WASH-1230 (VOL. III)

VOLUME III
COAL-FIRED FOSSIL PLANT

1000-MWE CENTRAL STATION POWER PLANTS
INVESTMENT COST STUDY

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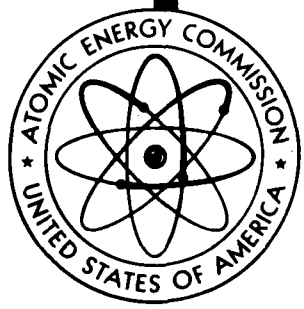

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INTRODUCTION

This report on a 1000 MWe nominally rated Coal-Fired Fossil Plant is one of a series of investment cost studies covering detailed cost and unit quantities performed under AEC contract number AT(30-1)-3032, formerly AT(30-1)-3770, modifications 9 and 10. Modification 9 consists of the following studies:

Volume No.	Title
I	Pressurized Water Reactor Plant
II	Boiling Water Reactor Plant
III	Coal-Fired Fossil Plant
IV	Oil-Fired Fossil Plant

Modification 10 consists of a study on a pool-type Liquid Metal Fast Breeder Reactor Plant.

The cost data for the nuclear plant studies are presented in accordance with Appendix A of "Guide For Economic Evaluation of Nuclear Reactor Plant Designs", USAEC Report Number NUS-531. This guide was modified for the fossil plant studies.

The intent of these studies is to present detailed cost information for a series of 1000 MWe electric generating plants to permit cost comparisons, evaluations and projections based on equivalent assumptions relative to site, labor, performance, and reference dates for cost data.

The cost data included in these reports is based on prices effective as of January 1971, and reflects to the maximum extent actual construction experience for units nearing completion or in operation. Table I-1 presents a summary of the detailed cost estimate that appears in section V of this report. This data should be adjusted to reflect normal contingency costs for material, labor and professional services. Use of this data for projection to a future operating date should be adjusted for escalation and interest during construction.

Similarly it is emphasized that a fundamental assumption of these reports is the unrestricted availability of water for once thru cooling with no provision for extended discharge, restricted intake velocities or dilution. These factors should be considered in applying these data to a specific site.

Table I-1

SUMMARY OF ESTIMATES

Coal-Fired Fossil Plant

Description	Coal		
	Material	Labor	Total
Land & Land Rights	$ 1,000,000	$ -	$ 1,000,000
Structures & Improvements			
Yardwork	1,117,000	1,404,000	2,521,000
Main Power Station Building	8,196,000	8,774,000	16,970,000
Containment Building	-	-	-
Turbine Room & Heater Bay	-	-	-
Intake & Discharge Structures	762,500	1,539,000	2,301,500
Primary Auxiliary Building	-	-	-
Radwaste Building	-	-	-
Fuel Handling Building	-	-	-
Control Room Building	-	-	-
Diesel-Generator Building	-	-	-
Administration Building	470,000	440,500	910,500
Service Building	-	-	-
Fan Room Building	-	-	-
Aux. Feed Pump Enclosure	-	-	-
Stacks	-	-	-
Total Structures & Improvements,-	10,545,500	12,157,500	22,703,000
Reactor Plant Equipment			
Reactor Equipment			
Reactor Coolant System			
Safeguards Cooling Systems			
Radioactive Waste Systems		(Not Applicable)	
Nuclear Fuel Handling Sys.			
Other Reactor Plant Equipt.			
Instruments & Controls			
Total Reactor Plant Equipment,-			

Table I-1 (Cont'd)

Description	Coal		
	Material	Labor	Total
Boiler Plant Equipment			
Steam Generating Equipt.	$20,925,000	$ 9,080,000	$30,005,000
Draft System	6,598,000	3,914,500	10,512,500
Fossil Fuel Equipment	8,005,000	3,709,000	11,714,000
Ash Handling System	1,196,000	1,124,500	2,320,500
Instruments & Controls	1,700,000	57,500	2,275,000
Miscellaneous Suspense Items	110,000	600,000	710,000
Total Boiler Plant Equipment,-	38,534,000	19,003,000	57,537,000
Turbine Plant Equipment			
Turbine Generator Equipt.	$20,041,500	$ 1,752,500	$21,794,500
Condenser Water System	2,101,000	2,188,400	4,289,400
Condensing Systems	3,200,800	1,511,000	4,711,800
Feedwater Systems	5,767,500	2,442,500	8,210,000
Other Turbine Plant Equipt.	4,241,500	4,144,000	8,385,500
Instruments & Controls	715,000	450,000	1,165,000
Total Turbine Plant Equipment,-	36,067,300	12,488,400	48,555,700
Electric Plant Equipment			
Switchgear	1,378,800	271,000	1,649,800
Station Service Equipment	3,572,000	662,000	4,234,000
Switchboards	220,000	55,000	275,000
Protective Equipment	92,000	175,000	267,000
Elect. Struct. & Wiring Cont.	553,000	1,886,000	2,439,000
Power & Control Wiring	1,376,200	2,545,500	3,921,700
Total Electric Plant Equipment,-	7,192,000	5,594,500	12,786,500

Table I-1 (Cont'd)

Description	Coal Material	Coal Labor	Coal Total
Miscellaneous Plant Equipt.			
Transportation & Lifting Eqt.	$ 205,000	$ 57,000	$ 262,000
Air, Water & Steam Serv. Sys.	1,173,500	1,455,000	2,628,500
Communications Equipt.	60,000	90,000	150,000
Furnishing & Fixtures	420,000	57,500	477,500
Total Miscellaneous Plant Equipment,-	1,858,500	1,659,500	3,518,500
Subtotal:	95,197,300	50,902,900	146,100,200
Undistributed Costs			
Professional Services	$ -	$ -	$ 13,650,000
Other Undistributed Costs			
Temporary Facilities	1,050,000	2,375,000	3,425,000
Construction Equipment	5,525,000	525,000	6,050,000
Construction Services	1,755,000	535,000	2,290,000
Operator training, spare parts, Owner's Gen'l Offices and Administ. Costs	-	-	2,600,000
Total Other Undistributed Costs,-	10,930,000	3,435,000	14,365,000
Total Base Const. Costs			174,115,200

SECTION 2

SITE AND ENVIRONMENT

This section sets forth the site and environmental data, as defined in Appendix A of "Guide for Economic Evaluation of Nuclear Reactor Plant Designs," USAEC Report NUS-531, modified to reflect Fossil Plant Siting. This data forms a basis of the criteria for designing the facility and for evaluating the ambient air quality concentrations that result from the emissions of a single point source.

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2.1 Topography and General Site Characteristics

The site is located on the east bank of the North River at a distance of twenty-five miles south of Middletown, the nearest large city. The North River flows from north to south and is one-half mile (2600 feet) wide adjacent to the plant site. A flood plain extends from both river banks an average distance of 1/2 miles, ending with hilltops generally 150 to 250 feet above the river level. Beyond this area, the topography is gently rolling, with no major critical topographical features. The plant site itself extends from river level to elevations of fifty feet above river level. The primary structures and the switchyard will be located on level ground at an elevation of eighteen feet above the mean river level. This elevation is ten feet above the 100-year maximum river level, according to U. S. Army Corps of Engineers studies of the area.

In order to optimize land area requirements for the fossil fueled plant site, maximum use of the river location was employed. The primary structure is located 400 feet from the east bank of the river. The site land area was taken at approximately 500 acres.

2.2 Site Access

Highway access is provided to the Hypothetical Site by five miles of secondary road connecting to a state highway; this road is in good condition and needs no additional improvements. Railroad access will be provided by constructing a railroad spur which intersects the B&M Railroad. The length of the required spur from the main line to the plant site is assumed to be five miles in length for all plant sizes. The North River is navigable throughout the year with a

forty-foot wide channel, 12 feet deep. The distance from the shoreline to the center of the ship channel is 2000 feet. All plant shipments will be made overland except that heavy equipment may be transported by barge. The Middletown Municipal Airport is located 3 miles west of the State highway, 15 miles south of Middletown, and 10 miles north of the site.

2.3 Population Density and Land Use

The Hypothetical Site is near a large city (Middletown, 250,000 population) but in an area of low population density. Variation in population with distance from the site boundary is:

Miles	Cumulative Population
0.5	0
1.0	310
2.0	1,370
5.0	5,020
10.0	28,600
20.0	133,000
30.0	1,010,000

There are five industrial manufacturing plants within 15 miles of the Hypothetical Site. Four are small plants employing less than 100 people each. The fifth, near the airport, employs 2500 people. Closely populated areas are found only in the centers of the small towns so the total land area used for housing is small. The remaining land, including that across the river, is used as forest or cultivated crop land, except for railroads and highways.

2.4 Cooling Water and Public Utility Services

Utilities are available as follows:

- The North River provides an adequate source of raw make up and condenser cooling water for the ultimate station capacity. The average maximum temperature is 75°F and the average minimum is

39°F. The mean annual temperature is 57°F. (These temperatures are such as to enable the turbine back-pressure to be specified as 1.5 inches Hg. absolute).

- Natural gas service is available two miles from the site boundary on the same side of the river.

- Communication lines will be furnished to the project boundaries at no cost.

- Power and water for construction activities are available at the southwest corner of the site boundary.

2.5 Meteorology and Climatology

Prevailing Wind

According to Weather Bureau records at the Middletown Airport, located ten miles north of the site on a low plateau just east of the North River, surface winds are predominantly southwesterly 4 - 10 knots during the warm months of the year, and westerly 6 - 13 knots during the cool months.

There are no large diurnal variations in wind speed or direction. Observations of wind velocities at altitudes indicate a gradual increase in mean velocity and a gradual veering of the prevailing wind direction from southwest and west near the surface to westerly and northwesterly aloft.

In addition to the above, studies of the area indicated that there is a significant channeling of the winds below the surrounding hills into the north-south orientation of the North River. It is estimated that winds within the river valley blow approximately parallel to the valley orientation in excess of 50 percent of the time.

Atmospheric Diffusion Properties

During the warm months of the year, according to analysis of Weather Bureau records, the atmospheric conditions near the surface are 25 percent unstable (Pasquill A, B, and C), 40 percent neutral (Pasquill D), and 35 percent

stable (Pasquill E and F). Average wind speeds are approximately six miles per hour during unstable conditions, ten miles per hour during neutral conditions, and four miles per hour during stable conditions.

During the cool months of the year, the atmospheric conditions are 15 percent unstable, 50 percent neutral, and 35 percent stable. Average wind speeds are six miles per hour during unstable conditions, twelve miles per hour during neutral conditions, and four miles per hour during stable conditions.

Severe Meteorological Phenomena

A maximum instantaneous wind velocity of 100 mph has been recorded at the site. During the past 50 years, three tropical storms, all of them in the final dissipation stages, have passed within 50 miles of the site. Some heavy precipitation and winds in excess of 40 miles per hour were recorded, but no significant damage other than to crops resulted.

The area near the site experiences an average of 35 thunderstorms a year, with maximum frequency in early summer. High winds near 60 mph, heavy precipitation, and hail are recorded about once every four years.

In forty years of record, there have been twenty tornadoes reported within fifty miles of the site. Maximum tornado frequency occurs in May and June.

During the past forty years, there have been ten storms in which freezing rain has caused power transmission line disruptions. Most of these storms have occurred in early December.

Ambient Background Concentrations:

Background concentrations of SO_2, NO_x and particulates are typical of a rural area approximately 30 miles from a major industrial metropolitan center. They should be considered when determining the plant's adherence to the guidelines.

Air Quality Estimation:

Ambient pollutant levels may be estimated through the application of atmospheric diffusion models. The estimates are based primarily upon the pollutant emissions,

meteorology, and topography as previously described. Several procedures are available for estimating air quality based on atmospheric dispersion. The complexity and sophistication of these procedures range from a few simple calculations that may be made manually to thousands of calculations that require a computer. The method presented here is the point model where the air quality results from a single point source of pollutant within the site boundary.

Point Model

The ambient air quality concentrations that result from the emissions of a single point source have a large degree of variability depending upon the meteorological conditions. Because of this, the short term air quality concentrations are of more concern then the long term. Short term maximum concentrations are assumed to occur when the plume is trapped in a mixing layer of limited depth. In this case, the 1-hour ground level concentration from a single point source may be estimated from the following equation:

$$X = \frac{Q}{\sqrt{2\pi}\,\sigma y\, Lu} \exp\left[-.5(y/\sigma y)^2\right]$$

where:

X = concentration, gm/meter^3
Q = source emission rate, gm/sec.
σy = the standard deviation in the crosswind direction of the plume concentration distribution, meters
L = height of the mixing layer, meters
u = wind speed, meters/second
y = cross wind distance, meters

The values of the meteorological parameters are based on the meteorological conditions in the vicinity of the plant. Multiplying the estimated one-hour concentration by 0.25 may be used to estimate a maximum 24-hour concentration. This factor is deemed appropriate for the meteorological conditions to which the above equation applies. The factor implies that the meteorological conditions persist 6 hours of a 24-hour period. During the remaining 18-hours, wind

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direction and other meteorological parameters are such that the source has no impact upon the location subjected to contamination during the 6-hour period. The estimated maximum 24-hour concentration may be compared to the maximum 24-hour national standards.

Under certain source and meteorological conditions, the above equation may not be appropriate; however, other equations* are available that may be used.

The procedure outlined above is that proposed by the Environmental Protection Agency in the Federal Register dated August, 1971, Volume 36, Number 158.

2.6 Geology and Seismology

Soil Profiles and Load Bearing Characteristics

Soil profiles for the site show alluvial soil and rock fill to a depth of eight feet; Brassfield limestone to a depth of 30 feet; blue weathered shale and fossiliferous Richmond limestone to a depth of 50 feet; and bedrock over a depth of 50 feet. Allowable soil bearing is 6000 psf and rock bearing characteristics are 18,000 psf and 15,000 psf for Brassfield and Richmond strata, respectively. No underground cavities exist in the limestone.

Seismology

This is a Zone 1 site, as designated by the Uniform Building Code, based on the observation of three earthquakes of seismic intensities 4-6 on the Modified Mercall scale during the period 1870-1958, causing minor damage to towns in the surrounding area.

2.7 Sewage

All sewage must receive primary and secondary treatment prior to discharge into the North River.

* Turner, D. B., "Workbook of Atmospheric Dispersion Estimates," Public Health Service Publication No. 999-AP-26.

1000 MW COAL-FIRED PLANT

TECHNICAL DESCRIPTION

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SECTION 1

INTRODUCTION

This report describes the Middletown Power Generating Station utilizing a coal-fired steam supply system. The station is located on the east bank of the North River at a distance of twenty-five miles south of the nearest large city.

The plant incorporates a once-through supercritical, single stage reheat type steam generator to supply steam to a tandem compound six flow turbine with 33½ inch last stage buckets. All on-site facilities are provided for a complete and operable plant. The heat balance shown on plate 8 reflects typical steam conditions for a 1000 MWe nominally rated plant.

A closed cycle system for the plant consists of two double string high pressure heaters, one deaerator, three double string low pressure heaters, one triple string low pressure heater, two boiler feed pumps with steam turbine drives, three heater drain pumps, each with a drain receiver, three booster pumps, three surface condensers with three condensate pumps and six circulating vertical pumps.

SECTION 2

STEAM GENERATOR AND AUXILIARIES

a. Steam Generator

The steam generator is a coal-fired, once-through, supercritical, single reheat type designed to operate at the superheater outlet at a supercritical pressure of 3500 psig and temperature of 1005°F, and at the reheater outlet at 630 psig and 1005°F.

Feedwater is fed into the economizer inlet at one end of the unit and leaves as superheated steam at the superheat outlet. The once-through forced circulation principle is a continuous water and steam flow circuit, consisting of a series of component pressure parts, originating at the boiler feed pump and terminating at the main turbine stop valve as one continuous piping system. The boiler feed pump supplies the pressure to satisfy the turbine throttle demand after forcing water through the complete circuit, namely; check and stop valves, feedwater piping and high pressure heaters, economizer, evaporating surface (furnace enclosure), primary superheater, secondary superheater, main steam piping, high pressure turbine stop valve.

As the water passes through the tubes, absorbing heat, its enthalpy increases to transform the water to steam which then becomes superheated for the high pressure turbine.

Steam from the high pressure turbine returns via the cold reheat piping to the reheater inlet header, flows through the reheater to the reheat outlet headers and hot reheat piping to the intermediate pressure turbine.

Main steam temperature is maintained at design temperature by attemperation. Reheat steam temperature is maintained by gas recirculation and attemperation. The entire steam generating unit, flues and ducts, air heaters and recirculation system is covered with block insulation and ribbed aluminum lagging.

A bypass system is provided around the turbine and superheater to permit the necessary water flow through the tubes at such times when the heat absorbed is not sufficient to produce steam quality and temperature suitable for the turbine, such as during start-up. This bypass provides means for dissipating pressure and temperature from the boiler down to the condenser conditions. At time of overpressure, relief is provided through the bypass. Automatic controls with interlocks are provided with the boiler to assure sufficient water flow at any time there is heat input. This protection is the prime essential to prevent over temperature rather than overpressure of the tube metals.

b. Fuel Burning System

Coal from the bunker passes through the coal valves to the volumetric type feeders. A total of nine feeders regulate the quantity of coal to the nine planetary roll and table pulverizers. The pulverizers crush the coal to a powder consistency and is blown into the furnace through seventy two, horizontal intervane burners. Twenty four mechanical atomizing oil burners are furnished with the steam generator suitable for firing oil No. 2 for a 17% of full load firing rate in an emergency.

Sealing air is provided by five seal air blowers.

c. Soot Blowing System

The steam generator is equipped with an automatic sequential soot blowing system for the purpose of removing soot and ash from the boiler surfaces to maintain proper heat transfer. The system consists of 40 fuel retracts in the furnace, superheater and reheater sections, and 16 half retracts in the economizer section. The soot blowers use compressed air as the blowing medium with electric motors for rotating and traversing of the lances. Three, thirteen stage, centrifugal compressors supply the required sootblowing air at a pressure of 300 psig to pressure reducing stations to the pressure required by the sootblowers.

Each blower is provided with a mechanically operated poppet valve which has an adjustable blowing medium pressure control. Opening of the valve is automatically controlled by the travel of the blower carriage. An adjustable trip pin on the carriage assembly operates the cam and arm assembly to automatically open the poppet valve, admitting blowing medium when the lance tube is projected to the blowing position. The valve will be closed automatically when the unit has retracted to the non-blowing position. After the blowing medium has been turned off, the unit will continue to retract to the rest position, where the controls will reset for future operation.

d. Draft System

Two half-capacity forced draft fans supply combustion air to the steam generator. They are located in individual rooms designed to provide sound proofing.

Each forced draft fan discharges through a regenerative type air heater to the burner windboxes. An air foil type duct section between the air heaters and the windbox measures the air flow.

The products of combustion pass through the superheater, reheater, and economizer sections of the steam generator, through the regenerative air heaters, electrostatic precipitator and to the chimney. Each fan room is supplied with two fan inlet silencers consisting of parallel acoustic splitters installed in a rectangular steel housing.

Two regenerative type air heaters provided with a low variable speed drive heat the air to the required temperature for combustion.

Each heater has 400,000 square feet of heating surface. The cold end layer is made of corrosion-resistant low-alloy steel mounted in baskets for side removal.

Two double compartment electrostatic precipitators are installed at the air preheater outlet to collect the suspended particles by applying high

voltage charges to the particles, collecting them on plates and remove the precipitated material to external hoppers. Each precipitator is provided with twelve hoppers, each with four 1000 watt heaters, fabricated of 1/4" steel plate and having a total capacity of 47,700 cu. ft.

The reinforced concrete chimney is constructed with independent insulated steel liners, flues, vertical ladders, doors, windows, aviation obstruction lighting system, lightning protection system and power systems. Stack height is 800 feet with top shell inside diameter of 37 ft. and bottom shell inside diameter of 72 ft. and is sized to handle 3,000,000 cfm of flue gas.

SECTION 3

COAL HANDLING SYSTEM AND ASH HANDLING SYSTEM

The coal is transported from the mine in specially constructed cars assembled into a unitrain comprised of high capacity, semi-automatic, bottom-dump hopper cars.

Each unitrain consists of six diesel-electric units, comprising 140 hopper cars and a waycar (caboose). The hopper cars are of the open-top, semi-automatic, bottom-dump type and have a synchronized dumping cycle of about 30 seconds, 6 seconds doors open, 16-20 seconds dump, 6-10 seconds doors close.

The waycar (caboose) is equipped with radiotelephone communication equipment. This enables the rear trainmen to be in continuous contact with the engine crew, dispatchers, and operators at the stations between the mine and the plant.

Terminal facilities and trackage are designed to permit continuous cycle of unitrain operation.

The coal is unloaded in a 120' long x 14' wide pit which consists of six in-line hoppers; each hopper is 20 feet in length with an 8 feet long x 6 feet wide vibrating feeder under each hopper which is automatically controlled to unload sequentially on belt conveyor No. 1 running beneath the feeders and transfers coal to inclined conveyor No. 2 over the coal scale. The coal is then either passed through sample system to the stacking out conveyor No. 3 and to the stock pile area, or fed into the crusher and transported up to coal bunkers in the boiler room. The unloading system is designed to provide an automatic unattended system in which a maximum of 3,000 tons of coal per hour will be conveyed to the reclaim pile. The feed rate is controlled by feeders beneath the unloading hoppers.

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The reclaim system is designed for automatic unattended continuous operation in which the quantity of coal reclaimed matches the burning rate. It consists of an underground structure beneath the 60 day storage pile, with stainless steel reclaim hopper, vibrating feeders and conveyors to transport coal to the crusher with a magnetic separator located at the inlet of the crusher. Crushed coal is transported up to the transfer tower by conveyor No. 6 and transferred to conveyor No. 7 which runs over the bunkers serving the individual pulverizers. Coal on the conveyor No. 7 is unloaded into a bunker by the tripper which moves to the next bunker automatically when the bunker is full.

A coal sampling system is included to provide a representative sample of all coal passing the sampling point. There are two sampling systems, one for receiving system located at the discharge end of conveyor No. 2 in the stack house and the second in the reclaim system located at the discharge end of the conveyor No. 6 in the transfer tower.

The two crushers are of the reversible hammermill type, complete with an internal circulating oil system, consisting of reservoir, pump, 300 hp motor, filters, etc.; each crusher has a capacity of 700 tons per hour.

