for stability classes A through D and set equal to 5000 meters for stability classes E and F.

TABLE 2

Source Operating Characteristics[1]

Source Name	UTMs (km E, km N)	Stack Height (ft)	Stack Diameter (ft)	Exit Temperature (°F)	Exit Velocity (ft/min)
Main Stack	697.690, 3857.760	150	7.5	300	2875
Powdered Limestone Storage Bin	697.739, 3857.805	52	2	70	207
Hydrated Lime Storage Bin	697.715, 3857.763	52	2	70	207
Ash Storage Bin	697.714, 3857.810	57	2	210	207

(1) Data supplied by Mr. K. Woodruff.

TABLE 3

Criteria Pollutant Emission Rates

Pollutant	Source Name	Emission Rates[1]	
		lbs/hr	tpy[2]
Sulfur dioxide	Main Stack	17.43	76.34
Nitrogen dioxide	Main Stack	22.41	98.16
Total suspended particulates[3]	Main Stack	4.98	21.81
	Powdered Limestone Storage Bin	5.57×10^{-2}	0.24
	Hydrated Lime Storage Bin	5.57×10^{-2}	0.24
	Ash Storage Bin	5.57×10^{-2}	0.24
Carbon monoxide	Main Stack	22.41	98.16
Lead	Main Stack	2.07×10^{-1}	0.91

(1) Source: Energy Products of Idaho.
(2) Based on 8,760 hours of operation.
(3) PM_{10} assumed equal to TSP.

TABLE 4

Receptor Locations and Heights Included in the Screening Model Analysis

Distance (m)	Height (ft msl)	Distance (m)	Height (ft msl)	Distance (m)	Height (ft msl)
23[1]	145	1400	150	6000	167
100	145	1600	155	7000	173
200	145	1800	155	8000	177
300	150	2000	150	9000	176
400	150	2250	150	10000	175
500	150	2500	155	12000	175
600	150	2750	155	14000	200
700	155	3000	160	16000	194
800	155	3500	160	18000	217
900	150	4000	160	20000	220
1000	150	4500	165		
1200	150	5000	160		

(1) Distance measured from the facility's main stack.

TABLE 5

Maximum Criteria Pollutant Impacts Predicted in the Screening Modeling Analysis

Pollutant	Averaging Period	SIL[1] ($\mu g/m^3$)	Maximum Concentration ($\mu g/m^3$)[2]	% of SIL
TSP/PM_{10}[3]	24-hour	5	4.98	100
	Annual	1	0.47	47
SO_2	3-hour	25	4.75	19
	24-hour	5	2.11	42
	Annual	1	0.20	20
NO_x	Annual	1	0.26	26
CO	1-hour	2000	6.79	< 1
	8-hour	500	5.09	1
Pb	24-hour	0.1	0.03	30

(1) Significant Impact Level.
(2) Maximum one-hour screening impact for all pollutants except TSP occurred 600 meters from the position of the main stack; maximum one-hour impact for TSP occurred 100 meters from the position of the main stack.
(3) Combined impact of the main stack and storage bins; other pollutants are emitted only from the main stack.

TABLE 6

Receptors Used in the Refined Modeling Analysis

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
109	10	145	200	10	145	300	10	145	400	10	145
500	10	145	600	10	140	700	10	135	800	10	120
900	10	115	1000	10	105	1200	10	90	1400	10	125
1600	10	140	1800	10	135	2000	10	135	2500	10	145
3000	10	140	4000	10	140	5000	10	150	116	20	145
200	20	145	300	20	145	400	20	150	500	20	150
600	20	145	700	20	140	800	20	140	900	20	135
1000	20	125	1200	20	85	1400	20	100	1600	20	115
1800	20	120	2000	20	135	2500	20	80	3000	20	75
4000	20	75	5000	20	75	127	30	145	200	30	145
300	30	145	400	30	150	500	30	150	600	30	150
700	30	145	800	30	145	900	30	135	1000	30	135
1200	30	90	1400	30	85	1600	30	85	1800	30	75
2000	30	70	2500	30	60	3000	30	65	4000	30	70
5000	30	70	145	40	145	200	40	145	300	40	145
400	40	145	500	40	150	600	40	150	700	40	145
800	40	145	900	40	145	1000	40	130	1200	40	105
1400	40	75	1600	40	55	1800	40	55	2000	40	65
2500	40	70	3000	40	70	4000	40	75	5000	40	75
105	50	145	200	50	145	300	50	145	400	50	145
500	50	145	600	50	145	700	50	145	800	50	145
900	50	130	1000	50	100	1200	50	60	1400	50	55
1600	50	55	1800	50	65	2000	50	75	2500	50	85
3000	50	75	4000	50	75	5000	50	85	230	60	145
300	60	145	400	60	145	500	60	145	600	60	145
700	60	145	800	60	140	900	60	120	1000	60	90
1200	60	60	1400	60	55	1600	60	55	1800	60	65
2000	60	70	2500	60	75	3000	60	75	4000	60	75
5000	60	85	222	70	145	300	70	145	400	70	145
500	70	145	600	70	145	700	70	145	800	70	145
900	70	115	1000	70	100	1200	70	55	1400	70	55
1600	70	60	1800	70	65	2000	70	70	2500	70	75
3000	70	70	4000	70	75	5000	70	75	221	80	145
300	80	145	400	80	145	500	80	145	600	80	145
700	80	145	800	80	145	900	80	145	1000	80	120
1200	80	55	1400	80	50	1600	80	60	1800	80	65
2000	80	80	2500	80	75	3000	80	75	4000	80	85
5000	80	90	221	90	145	300	90	150	400	90	150
500	90	150	600	90	150	700	90	150	800	90	150
900	90	150	1000	90	100	1200	90	55	1400	90	50
1600	90	60	1800	90	65	2000	90	80	2500	90	75
3000	90	80	4000	90	80	5000	90	90	138	100	145

TABLE 6

Receptors Used in the Refined Modeling Analysis (continued)

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
200	100	145	300	100	150	400	100	150	500	100	150
600	100	150	700	100	150	800	100	160	900	100	150
1000	100	120	1200	100	65	1400	100	50	1600	100	60
1800	100	65	2000	100	75	2500	100	75	3000	100	80
4000	100	80	5000	100	88	98	110	145	100	110	145
200	110	145	300	110	150	400	110	150	500	110	150
600	110	150	700	110	150	800	110	150	900	110	150
1000	110	120	1200	110	110	1400	110	55	1600	110	55
1800	110	65	2000	110	65	2500	110	80	3000	110	75
4000	110	75	5000	110	85	78	120	145	100	120	145
200	120	145	300	120	150	400	120	150	500	120	150
600	120	150	700	120	150	800	120	150	900	120	150
1000	120	150	1200	120	130	1400	120	90	1600	120	55
1800	120	50	2000	120	60	2500	120	75	3000	120	80
4000	120	80	5000	120	75	67	130	145	100	130	145
200	130	145	300	130	150	400	130	150	500	130	150
600	130	150	700	130	150	800	130	150	900	130	150
1000	130	150	1200	130	150	1400	130	130	1600	130	110
1800	130	65	2000	130	50	2500	130	65	3000	130	65
4000	130	75	5000	130	75	59	140	145	100	140	145
200	140	145	300	140	150	400	140	150	500	140	155
600	140	155	700	140	150	800	140	150	900	140	150
1000	140	150	1200	140	145	1400	140	140	1600	140	120
1800	140	110	2000	140	115	2500	140	60	3000	140	60
4000	140	60	5000	140	69	55	150	145	100	150	145
200	150	150	300	150	150	400	150	150	500	150	155
600	150	160	700	150	150	800	150	150	900	150	150
1000	150	150	1200	150	140	1400	150	115	1600	150	130
1800	150	130	2000	150	140	2500	150	145	3000	150	140
4000	150	105	5000	150	100	54	160	145	100	160	145
200	160	150	300	160	150	400	160	150	500	160	150
600	160	155	700	160	150	800	160	145	900	160	140
1000	160	145	1200	160	145	1400	160	140	1600	160	140
1800	160	145	2000	160	145	2500	160	150	3000	160	145
4000	160	140	5000	160	140	53	170	145	100	170	145
200	170	150	300	170	150	400	170	150	500	170	150
600	170	150	700	170	145	800	170	145	900	170	145
1000	170	145	1200	170	145	1400	170	140	1600	170	145
1800	170	145	2000	170	150	2500	170	155	3000	170	145
4000	170	145	5000	170	145	53	180	145	100	180	145
200	180	150	300	180	150	400	180	150	500	180	150
600	180	150	700	180	150	800	180	150	900	180	145

TABLE 6

Receptors Used in the Refined Modeling Analysis (continued)

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
1000	180	145	1200	180	145	1400	180	145	1600	180	145
1800	180	145	2000	180	145	2500	180	145	3000	180	145
4000	180	145	5000	180	145	55	190	145	100	190	145
200	190	145	300	190	145	400	190	145	500	190	145
600	190	150	700	190	150	800	190	150	900	190	145
1000	190	145	1200	190	145	1400	190	145	1600	190	145
1800	190	145	2000	190	145	2500	190	145	3000	190	145
4000	190	145	5000	190	150	43	200	145	52	200	145
100	200	145	200	200	145	300	200	145	400	200	145
500	200	145	600	200	145	700	200	145	800	200	145
900	200	145	1000	200	145	1200	200	145	1400	200	145
1600	200	145	1800	200	145	2000	200	145	2500	200	145
3000	200	145	4000	200	145	5000	200	155	59	210	145
100	210	145	200	210	145	300	210	145	400	210	145
500	210	150	600	210	145	700	210	145	800	210	145
900	210	145	1000	210	145	1200	210	145	1400	210	150
1600	210	150	1800	210	145	2000	210	145	2500	210	145
3000	210	145	4000	210	145	5000	210	155	29	220	145
52	220	145	100	220	145	200	220	145	300	220	145
400	220	145	500	220	150	600	220	150	700	220	145
800	220	145	900	220	145	1000	220	145	1200	220	150
1400	220	155	1600	220	155	1800	220	155	2000	220	150
2500	220	145	3000	220	145	4000	220	150	5000	220	155
26	230	145	52	230	145	100	230	145	200	230	145
300	230	145	400	230	145	500	230	150	600	230	150
700	230	145	800	230	150	900	230	150	1000	230	145
1200	230	150	1400	230	155	1600	230	155	1800	230	145
2000	230	149	2500	230	145	3000	230	150	4000	230	155
5000	230	155	24	240	145	52	240	145	100	240	145
200	240	145	300	240	145	400	240	150	500	240	145
600	240	150	700	240	150	800	240	150	900	240	150
1000	240	150	1200	240	150	1400	240	155	1600	240	150
1800	240	145	2000	240	145	2500	240	145	3000	240	150
4000	240	155	5000	240	155	23	250	145	52	250	145
100	250	145	200	250	145	300	250	145	400	250	150
500	250	150	600	250	150	700	250	150	800	250	150
900	250	150	1000	250	150	1200	250	150	1400	250	155
1600	250	155	1800	250	145	2000	250	145	2500	250	155
3000	250	160	4000	250	155	5000	250	150	23	260	145
52	260	145	100	260	145	200	260	145	300	260	145
400	260	150	500	260	145	600	260	150	700	260	150
800	260	145	900	260	150	1000	260	150	1200	260	150

TABLE 6

Receptors Used in the Refined Modeling Analysis (continued)

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
1400	260	150	1600	260	158	1800	260	150	2000	260	145
2500	260	145	3000	260	160	4000	260	155	5000	260	156
23	270	145	52	270	145	100	270	145	200	270	145
300	270	145	400	270	150	500	270	150	600	270	150
700	270	145	800	270	145	900	270	145	1000	270	150
1200	270	150	1400	270	150	1600	270	155	1800	270	150
2000	270	150	2500	270	155	3000	270	160	4000	270	156
5000	270	160	24	280	145	52	280	145	100	280	145
200	280	145	300	280	145	400	280	150	500	280	145
600	280	145	700	280	145	800	280	145	900	280	145
1000	280	150	1200	280	150	1400	280	150	1600	280	145
1800	280	150	2000	280	150	2500	280	155	3000	280	155
4000	280	155	5000	280	160	29	290	145	52	290	145
100	290	145	200	290	145	300	290	150	400	290	150
500	290	150	600	290	145	700	290	145	800	290	145
900	290	145	1000	290	145	1200	290	145	1400	290	145
1600	290	140	1800	290	140	2000	290	150	2500	290	145
3000	290	155	4000	290	160	5000	290	160	30	300	145
52	300	145	100	300	145	200	300	145	300	300	150
400	300	150	500	300	150	600	300	145	700	300	145
800	300	140	900	300	140	1000	300	130	1200	300	130
1400	300	130	1600	300	130	1800	300	130	2000	300	125
2500	300	150	3000	300	156	4000	300	160	5000	300	160
38	310	145	52	310	145	100	310	145	200	310	145
300	310	150	400	310	150	500	310	150	600	310	145
700	310	145	800	310	140	900	310	140	1000	310	130
1200	310	130	1400	310	130	1600	310	125	1800	310	125
2000	310	120	2500	310	145	3000	310	150	4000	310	155
5000	310	170	51	320	145	52	320	145	100	320	145
200	320	145	300	320	150	400	320	150	500	320	145
600	320	145	700	320	145	800	320	145	900	320	135
1000	320	125	1200	320	125	1400	320	130	1600	320	120
1800	320	110	2000	320	100	2500	320	135	3000	320	135
4000	320	160	5000	320	160	82	330	145	100	330	145
200	330	145	300	330	150	400	330	150	500	330	150
600	330	145	700	330	145	800	330	140	900	330	135
1000	330	125	1200	330	90	1400	330	95	1600	330	105
1800	330	125	2000	330	135	2500	330	135	3000	330	145
4000	330	160	5000	330	165	107	340	145	200	340	145
300	340	150	400	340	150	500	340	150	600	340	140
700	340	135	800	340	120	900	340	100	1000	340	85
1200	340	105	1400	340	130	1600	340	130	1800	340	130

TABLE 6

Receptors Used in the Refined Modeling Analysis (continued)

Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)	Dist. (m)	Dir. (deg)	Elev. (ft)
2000	340	130	2500	340	140	3000	340	145	4000	340	160
5000	340	165	107	350	145	200	350	145	300	350	145
400	350	150	500	350	145	600	350	145	700	350	145
800	350	140	900	350	115	1000	350	100	1200	350	110
1400	350	135	1600	350	140	1800	350	135	2000	350	135
2500	350	140	3000	350	150	4000	350	160	5000	350	160
107	360	145	200	360	145	300	360	145	400	360	150
500	360	145	600	360	145	700	360	145	800	360	140
900	360	115	1000	360	95	1200	360	95	1400	360	140
1600	360	145	1800	360	140	2000	360	140	2500	360	145
3000	360	150	4000	360	165	5000	360	165			

TABLE 7

Maximum Criteria Pollutant Impacts Predicted in the Refined Modeling Analysis for the Year 1989

Pollutant	Averaging Period	SIL[1] ($\mu g/m^3$)	Modeled Concentration ($\mu g/m^3$)	% of SIL	Class II PSD Increment ($\mu g/m^3$)	% of Increment	Impact Location[2]
TSP/PM_{10}[3]	24-hour	5	2.11	42	37	6	(180°, 53m)
	Annual	1	0.40	40	19	2	(30°, 127m)
SO_2	3-hour	25	3.76	15	512	< 1	(280°, 1000m)
	24-hour	5	1.00	20	91	1	(190°, 2500m)
	Annual	1	0.06	6	20	< 1	(190°, 2500m)
NO_x	Annual	1	0.08	8	25	< 1	(190°, 2500m)
CO	1-hour	2000	7.78	< 1	No increment	--	(150°, 1600m)
	8-hour	500	3.00	< 1	No increment	--	(50°, 800m)
Pb	24-hour	0.1	0.01	10	No increment	--	(190°, 2500m)

(1) Significant Impact Level.
(2) Measured from the location of the main stack.
(3) Combined impact of the main stack and storage bins; other pollutants are emitted only from the main stack.

8

DRAFT
OPERATIONS AND MAINTENANCE MANUAL

FOR

BCH Energy Limited Partnership
Mixed Waste Processing Facility
At The
Cumberland County Sanitary Landfill
Ann Street, Fayetteville, North Carolina

Draft
October 1992

Prepared By

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Resource Recovery Consultants
P.O. Box 42
Morrisville, PA 19067

TABLE OF CONTENTS

INTRODUCTION

The BCH Energy Limited Partnership Mixed Waste Processing Facility, also referred to as a Materials Recovery Facility (MRF), is a facility designed in accordance with State of North Carolina requirements for the receipt, processing, recovery and transfer of materials from 900 tons per day of municipal solid waste generated within the Counties of Bladen, Cumberland and Hoke.

This Operations and Maintenance Manual has been developed to comply with NC DEHNR requirements and will serve as a guide for all personnel involved in facility operations. It provides basic facility data and will be provided to all employees as part of the employee training program.

1.0 ROUTINE OPERATIONS PROCEDURES

Figure 1, PROJECT COMPONENT CHART, indicates that the MRF project consists of three major components:

Project Administration

Facility Operations

Transportation Operations

Procedures for operation of each major component are outlined as follows:

1.1 Project Administration

This component of the project has two office locations as follows:

BCH Energy Limited Partnership
c/o VEDCO Energy Corp.
Suite 940
11757 Katy Freeway
Houston, TX 77079
Phone No. (800) 285-8331
FAX No. (713) 293-0240

BCH Energy Limited Partnership
Ann Street
Fayetteville, NC

The Houston Office will act as the comptroller for the project. The office will be equipped with a computer terminal tied directly to the on-site scale computer system. A full time clerk will be responsible for daily monitoring and record keeping for the following:

Waste Quantities Received
Waste Quantities Recycled
Recycled Quantities Shipped
Residue Quantities Shipped
Revenue Receipts and Billing Statements
Deposits to Corporate Account
Payroll Expenses
All other Project Expenses

In addition, the Houston Office will manage all outside professional services, including, but not limited to:

C.P.A. Auditing Services
Legal Services
Engineering Services

The Fayetteville Office will be located on the second floor of the MRF building. This office will house the on-site administrative employees including:

Plant Manager
Assistant Plant Manager
Transportation Manager
Foreman
Secretary
Clerk

The on-site office staff will manage the MRF and transportation components serving the project on a daily basis. Administrative services will be provided to cover three basic areas:

Personnel
Clerical - Recordkeeping and Reporting
Revenue Collections

1.2 MRF Operations

Operation of the MRF requires private haulers and municipalities to deliver acceptable waste to the MRF.

Once trucks of waste arrive on site, the following operations will be performed.

A. Weighing of incoming loads by use of computerized scales.

B. Direction of trucks to the appropriate tipping floor/area.

C. Unloading of waste onto the appropriate tipping floor/area.

D. Inspection of waste as unloaded on tipping floor.

E. Stockpiling of waste on the tipping floor and feeding via front-end loader to the processing line.

F. Recovery of recyclables by mechanical and handpicking.

G. Baling and packaging of recovered materials for shipment to end users.

H. Loading of non-recoverable waste into open top containers or trailers for transfer to the Cumberland County Landfill for disposal.

I. Loading of RDF via compactors onto trailers for transport to the EGF.

J. Weighing of out-going trailers, for official records by the out-going computerized scale.

K. Daily facility inspection, maintenance and housekeeping.

1.3 Transportation Operations

The principal elements of this component are:

A. BCH Energy Limited Partnership (BCH) owned and operated fleet of 6 tractor rigs and 25 open top live bottom transfer trailers.

B. The BCH owned fleet will be supported by 3 levels of service.

1. On-site services consisting of a refueling station and a maintenance area.
2. Road service to be provided by service personnel and service vehicle of BCH.
3. Provisions for vehicle inspection and maintenance service prior to the trucks leaving the EGF for the return trip to the MRF.

1.4 Description of Routine Operations Procedures

During normal, routine operation of the MRF, solid waste collection vehicles will arrive at the facility via the main entrance road.

Upon arriving at the MRF, refuse trucks will proceed to the scale house to be weighed and to obtain a weight/ identification ticket. At no time will trucks be queuing on public roads. Noise levels of incoming vehicles will be measured on a random basis to determine compliance with North Carolina Noise Regulations. Trucks not meeting the standard will not be permitted to re-enter the facility until appropriate repairs are made to assure compliance with Noise Regulations.

