## 7.0 UTILITIES

### 7.1 STEAM SYSTEM

A package steam boiler from York Shipley is used to supply 150 psia steam at a design capacity of 10,000 lb per hr. The package includes a water softener, deaerator, chemical injection system, steam boiler, and a vendor supplied control package. The water softener is used to remove dissolved minerals from the feed water to prevent fouling in the equipment. The deaerator removes dissolved oxygen from the water to prevent corrosion. Chemicals are injected into the feed water before it enters the steam boiler to ensure clean water with no dissolved oxygen is used. The steam boiler burns natural gas as the source of heat to vaporize the feed water into steam.

Steam is used at various utility stations located in the PDF building. In the analyzer house where gas-chromatographs are used to determine the composition of various process streams, steam is used to provide heat for sample lines. Steam is also used to maintain the glycol/water system (described in section 7.4) temperature during plant startup and shutdown.

### 7.2 INSTRUMENT AND PLANT AIR

Compressed air demands in the facilities are met by two electrically driven air compressors; each delivers 750 SCFM of air at 125 psig discharge pressure. The compressed air used to operate various pneumatic instruments and valves is dried to -40$^0$F dew point of water before its application. Since the pneumatic instruments and valves are deemed to be crucial to the operation of the facilities, miscellaneous plant air consumers will be automatically shut off from air supply if the system pressure starts to fall, thus giving preference to instrument air.

Compressed air is used at various utility stations located in the PDF building. Other major compressed air users are the dust scrubbers, the wet gas scrubber in the desulfurization unit, and the MK dust suppressor. It is expected that one compressor will supply the total air requirements except when MK is being applied to the PDF.

### 7.3 COOLING WATER

Triton Coal Company has an 8-acre pond called Sedimentation Pond No. 1. It is used for settling suspended particles from the mine water before discharge. Cooling water circulation pumps take suction from this pond. The cooling water then flows through filters and into the cooling water system. The major users of cooling water are the PDF cooler, glycol/water trim cooler (described in section 7.4), dust scrubbers, dryer fines screw cooler, and dryer blower fluid coupling. All the water which is used solely for indirect contact heat-exchange operations is returned back to the pond. The heat that is added to the pond by heat-exchange operations is small, and natural evaporation of water from the pond will maintain a satisfactory pond temperature. The largest heat loads on the system are the PDF cooler and the glycol/water trim cooler.

## 7.4 GLYCOL/WATER CIRCULATING SYSTEM

The glycol/water system is a closed circulation heating and cooling system. During normal operation, process heat is first absorbed in the system and then given up to heat consumers or released to the atmosphere and/or cooling water. During startup and shutdown situations, when process heat is not available, the system is heated with steam to maintain the necessary user temperature.

A cold 50/50 glycol/water solution is stored in a 150-barrel storage tank. A circulation pump or its spare takes suction from the storage tank and discharges parallel streams through the following:

Pyrolyzer Quench Steam Condenser
Quench Oil (CDL) Coolers
Glycol/Water Steam Heater

During normal operation, glycol/water is used to condense steam in the pyrolyzer quench steam condenser. The steam is generated in the quench table by quenching pyrolyzed coal with water. In the CDL cooler (Figure 7.1), glycol/water extracts heat from the CDL so that the CDL can be recirculated to the top of the quench tower as reflux. During start-up and shutdown, the glycol/water is heated by steam in the glycol/water steam heater. The three heat absorbing streams rejoin, forming a hot glycol/water header to supply approximately 185°F glycol/water to heat consumers (i.e., tank heaters, heat tracings, and MK application heater).

The cool glycol/water streams returning from the heat consumers recombine into a header, and flow through a fin fan air/glycol heat exchanger (Figure 7.2) which cools the glycol/water to 95°F by forced convective air. If the ambient temperature is too high and the glycol/water cannot be cooled to the design temperature by the fin fan cooler alone, the glycol/water will be cooled further by heat-exchange with cooling water in the glycol/water trim cooler, which operates in series with the fin fan cooler. The glycol/water then returns to the storage vessel. The temperature of glycol/water to storage is controlled by a bypass across the two exchangers.

Since both of the glycol/water circulating pumps are driven by electric motors, in case of emergency, a small gear pump is used to supply glycol/water to critical heat traced lines. The electric motor for the smaller pump is connected to the emergency electric power supply.

## 7.5 POTABLE WATER

Potable water originates from the Buckskin Mine's water system and supplies the PDF area and administration building via an underground main. In the PDF area, potable water services the emergency eyewash and safety showers, and is the feedwater for steam generation. It is also the source of water for preparing the glycol/water solution in the storage tank.

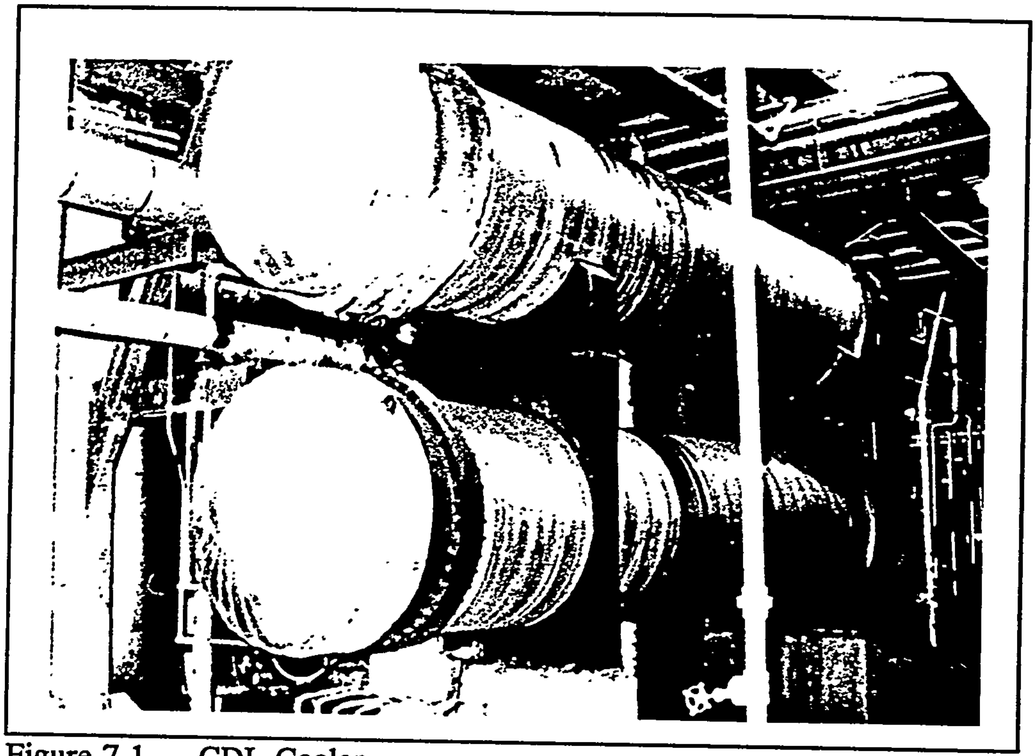


Figure 7.1 CDL Cooler

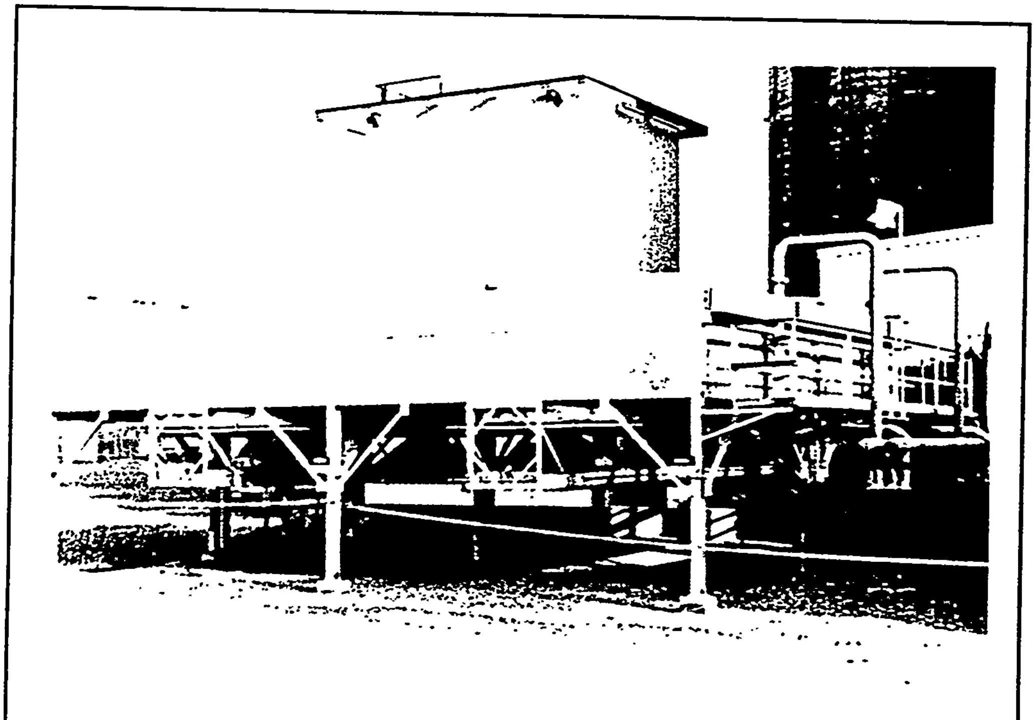


Figure 7.2 Fin Fan Glycol Cooler

## 7.6 FIREWATER

Firewater for the PDF area is supplied from the existing Triton underground firewater main. The new extension from the Triton system splits into three branches. One branch partially rings the unit area, supplying water to fire hydrants located outside the PDF structure. The second branch supplies firewater to hose stations located on each level of the screening structure. The third branch supplies firewater to hose stations on each level of the PDF building. There are ten levels in the PDF building. Each level contains, as a minimum, one firehose station. The water supply to each of the lower five levels contains a restriction orifice to prevent excessive flow from decreasing the available water to the upper five levels.

A firewater booster pump was installed to increase the head pressure of the firewater system within the PDF building, thus ensuring ample water is available to the upper levels. The pump takes suction from the underground firewater main and discharges through a vertical header supplying water to each level. The pump is not spared but does contain a full line size bypass. Normally, the bypass line is open and the pump is aligned for automatic starting. The building firewater pressure is maintained from the existing system through the pump bypass. If the water pressure within the building decreases due to heavy demand, a pressure instrument will sense the situation and automatically start the booster pump.

On the lowest level, the firewater header extends approximately five feet outside the PDF building and terminates with a block valve and two fire hydrant type nozzles. The intent is to connect a fire truck (pumping type) to the nozzles to supply the firewater when the firewater booster pump is out of service for maintenance. The fire truck pump will take suction from the underground firewater main through a fire hydrant nozzle.

## 7.7 NITROGEN

Liquid nitrogen is transported to the plant by truck and off-loaded into an 11,000 gallon cryogenic storage vessel. Pressure on the liquid nitrogen storage vessel is maintained at 100 psig. The liquid nitrogen is vaporized to supply gaseous nitrogen to the facilities at 100 psig and 40°F. The vaporizing coils are contained in a static water/glycol mixture bath that is direct fired by a natural gas burner.

Nitrogen is distributed to utility (hose) stations in the PDF and screening buildings. Additionally, it is hard piped with pressure regulators and trip valves to prevent vacuum conditions from occurring in the following vessels:

Coal Dryer
Dryer Cyclone
Pyrolyzer
Pyrolyzer Cyclone
Pyrolyzer Quench Chamber
ESP's

In case of a process upset where the above equipment maybe subjected to vacuum conditions, nitrogen will be introduced into these vessels to maintain a preset minimum internal pressure. In addition, before each startup, nitrogen is used to inert the drying and pyrolyzing loops to reduce the oxygen content. It is supplied to the combustors as purge gas to inert the combustor before it is lighted. It is also used as the purge gas for various instruments. Moreover, the ESP vessels require nitrogen to continually purge and pressurize the electrical connection dome chamber.

### 7.8 NATURAL GAS

Natural gas is the main source of fuel for all the building heating equipment in the facilities. It is supplied to the unit area from Western Gas Processors Pipeline. Natural gas is used to fire the space heaters, nitrogen vaporizer, feed coal silo heater, PDF silo heater, package steam boiler, and both dryer and pyrolyzer combustors.

## 8.0 CONSTRUCTION

### 8.1 CONTRACTING METHODOLOGY

Construction of the ENCOAL LFC plant was done by Kellogg Construction Inc. (KCI) as part of the EPC contract with The MW Kellogg Company. Due to the short time allowed by the original Construction Schedule shown in Figure 8.1, a fast track approach was used, that is the field construction overlapped the engineering phase for all but the first two months. KCI, as the project manager, chose to implement the project by hiring subcontractors rather than use their own labor due to the remoteness of the location compared to their normal work area. KCI was able to find an adequate number of qualified local contractors to bid and perform the work. All work was done on a merit shop basis.

Shortly after the ENCOAL Project was approved and went into design, Triton Coal Company, the site host started construction on a project to expand the Buckskin Mine coal handling facilities. A number of interferences between the two projects resulted in some design changes, but for the most part, there were advantages to both projects being in construction at the same time. Having contractors available on site reduced mobilization costs and being able to offer more work made contractors more competitive. In the case of the earthwork and the concrete silos, ENCOAL being a sister company to Triton, was able to "tag on" to existing competitively bid contracts and start field construction as soon as the design work was done in those areas. As a result, ENCOAL subcontracted directly for the earthwork and silos and KCI managed the work in the field.

ENCOAL MILD GASIFICIATION DEMONSTRATION PROJECT
CONSTRUCTION SCHEDULE
THE M.W. KELLOGG COMPANY PROJECT No. 6883

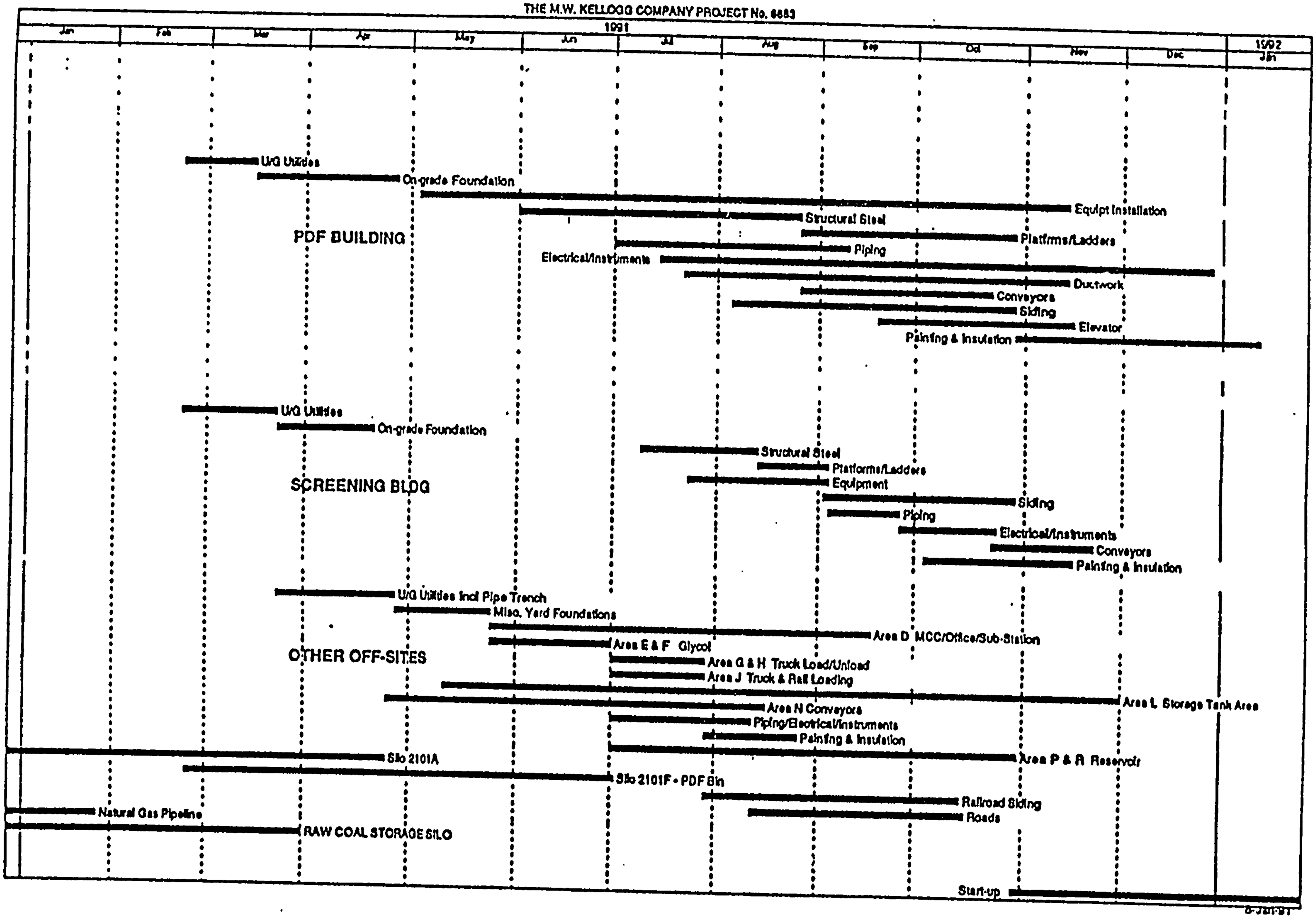


Figure 8.1

## 8.2 CONTRACT PACKAGES

As discussed above, KCI elected to perform the construction phase by using subcontractors for all field work. The result was 17 major subcontract "packages" for specialty work as outlined in Table 8.1. The advantages of this method were:

(1) improved ability to do work in parallel and save time
(2) allowed better match of subcontractor skills with the specialty work to be done and saved the mark-up that a general contractor would charge,
(3) allowed more small and small disadvantaged businesses to compete for the work, and
(4) enabled KCI to use more local contractors.

The disadvantages of the subcontractor approach were:

(1) more effort was required to coordinate the on-site work and
(2) there were more interface points between subcontractors that had to be worked out.

The advantages far outweighed the disadvantages on the project and many qualified local firms were successfully employed.

## 8.3 EARTHWORK, SURVEYING AND TESTING

The initial rough excavation for the PDF plant and screening building was done by Triton using a large mining shovel and trucks. Several thousand yards of material had to be moved and this was the most efficient and expedient method. Completed in September, 1990, the work only took two days. For the fine grading at the plant site and overall site preparation, a contract was awarded to the low bidder on the Triton expansion project. Early surveying work was also done by extending one of Triton's contracts since they were on site and had all the ground control points established. This initial work was managed by ENCOAL and Triton prior to mobilization of KCI in the field.

By October, 1990, Kellogg had completed enough engineering to define the scope of work for a total site preparation package, complete with drainage, roads, ponds, plant buildings and tank farms as described in Section 5.1. KCI then mobilized at the plant site and developed an office for the construction team that would follow. They bid the earthwork, surveying and materials testing and awarded new subcontracts for each. Site preparation began in earnest at this point.

As a matter of practice, all engineered backfill was tested for compaction and all structural concrete was tested for proper mix qualities. Test cylinders were taken from each major concrete pour and tested for seven day and 28 day strengths. Spot checking of welding was done for general piping and plate work. Natural gas piping was inspected by x-ray techniques on 100% of the welds. A materials testing contractor performed all of these services.

**Table 8.1 Subcontractors for ENCOAL Project**

| PACKAGE | SUBCONTRACTOR | SMALL BUS. (Y/N) | PEAK STAFF | AMOUNT (M$) |
|---|---|---|---|---|
| Mechanical Erection | Summit Construction | N | 125 | 6,564 |
| Electrical & Instr. | West Electric | N | 35 | 2,072 |
| Architectural Bldgs. | Hladky Construction | Y | 20 | 440 |
| Above Ground Piping | Hladky Construction | Y | 8 | 283 |
| Earthwork | AGE Construction | Y | 7 | 546 |
| Foundations | Hladky Construction | Y | 22 | 773 |
| Concrete Silos | Hoffman Inc. | Y | 20 | 3,000 |
| Surveying | Eagle Surveys | Y | 3 | 64 |
| Materials Testing | C.E. & M.T. | Y | 2 | 71 |
| Underground Piping | Larry's Inc. | Y | 12 | 869 |
| Insulation | Hladky Construction | Y | 6 | 245 |
| Ceramic Lining | Coors Inc. | N | 5 | 135 |
| Rail Siding | Midwest Railroad | Y | 9 | 127 |
| Large Storage Tanks | Rocky Mountain Fab. | N | 10 | 264 |
| Firewalls | Caspar Builders | Y | 4 | 31 |
| Tank Lining | Western States | Y | 4 | 46 |
| Equip. Foundations | Larry's Inc. | Y | 12 | 541 |

## 8.4 STORAGE SILOS

The design for the demonstration facilities called for three days of raw coal storage ahead of the PDF plant, two days of PDF storage after the plant and 12,000 tons of long term PDF storage for unit trains. To accomplish the latter, a swap was worked out with Triton to add 12,000 tons of raw coal storage in the new expansion facilities (a more useful arrangement for them) and take ownership of two existing 6000 ton storage silos that were much easier for ENCOAL to use. Included was the use of some existing conveyors, sampling systems, additional storage silos and rail loading facilities. This saved ENCOAL a great deal of additional capital and construction work that would have been required to meet the needs for long term PDF storage with its own new silo.

Hoffman Inc. was the successful bidder on Triton's two planned 12,000 ton silos for their expansion project. Consequentially, ENCOAL negotiated a contract with Hoffman for a third identical silo. Construction of this silo was managed by Triton and was well underway when KCI moved to the site. The Project Master Schedule reflected that ENCOAL's raw coal silo would have to be constructed very early in the job, because it would be very difficult if not impossible to build after Triton's expansion conveyors were installed. The active rail loop on one side and the conveyors on the other would prevent access. Therefore, the design, specifications, bid and award of this silo was expedited by Kellogg. Construction of the 3000 ton feed coal silo beginning with the caissons and pile cap was started in November, 1990 as a result of these efforts. The slip-formed, continuous concrete pour was completed in early February, 1991 during a fortunate break in the weather. Figures 8.2 and 8.3 show the slip form just prior to starting and the completed silo respectively. The silo internals and roof were completed in April, 1991.

The remaining 1000 ton PDF product silo also needed to be completed fairly early in the schedule to avoid conflict for access with the mechanical erection contractor. Being very similar in design to the raw coal silo, the contract for the PDF silo was negotiated with the low bidder of all the other silos. Caissons and a pile cap were also required for this silo, but the depth was much less, being on the order of 20 feet. The PDF silo slip was completed in May, 1991 and the internals and roof in July, 1991. Both the raw coal and PDF silos were equipped with a stainless steel hopper liner to improve material flowability.