The ash handling system includes an automatic hydraulic bottom ash system complete with slagneck, cylindrical cooling trough, adjustable weir, pressurized poke doors, slag tank, dewatering bins, double roll clinker grinder, hydro-ejector, contromatic operated ashflow segregating valves, automatic sequence control, etc.; an automatic pneumatic fly ash handling system complete with silos, air electric materials handling valves, dust transport piping, hydrovactor, air electric vacuum breakers, automatic sequential control step switch, etc.

SECTION 4

LIGHT FUEL OIL SYSTEM

The light fuel oil system provides oil to the main steam generator in an emergency, auxiliary boiler and the various diesel engines.

The unloading facilities include a pump, two tank car unloaders, a truck fill station, a positive displacement meter, and a 150,000 gallon storage tank.

Three pumps provide the fuel oil requirements of the main steam generator and auxiliary boilers. Two pumps supply the fuel oil requirements of the diesel engines.

SECTION 5

TURBINE GENERATOR AND AUXILIARIES

The turbine generator can deliver 1,042,803 KWe allowing 42,803 KWe for auxiliary power requirements at the generator terminal when operating at 3500 psig and 1000°F throttle; 605 psig and 1000°F reheat outlet; zero percent make-up; 1.5" HgA back pressure; two boiler feed pumps with turbine drives; and seven stages of feedwater heaters in service.

The turbine is tandem compound six flow exhaust, 3600 rpm with 33½ inch last row blades. Throttle steam enters the high pressure turbine through a single control stage, reverses direction, achieves mass flow cooling of the inlet nozzle chambers and then flows through the stages of blading before exhausting to the reheater.

The reheated steam enters the intermediate pressure turbine and then flows to the low pressure turbines employing 33½ inch long last row blades.

a. Turbine Accessories

The turbine accessories include: a control and protective valve system, electrohydraulic control system, automatic stop and emergency trip system, complete lubrication pumping system, gland sealing system, motor-operated drain valves, exhaust casing spray nozzles, A.C. motor-operated rotor turning gear with manual and automatic remote engagement including zero speed indicator interlocked with the lubrication system through a pressure switch to prevent operation without bearing lubrication, protective devices, appropriate supervisory instruments, thermocouples and resistant temperature detectors, thermometers, oil pressure gauges and miscellaneous gauges, rotor-grounding device, electric tachometer with speed indicator, turbine metal appearance lagging with sound-proofing material, insulating material with reusable blanket covering for the removable joints, lifting slings and special tools

and wrenches, shims, seating and soleplates for alignment of the unit, motor operated vacuum breaker valve, temporary blowdown covers and valve seat blanking plates for steam blowout, connections on turbine for enthalpy drop tests, hangers for all piping and valves, and 200°C oil resistant control cable for all internal wiring on turbine auxiliaries.

b. Turbine Oil System

A main shaft driven oil volute type centrifugal pump supplies the oil required for the lubrication system during normal operation and provides high pressure and low pressure back-up oil for the hydrogen seal oil system of the generators.

An A.C. motor driven oil pump supplies bearing oil and primes the main pump. The main pump overtakes this pump at about 90% speed. A control station at the turbine bench board starts the pump automatically, provided the switch is not in "lock-off" position, when the bearing oil pressure drops below 9 psig. The pump will continue to run until stopped by the operator.

A small motor driven centrifugal pump provides an additional source of back-up oil for the hydrogen seal oil system of the generator. A control station at the turbine bench board will start the pump automatically, provided the switch is not in "lock-off" position, when the bearing oil pressure drops below 7 psig. The pump will continue to run until stopped by the operator.

A D.C. motor driven emergency bearing oil pump is provided to furnish a final back-up to the bearing oil system. This pump protects the turbine in case of loss of A.C. power.

The oil reservoir contains a screen for removing foreign materials from the oil drained into the reservoir; ejector, orifices and check valves; two oil coolers; float-type oil level indicator with high and low alarms; pressure switches with test valves for automatic starting of the turning gear and emergency bearing oil pumps; and one vapor extractor.

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c. Turbine Oil Conditioning System

The lubricating continuous bypass oil conditioning system has a capacity of 3600 gallons per hour of 150 ssu viscosity at 100°F lubricating oil. The clean oil storage capacity in the conditioner is 1500 gallons at turbine shutdown. It consists of the following equipment: centrifugal type lubrication oil purifier with inlet and discharge pump; necessary instruments, breakover switch, feed/stop valve; electric controller and safety interlocks with 142 kw heater; centrifuge driven by an open drip-proof motor; piping and wiring.

The oil purifier is capable to produce a purified oil having a moisture content of 0.1% by volume and a solids content of .02% by volume.

d. Turbine Gland Steam Sealing System

The gland steam sealing system provides sealing of the turbine shaft between the turbine shells or the exahust hood and the atmosphere under all conditions of turbine loading. The shaft packings seal against leakage of air into the condenser (vacuum packings) and prevent steam from blowing out into the turbine room (pressure packings).

The steam sealing system provides the above functions automatically at all loads and consists of the following equipment: oil operated dual feed steam regulator; gland steam exhauster; motor operated valves for main steam feed to regulator, auxiliary steam feed regulator, main steam bypass feed, regulator bypass unloaded valve; blowdown valve; three-way diverting valves and ventilator valve. During the starting period steam is supplied from the auxiliary boiler or the main boiler supply. During operation at partial loads the gland sealing steam is supplied from the cold reheat line and HP and LP turbine glands. As the reheat pressure increases, the regulator in the boiler supply closes until all steam is finally supplied from the cold reheat. At high loads, the HP and IP turbine glands provide more steam than the LP turbine glands require. The excess steam is relieved to the main condensers through a spillover valve. The gland condenser is designed with stainless steel tubes for 400 psig pressure and 125°F cooling water.

e. Generator

The generator has a rating of 1,158,670 kva with 0.90 PF. It has a totally enclosed hydrogen cooled (at 75 psig) rotor. The stators are liquid conductor-cooled type with pure water as the liquid coolant. The generator stator is furnished with its internal cooling construction including: hydrogen coolers; terminal bushings; instruments; grounding pads; seal housing insulation; foundation plates, shims, removal logging; and special tools.

The generator stator also is furnished with the following external equipment: pure water circulating and cooling unit assembled on a base and including storage tank, pumps, coolers, deionizer, flow meter, conductivity cells, gauges, piping, valves, filters, instruments, and regulating equipment; stator winding control cabinet assembled and combined with the hydrogen control cabinet including annunciator and all necessary control devices.

The generator hydrogen system includes: two hydrogen coolers; one seal oil unit on a base; hydrogen manifold with one bottle pressure regulator with high and low pressure gauges, pressure switch for hydrogen supply pressure "low" alarm, shut-off valves and bottle connectors; generator hydrogen pressure regulator; hydrogen storage bottles; control cabinet; temperature detectors; and special tools.

The carbon dioxide system consists of a 4 ton liquid carbon dioxide storage unit with refrigeration system, vaporizer, relief valves and two pressure reducing valves. Carbon dioxide is used for purging hydrogen or air during shutdown.

f. Exciter

The exciter is of the direct connected, shaft-driven, rotating rectifier, brushless type. It is rated at 4000 kw, 500 volts, 8000 amperes, 3600 rpm.

The exciter is totally enclosed with suitable heat exchangers and means for circulating air within the exciter housing. The recirculating ventilation system is equipped with water to air coolers. The excitation switch gear is an integrated unit of standard low voltage, indoor metal enclosed. The function of the excitation switch gear is to connect, rectify and control excitation to the A.C. brushless exciter from a permanent magnet generator with an A.C. output. Reactivation is accomplished by a power unit and automatic control by a voltage regulator.

SECTION 6

HEAT REJECTION SYSTEMS

a. Condensers and Condenser Vacuum Pumps

Three surface condensers single stage, single pass with fabricated steel water boxes and steel shell. The condensers are designed to handle the heat rejection from the low pressure main turbines and boiler feed pump turbines at a design back pressure of 1.5 inches HgA for the main turbine and 2 inches HgA for the boiler feed pump turbines. Each condenser has a condensing surface of 115,600 square feet; 11,035 one inch diameter, 40 ft. long, 22 BWG A-249 welded Type 304 stainless steel tubes, with a cleanliness factor of 90%; 175,849 gpm of cooling water at $57^{o}F$ and $15.9^{o}F$ temperature rise at 8 ft./sec. tube velocity. Six condenser vacuum pumps, each with a rated holding capacity at 1.5 inches HgA of 24 scfm and rated hogging capacity of 800 scfm at 15 inches HgA, hold the condenser vacuum to 1.5 inches HgA.

b. Circulating Water System

The circulating water system supplies screened North River water, pumped by six circulating water pumps each with a design rating of 88,000 gpm at 21 ft. total dynamic head. The circulating water piping is precast reinforced concrete pressure pipe laid with steel and rubber-gasketed joints.

Six traveling screens are provided to remove leaves, twigs and other debris from the river water to prevent restriction of flow of water in the condenser tubes. The traveling screens are 8 ft. wide by 43 ft. long each supplied with 49 baskets, 2 ft. high by 8 ft. long covered with .080 inch dia. Type 304 stainless steel wire cloth with 3/8 inch square openings.

Spray nozzles are provided at each screen utilizing water at 100 psi to wash the accumulated debris from the screens. The variable weir maintains a constant discharge channel water level to allow the recovery of a substantial portion of the circulating pumps discharge head by virtue of the syphon effect. This is accomplished by the automatic positioning of two nested submerged movable gates, installed in the discharge channel.

The chlorination system is provided to inject sodium hypochloride solution into the river water as it leaves the traveling screens to prevent the formation of algae and slime in circulating water system. It includes storage tanks, pumps, control devices and diffusers.

SECTION 7

CONDENSATE AND FEEDWATER HEATING SYSTEMS

a. Condensate System

The condensate system comprises the feedwater cycle between the condenser hotwell and the deaerating heater and consists of condensate pumps, booster pumps, heater drain pumps, low pressure feedwater heaters, condensate polishing and condensate transfer pumps. The arrangement of the condensate system components provides for recirculation at low flows, hotwell level control, make-up, spillover and storage.

The three condensate pumps are rated each at 3,000 gpm and 350 ft. total dynamic head and take suction from the condenser hotwell and discharge through the gland steam condenser and condensate polishing equipment to the suction of the condensate booster pumps. The three condensate booster pumps each rated at 3100 gpm and 462 feet of total dynamic head discharge through the low pressure heaters into the deaerating heater.

Low pressure heaters No. 1 have stainless steel tubes and consist of three 9320 sq. ft. horizontal feedwater heaters each transferring 97.1×10^6 btu/hr with a design terminal temperature difference of $3^{\circ}F$. Low pressure heaters No. 2 have stainless steel tubes and consist of two 9840 sq. ft. horizontal feedwater heaters with internal drain coolers, each transferring 93×10^6 btu/hr and designed for $10^{\circ}F$ drain cooler approach and $3^{\circ}F$ terminal temperature difference.

Low pressure heaters No. 3 have stainless steel tubes and consist of two 10,870 sq. ft. horizontal feedwater heaters with internal drain coolers and desuperheating section each transferring 106.6×10^6 btu/hr with design drain cooler approach of $10^{\circ}F$ and terminal temperature difference of $3^{\circ}F$.

Low pressure heaters No. 4 have stainless steel tubes and consist of two 12,530 sq. ft. horizontal feedwater heaters with internal drain coolers and desuperheating section each transferring 106.5 x 10^6 btu/hr with design drain cooler approach of 10°F and terminal temperature difference of 3°F.

Low pressure heater No. 5 or deaerating heater consists of a 10 foot dia. x 46 ft. long deaerator and a 12 ft dia. x 100 ft. long storage tank.

The heater strings and a bypass are designed to pass full flow while one string of heaters is removed from service for repairs. Three heater drain pumps with receivers each rated at 800 gpm and 600 ft. TDH pump the drains from the low pressure heaters No. 1 into the condensate header.

b. Feedwater Heating System

The feedwater heating system consists of two 55% capacity boiler feed pumps, two sets of high pressure heaters and the interconnecting piping, valves and controls. The boiler feed pumps take suction from the deaerating heater storage tank and discharge through the high pressure heaters and into the economizer of the steam generator. The heaters are arranged in two parallel strings, permitting one string to be removed from service while the unit is in operation.

High pressure heaters No. 6 have stainless steel tubes and consist of two 19,380 sq. ft. horizontal heaters with desuperheating section and internal drain coolers each transferring 134.5 x 10^6 btu/hr with design drain cooler approach of 10°F and terminal temperature difference of 2°F.

High pressure heaters No. 7 have stainless steel tubes and consist of two 24,300 sq. ft. horizontal heaters with desuperheating section and internal drain coolers each transferring 292.8 x 10^6 btu/hr with design drain cooler approach of 10°F and terminal temperature difference of -2°F.

The boiler feed pumps have interchangeable inner assemblies and each pump is provided with temperature thermocouples and vibration pickups. Each pump is rated at 3,465,000 #/hr and 10,750 ft TDH. Each pump is driven by a steam turbine drive. The turbine drives, each rated at 22,170 hp and 5350 rpm, operate with low pressure steam supplied from the main turbine or during low load operation with steam from the cold reheat line and during start-up with steam from the auxiliary boiler.

Each turbine drive is furnished with one lubricating oil system consisting of lubricating oil console complete with reservoir and piping, motor driven oil pumps, oil coolers, filters, pressure regulating valves, supervisory instruments, protective devices, oil purification system etc.

SECTION 8

INSTRUMENTS AND CONTROLS

Include control boards, annunciator system, integrated combustion feedwater control, coordinated control system to provide regulation of feedwater flow, fuel and air inputs, spray injection, reheat control and the turbine-governor motor as required to maintain desired generation, steam pressure and temperature, boiler feed pump recirculation controls, hydrogen temperature control, turbine oil temperature control boiler feed pump turbine bearing oil temperature control, steam generator ignition and fuel system interlocks, draft system interlocks, turbine generator controls and interlocks, boiler feed pump turbine and interlocks, air compressor control and instrument station air system, service water temperature and pressure control, computer, back-up scanner recorder, circulating water system controls, etc.

SECTION 9

CLOSED COOLING WATER SYSTEM

The closed cooling water system provides water to the sample coils, pump glands and motor bearings, pulverizers, forced draft fans oil coolers and the air heater oil coolers, turbine generator oil and hydrogen coolers, boiler feed pump turbine oil coolers, soot blowing air compressor coolers, instrument and station air aftercoolers, condenser vacuum pumps, air conditioners, etc. It includes three pumps @ 8000 gpm capacity with a total head of 50 psi, each driven by a 350 hp, 1800 rpm, 4000 volt, 3 phase 60 cycle motor, three horizontal single pass heat exchangers 5,000 sq. ft. each transferring 35 x 10^6 btu/hr., 150 psig shell and tube design pressure, piping and valves.

SECTION 10

WATER TREATMENT SYSTEM

The plant overall water treating system shown on Figure 10-1 consists of the raw water treating system, demineralizer system, polishing system and the chemical feed system.

Water is supplied to the raw water treatment system by the service water pumps. After the raw water treatment of softening, coagulation (by reactivators) and filtration (by gravity filters) the water is pumped by the treated water pumps to the treated water storage tank. A treated water transfer pump takes suction from the treated water storage tank and supplies the fire service water tank.

A supply header from the treated water storage tank supplies the suction supply of the demineralizer feed pumps. The discharge header from the demineralizer feed pumps supplies the demineralizers and other services requiring treated water. With the head of pressure supplied by the basic demineralizer feed pumps the water flows through the demineralizers to the demineralized water storage tank.

When heat cycle make-up (condensate) is required, the demineralized water is admitted to the condenser hotwell by gravity and passes through the polishing demineralizer to the polished condensate water storage tank. From the polished condensate water storage tank, the polished water is admitted to the condenser hotwell by gravity head through a control valve regulated from hotwell level demand.

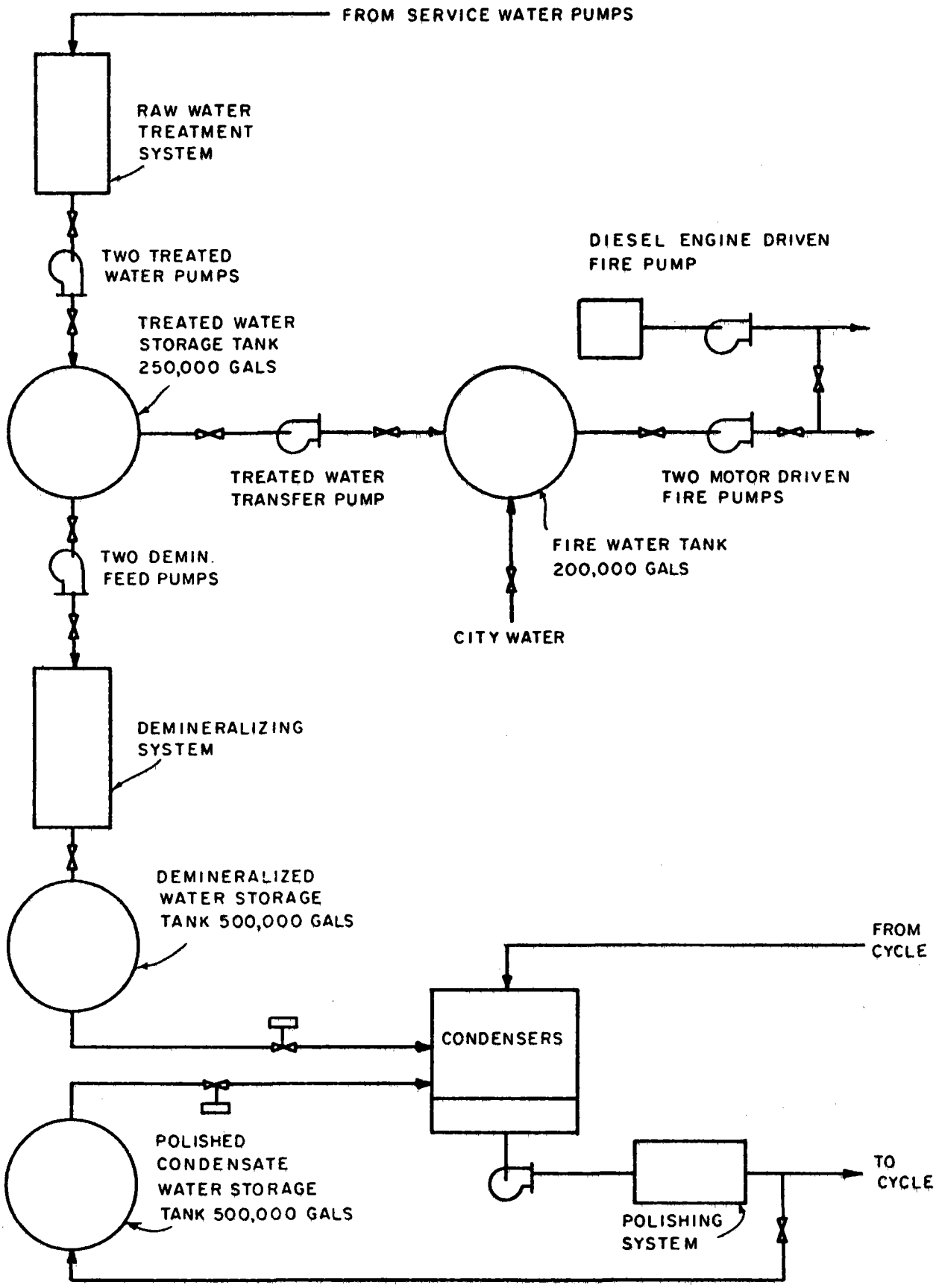

FIG.10.1 WATER TREATMENT SYSTEM

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SECTION 11

AUXILIARY BOILERS

The auxiliary steam boiler supplies steam when the main steam generator is out of service to the building heating system; demineralizer caustic heat exchangers; during start-up to the boiler feed pump turbine, turbine gland sealing, and steam coil face dampers at forced draft fan inlet; and steam for the chemical cleaning of the main steam generator. The auxiliary boiler consists of an auxiliary draft fan, feed pumps, fuel oil pumps, deaerator, blow-off tank, chemical feed pumps and controls.

SECTION 12

OTHER MECHANICAL EQUIPMENT

a. Emergency Diesel Generators

The two 500 kw emergency diesel generators supply power in case of loss of station auxiliary power to the emergency lights, battery chargers, auxiliary boiler equipment, turbine generator, computer room etc. The diesel generators are supplied with a day tank, fuel pumps, lube oil system, cooling system and starting system.

b. Air Compressors

Two horizontal, motor driven, single-stage, double acting, non-lubricated instrument air compressors rated at 215 scfm and 100 psig each supplied with intake filter and silencer, after-cooler, air dryers, dual control, and receiver.

Two angle type, motor-driven, two-stage, double acting, lubricated station air compressors, including intake filter, intercooler and aftercooler, dual control and receiver; rated 320 scfm at 125 psig discharge pressure.

c. Service Water Pumps

Two vertical service water pumps are supplied to deliver 5000 gpm of river water at 220 ft. of total dynamic head.

d. Unit Cranes

One 175 ton overhead traveling crane with a 25 ton auxiliary hook and outrigger hook is installed in the turbine building. Two 20 ton overhead traveling cranes are installed in the heater bay. Monorail hoists or removable "A" crane are provided to service the boiler feed pump and turbine drive, the forced draft fan motor, bearing caps and other auxiliary equipment.

e. Gas Turbine Generator

Power required during plant startup, normal shutdown and after turbine trip is furnished by the 138 kV feeder from an offsite source and a 23.4 MVA gas turbine generator located on the site.

f. Fire Protection System

The fire protection system is designed to conform to the guide lines set up by NEPIA.

The fire line headers are designed as a loop system to permit water flow in either direction. Sectionalizing valves throughout the system are located to permit isolating damaged sections of header.

The water supply for the plant fire protection (yard fire hydrants, building hose cabinets, fixed spray automatic deluge and sprinkler systems) systems will be provided by three (3) 2,000 gpm, 150 psig fire pumps. Two of the pumps will be motor driven and will take suction from a ground based treated water fire service storage tank. The water in the fire service storage tank is supplied by a transfer pump which takes suction from the treated water storage tank or supplied from the city water supply. Piping at the tank will be arranged so that a minimum of 200,000 gallons of water will be available for fire protection at all times. Pressurization of the fire system is maintained by a 100 gpm "jockey" pump. This pump will start when the pressure drops to 135 psig.

The motor driven fire pumps start automatically on a drop in line pressure. One pump starts automatically when the pressure drops to 130 psi and the other starts automatically when the pressure drops to 120 psi. Both are activated by pressure switches to start and stop as required. Starting of each pump will be annunciated by an alarm. If the pressure drops to 100 psi, an emergency alarm sounds.

