**Beneficiation-Hydroretort Processing of U.S.
Oil Shales, Engineering Study, Volume III**

Final Report

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By
Mineral Resources Institute
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FOREWORD

This report has been divided into three volumes. Volume I describes the MRI beneficiation work. In addition, Volume I presents the results of joint beneficiation-hydroretorting studies and provides an economic analysis of the combined beneficiation-hydroretorting approach for processing Eastern oil shales. Volume II presents detailed results of hydroretorting tests made by HYCRUDE/IGT on raw and beneficiated oil shales prepared by MRI. Volume III comprises detailed engineering design drawings and supporting data developed by the Roberts and Schaefer Company, Engineers and Contractors, Salt Lake City, Utah, in support of the capital and operating costs for a conceptual beneficiation plant processing an Alabama oil shale.

Volume I has been printed by the Office of Scientific and Technical Information (OSTI) and may be purchased from the National Technical Information Service (NTIS). Volumes II and III have not been printed, but microfiche or blowback copies may be purchased from NTIS. All volumes can be ordered under the same report number: DOE/LC/11066-2719.

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ABSTRACT

The Mineral Resources Institute of the University of Alabama, via a grant from the United States Department of Energy, is engaged in a three-year study of the beneficiation of Eastern oil shales to produce oil shale concentrate for retorting. As a part of its investigation the Mineral Resources Institute subcontracted with Roberts & Schaefer Company, engaged in the business of engineering and constructing mineral processing and material handling facilities, to prepare a conceptual design as well as capital cost and operating cost estimates for a commercial oil shale beneficiation facility.

This report describes a beneficiation facility designed to process 1620 tons per day of run-of-mine Alabama oil shale containing 12.7 gallons of kerogen per ton of ore (based on Fischer Assay). The beneficiation facility will produce briquettes of oil shale concentrate containing 34.1 gallons of kerogen per ton (based on Fischer Assay) suitable for feed to a hydrotretort oil extraction facility of nominally 20,000 barrels per day capacity. The beneficiation plant design prepared includes the operations of crushing, grinding, flotation, thickening, filtering, drying, briquetting, conveying and tailings empoundment.

A complete oil shale beneficiation plant is described including all anticipated ancillary facilities. For purposes of determining capital and operating costs, the beneficiation facility is assumed to be located on a generic site in the state of Alabama. The facility is described in terms of the individual unit operations with the capital costs being itemized in a similar manner. Additionally, the beneficiation facility estimated operating costs are presented to show operating costs per ton of concentrate produced, cost per barrel of oil contained in concentrate and beneficiation cost per barrel of oil extracted from concentrate by hydrotretorting. All costs are presented in fourth quarter of 1988 dollars.

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1.0 INTRODUCTION

This engineering study titled "Beneficiation of Eastern Oil Shales to produce Oil Shale Concentrate for Retorting", has been prepared in association with the Mineral Resources Institute of the University of Alabama, at Tuscaloosa, Alabama.

The process design research and development information, and flowsheet criteria for the beneficiation and concentration of eastern oil shale was provided to Roberts & Schaefer Company by the Mineral Resources Institute. From this information a commercial beneficiation facility design was prepared and its capital and operating cost determined.

This document presents the results of this work.

2.0 EXECUTIVE SUMMARY

This engineering study has been performed by Roberts & Schaefer Company under a sub-contract agreement between the Board of Trustees of the University of Alabama, a Corporation, thru the Mineral Resources Institute, under the U.S. Department of Energy Grant Entitled "Beneficiation - Hydroretort Processing of Oil Shale", Grant No. DE-FG21-85LC11066, Subcontract No. 5-30334.

This engineering study provides the preliminary design of a commercial processing facility to beneficiate 34,956 tons per day of run-of-mine eastern oil shale, (12,760,000 tons per year) containing an average of 12.7 gallons of kerogen per ton of ore (as determined by Fischer Assay) to produce 4,380,000 tons per year of concentrate containing an average of 34.1 gallons of kerogen per ton (as determined by Fischer Assay), equalling 3,547,800 barrels of kerogen per year. The process plant design recovery of kerogen is 92 percent. Hydroretorting will produce approximately 20,000 barrels of oil per day from this concentrate production. The processing facility is designed to operate 365 days per year, with a 90 percent availability.

The capital investment requirement for the processing facility is estimated to be \$240.2 million in 1988 dollars. The operating cost is estimated to be \$64.9 million per year, again in 1988 dollars. The capital and operating costs have been prepared to an accuracy of ± 15 percent. The operating cost shown above does not include the annual cost of capital or the cost of mined ore to feed the beneficiation facility. The total operating cost including the cost of capital and the cost of the mined ore to feed the plant is approximately \$153.1 million annually.

The process facility general plan configuration has been developed for a "Greenfield" siting, located in central Alabama, and requiring approximately 3500 acres (this allows for 25 years of tailings disposal). The facility plan is not fitted to a single specific site, but prepared for a generally level site. The facility includes all supporting ancillary structures necessary for the management, administration, operation and maintenance.

The process for the production of oil shale concentrate, involves the steps of crushing, grinding, flotation, thickening, filtration, drying and agglomeration. From the run-of-mine ore the beneficiation facility produces a finished concentrate product that is agglomerated into a briquette form for retorting. Optimization of the basic process by Mineral Resources Institute preceded preparation of the final material balance flowsheets and engineering design drawings of the facility.

Engineering design drawings provided in the report, include the Process Flowsheets, Piping and Instrumentation Diagrams, Electrical One-line Drawings, and the Facility General Arrangement Drawings. The engineering design drawings are the basis for preparing the economic evaluation of the facility. In preparing the capital and operating costs, quotations were solicited for the major components of equipment and materials. Estimating guidelines were applied to labor and construction cost components, and historical data was used from Roberts & Schaefer Company's engineering and construction cost data base.

The capital cost estimate prepared, is assembled into cost accounts for each process area, supported with detailed take-off sheets listing equipment, materials, and construction labor. Also included are engineering, construction management, field changes, technical services, fees, taxes, insurance, and start-up / commissioning. Additionally, the capital cost includes the initial contingent of grinding media.

The operating cost estimate prepared, provides for all operating production labor and supervision, materials, utilities and consumables used in the production of the concentrates. A total staff of 154 personnel are required for the 24 hour per day operation, consisting of 24 supervisory, 84 operating and 46 maintenance personnel. The operating cost of \$64.9 million is \$14.81 per ton of concentrate produced (4,380,000 tons per year). The total operating cost is \$153.1 million, which includes capitalization cost (\$37.3 million) and mined ore to feed the plant (\$50.9 million), and is equivalent to \$34.95 per ton of concentrate produced.

An "Equipment List" that identifies each piece of equipment is provided in the report.

3.0 DESIGN CRITERIA

The Mineral Resources Institute provided Roberts & Schaefer Company with the basic design criteria and types of processing equipment desired for the facility. The following criteria are the basis for the beneficiation facility design:

Plant Availability	90% *24 hr/day 365 day/year
Average Plant Feed	34,956 tons /day
Run-of-Mine Material Bulk Density	100 lb / cubic foot
Run-of-Mine Material Specific Gravity of Solids	2.4
Product Size from Crushing Circuit	80% -3/8"x0"
Crushing Power Requirement	1.4 kw-hr / ton
Product Size from Primary Grinding	80% -28 Mesh
Primary Grinding Power Requirement	7 kw-hr / ton
Product Size from Primary Stirred Ball Mill Grinding	80% -20 Micro
Primary Stirred Ball Mill Grinding Power Requirement	21 kw-hr / ton
Product Size from Re grind Stirred Ball Mill Grinding	90% -10 Micron
Re grind Stirred Ball Mill Grinding Power Requirement	14 kw-hr / ton
Primary Flotation Feed Dilution	11% Solids
Primary Flotation Retention Time	10 Minutes
Primary Flotation Froth	9% Solids 2.2 S.G. Solids
Primary Flotation Tailings	2.8 S.G. Solids 583 Tons/hr Solids
Cleaner Flotation Feed Dilution	10.4% Solids
Cleaner Flotation Retention Time	8% Solids 1.8 S.G. Solids
Cleaner Flotation Tailings	2.8 S.G. Solids 494 Ton/hr Solids
Primary Thickener Underflow	35% Solids
Concentrate Thickener Underflow	30% Solids
Dryer Discharge	92% Solids

Agglomeration Binder

2-1/2% by weight
Lignosulphonate @
50% Solids

Briquette Size

3/8" x 1/2" x 3/4"

Subsequent to receipt of the basic design criteria, Roberts & Schaefer Company developed more detailed design which is listed on the following pages (Table 3.1).

TABLE 3.1 DESIGN CRITERIA

MRI / HYCRUDE OIL SHALE BENEFICIATION PROJECT			
ROBERTS & SCHAEFER CONTRACT 8820			
		DESIGN CRITERIA	
ITEM	DESCRIPTION	CRITERIA	EQUIPMENT SIZE
1	PLANT CAPACITY		
	Alabama High Grade		
	Hydrotort-Nominal average output	20,000 bbl / day	
	Average Plant Feed	12,760,000 tons / yr	
		34,956 tons /day (365 day/yr)	
		12.7 gal / ton - Fisher Assay	
		10,570 bbl / day (365 day/yr)	
	Average Plant Output		
	Concentrate without binder	4,270,000 tons / yr	
		11,702 tons / day (365 day/yr)	
		34.9 gal /ton - Fisher Assay	
		9,720 bbl / day (365 day/yr)	
	Concentrate with 2.5% binder	4,380,000 tons / yr	
		11,994 tons / day (365 day/yr)	
		34.1 gal /ton - Fisher Assay	
		9,720 bbl / day (365 day/yr)	
	Plant Availability	90% of 365 day/yr, 24 hr/day	
	Operating Hours	7884 hours/yr	
	Plant Design Feed Rate	1620 tons / hr	
		(12,800,000/ (365*24*.90))	
	Plant recovery of oil		92%
	Power required for crushing & grinding	44 Kw-hr/ton	

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ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
2	CRUSHING PLANT		
	Run-of-mine feed	1620 ton / hr	
	Bulk Density	100 lb / cu ft	
	Material Size	36" x 0	
	Specific Gravity of Solids	2.4 S. G.	
	Moisture	5% moisture	
	Crushing power requirement	3100 HP = 1.4 Kw-hr/ton	
	Ore delivery to plant	170 ton end-dump truck	
	Stages of crushing	3 Stage	
	Primary Crushing		
	Crusher Type		Gyratory, size 60-90 6" Open Side Setting
	Secondary Crushing		
	Crusher Type		Standard Head Cone
	Size		(2) 7 ft Standard, Heavy Duty Operated in Open Circuit 7/8" to 1" CSS
	Feed Rate to Crusher	630 ton / hr each	
	Type of Scalping Ahead of Crusher		Vibrating Grizzly Feeder
	Feed Rate to Scalper	810 ton / hr each	
	Feed Size	10" x 0 (80% pass 6")	
	Scalping Size	2"	

1
00
1[illegible]

TABLE 3.1 DESIGN CRITERIA

ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
3	GRINDING		
	Primary Grinding		
	Circuit	Open Circuit Grinding	
	Feed Rate	3 @ 540 ton / hr =	
		1620 ton / hr total	
		65% solids = 6186 gpm pulp	
	Feed Size	80% passing 3/8" (9525 micron)	
	Discharge Size	80% passing 28 Mesh (590 micron)	
	Power requirement	15000 HP = 7 Kw-hr/ton	
	Size		3 @ 18 ft dia by 24 ft long
			5000 HP each =15,000 hp total
			2" diameter balls
			35% ball charge
	Primary Stirred Ball Mill		
	Circuit	Open Circuit Grinding	
	Feed Rate	1620 ton / hr total	
		50% solids =9180 gpm pulp	
	Feed Size	80% passing 28 Mesh (590 micron)	
	Discharge Size	90 % passing 20 micron	
	Power requirement	45,000 HP = 21 Kw-hr/ton	
	Size		18 @2500 liter
			2500 HP each = 45,000 HP
			2mm diameter steel balls
			75% ball charge
	Regrind Stirred Ball Mill		
	Circuit	Open Circuit Grinding	
	Feed Rate	1037 ton / hr total	
		35% solids = 9,558 gpm pulp	
	Feed Size	90 % passing 20 micron	
	Discharge Size	90 % passing 10 micron	
	Power requirement	30,000 HP = 14 Kw-hr /ton	
	Size		15 @1500 liter
			2000 HP each = 30,000 HP
			2mm diameter steel balls
			75% ball charge