Upon leaving the scale house, each truck will be directed to the appropriate tipping location depending upon the type of waste.

The collection vehicles will back into the designated tipping location and the driver will give the ticket to one of the Spotters stationed on the tipping floor. The Floor Spotter will observe the unloading of the truck, specifically looking for undesirable materials, waste types which do not comply with waste type identified on the ticket, and unacceptable wastes. The Floor Spotter will mark appropriate changes on the ticket and return it to the driver. Floor Spotters are specifically trained in the identification of waste types and identification of potentially hazardous and unacceptable wastes.

The truck driver then drives to the outgoing truck scale for tare weight and turns in the ticket to the scale operator.

Any hazardous or suspicious waste identified at the time of unloading will be placed in a designated storage area for appropriate handling and disposal. The NC DEHNR Fayetteville office will be notified by telephone. A licensed hazardous waste transportation and disposal firm, under contract to the facility, will be notified to arrange disposal for all hazardous substances on as needed basis.

Acceptable waste on the tipping floor will be stockpiled and moved to the appropriate process feed conveyor by two wheel loaders. Non-processible waste will be loaded into 40 cubic yard open top, roll-off containers for transfer to the adjacent Cumberland County Landfill.

Front end loaders will push MSW onto an apron conveyor which feeds the MRF process line. This conveyor moves MSW past Picking Station No. 1 where pickers will manually remove large and non-processible materials, as well as newspaper and corrugated paper prior to screening in Trommel No. 1.

Tromel No. 1 is equipped with blades and spikes to break open plastic bags and remove materials less than six inches in size. Minus 6-inch material passes under Magnetic Separator No. 1 to recover most of the ferrous metals, then to Trommel No. 2 where material less than 2 inches in size will be removed. The minus 2-inch material will be conveyed to roll-off containers for transfer to the adjacent sanitary landfill for disposal.

Oversize materials from Trommel No. 2 are conveyed to an Eddy Current Separator for recovery of aluminum cans. The stream then is conveyed to Picking Station No. 3 where additional aluminum, as well as plastics (HDPE and PET) are recovered from the stream. Remaining materials are conveyed to compactors for loading onto live bottom transfer trailers.

The material from Trommel No. 1, which is larger than six inches, is conveyed to Picking Station No. 2 for recovery of ferrous metals, non-ferrous metals and plastics. The stream from Picking Station No. 2 passes Magnetic Separatpr No. 2 for recovery of additional ferrous metals. The remaining MSW then joins the output from Picking Station No. 3 and is conveyed to the compaction loadout system.

Products fecovered from the MSW are processed as follows:

1. Bulky wastes shall be placed in roll-off containers for transfer to the landfill.
2. Corrugated paper shall be conveyed to Baler No. 1 for baling.
3. Newsprint shall be conveyed to the same baler for baling.
4. Bulky aluminum and bulky ferrous metals shall be placed in roll-off containers for shipment to market.

5. Plastics shall be conveyed to a perforator and Baler No. 2 for baling.

6. Ferrous metals from the Magnetic Separators shall be loaded into roll-off containers or open top trailers for shipment to market.

7. Aluminum cans shall be conveyed to a can densifier for baling in the form of biscuits in preparation for market.

At the end of each operating day, the tipping floor and MRF areas will be swept clean.

An in-house security team will provide on-site security during all hours including nights and weekends. Such personnel will utilize a punch-in system at key stations throughout the MRF site during non-operating hours.

A Road Service Man will be provided with a service van for the purposes of minor vehicle maintenance, safety checks and the recording and logging of vehicle maintenance and service records.

All on-site personnel will be equipped with 2-way radios to facilitate on-site communications. The transfer tractors and service van will be equipped with radios to assure prompt, reliable communications with operating personnel at the MRF and EGF facilities.

1.5 Interim Storage Procedures for Recovered Materials

Ferrous Metals - Steel scrap will be stored in roll-off containers or open top trailers prior to shipment to end users.

Aluminum - Bulky aluminum will be stored in roll-off containers prior to shipment to end users. Aluminum cans will be densified into biscuits upon recovery. Biscuits will be stacked in mill bundles and will be stored in van trailers prior to shipment to end users.

Paper - Various grades of paper will be stored in live bottom bins prior to baling. Baled paper will be stored in the MRF prior to loading into van trailers for shipment to end users. All storage will be indoors or in closed containers or trailers.

Plastics - Plastic bottles recovered from the waste will be stored in live bottom bins by type prior to perforation and baling and shipment to end users. Bales may be stored within the facility or loaded directly into van trailers for shipment to end users.

Glass & Grit - This material will be stored in open top trailers or roll-off containers prior to transfer to the landfill or end users.

2.0 FACILITY AND PERSONNEL PROTECTION

2.1 Training

All employees will receive on-site training in order to acquaint them with the potential problems and emergencies that can arise in the operation of the MRRF facility. During training each employee will be given specific instructions on OSHA Rules and Procedures. The procedures to be followed in case of emergencies (Emergency Contingency Plan-Section 14) will be outlined and reviewed at monthly Safety Meetings during the year. Pertinent segments of OSHA Rules and Procedures are included as Attachment I to this Manual. This O&M Manual will serve as the basis for the personnel training program as outlined in Section 11.

2.2 Equipment and Uniforms

All employees will be provided Safety Shoes and Hard Hats before being allowed to commence work. Uniforms will be provided in order to easily distinguish plant employees from visitors and collection vehicle drivers. Protective safety gear will be maintained on-site for use in the event of accidental receipt of any hazardous substance and other emergencies.

A list of equipment and supplies maintained on-site is as follows:

Item	No. Stocked
Corrosive & Acid Resistant Uniforms	2
Work Gloves & Rubber Gloves	60

Goggles	12
Ear Muffs	12
Respirator Masks-Full Face	2
Respirator Masks-Half Face	12
First Aid Kits	4
Eye Wash Station	1
Safety Vests	24
Hard Hats	24
Rain Gear	6
Flashlights	12
Fire Extinguishers-6 pound size	6-Tipping Floor 6-Recovery Areas 3-Office 1-Scale House

2.3 Locker Storage

All on-site employees will be provided a locker in the second floor locker room area for safekeeping of each employee's personal belongings.

3.0 NOISE, LITTER, ODOR AND VECTOR CONTROL

3.1 Noise

Noise is emitted by several sources. For purposes of this Manual they will be grouped into two categories: refuse collection vehicles and MRF vehicles and equipment. Noise control measures for each category are described as follows:

Refuse Collection Vehicles - Refuse collection vehicles will be monitored as they enter the site on a random basis. A designated employee will stand within the Noise Monitoring Area, a concrete pad situated along the roadway near the inbound truck scale.

- o The Sound Level Meter owned and maintained by MRF is a Realistic Model No. 33-2050. A copy of the Owner's Manual is included in Appendix H.
- o This employee will calibrate the noise meter in accordance with the manufacturer's instructions.
- o Noise readings will be observed as collection vehicles approach the inbound truck scale.
- o Vehicle owner and ID number will be observed.
- o If readings are less than 85 dBA, the meter reader will direct the scale operator to allow the vehicle to proceed to the MRF.
- o If readings are greater than 85 dBA, the meter reader will check whether this is the first time for the specific truck to exceed the noise limitation.

a. If a first offense, the driver will be issued a warning notice. After receiving this notice, the vehicle will proceed to the MRF. A copy of the notice will be mailed to the vehicle owner. A record will be maintained.

b. If a second offense, the truck driver will be permitted to unload refuse at the MRF, but will be issued a notice that it will not be permitted to unload the next time. The vehicle will be directed to exit from the site and not return until appropriate repairs have been made.

c. In either case, the meter reader will enter the date, ID number, dBA reading, and other data onto a Vehicle Execessive Noise Data Form. (Exhibit 1) Records of all data and notices will be maintained by the MRF office.

MRF Vehicles and Equipment - MRF vehicles and equipment expected to create noise include truck tractors, wheel loaders, utility truck and sweeper. Each of these will be checked monthly for noise levels. If noise levels are approaching noise limits, mufflers, exhaust silencers, and other exhaust system components will be replaced as required to maintain all vehicles within the noise limitations specified by NC DEHNR. Records of tests conducted on MRF equipment will be maintained by the facility office.

3.2 Litter

Litter control will be exercised through preventative and routine operational measures using Best Management Practices.

- o Incoming roll-off vehicles will not be permitted to remove tarpulins, covers, or other closures prior to entering the tipping building.
- o Incoming packer trucks (front loader, side loader, rear loader) will not be permitted to have turnbuckles or tailgate unlatching mechanisms loosened or opened prior to entering the tipping building.
- o Roll-off vehicles and packer trucks will be directed to return the tilt frame/tailgate to the normal position while within the tipping building to minimize the effects of wind and the potential for wind-blown litter.
- o MRF transfer trailers and roll-off containers will have tarpaulins placed over their tops immediately prior to exiting from the MRF.
- o Wheel loaders working on the tipping floor will keep solid waste away from door openings to prevent windblown litter. Under no circumstances will waste susceptible to being blown away be discharged or stored outside of the tipping building.
- o During slow periods throughout the working day and as necessary, a wheel loader will be driven to the RDF trailer loading area. Available personnel will use hand implements (push broom, square bladed shovel) to collect spillage and directly load it into the wheel loader bucket. The wheel loader will then travel back

to the tipping floor. Alternatively, the material may be loaded into a container and transported by the wheel loader back to the tipping floor.

- The Elgin Sweeper will be used on a daily basis to sweep the on-site roadways. On-site personnel will be assigned responsibility for inspecting the site daily and retrieving litter as required. Litter will be placed in a bag or container and transported to the tipping floor.

3.3 Odor

Odor will be controlled through the routine daily transfer of recovered products and processed and bypass waste out of the facility (in transfer trailers) and through good housekeeping practices, as well as through the installation and operation of a dust collection and odor adsorption system on the MRF. All refuse handling facilities normally have a residual odor, but this will be kept to a minimum through the following practices:

- When a choice can be made for processing a load of putrescible refuse (household or restaurant refuse, for example) instead of a less odiferous type of waste (dry commercial waste, for example), the putrescible waste will be processed first.
- Daily sweeping and cleaning of the facility tipping floor will keep odors to a minimum.

- If odor becomes a noticeable problem during certain time periods, a sweeping compound (Odorid, Odor Control Granules, or equal) will be distributed on the tipping floor by a broadcast-type spreader at the end of the work day after the tipping floor has been swept and cleaned.
- During operation of the MRF, the MRF building will be kept under negative pressure by the operation of a dust collection system. Such system will include a fabric filter for removal of dust particles followed by a carbon adsorption system for removal of odors prior to air discharge to atmosphere.

3.4 Vectors

Vectors will be controlled primarily through good housekeeping practices and no long term storage of unprocessed waste. A vermin control program is to be developed and directed by a qualified firm. This will provide a continuing control and prevention program. The program as well as application of any pesticides will be by qualified personnel as set forth by the North Carolina Pesticide Control Code.

4.0 NON-ROUTINE OPERATIONS PROCEDURES

Procedures for operating the MRF when equipment becomes temporarily inoperable are presented as follows:

4.1 Scale House Truck Scales

- If the scale computing equipment becomes inoperable, the "Scale Operator" will contact the "Plant Manager" to report the malfunction and take appropriate steps to repair the equipment.
- During the time until the computing equipment becomes operational, the "Scale Operator" will manually enter the vehicle ID number, truck size (roll-off container size) and vehicle weights from the truck scales onto the "Temporary Scale Record Form."(Exhibit 2)
- If the scale equipment can not be returned to working order by in-plant personnel, the scale maintenance contractor will be contacted for an emergency service call to the site.
- If there is a power outage, or both truck scales are fully inoperable (faulty load cell), the Scale Operator will manually enter the company, vehicle ID number, truck size and refuse type (under GROSS VEHICLE WEIGHT heading) by ID number. (See Temporary Scale Record Form - Exhibit 2)

- In the event of malfunction of either the in-going truck scale or out-going scale, traffic may be re-routed to utilize the one remaining scale in operation.
- If vehicles can not cross the truck scales, safety cones will be placed in front of and around the inoperable truck scale. Traffic will be directed around the scales.

4.2 <u>Wheel Loader</u>

- If a wheel loader becomes inoperable, the "Loader Operator" will contact the Lead Operator or Plant Manager. The Lead Operator will direct the mechanic to the tipping floor to determine with the "Loader Operator" the nature of the problem. The loader will be moved out of the tipping floor area and into the maintenance area for repairs. The facility will continue in operation using the second wheel loader.
- If it is determined by maintenance personnel that repairs requirements are extensive, the Plant Manager will contact a nearby machinery company, to request a wheel loader rental. Pre-arrangements will have been made between BCH and a machinery company to provide a backup wheel loader for this purpose.
- The operable wheel loader on-site will begin stockpiling incoming waste, in addition to feeding the processing system. The facility can be operated with

one wheel loader, due to the size machines on-site equipped with 6 cubic yard buckets.

4.3 Conveyors, Trommels, Balers, Magnetic Separator, Eddy Current Separators, Compactors

If one of these becomes inoperable, the Plant Manager and an on-site Mechanic will be notified of outage. A decision will be made as to whether to remain shutdown until repairs can be made, or to activate bypass provisions or activate redundant equipment built into the processing system.

4.4 Transfer Trailer

- o If a transfer trailer becomes inoperable, the "Tractor Trailer Driver" will telephone the MRF Facility. Depending on the type or location of the breakdown, the following personnel would be contacted:

  Off-Site - EGF Contact

  Mechanical/On-Site - Mechanic

  Tires/On-Site - Road Service Personnel
- o The Transportation Manager will be notified of the outage and the equipment schedule modified as may be required. If necessary, equipment from a contracted hauling service will be requested to provide a backup equipment.

4.5 Inadvertently Accepted Unacceptable Waste

- o Suspicious or unacceptable waste detected at the time of unloading will be immediately placed in a designated storage area to await inspection and proper disposal. The Load Operator or Plant Manager will notify the NC DEHNR.

- o If suspicious waste is identified on the tipping floor, the "Loader Operator" will isolate the unacceptable waste from surrounding material using the loader. The unacceptable waste will be moved by the loader to the designated storage area. The NC DEHNR will be notified.
- o Suspicious or unacceptable wastes will be placed in a 20 cubic yard roll-off container. The container will be stored in a designated area. The container will be labelled with <u>Danger</u> signs. In this way the material will be protected from the ongoing operations.
- o The NC DEHNR will be notified in the event of receipt of unacceptable or hazardous wastes. A licensed hazardous waste transportation and disposal firm under contract to BCH will be notified to make arrangements for the removal and proper disposal of the materials.

4.6 Power Outage

During a temporary power outage, the following procedures will be followed:

- o The Weigh Master will manually enter the company, vehicle ID number, truck size and refuse type (under GROSS VEHICLE WEIGHT heading) by ID number. (See Temporary Scale Record Form - Exhibit 2)

- o Collection vehicles will proceed to the tipping building for unloading on the tipping floor.
- o Battery powered security lighting will be on.
- o Wheel loaders and other mobile equipment will turn on lights when operating within the building.
- o Personnel in the MRF Area will undertake cleanup operations while awaiting restoration of power.

5.0 FIRE PREVENTION AND CONTROL

Fire prevention and control is accomplished through the construction and maintenance of the MRF in compliance with codes and regulations of the State of North Carolina, County of Cumberland and City of Fayetteville and through proper personnel training. The processing building and equipment will be equipped with appropriate sprinkler systems. Smoking is not permitted in the tipping or MRF processing building.

Fire hydrants are located on-site. Lengths of fire hose are stored in areas adjacent to the tipping floor and MRF areas.

Fire extinguishers (A, B, C type) are maintained within the facility, office area, maintenance area and in the scale house.

A regular monthly inspection program of all firefighting equipment and systems will be conducted by the Plant Manager.

Communication systems and alarm systems will be tested on a monthly basis.

A fire training program will be provided by the local Fire Department.

Emergency Contact Information is to be posted by all telephones in the facility.

In the event of receipt of a 'hot load' of waste material, that is a load smoldering, smoking or burning, the procedure will be to immediately dump the load on a paved roadway. A front-end loader will be used to isolate the 'hot' material from the rest of the load. On-site fire fighting equipment (hose and fire hydrant) will be put into service. At the time of noticing the 'hot load', the local fire department will be notified.

6.0 FACILITY SHUTDOWN PROCEDURES

The facility will be shutdown at the end of each operating day in accordance with the procedures outlined.

6.1 Scale House

- Data recorded by the truck scale data management system will be down loaded to the MRF central data storage system by the Weigh Clerk.
- All daily transactions will be checked by the Weigh Clerk. Appropriate documents will be taken to the Plant Manager.
- The Scale House lights will be kept on for security purposes. The thermostat will be turned down to a lower heating setting or the air conditioning "off". The Scale House windows and door will be locked by the Weigh Clerk.

6.2 MRF Processing Building

Housekeeping

- The tipping floor will be cleaned first by a wheel loader bucket. Dry sweeping of the tipping floors and recovery areas will be conducted with sweepings picked up by square bladed shovels and placed into a wheel loader bucket. The bucket will be dumped into a roll-off container. The mobile sweeper will be used as required.

- The MRF and all Picking Stations will be swept with all sweepings placed into fork lift hoppers for transfer to a roll-off container.
- The RDF loadout area will also be swept, with sweepings picked up by a square bladed shovel and placed into a wheel loader bucket. The bucket will be dumped into a roll-off container. The mobile sweeper will be used as required.

Equipment

- Wheel loaders will be driven to the fueling area and the fuel tanks topped off with diesel fuel. They will then be driven to the tipping floor for parking overnight. The sweeper will also be parked on the tipping floor.

Security

- After all equipment is parked, the building will be secured. The rollup doors will be closed, emergency exit doors checked and lights turned off.
- Lights, thermostats and doors will be checked in the administrative area.

6.3 Site

Housekeeping

- The roadways and all work areas will be swept by the Elgin Sweeper. Fence lines will be visually inspected for litter and cleaned as necessary. The sweeper will operate daily on all facility roadways.

Equipment

- o Fueling equipment will be turned off and locked after all mobile equipment and tractor trailers are fueled.
- o Tractor trailers will be parked in the area designated near the scales. All other mobile equipment will be parked inside one of the facility buildings.

Security

- o After all employees exit from the facility, the main gate will be locked.
- o Security personnel will be on-site throughout all non-working hours.
- o Site lighting will be actuated by photocells to maintain a lighted site during night time hours.

7.0 FACILITY SECURITY

- Security will be provided by security staff personnel on a 24 hour per day basis, or at all times other than normal facility operating hours. Routine patrol of the site will be conducted. Check-in points or key stations will be installed throughout the facility and site.
- Fencing and locked gates will prevent unauthorized entry into the site during non-working hours.
- Site lighting will illuminate roadways and building entrances at night time.
- The fire sprinkler system will have an alarm to indicate if the system is actuated.

7.1 Facility Security

To assist with facility security, the following will be provided:

- Security by Fencing - To maintain control of access to the facility, the entire perimeter of the site is fenced. The only access point is through the main entrance gate in full view of personnel at all hours. The main entrance gates are to be closed and locked during non-operating hours.
- Security by Lighting - The entire site will be lighted during night hours by the grounds lighting system. Any light found to be out or improperly functioning is to

be repaired immediately. Lighting will be inspected on a daily basis.

- o Equipment Security - To protect the fleet of transfer tractor-trailers, all units are to be inspected before leaving the facility and again at the EGF site before returning to the MRF.

8.0 INSPECTION PLAN

The inspection plan is presented in tabular form. Major facility components are listed for the Scale House, MRF Building and Facility Site Improvements. Items to be checked and the frequency of inspection are presented.

Repairs or corrective actions required will be performed in accordance with equipment manufacturers recommended procedures. Copies of equipment maintenance procedures are included in the Appendices of this Manual.

All inspection records are to be maintained in a bound Inspection Log Book.