The two motor driven fire pumps are backed up by a 2,000 gpm, 150 psig diesel engine driven fire pump. This pump takes suction from the river. This pump is started and stopped manually from the control room on locally mounted switches.

1000 MW COAL-FIRED PLANT

EQUIPMENT LIST

The following Equipment List describes those major components considered during the development of this study. Each of the components is briefly described in terms of design, pressures, temperatures, flow, capacities, materials, etc. sufficiently to correlate same from the Cost Estimate for the 1000 MWe Nominally Rated Coal-Fired Plant.

As a convenience for cross-referencing between the Cost Estimate and the Equipment List, the account number has been added at the left-hand column of the Equipment List. The account numbers are intended to correlate with equipment identified in the Cost Estimate.

STRUCTURES AND IMPROVEMENTS

Account No.		Description
111.15	Sewage Treatment System	One (1) activated sludge type (Aerobic Digestion Process) 10,000 gallons per day sewage treatment plant.
112.222	Heating and Ventilating Systems (Boiler and Turbine Rooms)	
	Heating	Fifty (50 steam unit heaters each rated at 400,000 Btu's per hour furnished with ½ hp motor and controls.
	Ventilation	Twenty-five (25) roof ventilators each rated at 50,000 cfm.
	Heating and Ventilating Systems (Heater Ray and Coal Conveyor Area)	
	Heating	Twenty (20) steam unit heaters each rated at 400,000 Btu/hr furnished with ½ hp motor and controls.
	Ventilation	Fifteen (15) ventilations each rated at 50,000 cfm.
	Heating, Ventilation and Air Conditioning (Control Building)	
	Heating	80 kw of electric Sill-Line Heaters, in varying lengths, for the first and second floors of the Control Building.
	Ventilation	Two (2) exhaust fans (one standby) each rated at 25,000 cfm with a 10 hp motor complete with make-up air louvers, exhaust ductwork and controls. Two (2) exhaust fans, same as above, each rated at 16,500 cfm with a 7½ hp motor.
	Air Conditioning	30 tons of air conditioning for the Control Room, complete with ductwork, HEPA and carbon filters and booster fans for emergency use, and remote controls.
	Heating and Ventilation (Auxiliary Boiler Room, Machine Shop and Diesel Generator Room)	
	Heating	Five (5) steam unit heaters each rated at 300,000 Btu/hr and furnished with ½ hp motor and controls.

Account No.		Description
	Ventilation	Six (6) roof and wall ventilators each rated at 50,000 cfm.
	Heating and Ventilation (Pump Room, Battery Rooms, Toilets, Lockers etc.)	
	Heating	Two (2) steam unit heaters each rated at 400,000 Btu/hr and furnished with a ½ hp motor and controls. Six (6) steam unit heaters rated at 20,000 Btu/hr.
	Ventilation	Six (6) roof and wall ventilations each rated at 20,000 cfm.
112.231	Fire Protection	The hose reel assemblies are continuous flow units provided with two 50' lengths of 1½" hose.
112.24	AC Automatic Transfer Switches	Four transfer switches, 120V, 1 phase, 2 wire normal supply, 125V DC emergency supply; and one transfer switch 120/208V, 3 phase, 4 wire, 125V DC emergency supply.
113.22	Heating, Ventilating and Air Conditioning (Administration Building)	
		140 tons of air conditioning, including supply and return ductwork, controls, necessary exhaust systems, supplemental electric base board heat, etc.

BOILER PLANT EQUIPMENT

Account No.		Description
121.11	Steam Generator	Once-through supercritical, single reheat type steam generator to supply steam to the turbine generator unit. Designed for continuous operation at 7,300,000 #/hr., 3500 psig and 1005°F at the superheater outlet and 6,500,000 #/hr., 630 psig and 1005°F at the reheater outlet; maximum allowable working pressure of 4,000 psig. The unit is arranged for firing pulverized bituminous coal having the following specifications:

HHV, Btu/#	10,800
Grindability, (HGU)	65
Total Moisture %	10
Feed Size, inches	1¼
Total Fuel Burned #/hr.	760,000

	Burners	Seventy two, horizontal intervane, pulverized coal burners with forced draft fronts and air control registers. Each burner is furnished with a mechanical atomizing oil fired pilot; with air register operator assemblies; and with flame detectors. The burners are furnished with a control panel and burner control and fuel safety and purge relay cabinet.
	Emergency Start Oil Burners	Twenty four mechanical atomizing oil burners equipped with manual shut-off valves. The oil burners are suitable for a 17% of full load firing rate.
	Seal Air Blowers	Five air blowers equipped with suitable dampers and controls; sized for 4500 - 6000 cfm at 42 in. Wg. Four blowers are capable of providing the required sealing air for each unit. Each blower is driven by a 60 hp 480 volt motor.
121.11	Air Preheaters	Two regenerative air preheaters, each have 400,000 sq. ft. of heating surface, provided with a low speed, variable speed motor drive and emergency compressed air drive.

Account No.		Description
121.12	Soot Blowers	Automatic sequential air blowing, electric motor operated system of soot blowers suitable for 300 psi. Each blower may be operated individually or in automatic sequence. Individual blowers may be omitted from the sequential blowing if desired.

No.	Type	Length of Travel	Location	Blowing Press. and CFM
40	Full Retracts	45 feet	Furnace, superheater & reheater	175 psig @ 2500 cfm
16	Half Retracts	22 feet 3 inches	Economizer	125 psig @ 2500 cfm
55	Wall Deslaggers		Furnace	200 psig @ 1440 cfm
6	Air Heaters		Air Heaters	250 psig @ 770 cfm

Soot Blowing Air Compressors	Three, vertically split modular construction, thirteen stage, centrifugal air compressors operating at 300 psig and 5000 cfm. The compressor motors are rated at 2250 hp, 1800 rpm, 6900 volt, three phase, 60 cycle.
122.11 Forced Draft Fans	Two half capacity forced draft fans. Each fan discharges through a regenerative type air heater to the burner windboxes; driven by a motor rated at 9000 hp, 900 rpm, 6900 volt, three phase, 60 cycle; equipped with Thomas type flexible couplings with limited end floats.

Design Data of forced draft fans:

	Test Block	Operating
Air Flow	1,000,000 cfm	890,000 cfm
Static Pressure	45 inches Wg.	34 inches Wg.
Air Temp. Rise	20°F	16°F
Power Input	7,900 bhp.	5600
Fan Speed	900 rpm	885 rpm
Air Temperature	100°F	

Fan Room Inlet Silencers	Four fan room inlet silencers consisting of parallel acoustic splitters installed in a rectangular steel housing.

Account No.		Description
122.31	Electrostatic Precipitators	Two double compartment electrostatic precipitators each to handle 1,500,000 cfm at 300°F with an efficiency of 99.5%. The shell is fabricated from ¼" ASTM A-7 steel plate, provided with penthouse, eight access doors, flue connections and support attachments. Each precipitator is provided with twenty-four fabricated of ¼" steel having a total capacity of 47,700 cu. ft. Four 1000 watt heaters are provided for each hopper with an inlet and outlet thermostat. The collecting electrodes have a total effective plate area of 300,000 sq. ft. The discharge electrodes consist of mild steel wire with a total effective wire length of 207,000 ft. A total of 6,900 electrodes per precipitator; vibrator type rapper including 96 collector rappers and 48 discharge rappers per precipitator.
122.61	Reinforced Concrete Chimney	One reinforced concrete chimney constructed with independent insulated steel liners, 1 flue, vertical ladders, two double doors in the chimney shell at grade, aviation obstruction lighting system, lightning protection system and power systems, etc. Dimensions: Height of shell above foundation 800 ft. Shell I.D. (at top) 37 ft. Shell O.D. (at top) 38 ft. 8 in. Wall thickness (at top) 10 in. Shell O.D. (at bottom) 79 ft. Wall thickness (at bottom) 42 in.
125.11	Coal Unloading	The unloading pit is 120' long x 14' wide and consists of six in-line hoppers, each 20 feet in length with an 8 feet long x 6 feet wide vibrating feeder under each hopper which is automatically controlled to unload sequentially on belt conveyor No. 1 running beneath the feeders and transfers coal to inclined conveyor No. 2 over the coal scale. The coal is then either passed through sample system to the stacking out conveyor No. 3 and to the stock pile area, or fed into the crusher and transported up to coal bunkers in the boiler room. The unloading

Account No.		Description
	Coal Unloading (Cont'd)	system is designed to provide an automatic unattended system in which a maximum of 3,000 tons of coal per hour will be conveyed to the reclaim pile. The feed rate is controlled by feeders beneath the unloading hoppers.
	Reclaim System	The reclaim system consists of an underground structure beneath the 60 day storage pile, with stainless steel reclaim hopper, vibrating feeders and conveyors to transport coal to the crusher with a magnetic separator located at the inlet of the crusher. Crushed coal is transported up to the transfer tower by conveyor No. 6 and transferred to conveyor No. 7 which runs over the bunkers serving the individual pulverizers. Coal on the conveyor No. 7 is unloaded into a bunker by the tripper which moves to the next bunker automatically when the bunkers is full.
	Coal Sampling System	The coal sampling system provides a representative sample of all coal passing the sampling point. There are two sampling systems, one for receiving system located at the discharge end of conveyor No. 2 in the stack house and the second in the reclaim system located at the discharge end of the conveyor No. 6 in the transfer tower.
	Coal Crushers	Two reversible hammermill type coal crushers, each complete with an internal circulating oil system, consisting of reservoir, pump, 300 hp motor, filters, etc. Each crusher has a capacity to granulate frozen lumps of 1¼ in. by 0 in. coal, size feed of 26 in. and under, to produce a 97% to 100% minus 1¼ in. product at a capacity of 700 tons per hour.
125.41	Coal Pulverizers	Nine planetary roll and table pulverizers. Each pulverizer is driven by a constant speed, high starting torque, low starting current, squirrel cage induction motor with horrizontal shafts rated at 400 hp, 900 rpm, 480 volts, three phase, 60 cycle.

Account No.		Description
125.41	Coal Feeders and Primary Air Fans	Nine volumetric type feeders deliver coal to the respective pulverizers at a controlled rate. Each feeder is furnished with a 304 stainless steel hopper and an adjusto speed transistor drive unit complete with cabinet and feed rate indicator. Total horsepower required per feeder is 3 hp. Four primary air fans each driven by a 1500 hp, 1800 rpm, 6900 volt, three phase, 60 cycle motor.
125.51	General	The light fuel oil system is comprised of unloading, boiler service and auxiliary service.
	Unloading	A pump, two tank car unloaders and a truck fill station is provided to transfer delivered oil to the 150,000 gal. storage tank. The fuel entering the tank is metered through a positive displacement meter. The fuel unloading pump is designed to deliver 330 gpm, 60 psi, total head with a 20 hp, 3500 rpm, 480 volt, 3 phase, 60 cycle motor.
	Boiler Service	Three pumps provide a continuously pressurized oil supply through tank recirculation for the main boiler with positive displacement meters. Each pump is designed to deliver 130 gpm, 440 psi total head with a 50 hp 3500 rpm, 480 volt, 3 phase, 60 cycle motor.
126	Ash Handling System	The ash handling system includes an automatic hydraulic bottom ash system complete with slagneck, cylindrical cooling trough, adjustable weir, pressurized poke doors, slag tank, dewatering bins, double roll clinker grinder, hydro-ejector, contromatic operated ashflow segregating valves, automatic sequence control, etc.; an automatic pneumatic fly ash handling system complete with silos, air electric materials handling valves, dust transport piping, hydrovactor, air electric vacuum breakers, automatic sequential control step switch, etc.
126.12	Ash Sluice Pumps	Two 2400 gpm, 560 TDH ash sluice pumps each driven by a 450 hp, 3600 rpm, 6900 volt, three phase, 60 cycle motor.

Account No.		Description
127.11	Instruments and Controls	Control boards, annunciator system, integrated combustion feedwater control, coordinated control system to provide regulation of feedwater flow, fuel and air inputs, spray injection, reheat control and the turbine-governor motor as required to maintain desired generation, steam pressure and temperature, boiler feed pump recirculation controls, hydrogen temperature control, turbine oil temperature control boiler feed pump turbine bearing oil temperature control, steam generator ignition and fuel system interlocks, draft system interlocks, turbine generator controls and interlocks, boiler feed pump turbine and interlocks, air compressor control and instrument station air system, service water temperature and pressure control, computer, back-up scanner recorder, circulating water system controls, etc.
127.12	BTG Board (Boiler Turbine Generator)	The BTG Board is of duplex walk-in construction with a benchboard. It is divided into five (5) sections: protective relaying; turbine, boiler and generator control; and metering.
127.15	Computer	One Westinghouse PRODAC 250 process computer system.

TURBINE PLANT EQUIPMENT

Account No.		Description
141.1	Turbine	1043 MW turbine; tandem compound six flow exhaust; 33½ inch last stage buckets, rating at 1½ inch Hg absolute; 3600 rpm. Turbine throttle conditions 3500 psig at 1000°F and reheat conditions 630 psia.
	Generator	1,147,848 KVA; 3600 rpm, 3 phase, 22 kv, hydrogen cooled at 75 psig.
	Exciter	Direct connected rotating rectifier brushless exciter; 4000 kw, 500 V.
	Hydrogen and Carbon Dioxide System	Hydrogen at 75 psig is provided to cool the generator. Included are storage tubes, piping manifold, storage control cabinet and supply control station. Carbon dioxide is provided for purging the generator.
141.4	Lubricating Oil Conditioning Equipment	One continuous by-pass lube oil conditioner 3600 GPH capacity; with clean and dirty oil storage tanks, circulation pump and transfer and clean-up pump.
141.431	Fire Protection Systems	Water spray, automatically operated and remote-manual with automatic detection. Fire protection includes automatic water spray systems with automatic detection, fire detection and alarm panels and necessary piping, fittings, flanges and valves.
142.11	Traveling Screens	Six 8 ft. wide by 43 ft. high screens, traveling at 10 fpm. Each screen has 49 baskets, 24 inches high and 8 ft. long, covered with .080 dia. Type 304 stainless steel wire cloth with 3/8 inch square openings. Each screen passes 88,000 gpm at a velocity of 2.0 fps to a circulating water pump and is cleaned by a spray system. One 4 ft. wide screen with same construction that passes 10,000 gpm to service water pumps at a velocity of 1.37 fps.
142.15	Chlorination System	The chlorination system consists of storage tanks, pumps, control devices and diffusers.

Account No.		Description
142.2111	Circulating Systems	Six vertical motor driven pumps each to deliver 88,000 gpm @ 21 ft. TDH, 89% efficiency, 590 rpm, 524 BHP, with 600 hp, 600 rpm, 6900 volts, 3 phase, 60 cycle, with steel casing, chrome steel shaft and propeller.
142.221	Variable Weir	The variable weir system consists of automatic positioning of two nested submerged moveable gates, installed in the discharge channel.
143.11	Condensers	Three main surface condensers single stage, single pass with fabricated steel water boxes and steel shell. Each with condensing surface of 115,600 square feet, 11,035 tubes 1 inch, 22 BWG 40 ft. long A-249 welded Type 304 stainless steel. 175,849 gpm cooling water required at 57°F with 90% tube cleanliness factor, 15.9°F temperature rise, tube velocity 8 ft./sec. and 1.5" Hg absolute exhaust pressure.
143.211	Condensate Pumps	Three condensate pumps rated at 3,000 gpm, 350 ft. TDH, 86% efficiency at 1185 rpm, driven by 350 hp, 1200 rpm, 480 volts, 3 phase, 60 cycle.
143.212	Booster Pumps	Three horizontal condensate booster pumps each delivering 3100 gpm at 462' TDH with a suction temperature of 101.4°F. Each driven by 500 hp, 6900 V, three phase, 60 cycle, 3550 rpm motor.
143.213	Condensate Transfer Pumps	One condensate transfer pump delivers 1500 gpm at 400' TDH and 70°F temperature. Driven by a 250 hp, 3550 rpm, 480 V, three phase, 60 cycle motor.
143.221	Condensate Water Storage Tank	One stainless steel condensate water storage tank having a capacity of 500,000 gallons.
143.33	Condenser Air Removal Equipment	Condenser Vacuum Pumps - six, two per condenser, cast iron construction, fitted with a steel shaft and directly connected through a fast gear type flexible coupling to a 125 hp motor. Rated holding capacity at 1.5" Hg A is 24 scfm and hogging capacity at 15" Hg A is 800 scfm. 125 hp induction motor, 600 rpm, 480 volt, 60 cycles.

Account No.		Description
144.11	Feedwater Heating System	
	No. 1 Low Pressure Heaters	Three 9,320 sq. ft. horizontal feedwater heaters with $3^{o}F$ terminal difference each transferring 97.1×10^{6} Btu/hr; 50 psig shell design, 750 psig tube design. Each with 42" ID steel shell, steel tube channel and plates and baffles; A-249 - Tp 304 U tubes 3/4" OD No. 20 BWG with effective length of 45 ft.
	No. 2 Low Pressure Heaters	Two 9,840 sq. ft. horizontal feedwater heaters with $10^{o}F$ approach and $3^{o}F$ terminal difference each transferring 93.0×10^{6} Btu/hr; 50 psig shell design, 750 psig tube design. Each with 44 inch ID steel shell, steel tube channel and plates and baffles; A-249 - Tp 304 stainless steel tubes 3/4" OD, No. 20 BWG with effective length of 40 ft.
	No. 3 Low Pressure Heaters	Two 10,870 sq. ft. horizontal feedwater heaters with $10^{o}F$ approach and $3^{o}F$ terminal difference each transferring 106.60×10^{6} Btu/hr; 50 psig shell design, 750 psig tube design. Each with 52 inch ID steel shell, steel tube channel and plates, and baffles; A-249 - Tp 304 stainless steel tubes 3/4" OD, No. 18 BWG with effective length of 40 ft.
	No. 4 Low Pressure Heaters	Two 12,530 sq. ft. horizontal feedwater heaters with $10^{o}F$ approach and 3oF terminal difference each transferring 106.5×10^{6} Btu/hr; 100 psig shell design, 750 psig tube design. Each with 52 inch ID steel shell, steel tube channels and plates, and baffles; A-249 - Tp 304 stainless steel tubes, 3/4" OD No. 18 BWG with effective length of 46 ft.
	No. 5 Low Pressure Heater (Drains Deaerator)	One full size, horizontal; 10 ft. dia. and 46 ft. long deaerator; 12 ft. dia. and 100 ft. long storage tank. Feedwater leaving deaerator: 6,930,000 #/hr. @ $354^{o}F$. Condensate entering deaerator: 5,653,000 @ $308^{o}F$. Extraction steam entering deaerator: 242,000 #/hr. @ 1349.6 Btu/# and 141 psia. Heater drains entering deaerator 1,035,000 #/hr. @ $372^{o}F$ and 325 psia. Design pressure 200 psig to 29 inches vacuum.

Account No.		Description
	No. 6 High Pressure Heaters	Two 19,380 sq. ft. horizontal feedwater heaters with $10^{o}F$ approach and $2^{o}F$ terminal difference, each transferring 134.50×10^{6} Btu/hr; 450 psig shell design, 5000 psig tube design. Each with 60 inch ID steel shell, steel tube channels and plates, and baffles; A-249 - Tp 304 stainless steel 3/4" OD, No. 14 BWG tubes with effective length of 34 ft.
	No. 7 High Pressure Heaters	Two 24,300 sq. ft. horizontal feedwater heaters with $10^{o}F$ approach and $-2^{o}F$ terminal difference. Each transferring 292.8×10^{6} Btu/hr; 800 psig shell design and 5000 psig tube design. Each with 72 inch ID steel shell, steel tube channels and plates, and baffles; A-249 - Tp 304 stainless steel 3/4" OD, No. 14 BWG tubes with effective length of 38 ft.
144.21	Boiler Feed Pumps and Drive Turbines	Pump - two one-half size horizontal, high speed, multistage, double case barrel type, centrifugal pumps each delivering 3,465,000 #/hr. at 10,750 ft. TDH with a suction temperature of $355^{o}F$. Each with chrome-steel casing, case wearing rings, impeller and shaft. Provided with Kingsbury type thrust bearing, sleeve type radial bearings and provision for bearing thermocouples and vibration probes. Drive Turbine - each pump directly driven by a turbine rated at 22,170 hp and 5,350 rpm. Turbine operates at normal loads with cross-over steam and steam direct from steam generators during start-up and reduced load operation.
144.231	Heater Drain Pumps and Receivers	Three horizontal heater drain pumps, each delivering 800 gpm at 600 ft. TDH with a suction temperature of $168^{o}F$; each driven by a 150 hp, 480 volt, 3 phase, 60 cycle, 3550 rpm motor. Pump bowls, shaft, impellers, bearings, shaft sleeve and pump head are chrome steel and pump outer case and column are carbon steel. Three vertical heater drain receivers, 6 ft. dia. x 13 ft. high.

Account No.		Description
145.31	Closed Water Cooling System	The closed cooling water system includes three pumps @ 8000 gpm capacity with a total head of 50 psi, each driven by a 350 hp, 1800 rpm, 480 volt, 3 phase, 60 cycle motor, three horizontal single pass heat exchangers 5,000 sq. ft. each transferring 35 x 10^6 Btu/hr., 150 psig shell and tube design pressure.
145.41	Raw Water Treating System	The raw water treating system is sized to handle a maximum capacity of 800 gpm and includes the following components: 1) One reactivator flow split box. 2) Two reactivators with integral clean-wells (each 400 gpm capacity and 30,000 gallons clearwell capacity). 3) One ferric sulphate feeder and solution pump. 4) Two lime feeders and solution pumps. 5) One chemical solution flow split box. 6) Two gravity filters of 400 gpm capacity each, 15 feet dia. x 17 feet high. 7) One local control panel with annunciator, flow recorder indicator, timers, control switches, level indicator gauge, etc. 8) Two treated water pumps each of 800 gpm capacity and a total head of 40 psi driven by a 30 hp motor, 1770 rpm, 3 phase, 60 cycle, 480 volts. 9) 250,000 gallon carbon steel treated water storage tank, 34 feet dia. x 39 feet high.
	Demineralizer System	The Demineralizer System includes the following components: 1) Two demineralizer feed pumps, 400 gpm at total 91 psi, with a 40 hp, 3550 rpm, 3 phase, 60 cycle, 480 volt motor. 2) Two Cation exchangers, 160 gpm, 54" dia. x 8'-0" high. 3) Two Anion exchangers, 160 gpm, 54" dia. x 8'-0" high. 4) Two 120 gph acid pumps with a 3/4 hp, 1750 rpm motor. 5) Two 65 gph caustic pumps with a 3/4 hp, 1750 rpm motor. 6) Two caustic heat exchangers to heat 16.4 gpm of 4% caustic solution from 40 F to 110 F utilizing 800 lbs./hr. of 20 psig steam.