TABLE 3.1 DESIGN CRITERIA

ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
4	FLOTATION		
	Primary Flotation		
	Feed	3 @ 540 ton / hr = 1620 ton / hr 11% solids = 55,128 gpm pulp 1.07 pulp density(specific gravity)	
	Retention time	10 minutes	
	Size		72,000 cubic ft 3 lines each with 2 banks of (8) 1500 cu ft cells each
	Reagent	Pine Oil, 1.0 lb/ton or Dow Froth 250, 0.1 lb/ton	
	Froth Overflow(Concentrate)	1037 ton/hr total @ 9% solids = 43807 gpm 1.05 S.G. pulp, 2.2 S.G. solids	
	Tailings	583 ton / hr total @ 18.2% solids = 11325 gpm 1.13 S.G. pulp, 2.8 S.G. solids	
	Cleaner Flotation		
	Feed	3 @ 346 ton / hr = 1037 ton / hr 10.4% solids = 37,621 gpm pulp 1.06 pulp density(specific gravity)	
	Retention time	14 minutes	
	Size		72,000 cubic ft 3 lines each with 2 banks of (8) 1500 cu ft cells each
	Reagent	Pine Oil, 1.0 lb/ton or Dow Froth 250, 0.1 lb/ton	
	Froth Overflow	543 ton / hr total @ 8% solids = 26,183 gpm 1.04 S.G. pulp, 1.8 S.G. solids	
	Tailings	494 ton / hr total @ 15.5% solids = 11458 gpm 1.11 S.G. pulp, 2.8 S.G. solids	

TABLE 3.1 DESIGN CRITERIA

ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
5	THICKENER		
	Primary Thickener		
	Feed	3 @ 346 ton / hr = 1037 ton / hr @ 9% solids = 43807 gpm 1.05 S.G. pulp, 2.2 S.G. solids	
	Underflow	35% solids = 9,558 gpm 1.24 S.G. Pulp	
	Overflow	34236 gpm Water	
	Settling Rate	1.196 ft / hr	
	Required area	Use 14 sq ft / ton / 24 hr	
	Size		3 @ 400 ft diameter each
	Reagents	Nalco 8852 coagulant @ 10 ppm and Nalco 8872 flocculant @ 20 ppm	
	Concentrate Thickener		
	Feed	3 @ 181 ton / hr = 543 ton / hr @ 8% solids = 26,183 gpm 1.04 S.G. pulp, 1.8 S.G. solids	
	Underflow	30% solids = 6275 gpm 1.15 S.G. Pulp	
	Overflow	19908 gpm + recycled filtrate @ (4527gpm) = 24435 gpm total	
	Settling Rate	1.046 ft / hr	
	Required area	Use 22 sq ft / ton / 24 hr	
	Size		3 @ 350 diameter each
	Reagents	Nalco 8852 coagulant @ 10 ppm and Nalco 8872 flocculant @ 20 ppm	

TABLE 3.1 DESIGN CRITERIA

ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
6	FILTRATION		
	Feed	3 @ 181 ton / hr = 543 ton / hr 30% solids = 6275 gpm 1.15 S.G. Pulp, 1.8 S. G. solids	
	Filter Rate		
	Filter Area		
	Recirculating Load	Negligible	
	Filter Discharge	543 ton / hr total 20% solids = 1749 gpm 1.55 S.G. Pulp, 1.8 S. G. solids	
	Size		9 @ 2153 sq ft each = 19377 sq ft total. Larox CF-200
7	DRYING		
	Feed	3 @ 181 ton / hr = 543 ton / hr @80% plus 3 @ 28 ton/hr rejected briquettes @ 90% solids = 627 ton / hr @ 81.3% solids 1.57 S.G. Pulp, 1.8 S.G. Solids	
	Dryer discharge	543 ton / hr new plus 84 ton / hr recirc- ulated = 627 ton / hr total 8% moisture	
	Maximum drying temperature	180 degrees C	
	Dryer BTU	6 @ 44 Million BTU/hr = 264 Million BTU/hr	
	Size		(6) No.20 C-E Raymond Cage Mill Flash Dryers

TABLE 3.1 DESIGN CRITERIA

ITEM	DESCRIPTION	CRITERIA	EQUIPMENT
8	AGGLOMERATION		
	Feed	3 @ 181 ton / hr = 543 ton / hr plus 3 @ 28 ton / hr recirculated = 627 ton/hr 8 % moisture, 1.69 S. G. of pulp	
	Binder	2 1/2 % Lignosulfonate @ 50% solids	
	Resulting Feed	557 ton / hr plus 81 ton / hr = 638 ton/hr 10% moisture, 1.67 S.G. pulp	
	Briquette size	3/8" x 1/2" x 3/4"	
	Briquetting pressure required	10,000 to 16,000 psi	
	Recirculating load from screening	15% recirc. = 81 tph New feed = 557 tph Total feed = 638 tph	
	Size		(18) Komarek Inc. model DH500-28x27 roll press briquetters roll separating force = 0 to 150 tons
9	TAILINGS		
	Feed to pond	583 ton / hr + 494 ton / hr = 1077 ton /hr total 16.8% Solids = 22783 gpm pulp 8,500,000 ton / yr	
	Water reclaimed from pond	67 percent = 14160gpm	
10	SITE CONDITIONS		
	Location	Generic site in central Alabama	
	Elevation	Approximately 600 feet above sea level	
	Seismic	Zone 1	
	Temperature Range	-10 to 110 degrees F	
	Average Rainfall	56 inches per year	

4.0 DESCRIPTION OF FACILITY

4.1 General

The oil shale beneficiation plant will involve crushing run-of-mine ore with a kerogen content of 12.7 gallons per ton (Fischer Assay), flotation, gravity thickening, filtering, drying and briquetting operations. The product of the beneficiation process is in the form of 1/2 x 3/8 x 3/4-inch briquettes of oil shale concentrate with a kerogen content of 34.1 gallons per ton (Fischer Assay).

The crushing plant consists of a single line of three stage crushing in closed circuit and includes three stockpiles for storage of 3/8 x 0-inch crushed ore ahead of the grinding circuits.

The process plant is divided into three separate circuits operating in parallel beginning with the raw shale ore reclaim and continuing through briquetting operations. The three circuits are identified as "Circuit A", "Circuit B" and "Circuit C" on the process flowsheets. The three circuits are designed to operate independently so that one or two circuits may operate while the third is shut down for maintenance or all circuits can be operating at one time.

The plant design includes control by Programmable Logic Controller (PLC) with three separate control rooms; one in the crushing area, a second in the grinding and flotation area, and the third in the dewatering and agglomeration areas. The central control room in the grinding and flotation area will be able to monitor status of operations in all plant areas.

The crushing plant is able to operate while the remainder of the plant is shut down or until all of the stockpiles are full.

The grinding and flotation areas can operate while the crushing plant is shut down, limited by the point at which the crushed ore storage piles are depleted (approximately 27 hours of live storage capacity).

The grinding and flotation areas can operate for a limited time while the dewatering and agglomeration operations are shut down, governed by the point at which the depth of solids in the thickeners becomes too great to allow adequate settling depth to clarify the overflow.

The dewatering and agglomeration areas can operate for a limited time while the grinding and flotation operations are shut down until the time at which the thickened material in the concentrate thickeners is depleted.

In general, all process pumps in the plant are backed up by installed spares with the exception of the flotation froth pumps which are installed in a quantity of two per bank of cells.

Dust is controlled by suppression (sprays) and collection at the crushing plant and by collection at the drying and briquetting areas. Baghouse-type dust collection is

incorporated, one each at primary, secondary and tertiary crushing areas, one at each of the six flash dryers and one collection unit for each of the three briquetting circuits.

For purposes of isolating capital and operating costs of various operations, the beneficiation facility has been divided into a number of areas as follows:

<u>Area No.</u>	<u>Description</u>
00	General - Includes main power distribution, piping and other items that serve the entire plant rather than a specific operation.
01	Crushing and ore storage
02	--Deleted--
03	Ball mill grinding
04	Stirred ball mill grinding
05	Flotation
06	Thickening
07	Filtration
08	Drying
09	Briquetting
10	--Deleted--
11	Tailings disposal
12	Mill buildings
13	Ancillary buildings
14	Site preparation and fence
15	Mobile equipment

The area number becomes the first two digits of the equipment numbers shown on the flowsheets and on the equipment list.

4.2 Area 01-Crushing and Ore Storage

The crushing plant consists of a single circuit as compared to the processing plant's three parallel circuits.

Run-of-mine ore, nominally sized at 36 x 0-inch is transported from the open pit mine to the primary crushing station by 170-ton capacity end-dump haul trucks. The ore is either dumped directly into the primary crusher dump hopper or onto a stockpile adjacent to the dump hopper. Ore from the stockpile would be reclaimed by front-end loader and dumped into the hopper. The dump hopper feeds directly into a 60 x 90-inch gyratory crusher(see

drawing 8820-L3). The crusher is set at a 6-inch open side setting and will pass 10 x 0-inch material at a rate of 1620 Tons/hr (2000 pound tons). The crushed product is discharged into a 200-ton vault directly below the gyratory crusher from which it is reclaimed by a 60-inch wide by 30-foot long variable speed apron feeder.

A 48-inch wide belt conveyor receives the 10 x 0-inch crushed material from the apron feeder and transports it to a 3200-ton capacity surge bin which provides two hours of surge capacity ahead of the secondary crushing units. Ore is reclaimed from the surge bin via two 54-inch wide by 24-foot long variable speed vibrating grizzly feeders with 8-foot long stepped grizzly sections. The grizzly bars are spaced with 3-inch clear openings which will allow the smaller material to be removed ahead of the secondary crushers.

The oversize material, 10 x 3-inch, discharges from the grizzly feeders into two 7-foot standard head, heavy duty cone crushers set at a 1-inch closed side setting and which produce 2 x 0-inch product. The product from the secondary crushers is collected on two 48-inch belt conveyors along with the undersize material from the vibrating grizzly feeders and is transported to a 1600-ton surge bin at the tertiary crushing station (See drawing 8820-L4). This surge bin provides one hour of surge capacity ahead of the tertiary crushers.

The material is reclaimed from the 1600-ton surge bin by four 54-inch wide by 20-foot long variable speed vibrating pan feeders which discharge onto four 8-foot wide by 24-foot long, double deck vibrating screens. The screen top deck has 1-inch square openings and the screen bottom deck has 5/8-inch square openings which will produce a nominal 3/8 x 0-inch screen undersize product. The oversize material from both screen decks discharges into four 7-foot shorthead, heavy duty cone crushers set a 3/8-inch closed side setting which produce a 3/4 x 0-inch product. The product from the four tertiary crushers is collected on two 36-inch belt conveyors operating in parallel and recirculated back to the 48-inch secondary crusher collecting conveyors via two transfer stations. The recirculated material again passes through the 1600-ton surge bin and the nominally 3/8 x 0-inch is removed at the vibrating screens ahead of the tertiary crushers.

The screen undersize material, the 3/8 x 0-inch product, from the four vibrating screens is collected on a 48-inch belt conveyor, transferred onto another 48-inch belt conveyor for transportation to the crushed material stockpiles.

Crushed material can be deposited into any of three stockpiles by a system of flop gates and conveyors over the top of the piles. Material will be deposited onto the stockpiles via stacking tubes for dust control (see drawing 8820-L5). Each stockpile will be equipped with a water spray system for additional dust control.