INSPECTION PLAN

FACILITY COMPONENT and ITEMS TO BE CHECKED/LOGGED and REPORTS MAINTAINED

Scale House

Truck Scales

- o Scale deck clearances; Daily Inspection
- o Loadcells, Data Management System, Scale Calibration; Manufacturers Requirements

Building Exterior

- o Roof, siding, foundation wall; Annual Inspection

Gutters

- o Clean out leaves, etc.; Annual Inspection (Fall)

HVAC

- o Furnace filters; Semi-annual Inspection
- o Controls/Components; Manufacturers Requirements

Noise Meter

- o Meter; Manufacturers Requirements

Fire Extinguishers

- o Proper Pressure; Monthly Inspection

First Aid Kit

- o Completely stocked; Monthly Inspection

Electrical System

- o Disconnect Boxes & Circuit Boxes; Semi-annual Inspection

MRF Building

Building Exterior

- o Roof, siding, foundation wall; Annual Inspection

Gutters

- o Clean out leaves; Annual Inspection (Fall)

Rollup Doors

- o Slats, door guides; Daily Inspection

Sprinkler System

- o Entire System; per Fire Department and manufacturer requirements; minimum monthly inspection

Fire Extinguishers

- o Proper pressure; Monthly Inspection
- o Operating condition; Monthly Inspection

First Aid Kits

- o Completely stocked/equipped; Monthly Inspection

Emergency Lighting

- o Battery packs; Monthly Inspection

HVAC

- o Filters; Semi-annual Inspection
- o Controls/Components; Manufacturer Requirements

Emergency Exit Doors

- o Proper Operation; Monthly Inspection

Electrical System

- o Disconnect Boxes, circuit breakers; Semi-annual Inspection

Communication and Alarm Systems

- o Indicators, horns, per manufacturers requirements; minimum monthly inspection

Site Improvements

Catch basins

- o Sediment; Semi-annual Inspection

Fence

- o Barbed wire, fabric, posts; Semi-annual Inspection and portions during litter patrol

Pavement

- o Cracking, settlement; During daily sweeping

Landscaping

- o Trees, shrubs; Monthly Inspection

Fuel Tank

- o Monitoring system operation; Semi-annual Inspection

9.0 MAINTENANCE PLAN

9.1 Purpose

The purpose of the plan is to establish maintenance procedures for providing a high level of assurance that the MRF operations are not unduly affected by malfunctions and adverse incidents. This plan is intended to be responsive to the results of inspection work performed under the Inspection Plan. To this end, if certain repeated deficiencies are noted during inspections, these deficiencies may be addressed as maintenance items by addenda to the maintenance plan, which concentrates on mechanical and electrical equipment.

9.2 Personnel

Maintenance will be performed by maintenance crew personnel, under the direction of the Lead Operator and Plant Manager.

9.3 Training

Maintenance training will take the form of meetings, maintenance run-throughs, discussions, and practice in filling out report forms. Training will be an ongoing process, reinforced by experience and by discussions with the Plant Manager.

9.4 Incident Prevention

A proper maintenance program assists in preventing environmental incidents. These incidents may be caused by malfunctioning electrical and mechanical equipment, the prime target of the maintenance program.

9.5 Malfunction Prevention

An effective maintenance program reduces electrical and mechanical malfunctions to a minimum, makes the working environment safer, and saves significant downtime in the long term.

9.6 Failure Analysis

In standard industrial practice, various system failure analytical methods have evolved over the years. For the purpose of evaluating the MRF operations, the Failure Modes and Effects Analysis (FMEA) method has been selected. This method is qualitative in nature and can be diagramatically presented. The FMEA chart for the facility is presented as Figure 3.

The FMEA indicates various failures that can occur due to a variety of causes including breakdowns, inclement weather, accidental damage, and a shortage of RDF transfer trailer vehicles.

The result of these major component failures can be either stoppage of the facility or an increased potential for accidental damage. Neither of these results is acceptable. The maintenance plan must be implemented in a manner that reduces or prevents the possibility of failure of any of the system components. A discussion of the component failures follows:

o Access - The site access point must be controlled to prevent unauthorized access, and to promote smooth vehicle flow. Inclement weather, breakdown of traffic control, or damage to traffic control devices may cause a failure of this system component. A failure will result in loss of access control and a reduction in traffic control. In this event, there is an increased risk of accidental damage. Site access will be subject to maintenance which will keep signs, gates, locks and traffic control systems in order.

- Weighing - Weighing will not be accomplished if no refuse is available. The weighing system may fail due to scale breakdown or damage or computer management system failure. The scale and computer system will be carefully maintained in strict accordance with manufacturers recommendations. Spare parts will be maintained and a service agreement with the vendor will be in place.
- Direction - Once on-site and weighed, vehicles must be directed by traffic control to the appropriate tipping floor bay area. A loss of control or loss of traction on the pavements will result in an increased potential for accidental damage. Pavement will be maintained and signs will be maintained and repaired if damaged.
- Approach and Bays - The approach and bay areas will be subject to the same failure potentials, and therefore the same maintenance procedures, as the direction component.

- Discharge - Refuse discharge may experience failure due to a lack of incoming refuse, accidental damage or breakdown of equipment. In order to reduce the stoppage potential, the facility equipment will be maintained and repaired.
- Holding - The refuse holding function may fail due to a lack of RDF transfer trailers available to load, due to breakdowns or damage to the mechanical Processing and loading equipment, or due to emergencies such as fire. In order to reduce this failure potential, alarms, fire protection systems, and all RDF transfer and processing equipment will be maintained and repaired if damaged.
- Processing, Recovery and Transfer - The processing, recovery and transfer operation may fail due to breakdown, damage or lack of RDF transfer or product trailers. Lack of trailer failure causes have been addressed previously. The breakdown and damage of equipment will be dealt with by maintenance and by damage repair.
- Departure - Prior to departing, the RDF transfer trailer or product trailer will be inspected and covered. At that point, the vehicle will be subject to the same failure potentials and the same maintenance procedures as discussed for approach.
- Direction - This component is equivalent to that previously discussed for Direction.
- Weighing - This has been discussed previously as incoming vehicle Weighing.

- Egress - This component is equivalent to that discussed for Access.
- Trailer Transit - This component may fail due to vehicle breakdown, inclement weather, road hazards, accidents or difficulties encountered at the end user or disposal site. Vehicle preventative maintenance and the correct outfitting of vehicles will make them more roadworthy in poor weather and will reduce the accident and breakdown potential.
- Emergency Operations - In the event of a natural disaster such as a hurricane or flood, it is possible that operations would be impaired. If an event occurred or appeared imminent, no additional waste would be accepted by the facility. Bypass waste would go directly to the adjacent sanitare landfill. Loadout of waste already in the facility could be accomplished by staging transfer trailers on the tipping floor and loading them with front-end loaders. Alternatively, the existing balers which will be maintained on standby could be activated to bale the solid waste. Emergency standby generators are maintained on-site in the event of an extended power outage.

9.7 Spare Parts Inventory

The spare parts inventory will include parts and supplies as are needed for all components of the MRF operation. Contingency items, parts for the wheel loaders, conveyors, magnetic separator, trommels, eddy current separator, balers, compactors, transfer trailers and parts for the scales are included as recommended by the manufacturers. Other parts and materials to be inventoried are as follows:

- o Access, Traffic Control, Security - Spare parts to be inventoried include keys and locks, bulbs and reflectors, signs and various switches. If mechanical damage occurs to major components such as gates or light poles, purchases will be made at the time of damage to facilitate repair.
- o Vehicles and other equipment - Spare parts include supplies and parts needed to keep the vehicles and other equipment operational and includes maintenance supplies such as air filters and oil filters, belts, rollers, bearings, etc. as well as lubricants.
- o Alarm, Communication and Power Systems - Spare parts include smoke detectors, batteries, flasher and alarm lights and, reflectors, fuses, circuit breakers, various switches and wire stock.
- o Fire Protection Systems - Spare parts include some replacement piping and fittings, various solenoid and other valves and packing, sprinkler heads, equipment and supplies required by code and considered to be in accordance with good practice as determined in conjunction with local fire department personnel.

9.8 Anticipated Repairs

Repairs anticipated for the facility operation have been identified and considered as part of the FMEA. Facilitation of repairs consists of proper spare parts inventory, maintenance crew and select agreements for occasional off-site support.

Operation and Maintenance Manuals for all facility equipment are included in the Appendices of this O&M Manual.

9.9 Record Keeping

Checklist forms will be utilized to maintain maintenance records. These forms will be based upon the equipment maintenance needs, and will be done in concert with the Inspection Plan. Inspection and maintenance efforts will form a check and balance system that will be complementary and mutually supportive. In the case of damage repairs, a special record describing the damage and subsequent repair will be kept. In the case of off-site support needs, a descriptive record will also be kept. These records and the routine checklist forms will be maintained in a permanent file.

9.10 Maintenance Schedule

Maintenance schedules will be in accordance with procedures set forth by the various manufacturers as included in the maintenance manuals supplied for the equipment. These are included in the Appendices of this document.

10.0 FACILITY STAFFING PLAN

All employees must complete an Employment Application Form Exhibit 4, and be interviewed by the Plant Manager and President prior to employment. Upon being hired, the first day on the job, each employee will attend a mandatory orientation session in the on-site plant office. During orientation, employees will receive instructions on all plant operational procedures and be advised of all rules to be followed during routine and emergency operating situations. Ongoing monthly safety meetings and specialized training sessions, e.g. for the proper identification and handling of hazardous or potentially hazardous materials will be conducted. (See Section 11.0).

Employee wages and benefits are to be set using local prevailing wage rates and benefits as a guideline.

Job descriptions for each employee position are included as Exhibit 5.

Staffing for the MRF is estimated as follows:

Plant Manager	1
Assistant Plant Manager	1
Transportation Manager	1
Scale Clerk	2
Lead Operator	2
Front End Loader Operator	2
Pickers	16
Maintenance	3
Maintenance Helper	3
Forklift Operator	2
Truck Drivers	4

11.0 TRAINING PLAN

The personnel training program is directed by the Plant Manager. During the training program, employees are instructed in:

- Worker Safety and Health
- Safety Equipment
- Facility Operations
- Facility Maintenance
- Noise Monitoring
- Potential hazards and adverse environmental impacts associated with handling municipal solid waste.
- Monitoring of incoming waste materials.
- Identification and proper handling of unacceptable or potentially hazardous wastes.
- Proper handling and storage procedures for all waste types, including suspected hazardous substances.
- Fire Safety Procedures
- Emergency Procedures and the Emergency Contingency Plan.
- Record Keeping for inspections, maintenance and tests for appropriate personnel.

Training will be conducted on a continuous basis as part of monthly safety meetings. New employees will receive initial training as part of the orientation program.

As each employee completes the training program, a Certificate of Completion will be prepared and made part of the personnel records file.

Equipment supply companies will provide training for all equipment operators. Classroom training as well as actual operator training will be conducted at equipment company sites by qualified personnel. All equipment operators undergo such training prior to operating MRF equipment.

All personnel will receive training in the proper identification and safe handling of hazardous or suspected hazardous materials. Training will be conducted by personnel from a qualified firm.

Truck drivers, mechanics and equipment operators will undergo training provided by appropriate companies.

The local Fire Department will provide a fire safety training program.

All truck drivers and mechanics will be instructed by the truck vendor.

Computer training for office and scalehouse personnel will be provided by the vendor.

12.0 SAFETY PLAN

All plant operating and maintenance personnel will be provided with:

Hard Hats

Gloves

Safety Shoes/Boots

Safety Goggles

Dust Masks

Hearing Protectors

Uniforms

Other Safety equipment as specified tasks require

At the time of initial employee training and as followed up during monthly safety meetings, personnel will be knowledgeable and familiar with all safety and emergency procedures, equipment and emergency systems and procedures necessary to respond to such situations. These include:

- o Procedures for using, inspecting and replacing all emergency equipment.
- o Procedures for using communication equipment and alarm systems.
- o Procedures for responses to spills, fires, etc.
- o Procedures to follow in the event the facility must be shut down or evacuated due to an emergency, including evacuation routes.

All employees will be familiar with the Emergency Contingency Plan (Section 14).

All employees will know the local telephone number to report Fire or other Emergencies.

13.0 WASTE INSPECTION AND CONTROL PLAN

As has been indicated throughout this Manual, incoming waste is to be constantly inspected for suspected hazardous or unacceptable waste materials. The emphasis to this point has been on potentially hazardous materials.

The MRF's main function will be to recover paper, plastics, aluminum, ferrous metals and RDF from commercial and householdwastes. To insure maximum recovery of these materials, inspection employees and picking personnel will be trained in every aspect of identification and proper routing of recoverables to the designated recovery areas.

Potentially hazardous wastes will be stored in a roll-off container until inspected and removed by a licensed hazardous waste transportation and disposal firm under contract to the facility.

Acceptable waste is limited to mixed municipal solid waste from commercial and residential generations. Only material delivered in solid waste collection vehicles will be permitted to utilize the facility.

14.0 EMERGENCY CONTINGENCY PLAN

The NC DEHNR Facility Permit requires: A Contingency Plan which delineates procedures for responding to various emergencies. Copies of the contingency plan shall be submitted to the local police and fire departments, hospital, and the local and county emergency response agencies.

The local Police, Fire Department and Health Officials have the right to immediate access to the facility. The Emergency Coordinator is the Plant Manager. Secondary Emergency Coordinator is the Assistant Plant Manager.

14.1 Fire

It is envisioned that the possibility of a fire could occur at any of the following locations:

1. In Haulers or MRF Vehicles prior to entering or after leaving.
2. In Haulers Vehicles on the Tipping Floor.
3. In Waste or Recovered Products within the MRF Building.
4. In MRF Transfer Vehicles in the Loadout Area.
5. In MRF Transfer Vehicles while en route to the EGF.

In case of fire event at locations 1 through 4, immediate notification procedures and actions to be taken are as follows:

Call Local Fire Department

Call NC DEHNR Regional Office

Actions: Location 1. Vehicles should discharge load onto a paved roadway. A front-end loader will be dispatched to spread the load to isolate material and reload after material is extinguished. If on-site, hoses and fire hydrants to be utilized. Locations 2 and 4, vehicles exit building and discharge load on paved roadway. Front-end loader and other procedures same as for 1. Location 3, front-end loaders isolate material while on-site hoses are used to quench material.

In case of fire event in MRF Vehicles en route to the EGF, driver of the vehicle is to immediately use the in-truck radio to call the MRF Base. MRF Base is to immediately notify the Emergency Unit in the Local Community where truck is at the time. All MRF vehicles will be equipped with hand held fire extinguishers.

14.2 Floods

In the event of flooding in the area of the facility, access to the site could be impaired.

In the event of access road flooding, operations will be curtailed.

In the event of floods or events which would impair facility operation for more than 1-day, the NC DEHNR will be notified.

14.3 Hazardous Substance Discharges

The facility is not permitted to handle hazardous wastes of any kind. This, however, does not preclude the possibility that some hauler may knowingly or unknowingly deliver a hazardous material to the MRF. As a safeguard against this, and to minimize the potential:

- o Any vehicle suspected of carrying hazardous materials is to be pulled out of line and inspected by MRF trained personnel.
- o If personnel find any evidence of a possible hazardous substance, the vehicle will not be allowed to unload and the NC DEHNR will be notified immediately, giving full particulars of the situation.
- o If a vehicle reaches the tipping floor and during the process of unloading, it is discovered, that a hazardous or suspected hazardous substance has been discharged, the material will be isolated in the designated area. The NC DEHNR is to then be immediately notified.

To provide protection in the event of a spill, absorbent materials including sand and speedi-dri will be stored on-site in bags. A minimum of 500 pounds of each will be maintained. In addition, a roll of 4-mil polyethylene sheeting will be maintained on-site.

14.4 Peak Loadings

Due to various reasons, the facility may experience waste loadings in excess of the 900 tons per day average. Such peak loadings may result due to seasonal fluctuations, waste collection delays as a result of snowstorms or hurricanes, as well as potential emergency events. The facility has a maximum design capacity of 1800 tons per day.

In the event of peak loadings exceeding 1800 tpd, on-site working hours may be extended and personnel may be required to work overtime. Outside transfer trailer and dump trailer operators under agreement with BCH to provide standby equipment and hauling services are to be notified by the Plant Manager to assuure that required equipment is available.

In the event of backup of incoming waste at the facility, no waste will be unloaded unless there is room on the tipping floor. Incoming collection vehicles will be staged on-site until they can be unloaded in the building. In the event of inability to unload waste in the facility, trucks may be directed to bypass the facility and proceed directly to the Cumberland County Sanitary Landfill.

14.5 Evacuation Plans

Evacuation of the facility would be required in the event of a life-threatening emergency such as fire, explosion, major hazardous substance release or other public safety emergency either on the site or in the immediate vicinity. Depending on the nature of the emergency, incoming waste vehicles would be directed to the back-up landfill, all equipment would be parked and shut down as quickly as possible. The Emergency Coordinator would provide instructions via the internal plant radio system. Non-essential personnel, or all personnel would be directed to a designated off-site secure area as directed by the Emergency Coordinator.

14.6 Amendments

Amendments to the Contingency Plan will be submitted to NC DEHNR, as well as the local police, fire and emergency response agencies whenever facility changes are made which modify the operation or have any impact on emergency preparedness, or in the event of key personnel changes.

14.7 Emergency Services Contacts

OPERATIONS & MAINTENANCE MANUAL

FOR THE

BCH ENERGY LIMITED PARTNERSHIP

RDF-FIRED

ENERGY GENERATION FACILITY

BLADEN COUNTY, NC

DRAFT
OCTOBER 1992

NOTE: This Draft O&M Manual is for a typical atmospheric fluidized bed combustion system and is not site and vendor specific for the proposed BCH Energy Facility.

DRAFT

OPERATIONS & MAINTENANCE MANUAL

INTRODUCTION

This Manual has been prepared to serve as a guide in understanding and conducting various operations of the Energy Generation Facility and to provide assistance in operator training and familiarization.

This Manual consists of the following sections:

1. Safety Instructions
2. Theory of Operation
3. System and Subsystem Description
4. Operating Procedure
5. Maintenance
6. Vendor Data List

The entire facility is composed of many components manufactured by vendors other than the fluid bed combustor supplier. This Manual does not include details of the operation, maintenance and safety aspects of those components; the appropriate vendor data should be consulted in conjunction with information contained herein.

Conventions Followed In This Manual:

NOTE: *This is the format used for a note. Notes provide information that is of special importance to assure proper operation and maximum benefit from the equipment being described.*

CAUTION!

THIS IS THE FORMAT USED FOR A CAUTION MESSAGE. A CAUTION MESSAGE CONTAINS INFORMATION THAT IS CRITICAL TO SAFE OPERATION OF THE EQUIPMENT. IF CAUTIONS ARE NOT OBSERVED, EQUIPMENT MAY BE DAMAGED AND AN UNSAFE CONDITION MAY DEVELOP.

WARNING

THIS IS THE FORMAT USED FOR A WARNING MESSAGE. A WARNING MESSAGE CONTAINS INFORMATION THAT MUST BE OBSERVED TO PREVENT SERIOUS INJURY OR POSSIBLE DEATH OF OPERATING AND MAINTENANCE PERSONNEL.

1 IMPORTANT SAFETY CONSIDERATIONS

This manual section discusses safety considerations associated with the operation and maintenance of EPI supplied equipment and provides guidelines which should be followed to minimize risk to personnel. Throughout this manual, various references are made to equipment and operations which can be hazardous to plant personnel if they fail to take necessary safety precautions when performing operation and maintenance activities. It is important that the safety considerations described here for EPI supplied equipment be incorporated into an overall plant safety policy.

This safety information is believed to be accurate as of the date of issue, but is offered without guarantee. Conditions of use and suitability for use are beyond EPI's control: therefore, all risks associated with the use of the product are assumed by the user. EPI assumes no responsibility for any injuries or damages caused by the product even if safety procedures are followed as outlined herein. It is the responsibility of the plant management to provide adequate safety information for particular hazards.

Caution and warning signs are posted wherever practical. These warnings should be observed at all times. This is a list of potentially dangerous areas:

1) The fuel handling system (shredder, storage bins, metering bins and conveyors)

2) Bed cone access doors

3) Vibrating conveyor access doors

4) Combustor viewports

5) Access doors to the flue duct

6) Access doors to the combustor

7) Access door to the preheater

8) All rotating equipment

9) Access doors to the bucket elevator

10) Areas with high voltage equipment or power supplies

11) Hot surfaces (steam lines, high pressure hot water)

12) Areas handling bed and tramp material

12) Access door to the boiler

14) Access door to the economizer

15) Access doors to the FD and ID fans

16) Access doors to the baghouse

17) Access doors to the stack

18) Screw conveyors

EPI cannot possibly foresee all hazards which may occur; therefore, the burden of safe operation and maintenance ultimately falls upon those who are involved in such activities. Equipment that is idle may start up at any time automatically, without warning. It is the responsibility of the individual maintenance person or operator to be aware of the safety aspects and to LOCK-OUT equipment before performing maintenance or other functions in or around the equipment.