Account No.		Description
	Demineralizer System (Cont'd)	7) Two recycle pumps, 100 gpm at 50 psi with a 5 hp, 3600 rpm motor. 8) Controls and instrumentation including a local panel with a service selector, power switch, "Regen. Test" pushbuttons, "Alarm Silence" pushbuttons for annunciators, and local "start-stop" motor pushbutton stations, etc. 9) One stainless steel basic demineralized water storage tank of 500,000 gallons - size: 44 ft. dia. x 46 ft. high.
	Condensate Polishing System	The Polishing System consists of the following equipment: 1) One 500,000 gallon stainless steel polished deionized water storage tank - size 44' dia. x 46' height. 2) One precoat tank to prepare a precoat slurry with agitator. 3) Dust collector to remove resin fines from the air. 4) Three precoat type filter deionizer tanks containing nylon wound filter elements. 5) Precoat pumps for transferring precoat material to the filter deionizer tanks. 6) Blower for backwashing filter elements. 7) Control panel for precoat system and filter deionizer tanks. 8) Associated valves. 9) Control, interlocks and alarms. 10) One motor driven air compressor.
145.51	Chemical Feed System	The chemical feed system consists of: 1) Two 3 gph, 450 psig ammonia feed pumps with automatic stroke adjustment, pumping 28% aqua ammonia solution. 2) Two 3 gph, 450 psig hydrazine injection pumps with automatic stroke adjustment, pumping 5% hydrazine solution. 3) Two 10 gph, 50 psig ammonia transfer pumps with manual stroke adjustment. 4) Local control panel.

ELECTRIC PLANT EQUIPMENT

Account No.		Description
151.21	6900 Volt Metalclad Switchgear	The switchgear is arranged into two (2) sections. Each consists of one (1) 2000 Ampere Bus, and three (3) incoming line unit breakers. Incoming lines are from the Unit Auxiliary Transformer, Station Auxiliary Transformer and the alternate start-up source. Each incoming line unit is rated at 2000 Amperes. Section No. 1 has nineteen (19) feeder units consisting of, seventeen (17) 1200 Ampere breakers (including 2 spares) and two (2) future spaces. Section No. 2 has nineteen (19) feeder units consisting of, seventeen (17) 1200 Ampere breakers (including 2 spares) and two (2) future spaces.
151.22	480 Volt Motor Control Center	Twenty-one (21) 480 Volt Motor Control Centers (MCC) are located at various points of electrical load concentrations. Each motor control center has an incoming line compartment with main lugs only (size and number as req'd). Each compartment is provided with a fused disconnect (current limiting fuses), motor starter, overload relay, and control power transformer as required by the individual auxiliaries. Reversing contactors are provided with electrical and mechanical interlocks. The MCC's are standard NEMA-1 construction, and are of four different load classes. The ampere rating and the number of MCC's are: seven (7) 1200 AMP, four (4) 1000 AMP, eight (8) 600 AMP, and two (2) 200 AMP.
151.24	Miscellaneous Control Devices	100 miscellaneous pushbutton stations, magnetic starters, selector switch stations, and manual motor starters.
	AC Panelboards	All panels have main lugs and feeder breakers. One (1) 120/240V, 1 phase, 3 wire power panel. Four (4) 120V, 1 phase, 2 wire power panels. Twelve (12) 120/208V, 3 phase, 4 wire power panels.
	Freeze Protection Distribution Panels	Three (3) 120/208V, 3 phase, 4 wire panels with main lugs and feeder breakers.

Account No.		Description
152.11	Unit Auxiliary Transformer	FOA Class, 3 phase, 60 cycle, 22 kv delta, 6.9 kv wye with plus 10 percent, minus 5 percent LTC. The BIL is 150 kv for the high voltage windings and 110 kv for the low voltage windings. The FOA output is 43 Mva at 55°C temperature rise.
152.12	Station Auxiliary Transformer	FOA Class, 3 phase, 60 cycle, 138 kv delta, 6.9 kv sye with plus 10 percent, minus 5 percent load tap changing. The BIL is 550 kv for the high voltage winding and 110 kv for the low voltage windings. The FOA output is 43 Mva at 55°C temperaturee rise.
152.211	Station Service Transformer	Eight (8) AA/FA Class, 3 phase, 60 cycle, 6900V delta, 480V wye with plus and minus 2.5 percent TAPS. The BIL is 35 kv for the high voltage winding and 10 kv for the low voltage windings.
	480 Volt Switchgear	The eight (8) 480V buses are located in eight (8) separate 480 volt switchgear structures. They are rated at 600V and are each supplied thru an incoming line breaker with 75,000 ampere interrupting capacity, each of which are fed from one of the Station Service Transformers. The switchgears are listed below by name; also, indicated are the number of feeder breakers and their interrupting capacity rating. a) Pulverizer Switchgear; has ten (10) feeder breakers rated at 50,000 ampere i.c. b) Two (2) Emergency Generator Switchgear: each has three (3) feeder breakers rated at 50,000 ampere i.c. and two (2) emergency generator breakers rated at 75,000 ampere i.c. c) Conveyor Switchgear: has six (6) feeder breakers rated at 50,000 ampere i.c. and one (1) future space. d) Boiler Switchgear; has ten (10) feeder breakers rated at 50,000 ampere i.c. e) Turbine Switchgear; has seventeen (17) feeder breakers rated at 50,000 ampere i.c. and two (2) future spaces.

Account No.		Description
	480 Volt Switchgear (Cont'd)	f) Two (2) Plant Common Switchgear; each has nine (9) feeder breakers rated at 50,000 ampere i.c. and one (1) future space.
152.212	Miscellaneous Transformers	a) Three (3) 15 kva, eleven (11) 30 kva, sixteen (16) 45 kva, two (2) 75 kva, all 480-120/208V, 3 phase transformers for lighting and control power. b) One (1) 10 kva, two (2) 37½ kva, one (1) 7½ kva, all 480-120V 1 phase transformers for instrument control. c) One (1) 37½ kva, 480-120/240V, 1 phase transformer for power.
152.311	Main Battery Fuses	Two (2) main battery fuse enclosures complete with lugs and fuses rated at 800 amps, 15,000 amp i.c. at 125V DC.
	Station Batteries	Two station batteries rated 125V DC, 60 cell lead acid type, one rated 960 amp-hour at 8 hour rate, and the other rated 1320 amp-hour at 8 hour rate.
152.312	Battery Chargers	Two static rectifier type rated at 50 kw each, 360 amp, 140V DC output.
152.321	Emergency Diesel Generators	Two emergency generators rated at 500 kw, at 1800 rpm, with 0.8 power factor, 480/277YV, 3 phase, 60 cycle a-c generator. Each generator is supplied with a 3,000 gallon underground day tank, fuel pumps, lube oil system, engine cooling system, and starting system.
152.3213	Fire Protection Systems	Water spray, automatically operated and remote-manual with automatic detection. Fire protection includes automatic water spray systems with automatic detection, fire detection and alarm panels and necessary piping, fittings, flanges and valves.
152.322	Gas Turbine Generator	One 23.4 MVA, 0.9 P.F., 6.9 kV outdoor gas turbine generator set including simple cycle fixed turbine, 6.9 kV electrical generator, protective system, automatic start-stop, synchronizer, sequencer, and auxiliary start, fuel and lubrication systems.

Account No.		Description
	Gas Turbine-Generator Switchgear	One (1), 6900 volt, metalclad, outdoor switchgear, with one (1) 3000 amp gas-turbine generator Main Breaker.
	Gas Turbine-Generator Bus Duct	One (1) 2500 amp, 7.5 kv Class, 3 phase Bus Duct, from the gas-turbine generator Main Breaker to the two (2) 2000 amp 6900V switchgear buses.
152.332	Inverter	Two (2) 37½ kva and one (1) 7½ kva static inverters for the instrument buses.
153.11	Supervisory Control Panels	The Supervisory Panels are vertical walk-in type structures. The panels are divided into fourteen (14) relative areas to show the location of control components and information display pertaining to the various subsystems.
153.22	DC Power Panels	a) Two (2) 125V DC Power Panels with 1200 ampere main buses. Panel No. 1 has ten (10) branch circuits with 20,000 amp i.c. breakers Panel No. 2 has fifteen (15) branch circuits with 20,000 amp. i.c. breakers. b) One (1) 125V DC Power Panel with 600 ampere main bus, and twenty-one (21) branch circuits with 20,000 amp i.c. breakers.
	DC Distribution Panels	Five (5) 125V DC Distribution Panels, 100 ampere main bus, each with 20 branch circuits with 10,000 amp i.c. breakers.
156.1	Generator Main Leads	An isolated phase bus is run between the generator line terminals and the low voltage bushings of the main step-up power transformers. The leads are rated 23 kv, 32,000 amperes, 150 kv Basic Impulse Level, 65°C temperature rise with forced air cooling.
	Neutral Transformer	The generator neutral is grounded through a 45 kva, single phase transformer rated at 20,000 volts on the primary and 240 volts, on the secondary. The secondary is connected to a 64 kw, 0.52 OHM resistor bank.
156.221	Diesel Generator Cable	Diesel generator cable is run between the 500 kw diesel generator and the 480 volt switchgear. The bus is rated 1000 amperes, 600V AC, 3 phase, 3 wire at 55°C rise.

MISCELLANEOUS PLANT EQUIPMENT

Account No.		Description
161.11	Cranes (Turbine Building)	Turbine Building - one (1) 150 ton overhead traveling crane with 25 ton auxiliary hook. Main hook 89 ft. lift, auxiliary hook 85 ft. lift. Main hoist speed 4 FPM, auxiliary hoist speed 15 FPM, bridge speed 75 FPM, trolley speed 50 FPM.
162.1111	Station Air Compressors	Two angle type, motor-driven, two-stage double acting, lubricated compressors including intake filter, 100 hp motors intercooler and after cooler, dual intercooler and after cooler, dual control and receiver; rated 320 scfm at 125 psig discharge pressure.
162.1112	Instrument Air Compressors and Air Dryers	Two horizontal, motor driven, single-stage, double acting, non-lubricated compressors, including intake filter and silencer, aftercooler, air dryers, dual control, receiver and 60 hp motor with V-belt drive; each rated 215 scfm at 100 psig discharge pressure.
162.211	Service Water Pumps	Three vertical service water pumps each to deliver 5000 gpm at 220 ft. TDH; 85% efficiency, driven by a 350 hp, 60 cycle, 3 phase, 480 volt motor at 1770 rpm. Each with steel column and discharge tee, chrome steel shaft, cast iron bowls, bronze impellers and bearings.
162.221	Motor Driven Fire Pumps	Two motor driven fire pumps each having 2000 gpm capacity at 150 psi total head driven by a 250 hp, 1750 motor.
	Motor Driven "Jockey" Pump	One jockey pump having a capacity of 100 gpm. This pump starts when the system pressure drops to 135 psig.
	Diesel Engine Driven Fire Pump	The fire pump has a capacity of 2000 gpm at a total head of 150 psi driven by a 250 hp, 1750 rpm diesel engine. The engine is equipped with a hot start engine preheater, fuel system, muffler, 350 gallon fuel tank, batteries and battery chargers, and combined manual-automatic controller.
	Treated Water Transfer Pump	One motor driven treated water transfer pump having 1000 gpm capacity at 50 psi total head, driven by a 50 hp motor.

Account No.		Description
162.242	Fire Protection System	The fire protection system includes a network of fire service water piping, a 200,000 gal fire service water storage tank, a diesel engine driven fire pump, fire protection systems for coal handling, generator hydrogen seal oil unit, turbine oil reservoir and transformers, and hydrants and hose reels located at various places throughout the plant and yard.
162.31	Auxiliary Boiler and Related Equipment	The auxiliary boiler has the following design parameters: Evaporation Rate = 80,000 #/hr. Steam Temperature = 500°F Light Fuel Burned = 5,450 #/hr. Efficiency = 80.1% Feedwater Temperature = 225°F Operating Pressure = 250 psig
	Auxiliary Forced Draft Fan	The auxiliary boiler forced draft fan mounted on the boiler has a rated capacity of 24,500 cfm at 14.7" H_2O static pressure driven by a 75 hp, 1750 rpm motor.
	Auxiliary Boiler Feed Pumps	Two auxiliary boiler feed pumps each have a capacity of 180 gpm at 323 psi total head, each driven by a motor rated at 50 hp, 3600 rpm, 480 volt, 60 cycle, 3 phase.
	Auxiliary Boiler Fuel Oil Pumps	Two auxiliary fuel oil pumps each have a capacity of 17 gpm at 150 psi discharge pressure, driven by a 3 hp, 480 volt, 3 phase, 60 cycle, 1750 rpm motor.
	Auxiliary Boiler Deaerator	One auxiliary deaerator rated at 90,000 #/hr. feedwater.
	Auxiliary Boiler Blowoff Tank	The blowdown tank is 3' dia. x 5' high designed for 250 psig pressure and receives the intermittent and continuous blowdown from the boiler.

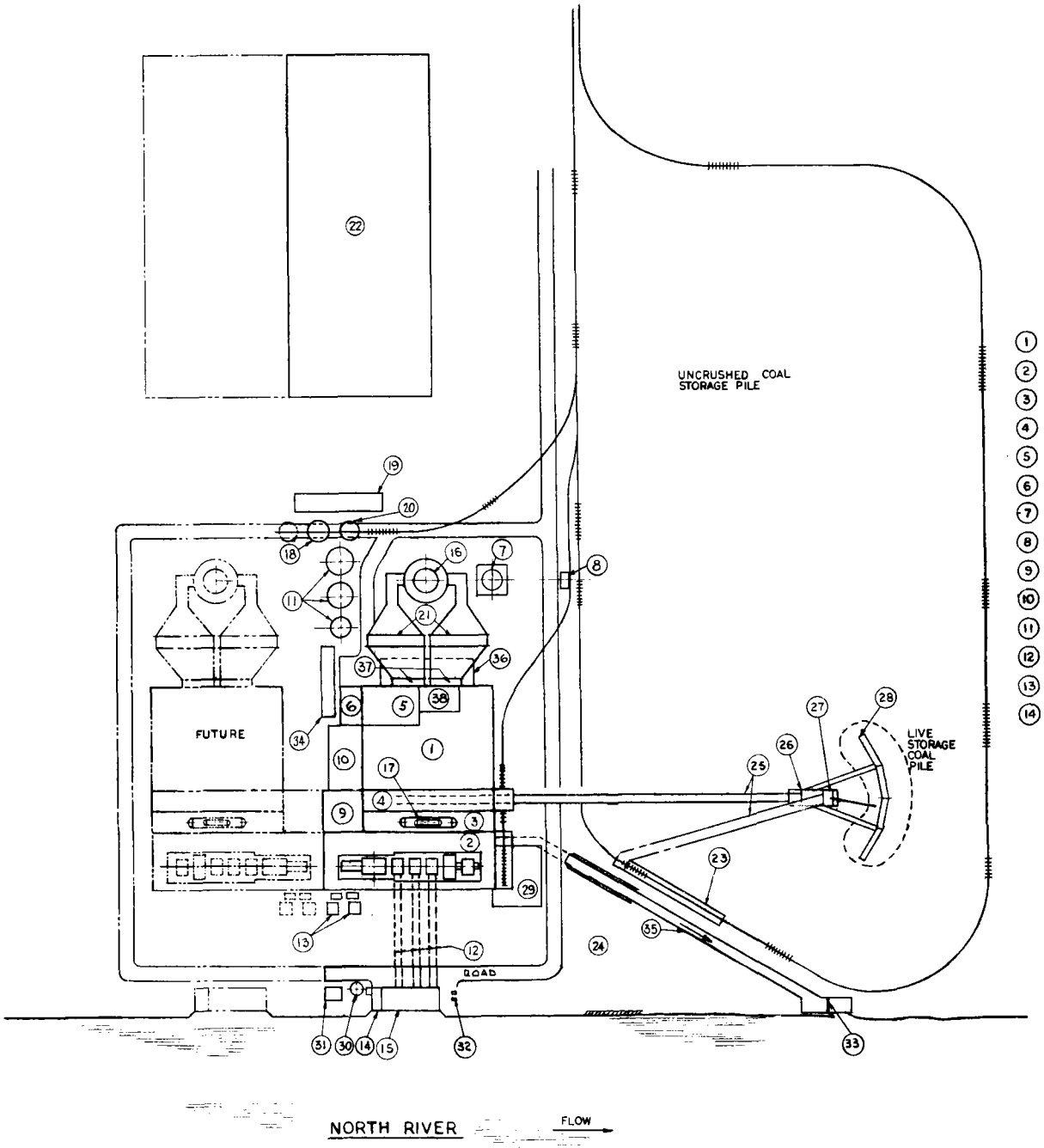
Account No.		Description
	Auxiliary Boiler Chemical Feed Pumps	Two pneumatic stroke adjustment chemical feed pumps with ¼ motors, one for 5% ammonia and the other for 5% hydrazine solutions rated at 1 gph and 400 psig discharge pressure.
163.15	Plant Communication System	One plant communication system consisting of approximately 115 speakers, 130 hand-sets and amplifiers, and one communications desk with associated monitoring equipment.
163.25	Noise Monitoring System	One noise monitoring system consisting of microphone assemblies, amplifier and speaker assembly, position selector switch and plug-in head set and jack station.

1000 MW COAL-FIRED PLANT

LIST OF DRAWINGS

Plate No.	Drawings
1	Plot Plan
2	Ground Floor Plan
3	Operating Floor Plan
4	Cross Section
5	Flow Diagram - Coal Unloading
6	Flow Diagram - Stm, Cond., F.W.
7	Electrical Single Line
8	Heat Balance

CF



LEGEND

1. BOILER
2. TURBINE BUILDING
3. HEATER BAY
4. BUNKER BAY
5. MACHINE SHOP (GRADE FL.)
6. DIESEL GENERATOR ROOM
7. LIGHT OIL TANK
8. LIGHT OIL UNLOADING PUMP
9. CONTROL ROOM (OP. FLR.)
10. WATER TREATMENT ROOM
11. WATER TANKS
12. CIRCULATING WATER INTAKE PIPES
13. TRANSFORMERS
14. SERVICE WATER PUMP HOUSE
15. CIRCULATING WATER INTAKE STRUCTURE
16. STACK
17. DEAERATOR
18. FLY ASH SILO
19. ASH SETTLING BASIN
20. DEWATERING BIN
21. PRECIPITATORS
22. SWITCHYARD
23. COAL UNLOADING PIT
24. PARKING AREA
25. CONVEYORS
26. CRUSHER HOUSE
27. STACKER HOUSE
28. RECLAIM PIT
29. ADMINISTRATION BUILDING
30. FIRE WATER TANK
31. GASES STORAGE
32. CHLORINATION EQUIPMENT
33. VARIABLE WEIRS
34. GAS TURBINE GENERATOR
35. DISCHARGE TUNNEL & CANAL
36. FAN ROOM
37. AIR PREHEATER
38. AUXILIARY BOILER ROOM

SITE PLOT PLAN

0 50 100 200 300 FT.

SCALE

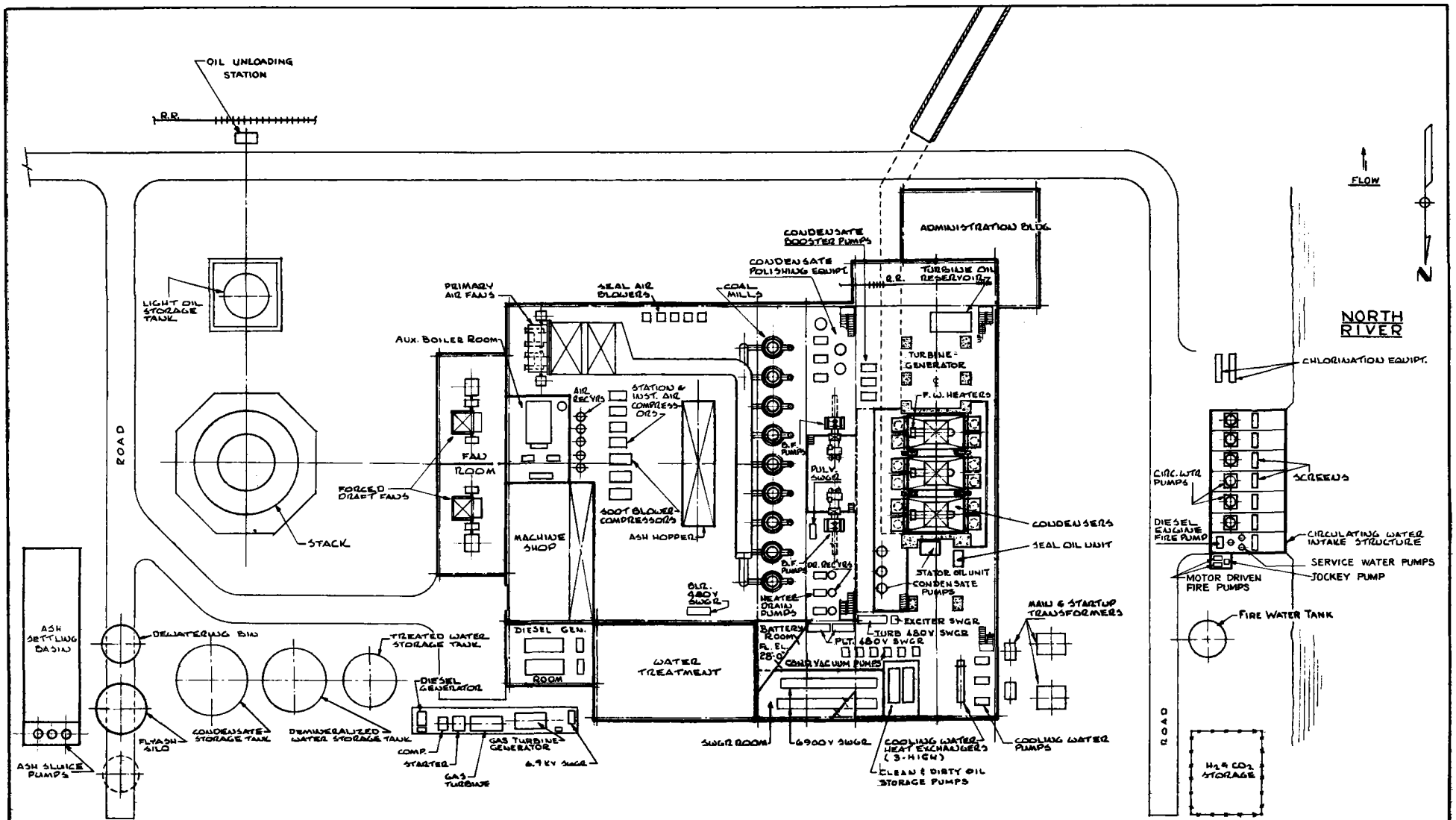
PLATE 1

3-8-71

MECHANICAL
PLOT PLAN
1000 MW - COAL FIRED UNIT
MIDDLE TOWN HYPOTHETICAL SITE

united engineers & constructors inc.