The crushed ore will be stored in three uncovered stockpiles (see drawings 8820-L2 and L5) each having a live storage capacity of 15,000 tons for a total live storage capacity of 45,000 tons. This will provide approximately 27 hours of surge capacity when the processing plant is operating at the design capacity of 1620 Tons/hr.

4.3 Area 03 through Area 06- Reclaim, Grinding, Flotation and Thickening

Area 03 begins with the reclaim of the crushed ore from the stockpiles (see drawing 8820-L5). Crushed ore to feed the processing plant will be reclaimed from the storage piles by a system of three reclaim conveyors (one per each processing circuit). Each reclaim conveyor will be fed by five vibrating pan feeders which will be automatically controlled by a signal from the belt scale on the reclaim conveyor. The control of the reclaim system will be from the grinding and flotation area control room. The reclaim tunnels will be concrete box structures and each will be equipped with a 5-foot diameter escape and ventilation tube of corrugated metal pipe. Each tunnel will also contain a floor sump and pump to remove any water that flows into the tunnel.

Included in the material reclaim area will be a system for feeding grinding media for the primary ball mills onto the plant feed conveyors to automatically make up for the media that is consumed in the primary grinding process. This will be accomplished by way of grinding ball storage hoppers and feeders over the reclaim tunnels for each plant feed conveyor. The grinding ball feeder will be a flexwall type feeder that will be run for a short period several times per shift to add grinding balls to the system. The grinding balls added will be of the 2-inch diameter size. It is estimated that approximately 80,000 pounds of grinding balls will be used daily, or approximately two truck loads of balls per day.

The 3/8 x 0-inch (nominal) plant feed material will discharge directly from the plant feed conveyors into three 18-foot diameter by 24-foot long, 5000 horsepower ball mills (see drawings 8820-L6 and L7). The feed rate to each ball mill will be 540 Tons/hr (bone dry basis) and will have a moisture content of about 5 percent. Approximately 1050 gal/min of water will be added at the ball mill inlet to bring the feed to 65 percent solids. The primary ball mills will reduce the 3/8 x 0-inch (9525 micron) feed to 28 mesh (590 micron). The power required for this reduction has been determined by Mineral Resources Institute laboratory testing to be 7 kilowatt-hr per ton. The primary ball mills will each discharge into a 3000 gallon sump.

Area 04 includes six primary stirred ball mills per circuit (18 total) and five secondary (regrind) stirred ball mills per circuit (15 total). Slurry from the primary ball mills in Area 03 is pumped at a rate of approximately 2100 gal/min of slurry per circuit to mechanical, 6-way, pulp distributors which divide the feed to the primary stirred ball mills. Each 6-way distributor will have an overflow directed back to the primary ball mill discharge sumps.

The slurry is sampled ahead of the pulp distributors by an intermittent sample cutter. These samples will provide information on the amount of kerogen in the plant feed.

In the pulp distributor, the slurry will be further diluted by the addition of about 1000 gal/min of water to bring the primary stirred ball mill feed to 50 percent solids. The feed to the primary stirred ball mills is approximately 3100 gal/min of slurry at 540 Tons/hr (dry solids) per circuit. From the pulp distributor the slurry will be pumped to the primary stirred ball mills via one pump per mill.

The six 2500 horsepower primary stirred ball mills per circuit will reduce the material size from 80 percent passing 28 mesh (590 micron) to 80 percent passing 20 micron. The power required for this reduction has been determined by Mineral Resources Institute laboratory testing to be 21 kilowatt-hours per ton. The stirred ball mills will have a ball charge of 75 percent by volume of 2 millimeter diameter steel balls.

The discharge from the primary stirred ball mills will report to a common 3000 gallon capacity sump (one per circuit). From there a single pump per circuit (backed up by an installed spare) will move the slurry into Area 05 which is the flotation operation, consisting of rougher and cleaner flotation. The minus 20 micron material from the primary stirred ball mills is split in a 2-way mechanical distributor to two banks of rougher flotation machines per circuit. In the distributor before the rougher flotation, approximately 15,300 gal/min of dilution water is added to the 3100 gal/min of slurry to bring the slurry to 11 percent solids in order to optimize flotation. The concentrate froth from the rougher flotation cells reports to 400-foot diameter by 10-foot deep primary thickeners (one per circuit for a total of three) where it is thickened to 35 percent solids. The thickeners are designated as Area 06. The primary thickener underflow is pumped back to the grinding area where it is split in a 5-way mechanical distributor and fed by slurry pumps to the regrind stirred ball mills. There are five 2000 horsepower regrind stirred ball mills per circuit which reduce the material to 90 percent passing 10-micron. The power required for this reduction has been determined by Mineral Resources Institute laboratory testing to be 14 kilowatt-hours per ton. The regrind stirred ball mills will also have a 75 percent by volume ball charge of 2 millimeter diameter steel balls.

The discharge from the regrind stirred ball mills reports to 3000 gallon sumps (one per circuit) and then is pumped to 2-way mechanical distributors ahead of the cleaner flotation banks. Just ahead of the 2-way distributors, the slurry is sampled by an intermittent slurry sampler. The samples obtained will indicate the amount of kerogen in the concentrate prior to cleaner flotation.

Approximately 9300 gal/min of water added in each of the 2-way mechanical distributors to dilute the slurry to 10.4 percent solids prior to cleaner flotation .

The cleaner and rougher flotation cells are all identical 1500 cubic foot cells with eight cells per bank. There are two banks of cleaner and two banks of rougher flotation cells per circuit for a total of twelve banks or ninety-six cells, each powered by a 75 horsepower motor. Pressurized air for the flotation cells is provided by six blowers, two per circuit, located at the midpoint of the flotation banks.

The froth from the cleaner flotation is pumped to three 350-foot diameter by 8-foot deep concentrate thickeners (one per circuit). The concentrate thickener underflow is pumped to the filtering operation which is Area 07.

The primary and concentrate thickeners are constructed with no tunnels underneath. The thickener underflows are pumped by vertical centrifugal pumps with the discharge line routed up through the centerwell and back to the pipe rack located between the primary and concentrate thickeners. The clarified water from the thickeners reports to two 60,000 gallon sumps, one that serves the three primary thickeners and one that serves the three

concentrate thickeners. From there it is pumped back to the process water storage tank. There are three operating and one spare pump at each of the two sumps pumping approximately 34,200 gal/min and 24,400 gal/min respectively from the primary and concentrate thickeners.

4.4 Area 07-Filtration

The concentrate thickener underflow is pumped to the filtering area and is sampled by mechanical intermittent sample cutters ahead of 3-way mechanical distributors that split the flow to three filters per circuit. One high-pressure pump per filter moves the slurry from the distributor through the individual filters. The filters selected are automatic chamber filters manufactured by Larox Inc. but similar filters by other manufacturers could be considered. The filtering is a batch operation with a complete cycle occurring about every 15 minutes.

Each filter consists of eighty frame and diaphragm compartments each with a continuous filter cloth all mounted in a vertical plane. The filter cake is discharged onto one 72-inch collecting conveyor below each filter press. The filtrate from the filtering operation is pumped back to the concentrate thickener. The filter cake from three filters at about 80 percent solids is collected on a single 36-inch wide flexwall conveyor and transported to one 200-ton surge bin per circuit. Flexwall conveyors are incorporated for their ability to convey material at a steep angle in order to reduce the space required between the filtering and drying operations.

4.5 Area 08-Drying

The filtercake is reclaimed from each of the filtercake surge bins by two screw conveyors and transported to two cage mill flash dryers in each circuit.

The dryers include air heaters, cage mills, ductwork, cyclones and dust collectors.

The material is dried in the vertical ductwork and collected in the cyclones. The cyclones are located directly over and discharge into the dry material distribution bins.

A portion of the dried product, estimated to be approximately 45 percent for purposes of sizing screw conveyors, will be collected in the dust collectors and conveyed to the dry material distribution bins via two screw conveyors per dryer or four per circuit.

Included with the drying equipment is a "dry divider" which diverts some of the dried material above the dry material distribution bin and recycles it back to the filter cake collecting conveyor. The dry divider is used to lower the moisture in the feed to the dryer and to improve the material handling characteristics.

The dryers will reduce the moisture content of the material to about 8 percent and remove about 30 Tons/hr of moisture per circuit. The dried material is discharged into two dry material distribution bins per circuit.

4.6 Area 09-Briquetting

The dried concentrate is reclaimed from the distribution bins by screw conveyors with mixing paddles and conveyed to six roll press briquetting machines per circuit. Lignosulfphonate binder is added in the mixing screw conveyors at a rate of 2-1/2 percent by weight or 4.5 Tons/hr per circuit. The roll press briquetting machines produce 3/8 x 1/2 x 3/4-inch briquettes of concentrate at a rate of 186 Tons/hr per circuit which includes the weight of the binder. The briquettes are conveyed via 36-inch wide flexwall conveyors to vibrating screens where the incompetent briquettes are removed and recycled back through the drying and briquetting operations. The competent briquettes are collected on a single conveyor that collects briquettes from all three circuits and transports them to a briquette storage pile ahead of the hydrotret facility. The briquettes discharge from the beneficiation plant at a rate of 557 Tons/hr. The system for reclaiming the briquettes from the storage pile and conveying them to the retort facility is not included in the scope of this report nor is it included in the cost estimates.

The briquetting binder is stored in an 870,000 gallon storage tank located in the reagent storage area, and pumped to a steady head tank ahead of the briquetting machines. There is one steady head tank for each circuit located in the briquetting area.

4.7 Area 11-Tailing Disposal

The tailings from rougher and cleaner flotation are sampled by twelve mechanical intermittent slurry sample cutters as the tailings discharge from the tailings boxes on the flotation machines, then the tailings flow by gravity in floor trenches to a common tailings sump outside of the process building. The tailings disposal system is designated as Area 11. From the common sump the tailings are pumped by two slurry pumps in series to the tailings pond which at the start of the oil shale beneficiation operation will be at a pumping distance of approximately 15,000 feet.

Incorporated into the beneficiation facility is a tailings pond to contain the flotation tailings from 25 years of operation at approximately 8.5 million Tons/year. To begin operations, a tailings pond will be constructed large enough to hold the tailings from the first two years of operation. This will require a pond approximately 6000 feet by 7900 feet and 20 feet high at the dam. After the first two years the dam will be built up annually to contain the yearly tailings production. After 25 years the tailings pond will extend to 8,000 feet by 15,000 feet measured to the top of the berm and the maximum height of the dam will be 100 feet. The dam will be constructed by downstream construction only.

The tailings pond is designed to be a zero discharge operation with the supernatant water being returned to the process. A pump barge supporting two operating pumps and one spare pump will be located near the dam.

It is estimated that two-thirds or approximately 14,000 gal/min of the water in the slurry pumped to the tailings pond will be reclaimed and pumped back to the process water storage tank for re-use in the beneficiation process.

4.8 Area 12-Mill Buildings

The proposed beneficiation facility includes two major mill buildings. The Grinding and Flotation Building is 380 x 420-feet and the Filtering, Drying and Briquetting Building is 280 x 330-feet. Both buildings are rigid steel-framed buildings with 26 gauge roofing and wall sheeting with insulation.

The Grinding and Flotation Building includes a full height sheeted wall between the grinding area and the flotation area to act as a sound barrier.

Two 30-ton, double girder, 100-foot span bridge cranes are included in the Grinding and Flotation Building, one running above the primary ball mill bay and the other above the stirred ball mill bay. In the flotation area there are twelve 5-ton monorail hoists, one centered above each bank of flotation cells. An open bay is included at the downstream end of the flotation cells for a laydown and maintenance area for the flotation equipment.

No cranes are included in the Filtering, Drying and Briquetting Building. It is anticipated that maintenance of filtering, drying and briquetting equipment would be performed using a mobile crane.

4.9 Ancillary Facilities

The oil shale beneficiation facility proposed includes all the supporting ancillary facilities necessary for its operation, maintenance, management and administration.