1.1 GOOD SAFETY PRACTICES

- ❑ Work in pairs.
- ❑ Open any access door carefully to prevent hot dust, ash, or other material from falling on you.
- ❑ Notify someone in charge that you are going inside the equipment.
- ❑ Make sure that equipment you are working on is locked out so that it does not start automatically while you are working on it.
- ❑ Be sure that you can get in and out of the access door quickly and easily.
- ❑ Before entering any confined space, be sure that the air quality is adequate for breathing.
- ❑ Be sure that there is solid, safe footing inside the equipment.
- ❑ Be sure that ash deposits and other materials are cool enough to touch.
- ❑ Use a protected light when inside the equipment.

1.2 PERSONAL SAFETY DEVICES

Operators and maintenance personnel should give careful consideration to their personal safety by having and using the following protective equipment:

1) Eye protection

2) Hard hat

3) Steel toe shoes

4) Fire resistant gloves for working around hot surfaces

5) Ear protection

6) Respiratory protection for working around fuel, bed material, ash handling and storage equipment, and other dusty environments

Make sure that each item of personal safety equipment meets all OSHA, state, and local safety requirements.

1.3 HAZARDOUS MATERIAL

It is the responsibility of the plant to provide adequate protection for personnel exposed to hazardous materials. Material Safety Data Sheets (MSDS) are available from material suppliers and should be kept on file at the plant. It is the employee's responsibility to be aware of and read all "Material Data Safety Reports" on hazardous materials posted by the employer.

1.3.1 Bed Material

Dust from the bed material is hhzardous to the lungs and care should be taken to prevent inhalation. Always wear a dust mask or respirator when working in a dusty environment. Bed material is an eye irritant, and contact with the skin, eyes, or mucous membranes should be avoided. Refer to the Material Safety Data Sheets (MSDS) in the appendix of this manual.

1.3.2 Limestone

Limestone dust is hazardous to the lungs and inhalation of it should be avoided. Always wear a dust mask or respirator when working in a dusty environment.

1.3.3 Boiler and Water Treatment Chemicals

A variety of chemicals may be used to treat the water for the steam generation system. Some of these chemicals may be strongly alkaline and may cause severe burns if they are allowed to contact the skin, eyes, or mucous membranes. Some of these chemicals may produce strong fumes and require the use of a respirator. Chemicals in dry, powdered form may create a dust hazard, so eye protection and a dust mask may be required. Always wear eye protection, appropriate gloves and protective clothing when handling hazardous chemicals. In all cases, be sure to consult the chemical manufacturer's Material Safety Data Sheets (MSDS) before handling any chemical.

1.4 FIRE HAZARDS

The area around the combustor and boiler should be periodically cleaned to prevent the accumulation of combustible material that might be ignited by heat or sparks escaping from the combustor. The combustion system must be periodically inspected for leaks which could create a fire hazard.

Care must be taken to keep the fuel processing building and equipment clean and free from fuel dust particle build up. When fuel is being shredded, accumulated dust may become a fire hazard, or even possibly an explosion hazard if enough fuel dust becomes airborne and an ignition source is present. Spontaneous combustion may occur if piles of fuel become wet or oil-soaked and lay undisturbed for a period of time. The

best fire protection is good housekeeping practices. Fuel dust should be removed and a general clean-up performed periodically.

Always keep fire fighting equipment available and in good condition.

1.5 WARNINGS

Operation and maintenance procedures must be performed on equipment and in situations where a hazard may exist if safety precautions are not observed. Throughout the operation and maintenance sections of this manual, warning messages are posted to alert personnel to observe special safety precautions. The format of these warning messages is as follows:

⚠ WARNING

THIS IS THE FORMAT USED FOR A WARNING MESSAGE. A WARNING MESSAGE CONTAINS INFORMATION THAT MUST BE OBSERVED TO PREVENT SERIOUS INJURY OR POSSIBLE DEATH OF OPERATING AND MAINTENANCE PERSONNEL.

*To insure that **all** operation and maintenance personnel are aware of **all of these warnings**, they are collected from throughout this manual and reproduced on the following pages. All personnel should read each warning on the following pages and each manual section where these warnings appear in context to insure that these precautions are observed.*

WARNING

NEVER DISCONNECT, BYPASS, OR ELIMINATE ANY SAFETY DEVICES. SEVERE EQUIPMENT DAMAGE, PERSONNEL INJURY, OR DEATH COULD RESULT.

NEVER PERFORM WORK ON OR ACCESS ANY DRIVEN EQUIPMENT WITHOUT FIRST LOCKING OUT THE POWER SOURCE.

BECAUSE OF THE DANGER OF ELECTROCUTION, ONLY QUALIFIED PERSONNEL SHOULD BE ALLOWED TO OPEN ELECTRICAL ENCLOSURES. THESE ENCLOSURES MAY CONTAIN VOLTAGES FROM MORE THAN ONE POWER SOURCE; THEREFORE, THE APPROPRIATE DRAWINGS AND VENDOR DATA SHOULD BE CONSULTED BEFORE ANY WORK IS PERFORMED.

TO AVOID HEARING DAMAGE AND DEAFNESS, WEAR ADEQUATE EAR PROTECTION WHEN IN THE VICINITY OF FANS, BLOWERS, PUMPS, AND OTHER EQUIPMENT WHICH EMITS LOUD SOUNDS.

MANY SURFACES THROUGHOUT THE SYSTEM ARE HOT. AVOID CONTACT WITH HOT SURFACES SEVERE BURNS CAN RESULT.

WARNING

DO NOT ACCESS ENCLOSED OR CONFINED AREAS DURING OPERATION. SEVERE INJURY OR DEATH CAN RESULT.

LACK OF COMBUSTION AIR MAY CAUSE VOLATILE GASES IN THE BOILER AND COMBUSTOR TO ACCUMULATE TO DANGEROUS LEVELS AND CREATE EXPLOSIVE CONDITIONS. AN EXPLOSION COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL AND EXTENSIVE EQUIPMENT DAMAGE.

THE PREHEAT BURNER START PURGE TIME OF THREE (3) MINUTES IS A MINIMUM AND SHOULD NOT BE REDUCED. INSUFFICIENT PURGE TIME CAN PERMIT EXPLOSIVE COMBUSTION OF VOLATILE GASES CAUSING SEVERE EQUIPMENT DAMAGE AND INJURY OR DEATH TO PERSONNEL.

PRIOR TO ENTERING AN AREA CONTAINING REFRACTORY OR SLAG, VERIFY THAT NO LOOSE PIECES OF REFRACTORY OR SLAG THREATEN TO FALL. SEVERE INJURY OR DEATH COULD RESULT IF PERSONNEL ARE STRUCK BY FALLING PIECES OF REFRACTORY OR SLAG.

⚠ WARNING

DO NOT ATTEMPT TO WORK AROUND THE BED CHANGEOUT SYSTEM WHILE IT IS OPERATING OR HOT. SEVERE BURNS OR INJURY FROM MOVING PARTS COULD RESULT. ALWAYS DISCONNECT AND LOCK OUT THE POWER AND AIR SUPPLY BEFORE WORKING ON THE SYSTEM.

INSURE THAT POSITIVE PRESSURE DOES NOT EXIST BEHIND ACCESS DOORS PRIOR TO OPENING. CONTACT WITH HOT GASES AND OTHER MATERIAL COULD CAUSE INJURY OR DEATH TO PERSONNEL.

DO NOT ENTER CONFINED SPACES UNLESS THE AIR TEMPERATURE INSIDE IS TOLERABLE AND THE AIR IS BREATHABLE.

NEVER ACCESS THE ASH SYSTEM WHILE IT IS HOT OR WHEN IT CONTAINS HOT ASH. WEAR PROTECTIVE CLOTHING WHEN WORKING WITH HOT ASH.

WARNING

NEVER ATTEMPT TO LOCATE PRESSURIZED LEAKS WITH YOUR HAND, ARM, OR ANY OTHER BODY PART. SEVERE INJURY OR DEATH COULD RESULT.

DO NOT OPERATE ANY EQUIPMENT WITHOUT PROPER GUARDS IN PLACE.

FAILURE TO INSPECT AND MAINTAIN STRUCTURAL SUPPORTS, INCLUDING PIPING SUPPORTS, COULD RESULT IN CATASTROPHIC FAILURE, INJURY, OR DEATH.

2 THEORY OF FLUIDIZED BED COMBUSTION

2.1 INTRODUCTION

The AFBB (Atmospheric Fluid Bed Burner) utilizes a heated bed of sand suspended (fluidized) within a rising column of air to burn many types and classes of fuel. This technique results in a vast improvement in combustion efficiency of high moisture content fuels, and is adaptable to a variety of "waste" type fuels. This type of fuel ranges from wood product waste (hog fuel) to refuse derived fuel. The combustion products from the burner, in the form of a hot gas, can be adapted for use in various plant processes.

A basic understanding of the factors involved in the combustion of various fuels in a fluidized bed incinerator and how they interact with each other is essential for the successful operation of the AFBB system. This section summarizes theories of basic combustion and overall system operation.

2.2 COMBUSTION OF A FUEL PARTICLE

Fuels which are burned in a fluidized bed normally contain water, part of it "bound" in the structure of the fuel particle, and the remainder of it "free" or clinging to the outer surface of the particle.

Before any fuel particle can be ignited and burned, all the free water must be evaporated from the surface, and most of the "bound" water must be driven off. While this is happening, the particle stays relatively cool, approximately 200°F. The rate at which the particle dries is largely dependent upon the particle size and the temperature of the gas surrounding it.

After the water has been driven off as steam, the temperature of the particle rises rapidly and the combustible volatile components are boiled out as a gas. These volatiles represent a major portion of the heating value of fuel. They may burn either in the fluidized bed or in the vapor space above the bed, depending upon where they were generated and the availability of air required to complete the combustion reaction.

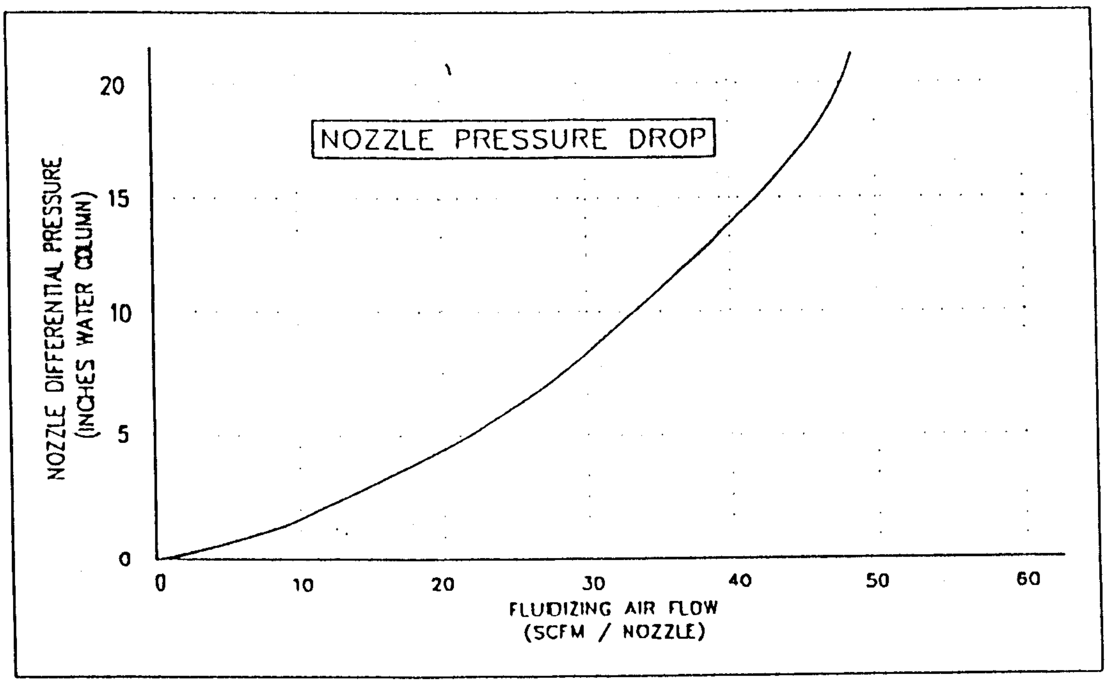
After both the water and volatiles have boiled off the fuel particle, the remaining material is charcoal. The larger particles of charcoal burn more slowly than the volatile material and ordinarily, due to their mass, burn in the fluid bed. The smaller particles may burn either in the bed or in the vapor space, depending upon their mass, and upward velocity of the combustion products in the combustion cell.

2.3 THE FLUIDIZATION PROCESS

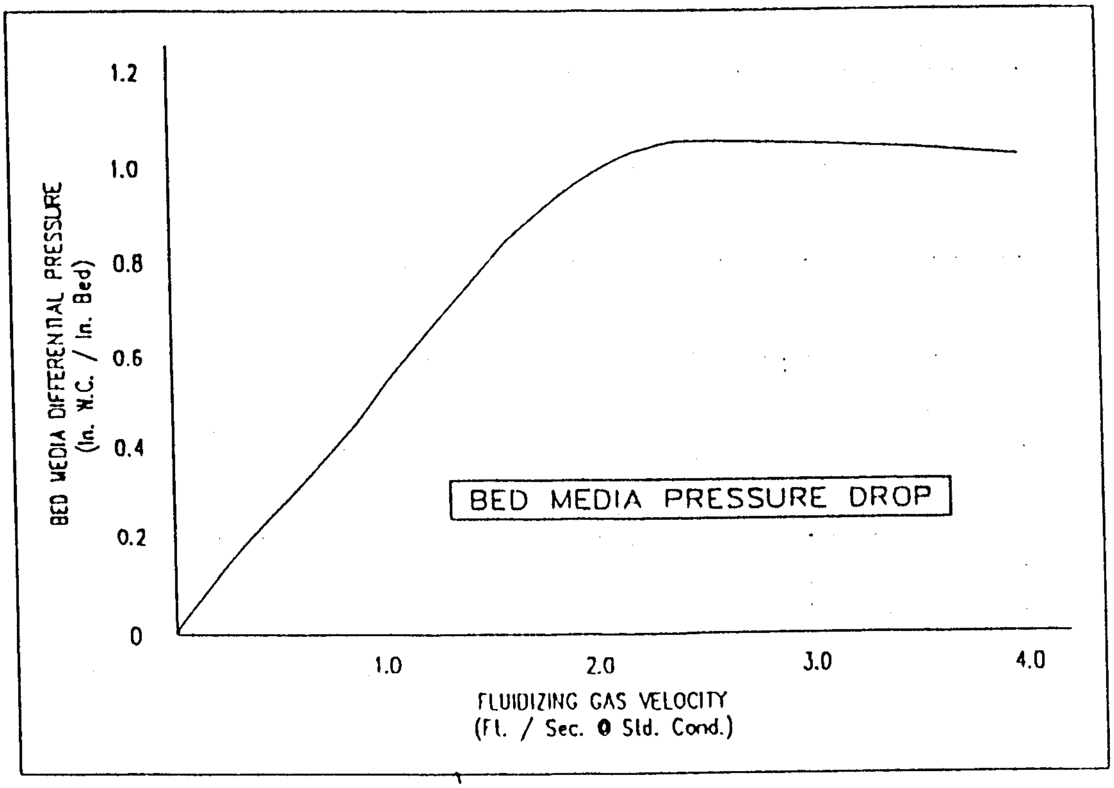
In order for a fluid bed to operate properly, the gas passing upward through the bed material must be at some minimum velocity. The required velocity is dependent upon the size, shape and density of the bed material.

The bed material depth, in expanded, or fluidized, condition, increases to about 1 1/2 times its static depth. As the fuel is distributed over the surface of the expanded bed, the heavier particles sink below the surface, becoming mixed with hot bed material and ignited, thereby giving up energy to maintain the bed temperature. Scrubbing action of the bed material on the fuel particle enhances the combustion process by stripping away the carbon dioxide and char layer which normally forms around the fuel particle. This allows the oxygen to reach the combustible material much more readily, thus increasing the rate and efficiency of the combustion process. The lighter fuel particles may burn on the surface of the bed or may be carried upward by the raising gases in the vessel to be consumed in the vapor space.

Lower gas velocities are required for a bed of small, light particles than would be required for a bed of large, heavy particles. For any given bed material, theoretical minimum gas velocity for fluidization can be determined. Gas velocities which greatly exceed the minimum value required for fluidization do not necessarily improve operation. In fact, excess gas velocities may cause localized spouting, excessive bed material carryover, and a residence time which is too short for proper combustion to take place. All these conditions reduce the effectiveness of the fluidized bed as an aid to combustion.

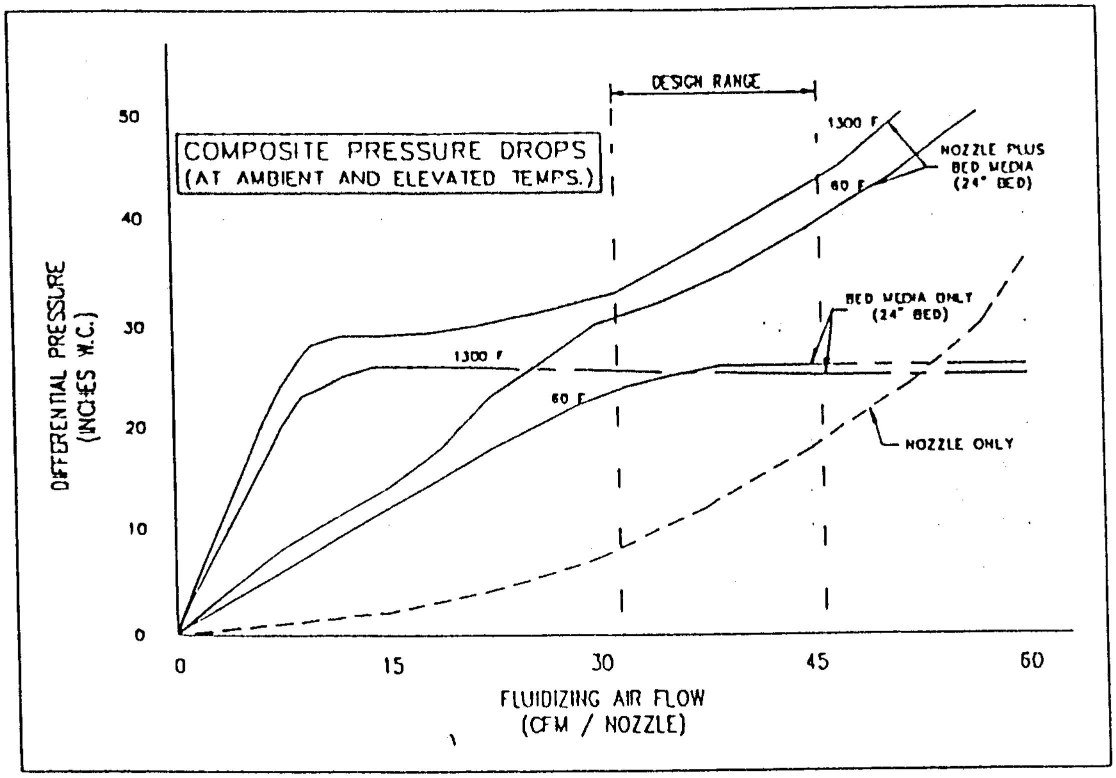


This graph depicts the air flow versus the nozzle differential pressure in a typical fluidized bed system. A nozzle pressure drop of about 8-12" WC is required to ensure an even distribution of air flow across the total bed area, based on a bed depth of 18 to 24 inches above the nozzles.