9674-D-2516



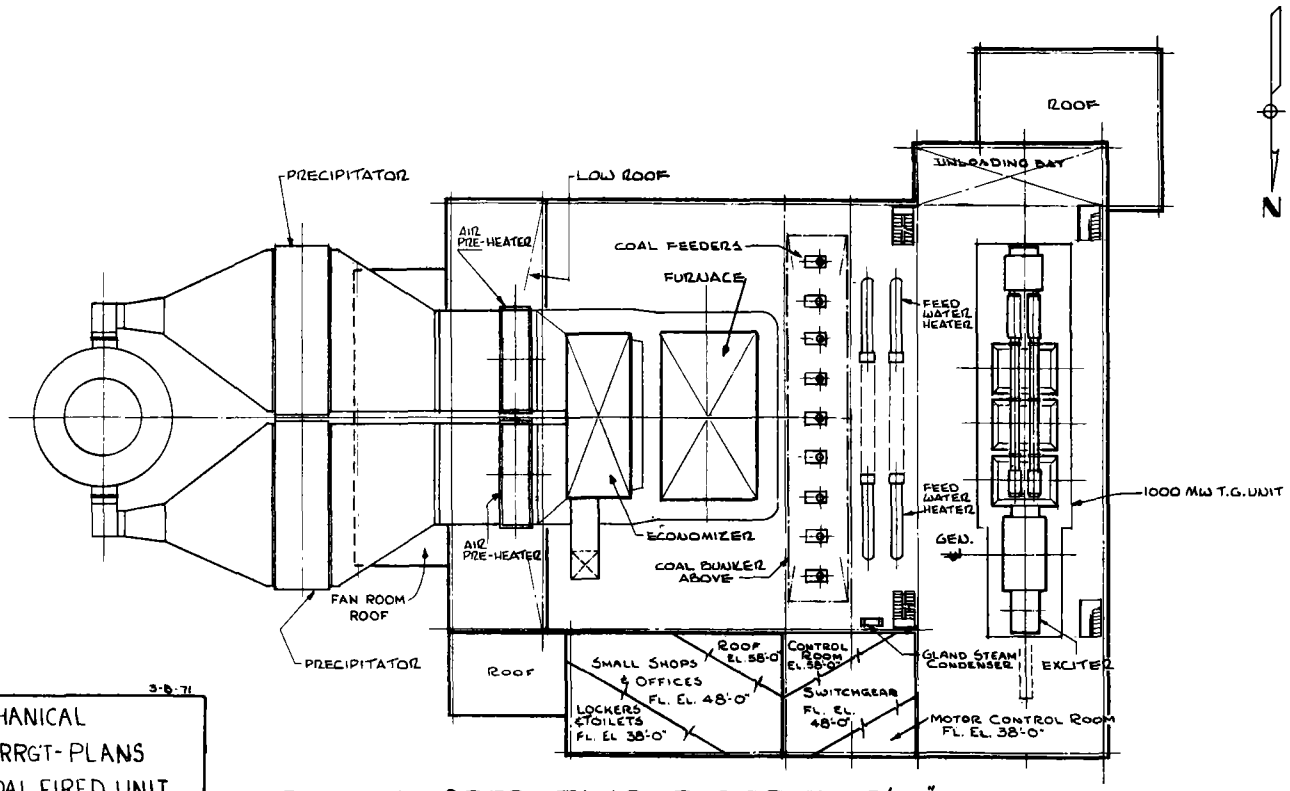
3-8-71

MECHANICAL
GENERAL ARRGT- PLANS
1000 MW-COAL FIRED UNIT
MIDDLETOWN HYPOTHETICAL SITE
united engineers & constructors inc.
9674-D-2519

PLAN @ GRADE EL. 18'-0"

0 40 80 120FT.
SCALE

PLATE 2



PLAN @ OPERATING FLOOR EL. 58'-0"

0 40 80 120 FT.

SCALE

3-8-71

MECHANICAL

GENERAL ARRGT- PLANS

1000 MW-COAL FIRED UNIT

MIDDLETOWN HYPOTHETICAL SITE

united engineers & constructors inc.

X74-0-2519

PLATE 3

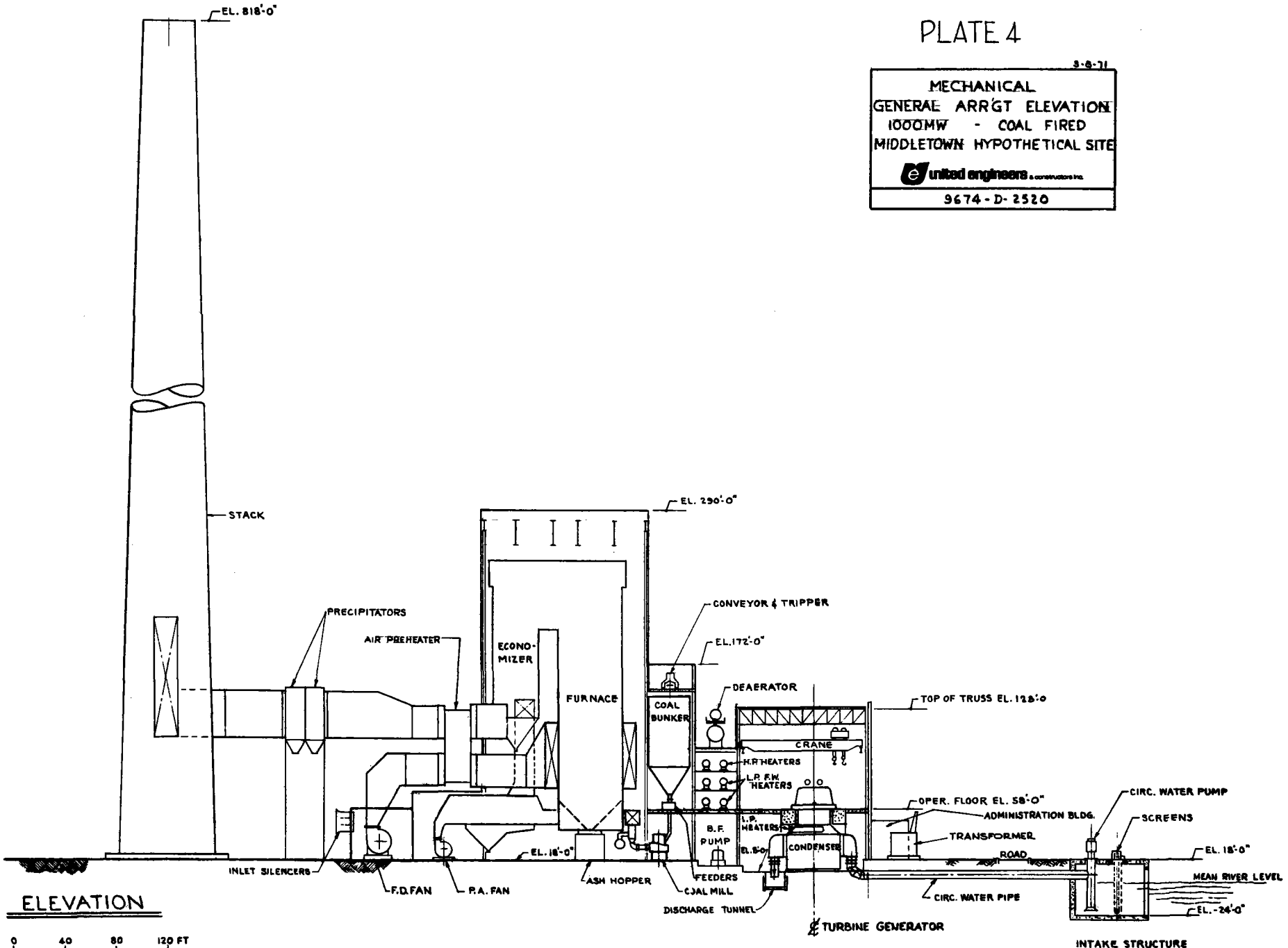
PLATE 4

3-8-71

MECHANICAL
GENERAL ARR'GT ELEVATION
1000MW - COAL FIRED
MIDDLETOWN HYPOTHETICAL SITE

united engineers & constructors inc.

9674-D-2520



ELEVATION

0 40 80 120 FT

SCALE

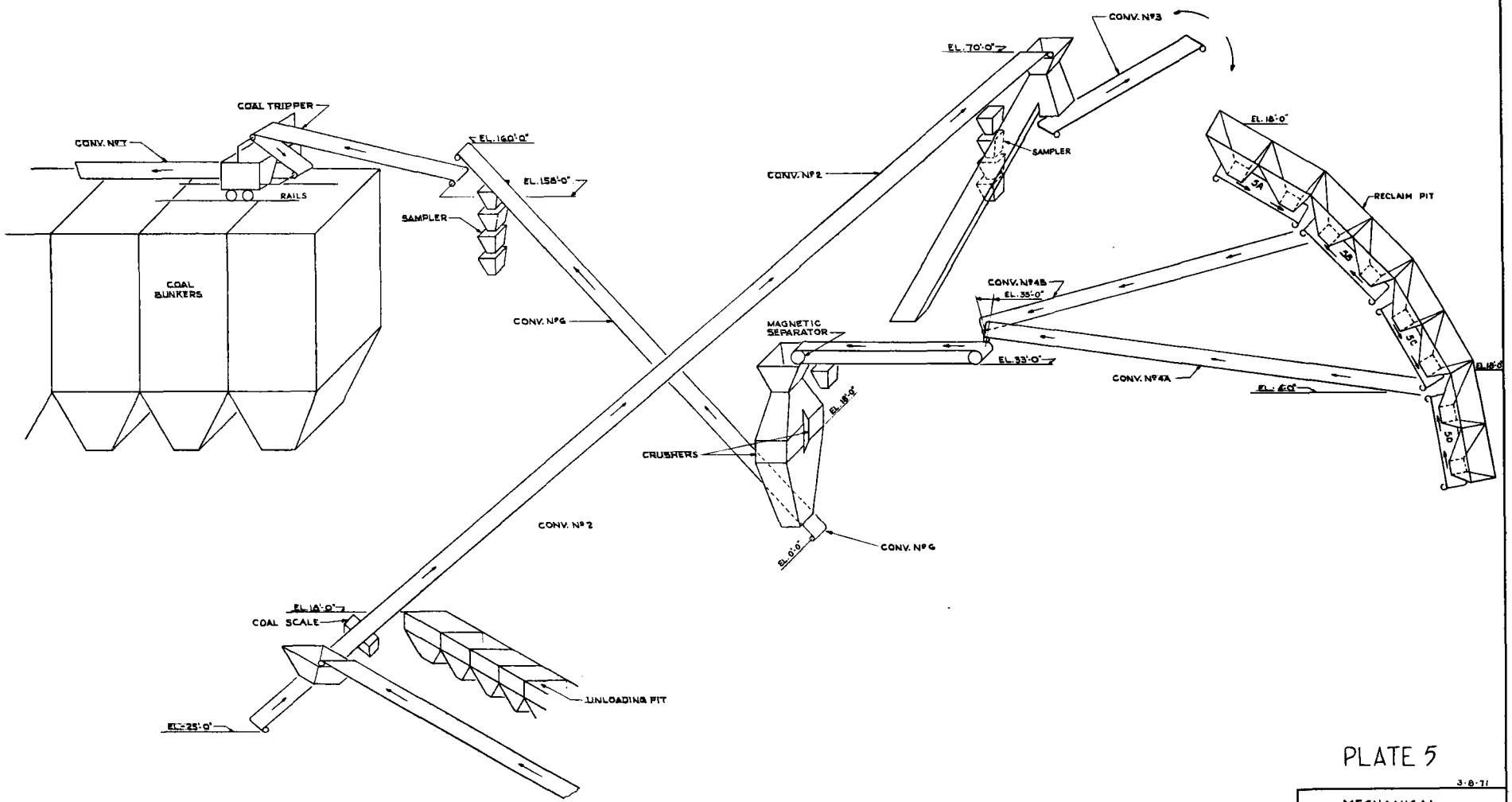


PLATE 5

3-8-71

MECHANICAL
COAL UNLOADING DIAGRAM
1000 MW COAL FIRED UNIT
MIDDLETOWN HYPOTHETICAL SITE

united engineers

9674 - D - 2513

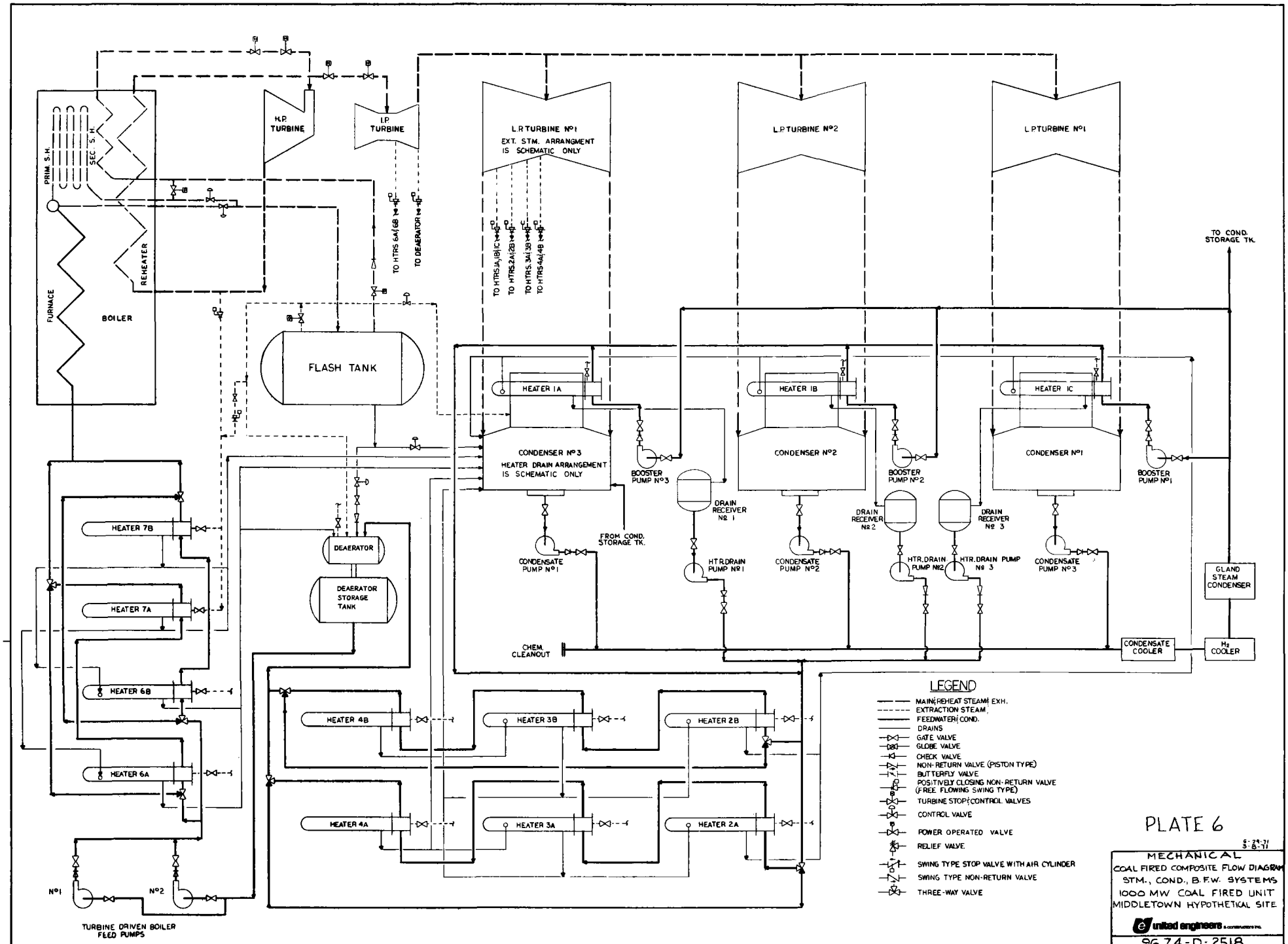


PLATE 6

6-29-71
5-8-71

MECHANICAL
COAL FIRED COMPOSITE FLOW DIAGRAM
STM., COND., B.F.W. SYSTEMS
1000 MW COAL FIRED UNIT
MIDDLETOWN HYPOTHETICAL SITE

united engineers & constructors inc.

9674-D-2518

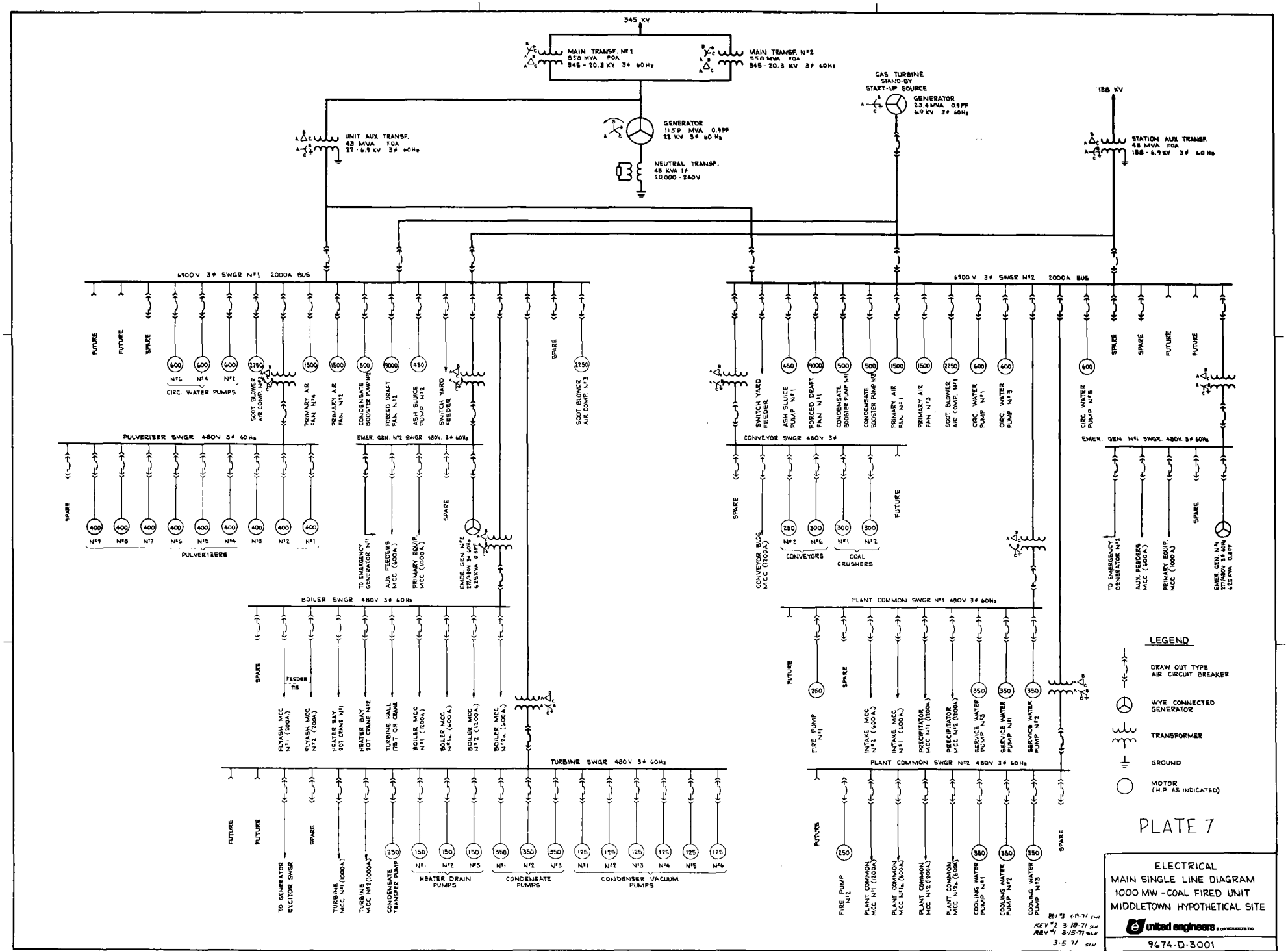


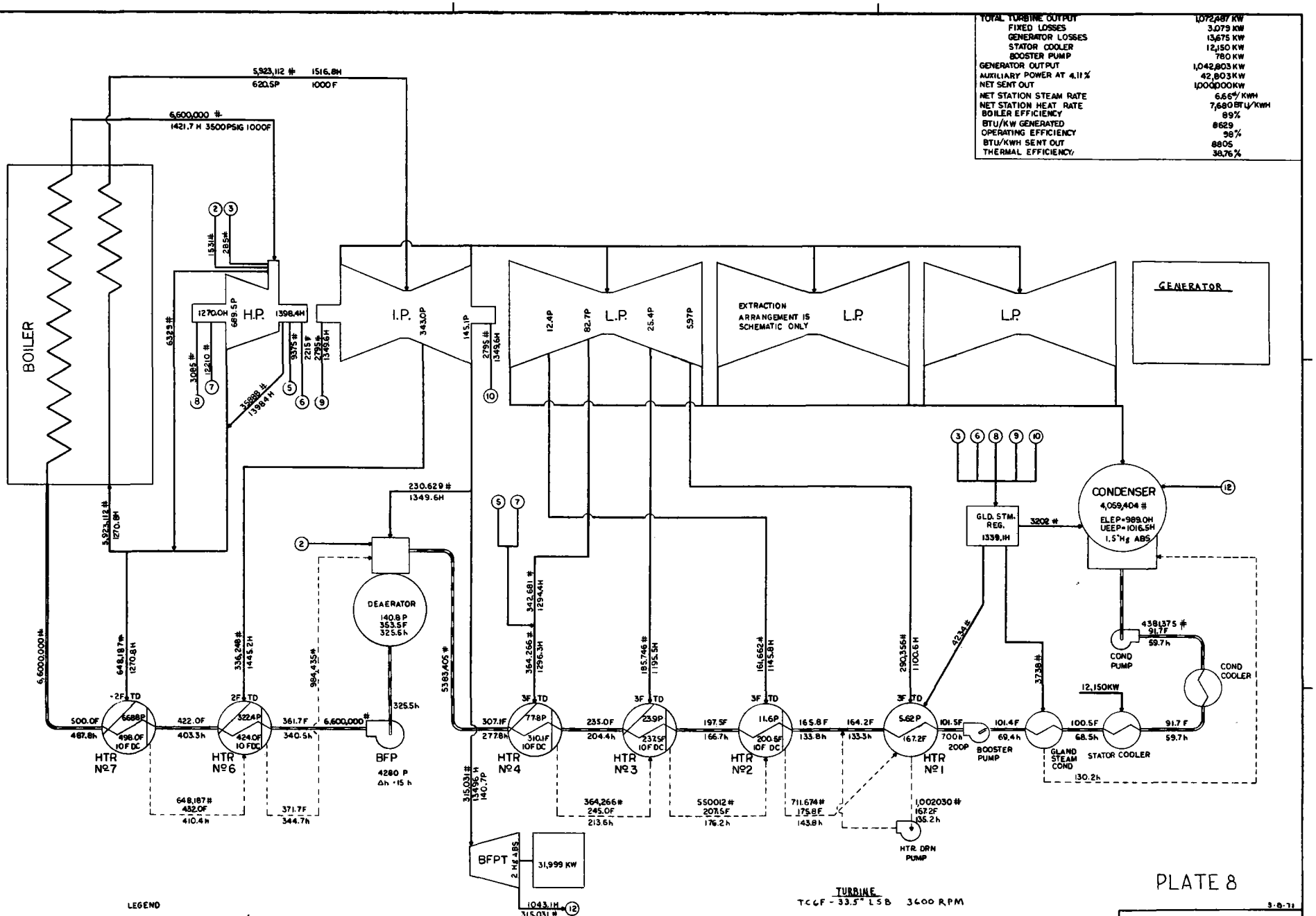
PLATE 7

ELECTRICAL
MAIN SINGLE LINE DIAGRAM
1000 MW - COAL FIRED UNIT
MIDDLETOWN HYPOTHETICAL SITE

united engineers & constructors inc.