The capital cost includes the following:

- A. A 150 x 200-foot electrical and mechanical maintenance shop,
- B. A 110 x 250-foot administration building located between the beneficiation facility and the hydroretort facility which would provide office space for administrative and clerical personnel for both facilities,
- C. Lunch room, rest rooms and office space in the Filtering, Drying and Briquetting Building,
- D. Men's and women's change rooms, laboratory room, lunch room and miscellaneous office space in the Grinding and Flotation Building,
- E. Storage tanks for plant process water, flotation reagent, thickener flocculant and coagulant and briquetting binder as well as a process water steady head tank,
- F. Dust suppression and dust collection equipment incorporated into the crushing area and briquetting area as required to meet dust emission standards,
- G. A 6-foot high chain link fence around the entire beneficiation facility including the tailings pond,

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December 1988

- H. Two guard buildings provided to monitor access to the facility, and
- I. Fire protection system per Factory Mutual requirements.

5.0 BENEFICIATION FACILITY COSTS

The capital costs and operating costs of the Oil Shale Beneficiation Facility are presented in this section. The cost estimates presented here are stated in fourth quarter 1988 dollars and are accurate to ± 15 percent.

5.1 Capital Costs

The estimated capital cost of the proposed Oil Shale Beneficiation Facility is \$240.2 Million as shown in the following itemization. These costs are subject to the cost exclusions listed in Section 5.1.2.

<u>Area</u>	<u>Capital Cost</u>
00-General	\$12,370,890
01-Crushing & Ore Storage	\$15,402,224
03-Ball Mill Grinding	\$ 8,848,402
04-Stirred Ball mill Grinding	\$67,950,453
05-Flotation	\$10,151,786
06-Thickening	\$15,219,511
07-Filtration	\$20,001,031
08-Drying	\$ 6,159,792
09-Briquetting	\$10,897,857
11-Tailings Disposal	\$ 663,306
12-Mill Buildings	\$11,661,630
13-Ancillary Buildings	\$ 4,096,097
14-Site Preparation & Fence	\$ 3,710,209
15-Mobile Equipment	\$ 1,745,000
Engineering	\$ 7,555,128
Engineering Direct Cost	\$ 188,878
Engineering Consultants	\$ 200,000
Construction Management	\$ 6,659,250
Startup	\$ 1,888,782
Field Changes	\$ 586,699
Sales & Use Tax	\$ 6,381,729
Insurance(General Liability)	\$ 1,227,708
Contractor Profit	\$ 9,443,909
Construction Services	\$ 1,495,000
Subtotal	\$224,505,271
Contingency	\$15,699,654
Grand Total (± 15 percent)	\$240,204,925

Table 5.1 calculates the total cost per ton of briquetted oil shale concentrate. Additionally shown is the beneficiation cost per barrel of Fischer Assay oil contained in the briquettes and the beneficiation cost per barrel of oil recovered by hydroretorting. Table 5.2 shows the capital cost per ton of concentrate produced, attributed to each line item of the capital cost estimate.

Table 5.3 shows the breakdown of materials and labor that comprise the capital cost totals for Area 00 through Area 15. Table 5.4 is a further breakdown of the material and labor cost for each area into the various trade disciplines that are required to perform the construction work, i.e. Mechanical, Piping, Structural, Platework, Concrete, Earthwork and Electrical.

Detailed material take-off sheets listing the material and labor costs for all items in each discipline are included in Section 10 of this report. The take-off sheets are grouped into areas such that all of the Area 01-Crushing and Ore Storage sheets for all seven disciplines are in one section, all of the Area 03- Ball Mill Grinding sheets for all disciplines are in another section, etc.

Freight is included in the material costs.

Construction management costs are calculated based on an estimated construction schedule of thirty (30) months. Tables 5.5 and 5.6 provide the calculations of Construction Management and Construction Services costs. Construction Management costs include on-site and office personnel responsible for scheduling, material receiving and control, quality assurance, contract management, records and reports, cost control and budget projections, construction safety and field engineering. Also included are subsistence for non-local employees, vehicle expenses, employee allowances and field office rental.

Engineering labor and direct costs, startup / commissioning costs, etc. are calculated as a percentage of the material and labor costs as indicated in Table 5.4. The cost of engineering consultants is estimated to be \$200,000.00 and includes consultants to assist with the tailings pond design and representatives of equipment manufacturers on site for assistance and troubleshooting during installation and startup.

A contingency is included to cover unforeseen conditions or events that may arise during the completion of the project as currently defined. The contingency is not intended to cover changes in the project scope.

5.1.1 Basis for Capital Cost Estimate

The basic process design research and development information and flowsheet criteria for the beneficiation process were provided to Roberts & Schaefer by the Mineral Resources Institute. From that starting point, Roberts & Schaefer Co. prepared detailed flowsheets, an equipment list, general arrangement drawings, piping and instrumentation drawings and electrical one-line drawings in sufficient detail to establish the degree of accuracy required for the estimate. The included drawings that provide the basis for the estimate are listed in Section 7

Equipment and material take-offs were prepared and current unit prices were applied for piping, structural, platework, concrete and electrical materials. Written quotations were solicited for mechanical process equipment. Quotations were received for complete conveyors including all mechanical components, trusses, stringers, bents, conveyor hoods etc.

The equipment installation rates are composite crew rates that include mobilization, crane rental and small tools.

5.1.2 Cost Exclusions

The capital cost estimate does not provide for the following items:

- A. The land on which the beneficiation facility would be constructed,
- B. Developement of water well(s) to provide water for the beneficiation facility
- C. Laboratory equipment and office furnishings,
- D. Cranes in the Filtering, Drying and Briquetting Building,
- E. Environmental impact studies for the proposed facility,
- F. The initial complement of flotation and thickener reagents, briquetting binder and lubricants,
- G. Potable water chlorination, filtering or treatment,
- H. Utility services to the site.

Table 5.1

TOTAL COST TO HYCRUDE PER TON AND PER BARREL

Cost of Capital Per Ton of Concentrate	$\frac{\$240.2 \text{ Million} \times 0.155}{4.38 \text{ Million Tons per Year}}$	= \$8.50 per Ton
Cost of Deferred Capital Per Ton of Concentrate **	$\frac{\$ 0.43 \text{ Million} \times 0.155}{4.38 \text{ Million Tons per Year}}$	= \$0.02 per Ton
Operating Cost Per Ton of Concentrate	$\frac{\$ 64.9 \text{ Million per year}}{4.38 \text{ Million Tons per Year}}$	= \$14.81 per Ton
Cost of Mined Ore Per Ton Of Concentrate	$\frac{\$ 3.99 \times 12.76 \text{ Million Tons Mined}}{\text{Ton} \quad 4.38 \text{ Million Tons of Concentrate}}$	= \$11.62 per Ton

(Includes capital, operating and development costs of mining the ore)

Total Cost Per = \$34.95 per Ton
Ton Of Concentrate

Mining and Beneficiation Cost $\frac{\$34.95}{\text{Ton of Conc.}} \times \frac{\text{Ton of Conc.}}{34.1 \text{ Gallon}} \times \frac{42 \text{ Gallon}}{\text{Barrel}} = \43.05
Per Barrel of Fischer
Assay Oil In Concentrate

Mining and Beneficiation Cost $\frac{\$43.05}{\text{Bbl in Conc.}} \times \frac{9720 \text{ Bbl in Conc.}}{20,000 \text{ barrel Recovered in Hydroretort}} = \$ 20.92$
Per Barrel of Oil
Recovered By Hydro-
Retorting

** Present Value of \$1.745 Million spent 10 years from the present
= \$ 1.745 Million / (1 + 0.15)¹⁰ = \$ 0.43 Million

NOTE: The above calculations are based on the following:

15% return on investment

25 year project life

Replacement of Mobile Equipment after 10 years of operation

Table 5.2 CAPITAL COSTS PER TON OF CONCENTRATE

Description	Capital Cost	Beneficiation Facility Capital Cost Per Ton of Concentrate @ 4,380,000 Tons of Briquettes per Year
Area 00 - General	\$12,370,890	\$0.44
Area 01 - Crushing & Ore Storage	\$15,402,224	\$0.55
Area 03 - Ball Mill Grinding	\$8,848,402	\$0.31
Area 04 - Stirred Ball Mill Grinding	\$67,950,453	\$2.40
Area 05 - Flotation	\$10,151,786	\$0.36
Area 06 - Thickening	\$15,219,511	\$0.54
Area 07 - Filtration	\$20,001,031	\$0.71
Area 08 - Drying	\$6,159,792	\$0.22
Area 09 - Briquetting	\$10,897,857	\$0.39
Area 11 - Tailings Disposal	\$663,306	\$0.02
Area 12 - Mill Buildings	\$11,661,630	\$0.41
Area 13 - Ancillary Buildings	\$4,096,097	\$0.14
Area 14 - Site Preparation & Fence	\$3,710,209	\$0.13
Area 15 - Mobile Equipment	\$1,745,000	\$0.06
Subtotal	\$188,878,188	\$6.68
Engineering	\$7,555,128	\$0.27
Engineering Direct Cost	\$188,878	\$0.01
Engineering Consultants	\$200,000	\$0.01
Construction Management	\$6,659,250	\$0.24
Startup	\$1,888,782	\$0.07
Field Changes	\$586,699	\$0.02
Sales & Use Tax	\$6,381,729	\$0.23
Insurance (General Liability)	\$1,227,708	\$0.04
Contractor Profit	\$9,443,909	\$0.33
Construction Services	\$1,495,000	\$0.05
Subtotal	\$35,627,083	\$1.26
Contingency	\$15,699,654	\$0.56
Grand Total (+ or - 15%)	\$240,204,925	\$8.50

8820 Recap & Summary Sheet

Project N°: 8820

University of Alabama~MRI/Hy crude Oil Shale Beneficiation Study

Location: Central Alabama

Project Description

Oil shale beneficiation plant to produce 4,380,000 tons per year of concentrated oil shale briquettes with 34.1 gallons per ton (Fischer assay) kerogen content. Plant includes crushing, grinding, flotation, thickening, filtering, drying, briquetting and conveying equipment.

Cost	Description	Material	Labor	Total
00	General	\$9,364,495	\$3,006,395	\$12,370,890
01	Crushing & Ore Storage	\$10,508,045	\$4,894,179	\$15,402,224
03	Ball Mill Grinding	\$6,733,485	\$2,114,917	\$8,848,402
04	Stirred Ball Mill Grinding	\$65,631,593	\$2,318,860	\$67,950,453
05	Flotation	\$9,035,271	\$1,116,515	\$10,151,786
06	Thickening	\$14,137,998	\$1,081,513	\$15,219,511
07	Filtering	\$18,595,689	\$1,405,342	\$20,001,031
08	Drying	\$5,314,266	\$845,526	\$6,159,792
09	Briquetting	\$9,453,846	\$1,444,011	\$10,897,857
11	Tailings Disposal	\$609,037	\$54,269	\$663,306
12	Mill Buildings	\$4,939,008	\$6,722,622	\$11,661,630
13	Ancillary Buildings	\$3,475,489	\$620,608	\$4,096,097
14	Site Preparation & Fence	\$0	\$3,710,209	\$3,710,209
15	Mobile Equipment	\$1,745,000	\$0	\$1,745,000
	Subtotals	\$159,543,222	\$29,334,966	\$188,878,188
	Engineering Labor			\$7,555,128
	Engineering Direct Cost			\$188,878
	Engineering Consultants			\$200,000
	Construction Mgmt			\$6,659,250
	Startup			\$1,888,782
	Field Changes			\$586,699
	Sales & Use Tax			\$6,381,729
	Insurance (General Liability)			\$1,227,708
	Contractor Profit			\$9,443,909
	Construction Services			\$1,495,000
	Subtotal			\$224,505,271
	Contingency			\$15,699,654
	Grand Total			\$240,204,925