This graph depicts the typical relationship between fluidizing velocity and air pressure drop across the bed material. The straight section of the curve shows that the pressure drop across the bed material increases almost linearly with air flow, up to about one inch WC per inch of bed depth. In this region, the air velocity is insufficient to overcome the weight of the bed material and the bed material remains in a static (motionless) state. The air is simply percolating up through minute voids which exist between the particles of bed material. At a velocity of about 2.25 feet per second, the pressure drop no longer increases linearly with flow. The particles are now being lifted by the upwardly moving air, resulting in the voids between the particles increasing in size to accommodate the additional air flow. At this point, each particle of the bed material is suspended in the air stream and is free to circulate much like water. This is the condition referred to by the term **fluidization.**

An important point to note is that the knee of the curve represents a definite air flow in pounds per unit time. This minimum air flow value also corresponds to a definite fuel feedrate needed to produce a given amount of energy at a given temperature. This minimum amount of energy represents the maximum turndown obtainable from a fluidized bed. An air flow which is less than the minimum fluidizing velocity will not provide adequate mixing of fuel with bed material. The bed material will then become static, with ambient air percolating up through it which rapidly cools the bed material below combustion sustaining temperatures.



This graph depicts the effects of different conditions on the fluidization process. The **NOZZLE ONLY** curve shows the pressure drop across the nozzles (in inches WC) versus the fluidizing air flow (in CFM per nozzle). The **BED MEDIA ONLY** curves show the pressure drop measured across 24 inches of bed material (above the top of the nozzles) at two different air temperatures, 60°F and 1300°F, respectively. The difference in these two curves illustrates the effect of bed temperatures on minimum fluidizing air flow. Fluidization occurs at a much lower air flow at the higher temperature.

The **NOZZLE PLUS BED MEDIA** curves are generated by summing each point on the **NOZZLE ONLY** curve with each point on the **BED MEDIA** curves. Thus, the curves show the relationship of total bed differential pressure (measured from the inlet vessel plenum upstream of the nozzles to the upper combustion cell above the active bed). Note the difference in minimum air flow (the knee of the curves) required to achieve fluidization at the two different temperatures.

It is important to remember that the total volume of air that is being blown by the forced draft (FD) fan is only one of the many factors involved in establishing optimum air velocity required for fluidization of the bed material. During normal operation when the bed material is at high temperature, heat is transferred to the air as it passes up through the bed material. As the air is heated, it expands, thus increasing in volume. This increase in volume results in a higher air velocity, as much as three to four times that occurring in a cold bed, particularly in the upper regions of the bed material. It is therefore possible to maintain optimum bed material fluidization with less air from the blower when the bed is hot than when it is cool.

The outside ambient air temperature will affect the density of air pumped by the main blower at a given damper position. Since density of the air is greater at lower temperatures, the proper fluidizing air damper setting for a 90°F summer day will generally provide excessive air flows on a 20°F winter day.

Under normal operating conditions, the actual air flow through the bed may be less than the theoretical air necessary to burn the fuel. Therefore, additional air is supplied to the combustion space above the bed to ensure that complete combustion occurs.

A portion of the additional overfire air required enters with the fuel from the fuel chute at a relatively constant rate. The remainder must be injected through the overfire air system.

2.4 RATIO OF AIR TO FUEL

Many types of biomass fuels have nearly the same fuel composition, therefore, require about the same amount of air for complete combustion. The combustion air is normally a mixture of oxygen (21 percent by volume), and nitrogen (79 percent by volume), with trace amounts of other gases.

When fuel burns, the oxygen is consumed, leaving a flue gas comprised of nitrogen, a small amount of oxygen and the combustion products, carbon dioxide and water. If exactly the right amount of air is used, there will be no oxygen left in the flue gas. This amount of air is referred to as **theoretical air.** Any extra air available over the theoretical air required for combustion is called **excess air.** In actual practice, no combustion processes are carried out using theoretical air, regardless of the fuel being burned (coal, oil, gas, RDF, wood, agri-waste, etc.). Some excess air is always used to ensure that the fuel is burned as completely as possible.

2.5 EFFECT OF WATER ON AIR/FUEL RATIO

The water content of the fuel being burned has a large effect on the amount of air needed to burn it. The amount of air required is directly proportional to the ratio of the bone-dry fuel content to the wet weight of fuel. For example, 50 percent water fuel requires only half as much air per pound of fuel as does bone-dry fuel since there is only half as much dry fuel per pound after it is dried.

Under carefully controlled conditions in a small fluid bed system, it is possible to burn fuels containing more than 65 percent water (wet basis). However, in production units, it becomes increasingly difficult to maintain good combustion conditions as the water content of the fuel increases over 55 percent. The allowable water percentage also depends on the fuel particle size. Since small particles have less residence time in the bed, combustion of these particles is less successful when the moisture content is high.

As water content of the fuel increases several changes in the combustion process take place:

1) The additional water must be boiled off before the dry combustible material can ignite and burn.

2) Less dry combustible material is available per pound of fuel to provide the heat necessary to boil off the water.

3) The total amount of air required for combustion of the fuel (on a pound-per-pound basis) decreases.

The combination of these factors normally results in a decrease in operating bed temperature in relation to fuel moisture content. Vapor temperatures will also decrease during this period, but not as rapidly as the bed temperature.

The amount of air required to burn fuel is strongly dependent upon the water content on a pound-per-pound basis. As the water content increases, more pounds of wet fuel must be burned to produce the energy required by the plant process. The end result, at a constant energy requirement, will be a relatively large increase in the fuel feedrate as the water content increases, with a smaller increase in total air flow requirements, based more on the change in the equivalent bone-dry fuel feedrate.

2.7 LIMESTONE ADDITIVE

Limestone is mixed with the fuel and introduced into the fluidized bed to reduce SO_2 emissions. The limestone reacts with the sulfur in the fuel and produces calcium sulfate, which is captured and removed as ash or remains in the bed. The action of the limestone also reduces slagging in the combustor bed material and boiler tubes by raising the ash softening temperature of certain fuels.

Fluidized Combustion System

Combustion of the material occurs in the fluidized bed and vapor space of the combustor vessel. Air to support combustion is supplied to the burner by the forced draft (FD) fan (through the fluidized bed) and by the overfire air system (through the overfire air nozzles).

The bed changeout system removes the bed material, screens it to remove any oversize particles, and reinjects the acceptable bed material back into the combustor bed. The bed material may also be diverted from the discharge of the bucket elevator into a storage bin so that maintenance activities can be performed on the empty combustor bed. A natural gas burner is used during startup to preheat the bed material to a temperature which will sustain combustion of the fuel.

Steam Generation System

Hot gases from the combustion system pass through the boiler and economizer to generate steam. An auxiliary natural gas burner is attached directly to the boiler so that steam can be generated when the fluidized bed combustion system is inactive.

Emissions and Combustion By-Product System

After combustion gases have passed through the boiler and economizer, they are pulled through the baghouse by an induced draft (ID) fan and exhausted from the off-gas stack. Emission monitoring equipment at the stack provides control information to all system processes to keep emissions within permissible levels. Ash is collected at the bottom of the boiler, economizer, and baghouse, and pneumatically conveyed to the ash bin.

Utilities

Electrical power, natural gas, and compressed air are supplied to the facility to support many processes.

A more detailed description of each subsystem is presented in the following pages. Individual components have been supplied by a large number of manufacturers and vendors. Detailed descriptions of equipment, as well as operating and maintenance instructions, may be contained in the documentation supplied by the manufacturer of the equipment. This documentation is supplied in a seperate set of binders. When available, the information supplied by the manufacturer should be consulted to suppliment the information presented in this manual.

3.2 FLUIDIZED COMBUSTION SYSTEM

The fluidized combustion system consists of the following components:

- ❑ Forced Draft (FD) Fan
- ❑ Dampers
- ❑ Preheat Burner System
- ❑ Primary Combustion Vessel
- ❑ Bed Changeout System

3.2.1 Forced Draft (FD) Fan

Fluidizing and combustion air is supplied by the forced draft fan. This fan assembly includes a fan, drive motor, variable inlet vane damper, casing splits, and outlet ducting which connects to the forced draft air damper and preheat combustor assembly.

3.2.2 Dampers

Several styles of dampers are used throughout the energy system to control the air, flue gas or ammonia mixture for optimum combustion. All are made of carbon steel. The following is a description of each of these control dampers.

Inlet Dampers

The FD fan variable vane damper (FCV-1410) is of the radial style with vanes that rotate in oil-less bearings. It is actuated by a Beck electric actuator.

The ID fan inlet box damper (PV-2501) has rectangular blades that are actuated by a Beck electric actuator. This damper is used to control furnace draft pressure from 0 to -5in wc.

Fluidizing Air Damper (Underfire Air Damper)

The fluidizing damper (FCV-1130) is a horizontal, dual vane damper mounted in oil-less high temperature carbon bearings. The damper is actuated by a Beck electric actuator. The damper is used to divert the air from the FD fan through the preheater during cold startup. During normal operation, the damper opening is modulated to fluidize the bed and control the air flow through the nozzles.

Overfire Air Damper

The two overfire air dampers are butterfly type. Each damper (FCV-1151 and FCV-1152) is actuated by Beck electric actuators (EZ-1151 and EZ-1152).

Overfire air is supplied by the FD fan through two dampers to two overfire air manifolds. Each manifold contains twenty-eight 1 1/2-inch pipe nozzles, so there is a total of fifty-six nozzles for the two manifolds.

3.2.4 Preheat Burner System

The preheat combustion system heats the fluidizing air to raise the bed media from ambient temperature to a temperature which will ignite the combustor fuel, and thus permit startup of the AFBB system.

The combustion device is an open-back, in-duct, natural gas burner. It is capable of delivering 10MM BTU/hour of clean flue gas at 800°F. A fixed profile plate at the burner provides the pressure differential required to operate the burner. The burner is designed to operate with a pressure differential of 0.6 in - 1.0 in WC across the profile plate.

The firing rate is maintained by monitoring the preheat outlet temperature at the manifold plenum. This temperature is controlled by modulating the amount of natural gas to the burner. The preheat temperature is limited by the mild steel construction of the plenum. If the temperature limit is exceeded, the controller that modulates the gas input will turn off the burner.

Preheat Burner Chamber Assembly

The combustor assembly is a tee section which is refractory lined and insulated. One end of the tee attaches to the main fluidizing air blower duct outlet and damper assembly. The other end of the tee attaches to the vessel plenum. The stem of the tee forms the cylindrical combustion chamber for the preheat burner and is approximately nine feet long. The combustion and dilution air are taken from the FD fan upstream from the fluidizing air damper (FCV-1130).

Preheat Burner Assembly

A 10MM BTU/hour natural gas burner assembly is supplied by EPI for the purpose of startup preheating of the fluidizing sand in the AFB. The Eclipse 680-TAHO rail burner fires into the chamber which heats fluidizing air from the FD fan to 800-900 F.

Natural gas is supplied to the burner through a double-block vented gas train built in accordance with NFPA-85. Combustion air is supplied by the FD Fan.

Instrumentation and Controls

Primary control and safety interlocks for the preheat burner are provided by a Fireye flame safeguard unit located near the burner assembly. This unit provides an automatic ignition sequence with the necessary flame detection and verification to ensure safe operating conditions at all times. One emergency stop push- button and status pilot light along with main flame and pilot flame indicating lights are provided in the local control panel to monitor the burner.

The signal from the EPI furnished thermocouple (TE-1412) is used to control the temperature of the preheated air entering the plenum.

3.2.5 Primary Combustion Vessel

A primary component of the energy conversion system is a cylindrical steel combustion cell lined with two inches of A.P. Green block insulation and six inches of A.P. Green KS-4 castable refractory. The lower eight feet of the combustion cell is lined with abrasion resistent A.P. Green LoAbrade castable refractory.

The combustion cell is made up of three flanged cylindrical sections and a top assembly. These parts are seal welded together to prevent leakage of hot gases. The three combustion sections are supported on a lower section which contains the inlet air plenum, manifolds, nozzles and a cone section which supports the bed material and funnels it into the bed material cleaning system.

Air distribution manifolds are seven inches wide by 12-inch high ducts, spaced four inches apart, extended diametrically across the combustion cell. The open end of each duct is seal welded to a plenum which extends about half-way around the outside combustion cell circumference. The opposite end of each duct is sealed and allowed to expand and contract in a slip sleeve arrangement. The four-inch spaces between the ducts allow the bed material to flow down through and into the lower cone for tramp material removal. The fluidizing nozzles, arranged in a six-inch by six-inch array, are screwed onto one-inch NPT nipples and protrude about six inches above the top of the manifolds. The fluidizing air from the FD fan enters at the center of the plenum, spreads to the manifolds, and is then distributed to the individual nozzles. The exhaust port in the nozzles are designed to ensure sufficient pressure drop, under normal operating conditions, to cause an even distribution of air to the entire bed area, regardless of uneven distribution of the bed material.

Bed material is normally maintained at 18 inches in depth above the nozzles when the bed is in the collapsed condition.

3.2.6 Bed Changeout System

The bed changeout system is designed to provide a means for continuous removal of non-combustible tramp material from the active region of the fluidized bed while the burner continues to operate. The tramp material, if allowed to accumulate, would eventually destroy the fluidizing properties of the bed material by increasing the average particle size to a point where fluidization could no longer occur. Also, the larger particles, rocks, bolts, etc., due to their higher mass, will fall through the fluidized bed material and collect at the nozzle orifice level. If not removed, they will restrict the air flow from the nozzles and cause localized areas of poor fluidization of the material, particularly directly under the fuel feed chute outlet. The tramp material is carried in with the fuel and generally consists of rocks, bolts, machine parts, etc. The bed changeout system is designed to accommodate the varying accumulation rate of tramp material.

The tramp and bed material flows downward between the fluidizing nozzles and air distribution manifold and is thus removed from the active region of the bed. Fluidizing air directed through slots under the nozzle support plates cools the bed material as it passes between the distribution manifolds.

Slidegate

The bed material from the combustor chamber's bottom is metered onto a vibrating conveyor by an air operated sliding gate valve. Cycle time is adjustable, and should be based on cleaning requirements. This open and closed time allows approximately 5,100 pounds of sand per hour to flow through the cone.

The slidegate valve is an eight-inch, horizontal slide, roller mounted, low profile, gate powered by a double acting air cylinder. Open/close action is controlled through a four-way solenoid valve.

A manually operated isolation slidegate is located directly above the automatic slidegate. This manual gate will remain open during operation. When it is necessary to perform maintenance and repair downstream, the manual gate will be closed to prevent hot bed material from discharging out of the combustor and injuring personnel and equipment.

Vibrating Screen Conveyor

From the slidegate, the bed and tramp material discharges to a single vibrating screen conveyor. This bed material screening unit incorporates a stainless steel mesh screen to separate tramp material from the bed material. The hole size is approximately 0.10". The conveyor side discharges the clean sand into the bucket elevator and the tramp material flows out the end to a Galbreath self-dumping, 5 cu yd capacity hopper. The vibrating conveyor is driven by a 2 HP, 1800 RPM, 480 VAC motor, and is designed to handle 5,100 pounds per hour of bed sand at 350°F.

Sand Reinjection Bucket Elevator

The sand reinjection bucket elevator, manufactured by FMC, conveys screened sand from the vibrating screen back to the combustor's fluidized bed. The capacity of the bucket elevator is ten tons per hour, operating at 225 ft/minute. This unit is powered by a 3 HP, 1800 RPM, three-phase electric motor.

Reinjection Slidegate Valve

The reinjection slidegate valve is similar to the vessel discharge slidegate valve and is manufactured by FNW. During normal operation of the bed changeout, the reinjection slidegate will remain open.

4 OPERATING PROCEDURES

The intent of this section is to provide general guidelines for the start-up and operation of the fuel processing, combustion, and steam generation systems. Although much of the facility's operation is automatic, experienced operators are necessary to monitor critical processes, correct off-normal conditions, start up, and shutdown the system. It is also important that operators and other personnel perform routine inspection to determine when maintenance is required. A thorough understanding of the system theory and operating procedures will qualify the operators to adjust certain parameters to obtain maximum performance.

NOTE: *This procedure is preliminary and subject to change by authorized EPI personnel. Be sure that you have the latest revision of this manual, which may incorporate changes to procedures given here.*

⚠ WARNING

NEVER DISCONNECT, BYPASS, OR ELIMINATE ANY SAFETY DEVICES. SEVERE EQUIPMENT DAMAGE, PERSONNEL INJURY, OR DEATH COULD RESULT.

NEVER PERFORM WORK ON OR ACCESS ANY DRIVEN EQUIPMENT WITHOUT FIRST LOCKING OUT THE POWER SOURCE.

4.1 PRESTARTUP CONSIDERATIONS

4.1.1 Safety Checks

✓ Is the maintenance work completed?

✓ Is the area and equipment clear of refuse?

✓ Are all personnel clear of hazardous locations?

✓ Is all hazardous equipment properly protected against injury to personnel?

✓ Are any safety tags or lockouts on motor control center?

✓ Are all pumps, motors and fans free to rotate?

✓ Is the emergency lighting operational?

✓ Are all warning devices (horns, bells, buzzers, and lights) operational?

✓ Are all access doors closed and secured?

✓ Are all motor junction boxes tightly covered?

✓ Is each operator equipped with safety eyeglasses, a hard hat, and safety shoes?

4.1.2 Utility Checks

1) Check motor centers to assure all breakers are closed and all lockout tags are removed.

2) Check all local disconnects to be sure they are closed.

3) Verify cooling water is available to the circulating water pumps, bearings, and seals.

4) Verify air supply to the bed slidegates, reinjection slidegate, diverter gates, and air actuated dampers.

5) Verify that natural gas is available at 10 psig to the gas trains.

4.1.3 Combustor Checks

1) Verify that the bed material depth in the burner is at the proper level; 18 to 30 inches above the top of the nozzles (static condition).

2) Verify that the fuel metering system is ready to deliver fuel.

3) Verify access doors are closed and secured.

4) Verify all fans are lubricated or full of oil and guards in place.

5) Verify that the vessel viewing port is closed.

6) Check the air operated bed slidegate and make sure that it is closed.

7) Verify that the manual backup cone slidegate is open.

8) Verify the vibrating conveyor and screen is operating properly. Ensure the access doors and conveyor covers are closed and secured.

9) Check that the reinjection bucket elevator is working and the bed reinjection slidegate is set in the open position to discharge into the reinjection chute.

10) Verify that the following power operated dampers are operating:

✓ ID inlet damper
✓ FD fluidizing damper
✓ The two overfire air dampers
✓ Inlet air damper of FD fan

4.1.4 Fuel System Checks

1) Verify that all equipment is operable and ready to supply fuel to the fuel metering bins.

2) Assure that the fuel chutes to the combustor are clear of fuel.

3) Check the hydraulic power units for proper level of hydraulic fluid and the fuel storage bin screw conveyors are free to turn under power. Check for oil leaks. Keep drip pans clean.

4) Fuel isolation slidegates must be closed.

4.1.5 Boiler System Checks

1) Verify that the boiler is full of water to the normal water level on the sight glass.

2) Check the boiler feedwater pump bearings.

3) Verify that the boiler feedwater system is properly valved in.

4) Frequently bleed air from the boiler and all other high points with bleeder valves.

4.3 ENERGY SYSTEM COLD START

The following procedure is to preheat the bed material to the proper temperature for startup if the bed temperature is less than 700°F.

Before preheating the bed, verify compliance with all prestartup considerations.

⚠ WARNING

BEFORE STARTING ANY PIECE OF MAJOR EQUIPMENT, HAVE AN OBSERVER MAINTAIN COMMUNICATION WITH THE OPERATOR AND VISUALLY VERIFY: 1) ALL PERSONNEL ARE CLEAR OF THE AREA; 2) ALL EQUIPMENT GUARDS AND OTHER PERSONNEL PROTECTION EQUIPMENT IS IN PLACE AND OPERATING; 3) EQUIPMENT IS FREE OF RESTRICTIONS, LUBRICATED AND OTHERWISE READY FOR OPERATION. THE FOLLOWING EQUIPMENT APPLIES: ALL FANS, ALL BLOWERS, BED CHANGEOUT SYSTEM, FUEL METERING SYSTEM, CIRCULATION PUMPS, PREHEATER, DAMPERS, ALL PUMPS, COMBUSTOR (LOOK THROUGH VIEWPORT). IN ADDITION, CAUTION IS ADVISED WHEN IN THE VICINITY OF OPERATING EQUIPMENT THAT EMITS LOUD NOISE SUCH AS FANS, BLOWERS, AND PUMPS. ALWAYS WEAR ADEQUATE EAR PROTECTION TO AVOID HEARING DAMAGE AND DEAFNESS.

4.3.1 Preheat Firing

The following is the procedure for starting the preheat burner:

1) Close the following dampers:

   - ✓ FD fan inlet vanes
   - ✓ Fluidizing air damper
   - ✓ Overfire air dampers
   - ✓ ID fan damper
   - ✓ Close all three manual inlet dampers in the baghouse.
   - ✓ Close all three outlet dampers in the baghouse (at local baghouse control panel).