9474-D-3001

REV °3 4-19-71 GLM
REV °2 3-18-71 GLM
REV °1 3-15-71 GLM
3-5-71 GLM


TOTAL TURBINE OUTPUT 1,072,487 KW
FIXED LOSSES 3,079 KW
GENERATOR LOSSES 13,675 KW
STATOR COOLER 12,150 KW
BOOSTER PUMP 780 KW
GENERATOR OUTPUT 1,042,803 KW
AUXILIARY POWER AT 4.11% 42,803 KW
NET SENT OUT 1,000,000 KW
NET STATION STEAM RATE 6.66#/KWH
NET STATION HEAT RATE 7,680 BTU/KWH
BOILER EFFICIENCY 89%
BTU/KW GENERATED 8629
OPERATING EFFICIENCY 98%
BTU/KWH SENT OUT 8805
THERMAL EFFICIENCY 38.76%
BOILER
5,923,112 # 1516.8H 620.5P 1000 F
6,600,000 # 1421.7 H 3500PSIG 1000F
H.P.
I.P.
L.P.
L.P.
L.P.
EXTRACTION ARRANGEMENT IS SCHEMATIC ONLY
GENERATOR
DEAERATOR 140.8 P 353.5 F 325.6 h
GLD. STM. REG. 1339.1H
CONDENSER 4,059,404 # ELEP=989.0H UEEP=1016.5H 1.5"Hg ABS
COND PUMP
COND COOLER
BOOSTER PUMP
GLAND STEAM COND
STATOR COOLER
HTR Nº7
HTR Nº6
HTR Nº4
HTR Nº3
HTR Nº2
HTR Nº1
BFP 4280 P Δh 15 h
BFPT 2 Hg ABS 31,999 KW
HTR. DRN PUMP
TURBINE TC6F - 33.5" LSB 3600 RPM
LEGEND
H,h — ENTHALPY — BTU/LB
— FLOW — LB/HR
P — PRE — PSIA
F — TEMP — °F
PLATE 8
3-8-71
MECHANICAL
COAL FIRED PERFORMANCE DIAGRAM
1000 MW COAL FIRED UNIT
MIDDLETOWN HYPOTHETICAL SITE
united engineers
9674-D-2517