Table 5.3 Capital Cost Summary by Areas

Area/ Cost	Area Description	Mech Equip Mat'l	Mech Equip Labor	Piping Mat'l	Piping Labor	Struct Mat'l	Struct Labor	Platewk Mat'l	Platewk Labor	Concrete Mat'l	Concrete Labor	Earthwk Mat'l	Earthwk Labor	Elect Mat'l	Elect Labor	Total
00	General	534,800	47,800	3,443,937	2,816,118	628,490	0							4,757,268	142,477	12,370,890
01	Crushing & Ore Storage	6,624,557	929,871			2,108,550	1,938,999	307,378	284,745	974,500	1,441,900			493,060	298,664	15,402,224
03	Ball Mill Grinding	5,699,499	1,429,513			127,379	129,092	166,648	143,995					739,959	412,317	8,848,402
04	Stirred Ball Mill Grinding	64,337,500	1,320,855			584,978	601,225	33,197	30,607					675,918	366,173	67,950,453
05	Flotation	8,301,414	422,365			236,111	217,489	186,659	202,166					311,087	274,495	10,151,786
06	Thickening	13,004,200	89,102			263,997	255,491			81,420	52,370			788,381	684,550	15,219,511
07	Filtering	17,870,286	726,330			215,641	217,489	62,487	64,741					447,275	396,782	20,001,031
08	Drying	4,895,286	499,142			192,474	193,359	12,331	12,493					214,175	140,532	6,159,792
09	Briquetting	8,548,379	815,031			358,470	193,359	61,828	62,018					485,169	373,603	10,897,857
11	Tailings Disposal	567,000	39,483											42,037	14,786	663,306
12	Mill Buildings					2,376,231	3,514,316			2,080,313	2,935,192			482,464	273,114	11,661,630
13	Ancillary Buildings					3,057,800	0			311,610	455,430			106,079	165,178	4,096,097
14	Site Preparation & Fence											0	3,710,209			3,710,209
15	Mobile Equipment	1,745,000	0													1,745,000
	Subtotals	132,127,921	6,319,492	3,443,937	2,816,118	10,150,121	7,260,819	830,528	800,765	3,447,843	4,884,892	0	3,710,209	9,542,872	3,542,671	188,878,188
	Engineering Labor	(4% Mat'l & Labor)														7,555,128
	Engineering Direct Cost	(2.5% Eng)														188,878
	Engineering Consultants															200,000
	Construction Mgmt															6,659,250
	Startup	(1% * Mat'l & Labor)														1,888,782
	Field Changes	(2% * Labor)														586,699
	Sales & Use Tax	(4% * Mat'l)														6,381,729
	Insurance (Gen'l Liability)	(.65% * Mat'l & Labor)														1,227,708
	Contractor Profit	(5% Mat'l & Labor)														9,443,909
	Construction Services															1,495,000
	Total															224,505,271
	Contingency															15,699,654
	Grand Total															240,204,925

Table 5.4 Capital Cost Summary by Area and Discipline

Table 5.5 CONSTRUCTION MANAGEMENT

Quantity								Total Cost
Roberts & Schaefer Co. Costs								
WAGES								
Project Construction Manager	1	\$42.50	per hour	40	hour/week	2.5	years	\$221,000
Assistant Construction Managers	2	\$42.50	per hour	40	hour/week	2.5	years	\$442,000
Area Engineers	5	\$42.50	per hour	40	hour/week	2.5	years	\$1,105,000
Area Field Engineers	10	\$32,000	per year	2.05	Fringe benefit multiplier	2.5	years	\$1,640,000
Clerical / Accounting	4	\$28,500	per year	2.05	Fringe benefit multiplier	2.5	years	\$584,250
SUBSISTENCE, VEHICLES, MISC.								
Subsistence	8	\$1,500	per month	30	months			\$360,000
Vehicles	8	\$800	per month	30	months			\$192,000
Miscellaneous	8	\$500	per month	30	months			\$120,000
Expense Allowance	14	\$500	per month	30	months			\$210,000
FIELD OFFICE EXPENSE								
Field office rental,supplies and equipment	1 lot	\$12,000	per month	30	months			\$360,000
Erection Contractor's Costs								
Superintendent	1	\$7,500	per month	30	months			\$225,000
Assistants	3	\$6,000	per month	30	months			\$540,000
Field office rental, supplies and equipment	1	\$4,000	per month	30	months			\$120,000
Startup and Commissioning	1 lot							\$50,000
Electrical Contractor's Costs								
Management	1 lot	\$21,500	per month	20	months			\$430,000
Field Office	1 lot	\$3,000	per month	20	months			\$60,000
TOTAL CONSTR. MANAGEMENT								\$6,659,250

Table 5.6**CONSTRUCTION SERVICES**

Item	Project Cost * *
Testing & Quality Control	\$300,000
Safety/First Aid Ambulance Service	\$150,000
Parking/Service Facilities	\$30,000
Security Service	\$390,000
Communications	\$180,000
Warehousing	\$75,000
Temporary Services	
Surveying	\$50,000
Permitting	\$20,000
Power/utilities	\$300,000
	<hr/>
	\$1,495,000

** Note: The costs listed above are based on a 30 month construction schedule.

5.2 Beneficiation Facility Operating Costs

The estimated cost to operate the Oil Shale Beneficiation Facility is approximately \$64,876,000 annually. This operating cost includes the following items listed in order from highest to lowest annual cost:

- Electrical power,
- Operating supplies,
- Natural gas,
- Labor,
- Supervision,
- Maintenance of tailings pond,
- Maintenance supplies, and
- General expense.

Table 5.7 lists these items, their corresponding annual costs and a tabulation for each item showing its associated cost per ton of concentrated briquettes produced by the beneficiation plant, the cost per barrel of kerogen contained in the concentrate (based on Fischer Assay) and the cost per barrel of oil extracted from the concentrate by the hydroretort process. The latter cost per barrel figure is the beneficiation cost only and does not include the retorting cost.

In previous research by the Mineral Resources Institute it has been shown that the oil recovery from the hydroretort process is approximately double the recovery of oil from the concentrate by Fischer Assay. The result of this phenomenon is shown in Table 5.7. The same quantity of shale concentrate that produces 9720 barrels of oil based on Fischer Assay produces about 20,000 barrels of shale oil when hydroretorted.

5.2.1 Basis for Operating Costs

The following procedures were followed in determining operating costs.

Information was gathered from Alabama utility companies for electrical power rates and natural gas rates. The connected horsepower for each motor was totaled for each of the plant areas. The number of operating hours was calculated based on 90 percent plant availability. Calculations are provided for several diversity factors ranging from 70 percent to 100 percent for each area of the facility as shown in Tables 5.9 through 5.19. It is estimated that the actual diversity will be approximately 70 percent which is the factor used in the electrical operating cost summary shown in Table 5.8. The diversity factor accounts for the equipment not always operating at full load amperage and equipment that runs only intermittently. Electrical operating cost for lighting the process buildings and ancillary buildings is based on a 100 percent diversity factor.

The operating cost for natural gas is calculated based on the fuel consumption for the cage mill flash dryers as quoted by the dryer vendor.

Either written quotations or verbal quotations were received from vendors of grinding media, flotation and thickener reagents and the binder used for briquetting. Grinding mill vendors were contacted regarding the estimated consumption of grinding media. The initial charge of grinding media required for plant startup is included in the capital cost estimate while the replacement media is included as an operating cost.

The calculation of the cost of operating supplies is shown in Tables 5.22 and 5.23. The cost of the required supervision, operating and maintenance personnel required to operate the beneficiation facility is shown in Table 5.24. The salaries listed are estimates of the probable salaries earned by persons in those job descriptions. Not included is the cost of administrative personnel. Table 5.25 is a breakdown of manpower requirements by shift and operating area.

The operating cost includes the annual enlargement of the tailings pond. The capital cost includes the construction of a tailings pond to contain the tailings from the first two years of operation then the tailings pond would be enlarged annually in order to contain the annual tailings production. The earthwork required for the 2-year tailings pond is subtracted from the earthwork required for the 25-year tailings pond and the result divided by 23 to find the average amount of earthwork required annually to increase the tailings pond capacity. The earthwork quantity take-off for the dam is based on an upstream slope of 1: 1.5 and a downstream slope of 1: 2.

The category "Maintenance Supplies" includes replacement for worn parts, lubricants, replacement liners for chutework, paint, etc. and is estimated to be 1 percent of the capital cost of materials.

General Expenses include such items as Property Taxes, Workmens Compensation, Liability Insurance, etc. These costs were estimated based on normal rates in the State of Alabama.

5.2.2 Cost Exclusions

The operating cost estimate does not include the following items:

- A. Revegetation of the tailings pond at the end of its design life,
- B. Cost of the initial complement of flotation and thickener reagents and
 briquetting binder
- C. Administrative personnel

Table 5.7 OPERATING COST SUMMARY

Item	Annual Cost	BENEFICIATION COSTS		
		Beneficiation Cost/Ton of Concentrate @4,380,000 Ton/Year of Briquettes	Beneficiation Cost/Barrel of Fischer Assay Kerogen @ 9720 bbl/day In Concentrate	Beneficiation Cost/Barrel of Retorted Product @ 20000 bbl/day (average)
Electrical Power (based on 70% diversity)	\$27,567,086	\$6.29	7.77	\$4.18
Operating Supplies	\$21,894,313	\$5.00	6.17	\$3.32
Natural Gas	\$5,557,274	\$1.27	1.57	\$0.84
Labor (Wage Roll)	\$4,097,730	\$0.94	1.16	\$0.62
Supervision	\$1,260,756	\$0.29	0.36	\$0.19
Maintaining Tailings Pond	\$1,600,667	\$0.37	0.45	\$0.24
Maintenance Supplies	\$1,598,030	\$0.36	0.45	\$0.24
General Expense (Includes Prop.Taxes ,Workmens Compensation Liability Insurance, etc.)	\$1,300,000	\$0.30	0.37	\$0.20
Total Operating Cost	\$64,875,856	\$14.81	18.29	\$9.83

TABLE 5.8 ELECTRICAL POWER CONSUMPTION COST SUMMARY

AREA	CONNECTED LOAD	ASSUMED DIVERSITY FACTOR	TOTAL OPERATING COST/YEAR
00	2,413	70%	\$541,795
01	4,415	70%	\$991,527
03	14,065	70%	\$3,158,388
04	69,916	70%	\$15,699,234
05	10,848	70%	\$2,435,994
06	3,927	70%	\$881,821
07	3,191	70%	\$716,620
08	2,929	70%	\$657,597
09	7,110	70%	\$1,596,516
11	3,486	70%	\$782,700
12	337	100%	\$108,102
13	130	100%	\$41,701
TOTAL	122,768		\$27,567,086

TABLE 5.9 ELECTRICAL POWER CONSUMPTION COST - TOTAL PLANT

TOTAL PLANT POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor

95%

Operating Hours/Month

657

LOAD INFORMATION;

Connected Load (KVA)

122,768

Diversity Factor %

1.00

0.80

0.75

0.70

TOTAL KVA DEMAND

122,768

98,214

92,076

85,938

ENERGY COSTS;

Demand Charges @ \$5.01/KVA

\$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents

0.0229

Cost for all other KWH/cents

0.00929

Fuel charges/cents

0.01788

CALCULATIONS:

Total KWH per month

80,658,576

64,526,598

60,493,932

56,461,266

Demand Charge

\$615,067.68

\$492,052

\$461,300.76

\$430,549.38

Cost for 1ST 250 KWH

\$702,846.80

\$562,275.15

\$527,135.10

\$491,995.05

Cost for all other KWH

\$464,189.49

\$371,350.08

\$348,142.12

\$324,934.16

Fuel Cost

\$1,442,175.34

\$1,153,735.57

\$1,081,631.50

\$1,009,527.44

Sub Total

\$3,224,279.31

\$2,579,412.80

\$2,418,209.48

\$2,257,006.03

DEDUCT (Federal Tax) 1.996%

\$64,356.62

\$51,485.08

\$48,267.46

\$45,049.84

Sub Total

\$3,159,922.69

\$2,527,927.72

\$2,369,942.02

\$2,211,956.19

State Utility Tax @ 1.8%

\$56,878.61

\$45,502.70

\$42,658.96

\$39,815.21

Sub Total

\$3,216,801.30

\$2,573,430.42

\$2,412,600.98

\$2,251,771.40

Gross Reciept Tax @ 2.02%

\$64,979.39

\$51,983.29

\$48,734.54

\$45,485.78

TOTAL OPERATING COST /MONTH

\$3,281,780.69

\$2,625,413.71

\$2,461,335.52

\$2,297,257.18

TOTAL OPERATING COST /YEAR

\$39,381,368.28

\$31,504,964.52

\$29,536,026.24

\$27,567,086.16

COST/KWH in Cents

0.04

0.04

0.04

0.04

TABLE 5.10 ELECTRICAL POWER CONSUMPTION COST - AREA 00

AREA 00 - MAIN POWER DIST.
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 2,413