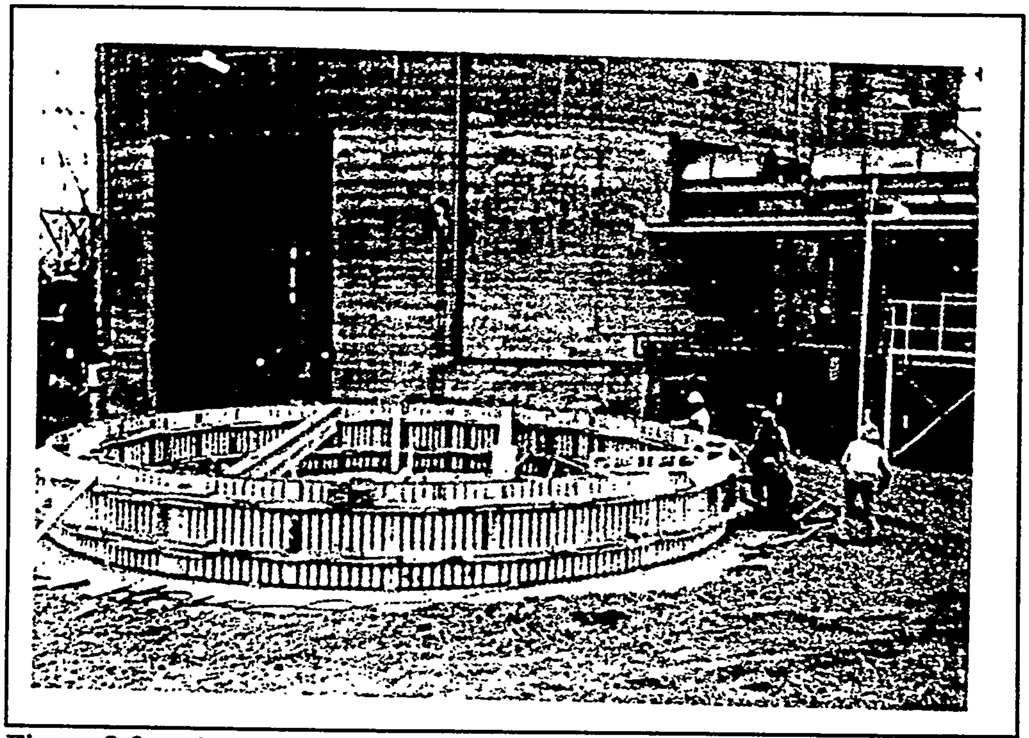


Figure 8.2 Raw Coal Silo Slip Form

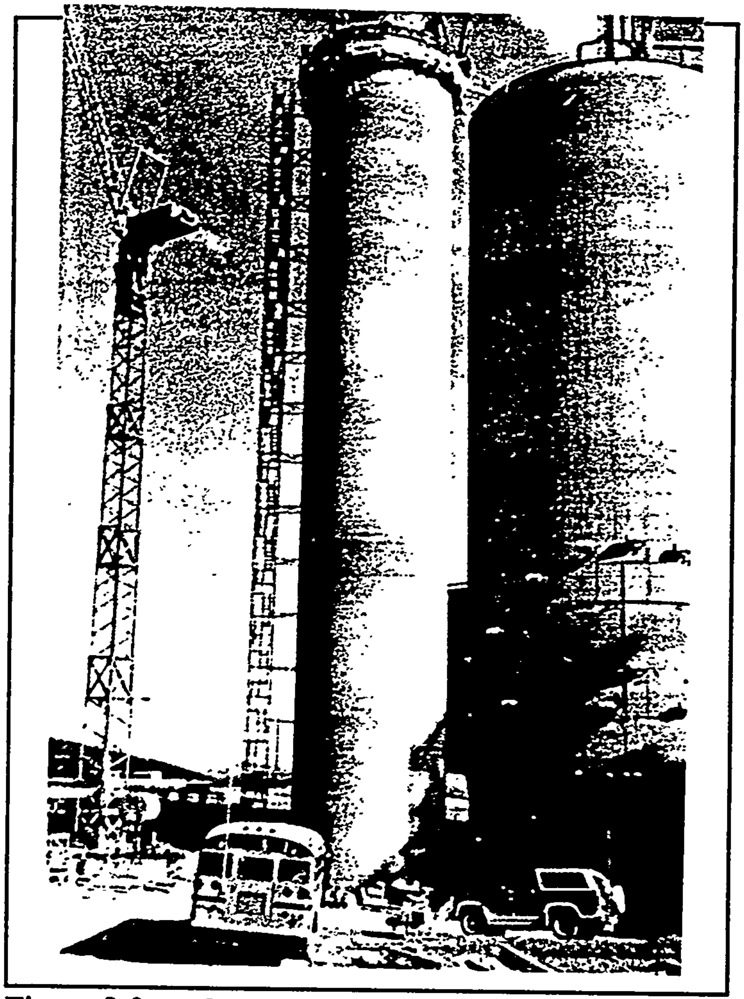


Figure 8.3 Completed Raw Coal Silo

## 8.5 PDF PLANT

The construction sequence for the PDF building began with the installation of a large spread footer type foundation with integral column supports for the building structure. This was followed by the underground and underfloor piping and foundations that mounted on the spread footer. Then the concrete frost walls, trenches and floor sections were poured. Next, the main erection of the structural steel and concurrent equipment installation was done. Delivery of several large pieces of equipment were critical to the erection sequence. The expediting schedule shown in Figure 8.4 was developed to track these major items and make appropriate adjustments in the construction sequence as needed. A detailed construction schedule was developed based on these expected deliveries of major equipment as shown in Figure 8.5. This schedule had to be adjusted several times due to late arrival of equipment. Finally, as the PDF building was topped out, installation of the steel siding commenced. The screening building, off-site buildings and piping were done essentially in parallel with the main plant erection. Electrical and instrumentation work trailed all mechanical/civil work and was completed last.

ENCOAL MILD GASIFICIATION DEMONSTRATION PROJECT
PRIORITY EQUIPMENT EXPEDITING DELIVERY GOALS
THE M.W. KELLOGG COMPANY PROJECT No. 6683

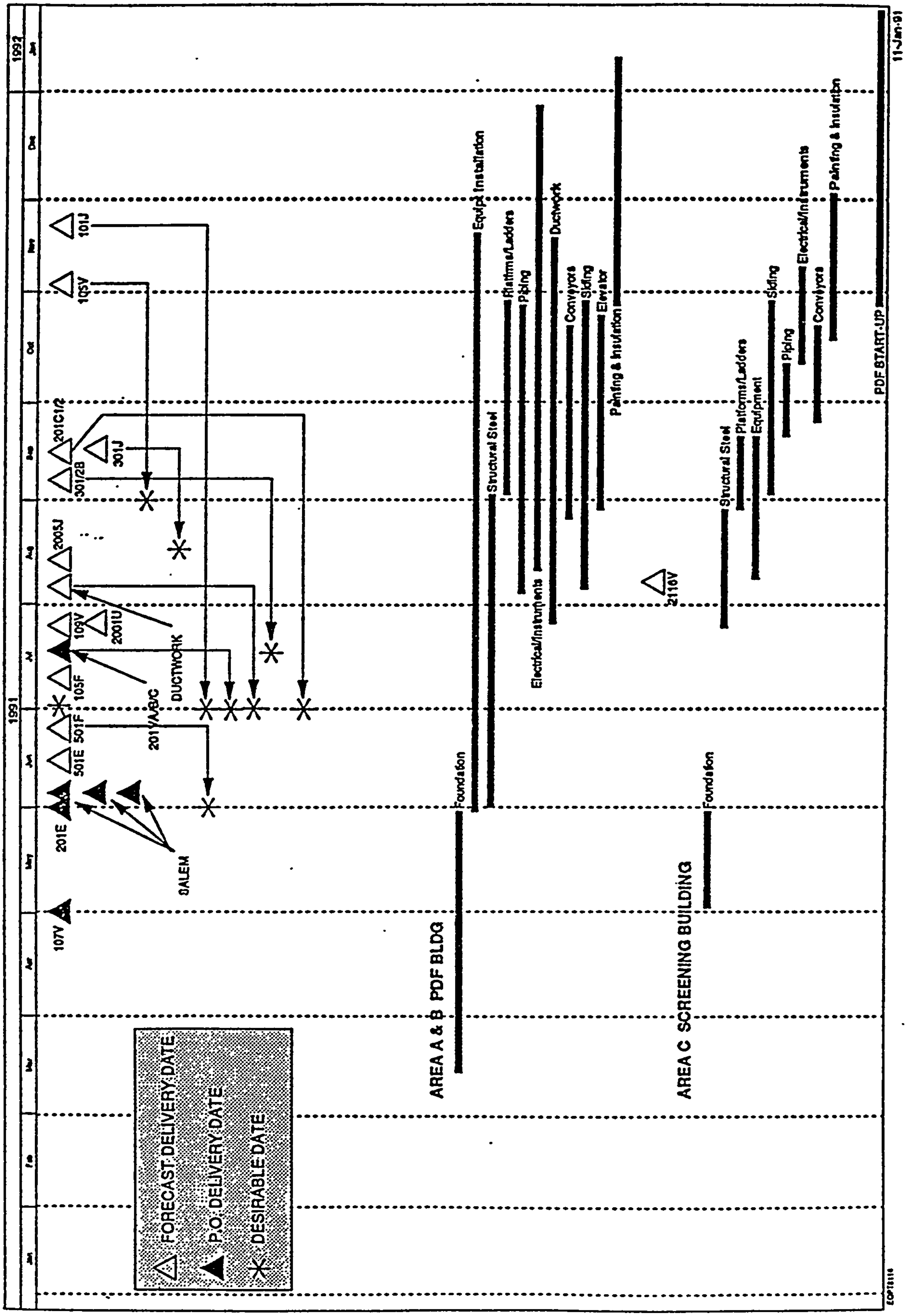
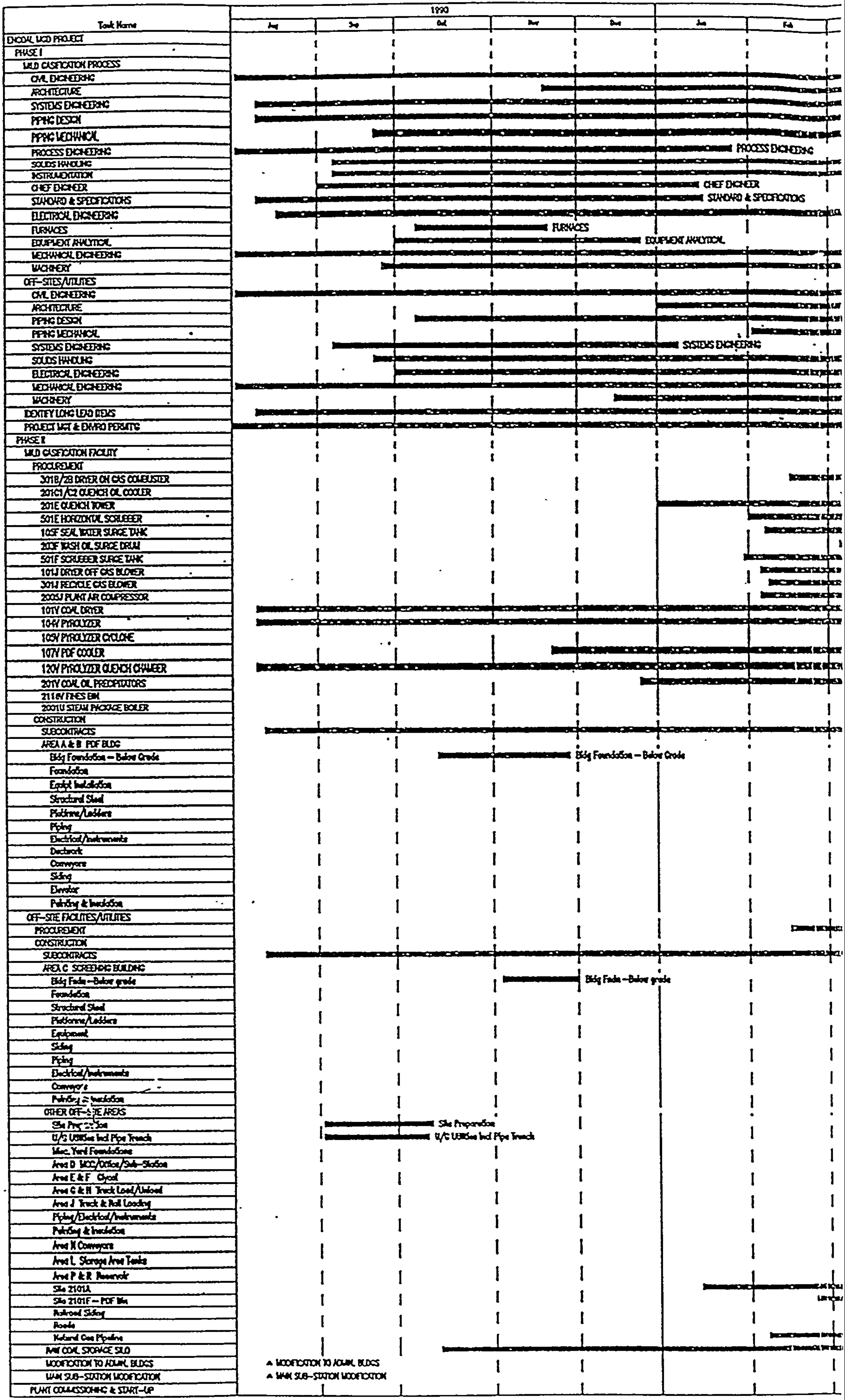


Figure 8.4


1990
Task Name
Aug
Sep
Oct
Nov
Dec
Jan
Feb
ENCOAL MCD PROJECT
PHASE I
MILD GASIFICATION PROCESS
CIVIL ENGINEERING
ARCHITECTURE
SYSTEMS ENGINEERING
PIPING DESIGN
PIPING MECHANICAL
PROCESS ENGINEERING
SOLIDS HANDLING
INSTRUMENTATION
CHIEF ENGINEER
STANDARD & SPECIFICATIONS
ELECTRICAL ENGINEERING
FURNACES
EQUIPMENT ANALYTICAL
MECHANICAL ENGINEERING
MACHINERY
OFF-SITES/UTILITIES
CIVIL ENGINEERING
ARCHITECTURE
PIPING DESIGN
PIPING MECHANICAL
SYSTEMS ENGINEERING
SOLIDS HANDLING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
MACHINERY
IDENTIFY LONG LEAD ITEMS
PROJECT MGT & ENVIRO PERMITS
PHASE II
MILD GASIFICATION FACILITY
PROCUREMENT
301B/2B DRYER OFF GAS COMBUSTER
201C1/C2 QUENCH OIL COOLER
201E QUENCH TOWER
501E HORIZONTAL SCRUBBER
105F SEAL WATER SURGE TANK
203F WASH OIL SURGE DRUM
501F SCRUBBER SURGE TANK
101J DRYER OFF GAS BLOWER
301J RECYCLE GAS BLOWER
2005J PLANT AIR COMPRESSOR
101V COAL DRYER
104V PYROLYZER
105V PYROLYZER CYCLONE
107V PDF COOLER
120V PYROLYZER QUENCH CHAMBER
201V COAL OIL PRECIPITATORS
2116V FINES BIN
2001U STEAM PACKAGE BOILER
CONSTRUCTION
SUBCONTRACTS
AREA A & B PDF BLDG
Bldg Foundation – Below Grade
Foundation
Equipt Installation
Structural Steel
Platforms/Ladders
Piping
Electrical/Instruments
Ductwork
Conveyors
Siding
Elevator
Painting & Insulation
OFF-SITE FACILITIES/UTILITIES
PROCUREMENT
CONSTRUCTION
SUBCONTRACTS
AREA C SCREENING BUILDING
Bldg Fndn – Below grade
Foundation
Structural Steel
Platforms/Ladders
Equipment
Siding
Piping
Electrical/Instruments
Conveyors
Painting & Insulation
OTHER OFF-SITE AREAS
Site Preparation
U/G Utilities Incl Pipe Trench
Misc. Yard Foundations
Area D MCC/Office/Sub-Station
Area E & F Glycol
Area G & H Truck Load/Unload
Area J Truck & Rail Loading
Piping/Electrical/Instruments
Painting & Insulation
Area K Conveyors
Area L Storage Area Tanks
Area P & R Reservoir
Silo 2101A
Silo 2101F – PDF Bin
Railroad Siding
Roads
Natural Gas Pipeline
RAW COAL STORAGE SILO
MODIFICATION TO ADMIN. BLDGS
MAIN SUB-STATION MODIFICATION
PLANT COMMISSIONING & START-UP
PROCESS ENGINEERING
CHIEF ENGINEER
STANDARD & SPECIFICATIONS
FURNACES
EQUIPMENT ANALYTICAL
SYSTEMS ENGINEERING
Bldg Foundation – Below Grade
Bldg Fndn – Below grade
Site Preparation
U/G Utilities Incl Pipe Trench
▲ MODIFICATION TO ADMIN. BLDGS
▲ MAIN SUB-STATION MODIFICATION

ILD GASIFICATION DEMONSTRATION PROJECT
CONSTRUCTION SCHEDULE
E M.W. KELLOGG COMPANY PROJECT No. 6683

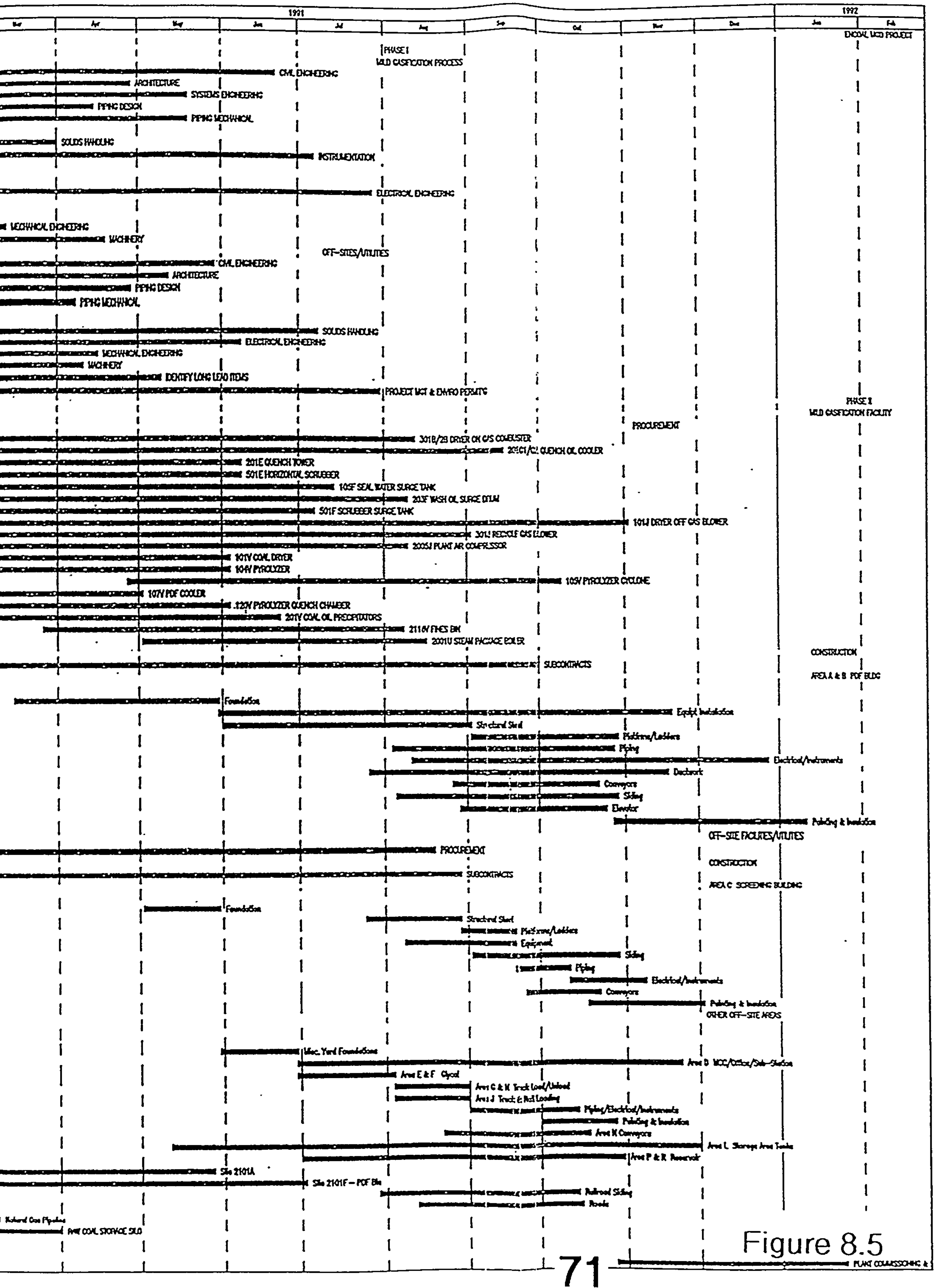


Figure 8.5

15-Jan-91

### 8.5.1 Foundations

Geotechnical surveys on the site showed that soil conditions were poor near the surface, but that with slightly more excavation, a suitable bearing zone could be reached in the area of the PDF building. This was not true for the silos because of the small diameter and high loading, thus caissons and pile caps were required. A spread footer for the PDF building had an additional advantage from a timing point of view; the foundation could be placed before winter weather arrived and it would take less engineering time to complete the design than for individual foundations for each piece of equipment, many of which were not even selected yet. Specifications and bid documents for the foundations package were prepared in Houston prior to KCI's mobilization. The bid was awarded and construction started in early October, 1990.

A ground breaking ceremony was held during mid-October in the initial stages of foundation installation. By the end of November, the largest monolithic pour in the state of Wyoming, a 3000 cubic yard base, was made (Figures 8.6-8.9). By the end of 1990, the columns were in place and the spread footings for both the PDF building and screening were backfilled with compacted material. Closely following the completion of the major plant foundations, a subcontract was awarded for the conveyor and tank foundations remote to the plant area. The same subcontractor was the successful bidder and they continued to work through the winter as the weather allowed, completing the additional foundations by May, 1991.

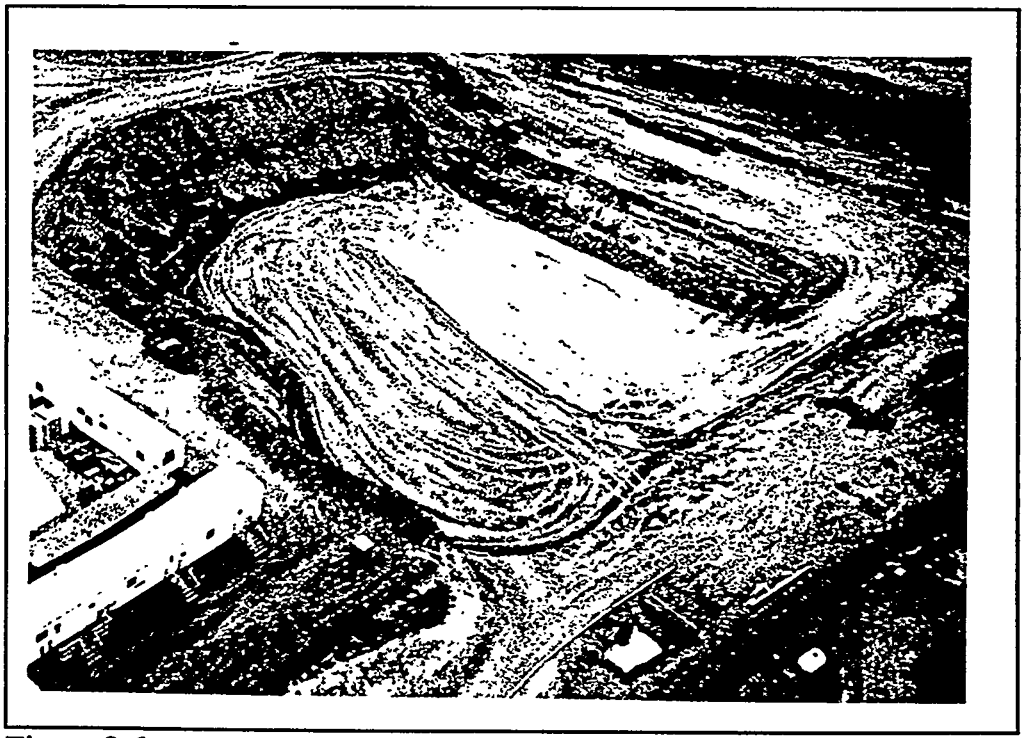


Figure 8.6 PDF Building Excavation

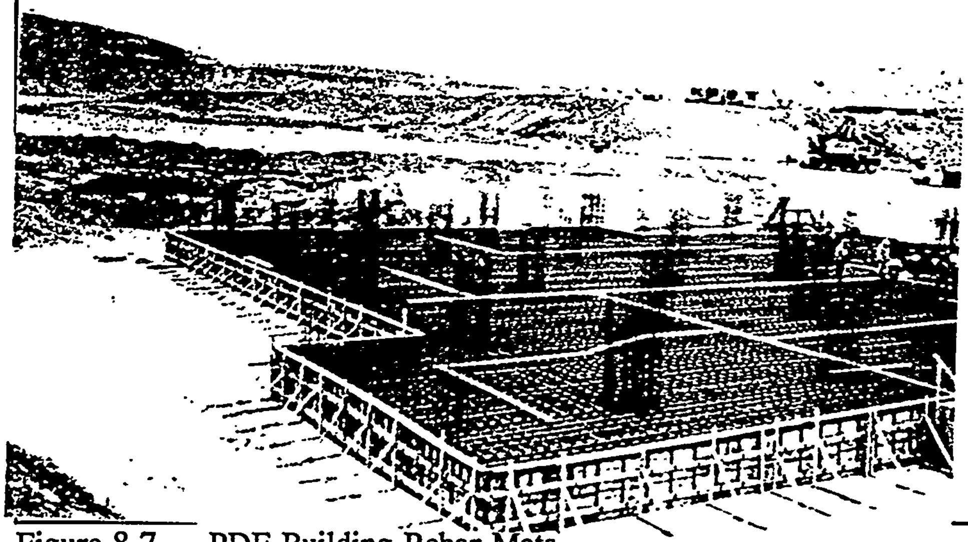


Figure 8.7 PDF Building Rebar Mats

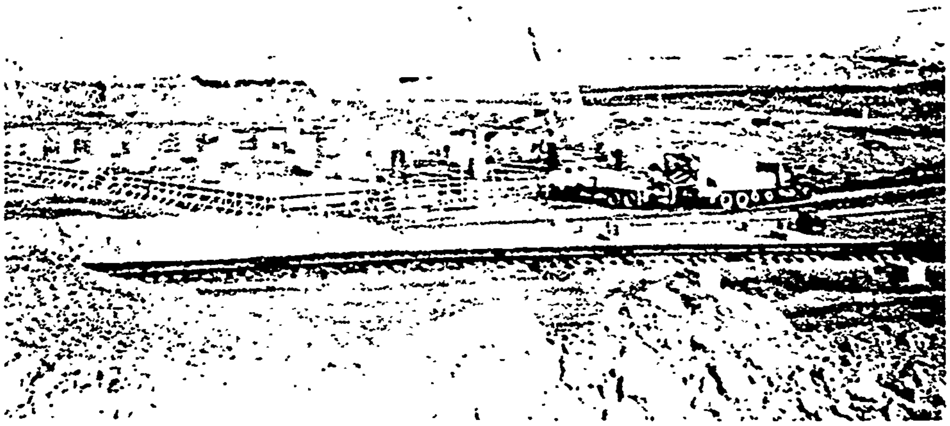


Figure 8.8 PDF Building Foundation Pour

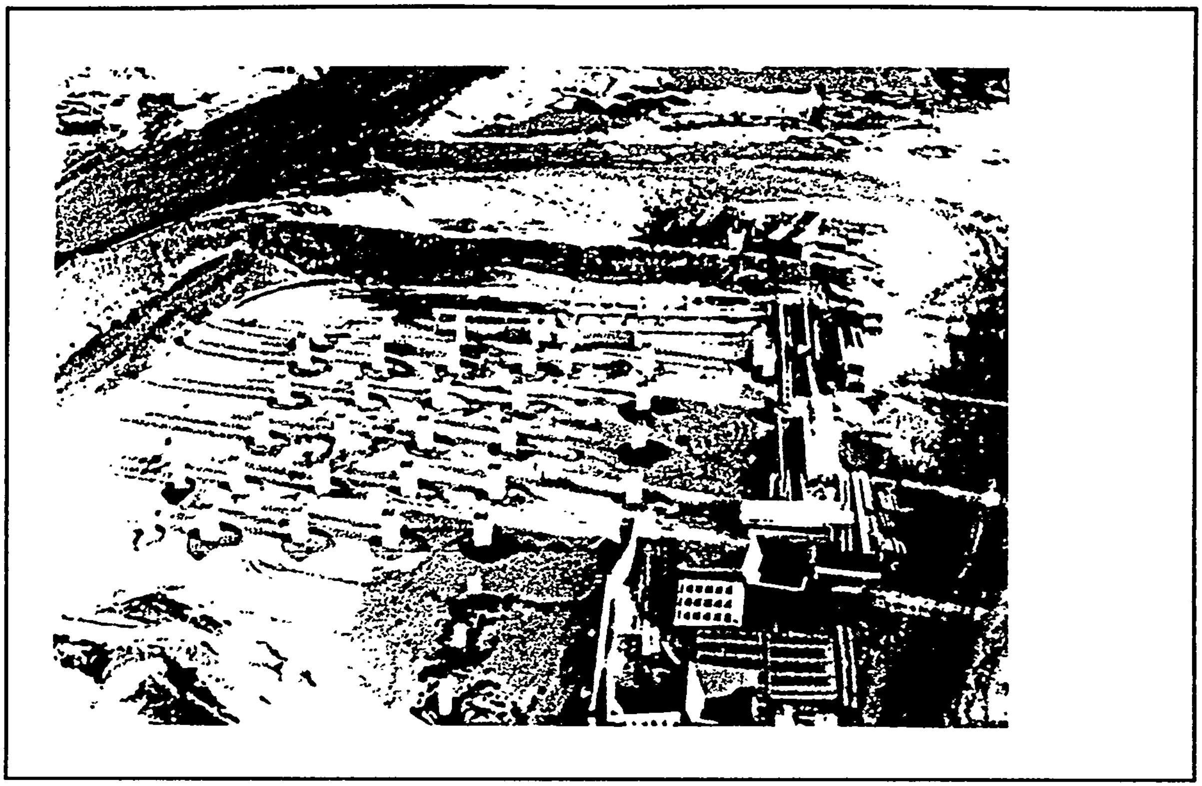


Figure 8.9 PDF and Screening Building Foundations

### 8.5.2 Underground Piping, Conduit and Equipment Foundations

Completion of the spread footer for the PDF building opened the way for the piping and equipment foundations that were located on top of it. Requiring different skills, these subcontracts were awarded separately. Most of the underground piping was specified as high density polybutylene plastic. Underground conduit was standard weight PVC covered with red dyed concrete outside of the plant area. The natural gas piping was polyethylene coated steel and the flue gas system discharge line which was 304 stainless steel. The subcontract for underground piping included all of the buried piping and conduit in the PDF/screening building area, natural gas piping to the property line at the gas supplier's metering station, firewater system with valves and hydrants, stainless line and the cooling water lines to and from the sedimentation pond. Work began as soon as the weather allowed in March 1991 and was completed by July.