Date: _____

ESTIMATE OF COST
FOR
1000 MW COAL FIRED PLANT

J.O. 9674.01

ACCT. NO.	DESCRIPTION	QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
10.	LAND AND LAND RIGHTS				$	$
101.	Land and Privilege Acquisition					
101.1	Allowance for purchase of approximately 500 acres of land including all surveys, privileges, clearing costs, etc. (M				1,000,000	
	Total Land and Land Rights,- (M				1,000,000	1,000,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS					$	$
111.	Yard Work						
111.11	General Cut and Fill						
	Includes excavation to rough grade in area outside of building lines. (Excavation in building areas is with buildings)						
	Common excavation	(L	100,000	cu yd	1.50	150,000	
		(M			.50	50,000	
	Yard fill	(L	Allowance			10,000	
		(M				5,000	
	Clearing of site	(L	Allowance			10,000	
		(M				5,000	
	Finish grading	(L	Allowance			35,000	
		(M				15,000	
		(L				205,000	
		(M				75,000	
111.12	Roads, Walks and Parking Areas						
	Access road to plant site area					Existing	
	Subgrade preparation - roads and parking lot	(L	32,000	sq yd	1.75	56,000	
		(M				5,000	
	Paving for roads and parking areas	(L	24,000	sq yd	2.00	48,000	
		(M			3.00	72,000	
	Walks and curbs	(L	Allowance			3,000	
		(M				4,000	
	Gutters	(L	12,000	lin ft	2.00	24,000	
		(M			2.50	30,000	
		(L				131,000	
		(M				111,000	
111.13	Retaining Walls						
	Forms	(L	20,000	sq ft	5.50	110,000	
		(M			.50	10,000	
	Reinforcing steel	(L	80	ton	270.00	21,600	
		(M			150.00	12,000	
	Concrete including finish, etc.	(L	1,200	cu yd	15.33	18,400	
		(M			23.33	28,000	
		(L				150,000	
		(M				50,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
111.	Yard Work (Cont'd)						
111.14	Fencing and Gates						
	Permanent fence (7' high plus barbed wire) including	(L	3,200	lin ft	2.50	8,000	
	gates, etc.	(M				16,000	
	Gate house	(L	Allowance			10,000	
		(M				5,000	
		(L				18,000	
		(M				21,000	
111.15	Sanitary Sewage Facilities						
	Sewage treatment facilities	(L	Allowance			25,000	
		(M				25,000	
	Connections between build-	(L	1,000	lin ft	25.00	25,000	
	ings and treating plant	(M			10.00	10,000	
		(L				50,000	
		(M				35,000	
111.16	Yard Drainage						
	Allowance for area drains on-site roads and railroad drains						
	Pipe and Fittings	(M	3,000	lin ft	6.00	18,000	
	Area drains	(M	Allowance			5,000	
	Installation	(L	3,000	lin ft	8.00	24,000	
		(M			1.50	4,500	
	Excavation and backfill	(L	3,000	cu yd	10.00	30,000	
		(M				7,500	
	Manholes and catch	(L	20			36,000	
	basins, etc.	(M				15,000	
		(L				90,000	
		(M				50,000	
111.17	Yard Lighting						
	Allowance for lighting yard areas, railroad and roads	(L	75	fixt		110,000	
	on-site, etc.	(M				40,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
111.	Yard Work (Cont'd)						
111.34	Bridges over Discharge Canal, etc.						
	Concrete slab on steel beam bridge spanning the extended discharge canal						
	Structural steel and	(L	40	ton	250.00	10,000	
	miscellaneous iron	(M			300.00	12,000	
	Forms	(L	6,000	sq ft	5.00	30,000	
		(M			.50	3,000	
	Reinforcing steel	(L	30	ton	250.00	7,500	
		(M			150.00	4,500	
	Concrete	(L	250	cu yd	10.00	2,500	
		(M			22.00	5,500	
		(L				50,000	
		(M				25,000	
111.43	Railroads						
	Offsite access railroad	(L	5	mi		490,000	
		(M				530,000	
	Onsite sidings, turn-outs,	(L	10,000	lin ft		110,000	
	etc.	(M				180,000	
		(L				600,000	
		(M				710,000	
	Total Yard Work,-	(L				1,404,000	
		(M				1,117,000	2,521,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
112.	Main Power Station Building Includes boiler room, bunker bay, heater bay, turbine room, water treating, control room and service areas.						
	Substructure						
112.1111	Earth excavation	(L	40,000	cu yd	4.00	160,000	
		(M			1.50	60,000	
112.1112	Rock excavation	(L	1,000	cu yd	25.00	25,000	
		(M			5.00	5,000	
112.1121	Dewatering	(L	Allowance			125,000	
		(M				20,000	
112.1131	Backfill - earth	(L	3,000	cu yd	4.00	12,000	
		(M			4.00	12,000	
112.1132	Backfill - sand and gravel	(L	10,000	cu yd	7.50	75,000	
		(M			5.00	50,000	
112.1311	Formwork	(L	90,000	sq ft	3.25	292,500	
		(M			.50	45,000	
112.1321	Reinforcing rods	(L	1,000	ton	400.00	400,000	
		(M			150.00	150,000	
112.1322	Reinforcing mesh	(L	110,000	sq ft	.25	27,500	
		(M			.20	22,000	
112.1331	Concrete	(L	22,000	cu yd	15.00	330,000	
		(M			20.00	440,000	
112.1341	Miscellaneous iron embedded in concrete	(L	100	ton	900.00	90,000	
		(M			500.00	50,000	
112.1342	Anchor bolts	(L	1,000	@	25.00	25,000	
		(M			10.00	10,000	
112.1351	Floor finish	(L	100,000	sq ft	.30	30,000	
		(M			.01	1,000	
	Total Substructure,-	(L				1,592,000	
		(M				865,000	2,457,000
	Superstructure						
	Concrete Floor Slabs						
112.1411	Formwork - metal	(L	115,000	sq ft	1.00	115,000	
		(M			.40	46,000	
112.1412	Reinforcing steel	(L	400	ton	400.00	160,000	
		(M			150.00	60,000	
112.1413	Concrete	(L	3,800	cu yd	25.00	95,000	
		(M			20.00	76,000	
112.1414	Floor finish	(L	100,000	sq ft	.50	50,000	
		(M			.20	20,000	
		(L				420,000	
		(M				202,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
112.	Main Power Station Building (Cont'd)						
	Steel and Iron						
112.1421	Structural steel frame	(L	14,200	ton	150.00	2,130,000	
		(M			320.00	4,544,000	
112.1422	Miscellaneous lintels, curb angles, ladders, hatch covers, etc.	(L	300	ton	1000.00	300,000	
		(M			400.00	120,000	
112.1423	Stair treads	(L	1,600	trd	20.00	32,000	
		(M			10.00	16,000	
112.1424	Floor grating	(L	150,000	sq ft	2.00	300,000	
		(M			1.50	225,000	
112.1425	Handrailing	(L	10,000	lin ft	7.50	75,000	
		(M			3.50	35,000	
		(L				2,837,000	
		(M				4,940,000	
	Walls, Roofs, etc.						
112.1431	Exterior metal wall panels - insulated	(L	270,000	sq ft	1.50	405,000	
		(M			1.00	270,000	
112.1441	Precast concrete roof slabs and metal deck	(L	120,000	sq ft	.75	90,000	
		(M			.75	90,000	
112.1451	Built-up roofing, flashing and insulation	(L	120,000	sq ft	.50	60,000	
		(M			.75	90,000	
112.1461	Masonry partition walls	(L	100,000	sq ft	3.00	300,000	
		(M			2.00	200,000	
112.1471	Personnel doors and hardware	(L	2,000	sq ft	5.00	10,000	
		(M			6.00	12,000	
112.1472	Rolling steel doors and operators	(L	2,000	sq ft	3.00	6,000	
		(M			7.00	14,000	
112.1481	Vinyl tile floors	(L	20,000	sq ft	.50	10,000	
		(M			.50	10,000	
112.1482	Ceramic tile floors	(L	5,000	sq ft	1.00	5,000	
		(M			1.00	5,000	
112.1483	Suspended ceilings and support structure	(L	13,000	sq ft	5.00	65,000	
		(M			5.00	65,000	
112.1484	Interior wall facing panels	(L	4,000	sq ft	1.00	4,000	
		(M			2.00	8,000	
		(L				955,000	
		(M				764,000	
112.149	Painting						
	Structural steel, miscellaneous iron, doors, ceilings, etc.	(L				500,000	
		(M				100,000	
	Total Superstructure,-	(L				4,712,000	
		(M				6,006,000	10,718,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
112.	Main Power Station Building (Cont'd)						
	Building Services						
	Plumbing and Drainage Systems						
112.211	Floor drainage including	(L				125,000	
	sump pumps	(M				50,000	
112.212	Roof drainage system	(L				235,000	
		(M				75,000	
112.213	Plumbing fixtures, drinking fountains, etc.	(L				100,000	
		(M				50,000	
		(L				460,000	
		(M				175,000	
	Heating and Ventilating						
112.222	Heating units, piping connections, etc.	(L				350,000	
		(M				150,000	
112.223	Ventilating fans, ducts, louvres, roof ventilators, etc.	(L				250,000	
		(M				300,000	
		(L				600,000	
		(M				450,000	
	Fire Protection						
112.231	Pipe, valves, hose racks, etc.	(L				150,000	
		(M				125,000	
112.24	Lighting and Service Wiring						
	Fixtures	(L				200,000	
		(M				200,000	
	Conduit and wiring	(L				950,000	
		(M				200,000	
	Switchgear, etc.	(L				50,000	
		(M				75,000	
		(L				1,200,000	
		(M				475,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
112.	Main Power Station Building (Cont'd)						
	Building Services (Cont'd)						
112.25	Elevator						
	5000 lb capacity elevator	(L	1			20,000	
		(M				80,000	
	Shaftway enclosure	(L				40,000	
		(M				20,000	
		(L				60,000	
		(M				100,000	
	Total Building Services,-	(L				2,470,000	
		(M				1,325,000	3,795,000
	Total Main Power	(L				8,774,000	
	Station Building,-	(M				8,196,000	16,970,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
113.	Administration Building						
	Four-story building 100'L x 50'W x 60'H						
	Floor area = 20,000 sq ft; cube = 300,000 cu ft						
	Substructure						
113.11	Excavation and backfill	(L	2,500	cu yd	3.00	7,500	
		(M			1.00	2,500	
113.13	Concrete work	(L	250	cu yd	200.00	50,000	
		(M			50.00	12,500	
		(L				57,500	
		(M				15,000	72,500
	Superstructure						
113.142	Structural steel and	(L	200	ton	200.00	40,000	
	miscellaneous iron	(M			400.00	80,000	
113.141	Floor slabs above grade	(L	15,000	sq ft	2.50	37,500	
		(M			1.50	22,500	
113.144	Roof and roofing	(L	5,000	sq ft	1.50	7,500	
		(M			1.50	7,500	
113.145							
113.143	Exterior walls	(L	18,000	sq ft	3.50	63,000	
		(M			2.50	45,000	
113.146	Interior partitions	(L	20,000	sq ft	1.50	30,000	
		(M			1.50	30,000	
113.148	Special finishes,	(L	Allowance			15,000	
113.149	painting, etc.	(M				35,000	
		(L				193,000	
		(M				220,000	413,000
	Building Services						
113.21	Plumbing and drains	(L	Allowance			40,000	
		(M				35,000	
113.22	Heating, ventilating and	(L	Allowance			100,000	
	air conditioning	(M				150,000	
113.24	Lighting and service	(L	Allowance			40,000	
	wiring	(M				40,000	
113.23	Fire protection	(L	Allowance			10,000	
		(M				10,000	
		(L				190,000	
		(M				235,000	425,000
	Total Administration	(L				440,500	
	Building,-	(M				470,000	910,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
114.	Intake and Discharge Structures						
114.1	Screen and Pump Well						
114.11	Excavation Work						
114.111	Dredging	(L	50,000	cu yd	1.50	75,000	
		(M			.50	25,000	
114.112	Rock excavation	(L	2,000	cu yd	20.00	40,000	
		(M			5.00	10,000	
114.113	Backfill	(L	15,000	cu yd	2.50	37,500	
		(M			2.00	37,500	
		(L				152,500	
		(M				72,500	225,000
	Concrete Work						
114.131	Formwork	(L	65,000	sq ft	5.00	325,000	
		(M			.60	39,000	
114.132	Reinforcing Steel						
	(Field fabricated)	(L	250	ton	400.00	100,000	
		(M			150.00	37,500	
114.133	Tremie concrete	(L	2,000	cu yd	20.00	40,000	
		(M			20.00	40,000	
114.133	Structural concrete	(L	4,000	cu yd	20.00	80,000	
		(M			20.00	80,000	
114.135	Concrete finish	(L				9,000	
		(M				1,500	
		(L				554,000	
		(M				198,000	752,000
	Miscellaneous Iron						
114.141	Embedded steel	(L	25	ton	1300.00	32,500	
		(M			600.00	15,000	
114.142	Platforms, covers, etc.	(L	45	ton	1200.00	54,000	
		(M			600.00	27,000	
		(L				86,500	
		(M				42,000	128,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
11.	STRUCTURES AND IMPROVEMENTS (Cont'd)					$	$
114.	Intake and Discharge Structures (Cont'd)						
114.1	Screen and Pump Well (Cont'd)						
114.15	Cofferdam						
114.151	Sheet piling including	(L	500	ton	350.00	175,000	
	removal, etc.	(M			200.00	100,000	
114.152	Bracing including	(L	200	ton	700.00	140,000	
	moving, removal, etc.	(M			200.00	40,000	
114.153	Construction ramps	(L	Allowance			100,000	
	including removal	(M				65,000	
114.154	Dolphins	(L	30	ton	300.00	9,000	
		(M			200.00	6,000	
114.155	Rock fill at toe of	(L	500	cu yd	10.00	5,000	
	sheeting	(M			15.00	7,500	
114.156	Dewatering	(L	Allowance			175,000	
		(M				20,000	
		(L				604,000	
		(M				238,500	842,500
114.16	Bulkhead at River						
114.1601	Excavation and rip-rap	(L				30,000	
	to hold sheeting	(M				125,000	
114.1602	Steel sheet piling	(L	300	ton	150.00	45,000	
		(M			200.00	60,000	
114.1603	Wales and tie-backs	(L				15,000	
		(M				5,000	
114.1611	Formwork	(L	5,000	sq ft	5.00	25,000	
		(M			.60	3,000	
114.1612	Reinforcing steel	(L	10	ton	400.00	4,000	
		(M			150.00	1,500	
114.1613	Concrete	(L	150	cu yd	30.00	4,500	
		(M			20.00	3,000	
114.162	Block walls	(L	5,000	sq ft	1.00	5,000	
		(M			1.00	5,000	
114.163	Coping	(L	200	cu ft	5.00	1,000	
		(M			5.00	1,000	
114.164	Sprinkler system	(L				5,000	
		(M				2,000	
114.165	Lighting	(L				7,500	
		(M				6,000	
		(L				142,000	
		(M				211,500	353,500
	Total Screen and Pump	(L				1,539,000	
	Well,-	(M				762,500	2,301,500
	Total Structures and	(L				12,157,500	
	Improvements,-	(M				10,545,500	22,703,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT					$	$
121.	Steam Generating Equipment						
121.11	Boiler and Accessories 7,300,000 #/hr. 3500 psig, 1005/1005 reheat, for coal firing, including,						
	Water walls						
	Superheater						
	Attemperator						
	Reheater						
	Economizer						
	Air heaters						
	Flues and ducts to preheaters						
	Soot hoppers						
	Gas recirculating fans and drives						
	Refractory, insulation and lagging						
	Start-up and by-pass equipment						
	Attemperator controls						
	Sealing air piping						
	Aspirating air piping						
	Remote lighters and controls						
	Supervision of erection						
	Purchase cost of above equipment and services (delivered)	(M				19,500,000	
	Erection	(L	865,000	MH	10.00	8,650,000	
		(M				400,000	
	Cleaning, testing, etc.	(L				100,000	
		(M				25,000	
		(L				8,750,000	
		(M				19,925,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
121.	Steam Generating Equipment (Cont'd)						
121.12	Soot Blowing System						
	Soot blowers	(M				425,000	
	Control cabinet	(M				30,000	
	Installation	(L				125,000	
		(M				5,000	
	Soot blowing air compressors - 5,000 cfm @ 300 psig with 2250 hp motors	(M	3			450,000	
	Installation	(L				60,000	
		(M				5,000	
	Piping connections	(L				135,000	
		(M				75,000	
	Foundations	(L				10,000	
		(M				10,000	
		(L				330,000	
		(M				1,000,000	
	Total Steam Generating	(L				9,080,000	
	Equipment,-	(M				20,925,000	30,005,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
122.	Draft System						
122.11	Forced Draft Fans						
	Fans - 890,000 cfm @ 36" Wg	(M	2	@		130,000	
	Installation	(L	2			55,000	
		(M				2,500	
	Motor drives - 9,000 hp, 900 rpm, 6900 Volt	(M	2	@		300,000	
	Installation	(L				30,000	
		(M				2,000	
	Fan foundations, fan room enclosure, intake silencers, etc.	(L				150,000	
		(M				175,000	
		(L				235,000	
		(M				609,500	
122.31	Precipitators						
	1,500,000 cfm electrostatic units 99.5% efficiency						
	Purchase cost	(M	2	@		3,500,000	
	Erection	(L				800,000	
		(M				10,000	
	Gunite lining	(L	Allowance			75,000	
		(M				25,000	
		(L				875,000	
		(M				3,535,000	
122.41	Draft Flues and Breeching						
	Air ducts from forced draft fans to preheaters and gas ducts from preheaters through precipitators to stack	(L	1,200	ton	500.00	600,000	
		(M			600.00	720,000	
	Dampers, expansion joints, etc.	(L				100,000	
		(M				100,000	
	Insulation and gunite lining	(L				150,000	
		(M				50,000	
		(L				850,000	
		(M				870,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
122.	Draft System (Cont'd)						
122.51	Precipitator and Duct Supports						
	Supporting structure for precipitator and ductwork between boiler house and stack.						
	Foundations	(L	40,000	sq ft	5.00	200,000	
		(M			2.50	100,000	
	Structural steel	(L	1,200	ton	250.00	300,000	
		(M			350.00	420,000	
	Stair treads	(L	600	trd	15.00	9,000	
		(M			10.00	6,000	
	Handrail	(L	3,000	lin ft	5.00	15,000	
		(M			5.00	15,000	
	Grating	(L	4,000	sq ft	2.50	10,000	
		(M			1.50	6,000	
		(L				534,000	
		(M				547,000	
122.61	Stacks						
	800' high concrete shell, 79' OD at base 39' OD at top with insulated steel liner, aviation warning lights, lightning protection etc.						
	Concrete shell	(L	14,000	cu yd	45.00	630,000	
		(M			40.00	560,000	
	Steel liner	(L				550,000	
		(M				315,000	
	Aviation lights, etc.	(L				10,000	
		(M				15,000	
		(L				1,190,000	
		(M				890,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
122.	Draft System (Cont'd)						
122.62	Stack Foundations						
	Excavation and backfill	(L	5,600	cu yd	5.00	28,000	
		(M			1.00	5,600	
	Formwork	(L	16,500	sq ft	4.00	66,000	
		(M			.60	9,900	
	Reinforcing steel	(L	200	ton	300.00	60,000	
		(M			150.00	30,000	
	Concrete	(L	5,000	cu yd	15.00	75,000	
		(M			20.00	100,000	
	Embedded metal	(L	2,000	lbs	.75	1,500	
		(M			.50	1,000	
		(L				230,500	
		(M				146,500	
	Total Draft System,-	(L				3,914,500	
		(M				6,598,000	10,512,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
125.	Coal Fuel Equipment						
	Outdoor Coal Handling System 3,000 TPH unloading; 1400 TPH reclaiming						
125.11	Main Equipment, etc.						
	Belt conveyors complete with supporting structures, motor drives, belts, etc.	(M	1,600	lin ft		1,000,000	
	Feeders, chutes, etc.	(M				400,000	
	Magnetic separators	(M				30,000	
	Belt scales	(M				40,000	
	Crushers	(M	2			300,000	
	Sampling equipment	(M				90,000	
	Erection of above	(L				850,000	
		(M				50,000	
125.12	Crusher house, transfer tower and stocking tower structures	(M				350,000	
	Erection	(L				250,000	
		(M				10,000	
125.13	Lighting, drainage, fire protection, etc. for	(L				200,000	
	coal handling system	(M				100,000	
125.14	Dust control equipment	(M				50,000	
	Installation	(L				20,000	
		(M				5,000	
125.15	Mobile equipment	(M				275,000	
		(L				1,320,000	
		(M				2,700,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
125.	Coal Fuel Equipment (Cont'd)						
125.16	Foundation, Pits and Tunnels						
	Unloading and reclaiming pits and tunnels; foundations for crusher house, stacker, conveyor bents, etc.						
	Excavation - earth	(L	10,000	cu yd	4.00	40,000	
		(M			1.00	10,000	
	Excavation - rock	(L	20,000	cu yd	20.00	400,000	
		(M			5.00	100,000	
	Dewatering	(L	Allowance			100,000	
		(M				10,000	
	Backfill	(L	5,000	cu yd	5.00	25,000	
		(M			5.00	25,000	
	Forms	(L	125,000	sq ft	4.50	562,500	
		(M			.60	75,000	
	Reinforcing	(L	600	ton	300.00	180,000	
		(M			150.00	90,000	
	Concrete	(L	8,000	cu yd	10.00	80,000	
		(M			20.00	160,000	
	Concrete finish	(L	50,000	sq ft	.20	10,000	
		(M			.01	500	
	Waterproofing	(L	40,000	sq ft	.50	20,000	
		(M			.50	20,000	
	Miscellaneous steel and iron	(L	50	ton	700.00	35,000	
		(M			400.00	20,000	
	Hoppers	(L				150,000	
		(M				200,000	
		(L				1,602,500	
		(M				710,500	
125.21	Indoor Distributing Conveyor and Trippers at Bunkers						
	Conveyor over bunker	(M				150,000	
	Installation	(L				50,000	
		(M				5,000	
	Traveling belt tripper	(M				25,000	
	Installation	(L				5,000	
		(M				1,000	
		(L				55,000	
		(M				181,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
125.	Coal Fuel Equipment (Cont'd)						
125.31	Coal Bunkers						
	Steel platework, stiffeners, etc.	(L	625	ton	200.00	125,000	
		(M			400.00	250,000	
	Gunite lining	(L				45,000	
		(M				15,000	
		(L				170,000	
		(M				265,000	
125.32	Bunker Outlet Gates, Chutes, Weigh Scales, Vibrators, etc.						
	Bunker outlet gates	(L	9	@		9,000	
		(M				13,500	
	Raw coal chutes to feeders	(L	9	@		13,500	
		(M				27,000	
	Vibrators	(L	None			-	
		(M				-	
		(L				22,500	
		(M				40,500	
125.41	Pulverizers and Accessories						
	Roll and table type pulverizers and drives, primary air fans and drives, primary air ducts, raw coal feeders, pulverized coal conduits, burners, etc.	(M				4,000,000	
	Erection	(L	50,000	MH	9.00	450,000	
		(M				20,000	
	Pulverizer foundations	(L				50,000	
		(M				50,000	
		(L				500,000	
		(M				4,070,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
125.	Coal Fuel Equipment (Cont'd)						
125.51	Ignition Oil System						
	Storage tank - 150,000	(L	1			5,000	
	gallon capacity	(M				15,000	
	Oil unloading pump	(M	1			2,500	
	Installation	(L				1,000	
		(M				200	
	Burner pumps and						
	strainers, etc.	(M	2			10,000	
	Installation	(L				3,000	
		(M				300	
	Piping connections	(L				20,000	
		(M				5,000	
	Foundations, fire	(L				10,000	
	barriers, etc.	(M				5,000	
		(L				39,000	
		(M				38,000	
	Total Coal Fuel	(L				3,709,000	
	Equipment,-	(M				8,005,000	11,714,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
126.	Ash and Dust Handling Systems						
	Bottom Ash Handling System						
126.11	Steel plate ash hoppers with refractory lining, seals, doors, etc.	(M				150,000	
	Erection	(L				135,000	
		(M				5,000	
126.12	Ash sluice pumps and drives	(M	2			30,000	
	Installation	(L				15,000	
		(M				500	
126.13	Ash transport piping	(L				75,000	
		(M				50,000	
126.14	Clinker grinder	(M	1			15,000	
	Installation	(L				4,500	
		(M				500	
126.15	Dewatering bins	(M	2			250,000	
	Erection	(L				150,000	
		(M				35,000	
126.16	Foundations	(L				30,000	
		(M				15,000	
126.17	Ash bin overflow piping	(L				60,000	
		(M				40,000	
126.18	Ash settling basin	(L				150,000	
		(M				100,000	
		(L				619,500	
		(M				691,000	
	Fly Ash and Dust Handling System (Pneumatic System)						
126.21	Equipment including exhausters, receivers, separators, unloaders, etc.	(M				175,000	
	Erection	(L				100,000	
		(M				10,000	
126.23	Dust transport piping, intakes, etc.	(L				150,000	
		(M				125,000	
126.25	Storage silo (concrete)	(L				150,000	
		(M				100,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
126.	Ash and Dust Handling Systems (Cont'd)						
	Fly Ash and Dust Handling System (Cont'd)						
126.26	Silo support structure,	(L				75,000	
	ventilation, etc.	(M				75,000	
126.27	Silo and area drain	(L				30,000	
	piping	(M				20,000	
		(L				505,000	
		(M				505,000	
	Total Ash and Dust Handling	(L				1,124,500	
	Systems,-	(M				1,196,000	2,320,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
127.	Instrumentation						
127.11	Instruments and Controls						
	Combustion control	(L				75,000	
	equipment	(M				325,000	
	Feedwater control	(L					
	equipment	(M	(With Turbine Plant)				
	Instrument air compressors	(L	(See Acct. 252.)			-	
		(M				-	
127.12	Boiler gauge boards and instruments including tubing						
	and wiring to terminal	(L				100,000	
	blocks	(M				200,000	
127.13	Miscellaneous boiler	(L				50,000	
	plant instruments	(M				100,000	
127.14	Instrument and control	(L				250,000	
	piping	(M				150,000	
127.15	Computer equipment	(L				100,000	
		(M				925,000	
	Television equipment	(L	None			-	
		(M				-	
	Total Instrumentation,-	(L				575,000	
		(M				1,700,000	2,275,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
12.	BOILER PLANT EQUIPMENT (Cont'd)					$	$
129.	Miscellaneous Suspense Items						
129.11	Painting						
	Allowance for painting of boiler equipment, draft system, fuel handling system, ash and dust	(L				400,000	
	handling system, etc.	(M				100,000	
129.12	Preliminary Operation						
	Allowance for stand-by craft labor and expense during start-up of boiler plant	(L				200,000	
		(M				10,000	
		(L				600,000	
		(M				110,000	710,000
	Total Boiler Plant Equipment,-	(L				19,003,000	
		(M				38,534,000	57,537,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT					$	$
141.	Turbine-Generator Equipment						
141.1	Turbine-Generator Unit						
	1,042,803 kw tandem compound, six flow 3600 rpm unit, with 33½" last stage buckets designed for throttle steam at 3500 psig at 1000°F and reheat conditions at 630 psig with an 1159 MVA 22,000 volt, 0.9 PF, 75 psi hydrogen cooled generator complete with hydrogen and lube oil systems, seal oil system, stop-throttle valves, cross-over piping, motors for auxiliary equipment, heat insulation, erection supervision, etc.	(M				19,350,000	
	Erection of above	(L				1,000,000	
		(M				200,000	
		(L				1,000,000	
		(M				19,550,000	20,550,000
141.2	Foundation and Supports						
141.211	Turbine-Generator Foundation Mat						
141.2111	Excavation	(L	3,000	cu yd	4.00	12,000	
		(M			1.00	3,000	
141.2112	Concrete fill	(L	1,000	cu yd	15.00	15,000	
		(M			25.00	25,000	
141.2113	Dewatering	(L	Included	with		-	
		(M	"Turbine	Room"		-	
141.2114	Forms	(L	6,600	sq ft	5.00	33,000	
		(M			.50	3,300	
141.2115	Reinforcing steel	(L	120	ton	250.00	30,000	
		(M			150.00	18,000	
141.2116	Concrete	(L	2,000	cu yd	6.00	12,000	
		(M			20.00	40,000	
141.2119	Miscellaneous iron	(L	12	ton	1500.00	18,000	
		(M			500.00	6,000	
		(L				120,000	
		(M				95,300	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
141.	Turbine-Generator Equipment (Cont'd)						
141.2	Foundation and Supports (Cont'd)						
141.212	Turbine-Generator Support						
	Reinforced concrete structure above foundation mat.						
141.2124	Forms	(L	35,000	sq ft	6.00	210,000	
		(M			1.00	35,000	
141.2125	Reinforcing steel	(L	380	ton	300.00	114,000	
	(Field fabricated)	(M			150.00	57,000	
141.2126	Concrete	(L	3,200	cu yd	20.00	64,000	
		(M			20.00	64,000	
141.2127	Rubbing Surfaces	(L	30,000	sq ft	.20	6,000	
		(M			.02	600	
141.2128	Expansion joint	(L				2,500	
		(M				2,600	
141.2129	Miscellaneous iron	(L	50	ton	1500.00	75,000	
		(M			600.00	30,000	
		(L				471,500	
		(M				189,200	
	Total Foundation and	(L				591,500	
	Supports,-	(M				284,500	876,000
141.4	Lubricating Oil System						
141.411	Lube oil purification unit and accessories	(M				13,500	
	Installation	(L				7,500	
		(M				1,500	
141.412	Lube oil transfer pump and motor	(M				1,800	
	Installation	(L				1,000	
		(M				200	
141.421	Clean and dirty oil storage tanks	(M				23,500	
	Installation including	(L				12,500	
	foundations, etc.	(M				9,500	
141.422	Interconnecting piping between equipment oil reservoirs and oil	(L				75,000	
	purification equipment	(M				50,000	
141.431	Automatic spray system for fire protection at lube oil	(L				20,000	
	and hydrogen areas	(M				15,000	
141.45	Initial oil supply	(M				25,000	
		(L				116,000	
		(M				140,000	256,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
141.	Turbine-Generator Equipment (Cont'd)						
141.5	Gas Systems						
	Hydrogen and CO_2 Equipment						
141.511	Hydrogen and CO_2 bottle	(L				15,000	
	storage racks	(M				50,000	
141.512	Manifolds at bottle storage racks and piping to						
	turbine-generator	(L				30,000	
	area	(M				17,000	
		(L				45,000	
		(M				67,000	112,000
	Total Turbine-Generator	(L				1,752,500	
	Equipment,-	(M				20,041,500	21,794,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
142.	Circulating Water System						
142.1	Water Intake Facilities						
142.11	Traveling screens - 6-8' wide						
	and 1-4' wide and 43' high	(M	7	@		120,000	
	Installation	(L				70,000	
		(M				7,000	
142.131	Trash racks (coarse screens)	(M	3,300	sq ft	11.00	36,300	
	Installation	(L				7,000	
		(M				3,000	
142.132	Trash rake	(M	1			23,500	
	Installation	(L				5,000	
		(M				1,500	
142.133	Fine screens	(M				9,000	
	Installation	(L				2,500	
		(M				500	
142.15	Water chlorination	(M				30,000	
	equipment and piping	(L				15,000	
	Installation	(M				5,000	
142.161	Sluice gates for service						
	water by-pass	(M	2			14,000	
	Installation	(L				3,000	
		(M				1,000	
142.162	Stop logs	(L				20,000	
		(M				10,000	
		(L				122,500	
		(M				260,800	383,300
142.211	Pumps and Drives						
142.2111	Circulating water pumps -						
	88,000 gpm @ 21 FTDH	(M	6			420,000	
	Motor drives - 600 hp	(M	6			180,000	
	Installation of pumps	(L				50,000	
	and motors	(M				5,000	
142.2112	De-icing water supply pumps	(M	2			70,000	
	Motor drives - 400 hp	(M	2			15,000	
	Priming ejectors	(M	2			1,000	
	Installation of above	(L				15,000	
		(M				1,500	
	Total Pumps	(L				65,000	
	and Drives,-	(M				692,500	757,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
142.	Circulating Water Systems (Cont'd)						
142.212	Intake and Discharge Lines						
	Connections from pump discharges to condenser inlets and from condenser outlets to discharge tunnel						
	Steel pipe and fittings	(L	260	ton	500.00	130,000	
		(M			600.00	156,000	
	Expansion joints	(L	18		1000.00	18,000	
		(M			1500.00	27,000	
	Steel supports including	(L	50	ton	600.00	30,000	
	H-piles, etc.	(M			250.00	12,500	
	Earth excavation	(L	3,500	cu yd	4.00	14,000	
		(M			1.00	3,500	
	Rock excavation	(L	2,500	cu yd	25.00	62,500	
		(M			5.00	12,500	
	Backfill	(L	5,600	cu yd	2.50	14,000	
		(M			1.00	5,600	
	Dewatering	(L	Allowance			25,000	
		(M				10,000	
	Formwork	(L	25,000	sq ft	4.00	100,000	
		(M			.50	12,500	
	Reinforcing steel	(L	120	ton	300.00	36,000	
		(M			140.00	16,800	
	Concrete	(L	1,500	cu yd	12.00	18,000	
		(M			20.00	30,000	
	Insulation	(L				10,000	
		(M				7,000	
		(L				457,500	
		(M				293,400	750,900
142.213	Warming Line						
	Connections from de-icing pumps discharge to outlets at screenwells						
	Steel pipe and fittings	(L	80	ton	500.00	40,000	
		(M			600.00	48,000	
	Expansion joints -	(L	4	@	500.00	2,000	
		(M			1000.00	4,000	
	Steel supports	(L	10	ton	600.00	6,000	
		(M			250.00	2,500	
	Earth excavation	(L	1,000	cu yd	5.00	5,000	
		(M			1.00	1,000	
	Backfill	(L	1,000	cu yd	2.50	2,500	
		(M			1.00	1,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
142.	Circulating Water Systems (Cont'd)						
142.213	Warming Line (Cont'd)						
	Dewatering	(L				5,000	
		(M				2,000	
	Formwork	(L	1,000	sq ft	4.00	4,000	
		(M			.50	500	
	Reinforcing steel	(L	10,000	lb	.20	2,000	
		(M			.08	800	
	Concrete	(L	70	cu yd	20.00	1,400	
		(M			20.00	1,400	
	Anchors	(L				1,000	
		(M				600	
		(L				68,900	
		(M				61,800	130,700
142.221	Discharge Tunnel Includes tunnel below turbine room floor and connection to discharge canal						
	Earth excavation	(L	2,500	cu yd	4.00	10,000	
		(M			1.00	2,500	
	Rock excavation	(L	4,000	cu yd	25.00	100,000	
		(M			5.00	20,000	
	Backfill	(L	1,000	cu yd	3.00	3,000	
		(M			2.00	2,000	
	Dewatering	(L	Allowance			45,000	
		(M				5,000	
	Formwork	(L	40,000	sq ft	4.00	160,000	
		(M			.50	20,000	
	Reinforcing steel	(L	200	ton	300.00	60,000	
		(M			140.00	28,000	
	Concrete including finish	(L	2,200	cu yd	12.50	27,500	
		(M			20.00	44,000	
	Miscellaneous iron	(L	20	ton	1000.00	20,000	
		(M			500.00	10,000	
	Granite wear slabs	(L	1,500	sq ft	4.00	6,000	
		(M			6.00	9,000	
	Stop logs	(L				10,000	
		(M				25,000	
	Adjustable weir	(L				10,000	
		(M				60,000	
		(L				451,500	
		(M				225,500	677,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
142.	Circulating Water Systems (Cont'd)						
142.222	Discharge Canal						
	Extension of discharge tunnel from turbine room wall to river						
	Excavation Work						
	(Also includes excavation work for deicing pump pit)						
	Earth excavation	(L	5,000	cu yd	3.00	15,000	
		(M			1.00	5,000	
	Rock excavation	(L	8,000	cu yd	25.00	200,000	
		(M			5.00	40,000	
	Backfill	(L	10,000	cu yd	2.50	25,000	
		(M			1.50	15,000	
	Temporary sheet pile	(L				20,000	
	cut-off walls	(M				10,000	
	Stop logs	(L	Allowance			15,000	
		(M				15,000	
	Pumping	(L	Allowance			100,000	
		(M				15,000	
	Rip-rap on bank and	(L				15,000	
	bottom of canal	(M				35,000	
		(L				390,000	
		(M				135,000	
	Concrete Work						
	Formwork	(L	50,000	sq ft	4.00	200,000	
		(M			.50	25,000	
	Reinforcing steel	(L	200	ton	350.00	70,000	
		(M			150.00	30,000	
	Concrete	(L	4,500	cu yd	10.00	45,000	
		(M			20.00	90,000	
	Miscellaneous iron	(L	Allowance			10,000	
		(M				5,000	
		(L				325,000	
		(M				150,000	
	Permanent Sheet Piling Flume						
	Steel sheeting	(L	700	ton	150.00	105,000	
		(M			200.00	140,000	
	Bracing	(L				40,000	
		(M				30,000	
	Protective coating	(L				30,000	
		(M				15,000	
		(L				175,000	
		(M				185,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
142.	Circulating Water Systems (Cont'd)						
142.222	Discharge Canal (Cont'd)						
	Discharge Structure						
	Outfall facilities	(L	Allowance			50,000	
		(M				50,000	
	Total Discharge Canal,-	(L				940,000	
		(M				520,000	1,460,000
142.223	Deicing Pump Pit Structure (Excavation work is included with Discharge Canal)						
	Formwork	(L	12,000	sq ft	4.00	48,000	
		(M			.50	6,000	
	Reinforcing steel	(L	60	ton	300.00	18,000	
		(M			150.00	9,000	
	Concrete	(L	700	cu yd	10.00	7,000	
		(M			20.00	14,000	
	Miscellaneous iron,	(L	10,000	lbs	.50	5,000	
	hatch covers, etc.	(M			.30	3,000	
	Shut-off gates	(L	2	@		3,000	
	(sluice gates)	(M				13,000	
	Stop logs	(L	400	sq ft	5.00	2,000	
		(M			5.00	2,000	
		(L				83,000	
		(M				47,000	130,000
	Total Circulating	(L				2,188,400	
	Water System,-	(M				2,101,000	4,289,400

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
143.	Condensing Systems						
143.1	Condensers						
143.11	115,600 sq. ft. surface, single pass condensers including shells, tube sheets, tubes, air ejectors, etc.	(M	3			2,000,000	
	Installation	(L				500,000	
		(M				15,000	
		(L				500,000	
		(M				2,015,000	2,515,000
143.2	Condensate System						
143.211	Condensate pumps - 3000 gpm @ 350 FTDH	(M	3			75,000	
	350 hp motors	(M				25,000	
	Installation of pumps	(L				15,000	
	and motors	(M				2,000	
143.212	Condensate booster pumps and drives	(M	3			130,000	
	Installation	(L				17,500	
		(M				3,300	
143.213	Condensate transfer pump and drive	(M	1			21,000	
	Installation	(L				2,500	
		(M				500	
143.221	Condensate storage tank 500,000 gallon capacity	(M	1			130,000	
	Field erection	(L				60,000	
		(M				5,000	
143.23	Condensate Piping						
	Includes all condensate piping from condenser through condensate pumps and heaters to boiler feed pump suction. Also includes makeup water connections						
	Pipe and fittings including shop fabrication	(M				300,000	
	Valves	(M				150,000	
	Hangers and supports	(M				50,000	
	Erection and welding including preheating and stress relief, etc.	(L				765,000	
		(M				35,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
143.	Condensing Systems (Cont'd)						
143.2	Condensate System (Cont'd)						
143.24	Insulation	(L				40,000	
		(M				25,000	
143.25	Foundations and Supports						
143.251	Condensate pump	(L				15,000	
	foundations	(M				15,000	
143.252	Condensate storage	(L				20,000	
	tank foundation	(M				20,000	
		(L				935,000	
		(M				986,800	1,921,800
143.3	Gas Removal System						
143.31	Steam jet air ejectors	(M	(Included with Condenser)				
	Installation	(L				-	
		(M				-	
143.33	Vacuum pumps for circulating water side of condenser	(M	6	@		150,000	
	Installation	(L				18,000	
		(M				2,000	
143.34	Condenser Air Removal Piping						
	Pipe and fittings including shop fabrication	(M				30,000	
	Valves	(M				7,500	
	Hangers and supports	(M				5,000	
	Erection and Welding	(L				55,000	
		(M				2,500	
143.35	Insulation	(L				3,000	
		(M				2,000	
		(L				76,000	
		(M				199,000	275,000
	Total Condensing	(L				1,511,000	
	Systems,-	(M				3,200,800	4,711,800