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

2,413 1,930 1,810 1,689

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 1,585,341 1,268,010 1,189,170 1,109,673

Demand Charge \$12,089.13 \$9,669 \$9,068.10 \$8,461.89

Cost for 1ST 250 KWH \$13,814.43 \$11,049.25 \$10,362.25 \$9,669.53

Cost for all other KWH \$9,123.63 \$7,297.39 \$6,843.66 \$6,386.16

Fuel Cost \$28,345.90 \$22,672.02 \$21,262.36 \$19,840.95

Sub Total

\$63,373.09 \$50,687.66 \$47,536.37 \$44,358.53

DEDUCT (Federal Tax) 1.996%

\$1,264.93 \$1,011.73 \$948.83 \$885.40

Sub Total

\$62,108.16 \$49,675.93 \$46,587.54 \$43,473.13

State Utility Tax @ 1.8%

\$1,117.95 \$894.17 \$838.58 \$782.52

Sub Total

\$63,226.11 \$50,570.10 \$47,426.12 \$44,255.65

Gross Receipt Tax @ 2.02%

\$1,277.17 \$1,021.52 \$958.01 \$893.96

TOTAL OPERATING COST /MONTH

\$64,503.28 \$51,591.62 \$48,384.13 \$45,149.61

TOTAL OPERATING COST /YEAR

\$774,039.36 \$619,099.44 \$580,609.56 \$541,795.32

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.11 ELECTRICAL POWER CONSUMPTION COST - AREA 01

AREA 01 - CRUSHING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 4,415

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

4,415 3,532 3,311 3,091

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 2,900,655 2,320,524 2,175,327 2,030,787

Demand Charge \$22,119.15 \$17,695 \$16,588.11 \$15,485.91

Cost for 1ST 250 KWH \$25,275.88 \$20,220.70 \$18,955.48 \$17,695.98

Cost for all other KWH \$16,693.25 \$13,354.60 \$12,518.99 \$11,687.16

Fuel Cost \$51,863.71 \$41,490.97 \$38,894.85 \$36,310.47

Sub Total

\$115,951.99 \$92,761.27 \$86,957.43 \$81,179.52

DEDUCT (Federal Tax) 1.996%

\$2,314.40 \$1,851.51 \$1,735.67 \$1,620.34

Sub Total

\$113,637.59 \$90,909.76 \$85,221.76 \$79,559.18

State Utility Tax @ 1.8%

\$2,045.48 \$1,636.38 \$1,533.99 \$1,432.07

Sub Total

\$115,683.07 \$92,546.14 \$86,755.75 \$80,991.25

Gross Receipt Tax @ 2.02%

\$2,336.80 \$1,869.43 \$1,752.47 \$1,636.02

TOTAL OPERATING COST /MONTH

\$118,019.87 \$94,415.57 \$88,508.22 \$82,627.27

TOTAL OPERATING COST /YEAR

\$1,416,238.44 \$1,132,986.84 \$1,062,098.64 \$991,527.24

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.12 ELECTRICAL POWER CONSUMPTION COST - AREA 03

AREA 03 - BALL MILL GRINDING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 14,065

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

14,065 11,252 10,549 9,846

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 9,240,705 7,392,564 6,930,693 6,468,822

Demand Charge \$70,465.65 \$56,373 \$52,850.49 \$49,328.46

Cost for 1ST 250 KWH \$80,522.13 \$64,417.70 \$60,393.03 \$56,368.35

Cost for all other KWH \$53,180.19 \$42,544.15 \$39,886.09 \$37,228.02

Fuel Cost \$165,223.81 \$132,179.04 \$123,920.79 \$115,662.54

Sub Total

\$369,391.78 \$295,513.89 \$277,050.40 \$258,587.37

DEDUCT (Federal Tax) 1.996%

\$7,373.06 \$5,898.46 \$5,529.93 \$5,161.40

Sub Total

\$362,018.72 \$289,615.43 \$271,520.47 \$253,425.97

State Utility Tax @ 1.8%

\$6,516.34 \$5,213.08 \$4,887.37 \$4,561.67

Sub Total

\$368,535.06 \$294,828.51 \$276,407.84 \$257,987.64

Gross Receipt Tax @ 2.02%

\$7,444.41 \$5,955.54 \$5,583.44 \$5,211.35

TOTAL OPERATING COST /MONTH

\$375,979.47 \$300,784.05 \$281,991.28 \$263,198.99

TOTAL OPERATING COST /YEAR

\$4,511,753.64 \$3,609,408.60 \$3,383,895.36 \$3,158,387.88

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.13 ELECTRICAL POWER CONSUMPTION COST - AREA 04

**AREA 04 - STIRRED BALL MILL GRINDING
POWER CONSUMPTION**

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 69,916

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND 69,916 55,933 52,437 48,941

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 45,934,812 36,747,981 34,451,109 32,154,237

Demand Charge \$350,279.16 \$280,224 \$262,709.37 \$245,194.41

Cost for 1ST 250 KWH \$400,269.10 \$320,216.43 \$300,201.83 \$280,187.23

Cost for all other KWH \$264,354.49 \$211,484.35 \$198,265.87 \$185,047.39

Fuel Cost \$821,314.44 \$657,053.90 \$615,985.83 \$574,917.76

Sub Total

\$1,836,217.19 \$1,468,978.68 \$1,377,162.90 \$1,285,346.79

DEDUCT (Federal Tax) 1.996%

\$36,650.90 \$29,320.81 \$27,488.17 \$25,655.52

Sub Total

\$1,799,566.29 \$1,439,657.87 \$1,349,674.73 \$1,259,691.27

State Utility Tax @ 1.8%

\$32,392.19 \$25,913.84 \$24,294.15 \$22,674.44

Sub Total

\$1,831,958.48 \$1,465,571.71 \$1,373,968.88 \$1,282,365.71

Gross Receipt Tax @ 2.02%

\$37,005.56 \$29,604.55 \$27,754.17 \$25,903.79

TOTAL OPERATING COST /MONTH

\$1,868,964.04 \$1,495,176.26 \$1,401,723.05 \$1,308,269.50

TOTAL OPERATING COST /YEAR

\$22,427,568.48 \$17,942,115.12 \$16,820,676.60 \$15,699,234.00

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.14 ELECTRICAL POWER CONSUMPTION COST - AREA 05

		AREA 05 - FLOTATION POWER CONSUMPTION			
ASSUMPTIONS;					
Single Metering Point					
Power Factor	95%				
Operating Hours/Month	657				
LOAD INFORMATION;					
Connected Load (KVA)	10,848				
Diversity Factor %		1.00	0.80	0.75	0.70
TOTAL KVA DEMAND		10,848	8,678	8,136	7,594
ENERGY COSTS;					
Demand Charges @ \$5.01/KVA	\$5.01				
ENERGY CHARGES:					
Cost for 1st 250 KWH/cents	0.0229				
Cost for all other KWH/cents	0.00929				
Fuel charges/cents	0.01788				
CALCULATIONS:					
Total KWH per month		7,127,136	5,701,446	5,345,352	4,989,258
Demand Charge		\$54,348.48	\$43,477	\$40,761.36	\$38,045.94
Cost for 1ST 250 KWH		\$62,104.80	\$49,681.55	\$46,578.60	\$43,475.65
Cost for all other KWH		\$41,016.61	\$32,811.78	\$30,762.46	\$28,713.14
Fuel Cost		\$127,433.19	\$101,941.85	\$95,574.89	\$89,207.93
Sub Total		\$284,903.08	\$227,912.18	\$213,677.31	\$199,442.66
DEDUCT (Federal Tax) 1.996%		\$5,686.67	\$4,549.13	\$4,265.00	\$3,980.88
Sub Total		\$279,216.41	\$223,363.05	\$209,412.31	\$195,461.78
State Utility Tax @ 1.8%		\$5,025.90	\$4,020.53	\$3,769.42	\$3,518.31
Sub Total		\$284,242.31	\$227,383.58	\$213,181.73	\$198,980.09
Gross Reciept Tax @ 2.02%		\$5,741.69	\$4,593.15	\$4,306.27	\$4,019.40
TOTAL OPERATING COST /MONTH		\$289,984.00	\$231,976.73	\$217,488.00	\$202,999.49
TOTAL OPERATING COST /YEAR		\$3,479,808.00	\$2,783,720.76	\$2,609,856.00	\$2,435,993.88
COST/KWH in Cents		0.04	0.04	0.04	0.04

TABLE 5.15

ELECTRICAL POWER CONSUMPTION COST - AREA 06

AREA 06 - THICKENING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 3,927

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

3,927

3,142

2,945

2,749

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 2,580,039 2,064,294 1,934,865 1,806,093

Demand Charge \$19,674.27 \$15,741 \$14,754.45 \$13,772.49

Cost for 1ST 250 KWH \$22,482.08 \$17,987.95 \$16,860.13 \$15,738.03

Cost for all other KWH \$14,848.10 \$11,880.00 \$11,135.13 \$10,394.05

Fuel Cost \$46,131.10 \$36,909.58 \$34,595.39 \$32,292.94

Sub Total

\$103,135.55

\$82,518.53

\$77,345.10

\$72,197.51

DEDUCT (Federal Tax) 1.996%

\$2,058.59

\$1,647.07

\$1,543.81

\$1,441.06

Sub Total

\$101,076.96

\$80,871.46

\$75,801.29

\$70,756.45

State Utility Tax @ 1.8%

\$1,819.39

\$1,455.69

\$1,364.42

\$1,273.62

Sub Total

\$102,896.35

\$82,327.15

\$77,165.71

\$72,030.07

Gross Receipt Tax @ 2.02%

\$2,078.51

\$1,663.01

\$1,558.75

\$1,455.01

TOTAL OPERATING COST /MONTH

\$104,974.86

\$83,990.16

\$78,724.46

\$73,485.08

TOTAL OPERATING COST /YEAR

\$1,259,698.32

\$1,007,881.92

\$944,693.52

\$881,820.96

COST/KWH in Cents

0.04

0.04

0.04

0.04

TABLE 5.16 ELECTRICAL POWER CONSUMPTION COST - AREA 07

AREA 07 - FILTERING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 3,191

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

3,191 2,553 2,393 2,234

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 2,096,487 1,677,321 1,572,201 1,467,738

Demand Charge \$15,986.91 \$12,791 \$11,988.93 \$11,192.34

Cost for 1ST 250 KWH \$18,268.48 \$14,615.93 \$13,699.93 \$12,789.65

Cost for all other KWH \$12,065.27 \$9,652.97 \$9,048.00 \$8,446.82

Fuel Cost \$37,485.19 \$29,990.50 \$28,110.95 \$26,243.16

Sub Total

\$83,805.85 \$67,050.40 \$62,847.81 \$58,671.97

DEDUCT (Federal Tax) 1.996%

\$1,672.76 \$1,338.33 \$1,254.44 \$1,171.09

Sub Total

\$82,133.09 \$65,712.07 \$61,593.37 \$57,500.88

State Utility Tax @ 1.8%

\$1,478.40 \$1,182.82 \$1,108.68 \$1,035.02

Sub Total

\$83,611.49 \$66,894.89 \$62,702.05 \$58,535.90

Gross Receipt Tax @ 2.02%

\$1,688.95 \$1,351.28 \$1,266.58 \$1,182.43

TOTAL OPERATING COST /MONTH

\$85,300.44 \$68,246.17 \$63,968.63 \$59,718.33

TOTAL OPERATING COST /YEAR

\$1,023,605.28 \$818,954.04 \$767,623.56 \$716,619.96

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.17 ELECTRICAL POWER CONSUMPTION COST - AREA 08