In parallel with the underground piping, a subcontract was awarded for the installation of the concrete piers, foundations, trenches and floors in the PDF and screening buildings. This work also began right after the winter weather cleared in March, 1991 and continued through June. Each individual concrete pier or foundation was excavated through the compacted backfill to the spread footer and attached to pre-installed rebar or dowelled into the foundation concrete. The pier was then formed, poured and backfilled. Figures 8.10 and 8.11 show the backfilled spread footer prior to starting piping and equipment foundations and Figure 8.12 shows these subcontracts completed.

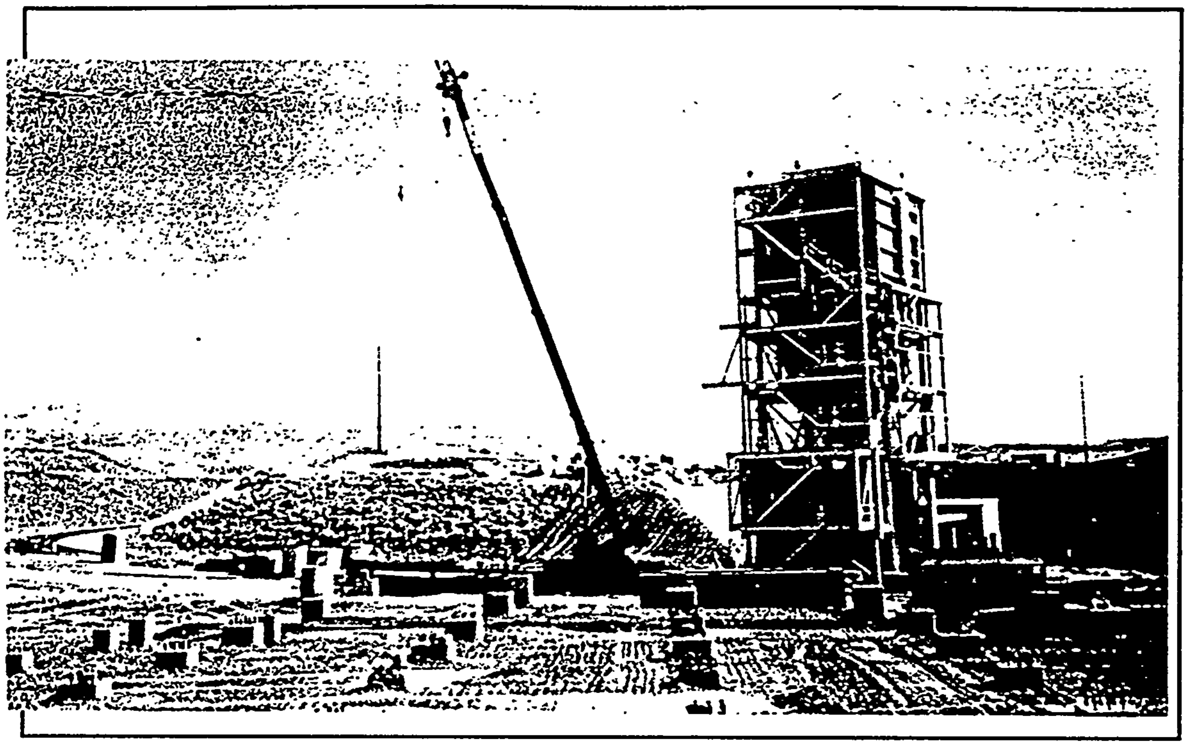


Figure 8.10 Backfilled PDF Building Foundation

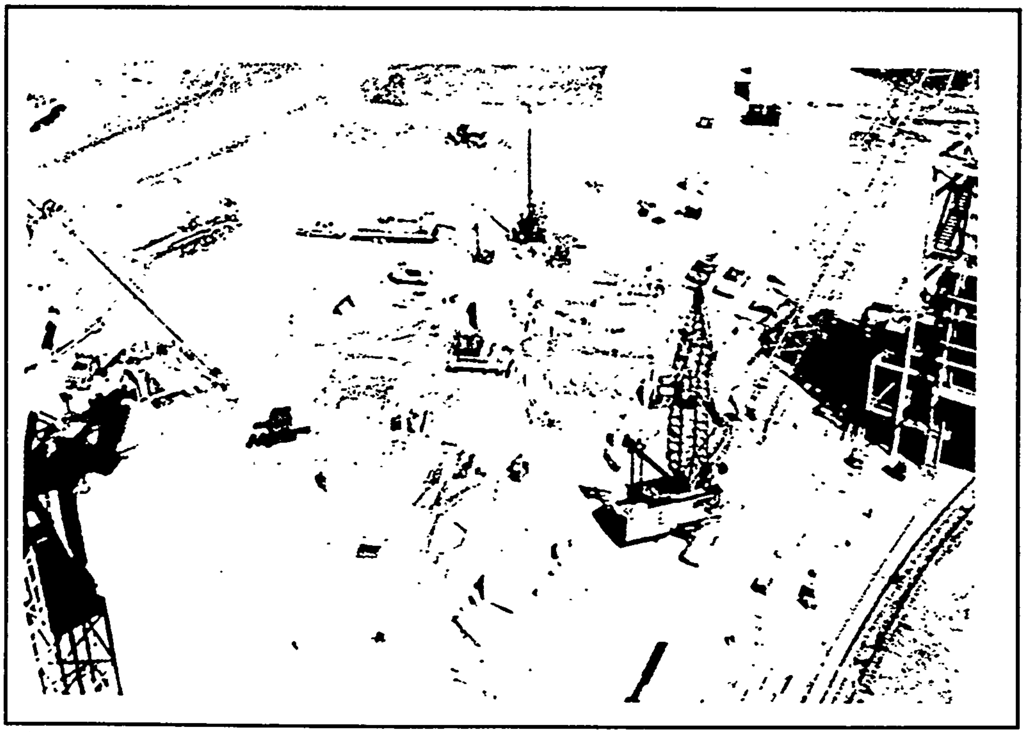


Figure 8.11 Underground Piping and Equipment Foundations in Progress

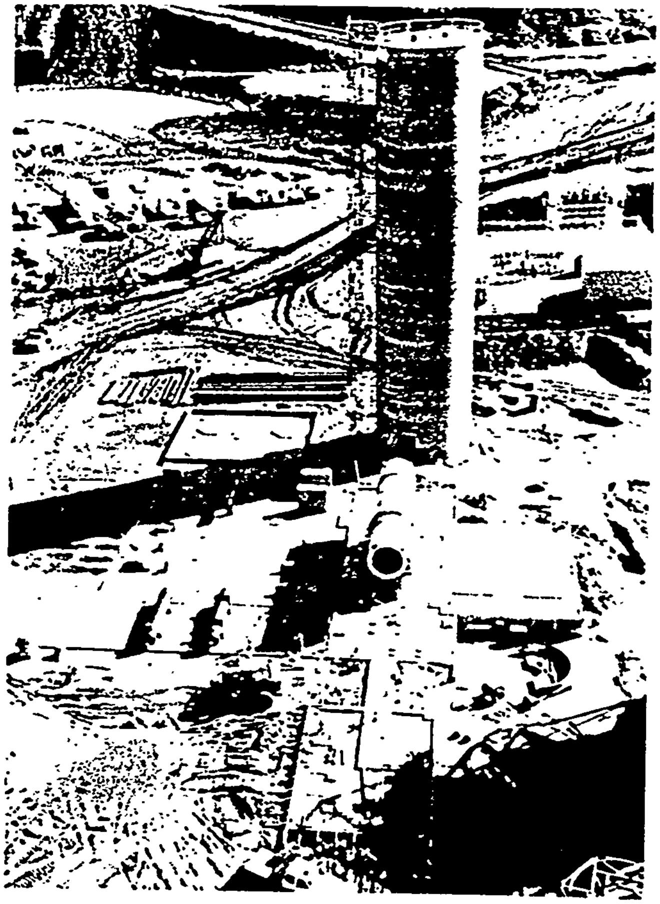


Figure 8.12 Completed Equipment Foundations and Floor Slabs

### 8.5.3 Mechanical Erection

A subcontract for the mechanical erection of the facilities was bid in February 1991 and awarded in April. It was planned to mobilize the subcontractor in May. However, about this time engineering delays and ensuing equipment delivery delays started to catch up with the Project. Structural steel and the first of the major equipment, scheduled to start arriving in May had slipped by more than a month. The mechanical subcontractor did mobilize by the end of May, but slowly so they did not run out of available work. As a reference for the discussions that follow, Appendix A contains a complete floor by floor description of the plant and screening buildings.

By the end of June, the Project worked through the delay problems and material delivery was in full swing. The PDF cooler, so large that it had to be delivered by rail, had arrived and was set as soon as the foundations were ready (Figure 8.12). The quench column was delivered in mid June and was set in place straight from the truck. Both of these pieces of equipment had to be set before work could begin on the structural steel.

The steel fabricator did an excellent job of keeping ahead of the erection contractor after they started receiving engineering drawings from Kellogg. The erection plan called for assembly of the PDF quench table, pyrolyzer and dryer on the ground one by one and lifting them into place as the structural steel was going up. The other major equipment that had to be set on elevated floors as the structure was going up were the purge gas scrubbers, ESP's, recycle blower, pyrolyzer cyclone, dryer cyclone and large diameter prefabricated ductwork. Figure 8.13 shows the quench column in place and the first of the structural steel in progress. In the lower right corner of the picture, the quench table assembly is in progress. Figure 8.14 shows the quench table in place.

The erection plan worked very well and provided the flexibility to deal with the delayed delivery of some pieces of equipment. Both of the large process gas blowers arrived more than a month late but posed no real problem in the erection sequence. The horizontal scrubber and ESP's arrived close to the required dates and were set in July. Figures 8.15 and 8.16 show the progress at this point. Placement of the structural steel on the 4th floor opened the way for the installation of the pyrolyzer vessel. The assembled pyrolyzer is shown on the ground in Figure 8.17 and in place in Figure 8.18. The roof of the pyrolyzer appears in the lower right corner of the picture. Erection of the PDF structure was at about 106' at this juncture where the floor area reduced to less than half of the ground floor area. Figure 8.18 also shows the installed combustors, motor control building and fines bin.

One of the longest delayed pieces of equipment was the pyrolyzer cyclone. Structural steel was temporarily omitted in the area just to the left of the pyrolyzer to accommodate installation of this large vessel when it finally arrived. Originally designed as a single unit, the manufacturer shipped the vessel in two pieces to save shop fabrication time and it had to be assembled in place. In Figure 8.18, the lower half of the pyrolyzer cyclone appears at the bottom of the picture on the delivery truck. Figure 8.19 shows the complete cyclone installed in the structure. (Center) This procedure delayed steel erection for two weeks.

The 6th floor was designed to support the dryer and is the bottom of zone 2, the specially designed dryer containment zone described in Section 5.1. This floor was covered with checker plate instead of grating like the rest of the floors in the plant. Figure 8.20 shows the start of the structural steel and 6th floor decking above the pyrolyzer. The plastic cover around the combustors is for weather protection for the refractory lining work in progress.

Like the pyrolyzer, the dryer shell was assembled on the ground as a unit and lifted into place after all supporting structural steel was in place. It did not fit together well and a lot of trimming and grinding was necessary to assemble it. Portions of the both the dryer and pyrolyzer grates and substructure were preassembled by the fabricators' shop. These structures were bolted in place loosely before installation of the roof of each vessel. After completion of the vessel, the grate assembly was rotated and all bolts were torqued and the nuts spot welded as required by the manufacturer. Figure 8.21 shows the completed dryer assembly and the inlet and outlet ductwork (120" OD).

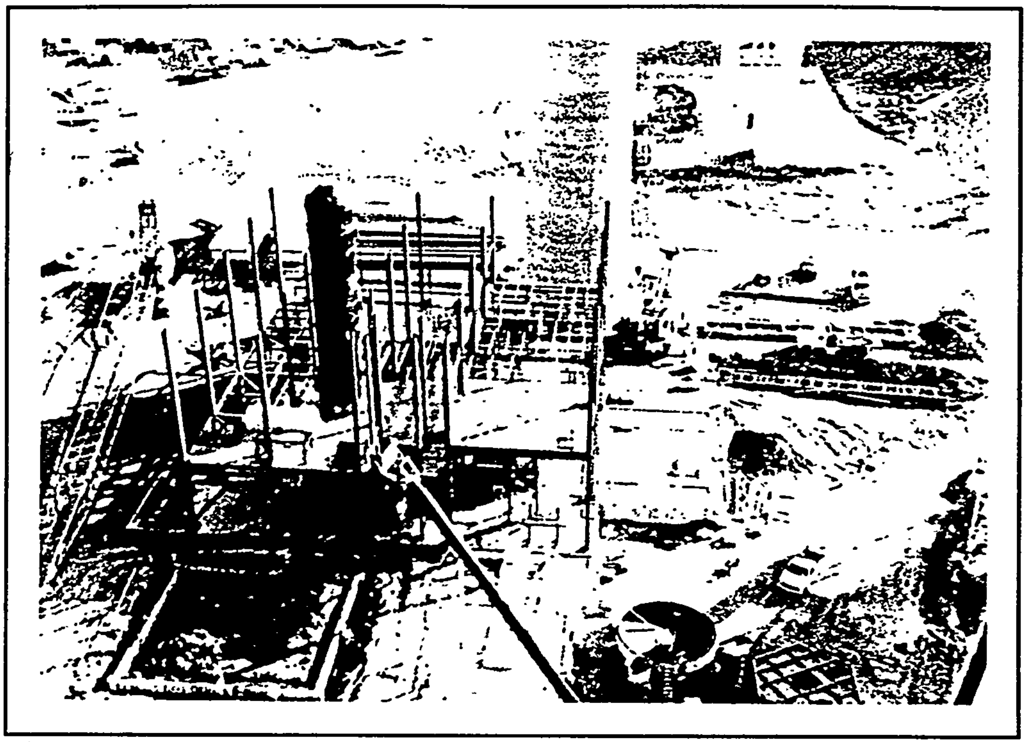


Figure 8.13 Quench Column and PDF Quench Table

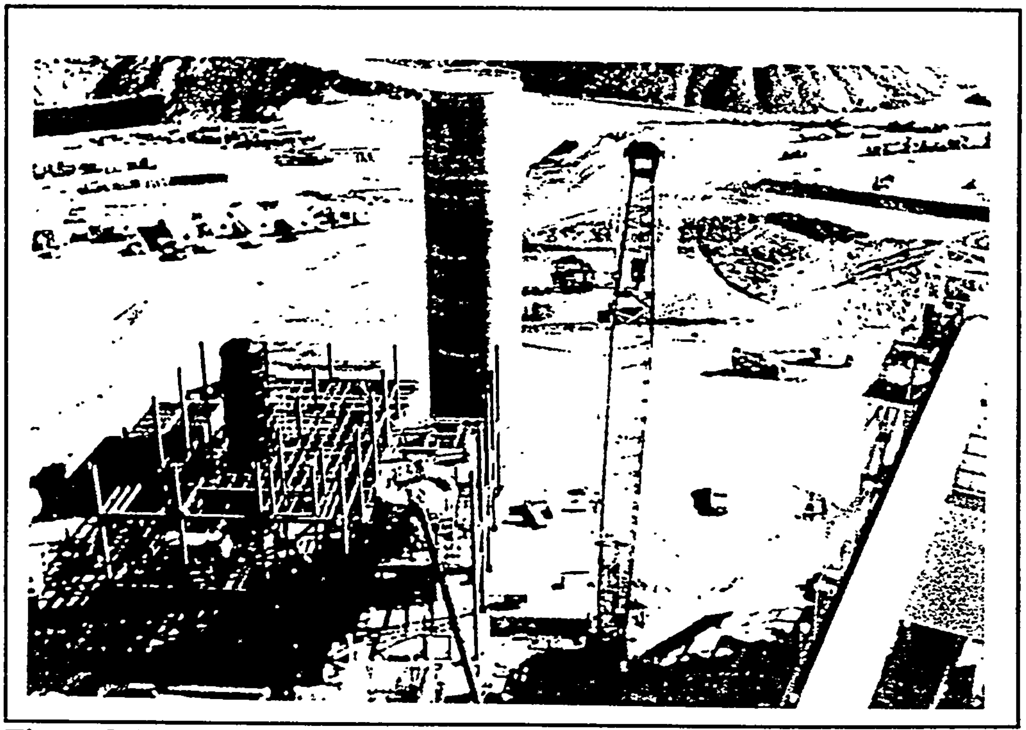


Figure 8.14 PDF Quench Table and 3rd Floor In Place

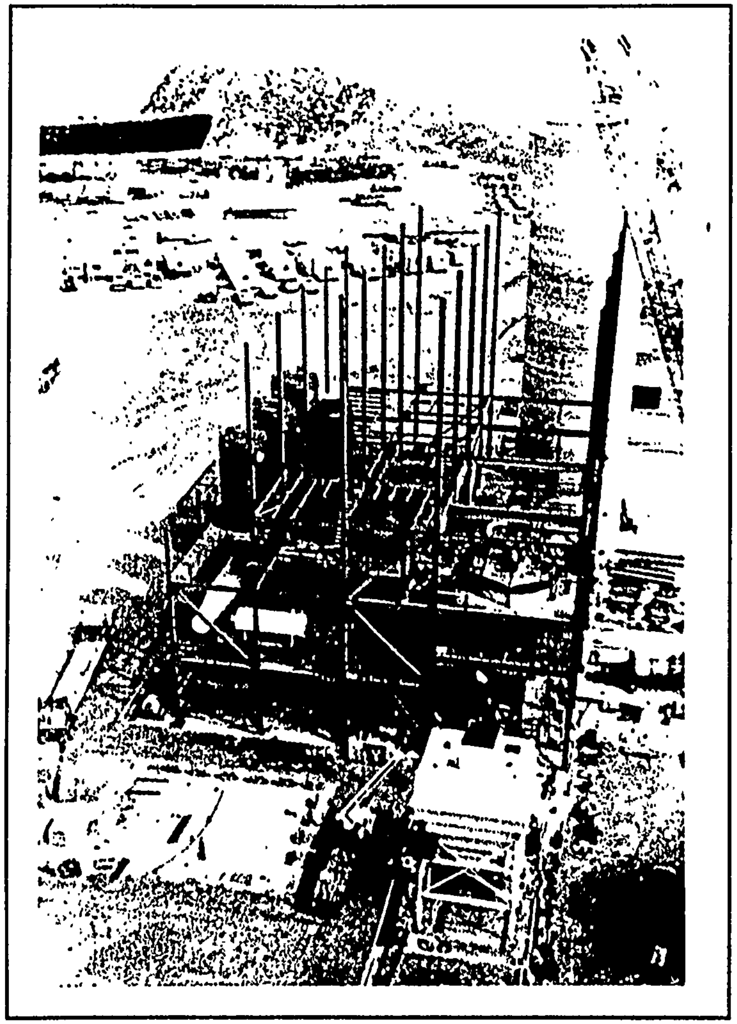


Figure 8.15 Blowers, ESP's and Horizontal Scrubber In Place

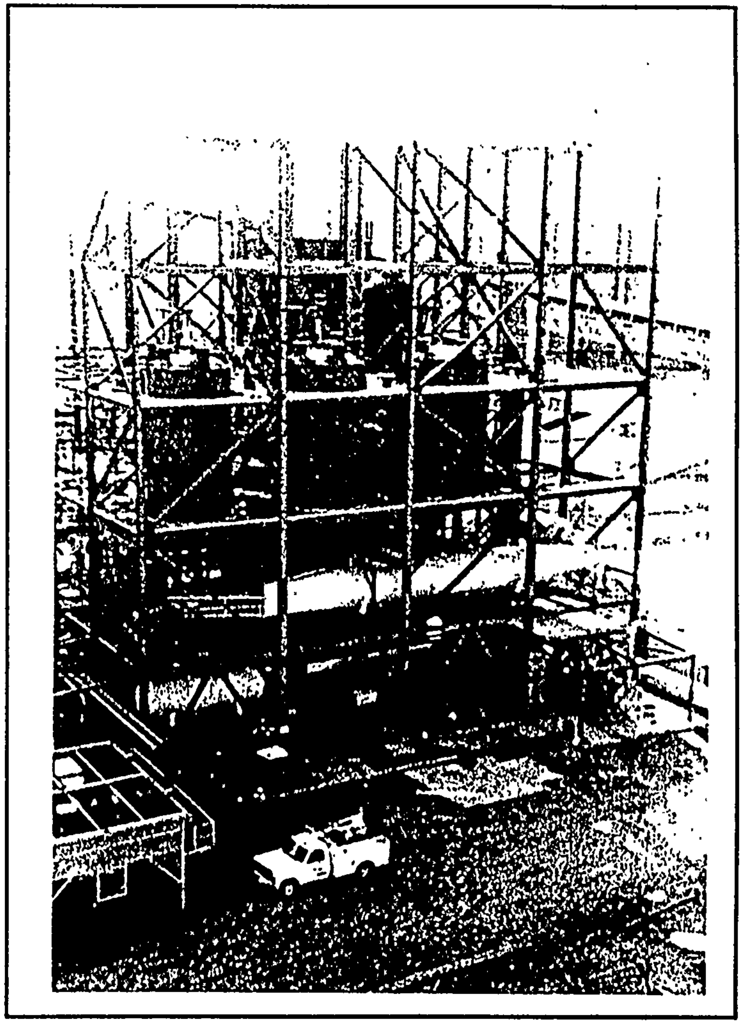


Figure 8.16 West View of ESP's and Horizontal Scrubber

The last large piece of equipment to arrive on site, two months behind schedule, was the dryer cyclone. Welded into three large pieces on the ground, each piece had to be lifted in through the open roof of the plant. As shown in Figure 8.22, structural steel installation continued as long as possible around the open area while waiting on delivery of the dryer cyclone. During this time, crews were reduced and shifted to the screening building, raw coal conveyor and product conveyors. The dryer cyclone arrived in late February 1992 and the final sections of structural steel were placed as shown in Figure 8.23.