2) Open baghouse bypass damper

3) Ensure that cooling water is available to the FD and ID fan bearing.

4) Start ID fan.

5) Place ID fan damper control (draft controller PIC-2501) in automatic mode, adjust setpoint to 0" WC.

6) Start FD fan.

7) Set the FD fan outlet pressure controller (PIC-1400) setpoint to +40" WC and place in **Auto**.

8) Place vapor space temperature limit controller (TIC-1121) into **Auto** with setpoint at 1750°F.

9) Start boiler feedwater electrical drive pump, open the steam drum vent, and place the drum level controller (LIC-3302) in **Automatic** with the set point at 0" WC.

10) Place the oxygen trim controller (AIC-5402) into manual with output to zero.

11) Place underbed preheat temperature controller (TIC-1430) in manual, with the output set to zero.

12) You are now ready to start the preheat burner.

13) Depress the preheat burner start button. The FD fan inlet damper and fluidizing air damper will automatically open to purge the system. When the purge fluidizing air damper reaches 40% open, the Purging Light comes on and the purge time begins (five minutes).

At the end of the purge cycle, the **purge complete** light comes on, indicating that the purge is complete. Fluidizing Air Damper will close. When closed, an ignition attempt is made and the ignition light comes on. If the ignition attempt is successful, the main gas valves will open and the main flame light will come on and the ignition transformer and pilot will turn off.

<u>NOTE:</u> *IF THE IGNITION ATTEMPT IS NOT SUCCESSFUL, THE FLAME FAILURE LIGHT WILL TURN ON, DETERMINE THE CAUSE OF THE FAILURE, CORRECT THE AIR FLOW, IF REQUIRED, AND RESET THE FLAME FAILURE LOCKOUT RESET BUTTON BEFORE MAKING ANOTHER ATTEMPT. START OVER BY DEPRESSING THE PREHEAT BURNER START BUTTON TO AGAIN PURGE THE SYSTEM.*

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14) When ignition is successful, visually verify a flame is present by looking through the preheat burner viewing port. Continuously monitor the preheater outlet temperature on the preheat temperature controller (TIC-1430) which continuously adjusts the gas valve. Set preheat temperature controller into automatic mode, with the setpoint at 350°F for 30 minutes, then raise setpoint to 800°F to continue the preheat cycle. (This is to limit thermal shock to the refractory within the preheat combustor tube.)

CAUTION!

CYCLING THE COMBUSTOR OR BED PREHEATER WITH FAST HEAT-UP OR COOL DOWN OF THE REFRACTORY LINING WILL REDUCE THE LIFE OF THE REFRACTORY. THIS TYPE OF OPERATION WILL CAUSE EXCESSIVE CRACKING AND SPALLING OF THE REFRACTORY.

4.3.2 Auxiliary Burner Startup

NOTE: *To limit the plants emissions during operation, a 3 cell filter baghouse emission control system has been provided. The baghouse has to have entering flue gas above the dewpoint to prevent blinding of the bag material.*

An auxiliary natural gas burner has been provided at the entrance to the boiler to provide two functions:

1) To provide auxiliary energy for steam production in the event of loss of solid fuels

2) To provide a sufficient temperature at the entrance to the baghouse during initial startup of the AFBB combustor, before solid fuel combustion has developed a a temperature which is high enough.

The operator must divert the flue gas around (bypass) the filter baghouse during initial startup until the inlet flue gas temperature is at 260°F or greater.

CAUTION!

IN NO CASE MAY THE TEMPERATURE EXCEED 400°F OR MAJOR DAMAGE WILL OCCUR TO THE FILTER BAGHOUSE BAGS.

The normal design inlet operating flue gas temperature at the baghouse is 340°F during stable operation.

Make sure that natural gas is available at the boiler; the high and low gas pressures are reset (at each switch on gas train); the two Honeywell flame protection management relays are reset in panel 3F; and correct hand valves are in position for operation.

NOTE: *It is advisable to clean the U.V. scanners at this time. Use only a soft tissue paper for this function.*

When the auxiliary operator has ensured the equipment is ready for operation the control room operator shall place the Fuelmaster controller (FIC-4000) to the hand position with output at zero. (This is the low fire position).

Make sure that the boiler steam drum vent is open.

The control room operator may then turn the auxiliary burner **on** at the computer keyboard.

The auxiliary burner combustion air fan will turn on and the burner will go through a **purge** sequence. The permissives or safeties provided include:

1) Auxiliary burner combustion air flow

2) Main ID fan on and draft at "0" WC

3) Boiler drum level not low-low

4) Auxilliary burner gas pressure switches proven

5) AFBB FD fan on (with minimum air flow)

6) Steam pressure not high-high

The Fuelmaster controller (FIC-4000) must remain in the **hand** position with the output at zero, until the boiler steam pressure reaches 40 psig. At this pressure, the operator should adjust output to 30% until boiler reaches 100 psig. After one hour at 100 psig, the operator should make sure that the steam pressure controller (PIC-3330) setpoint is 175 psig and in automatic; the steam flow controller (FIC-3300) setpoint is 70,000 lbs/hr and in automatic; and the vapor temperature controller (TIC-110) setpoint is at 1725°F and in automatic. The selected output of these three controllers is the remote cascade setpoint to the master fuel rate controller, which will control the firing rate of the boiler auxilliary burner as well as the solid fuel metering systems as they are brought on line.

⚠ WARNING

THE STEAM PRESSURE AT THE BOILER DRUM MUST NOT INCREASE OR DECREASE AT A RATE GREATER THAN 50# PER HOUR.

THE FOLLOWING SATURATED STEAM PRESSURE VS. TEMPERATURE IS PROVIDED FOR HANDY REFERENCE (APPROXIMATE VALUES). REFERENCE THE ASME STEAM TABLES FOR COMPLETE PRESSURE VS. TEMPERATURE VALUES.

1/2 psig = 212°F
40 psig = 250°F
100 psig = 338°F
175 psig = 365°F

With cold water (70°F), the boiler will require a minimum of three hours to heat up.

The control room operator should observe the baghouse inlet temperature until it reaches 260°F. At this time, the AFBB combustor is ready to receive solid fuel, which will be shredded wood and cardboard during startup.

4.3.3 AFBB Solid fuel Startup

If bed temperatures are less than 700°F, it will be necessary to preheat the bed. When the average of bed temperature thermocouples indicate 650°F or higher, the bed is ready to receive fuel for a system startup and the following procedure should be performed:

1) Start the ash collection fan.

3) If the baghouse inlet temperature is 260°F or higher, open the three outlet dampers on the filter baghouse cells (from the local field panel). Manually open the chain operated inlet dampers. The control room operator may now close the baghouse bypass damper. (At least 2 of the 3 baghouse cells must be open to close the bypass damper.)

4) Ensure that at least 1 fuel silo has ample fuel and that the appropriate silo unloading system is ready for operation. The auxiliary operator should manually operate the silo main sweep screw conveyor, the exit screw conveyor, and metering bin infeed chain conveyor to ensure operational readiness. All local switches should then be placed in auto when the system is ready for use.

5) Ensure fuel exists in Metering Bin No. 1 or 2. (Only 1 wood/ metering bin is needed to meter fuel at any given time).

6) Place the selected metering bin controller in manual with the output adjusted to zero. Make sure that the metering bin is full of wood/ fuel.

7) Start the fuel metering system. The appropriate target gate at the combustor will open, and, when fully open, the high pressure blower will start. When the

blower is running, the rotary valve will start after a delay to ensure that the lines are clear of fuel. The combustor is now ready to receive fuel.

NOTE: *Place an observer at the combustor viewport until bed temperature is above 1300°F. When the bed is above 1300°F, the combustor should be monitored every 20 minutes.*

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8) Start the appropriate metering variable speed drive and adjust the feedrate of the metering bin to approximately 15 RPM. After 10 to 15 seconds, reduce output to 0 RPM. Observe vapor temperatures of the AFBB and verify visually that there is fire in the combustor. When a temperature increase of 200°F is observed, restart the metering bin and raise its speed to 15 RPM for 20-30 seconds and observe the vapor temperature. After the temperature in the vapor space is greater than 800°F, the feedrate may be increased to a maximum of 20 RPM. When the vapor space temperature reaches 1200°F, shut off the under bed preheat burner and open the underfire air damper by raising the output of nozzle differential pressure controller (PIC-1130) until the nozzle ΔP is approximately 9" WC. Then place PIC-1130 into automatic mode.

CAUTION!

DO NOT OVERFEED COMBUSTOR AS SEVERE TEMPERATURE AND BOILER UPSET WILL RESULT. MAINTAIN A GRADUAL (100°F/HR.) TEMPERATURE INCREASE IN THE VAPOR SPACE.

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9) Gradually increase the metering speed in 3-5 RPM increments while watching bed temperatures (which should be increasing) on TI-1111 and TI-1114. Allow 1 to 3 minutes between each increase, and monitor the steam drum water level.

10) When bed temperatures have reached optimum (1300-1500°F), stop increasing metering bin rate and place appropriate metering bin rate controller into automatic cascade. Setpoint is from the master fuel rate controller demand, normally based on steam flow requirements.

11) Make sure that the O_2 trim control loop (AIC-5403) is in automatic with the setpoint at 6% O_2.

12) The boiler auxiliary burner should be shut down when the vapor temperature approaches 1700°F or greater and the bed media temperatures are stable in the 1300 to 1500°F range.

NOTE: *As the solids fuel combustion rate is increasing the auxiliary burner firing rate will be decreasing!*

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13) Start bed cleaning system. All local switches on Panel 1G should be in Auto (Local Bed Panel).

4.3.5 Boiler Feedwater and Drum Levels

Boiler Feedwater Pump

The plant will normally operate on the electrically driven BFW pump which should be used when ever power is available. At least once a week the operator should initiate the auxiliary steam driven turbine BFW pump for 30 minutes of operation. The turbine BFW pump has been provided to ensure feedwater is available to the drum during power outages. When this occurs the auxiliary operator should standby the boiler feedwater valve and manually operate the bypass to maintain drum level until the energy that is producing steam diminishes.

Drum Level

The boiler drum has four drum level switches attached to the water column.

high	alarm
low	alarm
low low	alarm auxiliary fuel trip
auxiliary low low	alarm auxiliary fuel and feed trip

⚠ WARNING

ANY TIME THE DRUM LEVEL GOES BEYOND THE LOWEST VISIBLE PORTION OF THE LOCAL GAUGE GLASS THE TOTAL SYSTEM MUST BE SHUT DOWN UNTIL VAPOR TEMPERATURES ARE 200°F AND THE SYSTEM AND TUBES ARE INSPECTED FOR DAMAGE. AT NO TIME SHOULD THERE BE BOILER FEEDWATER ADDED TO A BOILER DRUM IF THE LEVEL IS OUT OF SIGHT! SEVERE EQUIPMENT AND POSSIBLE PERSONNEL INJURY MAY OCCUR!

At least once per shift the water column should be blown down to reduce buildup. At local low-low water bypass push button has been provided to prevent trips during this time. The push button should be depressed at start of the blow down and kept depressed until the water is at normal drum level after blow down.

4.4 PEAK COMBUSTOR EFFICIENCY

Operation of a steam generating plant is a balance of inputs to outputs: the better the balance, the smoother the operation. Steam production requires that the weight of water entering the boiler equal the steam and blowdown exiting. Operating a combustor in an efficient and pollution free manner requires a precise proportion of fuel to combustion air. To equalize these inputs and outputs, one must understand the system, not just the network of hardware that comprises the system.

Too often, operators have confused operation with control system management. The operator must realize that a control system is hardware assembled to make operation easier, faster, and safer. The control of all major functions can be switched from automatic to operator control. To be effective, an operator must know not only what he is doing, but why it is done and what results from his action.

The prime consideration for all operation is the safety of people and equipment. Whenever there is any doubt about an unsafe condition, the operator must take immediate action to return the unit to a known safe condition, even if it means tripping the unit.

4.4.1 Fluidizing Air Control

There is a limited range of fluidizing air flow that will provide efficient combustion of fuel in the bed. The best means to determine bed combustion efficiency is to monitor the various bed temp-eratures and carbon monoxide generated. As steam load increases, and consequently the fuel feedrate, the bed temperature will increase (for constant air flow). However, sometimes due to a change in fuel particle size, moisture content, type, distribution and other conditions, combustion in the bed may not be optimal; therefore, fluidizing air flow must be increased or decreased with radical changes in fuel quality to optimize combustion efficiency. An overall bed temperature decrease may signal the need to decrease fluidization velocities slightly, while large temperature differentials between bed thermocouples (100°) may require more fluidization air for better mixing.

Increasing fluidizing air above minimum fluidization levels will reduce bed temperature, and may reduce or increase vapor temperature depending on fuel characteristics. Increased fluidization air will increase boiler mass flow, and increase excess combustion air for a constant fuel feedrate. The carbon monoxide monitor should be utilized to determine the efficiency of combustion after any change in fluidization. Bed fluidization should be monitored by examining the bed through the viewport.

4.4.2 Overfire Air Control

Should vapor temperature change, the upper, and lower overfire dampers will automatically adjust to raise or lower the vapor temperature. Sudden changes in vapor temperature or overfire air damper position may cause an increase in carbon monoxide emissions. It is best to make several small changes in control setpoint rather than one large one.

4.5 STEADY STATE OPERATION

The following procedures address the normal day-to-day operation of the plant and also the general principles and considerations which should be observed to achieve an efficient operation with minimum down time.

4.5.1 Normal Operating Limits

Condition	Limits
Active Bed Temperature	1300°F to 1650°F
Upper Vapor Temperature	1600°F to 1750°F
Combustion Air Flow	
Flue Gas Oxygen	4% to 10%
Differential Bed Pressure	28 to 38" WC
Preheat Temperature	800°F
Upper Bed Cone Temperature	< 600°F
Furnace Draft (at boiler)	0" WC
Nozzle ΔP	9 to 12" WC
Lower Bed Cone Temperature	100 to 180°F

If any of the above conditions are exceeded, refer to the **Off-Normal Conditions** section of this manual.

4.5.2 Combustor Operation

To achieve a Steady State condition, the bed temperatures should be controlled between 1300 F and 1650 F and the vapor temperatures between 1600-1750°F. This can be achieved by adjusting the ratio of fluidizing air to overfire air or adjusting the fuel feedrate. Note, any adjustment changes to the fuel/air ratio, a corresponding change will take place to the ambient air dampers to maintain 4-6% O_2 in the flue gas. Because of the nature of the fuel to be used or mixes of fuel that may occur, changes in fluidized combustion will cause the control to make automatic corrections to the vapor temperature, O_2 in the flue gas and steam pressure. The ID fan will automatically control furnace draft pressure.

4.5.3 Bed Handling System Operation

This system is used to remove noncombustible material from the bed during combustor operation. The following procedures are to be used to start, operate and shut down the bed material system.

1) Check tramp material receptacle is in place.

2) Start bed cleaning system. The bed reinjection valve will open and when proven open, the bucket elevator will start.

3) Vibrating screen will start when bucket elevator is proven operating.

4) The bed cone slidegate will automatically sequence.

5) Upon shutdown of bed system the bucket elevator will continue to run for 20 seconds for purposes of cleanout.

<u>NOTE:</u> *Overfire air is used to inject the bed material into the combustor after the isolation valve. See P&ID Drawing D-0202.*

Thermocouples located in the lower and upper cone, should be monitored periodically. Maximum temperature is 800°F for the upper cone and 180°F for the lower cone.

4.5.4 Fuel Feed Operation

Fuel feed to the combustor vessel is controlled primarily by steam flow demand. It is also controlled by the vapor temperature control loop, if a high limit is exceeded (setpoint = 1725°F), and by the steam pressure control loop (set point = 175 psig). The fuel is fed out of three metering bins driven by variable frequency controller motors and feed screw conveyors.

4.5.5 Bed Additive

To reduce slagging in the combustor and steam generating tubes, an additive material (limestone) is added to the fuel coming into the two wood/ - , metering bins. The additive material is stored in a separate storage bin and metered out either automatically or manually.

The quantity of limestone addition is controlled automatically by preset timed injection intervals. This time is based upon experience by the operator.

Fuels containing higher concentrations of potassium and sodium require greater quantities of limestone additive. Potassium and sodium cause ash to soften at lower temperatures and therefore become more likely to foul surfaces in the combustor and boiler areas. Limestone additive raises the softening temperature of high potassium and sodium ash and makes it more "removable". The fuel type and experience will dictate the exact quantity of limestone required.

4.5.6 Sootblowers

There are a total of ten sootblowers in the boiler building. Eight of these are found on the boiler, and two of them are located on the economizer. All sootblowers are activated from the supervisor station by the use of operator tags which are found in the overview display of the preformatted displays.

The action of the individual sootblowers can be accomplished by the operator in four different modes from the overview display. The first command mode will allow all ten sootblowers to sequence through their cycles one at a time. The second command only initiates the operation of the boiler sootblowers. The third command sequences the economizer sootblowers. The fourth command mode is actually ten individual inputs that are set by the operator which will allow them to activate any of the ten sootblowers.

4.5.7 Ash Silo Unloading

The ash silo unloading is all controlled locally by the attendant. A three gage switch box is located by the ash dumping system which allows the attendant to automatically start and stop the unloading of the ash silo. An emergency stop button is also provided for safety. The ash vibrator is automatically controlled in the event of bridging by the low-low level switch on the ash silo. Three ash system alarms are also monitored at the control room. The following ash system alarms include:

1) High bin level
2) Low ash conditioner feedwater pressure
3) Gate problem alarm

4.5.8 Other Operating Considerations

During normal operations, a log book should be kept and all off-normal conditions recorded for future reference. A listing of the current operating setpoints should be maintained in the log, and should be updated as operational parameters change.

Periodic walk-around inspections should be performed on at least an hourly basis and should include the following:

- ✓ Check fan and pump bearings for excessive temperatures and vibration.
- ✓ Check tramp bin and keep from over filling.
- ✓ Check hydraulic systems for vibration, temperature and oil leaks.
- ✓ Inspect fuel bin chain drives.
- ✓ Inspect vibrating screen conveyor. Keep screen clean.
- ✓ Inspect bucket elevator.
- ✓ Inspect plant air system for leaks and sufficient pressure.
- ✓ Inspect all damper power actuators.
- ✓ Inspect all manual dampers.

- ✓ Inspect all ductwork.
- ✓ Inspect ash drop out points.
- ✓ Inspect bed additive system.
- ✓ Inspect for steam and water leaks.

CAUTION!

OPERATING THE BAGHOUSE AT OR BELOW THE MINIMUM PERMISSIBLE TEMPERATURE (LESS THAN 260 F) MAY CAUSE CONDENSATION, "BAG BLINDING", AND BAG DAMAGE. BAG BLINDING INCREASES THE PRESSURE DROP ACROSS THE BAGHOUSE AND DETERIORATES PERFORMANCE.

Blinded bags can be impossible to clean even with repeated cleaning cycles. As a result, the system develops high differential pressure, possibly beyond the capabilities of the induced draft fan.

Early warning of an impending failure can prevent excessive down-time. Only by taking readings on a regular basis can a documented history on the Fluid Flame(R) unit be built up. From this history, operating trends can be recognized and correction taken at an early date. For example, an indication of bed level can be determined. Bed level is directly related to bed differential pressure reading. If bed differential pressure readings are showing a downward trend over a period of time, then the bed level is decreasing; however, the bed differential pressure readings can be compared only if the nozzle flow readings, vessel temperature readings and vessel pressure are the same as when the previous readings were taken.

During steady state operation, a periodic recording of the system pressure, flows and temperatures should be maintained to observe trends and permit correction for a more efficient operation. It is suggested these readings be taken at a minimum of every two hours and more often if transient conditions occur.

In addition, it is suggested that a spiral-bound notebook be kept with log forms to elaborate on the off-normal conditions and the action performed by the operator. It also helps to be sure proper boiler maintenance is being performed.

4.5.9 Fuel Feed Restart

There will be occasions during normal operation when an interruption of the fuel feed occurs due to equipment failure or safety trips. When this occurs, care must be exercised to restart the unit. If the system has been down, even for only a short period of time, the master fuel controller must be switched to Manual mode and a normal (less than 40%) fuel feedrate set in. Controller output must then be manually raised in discrete steps until previous operating temperature is obtained. Only then should the controller be shifted back to Automatic mode.