AREA 08 - DRYING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor

95%

Operating Hours/Month

657

LOAD INFORMATION;

Connected Load (KVA)

2,929

Diversity Factor %

1.00

0.80

0.75

0.70

TOTAL KVA DEMAND

2,929

2,343

2,197

2,050

ENERGY COSTS;

Demand Charges @ \$5.01/KVA

\$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents

0.0229

Cost for all other KWH/cents

0.00929

Fuel charges/cents

0.01788

CALCULATIONS:

Total KWH per month

1,924,353

1,539,351

1,443,429

1,346,850

Demand Charge

\$14,674.29

\$11,738

\$11,006.97

\$10,270.50

Cost for 1ST 250 KWH

\$16,768.53

\$13,413.68

\$12,577.83

\$11,736.25

Cost for all other KWH

\$11,074.64

\$8,858.95

\$8,306.92

\$7,751.11

Fuel Cost

\$34,407.43

\$27,523.60

\$25,808.51

\$24,081.68

Sub Total

\$76,924.89

\$61,534.23

\$57,700.23

\$53,839.54

DEDUCT (Federal Tax) 1.996%

\$1,535.42

\$1,228.22

\$1,151.70

\$1,074.64

Sub Total

\$75,389.47

\$60,306.01

\$56,548.53

\$52,764.90

State Utility Tax @ 1.8%

\$1,357.01

\$1,085.51

\$1,017.87

\$949.77

Sub Total

\$76,746.48

\$61,391.52

\$57,566.40

\$53,714.67

Gross Reciept Tax @ 2.02%

\$1,550.28

\$1,240.11

\$1,162.84

\$1,085.04

TOTAL OPERATING COST /MONTH

\$78,296.76

\$62,631.63

\$58,729.24

\$54,799.71

TOTAL OPERATING COST /YEAR

\$939,561.12

\$751,579.56

\$704,750.88

\$657,596.52

COST/KWH in Cents

0.04

0.04

0.04

0.04

TABLE 5.18 ELECTRICAL POWER CONSUMPTION COST - AREA 09

AREA 09 - BRIQUETTING
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 7,110

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

7,110 5,688 5,333 4,977

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 4,671,270 3,737,016 3,503,781 3,269,889

Demand Charge \$35,621.10 \$28,497 \$26,718.33 \$24,934.77

Cost for 1ST 250 KWH \$40,704.75 \$32,563.80 \$30,531.43 \$28,493.33

Cost for all other KWH \$26,883.12 \$21,506.50 \$20,164.23 \$18,818.19

Fuel Cost \$83,522.31 \$66,817.85 \$62,647.60 \$58,465.62

Sub Total

\$186,731.28 \$149,385.15 \$140,061.59 \$130,711.91

DEDUCT (Federal Tax) 1.996%

\$3,727.16 \$2,981.73 \$2,795.63 \$2,609.01

Sub Total

\$183,004.12 \$146,403.42 \$137,265.96 \$128,102.90

State Utility Tax @ 1.8%

\$3,294.07 \$2,635.26 \$2,470.79 \$2,305.85

Sub Total

\$186,298.19 \$149,038.68 \$139,736.75 \$130,408.75

Gross Receipt Tax @ 2.02%

\$3,763.22 \$3,010.58 \$2,822.68 \$2,634.26

TOTAL OPERATING COST /MONTH

\$190,061.41 \$152,049.26 \$142,559.43 \$133,043.01

TOTAL OPERATING COST /YEAR

\$2,280,736.92 \$1,824,591.12 \$1,710,713.16 \$1,596,516.12

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.19 ELECTRICAL POWER CONSUMPTION COST - AREA 11

AREA 11 - TAILINGS POND
POWER CONSUMPTION

ASSUMPTIONS;

Single Metering Point

Power Factor 95%

Operating Hours/Month 657

LOAD INFORMATION;

Connected Load (KVA) 3,486

Diversity Factor % 1.00 0.80 0.75 0.70

TOTAL KVA DEMAND

3,486 2,789 2,615 2,440

ENERGY COSTS;

Demand Charges @ \$5.01/KVA \$5.01

ENERGY CHARGES:

Cost for 1st 250 KWH/cents 0.0229

Cost for all other KWH/cents 0.00929

Fuel charges/cents 0.01788

CALCULATIONS:

Total KWH per month 2,290,302 1,832,373 1,718,055 1,603,080

Demand Charge \$17,464.86 \$13,973 \$13,101.15 \$12,224.40

Cost for 1ST 250 KWH \$19,957.35 \$15,967.03 \$14,970.88 \$13,969.00

Cost for all other KWH \$13,180.67 \$10,545.29 \$9,887.39 \$9,225.71

Fuel Cost \$40,950.60 \$32,762.83 \$30,718.82 \$28,663.07

Sub Total

\$91,553.48 \$73,248.15 \$68,678.24 \$64,082.18

DEDUCT (Federal Tax) 1.996%

\$1,827.41 \$1,462.03 \$1,370.82 \$1,279.08

Sub Total

\$89,726.07 \$71,786.12 \$67,307.42 \$62,803.10

State Utility Tax @ 1.8%

\$1,615.07 \$1,292.15 \$1,211.53 \$1,130.46

Sub Total

\$91,341.14 \$73,078.27 \$68,518.95 \$63,933.56

Gross Receipt Tax @ 2.02%

\$1,845.09 \$1,476.18 \$1,384.08 \$1,291.46

TOTAL OPERATING COST /MONTH

\$93,186.23 \$74,554.45 \$69,903.03 \$65,225.02

TOTAL OPERATING COST /YEAR

\$1,118,234.76 \$894,653.40 \$838,836.36 \$782,700.24

COST/KWH in Cents

0.04 0.04 0.04 0.04

TABLE 5.20 ELECTRICAL POWER CONSUMPTION COST - AREA 12

AREA 12 - MILL BUILDING GENERAL LIGHTING		
ASSUMPTIONS;		
Single Metering Point		
Power Factor	95%	
Operating Hours/Month	657	
LOAD INFORMATION;		
Connected Load (KVA)	337	
Diversity Factor %		1.00
TOTAL KVA DEMAND		337
ENERGY COSTS;		
Demand Charges @ \$5.01/KVA	\$5.01	
ENERGY CHARGES:		
Cost for 1st 250 KWH/cents	0.0229	
Cost for all other KWH/cents	0.00929	
Fuel charges/cents	0.01788	
CALCULATIONS:		
Total KWH per month		221,409
Demand Charge		\$1,688.37
Cost for 1ST 250 KWH		\$1,929.33
Cost for all other KWH		\$1,274.21
Fuel Cost		\$3,958.79
Sub Total		\$8,850.70
DEDUCT (Federal Tax) 1.996%		\$176.66
Sub Total		\$8,674.04
State Utility Tax @ 1.8%		\$156.13
Sub Total		\$8,830.17
Gross Reciept Tax @ 2.02%		\$178.37
TOTAL OPERATING COST /MONTH		\$9,008.54
TOTAL OPERATING COST /YEAR		\$108,102.48
COST/KWH in Cents		0.04

TABLE 5.21 ELECTRICAL POWER CONSUMPTION COST - AREA 13

		AREA 13 - ANCILLARY BLDGS. GENERAL LIGHTING	
ASSUMPTIONS;			
Single Metering Point			
Power Factor	95%		
Operating Hours/Month	657		
LOAD INFORMATION;			
Connected Load (KVA)	130		
Diversity Factor %			1.00
TOTAL KVA DEMAND			130
ENERGY COSTS;			
Demand Charges @ \$5.01/KVA	\$5.01		
ENERGY CHARGES:			
Cost for 1st 250 KWH/cents	0.0229		
Cost for all other KWH/cents	0.00929		
Fuel charges/cents	0.01788		
CALCULATIONS:			
Total KWH per month		85,410	
Demand Charge		\$651.30	
Cost for 1ST 250 KWH		\$744.25	
Cost for all other KWH		\$491.53	
Fuel Cost		\$1,527.13	
	Sub Total	\$3,414.21	
DEDUCT (Federal Tax) 1.996%		\$68.15	
	Sub Total	\$3,346.06	
State Utility Tax @ 1.8%		\$60.23	
	Sub Total	\$3,406.29	
Gross Reciept Tax @ 2.02%		\$68.81	
TOTAL OPERATING COST /MONTH		\$3,475.10	
TOTAL OPERATING COST /YEAR		\$41,701.20	
COST/KWH in Cents		0.04	

Table 5.22

COST OF OPERATING SUPPLIES

Item	Usage	Units	Tonnage Basis		Item Usage			Item Unit	Annual
			Quantity	Units	Lbs/Hr	Lbs /Day	Lbs/330 Days	Cost	Cost
Grinding Balls									
Primary Mills	2	Lb/Ton	1620	TPH	3,240	77,760	25,660,800	\$0.25	\$6,415,200
Primary Stirred Ball Mills	30	Gm/Ton	1620	TPH	107	2,569	847,824	\$1.00	\$847,824
Regrind Stirred Ball Mills	30	Gm/Ton	1037	TPH	69	1,645	542,712	\$1.00	\$542,712
Subtotal Grinding Balls									\$7,805,736
Flotation Reagent									
Rougher Flotation	0.1	Lb/Ton	1620	TPH	162	3,888	1,283,040	\$0.50	\$641,520
Cleaner Flotation	0.1	Lb/Ton	1037	TPH	104	2,489	821,304	\$0.50	\$410,652
49 Flocculant (Nalco 8872)									
Primary Thickener	20	PPM	3844	TPH(pulp)	154	3,690	1,217,779	0.772	\$940,126
Concentrate Thickener	20	PPM	2637	TPH (pulp)	105	2,532	835,402	0.772	\$644,930
Coagulant (Nalco 8852)									
Primary Thickener	10	PPM	3844	TPH (pulp)	77	1,845	608,890	0.487	\$296,529
Concentrate Thickener	10	PPM	2637	TPH (pulp)	53	1,266	417,701	0.487	\$203,420
Subtotal Reagents									\$3,137,177
Binder for Briquetting	0.025	Ton/Ton	543	TPH	27,150	651,600	215,028,000	0.05	\$10,751,400
Small Items & Miscellaneous									\$200,000
Total Operating Supplies									\$21,894,313

Table 5.23 OTHER OPERATING EXPENSES

NATURAL GAS

	Hourly Usage		Operating Hours Per Year (avg)	Annual Consumption	Cost per MM BTU	Annual Cost
Total Natural Gas Usage Cost	264	MM BTU	7,884	2,081,376 MM BTU	\$2.67	\$5,557,274

MAINTENANCE SUPPLIES

	Annual Cost
Maintenance Supplies Costs (1% of Capital Cost of Materials)	\$1,598,030

MAINTAINING TAILINGS POND

	Engineered Fill Required for 23 years operation	Engineered Fill req'd per Year (average)	Cost Per Cubic Yard	Annual Cost
Tailings Pond Maintenance	19,376,500 cubic yards	842,457 cubic yards	\$1.90	\$1,600,667

Table 5.24

LABOR COSTS

Item	No.	Annual Salary	Total Amount
SUPERVISION			
Plant Superintendent	1	\$48,840	\$48,840
General Foreman	1	\$45,000	\$45,000
Metallurgist	1	\$45,000	\$45,000
Master Mechanic	1	\$42,400	\$42,400
Master Electrician	1	\$42,400	\$42,400
Maintenance Foremen	4	\$36,900	\$147,600
Operating Foremen	4	\$36,900	\$147,600
Service Personnel	11	\$34,700	\$381,700
Subtotal	24		\$900,540
40% Fringe Benefits			\$360,216
Subtotal Salary Cost			\$1,260,756
WAGE ROLL			
Operating Personnel	84	\$23,700	\$1,990,800
Maintenance Personnel	46	\$23,700	\$1,090,200
Subtotal			\$3,081,000
33% Fringe Benefits			\$1,016,730
Subtotal Wage Roll Cost			\$4,097,730
Grand Total Labor Cost			\$5,358,486