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
144.	Feedwater System						
144.1	Feedwater Heaters						
144.11	High and low pressure heaters with integral drains coolers	(M				1,800,000	
	Installation	(L				100,000	
		(M				10,000	
144.13	Insulation	(L				30,000	
		(M				30,000	
		(L				130,000	
		(M				1,840,000	1,970,000
144.2	Feedwater Pumps						
144.21	Main feed pumps - 7000 gpm @ 10,750 FTDH	(M	2			300,000	
	Turbine drives - 22,170 hp	(M	2			1,250,000	
	Installation of pumps and drives	(L	2			75,000	
		(M				5,000	
144.231	Heater drain pumps	(M	3	@		10,000	
	Motor drives	(M	3	@		6,000	
	Installation of pumps and drives	(L	3	@		10,000	
		(M				1,000	
144.232	Hotwell dump pump and motor Installation						
144.233	Drip tank drain pump and motor Installation						
144.25	Foundations for pumps including concrete work, anchor bolts, etc.	(L				10,000	
		(M				5,000	
144.26	Lube oil purification equipment for feed pumps and turbines	(M				10,000	
	Installation	(L				2,500	
		(M				500	
		(L				97,500	
		(M				1,587,500	1,685,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
144.	Feedwater System (Cont'd)						
144.3	Piping and Tanks						
144.31	Boiler Feed Piping						
	Includes piping from boiler feed pump discharge through high pressure heaters to steam generator						
	Pipe and fittings including shop fabrication	(M				600,000	
	Valves	(M				500,000	
	Hangers and supports	(M				150,000	
	Erection and welding						
	including preheating,	(L				1,170,000	
	stress relief, etc.	(M				50,000	
	Radiographs	(L				25,000	
		(M				50,000	
		(L				1,195,000	
		(M				1,350,000	
144.341	Extraction Steam Piping						
	Includes piping from turbine extraction points to heaters						
	Pipe and fittings including shop fabrication	(M				200,000	
	Valves	(M				200,000	
	Hangers and supports	(M				40,000	
	Erection and welding	(L				450,000	
		(M				50,000	
		(L				450,000	
		(M				490,000	
144.342	Heater Drain and Vent Piping						
	Includes drains from heaters to condensers						
	Pipe and fittings including shop fabrication	(M				150,000	
	Valves	(M				150,000	
	Hangers and supports	(M				30,000	
	Erection and welding	(L				360,000	
		(M				15,000	
		(L				360,000	
		(M				345,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
144.	Feedwater System (Cont'd)						
144.3	Piping and Tanks (Cont'd)						
144.35	Insulation						
	Boiler feed piping	(L				85,000	
		(M				65,000	
	Extraction steam	(L				75,000	
	piping	(M				55,000	
	Heater drain and	(L				50,000	
	vent piping	(M				35,000	
		(L				210,000	
		(M				155,000	
	Total Piping and Tanks,-	(L				2,215,000	
		(M				2,340,000	4,555,000
	Total Feedwater	(L				2,442,500	
	System,-	(M				5,767,500	8,210,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
145.	Other Turbine Plant Equipment						
145.1	Main Vapor Piping						
145.11	Main Steam Piping, etc.						
	Includes main steam lines from steam generator to turbine stop valves; steam to reheaters; steam to feed pump turbines; steam dump system, etc.						
	Pipe and fittings including shop fabrication	(M				1,570,000	
	Valves	(M				275,000	
	Hangers and supports	(M				300,000	
	Erection and welding						
	including preheating	(L				2,200,000	
	and stress relief, etc.	(M				100,000	
	Radiographs	(L				50,000	
		(M				100,000	
145.13	Insulation	(L				240,000	
		(M				160,000	
		(L				2,490,000	
		(M				2,505,000	4,995,000
145.2	Turbine Auxiliaries						
145.223	Heater drains receivers	(M	3			6,000	
	Installation	(L				3,000	
		(M				500	
145.251	Drip, drain and vent						
	piping from turbine	(L				360,000	
	plant equipment, etc.	(M				200,000	
145.261	Insulation -						
	Equipment	(L				1,500	
		(M				1,000	
	Piping	(L				20,000	
		(M				15,000	
	Total Turbine Auxiliaries,-	(L				384,500	
		(M				222,500	607,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
145.	Other Turbine Plant Equipment (Cont'd)						
145.3	Auxiliaries Cooling System						
145.31	Closed cooling water system pumps and motors	(M	3	@		30,000	
	Installation	(L				9,000	
		(M				1,000	
145.321	Surge tank for closed cooling water system	(M				7,500	
	Installation	(L				1,000	
		(M				500	
145.322	Heat exchangers for closed cooling water system	(M	3			90,000	
	Installation	(L				10,000	
		(M				1,000	
145.33	Cooling Water Piping						
	Closed systems for cooling air compressors, sample coolers condensate pump motor bearings, etc.						
	Pipe and fittings including shop fabrication	(M				175,000	
	Valves	(M				75,000	
	Hangers and supports	(M				35,000	
	Erection and welding	(L				360,000	
		(M				15,000	
145.34	Insulation	(L				3,000	
		(M				2,000	
145.36	Chemical feed equipment	(M				1,900	
	Installation	(L				1,500	
		(M				100	
		(L				384,500	
		(M				434,000	818,500
145.4	Water Treatment Systems						
145.41	Water treating plant including pretreatment, demineralizer and polishing system facilities complete	(L				250,000	
		(M				1,000,000	1,250,000
145.5	Chemical Treatment System						
145.51	Secondary chemical treatment for feedwater	(L				10,000	
		(M				20,000	30,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
145.	Other Turbine Plant Equipment (Cont'd)						
145.9	Miscellaneous Suspense Items						
145.92	Field painting of turbine						
	plant equipment	(L				275,000	
	and piping	(M				35,000	
145.93	Qualification of welders	(L				50,000	
	and welding procedure	(M				15,000	
145.94	Stand-by craft labor and						
	expense during plant	(L				300,000	
	start-up	(M				10,000	
		(L				625,000	
		(M				60,000	685,000
	Total Other Turbine	(L				4,144,000	
	Plant Equipment,-	(M				4,241,500	8,385,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
14.	TURBINE PLANT EQUIPMENT (Cont'd)					$	$
146.	Instrumentation and Control						
146.1	Turbine Plant Instruments						
	Main control panels with instruments piped and wired to terminal blocks						
	Local control boards with instruments piped and wired to terminal blocks						
	Control systems for process and auxiliary systems in turbine plant						
	Purchase cost of above	(M				600,000	
	Installation	(L				150,000	
		(M				15,000	
		(L				150,000	
		(M				615,000	765,000
146.4	Instrument and Control Piping						
	Instrument and control piping for turbine	(L				300,000	
	plant instruments	(M				100,000	400,000
	Total Instrumentation	(L				450,000	
	and Control,-	(M				715,000	1,165,000
	Total Turbine Plant	(L				12,488,400	
	Equipment,-	(M				36,067,300	48,555,700

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT					$	$
151.	Switchgear						
151.1	Generator Equipment Switchgear						
151.12	Neutral grounding compartment including transformer, resistor, etc.	(M	Included with "Unit"			-	
	Installation	(L				2,000	
		(M				100	
151.131	Bushing type current transformers - 4 sets	(M	Included with "Unit"			-	
	Installation	(L				3,500	
		(M				100	
151.132	Potential transformers, fuses, etc.	(M	6	@		15,000	
	Installation	(L				2,500	
		(M				100	
151.15	Exciter switchgear	(M	Included with "Unit"			-	
	Installation	(L				3,000	
		(M				500	
		(L				11,000	
		(M				15,800	26,800
151.2	Station Service Switchgear						
151.21	6900 Volt switchgear - metal clad, indoor type, consisting of 34 feeder breakers, 6 transformer and incoming line breakers, 4 bus-tie breakers and 6 PT compartments	(M	55	unit		1,000,000	
	Installation	(L				110,000	
		(M				8,000	
151.22	480 Volt motor control centers	(M	25	@		300,000	
	Installation	(L				100,000	
		(M				5,000	
151.24	Miscellaneous power panels, starters, push-button stations, etc.	(L				50,000	
		(M				50,000	
		(L				260,000	
		(M				1,363,000	1,623,000
	Total Switchgear,-	(L				271,000	
		(M				1,378,800	1,649,800

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
152.	Station Service Equipment						
152.1	Transformers						
152.11	Unit auxiliary transformer -						
	43 MVA, FOA, 22/6.9 KV	(M	1			200,000	
	Installation	(L				25,000	
		(M				1,000	
152.12	Station auxiliary transformer -						
	43 MVA, FOA, 138/6.9 KV	(M	1			340,000	
	Installation	(L				25,000	
		(M				1,000	
152.13	Foundations for trans-	(L	70	cu yd	200.00	14,000	
	formers	(M			50.00	3,500	
		(L				64,000	
		(M				545,500	609,500
152.2	Low Voltage Substations						
152.211	480 Volt substations - 8 6900/480 Volt - 2000/2666 KVA transformers, 8 incoming breakers, 4 bus-tie breakers, 70 feeder breakers and 8 PT compartments	(M				1,000,000	
	Installation	(L				170,000	
		(M				5,000	
152.212	Low voltage AC supply transformers -						
	480/120 V, etc.	(M	1,400	kva		20,000	
	Installation	(L	37	@		15,000	
		(M				500	
		(L				185,000	
		(M				1,025,500	1,210,500
152.3	Auxiliary Power Sources						
152.31	Battery Systems						
152.311	Control batteries - 60 cell, 960 and 1320 amp/hr batteries (1 of each)	(M	2	@		18,500	
	Installation	(L				10,000	
		(M				1,500	
152.312	Charging equipment	(M	2	sets		9,500	
	Installation	(L				4,000	
		(M				500	
		(L				14,000	
		(M				30,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
152.	Station Service Equipment (Cont'd)						
152.3	Auxiliary Power Source (Cont'd)						
152.32	Auxiliary Generators						
152.321	Diesel Engine Generators						
152.3211	500 kw diesel generators complete with controls, switchgear, etc.	(M	2	@		125,000	
	Installation	(L				12,500	
		(M				500	
152.3212	Fuel oil storage facilities	(L				2,500	
		(M				1,000	
152.3213	Automatic sprinkler system at diesels	(L				1,500	
		(M				1,500	
		(L				16,500	
		(M				128,000	
152.322	Gas Turbine Generator						
	21,000 kw gas turbine-generator complete with operating controls, cooling systems, etc.	(M	1			1,600,000	
	Installation	(L				200,000	
		(M				50,000	
	Gas turbine generator switchgear	(M				20,000	
		(L				2,000	
	Gas turbine generator bus duct	(M				50,000	
		(L				5,000	
	Foundations						
		(L				168,000	
		(M				40,000	
		(L				375,000	
		(M				1,760,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
152.	Station Service Equipment (Cont'd)						
152.3	Auxiliary Power Source (Cont'd)						
152.33	Motor-Generator Sets, etc.						
152.332	Inverters - 125 VDC/115 VAC						
	with switchgear, etc.	(M	82½	kva		82,500	
	Installation	(L	3			7,500	
		(M				500	
		(L				7,500	
		(M				83,000	
	Total Auxiliary Power	(L				413,000	
	Sources,-	(M				2,001,000	2,414,000
	Total Station Service	(L				662,000	
	Equipment,-	(M				3,572,000	4,234,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
153.	Switchboards						
153.11	Main control boards	(M				100,000	
	Installation	(L				25,000	
		(M				5,000	
153.12	Protective relay panels	(M				100,000	
	Installation	(L				25,000	
		(M				5,000	
153.22	DC distribution panels	(M				9,000	
	Installation	(L				5,000	
		(M				1,000	
	Total Switchboards,-	(L				55,000	
		(M				220,000	275,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
154.	Protective Equipment						
154.111	General station ground	(L				100,000	
	system	(M				50,000	
154.112	Cathodic protection	(L				65,000	
		(M				35,000	
154.211	Automatic fire protection	(L				10,000	
	for transformers	(M				7,000	
	Total Protective	(L				175,000	
	Equipment,-	(M				92,000	267,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
155.	Electrical Structures and Wiring Containers						
155.1	Underground Duct Runs						
	Concrete envelope including	(L				60,000	
	excavation, etc.	(M				30,000	
	Manholes	(L				20,000	
		(M				20,000	
		(L				80,000	
		(M				50,000	130,000
155.2	Cable Trays						
	6" wide trays and fittings)						
	12" " " " ")						
	18" " " " ")						
	24" " " " ")						
	36" " " " ")	(M				175,000	
	Erection including	(L				500,000	
	supports, hangers, etc.	(M				25,000	
		(L				500,000	
		(M				200,000	700,000
155.3	Conduit						
	Galvanized steel conduit	(L				1,200,000	
	fittings, supports, etc.	(M				275,000	
	PVC conduit, fittings,	(L				80,000	
	etc.	(M				20,000	
		(L				1,280,000	
		(M				295,000	1,575,000
155.4	Other Structures						
	Concrete footings for	(L				8,500	
	main bus supports	(M				3,000	
	Concrete footings for	(L				17,500	
	6900 volt bus supports, etc.	(M				5,000	
		(L				26,000	
		(M				8,000	34,000
	Total Electrical Structure	(L				1,886,000	
	and Wiring Containers,-	(M				553,000	2,439,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
156.	Power and Control Wiring						
156.1	Generator Bus Work						
	Main generator bus - 22 kv - 16,000 amp and 32,000 amp connections between generator and main transformers including forced air cooling equipment	(M				435,000	
	Installation	(L				145,000	
		(M				5,000	
	Connections to neutral ground equipment including enclosure	(M	Included with "Bus"			-	
	Installation	(L				6,500	
		(M				200	
	Auxiliary power transformer connection - 22 kv - 1500 amp bus	(M				60,000	
	Installation	(L				14,000	
		(M				1,000	
		(L				165,500	
		(M				501,200	666,700
156.2	Station Service Power Wiring						
156.211	Auxiliary transformer secondary leads to switchgear - 6900 volt, 4000 amp non-segregated bus duct	(M				100,000	
	Installation	(L				120,000	
		(M				5,000	
156.212	6900 Volt cable - 8 kv cable	(L				150,000	
		(M				100,000	
156.221	600 Volt power cable - 1/c - #12 to 1/c - 750 MCM	(L				600,000	
		(M				300,000	
156.222	Freeze protection cable	(L				120,000	
		(M				50,000	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
15.	ELECTRIC PLANT EQUIPMENT (Cont'd)					$	$
156.	Power and Control Wiring (Cont'd)						
156.3	Control Wiring						
	Multi-conductor #12 wire	(L				1,000,000	
		(M				200,000	1,200,000
156.4	Bus from gas turbine generator						
	to switchgear - single	(M	600	lin ft		65,000	
	phase - 2500 amp -	(L				90,000	
	6900 volt	(M				5,000	
		(L				1,080,000	
		(M				625,000	1,705,000
156.4	Instrument Wiring						
	Twisted pair, thermocouple leads, coaxial, triaxial						
	and other special	(L				300,000	
	instrument cable	(M				50,000	350,000
	Total Power and Control	(L				2,545,500	
	Wiring,-	(M				1,376,200	3,921,700
	Total Electric Plant	(L				5,594,500	
	Equipment,-	(M				7,192,000	12,786,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT					$	$
161.	Transportation and Lifting Equipment						
161.1	Cranes and Hoists						
161.11	Overhead traveling crane for turbine room - 175/25 ton capacity	(M	1	@		170,000	
	Erection	(L				50,000	
		(M				5,000	
161.132	Miscellaneous hoists	(L	Allowance			7,000	
		(M				25,000	
		(L				57,000	
		(M				205,000	262,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT (Cont'd)					$	$
162.	Air, Water and Steam Service Systems						
162.1	Air Systems						
162.1111	Station service air compressor - 320 scfm @ 125 psig with control equipment, inter-cooler, after cooler, intake filter, receiver, etc.	(M	2			25,000	
	Motor drive	(M	2			10,000	
	Installation	(L	2			15,000	
		(M				2,000	
162.1112	Instrument air compressors - 215 scfm @ 100 psig with control equipment, motors, coolers, filters, receivers, etc.	(M	2			25,000	
	Installation	(L				7,500	
		(M				1,500	
162.1113	Instrument air dryers	(L				2,500	
		(M				10,000	
162.112	Air distribution piping (excludes instrument air and control piping)	(L				180,000	
		(M				60,000	
		(L				205,000	
		(M				133,500	338,500
162.2	Water Systems						
	Service Water System						
162.211	River water supply pumps - 5000 gpm @ 220 FTDH	(M	3	@		15,000	
	Motor drives - 350 hp	(M	3	@		20,000	
	Installation	(L	3	@		17,500	
		(M				1,000	
	River water strainers - 5000 gpm capacity	(M	3			20,000	
	Installation	(L				2,500	
		(M				500	

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT (Cont'd)					$	$
162.	Air, Water and Steam Service Systems (Cont'd)						
162.2	Water Systems (Cont'd)						
162.291	Service water piping - complete river water distribution system from pump discharges at intake structure through the yard area and various buildings						
	including connections	(L				540,000	
	to equipment	(M				500,000	
	Excavation and backfill						
	for underground	(L	5,000	cu yd	7.00	35,000	
	portion of piping	(M			2.00	10,000	
		(L				595,000	
		(M				566,500	
	Yard Fire Protection System						
162.221	Diesel and motor driven						
	fire pumps	(M				60,000	
	Installation	(L				10,000	
		(M				1,000	
162.242	Water storage tank including						
	foundations, painting,	(L				75,000	
	etc.	(M				50,000	
162.292	Pipe and fittings	(M	5,000	lin ft	10.00	50,000	
	Hydrants and accessories	(M	25	@	500.00	12,500	
	Valves	(M				5,000	
	Hose stations	(M				15,000	
	Installation	(L	5,000	lin ft	25.00	125,000	
		(M			3.00	15,000	
	Excavation and backfill	(L	5,000	cu yd	7.00	35,000	
		(M			2.00	10,000	
		(L				245,000	
		(M				218,500	
	City Water Piping						
162.293	Extension of existing city water line and distribution						
	pipe. (Excludes building	(L				50,000	
	plumbing)	(M				15,000	
	Total Water Systems,-	(L				890,000	
		(M				800,000	1,690,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT (Cont'd)					$	$
162.3	Auxiliary Heating Steam						
162.31	Auxiliary Heating Boilers						
	80,000 #/hr oil fired unit complete with fuel storage facilities, fuel and steam piping connections, electrical controls and wiring,	(L	1	@		360,000	
	boiler enclosure, etc.	(M				240,000	600,000
	Total Air, Water and	(L				1,455,000	
	Steam Service Systems,-	(M				1,173,500	2,628,500

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT	(Cont'd)				$	$
163.	Communications Equipment						
163.1	Local Communications Systems						
163.15	Public Address and Inter-Communication System						
	Hand-sets, speakers,	(L				60,000	
	wire, etc.	(M				40,000	
163.2	Signal Systems						
163.21	Fire detection system	(L				20,000	
		(M				15,000	
163.25	Noise monitoring system	(L				10,000	
		(M				5,000	
		(L				30,000	
		(M				20,000	
	Total Communications	(L				90,000	
	Equipment,-	(M				60,000	150,000

ACCT. NO.	DESCRIPTION		QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
16.	MISCELLANEOUS PLANT EQUIPMENT (Cont'd)					$	$
164.	Furnishings and Fixtures						
164.1	Safety Equipment						
164.12	Portable fire extinguishers, fire blankets, etc.	(M				25,000	25,000
164.2	Shop, Laboratory and Test Equipment						
164.21	Machine Shop Equipment	(M				150,000	
		(L				25,000	
		(M				4,000	
164.23	Special laboratory furniture and fixtures	(M				50,000	
	Installation	(L				5,000	
		(M				1,000	
		(L				30,000	
		(M				205,000	235,000
164.3	Office Equipment and Furnishings						
164.31	Office furniture	(M	Allowance			50,000	
164.32	Office equipment	(M	(Not included)			-	50,000
164.4	Change Room Equipment						
164.41	Lockers and benches	(L				1,000	
		(M				10,000	
164.42	Laundry facilities	(L				1,500	
		(M				5,000	
		(L				2,500	
		(M				15,000	17,500
164.6	Dining Facilities						
	Cafeteria equipment	(L	Allowance			25,000	
		(M				125,000	150,000
	Total Furnishings and Fixtures,-	(L				57,500	
		(M				420,000	477,500
	Total Miscellaneous Plant Equipment,-	(L				1,659,500	
		(M				1,858,500	3,518,000
	Sub Total,-	(L				50,902,900	
		(M				95,197,300	146,100,200

ACCT. NO.	DESCRIPTION	QUANTITY	UNIT	RATES	AMOUNTS	TOTALS
91.	UNDISTRIBUTED COSTS				$	$
910.	Engineering, Construction Management and Field Supervision (Professional Services)					
910.11	Engineering Design and Drafting				5,500,000	
910.12	Licensing Expense				200,000	
910.13	Home Office Purchasing and Expediting Services				300,000	
910.14	Home Office Construction Management				300,000	
910.15	Field Supervision				4,850,000	
910.16	Relocation Expense of Key Personnel				100,000	
910.17	Job Office Expense				200,000	
910.18	Compensation				2,200,000	
	Total Professional Services				13,650,000	13,650,000
	Other Undistributed Costs (Classified)					
911.	Temporary Facilities (L				2,375,000	
	(M				1,050,000	
912.	Construction Equipment (L				525,000	
	(M				5,525,000	
913.	Construction Services (L				535,000	
	(M				1,755,000	
	Total (Classified) (L				3,435,000	
	(M				8,330,000	
	Other Undistributed Costs (Unclassified)					
*	Operator Training (M				100,000	
	Spare Parts (M				1,000,000	
*	Owners General Office and Administrative Cost (M				1,500,000	
	Total (Unclassified) (M				2,600,000	
	Total Other Undistributed Costs (L				3,435,000	
	(M				10,930,000	14,365,000
	Total Base Construction Cost					174,115,200

* Defined as material dollars to differentiate from craft labor dollars.