The girts and metal siding on the PDF structure began to be installed in November, 1991 at the lower levels of the building. The single layer, uninsulated panels went up fairly slowly due to wind and weather problems. A number of the openings on the upper floors changed during the building erection, thus requiring improvising by the siding subcontractor which slowed progress. Work on the siding was well underway in Figures 8.22 and 8.23.

After the dryer cyclone was set, the way was cleared for installation of the PDF S-Belt, GAMMA-METRICS analyzer and structural steel on top of the PDF silo. Figure 8.24 shows this work completed as well as the rest of the equipment, piping and ductwork in the top sections of the PDF building. On the south side of the building, the raw coal S-Belt was installed and the picture in Figure 8.25 was taken just before installation of the fiberglass stack. Final completion of PDF structure occurred in March, 1992 as illustrated in the aerial view in Figure 8.26.

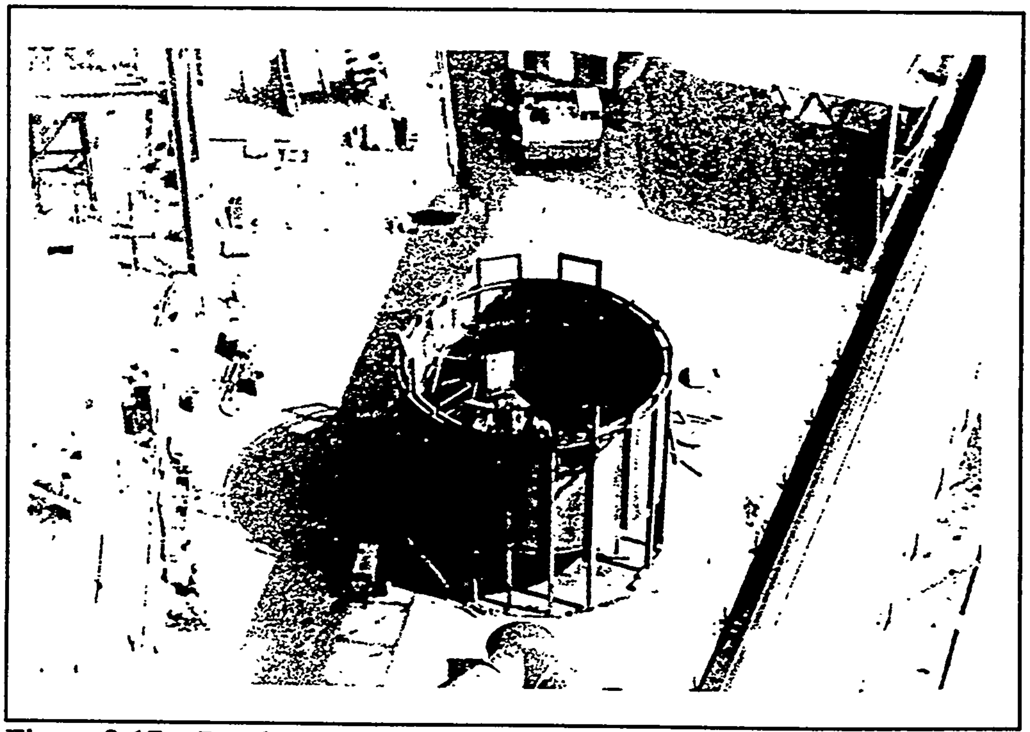


Figure 8.17 Pyrolyzer Assembly

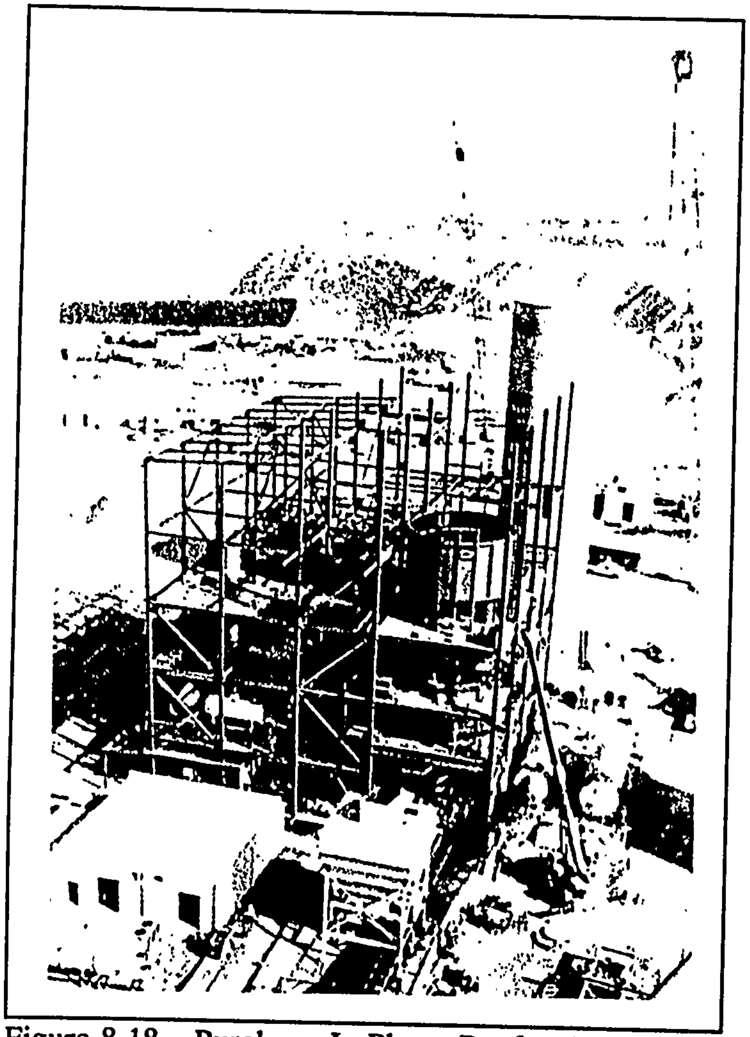


Figure 8.18 Pyrolyzer In Place. Roof at 106'

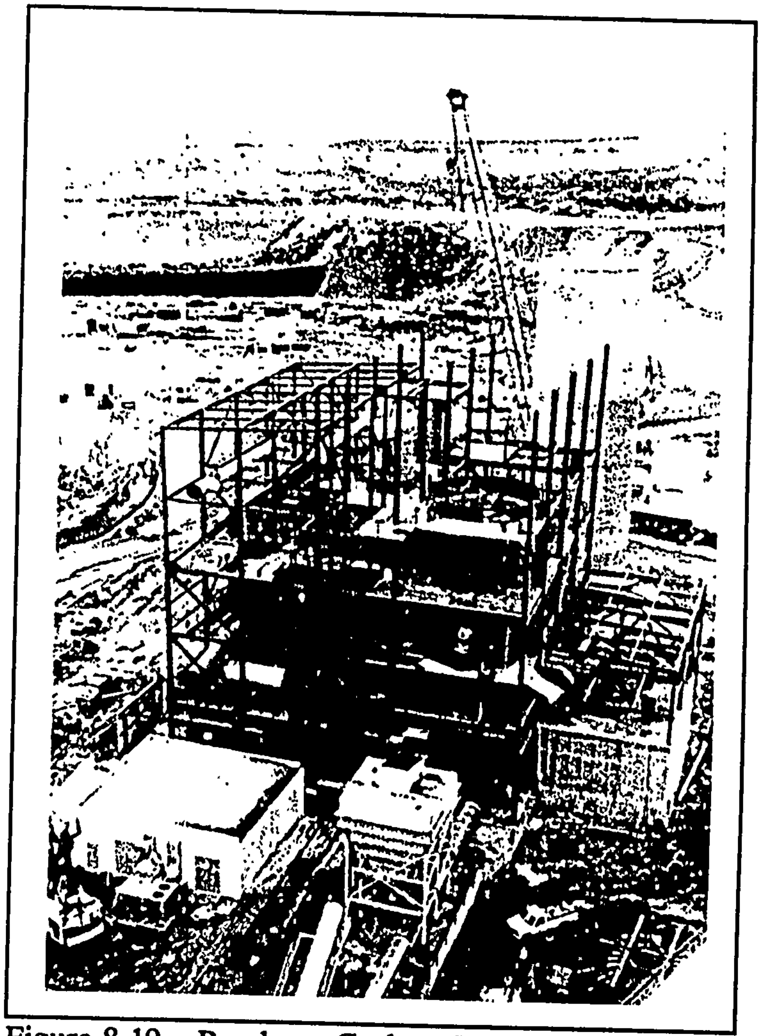


Figure 8.19 Pyrolyzer Cyclone Installed (Center)

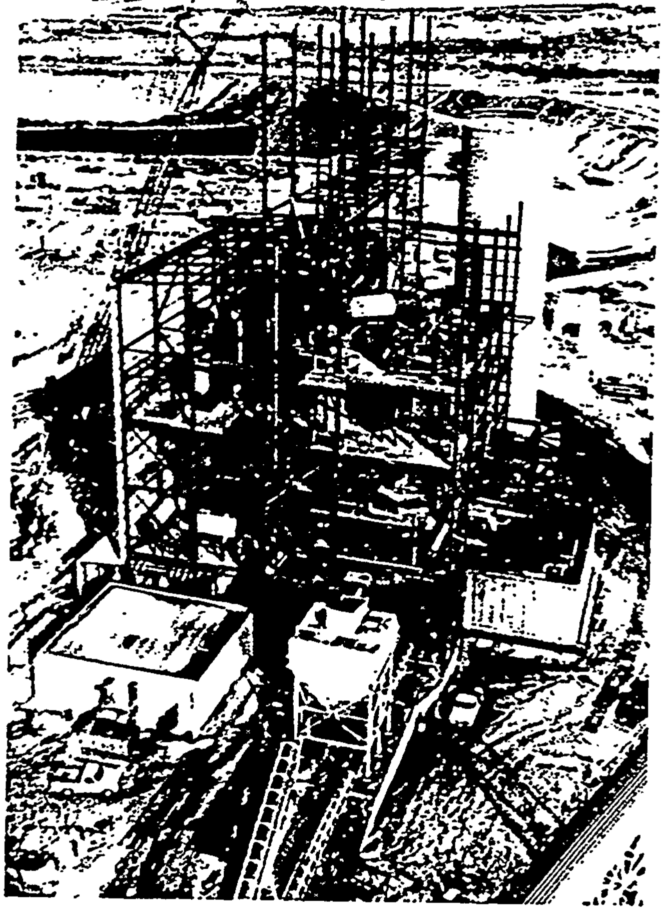


Figure 8.20 Start of 6th Floor Deck and Steel

Figure 8.21 Dryer, Inlet Duct and Outlet Duct

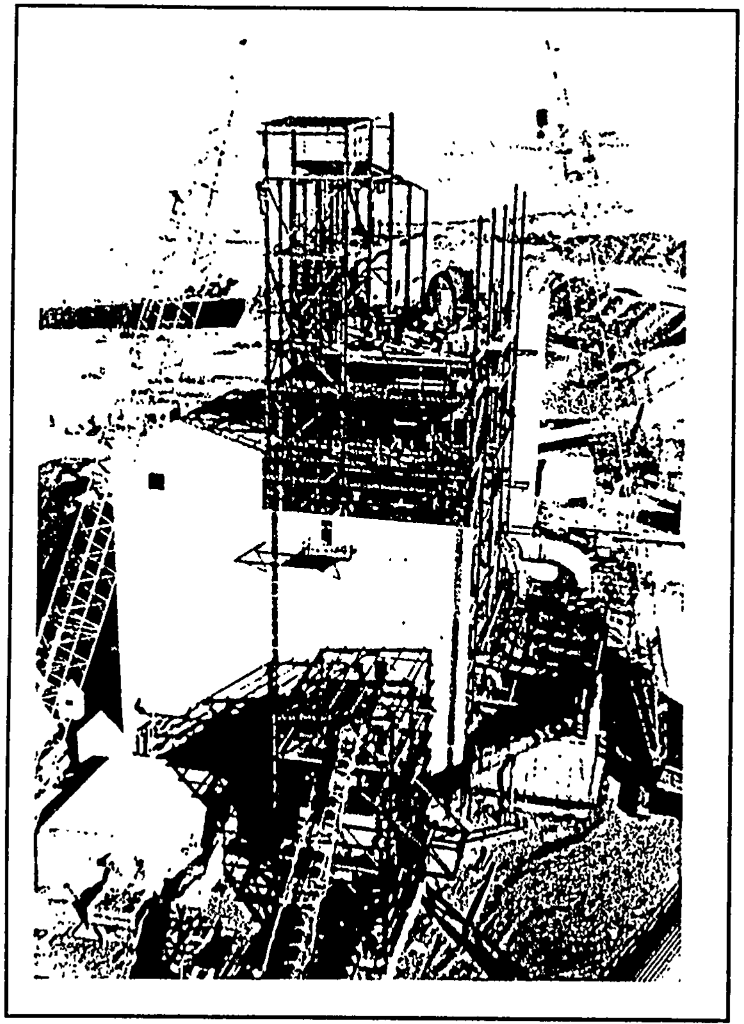


Figure 8.22 Dryer In Place Awaiting Cyclone

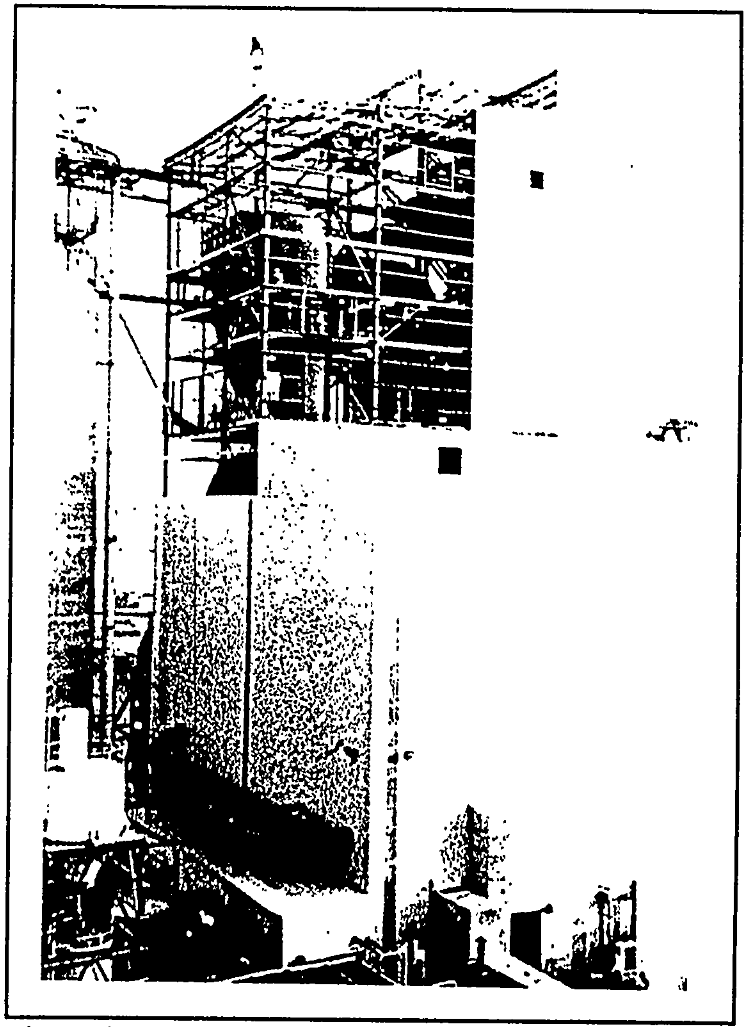


Figure 8.23 Dryer Cyclone and Structural Steel in Place

Figure 8.24 All Equipment and Structural Steel Complete

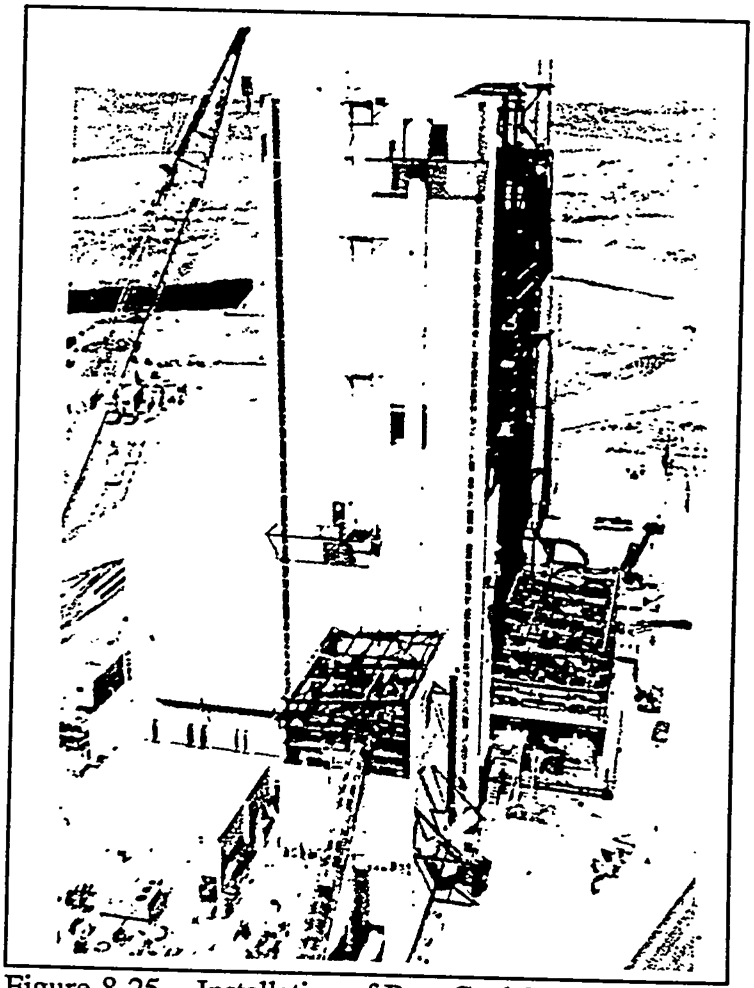


Figure 8.25 Installation of Raw Coal S-Belt and Roof

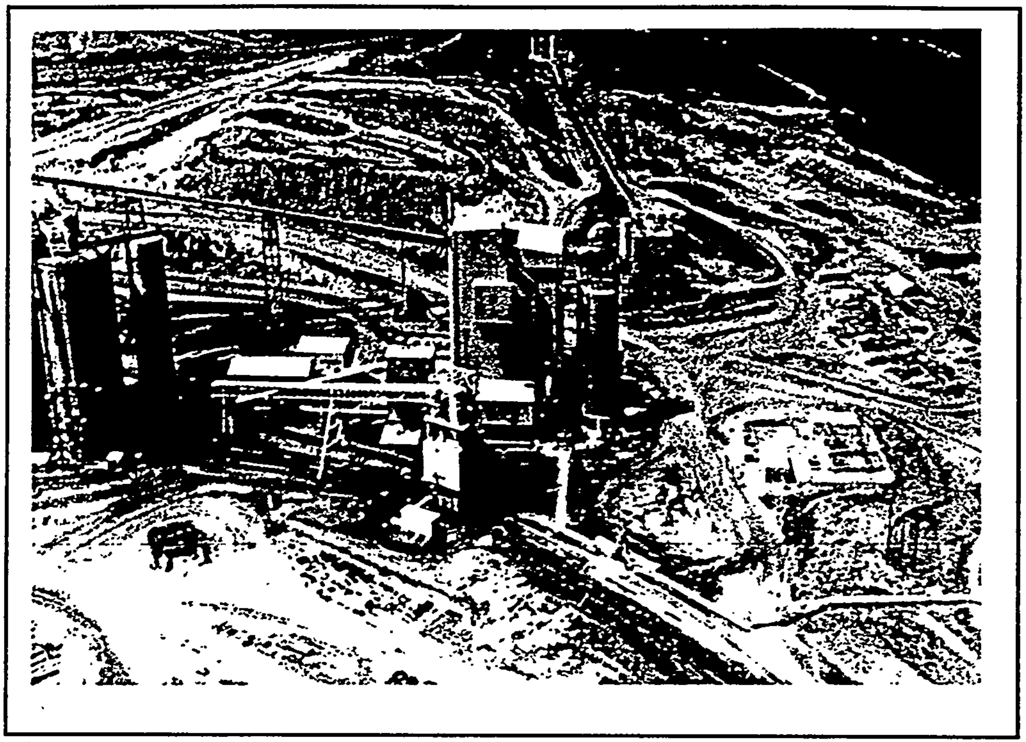


Figure 8.26 Aerial View of Completed Plant (Center)

## 8.6 SCREENING BUILDING

Separated from the main PDF structure by 20 feet, the raw coal screening building contains a large dust collector, a screen, crusher, 100 ton storage bin and loadout conveyor. This equipment was located remote from the plant due to electrical classification, noise and vibration. A spread footer foundation was also used for this 90 foot high structure and was installed under the same contract as the main plant. As mentioned above, whenever work slowed on the erection work on the PDF building, part of the construction crew moved to the assembly of the screening building.

First, the prefabricated, field erected storage bin was assembled and welded together. Then the building was erected around the bin, setting the equipment on each floor on the way up. The design of this building was completed by the KCI/ENCOAL engineering team in the field. Numerous misfits between the conveyors, mechanical equipment and building structure had to be corrected. The cost and schedule impacts of these changes were minor, however, since the building is small. The siding contractor moved over to the screening building after completing the PDF building and completed installation of the triple wall insulated panels in March, 1992.

A heating unit was installed on a small pad outside the building. Figure 8.27 shows the mechanically complete screening building just before starting the siding. The completed screening building structure is shown in Figure 8.28.

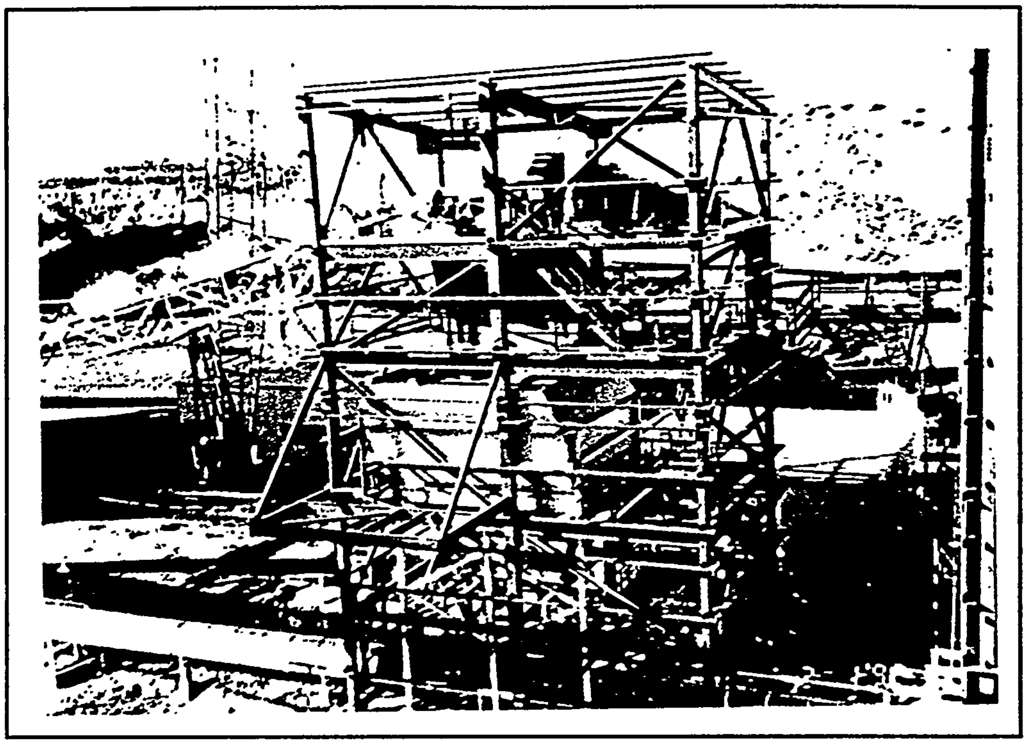


Figure 8.27 Screening Building Prior to Siding

Figure 8.28 Completed Screening Building

## 8.7 ABOVE GROUND PIPING

The above ground piping contract consisted of 5 oil lines, glycol/water heat tracing lines and the CDL loadout rack. The piping was installed on pipe racks between the PDF plant and the CDL tank farm (Figure 8.29). A large trench was included where the piping crossed a haul road for mine trucks. The work also included all of the piping inside the tank farm between the off-spec CDL tank and the 15,000 barrel storage tank, setting the pumps for CDL circulation and furnishing and installing the CDL truck/train loadout platform (Figures 8.30 and 8.31). This subcontract was bid and awarded in the fall of 1991 and most of the work was complete by December. However, late delivery of the 8" CDL loadout pump and especially the positive displacement meter delayed the final completion of the above ground piping package until April 1992.

## 8.8 ARCHITECTURAL BUILDINGS

Four buildings remote from the main PDF plant and screening building area were required for the ENCOAL Project. Two were pre-engineered metal buildings, the control room and the main electrical substation. The other two were concrete block, namely the motor control center (MCC) and the cooling water pump house. The four buildings were bid as a package under one subcontract and awarded in June 1991. Priority was placed on the MCC building to clear the way for the electrical and instrumentation subcontractor, since that is where the majority of the power and instrumentation wiring and switchgear had to be located. There were no major problems with the MCC building and it was completed in August (Figure 8.32). The next building in order of priority was the pump house, but it could not be started until a permit modification for the existing sedimentation pond changes was received. Therefore the subcontractor moved on to the substation building next.