If the above procedure is not followed, a hazardous condition may develop, perhaps resulting in an explosive mixture being generated in the burner. Depending upon the length of time the fuel feedrate has been off, the temperature may drop well below setpoint of the controller, resulting in an automatic increase of controller output. Restarting may result in an inadequate flame front and oxygen deficiency in the burner vessel. Volatile gases may then be boiled off from the fuel by hot bed material, to be later ignited in the off-gas ducting and boiler when the flame front is finally established.

If the inlet flue gas temperature to the baghouse is less than 260 F the boiler auxiliary burner must be re-started prior to introduction of solid fuels.

4.6 SHUTDOWN PROCEDURES

NOTE: *If possible, empty all metering bins of fuel prior to any shutdown. This will prevent packing of fuel bins and ease of re-start.*

4.6.1 Normal Shutdown

If desired, bed temperatures adequate for a hot restart (no preheat) can be maintained for several hours. Adequate bed temperature is considered to be greater than 700°F. Therefore, if the outage will be fairly short (several hours), it is desirable to maximize bed temperatures just prior to shutdown. Of course, if personnel are required to enter the vessel or related areas, cooling of the system is more appropriate (refer to cold standby procedures).

4.6.2 Hot Standby

The hot bed of a properly shut down combustor will cool approximately 20°F per hour (with all dampers closed). It is desirable, therefore, to make the bed as hot as possible just prior to shutdown. To do this, follow the procedure outlined below:

1) Increase fuel feedrate to cause a gradual and controlled bed temperature rise (50°F/minute).

2) When bed temperatures are averaging 1475°F, stop fuel feed and shut down high pressure blower(s). It is preferable to empty the metering bins of fuel prior to any shutdown.

3) Observe bed temperatures. When temperatures have decreased 75°F below maximum temperature obtained after the fuel feed shutdown, the operator may be assured there is no fuel remaining in the bed.

4) Shut down all fans except the ash collection fan and close the following dampers:

   ✓ Fluidizing Damper
   ✓ FD and ID Fan Inlet Dampers
   ✓ Overfire Air Dampers

NOTE: *It is desirable to operate the ash collection system for several hours (or as long as possible) to ensure that all ash is cleared out of hoppers and to prevent plugging during restart.*

5) Keep all combustor and boiler doors closed.

⚠ WARNING

DO NOT ENTER CONFINED SPACES UNLESS THE AIR TEMPERATURE INSIDE IS HUMANLY TOLERABLE AND THE AIR QUALITY IS BREATHABLE.

4.6.3 Cold Standby

If it is desired to cool the system down for personnel access, it may be done according to the following procedure:

1) Shut down all fuels and feed blowers

2) Continue air flow through the system until bed temperatures stop decreasing (100-150°F).

3) Shut down FD fan first, then proceed with the shutdown of all other equipment in a normal manner.

4) Open baghouse bypass damper.

5) Shut down ID fan.

6) Keep BFW pump on.

7) Keep ash collecting fan on for at least one hour.

4.6.4 Emergency Shutdown

In the event an emergency situation warrants the immediate shutdown of the combustor, follow the procedure below:

1) Decrease fuel feedrate to zero as rapidly as possible and stop blower.

2) Whenever possible, avoid stopping fans if bed temperatures are greater than 1600°F. Solidification of bed material can result.

3) Stop FD fan

4) Shut down ID fan

5) Keep BFW pump and ash collection fan on if power is available.

4.6.5 OFF-NORMAL CONDITIONS:FD Fan Trip

✓ Trips bed system
✓ Trips fuel system
✓ FD fan inlet damper closes
✓ Trips preheat burner
✓ Fluidizing damper closes

CAUSE	OPERATOR ACTION
1) Low-Low boiler drum level	1) Check boiler FW system and pumps.
2) ID fan tripped	1) Determine cause of fan failure and restart.
3) Vessel pressure High-High	1) Check operation of draft controls.
	2) Check baghouse operation (ΔP).
	3) Restart.
4) FD fan motor thermal overload	1) Establish normal voltage conditions.
	2) Reset overload relay.
	3) Check fan and motor bearings for cleanliness, lubrication, and wear.
	4) Check fluidizing damper position.

4.6.6 OFF-NORMAL CONDITIONS:ID Fan Trip

✓ Trips FD fan
✓ ID fan inlet damper closes
✓ Boiler trips

CAUSE	OPERATOR ACTION
1) ID fan motor thermal overload	1) Establish normal voltage conditions.
	2) Reset overload relay.
	3) Check fan and motor bearings for cleanliness, lubrication, and wear.

4.6.7 OFF-NORMAL CONDITIONS: Bed Temperature High

✓ Operates annunciator
✓ High-High temperature trips rotary feeder

CAUSE	OPERATOR ACTION
1) High fuel feedrate with insufficient fluidizing air	1) Open fluidizing air damper by raising setpoints on air flow controller.

4.6.8 OFF-NORMAL CONDITIONS: Bed Temperature Low

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Low fuel feedrate or poor fuel with too much fluidizing air	1) Reduce fluidizing air flow but do not allow bed to collapse.

4.6.9 OFF-NORMAL CONDITIONS: Vapor Space Temperature High

✓ Operates annunciator
✓ High-High temperature trips rotary feeder

CAUSE	OPERATOR ACTION
1) Vapor space temperature controller misadjusted or broken	1) Correct setpoint or repair as necessary.
2) Insufficient overfire air	1) Open overfire air dampers.
3) High demand on boiler	1) Reduce steam flow usage.
	2) Check setpoint on steam flow controller.

4.6.10 OFF-NORMAL CONDITIONS: Vapor Space Temperature Low

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Wet fuel	1) Adjust operation as necessary.
2) Loss of fuel	1) Determine reason and correct; check storage bin, conveyors, diverter bin, metering bin, rotary feeder, HP blower, etc.

4.6.11 OFF-NORMAL CONDITIONS: Low PLant Air Pressure

CAUSE	OPERATOR ACTION
1) Compressor not on	1) Determine reason and correct.
2) Supply line turned off	1) Turn supply line on.

4.6.12 OFF-NORMAL CONDITIONS: Fuel Metering System Tripped

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Motor overload on: HP blower, rotary feeder, metering screw, AC frequency drive	1) Reset overloads. Place selected controller in hand and reduce output to 40%. Restart HP blower, rotary feeder, and metering screw. Place controller back into auto, after system is stable.
2) Fuel line blockage	1) Clear blockage and restart system as in item (1), above.
3) Rotary feeder trip caused by: main blower trip, bed temp Hi-Hi, vapor temp Hi-Hi, feeder safety switch	1) Determine reason and correct. 2) Restart after bed and vapor temperatures are within normal ranges.

4.6.13 OFF-NORMAL CONDITIONS: Metering Bin Low Level

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) High fuel demand: silo unloader cannot keep up with demand.	1) None; if condition persists: a) reduce load, b) check main sweep auger teeth.
2) Unloader conveyor or diverter failure	1) Expedite repairs.
3) Storage bin problem	1) Determine problem and correct.
4) Storage bin sweep auger controller setpoint low	1) Increase setpoint to 1600-2000 psig
5) Storage bin auger teeth worn	1) Replace as necessary.

4.6.14 OFF-NORMAL CONDITIONS: Preheat Burner Trip

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Preheater outlet temperature high	1) Increase blend air and restart.
2) Gas pressure low or high	1) Establish correct gas pressure.
3) Flame loss	1) Check flame detection system.
	2) Adjust combustion air and blend air as necessary; restart.
4) FD fan trip	1) Refer to FD Fan Trip section.

4.6.15 OFF-NORMAL CONDITIONS: Bed Cleaning System Trip

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Upper cone temperature high (>850°F)	1) Wait until temperature is within normal range and restart.
2) Lower cone temperature high (>200°F)	1) Wait until temperature is within normal range; decrease bed slidegate operation frequency; restart.
3) FD fan trip	1) Refer to **FD Fan Trip** section.
4) Bucket elevator motor thermal overload	1) Replace belt or reset overload relay. 2) See cause 5, below.
5) Bucket elevator stops	1) Check drive belts. 2) Check for pluggage. 3) Verify that reinjection slidegate is open. 4) Verify that venturi is clear. 5) Check all bearings.
6) Vibrating screen stops	1) Verify that bucket elevator is not plugged. 2) Reset conveyor motor overloads. 3) Verify that conveyor is not overloaded. 4) Check all bearings. 5) Check for high cone temperatures (See cause 1 & 2, above)

4.6.16 OFF-NORMAL CONDITIONS: Bed Cleaning System Trip (continued)

CAUSE	OPERATOR ACTION
7) Slidegate not operating	1) Verify that conveyor and bucket elevator are operable.
	2) Verify adequate air supply to solenoid valve and power to solenoid.
	3) Verify that hand/off/auto switch is in **auto**.
	4) Check for slidegate blockage.
	5) Verify cycle time.
	6) Verify that limit switches are adjusted correctly.

4.6.17 OFF-NORMAL CONDITIONS: Excessive Bed Material Carryover With Tramp Off Vibrating Conveyor

CAUSE	OPERATOR ACTION
1) Plugged vibrating conveyor screen	1) Clear screen.
2) Slidegate cycle frequency too high	1) Reduce slidegate cycle frequency.
3) Slidegate open too long	1) Check valve operation; inspect for binding or low air supply.
	2) Adjust maximum open limit switch.

4.6.18 OFF-NORMAL CONDITIONS: High & High-High Boiler Drum Level

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Mis-adjusted drum level controller	1) Readjust drum level controller setpoint.
2) Level transmitter failure	1) Recalibrate, repair, or replace drum level transmitter.
3) Boiler feedwater valve leakage	1) Repair valve.
	2) Place controller in **hand** and close valve; stop boiler feedwater pump and observe drum level closely.

4.6.19 OFF-NORMAL CONDITIONS: Low Boiler Drum Level

✓ Starts standby pump
✓ Operates annunciator

CAUSE	OPERATOR ACTION
	1) **Immediately start standby pump!**
1) Mis-adjusted drum level controller	1) Readjust drum level controller setpoint.
2) Level transmitter failure	1) Recalibrate, repair, or replace drum level transmitter.
3) Boiler feedwater valve failure	1) Repair valve.
4) Worn pump	1) Repair worn pump.

4.6.20 OFF-NORMAL CONDITIONS: Low-Low Boiler Drum Level

✓ Operates annunciator
✓ Fuel trip
✓ FD fan trip

CAUTION!

IF DRUM LEVEL IS NOT RE-ESTABLISHED BEFORE IT IS OUT OF SIGHT IN GLASS, SHUT DOWN ID FAN AND COOL THE BOILER WITH NATURAL DRAFT (FANS OFF, DAMPERS OPEN). SHUT DOWN BOTH BOILER FW PUMPS AND PERFORM A THOROUGH INSPECTION OF ALL PRESSURE PARTS.

CAUSE	OPERATOR ACTION
1) Loss of feedwater supply	1) Re-establish feedwater supply; check valve positions; check motor overloads and reset if necessary.
2) High steam flow	1) Reduce firing rate.

4.6.21 OFF-NORMAL CONDITIONS: High-High Steam Pressure

✓ Operates annunciator
✓ Fuel trip

CAUSE	OPERATOR ACTION
1) Excessive fuel feed rate	1) Reduce fuel feed rate to combustor or auxilliary burner.

4.6.22 OFF-NORMAL CONDITIONS: High DA Tank Level

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Excessive condensate return flow	1) Re-establish normal level by draining tank.

4.6.23 OFF-NORMAL CONDITIONS: Low DA Tank Level

✓ Operates annunciator

CAUSE	OPERATOR ACTION
1) Insufficient condensate return	1) Determine reason and correct.
2) Loss of make-up water	1) Determine reason and correct.

4.6.24 OFF-NORMAL CONDITIONS: Baghouse Hopper Level High

CAUSE	OPERATOR ACTION
1) Ash system blower trip	1) Determine reason and correct.
2) Venturi plugged	1) Unplug venturi.

⚠ WARNING

NEVER OPEN THE ASH SYSTEM WHILE IT IS HOT OR WHEN IT CONTAINS HOT ASH. WEAR PROTECTIVE CLOTHING WHEN WORKING WITH HOT ASH.

4.6.25 OFF-NORMAL CONDITIONS: Baghouse High Differential Pressure

CAUSE	OPERATOR ACTION
1) Dirty filter bags	1) Verify that cleaning cycle is occuring properly.
2) Cleaning system not working	1) Verify adequate air pressure.
	2) Verify controls in automatic.
3) Dampers not open	1) Verify adequate air supply.
	2) Check for broken or binding actuator linkage.
4) Filter bags blinded	1) Replace blinded bags.

5 MAINTENANCE

The purpose of this Section is to provide general guidelines for preventative maintenance on the equipment supplied by EPI. Some equipment supplied by EPI is manufactured by others and therefore has recommended maintenance procedures in the associated equipment manual. The Owner's Manual should be read prior to performing maintenance on a piece of equipment. In case of discrepancies between the EPI Manual and the Vendor Equipment Manual, follow the instructions in the Equipment Manual.

5.1 MAINTENANCE SAFETY PRECAUTIONS

Work in pairs.

Open any access door carefully to prevent hot dust, ash or other materials from falling on you.

Notify someone in charge when you are going inside a confined space or equipment.

Wear gloves; use eye protection such as goggles, and wear protective clothing.

Make sure there is not combustible or inert gas inside confined spaces.

Make certain there is enough air to breathe.

Make sure you can get in and out of the access door quickly and easily.

Be sure there is solid, safe footing inside the equipment.

Make sure ash deposits and other materials are cool enough to touch.

Use a protected light when inside the equipment.

Make sure equipment is locked out at the motor control center.

5.5 FORCED DRAFT AIR SYSTEM

WARNING

NEVER PERFORM WORK ON OR ENTER ANY AREA OF THE FORCED DRAFT SYSTEM WITHOUT FIRST LOCKING OUT THE FD FAN MOTOR AND ID FAN MOTOR AT THE MOTOR CONTROL CENTER.

The forced draft (FD) air system is made up of several different components that require periodic inspection and maintenance. These components are listed with maintenance recommendations.

5.5.1 Inlet Air Silencer

The inlet air silencer has no moving parts. Inspect the screen and baffles for a buildup of particulate. Clean as often as needed to avoid restriction of incoming air.

5.5.2 Ambient Air Damper

Inspect and clean damper blades as often as necessary to avoid particle buildup. Excessive buildup will cause restriction of air flow. The damper does not require lubrication. Inspect actuator linkages for proper fit and attachment. There should be no binding in the movement.

5.5.3 Forced Draft (FD) Fan

During shutdown periods, check for cracks in the fan wheel of both FD and ID fans and make repairs according to manufacturer's recommendations or replace the fan wheel. Check the fan wheel for an accumulation of dirt or ash that may cause imbalance and possible vibration to the fans.

The FD Fan is supplied with Babbit bearings which are designed to operate at a maximum temperature of 200 F. If bearings show wiping or pulling of the Babbit, replace bearing sleeves. If bearings exhibit scouring of the journal during normal inspection, schedule an early shutdown and remove bearing sleeves. If the journal is lightly scoured, remove bearing housing and polish journal. If the journal is heavily scoured, replace the fan shaft.

During periods of extended shutdown, keep the motor interior dry with the built-in heaters. Lubricate the motor bearings according to the motor manufacturer's recommendations. Check the motor for abnormal vibration frequently. Conduct vibration readings before every scheduled maintenance shutdown.

For further details, refer to both Robinson Industries and General Electric vendor data.

5.5.4 Fluidizing Damper

The actuator linkage must be free and working properly. No lubrication is necessary for the bearings. Keep dust and debris away from the actuator bearings. Refer to Beck vendor data for actuator details.

5.5.5 Preheater

Check refractory during shutdowns and make necessary repairs. Check the gas burner and gas pilot burner and assure they are working properly. Check the gas valve train for leaks. Inspect the duct joints frequently for leaks. Refer to Eclipse vendor data for further details.

5.5.6 Fluidizing Nozzles

During shutdown of the combustor vessel, inspect the nozzles for sand erosion, pluggage, or failure and replace as necessary. Inspect the nozzle manifolds for erosion and cracks. Inspect the underside of all manifolds for plugged cooling slots and holes, and possible sand buildup. Inspect the inside of the manifolds from inside the plenum chamber. It is normal to have a small layer of bed material inside the manifolds. Remove accumulations restrict air flow to the nozzles.

5.6 OVERFIRE AIR SYSTEM

The overfire air system is made up of several different components that require periodic inspection and maintenance. Components are listed as follows:

5.6.1 Overfire Air Dampers

Refer to the (Engineer - list vendors) manual for maintenance instructions.

Check both actuators and linkages to verify that they are free and operating properly.

5.6.2 Overfire Air Nozzles

Overfire air is distributed through two manifolds which contain 28 nozzles each. Each nozzle is a 1 -inch pipe connected to a manifold. Inspect the duct for cracks and damage.

5.7 INDUCED DRAFT SYSTEM

5.7.1 Induced Draft (ID) Fan

The same considerations apply as those for the FD fan. Refer to Robinson Industries and General Electric vendor data for further information.

5.7.2 Off-Gas Stack

All connections to the stack must be air tight. Joints, dampers and access doors must seal completely. Cold air leakage to the stack not only lowers the stack gas temperature, which can cause condensate to form on the stack interior, but also increases the quantity of gas the stack must vent. Condensate formation in the stack can cause rapid corrosion of the stack materials.

5.8 BOILER FEEDWATER SYSTEM

5.8.1 Boiler Feedwater Pumps

The importance of a good maintenance program for the boiler feedwater pumps cannot be over-emphasized.

Refer to Peerless Pump Maintenance Manual for further information.

5.8.2 Turbine Drive

Maintenance information on the boiler feed pump turbine drive is contained in the ASC Complex Manual for the Deaerator.

⚠ WARNING

PUMPS WORKING AT HIGH PRESSURES AND TEMPERATURES ARE EXTREMELY DANGEROUS TO LIFE AND LIMB WHEN ANY PART OF THIS SYSTEM FAILS OR BEGINS TO FAIL. DO NOT ATTEMPT TO PERFORM ANY REPAIR WHEN THE SYSTEM IS IN OPERATION. SHUT DOWN THE SYSTEM AND LET IT COOL TO AMBIENT TEMPERATURE AND PRESSURE BEFORE MAKING REPAIRS.

5.8.3 Pipe Hangers

⚠ WARNING

FAILURE TO INSPECT AND MAINTAIN SPRING HANGERS COULD CAUSE FAILURE OF THE PIPING SYSTEM AND POSSIBLE INJURIES OR DEATH TO PERSONNEL.

5.8.4 Variable Support Spring Hanger

The following procedure is a general guideline for installation and adjustment. Refer to vendor data for further information.

1. Attach hanger to structure and pipe, as shown in the detail drawings. Lower hanger rod must be visible at the minimum thread engagement hole. Rods must engage all threads on nuts, clevises, turnbuckles, etc.

2. Once the hanger is securely installed in position, the tensioning nut or turnbuckle may be turned to tension spring to the cold position marked on the can.

3. Once tensioned, the travel stops must be removed by cutting the steel banding holding them in position and removing them.

4. The piping system should then be brought up to normal service temperatures. At this time, all spring hangers must be readjusted to the hot setting, as marked on the spring can load scale. Once this is completed, the hangers should not need readjusting.

5.9 STEAM GENERATION SYSTEM

Inspect the steam generating equipment periodically and before placing it in service to determine the condition and cleanliness of the equipment. This is to ensure that all equipment will function as designed. Repair should be performed promptly.

Fuel types and operating conditions will dictate the frequency of boiler cleaning. Initially, as a minimum, boiler surfaces should be inspected every 90 days. During every outage of sufficient length, all areas of the boiler should be accessed and inspected. Cleaning methods should be employed as required.

Inspect all access openings for tightness. Verify that there is sufficient refractory on the inside of the doors to protect them.

Check all external joints of the boiler casing, hoppers and duct for air or leakage. Take particular notice of leakage through any external expansion joints.

Steam or water leaks are generally detected by sight, sound or changes in makeup water requirements. These should be repaired immediately, if in the boiler or economizer, or as soon as possible otherwise.