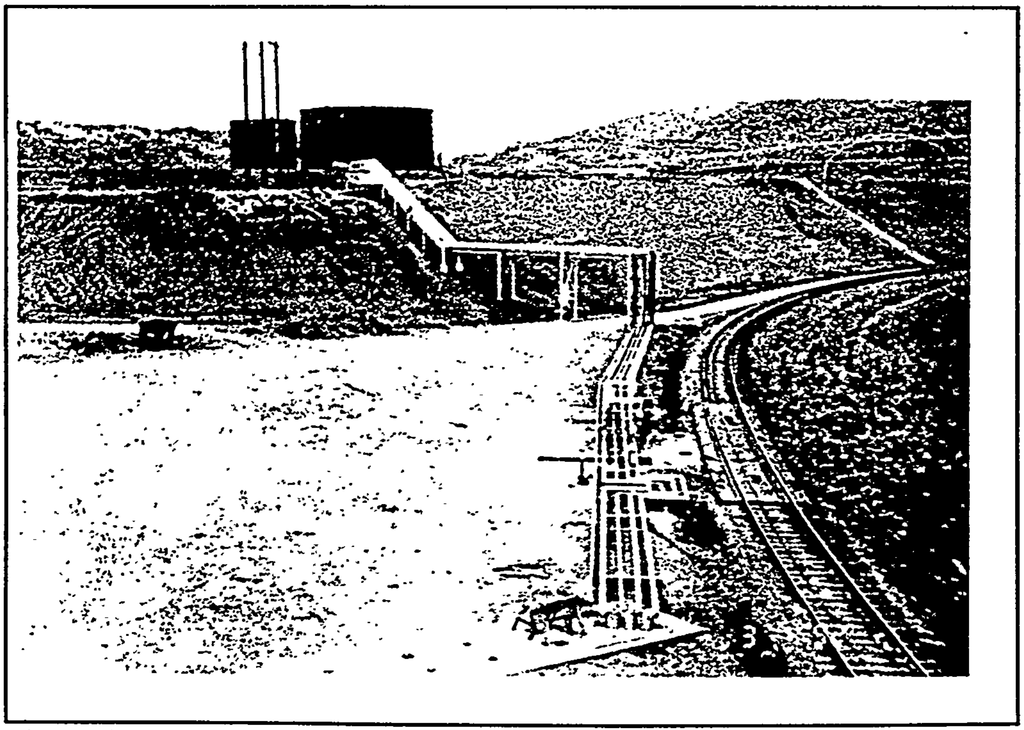


Figure 8.29 Above Ground Piping

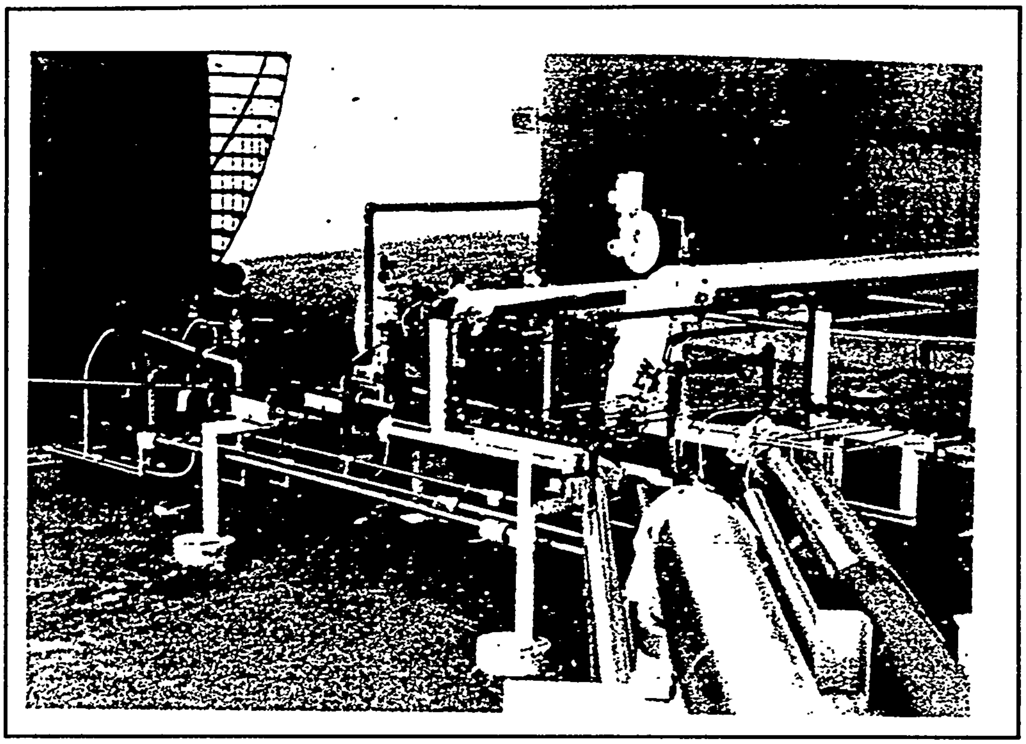


Figure 8.30    Tank Farm Piping

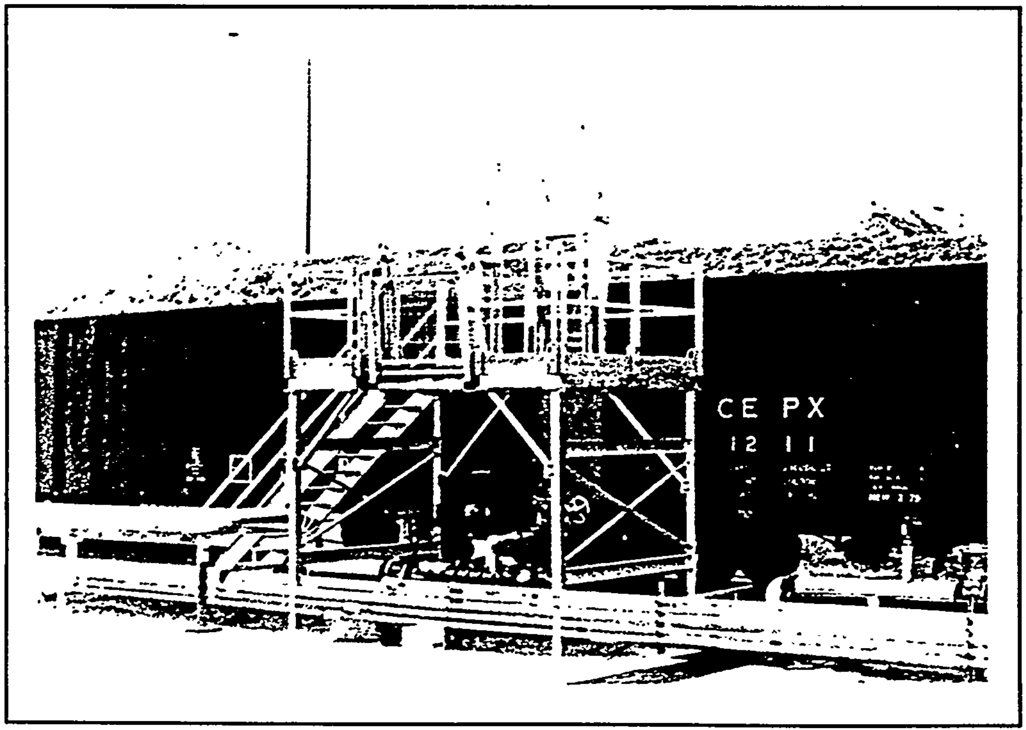


Figure 8.31    CDL Truck/Train Loadout Rack

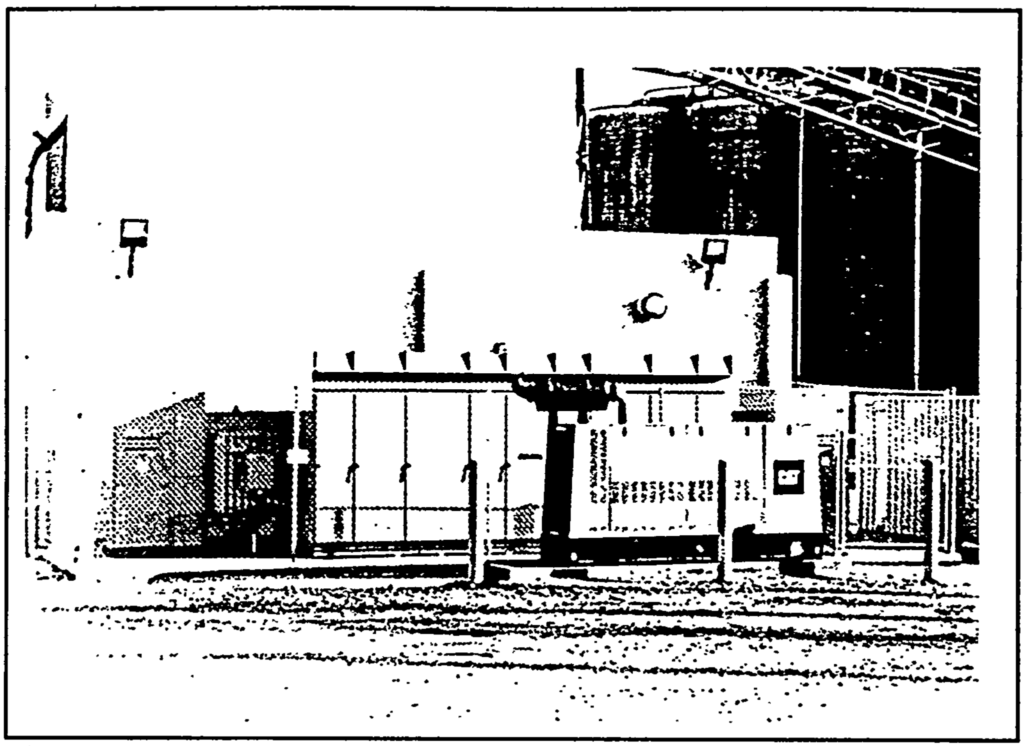


Figure 8.32 MCC Building and 480V Substation

The substation building was completed in September, 1991, opening the way for permanent power to be supplied to the construction site. Up to this point, construction power was supplied by a temporary tie-in to Triton's distribution system. ENCOAL's control building was last on the priority list. The foundations for the control building were placed at the same time as the MCC building in July while awaiting delivery of materials. The control building was framed in by the end of September and ENCOAL was able to move into its new offices in late November (Figures 8.33 and 8.34). Permit approval for construction of the pump house was finally received in September, 1991 and work was well underway by the end of the month. Completion of the pump house, including the setting of the pumps and piping was completed by the end of November, 1991 (Figures 8.35 and 8.36).

## 8.9 ELECTRICAL AND INSTRUMENTATION

Engineering and procurement of the electrical and instrumentation systems was the last home office work to be completed at Kellogg, as would be expected. The subcontract for the electrical and instrumentation field installation was bid in April, 1991 and awarded by mid-June. The subcontractor, mobilized in July as soon as enough materials were on hand to keep the crews efficiently working. The instrumentation portion of the work was in turn subcontracted to a specialist. Both of these subcontractors struggled for places to work at times throughout the project due to delays in equipment deliveries and slow progress on the mechanical erection of the PDF plant equipment. These problems were minimized by controlling staff levels to match the amount of work areas available. Use of cable trays in the PDF plant instead of individual conduit and the preplacement of conduit with the underground piping package significantly improved the productivity of the electrical installation crews. Together, these two items resulted in a lower peak workforce for the electrical and instrumentation subcontract than originally projected.

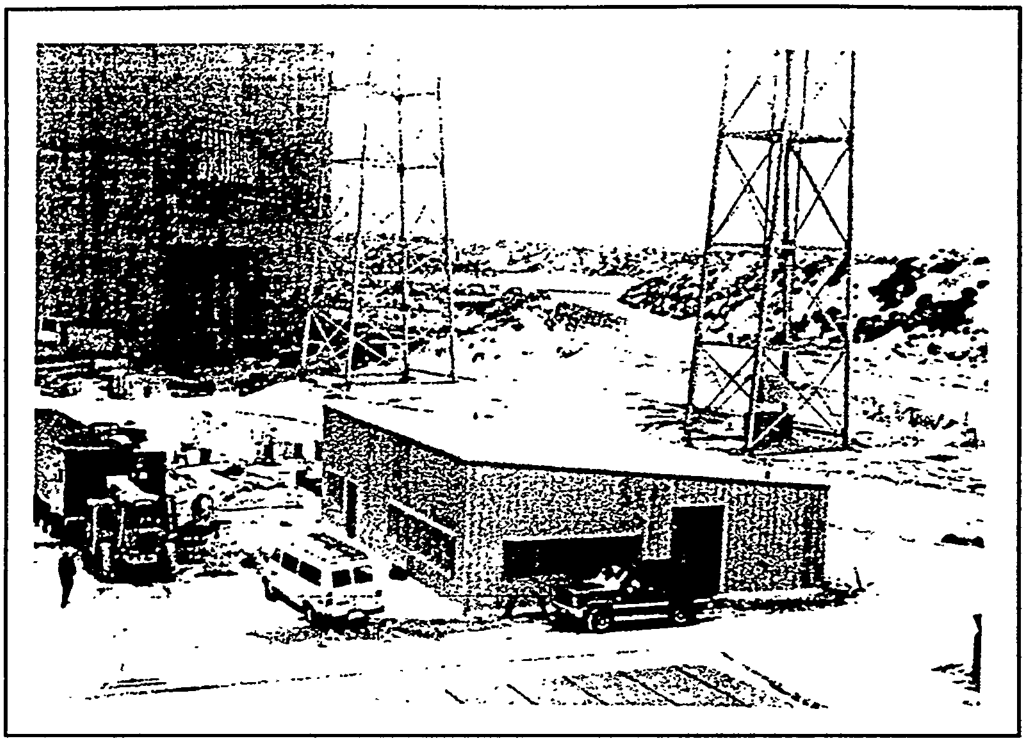


Figure 8.33 Control Building Near Completion

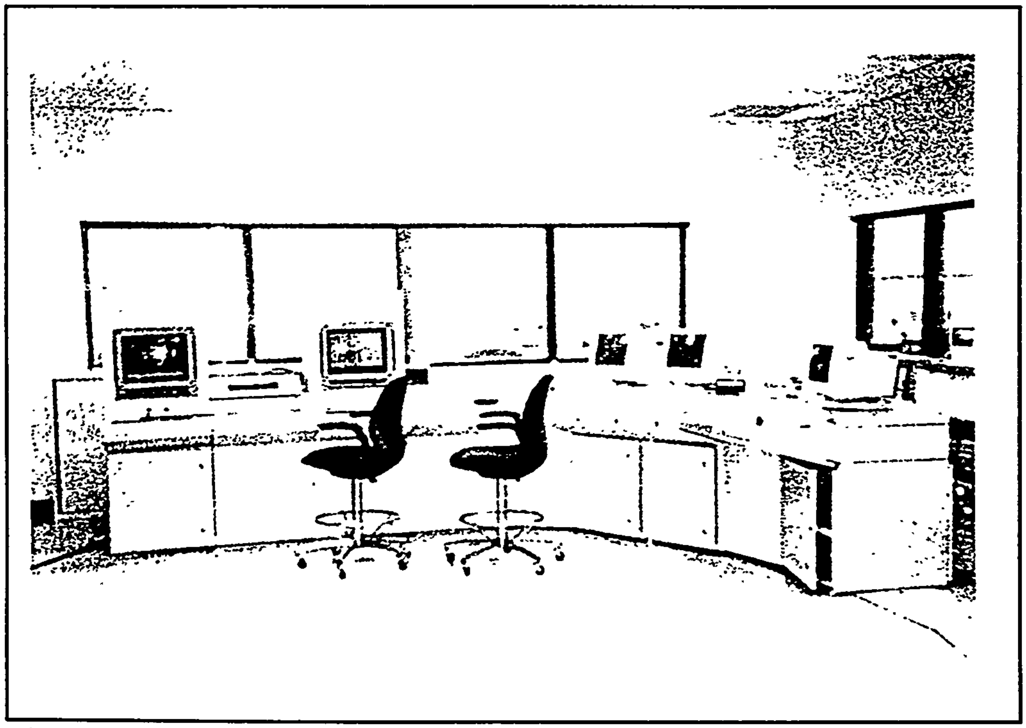


Figure 8.34 Original Control Room Layout

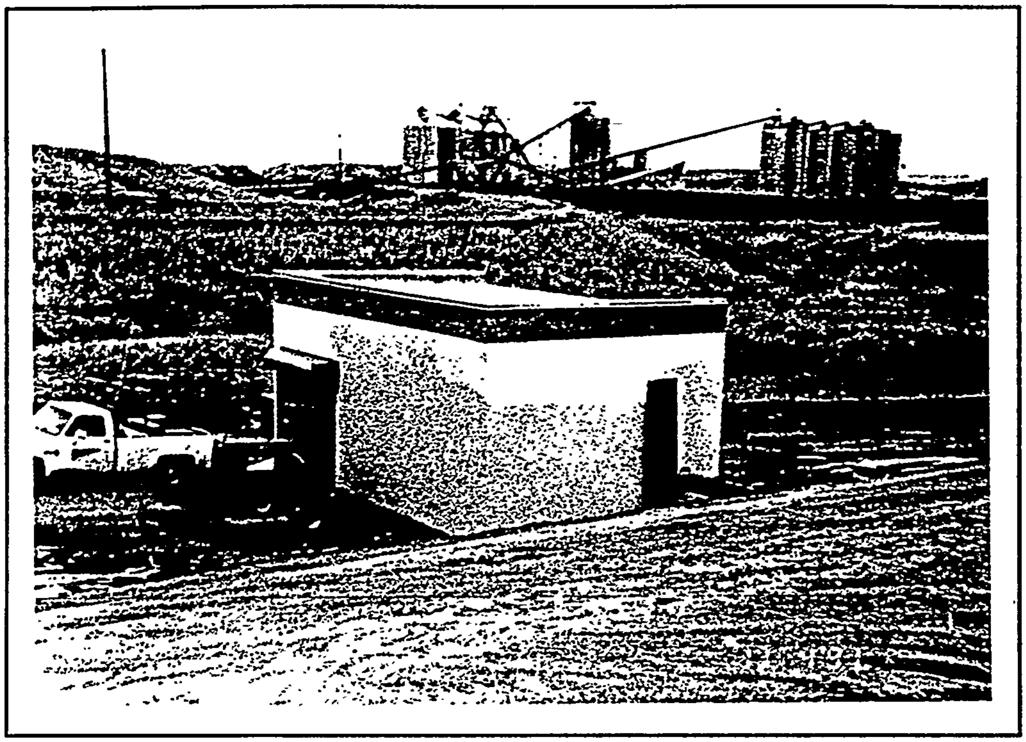


Figure 8.35 Cooling Water Pump House

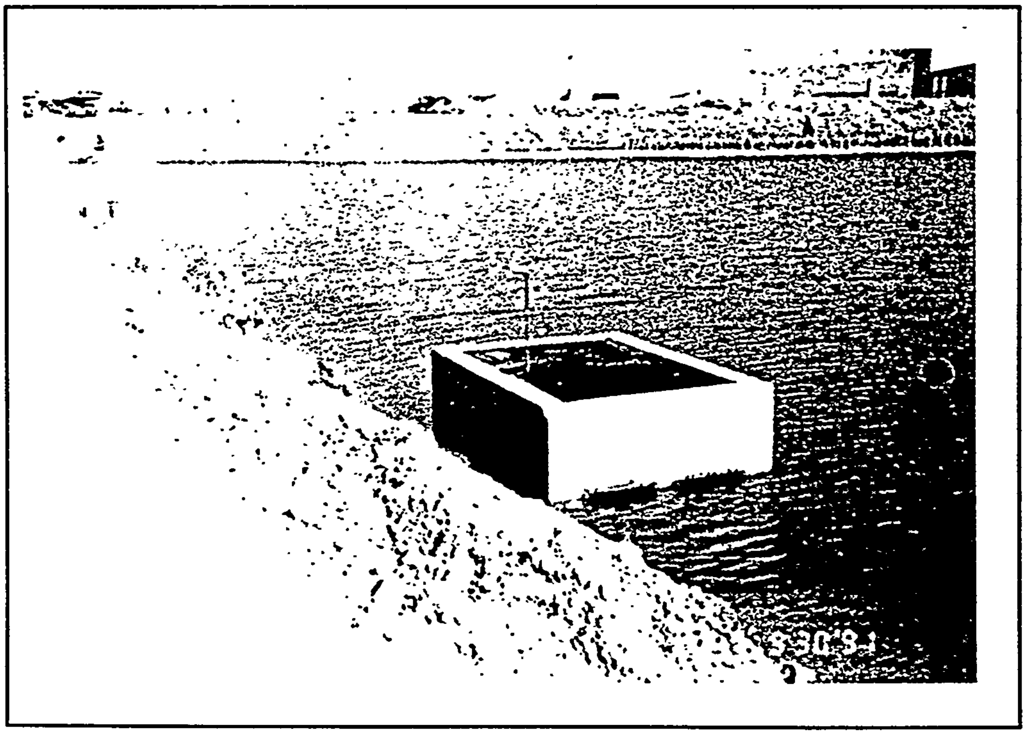


Figure 8.36 Cooling Water Intake - Existing Triton Pond

Overall the electrical and instrumentation work went fairly smoothly. There were only minor interface problems with other trades as these subcontractors followed behind and under the erection crews. One constant problem was weld splatter. Welders working overhead had to be reminded to put down fire blankets and use spotters to prevent people on the lower floors from being burned. The same was true for welders on the electrical and instrumentation crews when they were attaching conduit supports to the structure. Most of the motor controls and wiring were in place by January, 1992. Installation of the instrumentation wiring and equipment had to wait on completion of the piping, including flushing and testing. Terminations took place from mid-January through April, 1992, which included hooking up all motors and checking for rotation. The only subcontractor to remain through commissioning, the electrical and instrumentation crews worked closely with ENCOAL's operations staff to get all facilities ready to operate. They also helped calibrate all instruments. Final completion of the subcontract occurred in May, 1992.

## 8.10 MISCELLANEOUS

Several other subcontract activities were dovetailed into the construction effort over the course of the Project. These included the supply and field erection of the two CDL storage tanks (1-2100 bbl. and 1-15,000 bbl. shown in Figure 8.37) which was done on a turnkey basis. Insulation of the piping and pumps was part of the above ground piping subcontract. Epoxy lining for the CDL storage tanks and ceramic lining of the pyrolyzer cyclone were also done as separate subcontracts. As opposed to the insulation contractor, where there was a lot of interface with the other trades with the scaffolding, the latter two subcontracts were all internal and posed no problems. A railroad siding for up to 10 tank cars was constructed as part of the Project and it was done by a local subcontractor acceptable to the Burlington Northern Railroad (Figure 8.38). This work was done during the dry summer months of 1991 and was completed on August 15. Other small miscellaneous work that came up during the course of the Project was handled by extending the scope of work of existing subcontractors using quoted unit prices.

Although delays in the preferred construction schedule did occur, the overall project was completed two months before the baseline schedule submitted to the DOE, including commissioning and start-up. Figure 8.39 shows the percent completion versus time for the original planned construction period, as revised during the construction activity and the earned progress (actual). Figure 8.40 shows the actual manpower requirements versus the revised plan. The actual Phase I (Design) and Phase II (Construction and Start-Up) costs of $51,272,000 were right on budget.

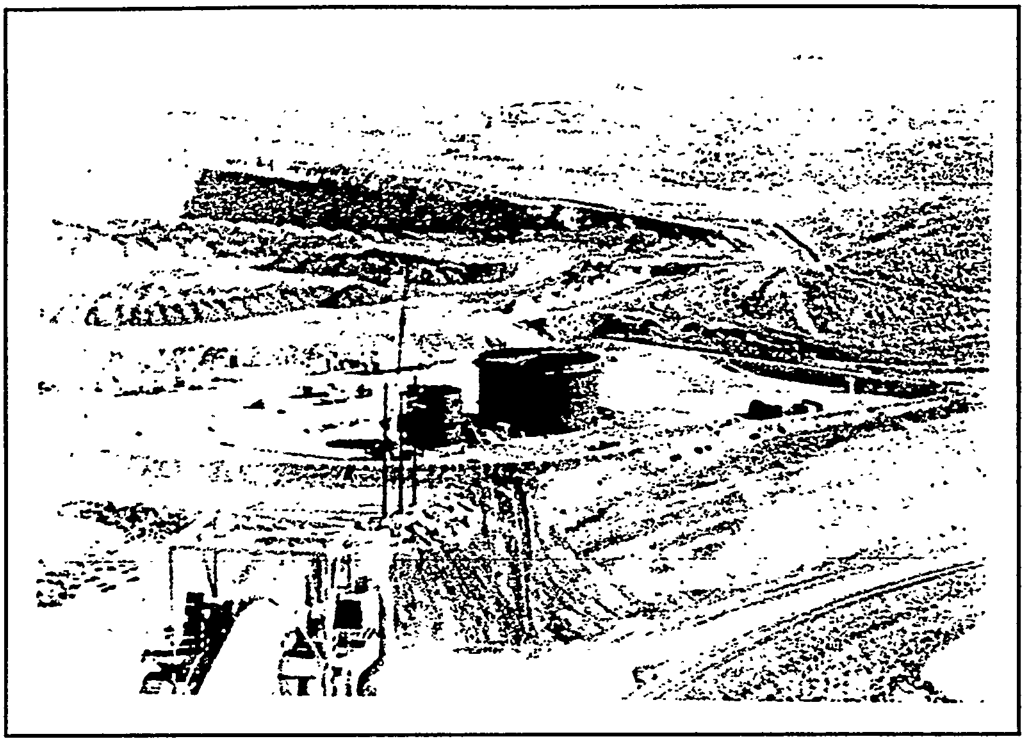


Figure 8.37 CDL Storage Tanks Under Construction

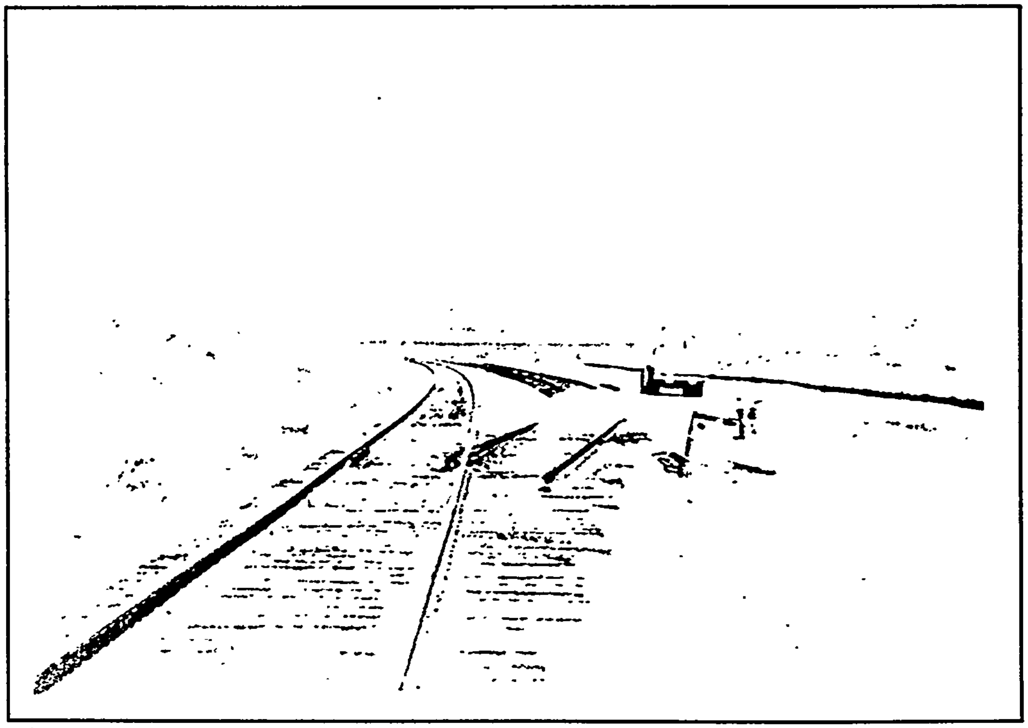
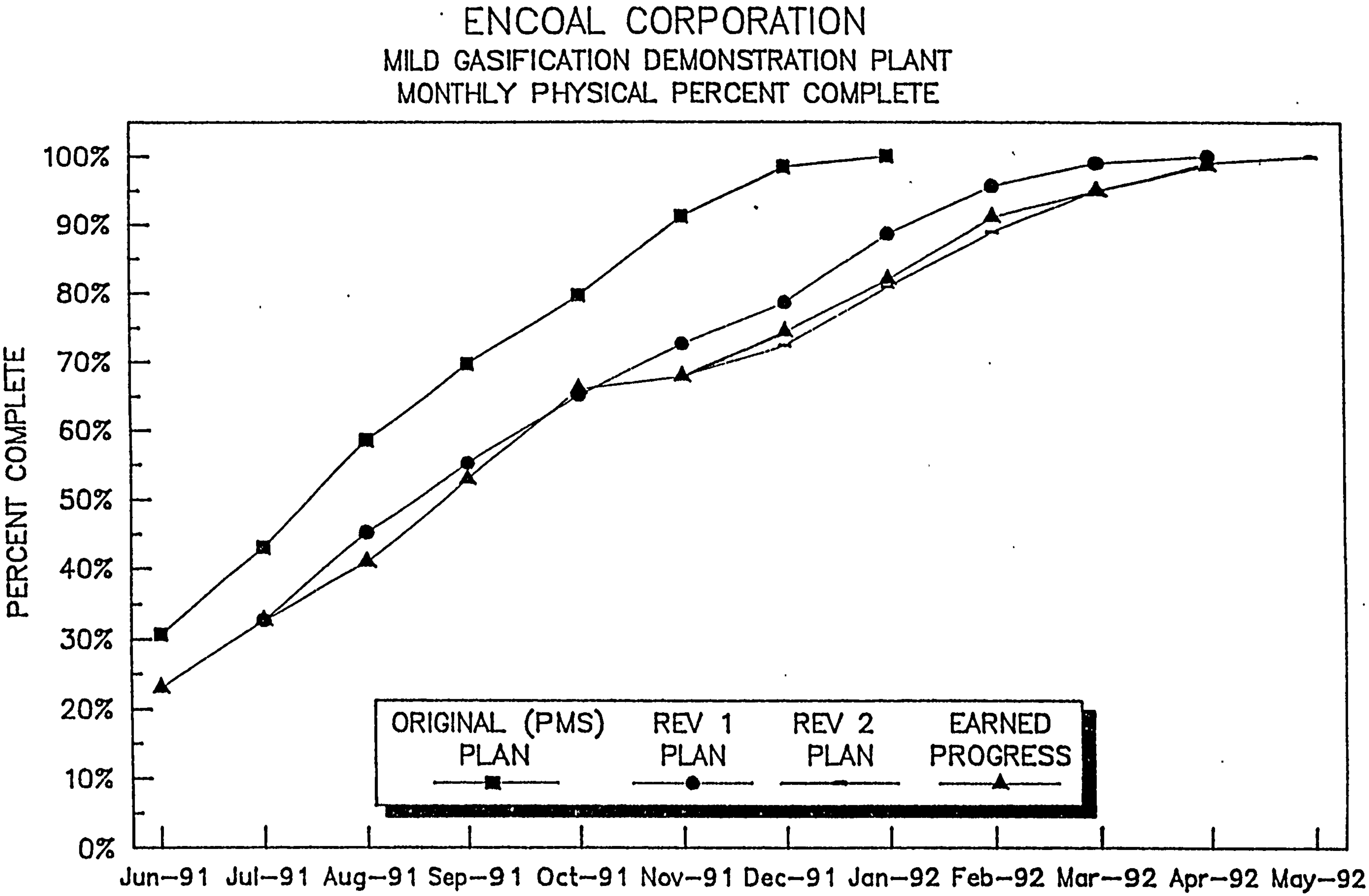
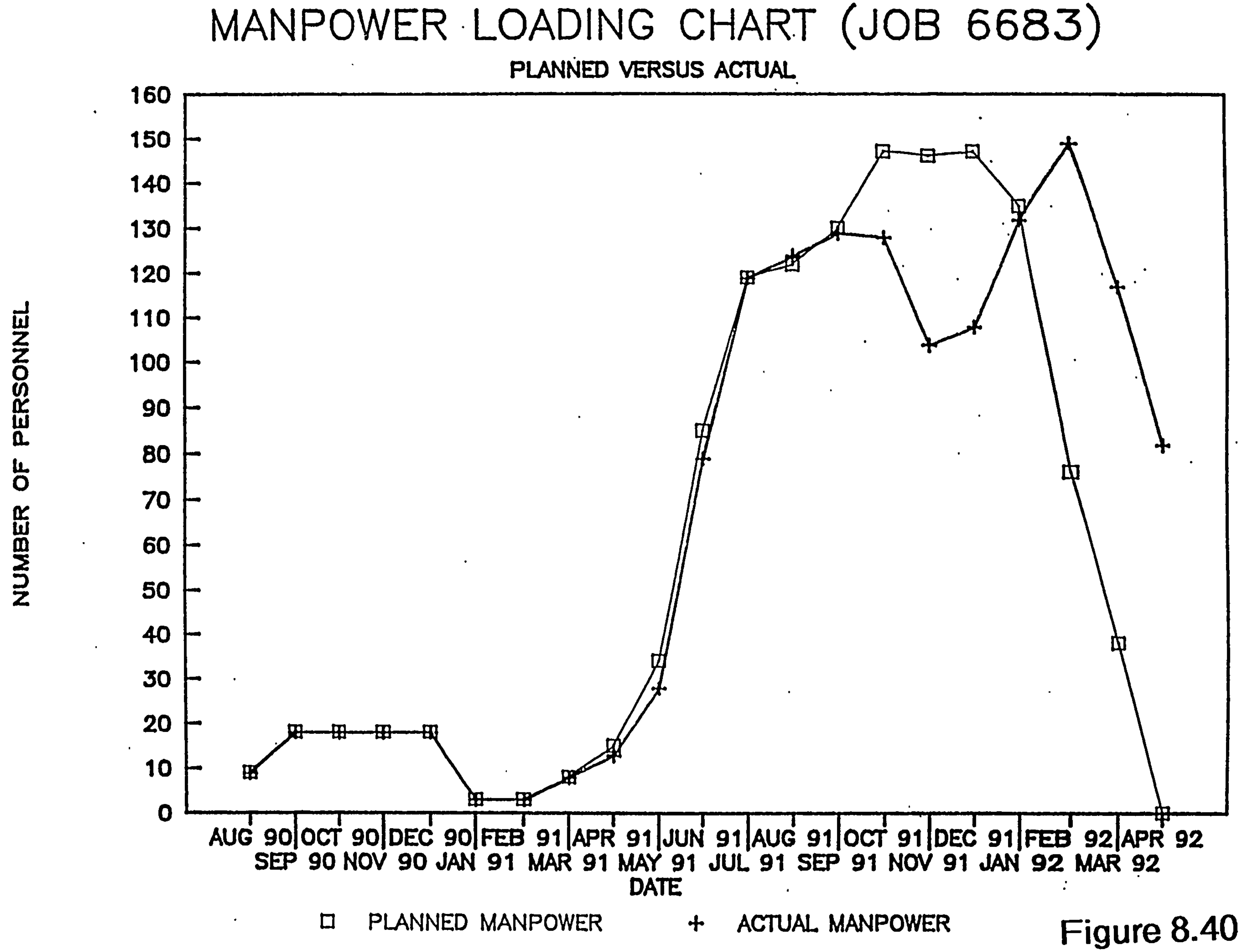


Figure 8.38 Rail Siding Under Construction


ENCOAL CORPORATION
MILD GASIFICATION DEMONSTRATION PLANT
MONTHLY PHYSICAL PERCENT COMPLETE

KCI CONSTRUCTORS, INC.
JOB 6683 – GILLETTE, WYOMING
DATA DATE 30 APRIL 1992

Figure 8.39


MANPOWER LOADING CHART (JOB 6683)
PLANNED VERSUS ACTUAL
NUMBER OF PERSONNEL
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
AUG 90
SEP 90
OCT 90
NOV 90
DEC 90
JAN 91
FEB 91
MAR 91
APR 91
MAY 91
JUN 91
JUL 91
AUG 91
SEP 91
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NOV 91
DEC 91
JAN 92
FEB 92
MAR 92
APR 92
DATE
□ PLANNED MANPOWER
+ ACTUAL MANPOWER

Figure 8.40

# 9.0 ENVIRONMENTAL CONCERNS

During design, a high priority was placed on the minimization of waste generation. Therefore, no significant environmental impacts or consequences are expected from the Project. All necessary permits for the construction of the facility were secured during the design phase of the Project. The design criteria for the demonstration plant met the Wyoming Department of Environmental Quality's Best Available Technology criteria in every aspect. The following sections briefly highlight the design measures taken in the affected environmental disciplines and their anticipated impacts.

## 9.1 AIR POLLUTANTS

During normal operation, any purge gas that is released to the atmosphere must pass through the desulfurization unit, and any purge gas that is produced in the pyrolyzer loop can be sent to the desulfurization unit only after it has been incinerated in the dryer combustor. Therefore, air pollutants emitted from the PDF building stack consist only of minor amounts of $NO_x$, $SO_x$, CO, hydrocarbons and particulates. Emissions for each pollutant are below the 100 ton per year level for named (fuel conversion) sources. Rigorous permitting and monitoring requirements were thus avoided. This was achieved through careful selection of appropriate pollution control technologies and process control equipment.

$NO_x$, CO, and hydrocarbons emissions are minimized by thermal decomposition in the dryer combustor. $SO_2$ and particulates emissions from the process are controlled by the purge gas treatment described in Section 6.13. In addition, particulates emissions from the crushing/screening building, raw coal storage silo, and PDF storage silo are controlled by wet scrubbers. The efficiencies of these scrubbers are over 99%.

## 9.2 WATER EFFLUENTS

The process is designed to operate such that no water will be condensed during normal operation, thus eliminating the generation of wastewater contaminated by hydrocarbons. All liquid effluents generated from plant upsets, such as off-specification CDL or intermediate products, can be recycled back to the facilities and upgraded. Internal recycling of process and clean-out water occurs through collection of such water in concrete floor containment trenches and vessels. This water, along with the pyrolyzer quench condensed water and other incidental streams (i.e., leaks from equipment seals), are collected for process usage.

Washdown water from the solids handling portion of the facilities, (i.e., from the raw coal storage silo, screening building, and solids handling systems in the PDF building), and the discharge from the wet scrubbers are collected in floor sumps located at various areas. It is then pumped to a collection sump in the screening building. This collection sump allows the effluent to pass through a bank of hydrocyclones for separation of solids from the liquid. The liquid portion is pumped to the Buckskin Mine Wastewater Reservoir No. 1 for treatment and settling prior to discharge to the environment. The separated fines are added to the fines storage bin in the screening building which is used to store the undersized material from the triple-deck vibrating screen. The fines are then returned to the Buckskin Mine product via truck or conveyor. When the hydrocyclones are out of service, all solids report to the settling pond.

The sodium sulfite effluent generated by the purge gas treatment system (described in Section 6.13) is pumped to a temporary precipitate storage reservoir. The reservoir provides sufficient surface area to promote natural evaporation of water and oxidation of sodium sulfite to sodium sulfate. This precipitate, in the form of a slurry, is nonhazardous and nontoxic. The temporary storage of the precipitate is confined within a clay liner until a permanent disposal facility is designed, permitted and constructed.

In the conceptual design, the permanent reservoir will be double lined with a leak detection/headbreak system. The liners will be composed of a primary synthetic membrane liner and a secondary amended clay liner separated by a geonet drainage layer. The reservoir will be designed to channel any leakage entering the drainage layer to sumps for return to the reservoir. This design allows both continual monitoring of the synthetic liner integrity and, in the event of a leak in the synthetic liner, maintenance of a minimum driving head on the secondary clay liner, thereby effectively preventing leakage through the liner system.

As discussed in Section 7.3, cooling water is obtained from Buckskin Mine Sedimentation Reservoir No. 1 for indirect cooling applications, make-up water, and washdown. The existing Triton water allocation rights encompass the net consumption that may be needed to supplement the cooling/make-up water stream. It is anticipated that the cooling water return to the reservoir will increase the reservoir temperature by 8 to 10°F. No environmental effects are predicted under the National Pollutant Discharge Elimination System (NPDES).

### 9.3 SOLID/HAZARDOUS WASTE GENERATION

No solid hazardous waste is expected to be generated from the process as explained in previous sections. Sodium sulfite solution will be sent to the temporary precipitate storage reservoir. If complete evaporation of water from the reservoir is assumed, a nonhazardous solid waste of coal fine/sodium sulfate mixture is obtained. Current design philosophy plans for the eventual on-site disposal of this material. The 1/8" x 0" rejected coal collected in the screening building is returned to the Buckskin Mine as a salable product, thus avoiding the generation of additional solid waste.

## 10.0 SAFETY PRACTICES

Safety is integrated into the design and operation of the facilities. The on-site safety program, established at the Buckskin Mine, was carried over to this Project. Specific ENCOAL safety procedures were developed which specify actions required during operation and maintenance of the facilities to protect workers' health and safety. During construction, the safety program was managed by KCI. There were a number of elements to their highly successful program that are discussed in more detail below.

## 10.1 INDUSTRIAL HYGIENE

Every effort was made during design to reduce worker exposures to potential hazardous materials or conditions. This was achieved through engineering controls. Monitoring will aid in evaluating the effectiveness of the engineering controls. The monitoring program will include personal monitoring of workers potentially exposed to a hazard as well as area and/or source monitoring. Remote air contaminant monitors will detect unsafe levels of CO, $H_2S$, $SO_2$ and $CH_4$. These monitors trigger audio signals to warn of air contaminants. They are part of the control systems that initiate and record alarm conditions and alert plant operators to initiate response procedures. A physical inspection and gas detection evaluation of the plant is conducted at least twice daily to ensure that areas are safe for workers.

## 10.2 PHYSICAL HAZARDS

The primary physical hazards associated with the project are noise, extreme temperatures, and combustible materials. Design efforts were made to select equipment that generate low sound intensities. Noise monitoring and surveys were conducted during startup to identify areas with noise levels which exceed the MSHA time weighted average limits. A hearing conservation program has been established for these areas.

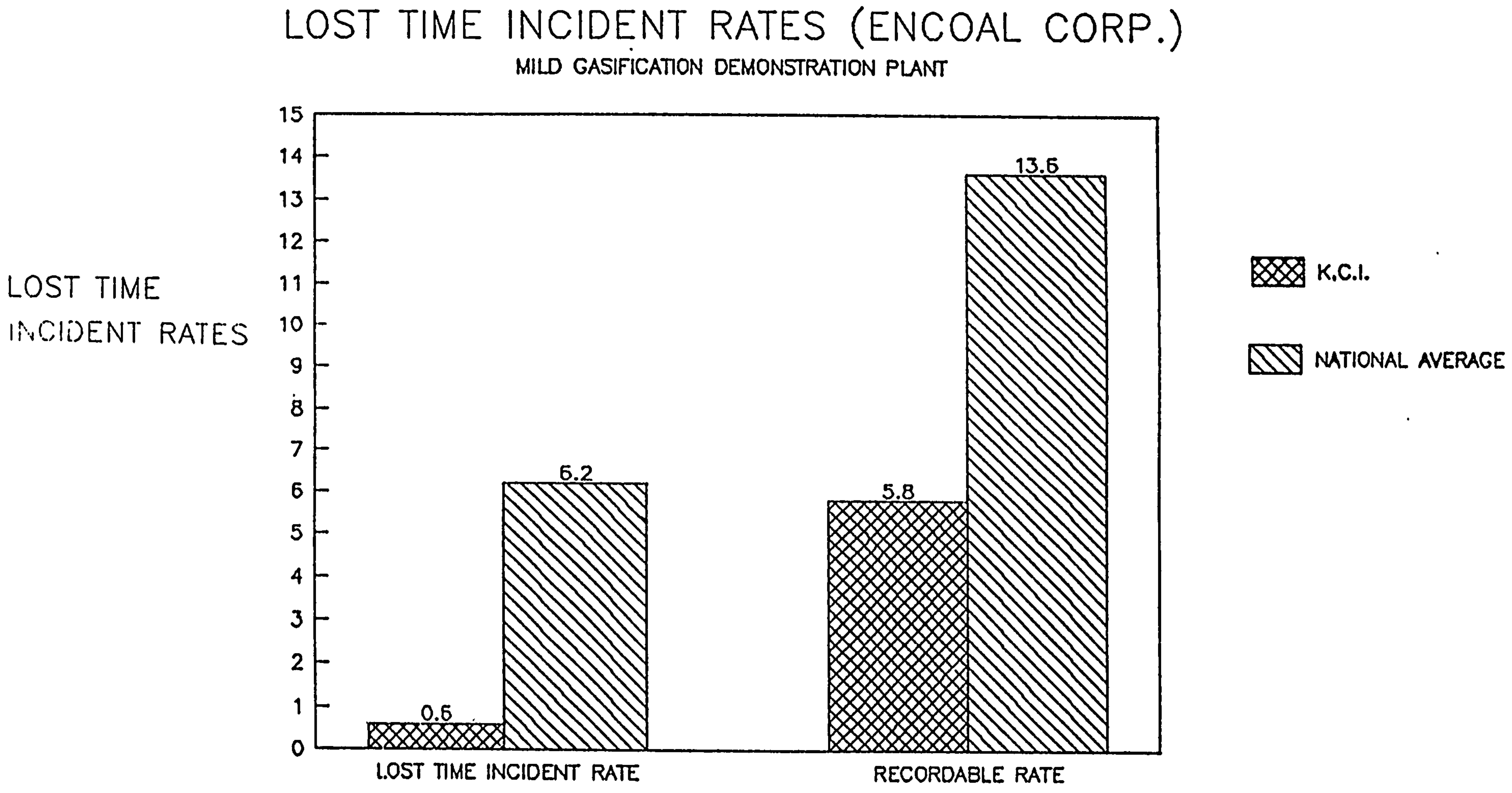
Heat stress will be evaluated during plant operations to determine if design measures (liners, coatings, insulation and ventilation) provide sufficient protection for the workers. Cold stress may be environmentally induced in excess of design considerations (siding, heating and ventilation systems). Additional operational measures will be determined pending the results of these assessments.

Combustible materials are inherent in any coal handling and processing facility. The major hazard is the accumulation of coal dust. Regular clean-up procedures must be practiced to prevent the accumulation of coal dust. Daily inspections are required throughout the facilities to ensure that no combustible material accumulates.

## 10.3 CONSTRUCTION SAFETY PRACTICES

The safety program administered by KCI during construction was very successful as documented by Figure 10.1 which shows the lost time and reportable incident rate for the construction phase of the Project. Basic construction safety practices were developed jointly by ENCOAL and KCI incorporating MSHA requirements and Triton's established practices. This effort resulted in a document that became part of all subcontractor's terms and conditions. In addition to the contractual requirements, a number of safety enhancement programs were institutionalized by KCI. These programs were a balanced combination of recognition/awards and positive, fair enforcement of all safety practices as follows;

| | |
|---|---|
| (1) Enforcement | Universally applied policies and rules together with appropriate discipline when needed. |



The incidence rates represent the number of injuries and illnesses or lost workdays per 100 full-time workers and were calculated as: (N/EH) X 200,000, where

N = Number of injuries and illnesses or lost workdays.
EH = Total hours worked by all employees during calendar year.
200,000 = Base for 100 equivalent full-time workers (working 40 hours per week, 50 weeks per year).

Figure 10.1

| | |
|---|---|
| (2) "Kelway" | A safety and productivity enhancement program that involves all site personnel and their families. At ENCOAL, safety awareness and involvement was achieved through a safety committee made up of representatives of each subcontractor, KCI and ENCOAL. A safety suggestion program, safety crew of the month, employee of the month, safety poster contests for children, family site tours, picnics, milestone celebrations and an awards program were all used to increase safety awareness. Periodic awards that were given included dinners for the employee and their spouse, caps, jackets, sweatshirts and belt buckles. A monthly site newsletter was also published with pictures and stories highlighting safety events and awards. |
| (3) "STOP" | Safety Training and Observation Program originally developed by the Dupont Company. Three series of classes were conducted during the construction period. |
| (4) Meetings | Daily "toolbox" safety meetings were held by each subcontractor and attended frequently by KCI/ENCOAL. A weekly safety committee meeting with minutes and action items was held and attendance was required by representatives of each subcontractor. |
| (5) Case Management | When an incident did occur, KCI worked with the subcontractors and local health providers to insure the employee was properly treated, but that no unnecessary prescriptions or treatments were directed that would increase the time away from work or elevate the level of an incident to a lost time. Local doctors visited the site to discuss working conditions, MSHA regulations and safety practices so they would be in a better position to judge an employees ability to perform their work safely. |

It is believed that all of these programs contributed to the excellent safety achievements on the Project. Several of these programs were adopted by subcontractors and ENCOAL for on going use.

## 11.0 CONCLUSIONS

The process engineering, detailed design and construction have been completed for the 1000 ton/day ENCOAL Mild Coal Gasification Project. The plant has processed subbituminous Powder River Basin low-sulfur coal and produced PDF and CDL. PDF is a premium solid fuel with good burning characteristics and low sulfur content. CDL has properties similar to a low-sulfur heavy industrial fuel oil.

The design of the demonstration plant is based upon pilot plant studies which provided operating data and properties of products. Mechanical equipment selection resulted from many discussions with equipment vendors, as well as from the knowledge and experience of members of the design team.

The major design accomplishments for the process are:

1. drying coal on a rotary grate by bringing it into direct contact with hot gas.
2. pyrolysis of dried coal on a rotary grate by bringing it into direct contact with hot gas.
3. cooling of pyrolyzed coal by direct water quenching and indirect heat-exchange with cooling water.
4. condensation of high boiling hydrocarbons from a gaseous stream by direct vapor/liquid contact in a packed-bed column without condensation of water.
5. treatment of a purge gas stream before its release to the atmosphere.

Sufficient operating flexibility is built into the plant to permit extensive evaluation of the major process variables. Environmental concerns and safety practices were given a very high priority in design considerations.

Construction of the plant was accomplished with few problems other than minor equipment delivery delays. The total construction from start to finish was less than 18 months due to the successful fast-track approach and the work was done within budget. An exemplary safety record was achieved.

It is believed that this process represents acceptable technology and marketing risks. Commercial plants should provide attractive investments. Both products are environmentally superior, and are viable fuels to help utilities meet the Clean Air Act Amendments of 1990.

## APPENDIX A

Simplified general civil designs for the ENCOAL facilities are shown in Figure A.1 to Figure A.14. Figure A.1 describes the general layout of the facilities. The dimensions of each structure and its relative position are approximated. The control room for the facilities is shown on Figures A.2 and A.3. Figures A.4 to A.13 show the PDF structure and its simplified floor plans. The relative dimension and position of each piece of equipment are approximated. Figures A.14 and A.15 describe the screening building. The equipment numbers shown on Figure A.6 to Figure A.14 are cross referenced to their general descriptions in Table A.1.