⚠ WARNING

DO NOT ATTEMPT TO LOCATE LEAKS WITH HANDS OR ANY PART OF YOUR BODY. SEVERE INJURY OR DEATH COULD RESULT.

5.9.1 Steam Drum

Inspect the steam drum every outage for accumulations of foreign material and broken hardware. Clean and repair as required.

Inspect the access doors for gasket installation.

Prior to operation be sure that all safety relief valve gags, spades, or manufacturing plugs, have been removed.

Check the set pressure stamping on the relief valve against the set pressure as listed on the P&IDs.

Inspect the tightness of all bolted equipment inside the stream drum.

Check for the correct installation of the demister pad.

Verify that all alarms and limit switches are functioning correctly.

Activate the auxiliary low water cut-out, and verify that it functions properly in both startup and shutdown of the unit.

Keep in mind that the above signal is one of the most important functions of the boiler operation.

The steam drum water level gage glass must be inspected frequently and kept clean. The gage glass may not read water level accurately if the drain valve is leaking. When blowdown is completed and valves are closed, visually confirm the return of water in the gage glass. Always be sure drain valves are closed tightly after a blowdown. Should a gage glass break during operation, close the gage glass valves and replace the broken glass immediately. Never attempt to operate for extended periods without a visual indication of water level.

The water column should be blown down each shift to remove accumulated boiler water sludge which may foul the water column and cause false water level observations.

5.9.2 Boiler Tubes

Check tubes for erosion, warpage, corrosion, and ash/slag accumulations on the tubes. Inspect refractory for cracks, loose pieces and general integrity. Severe warpage and ash/slag accumulation can create high velocity flue gas channeling through the assemblies that can erode tube material.

5.9.3 Sootblowers

Refer to Diamond Power vendor data for further details.

Check alignment of the steam nozzles on the blower elements with respect to the tube assemblies. Verify nozzles are aimed between assemblies, not directed towards a tube. Improper sootblower alignment can cause serious cutting of boiler tubes and result in tube failure. The start/stop positions of the steam blower sweeps must be checked frequently for compliance with the manufacturer's instructions.

⚠ WARNING

NEVER ALLOW ASH TO ACCUMULATE IN THE HOPPERS UNDER THE BOILER. NEVER OPEN THE ASH HOPPERS WHILE OPERATING OR WHEN HOT. WEAR PROTECTIVE CLOTHING WHEN WORKING WITH HOT ASH.

5.9.4 Economizer (Fin Tube)

During each outage check tubes for erosion, warpage, corrosion and ash accumulations on the tubes.

Inspect casing for cracks, loose pieces, and general integrity.

Severe warpage and/or ash accumulation can create high velocity gas channeled through the assemblies that can erode tube material.

If there are excessive ash accumulations, clean dirty areas thoroughly.

Refer to KenTube Installation and Operation Manual for future information.

5.9.5 Deaerator

Please refer to the ASC Complex Operation and Maintenance Manual for the Deaerator System. This manual contains instructions about the Deaerator itself, the boiler feed pump turbine, and the Deaerator trim, including level controls, steam pressure controls, and other items.

5.10 BAGHOUSE

Refer to Procedair vendor data for further information.

The baghouse is comprised of three separate filtering modules. It is capable of operating on two modules, with the third isolated for maintenance. Each of the modules has its own pressure differential indicator. There is also one overall pressure differential transmitter. Normally, the modules will cycle through a cleaning sequence automatically, depending on how often cleaning is required.

During shutdown for scheduled maintenance, the following items should be inspected and corrective action taken:

Check all three inlet dampers for binding, sealing capabilities and for corrosive/erosion.
Check all three outlet poppet valves for binding, sealing capabilities and corrosion/erosion.

Check each filter bag for rips, tears and flue gas erosion.

Check all filter bag clamps.

Replace filter bags that cannot be cleaned by the pulse jets.

Check hopper heater.

Check the hopper discharge for pluggage.

Check operation of air cylinder actuators.

Inspect and replace defective solenoid air valves.

Inspect all air hose and fittings for leaks.

Inspect all lift-off doors for a tight air seal.

Check vibrators.

Inspect level indicators.

⚠ WARNING

BAGHOUSE MODULES ARE SUBJECT TO HIGH TEMPERATURES (340°F) AND CAN CAUSE SEVERE BURNS WHILE HOT.

5.11 PREVENTIVE MAINTENANCE GUIDELINES

The following paragraphs are general guidelines which may be incorporated into the plant maintenance procedures. These guidelines are not intended to replace original manufacturer's recommendations. If a conflict exists, follow the original manufacturer's recommendations.

5.11.1 Rotating Equipment

Regularly perform the following on rotating equipment:

Check all electric motors for free rotation, without power.

Check all driven equipment for free rotation and possible imbalance.

Never operate pumps under power unless they are vented and completely filled with liquid.

Do not connect motors to driven equipment until the correct direction of the rotation is established.

<u>NOTE:</u> *IF CLICKING, RUMBLING OR ABNORMAL NOISES ARE EMITTED FROM A ROTATING BEARING, DO NOT ATTEMPT TO ELIMINATE THE SYMPTOM BY LUBRICATION. IT MUST BE REPLACED WITH A NEW BEARING.*

5.11.2 Vibration

Most motor driven equipment will normally exhibit a small amount of vibration. However, excessive vibration can destroy equipment and threaten the safety of personnel.

Following is a list of causes for excessive vibration:

Flexible couplings misaligned

Improperly bored coupling

Maximum .002 runout for 1750 RPM; maximum .001 runout for 3600 RPM).

Bent shaft

Bearings dirty or failing

Rotating elements not balanced

Misalignment between equipment and motor

NOTE: *EVERY THIRTY DAYS OF CONTINUOUS OPERATION, CHECK TIGHTNESS OF ALL FASTENERS SUBJECT TO ROTATING EQUIPMENT VIBRATION.*

If excessive vibration caused by rotating equipment occurs during normal operation, switch to standby equipment or begin shutdown of that piece of equipment. Continuous running of equipment with excessive vibration may cause:

Shafts to fatigue and rupture
Early bearing failure
Destruction of components
Base mounts to loosen
External structures to fail or come loose
Instruments to read inaccurately
Operator/personnel injury or death

5.11.3 Bearings

When removing or installing bearings, the following precautions must be followed:

Do not use a torch to remove an anti-friction bearing under any circumstance. Use a hand grinder to split the bearing races, if necessary. Heating a rotating shaft will cause distortion and eventual vibration.

Do not use a torch or open flame to heat a bearing before fitting it to a shaft. If necessary, heat the bearing in an electric oven or with induction heaters designed to heat bearings evenly.

When installing bearings, never apply pressure in such a manner that the pressure is transmitted through the rollers (ball, roller, taper, spherical, etc.)

Clean bearings thoroughly with clean solvent. Wipe away solvent with a clean, lint-free rag or clean, compressed air. Do not spin bearings with compressed air.

Whenever a piece of equipment is disassembled for repair, it is always good insurance to replace the bearings, regardless of their condition.

Keep exposed bearings covered at all times.

Bearing housings should be cleaned; also blow out the oil holes, if provided.

5.12 GEARING AND ENCLOSED GEAR TRAINS

Alertness to change in operating characteristics such as increased vibrations, oil leaks, temperature and noise can prevent costly shutdowns. Troubleshoot and eliminate the cause of the problem as soon as possible.

5.12.1 V-Belt Drives

The best belt tension for a V-belt drive is the lowest tension at which the belt will not slip under full load conditions.

Too much tension shortens belt life; too little tension causes slippage, which causes premature belt failure.

5.12.2 Chain Drives

Lubrication is the most important factor in maintaining high chain efficiency and providing a long service life.

Check for:

Sprocket and shaft alignment
Sprocket tooth wear
Proper chain tensioning
Adequate and correct lubrication
Visual indication of improper operation of the chain parts, such as unusual chain wear.

5.13 PREVENTIVE MAINTENANCE SCHEDULE

The schedule presented indicates the minimum initial recommendation for a preventive maintenance program. Cognizant of the fact that a good preventive maintenance program must take into account actual plant operating conditions and experience, EPI recommends a complete, comprehensive preventive maintenance plan be formulated from the vendor's maintenance plan and the actual operating experience of the plant.

A good preventive maintenance program will always mean more efficient operation, less breakdown maintenance, less unscheduled plant outages, and a reduction in the rate of "wear and tear" of the plant equipment. Thus, it must be implemented at all times, if possible.

Furthermore, a good operations record and a good maintenance record must be kept.

Deviation from normal operation, as reflected in the operations records, usually indicate an abnormal operating condition or an equipment fault. A deviation analysis must immediately be done and the cause of the deviation corrected as soon as possible to prevent breakdowns. This is part of good preventive maintenance.

A good maintenance record will always be a good basis for future maintenance programming and planning, and very useful for setting up an effective spare parts program.

PREVENTIVE MAINTENANCE

EQUIPMENT	MINIMUM FREQUENCY SHIFT	DAY	WEEK	MONTH	3MO	6MO	SHDN	REMARKS
Combustion Cell								
Check Bed Level			X					
Record Bed Temperature		X						
Inspect Refractory							X	
Inspect Nozzles							X	
1402-0101 Forced Draft Air								
Inspect FD Fan Bearings			X					Check Temperature &
Lubrication								
Inspect Inlet Damper							X	
Inspect Actuator			X					
Inspect Linkages			X					
Inspect Fan Rotor							X	Check for Vibrations
Frequency								
Inspect F.D. Motor Drive and Coupling							X	
Underfire Air								
Fluidizing Air Damper								
Inspect Bearings							X	Use anti-seize lubricant to
prevent Inspect Linkages							X	seizure
Inspect Actuator							X	
Overfire Air								
Inspect Dampers (2)			X					
Inspect Actuators (2)			X					
Inspect Bearings			X					
Preheater								
Inspect Burner							X	
Inspect Flame Rod							X	
Inspect Spark Plug							X	
Inspect Air Wings							X	
Inspect Gas Valve Train							X	Check for leaks
Inspect Duct Joints for Leaks		X						
Bed System								
Inspect Slidegates			X					
Inspect Air Cylinders			X					
Inspect Cam Rollers			X					
Inspect Vibrating Conveyor			X					
Inspect Coil Springs and Stabilizer		X						
Inspect Screen for Wear and Clean Screen								
Inspect Drive Arm and Bushings		X						
Inspect V-Belts				X				
Check Bearings				X				
Inspect Bucket Elevator				X				
Inspect Chain for Wear							X	
Inspect Buckets							X	
Inspect Gear Box and Bearings							X	
Inspect Motor Mounts, V-Belts							X	
Inspect Reinjection Slidegates							X	
Inspect Air Cylinder for Reinjection Slidegate							X	
Inspect Flop Gate							X	
Inspect Air Cylinder for Flop Gate							X	
Inspect Bearings							X	

PREVENTIVE MAINTENANCE

EQUIPMENT	MINIMUM FREQUENCY SHIFT	DAY	WEEK	MONTH	3MO	6MO	SHDN	REMARKS
Induction System								
Inspect Fan Bearings			X					Check Temperature and
Inspect Fan Rotor							X	Lubrication
Inspect Inlet Damper							X	
Inspect Linkages			X					
Inspect Actuator			X					
Inspect I.D. Motor Drive and Coupling							X	
Limestone System								
Inspect Vibrators			X					
Check Slidegates							X	
Inspect Air Cylinders							X	
Inspect Pneumatic Fill System for Plugging or Severe Erosion							X	
Boiler System								
Inspect Sightglass	X							
Inspect Boiler Tubes Headers, Drums and Refractory							X	Internal inspection of tubes refractory and sootblower
Blowdown - Continuous							X	cleaning patterns
Inspect Safety Valves							X	
Inspect Sootblowers							X	
Inspect Economizer							X	
Boiler Feedwater								
Inspect Mechanical Seals for Leakage		X						
Inspect Pumps, Bearings			X					
Check for Vibration			X					
Check Pipe Joints and Valves for Leaks			X					
Inspect Pressure Indicators, Pressure Regulating Valves, Pressure Relief Valves for Leaks or Malfunction			X					
Check Flow Indocators				X				
Inspect Couplings							X	
Inspect Electric Motor Drive							X	
Check B.F.P. Turbine Drive System							X	

PREVENTIVE MAINTENANCE

EQUIPMENT	MINIMUM FREQUENCY SHIFT	DAY	WEEK	MONTH	3MO	6MO	SHDN	REMARKS
Fuel Metering System								
Inspect Chain Drives for Wear and Proper Tension			X					
Check for Proper Lubrication of Chain/Sprockets, Bearings and other Lubricated Parts of the Variable Speed Drive System			X					
Inspect Bearings			X					
Inspect Metering Bins							X	
Inspect for Bent Augers							X	
Inspect the Motor, Speed Reducer, Coupling and other Components of the Metering Auger Drive			X					
Inspect the rotary Feeders and Motor Drives							X	
Pneumatic Fuel Transport System								
Inspect Filter/Silencer			X					
Check Blowline for Leaks			X					
Check that all Lubricating Points are Properly Lubricated			X					
Inspect the Rotary Feeders and Their Motor Drive							X	
Inspect the Blower Units							X	
Inspect the Motor, Sheaves and Belts of the Blower Drive Assembly							X	
Check Isolation Valves							X	
Check Wear Elbows for Wear Rate							X	
Flue Gas System								
Baghouse Assembly								
Inspect Air Line Filters and Blowdown Drains			X					
Check Lubricating Oil Levels			X					
Test Dampers/Poppet Valves for Proper Operation							X	
Check Fabric Filter for Corrosion				X				
Inspect Duckwork for Dust Buildup							X	
Lubricate Poppet Valves							X	
Inspect Air Cylinders							X	
Inspect Access Doors and Door Gaskets							X	

5.14 LUBRICATION SCHEDULE

Most electric motors are shipped with lubrication recommendations on attached tags. If the tag is missing, consult the manufacturer.

The following table provides a general guide to relubrication of electric motors:

HP Range	Std. Duty 8-Hour Day	Severe Duty 24-Hour Day	Extreme Duty (Very Dirty)
1 1/2 - 7 1/2	5 years	3 years	9 months
10 - 40	3 years	1 year	4 months
50- 150	1 year	9 months	4 months

Following are typical temperature/greasing intervals for pillow block type bearings:

Bearing Operating Temperature	Bearing Greasing Intervals
32 F to 120 F	6 to 12 months
120 F to 160 F	1 to 12 months
160 F to 200 F	1 to 4 weeks

Oil-lubricated bearings require mineral oils free from water, sediment, acid or resins, with suitable viscosity to handle the operating temperature. Viscosity is measured in units called Saybolt Universal Seconds (SUS). The larger the SUS number, the better the filming action of the oil. Viscosity will drop as the temperature of an oil increases. A typical SAE-20 oil has 349 SUS at 100 F, but 57 SUS at 210 F. Oil with the following SUS viscosities is recommended for use at plant operating temperatures.

Ball Bearings	70 SUS
Roller Bearings	100 SUS
Spherical Thrust Bearings	150 SUS

Typical Oil Viscosities

SAE 10 Oil	SUS 183 @ 100 F 46 @ 210 F
SAE 20 Oil	SUS 348 @ 100 F 65 @ 210 F
SAE 30 Oil	SUS 489 @ 100 F 97 @ 210 F

Check with your oil supplier for SUS values pertaining to your operating temperatures. Oil lubrication schedules do not take into consideration adverse environmental conditions (moisture, dirt, etc.). During the first year of operation, it would be advisable to inspect the oil frequently for visual contaminants and to ask your local oil supplier to test used oil samples for contamination.

The Lubrication Schedule in this section is intended to be used as a guideline. The schedule shows lubrication type and frequency for various equipment components. the guideline is provided for maintenance personnel to utilize in conjunction with present plant operating procedures and specific manufacturer's recommendations. Refer to Vendor Data for additional information.

NOTE: *It is suggested the operating contractor contact a local lubrication/oil distributor to perform a lubrication survey of the plant. This survey should indicate the lubrication type, frequency, and quantity for each piece of equipment.*

Lubrication volume refers to the quantity of grease for a standard low pressure hand operated grease gun. The following are approximate quantities for a grease gun.

4 Grams	3 Pumps
6 Grams	4 Pumps
10 Grams	7 Pumps
27 Grams	19 Pumps

One ounce = 28 1/3 Grams

Not all of the lubricants listed are to be used on this power plant.

5.15 Hydraulic Maintenance

Cleanliness in the work area is important when servicing hydraulic systems. Keep dirt and other contaminants out of the system. Small particles can score valves, seize pumps/motors, clog orifices and cause extensive damage. Here are some common problems:

- Not enough oil in the reservoir

- Clogged or dirty oil filters
- Loose intake lines
- Incorrect oil in the system

When adding or changing hydraulic oil, be sure the area around the filler is clean and the container used to transport the oil is clean and protected from contamination. Change the oil filters often to avoid clogging and the inability of the oil to keep contaminates in suspension.

Prevent the oil from overheating. The reservoir and oil coolers should keep the system from overheating. Overheating can cause the following:

- Break down of the oil
- Damage the seals
- Coat parts with varnish deposits
- Cause extra leakage past working parts
- Reduce the output of the system

Codes in the following Lubrication Schedule refer to the following lubricants:

CODE	MANUFACTURER	LUBRICANT - GREASE	REMARKS
A	Penzoil	EP712	General Purpose, E.P. Lithium
	Mobile	Mobilux EP2	Base Grease, NLGI-2
	Sun Oil	Prestige 742-EP	
	Shell	Alvania No. 2	
	Union Oil	Unoba EP#2	
	Texaco	Multipak EP2	
	Chevron	Polyurea EP2	
	Exxon	Lidok EP#2	
	Gulf Oil	Crown EP2	
B	Standard Oil	Van Caloria 40M	Graphite and Silicon
C	Fisk	Lubriplate GR-132	Special Grease

CODE	MANUFACTURER	LUBRICANT - OILS	REMARKS	AMBIENT TEMP.
D	Amoco	#31	AGMA #2	
	Arco	Duro S-315		15 F
	Citgo	Pacemaker 30		to
	Exxon	Teresstic 68		40 F
	Gulf	Harmony 68		
	Shell	Turbo 68		
	Texaco	Regal RO-68		
E	Amoco	#51	AGMA #3	
	Arco	Duro S-465		
	Citgo	Pacemaker 60		40 F
	Exxon	Teresstic 100		to
	Gulf	Harmony 90		60 F
	Shell	Turbo 100		
	Texaco	Regal RO-100		
F	Amoco	#75	AGMA #4	
	Arco	Duro S-700		
	Citgo	Pacemaker 80		50 F
	Exxon	Teresstic 150		to
	Gulf	Harmony 150D		85 F
	Shell	Turbo 150		
	Texaco	Regal RO-150		
G	Amoco	#95	AGMA #5	
	Arco	Duro S-1000		
	Exxon	Nuto 220		85 F
	Gulf	Harmony 220		to
	Shell	Tellus 220		125 F
	Texaco	Regal RO-220		
H	Barber-Coleman	Immersion Oil, BYZP-195-1	Special Oil by BC	

		HYDRAULIC OILS
I	Sinclair	Duro AW-31
	Citco	XC30 Pacemaker
	Mobile	D.T.E. 26
	Ashland	Ultramax AW-30
	Humble	Nuto AW-30
	Shell	Tellus No. 933
	Sun	DX - Roza - 1320
	Standard (Ohio)	Dura RX Anti-Wear 300
	Pure (Union)	Durapale RX Anti-Wear 300
	Phillips	Magnus A, Grade 315
	American	Rykon Industrial Oil No. 31
	Gulf	Harmony 54 AW
	Chevron	Hydraulic Oil No. 15
	Std. Oil of Calif.	Hydraulic Oil No. 15
	Std. Oil of B.C.	Hydraulic Oil No. 15
	Std. Oil of Kentucky	Hydraulic Oil No. 15

LUBRICATION SCHEDULE

EQUIPMENT	LUBE CODE	LUBE VOL	MINIMUM FREQUENCY DAY	WEEK	MONTH	3MO	6MO	12MO	REMARKS
Drag Chain Conveyor									
Bearings	A					X			
Chain Drive/Sprockets	G					X			
Gear Box	G					X			
Motor	A					X			
Steep Angle Conveyor									
Torque Arm Reducers	G					X			
Return Conveyor									
Bearings	A					X			
Cross-Over Conveyor									
Motor	A					X			
Ash Augers									
Bearings	A								
Gear Box	G								
Motor	A								