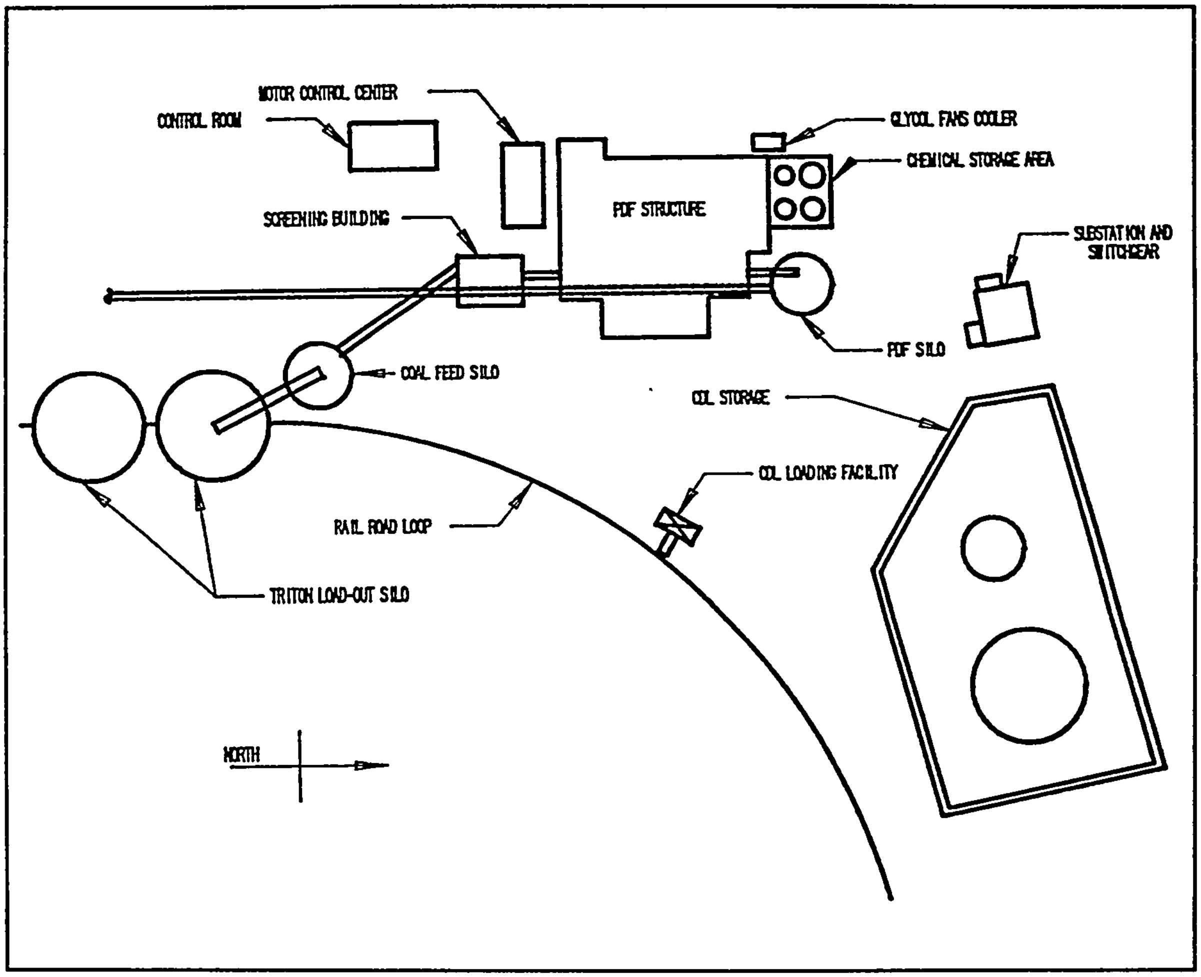


Figure A.1 ENCOAL Facilities Layout

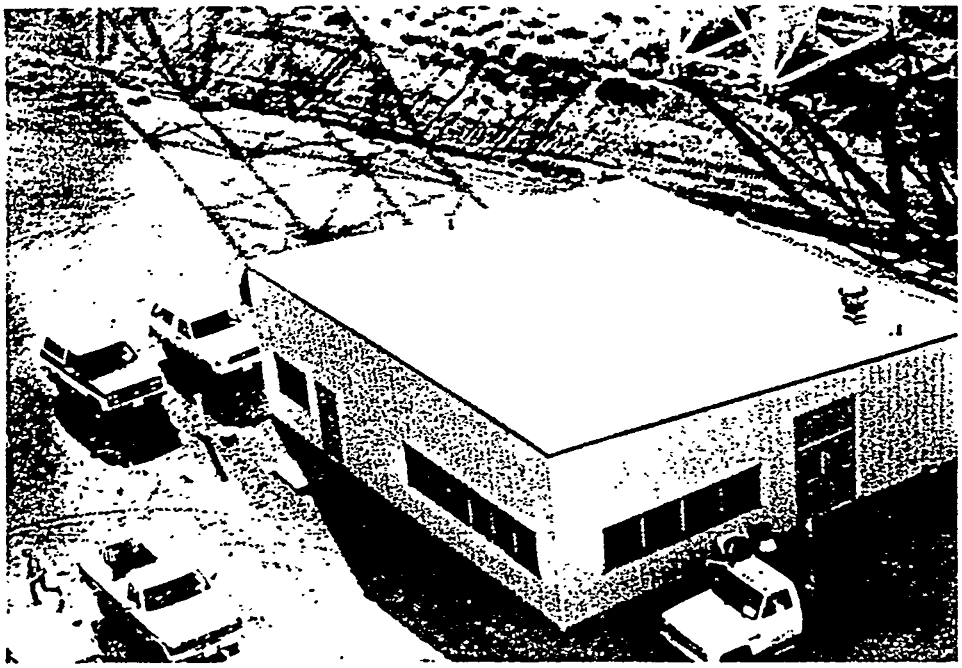


Figure A.2 Control Room

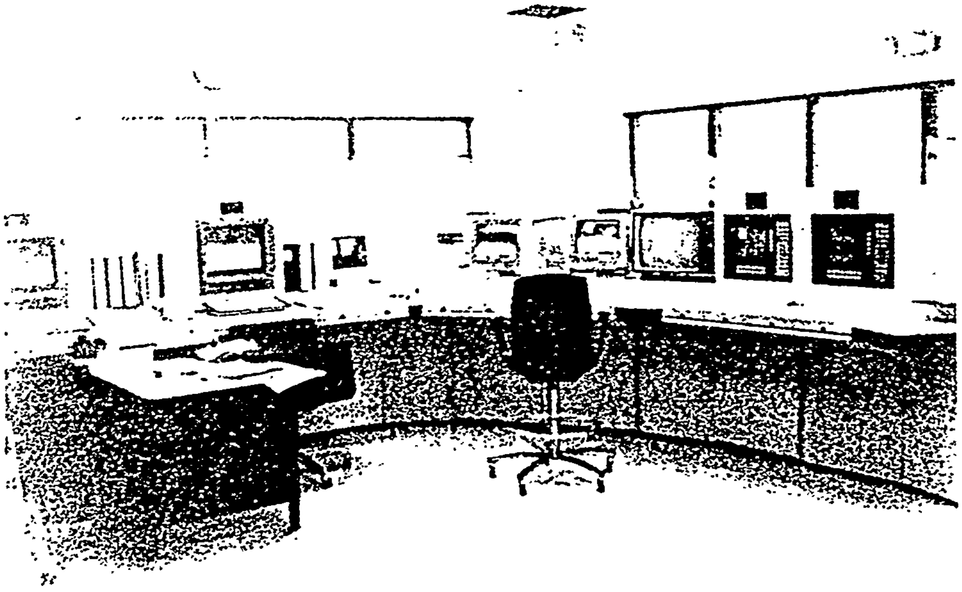


Figure A.3 Interior of the Control Room

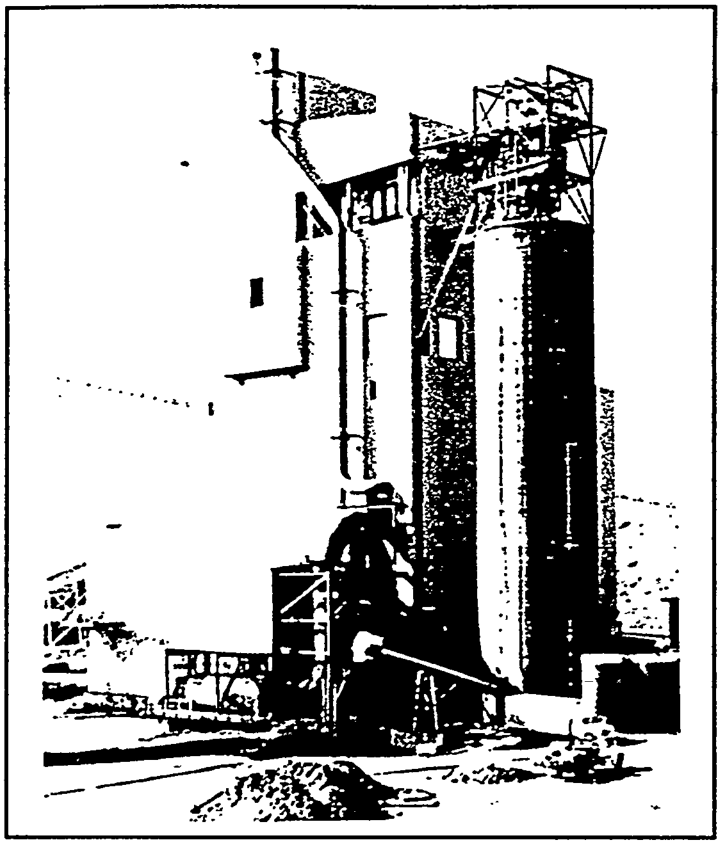


Figure A.4 PDF Structure Looking Southwest

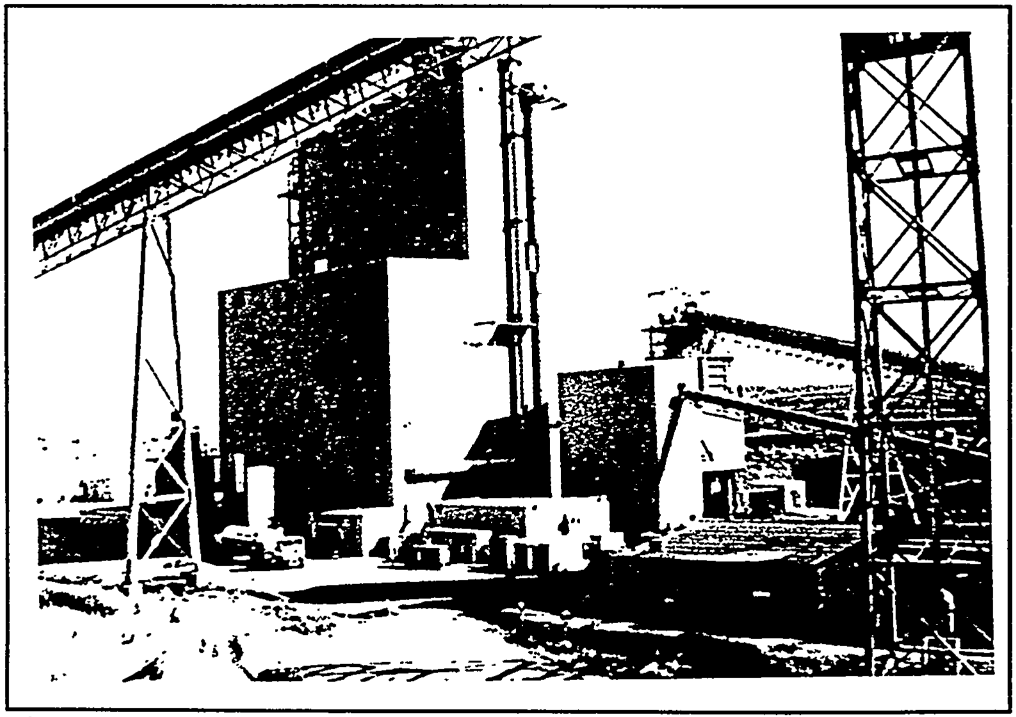


Figure A.5 ENCOAL Facilities Looking Northeast

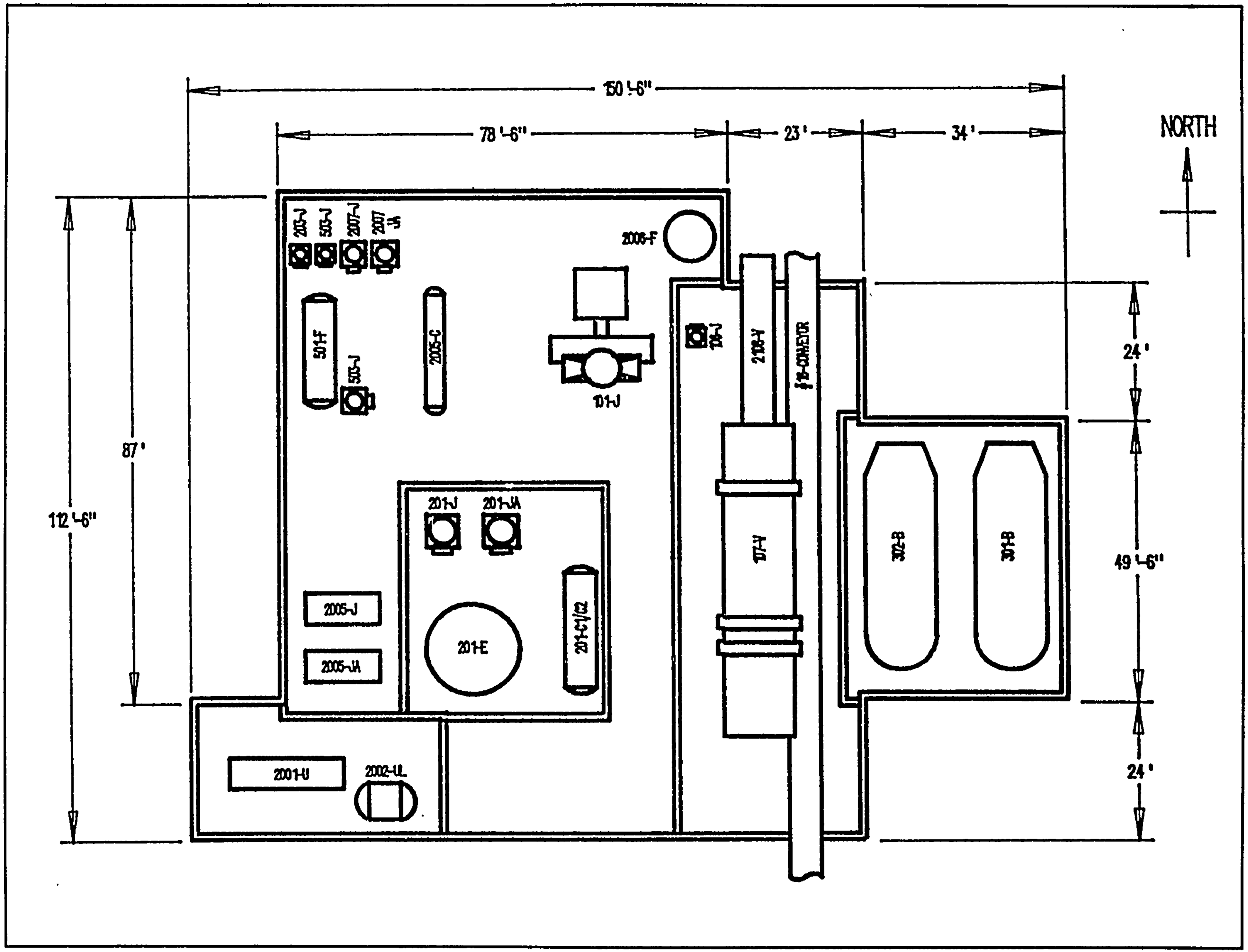


Figure A.6 PDF Structure Floor Plan (Elevation 100'-6")

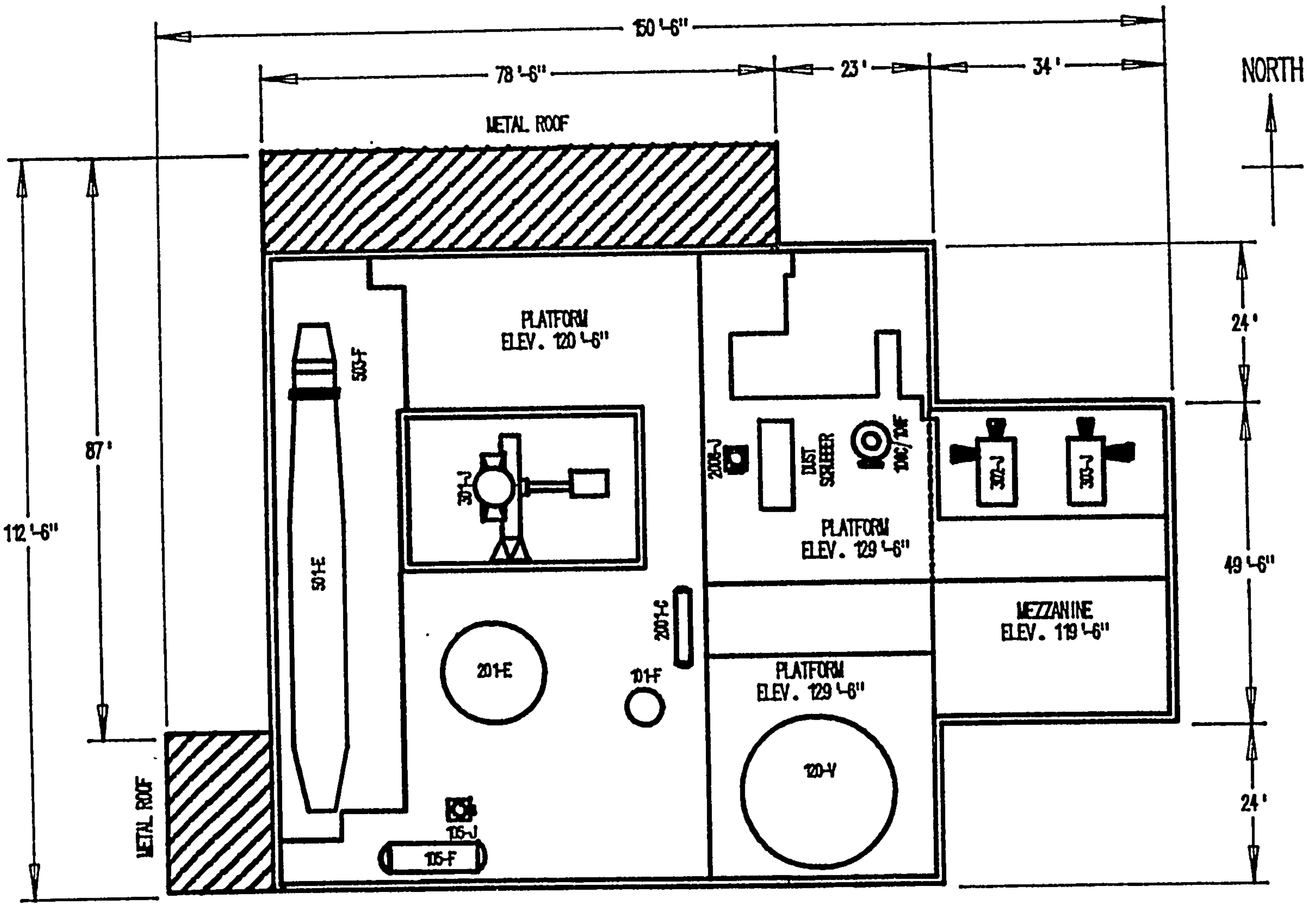


Figure A.7 PDF Structure Floor Plan (Elevation 129'-6")

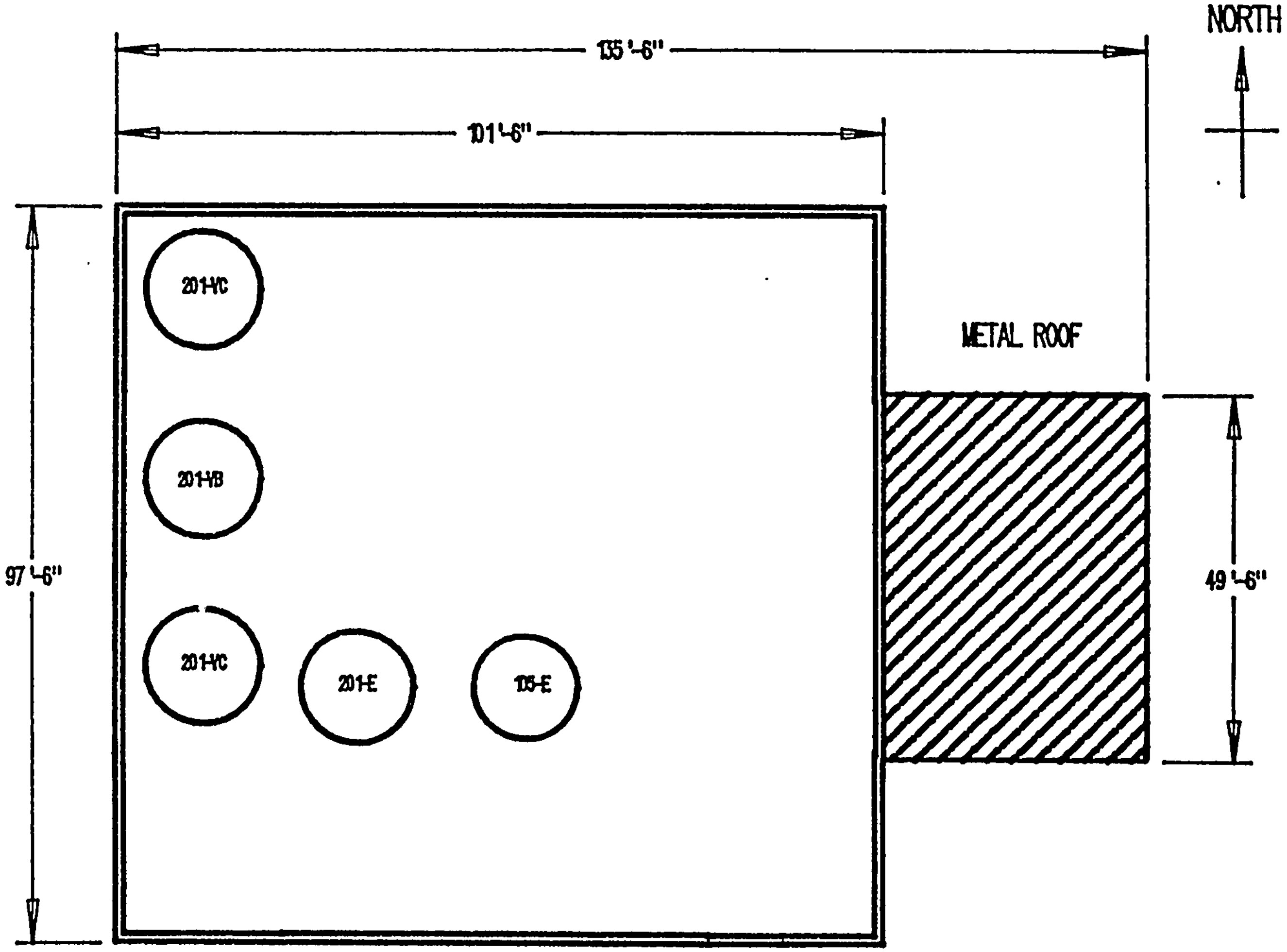


Figure A.8 PDF Structure Floor Plan (Elevation 142'-6")

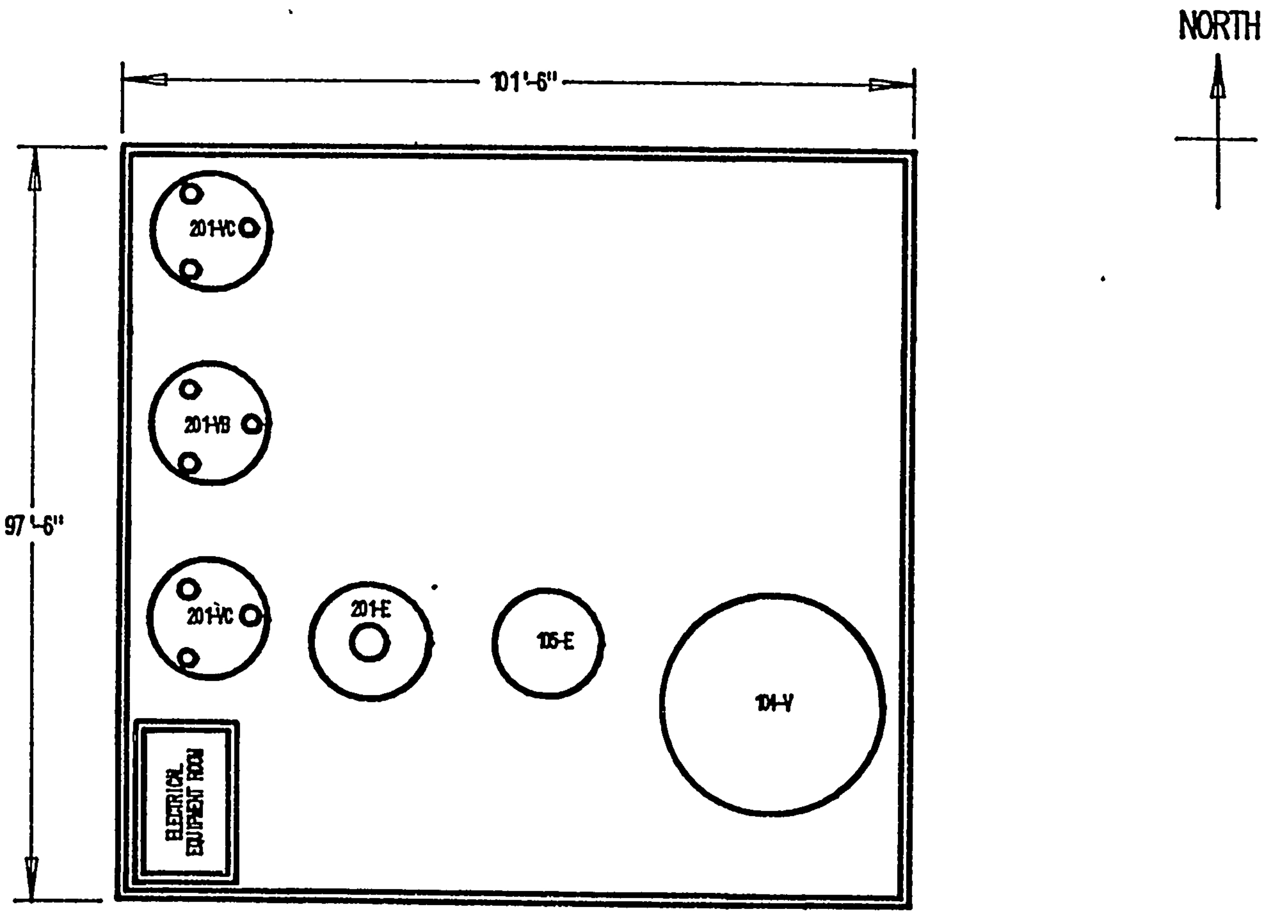


Figure A.9 PDF Structure Floor Plan (Elevation 162'-0")

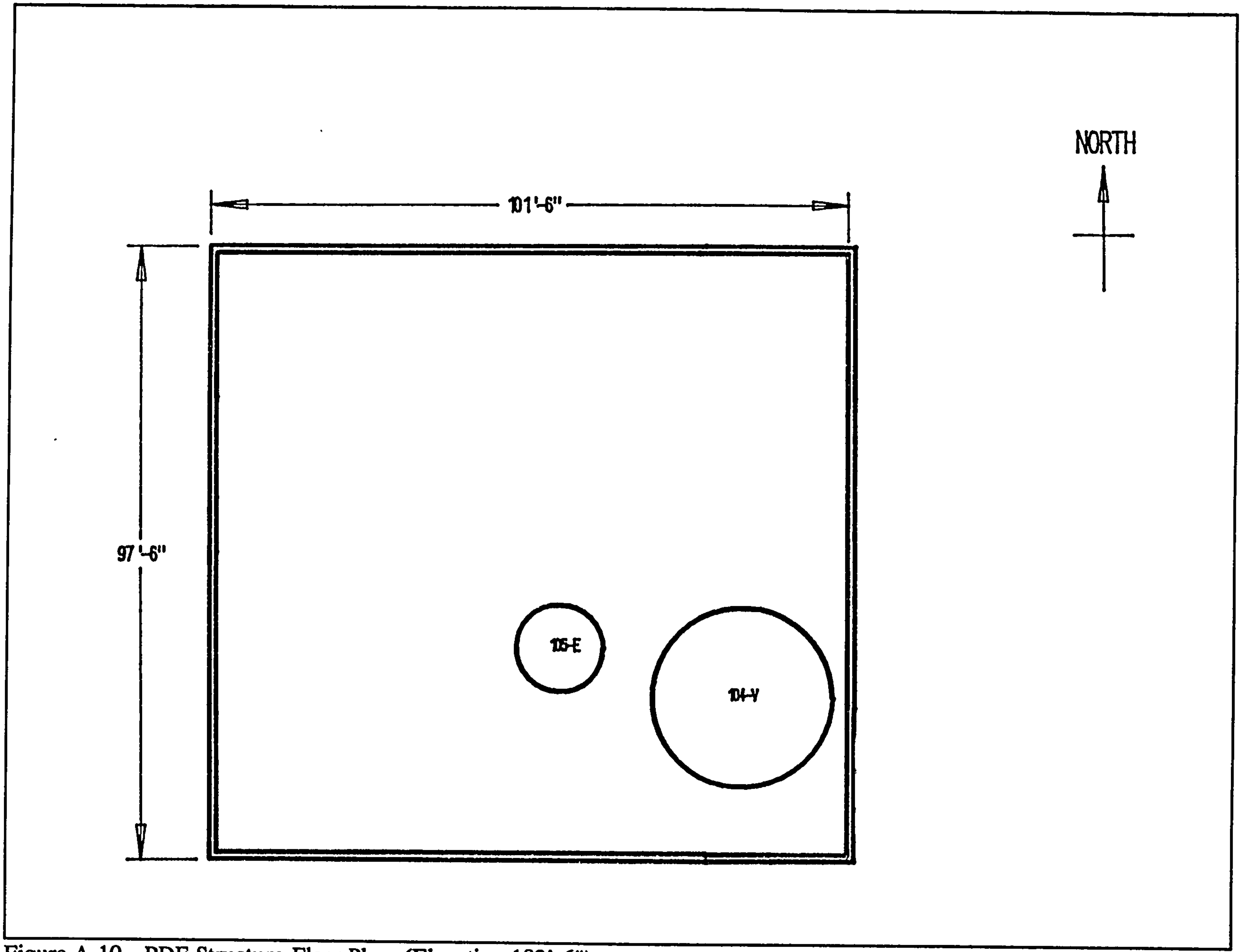


Figure A.10 PDF Structure Floor Plan (Elevation 182'-6")

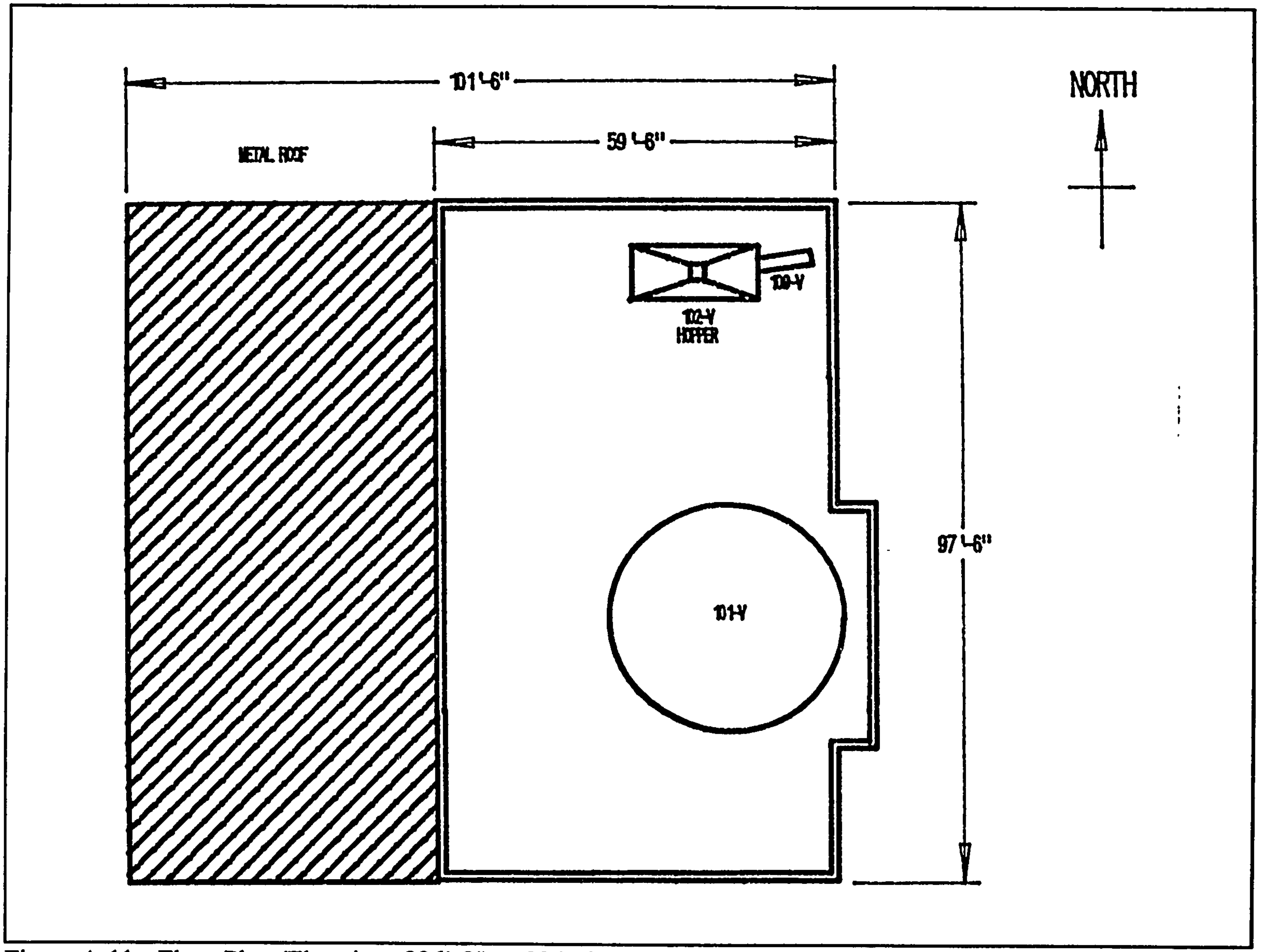


Figure A.11 Floor Plan (Elevations 206'-3" to 225'-6")

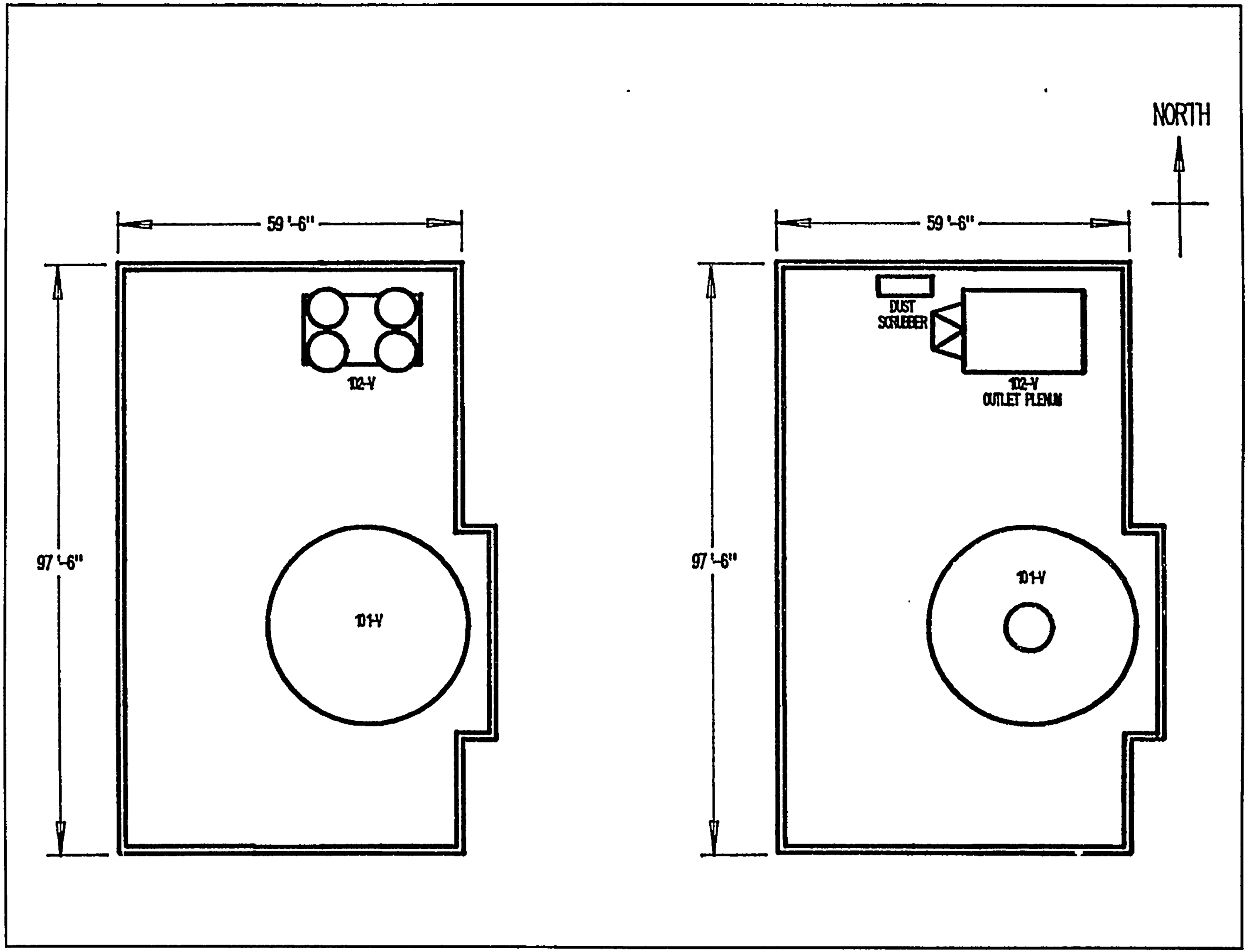


Figure A.12 PDF Structure Floor Plan (Elevations 225'-6" and 235'-6")

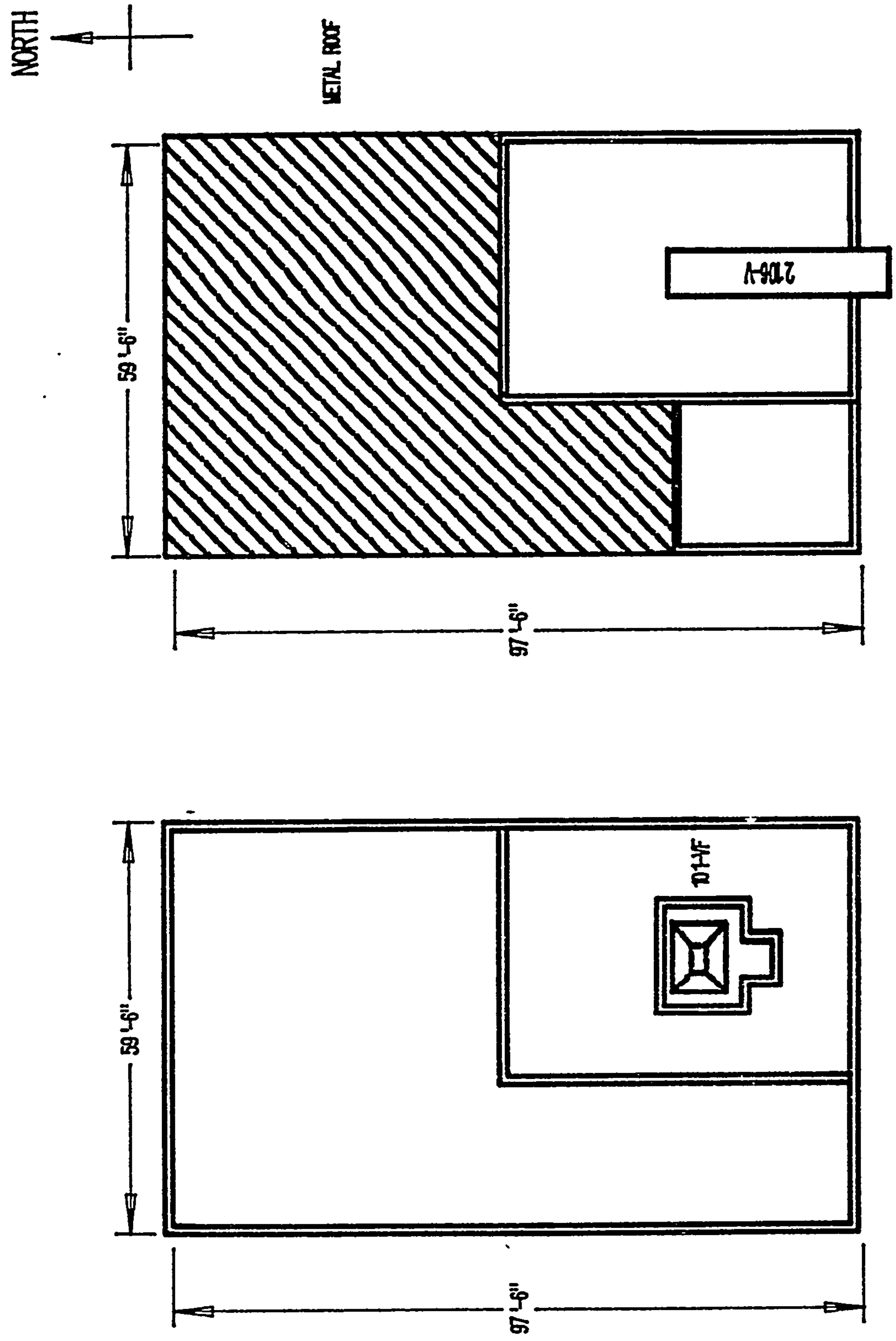


Figure A.13 PDF Structure Floor Plan (Elevations 260'-6" and 279'-2")

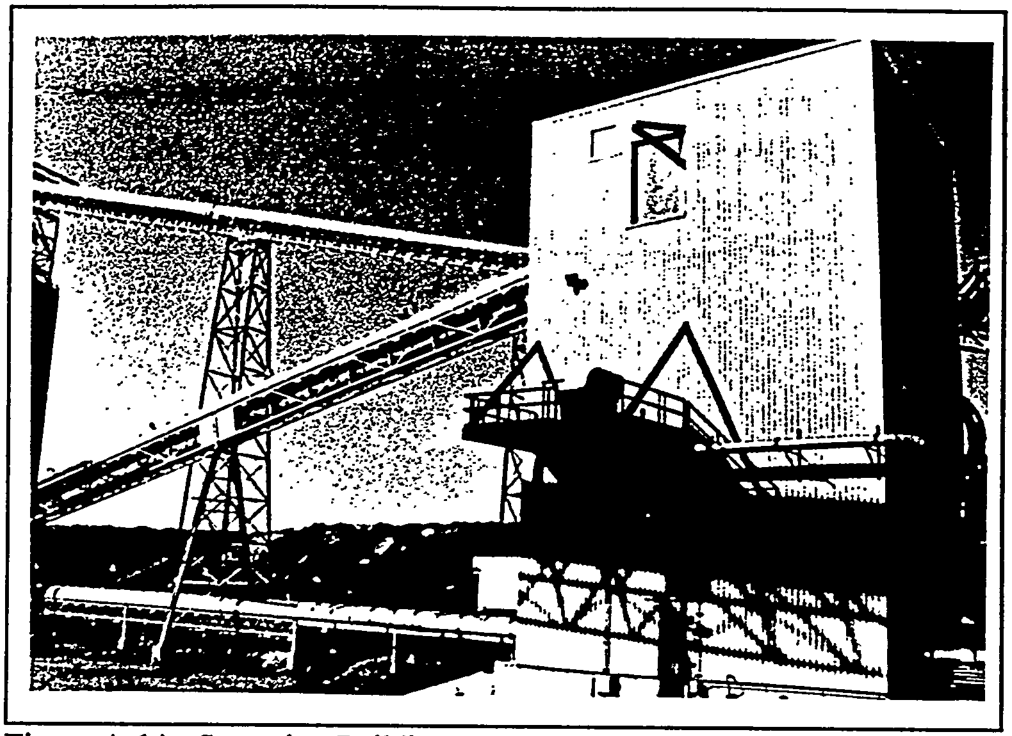
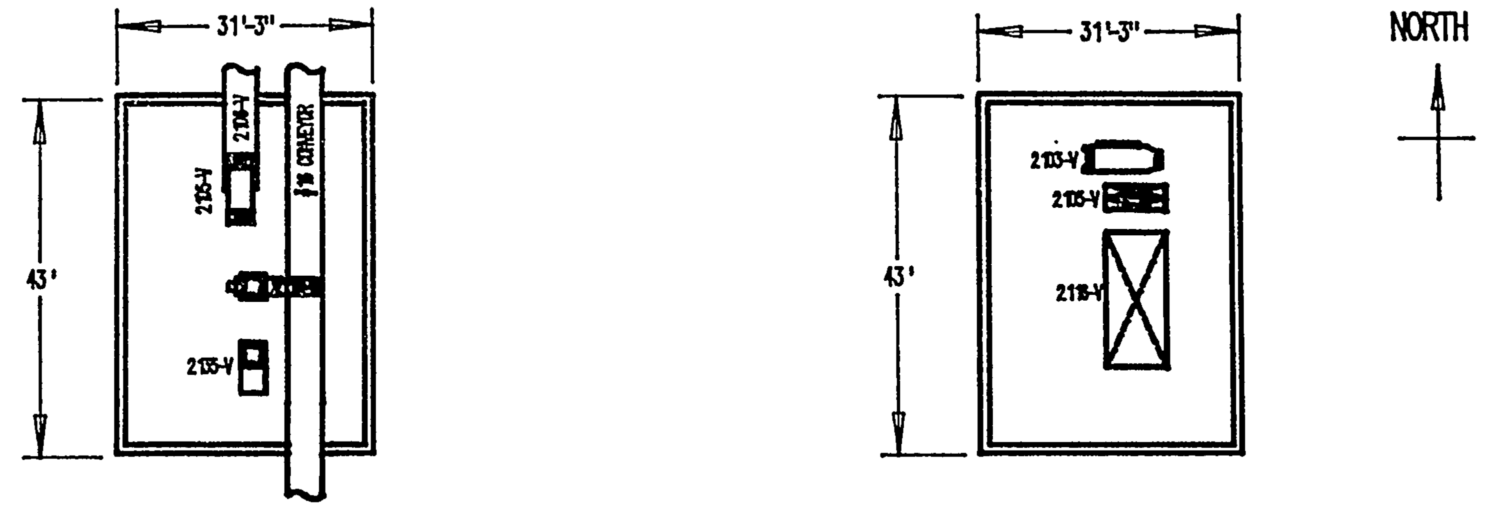


Figure A.14 Screening Building



FLOOR PLAN - ELEV. 100'-6" TO 124'-0"

FLOOR PLAN - ELEV. 124'-0" TO 140'-0"

FLOOR PLAN - ELEV. 140'-0" TO 151'-0"

FLOOR PLAN ELEV. - 151'-0" TO 162'-0"

Figure A.15 Screening Building Floor Plan

## Table A.1

## Equipment List

| Equipment # | Description |
|---|---|
| 101-F | Fine Slurry Mixing Tank |
| 101-J | Dryer Recirculation Blower |
| 101-V | Coal Dryer |
| 101-VF | Dryer Feed Hopper |
| 102-V | Dryer Cyclone |
| 104-V | Coal Pyrolyzer |
| 105-F | Seal Water Surge Tank |
| 105-J | Seal Water Circulation Pump |
| 105-V | Pyrolyzer Cyclone |
| 106-C | Pyrolyzer Quench Steam Condenser |
| 107-V | PDF Cooler |
| 109-V | Dryer Fine Screw Conveyor/Cooler |
| 120-V | Pyrolyzer Quench Chamber |
| 2001-C | Steam/Glycol Heat Exchanger |
| 2001-U | Steam Boiler |
| 2002-UL | Steam Boiler Deaerator |
| 2005-C | Glycol/Water Trim Cooler |
| 2005-J | Air Compressor |
| 2005-JA | Air Compressor |
| 2006-F | Oily Water Storage Tank |
| 2006-J | Oily Water Pump |
| 2007-J | Glycol Circulation Pump |
| 2007-JA | Glycol Circulation Pump |
| 2008-J | Cooling Water Booster Pump |
| 201-C1/C2 | CDL Cooler |
| 201-E | Quench Tower |
| 201-J | CDL Circulation Pump |

| Equipment # | Description |
|---|---|
| 201-JA | CDL Circulation Pump |
| 201-VA | Electrostatic Precipitator |
| 201-VB | Electrostatic Precipitator |
| 201-VC | Electrostatic Precipitator |
| 203-J | Wash Oil Circulation Pump |
| 2101-J | Firewater Booster Pump |
| 2101-V | Triple Deck Coal Screen |
| 2102-V | Coal Feed Conveyor |
| 2103-V | Coal Crusher |
| 2104-F | Screening Building Dust Scrubber |
| 2106-V | Feed Coal "S" Belt Conveyor |
| 2108-J | Screening Building Dust Scrubber Blower |
| 2108-V | PDF "S" Belt Conveyor |
| 2116-V | Coal Fine Collection Bin |
| 2117-V | #16 Conveyor to Triton Facilities |
| 2119-V | Vibrating Feed Under 2116-V |
| 301-B | Dryer Combustor |
| 301-J | Pyrolyzer Recirculation Blower |
| 302-B | Pyrolyzer Combustor |
| 302-J | Pyrolyzer Combustion Air Blower |
| 303-J | Dryer Combustion Air Blower |
| 501-E | Horizontal Scrubber |
| 501-F | Scrubber Surge Tank |
| 501-J | Sodium Carbonate Circulation Pump |
| 503-F | Wet Gas Scrubber |
| 503-J | Sodium Carbonate Makeup Pump |

Appendices B, C, D, and E Omitted