Table 5.25 BREAKDOWN OF MANPOWER REQUIREMENTS

	SHIFT	Day	Evening	Night	Total	
SUPERVISION						
Plant Superintendent		1	-	-	1	
General Foreman		1	-	-	1	
Metallurgist		1	-	-	1	
Master Mechanic		1	-	-	1	
Master Electrician		1	-	-	1	
Maintenance Foremen		1	1	1	4.2	*
Operating Foremen		1	1	1	4.2	*
Subtotal Supervision					13.4	
SALARIED SERVICE PERSONNEL						
Laboratory		1	1	1	4.2	*
Health & Safety		1	-	-	1	
Security Guard		1	1	1	4.2	*
Receptionist		1	-	-	1	
Subtotal Service Personnel					10.4	
Total Salaried Personnel					23.8	
OPERATING & MAINTENANCE					Operating Total *	Maintenance Total*
Area 01-Crusher						
Crusher Operator (control room)		1	1	1	4.2	
Laborers		3	3	3	12.6	
Maintenance		4	1	-		7
Area 03-Ore Reclaim and Primary Grinding						
Mill Operator (control room)		1	1	1	4.2	
Laborers		2	2	2	8.4	
Bulldozer Operator @ Ore Storage		1	1	1	4.2	
Maintenance		4	1	1		8.4
Area 04-Stirred Ball Mill Grinding						
Operator		Included in Area 03			0	
Laborers		1	1	1	4.2	
Maintenance		Included in Area 03				0

- * A multiplier of 1.4 is incorporated to account for the number of shifts worked in a 7-day operating week.

Table 5.25 BREAKDOWN OF MANPOWER REQUIREMENTS

	SHIFT	Day	Evening	Night	Total	
Area 05-Flotation						
Operator		Included in Area 03			0	
Laborers		1	1	1	4.2	
Maintenance		4	1	-		7
Area 06-Thickening						
Operator		Included in Areas 03 & 07			0	
Laborers		1	1	1	4.2	
Maintenance		2	-	-		2.8
Area 07-Filtering						
Operator (control room)		1	1	1	4.2	
Laborers		1	1	1	4.2	
Maintenance		2	1	-		4.2
Area 08-Drying						
Operators		Included in Area 07			0	
Laborers		1	1	1	4.2	
Maintenance		2	1	-		4.2
Area 09-Briquetting						
Operator		Included in Area 07			0	
Laborers		1	1	1	4.2	
Maintenance		2	2	2		8.4
Area 11-Tailings						
Laborers		1	1	1	4.2	
Maintenance		1	-	-		1.4
Area 12-Mill Buildings						
Janitor		1	-	-	1.4	
Area 13-Ancillary Buildings						
Elect. & Mech. Technicians		2	2	2	8.4	
Area 15-Mobile Equipment						
Equipment Operators		1	1	1	4.2	
Maintenance		1	1	-	2.8	2.8
Total Oper. & Maint. Personnel					84	46.2
Grand Total Manpower					154	

- * A multiplier of 1.4 is incorporated to account for the number of shifts worked in a 7-day operating week.

6.0 RECOMMENDATIONS AND CONSIDERATIONS

Further research and testing and / or changes to the flowsheet could possibly reduce the capital and operating costs of the beneficiation facility described in this report .

Potential considerations for changes to the flowsheet and additional testing could include one or more of the following items.

- A. Incorporation of column flotation could replace the conventional flotation cells and eliminate or reduce the number of regrind stirred ball mills. Recent research by the Mineral Resources Institute indicates that column flotation technology could yield approximately the same recovery of kerogen as conventional cell flotation even when using feed to the flotation column in the 20 micron size range. This could allow for the elimination of the regrind stirred ball mill circuits and the approximately 30,000 connected horsepower associated with them. Further testing would be required.
- B. Replacement of the primary stirred ball mills with conventional ball mills capable of grinding the material down to 80 percent passing 20 microns would reduce the equipment cost associated with the large quantity of primary stirred ball mills. Even though energy requirements would be essentially the same, the capital cost could be reduced and the operating cost for grinding media could possibly decrease. Further testing by grinding equipment manufacturers would be required.
- C. Direct fluid bed retorting of the moist material in the 10-micron size range would mean that the drying operation could be eliminated or substantially reduced and briquetting operations could be eliminated from the beneficiation facility. The resulting savings would be in equipment cost, energy cost and cost of briquetting binder. However, there might be additional equipment and operating costs involved in the retorting operation. Further testing would be required.
- D. Further testing by equipment manufacturers using large samples of the finely ground oil shale concentrate would enable the manufacturers to more accurately predict the performance of the equipment. For example, the Larox filter manufacturer quoted equipment that will produce a filter cake with a moisture content of 20 percent, but also stated that moisture contents in the range of 8 to 10 percent have been achieved when filtering other materials. Reducing the filter cake to this range of moisture content would allow for a substantial reduction or complete elimination of drying equipment and associated drying energy requirement.

7.0 DRAWINGS

Roberts & Schaefer Company has prepared the following drawings which are the basis of the capital and operating cost estimates.

Drawing Number	Title
8820-L1	Overall Site Plot Plan
8820-L2	Crushing Circuit Plot Plan
8820-L3	Primary-Secondary Crusher Station, General Arrangement Sections
8820-L4	Tertiary Crushing Station, General Arrangement Sections
8820-L5	Storage Piles and Reclaim to Mills, General Arrangement Elevations
8820-L6	Grinding and Flotation Area, Plan View
8820-L7	Grinding and Flotation Area, Elevations and Sections
8820-L8	Primary & Concentrate Thickeners, Sections & Elevation
8820-L9	Filtering, Drying & Briquetting Building, Plan View
8820-L10	Filtering, Drying & Briquetting Building, Elevations and Sections
8820-FS1	Crushing Area Flowsheet
8820-FS2	Process Plant Flowsheet
8820-FS3	Process Plant Flowsheet
8820-FS4	Process Plant Flowsheet
8820-PP1	Piping & Instrument Diagram, Crushing Circuit
8820-PP2	Piping & Instrument Diagram Process Plant
8820-PP3	Piping & Instrument Diagram Process Plant
8820-PP4	Piping & Instrument Diagram Process Plant
8820-E1	Block Diagram and Symbols
8820-E2	One Line Diagram - 7.2 KV Distribution
8820-E3	One Line Diagram - 7.2 KV Motor Control Centers
8820-E4	One Line Diagram - 7.2 KV Motor Control Centers
8820-E5	One Line Diagram - 480 V Motor Control Centers
8820-E6	One Line Diagram - 480 V Motor Control Centers
8820-E7	One Line Diagram - 480 V Motor Control Centers
8820-E8	One Line Diagram - 480 V Motor Control Centers
8820-E9	One Line Diagram - 480 V Motor Control Centers

12-7-88	PROGRESS MEETING REVIEW	12-7-88	PROGRESS MEETING REVIEW
12-7-88	GENERAL	12-7-88	GENERAL
12-23-88	GENERAL	12-23-88	GENERAL
DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY MERRELL	PLOT PLAN	SCALE 1" = 200'	DATE 11-11-88
CHECKED BY RHR	OVERALL SITE	DESIGNED BY	
APPROVED BY	UNIVERSITY OF ALABAMA MRI/HYCRUDE	PROJECT NO.	8820-L1
	OIL SHALE BENEFICIATION PROJECT		

2

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION
		12-9-88	MINOR REVISIONS
		11-23-88	ADDED GRINDING BALL STOR.
		11-3-88	CUSTOMER REVIEW

ROBERTS & SCHAEFER
 ENGINEERS AND CONTRACTORS
 CHICAGO - SALT LAKE CITY

MADE BY MERRELL
 CHECKED BY RHR
 APPROVED BY [Signature]

PLOT PLAN
 CRUSHING CIRCUIT
 UNIVERSITY OF ALABAMA MRI/HYCRUDE
 OIL SHALE BENEFICIATION PROJECT

SCALE 1" = 40'-0"
 DATE 10-11-88
 DRAWING NO. 8820-L2
 REV. 3

2

ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY				GENERAL ARRANGEMENT SECTIONS PRIMARY - SECONDARY CRUSHER STA. UNIVERSITY OF ALABAMA MRI/HYCRUDE OIL SHALE BENEFICIATION PROJECT		SCALE 1" = 20'-0"	DATE 10-3-88
DATE		DESCRIPTION OF REVISION		DATE		DESCRIPTION OF REVISION	
11-3-88		CUSTOMER REVIEW					

8820-L3

8820-L2

SECTION: E

SECTION (F)

SECTION (D)
8820-L2

[illegible]

2

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY H.L. NUTTALL
CHECKED BY RHR
APPROVED BY [Signature]

GENERAL ARRANGEMENT - ELEVATIONS
STORAGE FILES & RECLAIM TO MILLS
UNIVERSITY OF ALABAMA, MRI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE 1" = 20'
DATE OCT. 3, '88
DRAWING NO. 8820-L5
REV. 2

2

ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY				MADE BY H.C. NUTTALL CHECKED BY RHR APPROVED BY <i>[Signature]</i>		GRINDING AND FLOTATION AREA PLAN VIEW		SCALE 1" = 20' DATE 11-22-88	
PROJECT: 11-7-88 PROGRESS MEETING REVIEW				UNIVERSITY OF ALABAMA, MRI / HYCRUDE		8820-L6		OIL SHALE BENEFICIATION PROJECT	
DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION
2-9-88	MINOR REVISION		

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY: H.T. NUTTALL
CHECKED BY: RHR
APPROVED BY: [Signature]

GRINDING AND FLOTATION AREA
ELEVATIONS AND SECTIONS
UNIVERSITY OF ALABAMA, MRI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE: 1" = 20'
DATE: 11-18-68
DRAWING NO.: 8820-L7

2

ELEVATION-DETAIL (2)
SCALE: 1/8"=1'-0"

ELEVATION-DETAIL (3)
SCALE: 1/8"=1'-0"
(CONCENTRATE THICKENER SIMILAR)

ELEVATION: THICKENER SECTION (A)
SCALE: 1"=30'-0"

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION
11-7-88	PROGRESS MEETING REVIEW		

ROBERTS & SCHAEFER
Company
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY RF
CHECKED BY RHR
APPROVED BY [Signature]

SECTION - ELEVATION
PRIMARY & CONCENTRATE THICKENERS
UNIVERSITY OF ALABAMA MRI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE 1"=30'-0"
DATE 12-1-88
DRAWING NO. 8820-L8
REV. 1

PLAN
FILTERING, DRYING & BRIQUETTING BUILDING
 SCALE: 1" = 20'-0"

THIS PLATFORM
 IS TYPICAL FOR
 ALL THREE CIRCUITS

PLAN - UPPER PLATFORM
 SCALE: 1" = 20'-0"

REV	DATE	DESCRIPTION OF REVISION	REV	DATE	DESCRIPTION OF REVISION
1	12-7-88	PROGRESS MEETING REVIEW			

ROBERTS & SCHAEFER
 ENGINEERS AND CONTRACTORS
 CHICAGO - SALT LAKE CITY

MADE BY RF
 CHECKED BY RHR
 APPROVED BY [Signature]

FILTERING, DRYING & BRIQUETTING BUILDING
PLAN VIEW
 UNIVERSITY OF ALABAMA - MRI/HYGRADE
 OIL SHALE BENEFICIATION PROJECT

SCALE 1" = 20'
 DATE 11-18-88
 DRAWING NO. 8820-L9
 SHEET 1

ELEVATION-SECTION **B**

THIS SECTION IS TYPICAL FOR ALL THREE CIRCUITS

ELEVATION-SECTION **C**

ELEVATION-SECTION **A**

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION
12-8-88	PROGRESS MEETING REVIEW		

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY RF
CHECKED BY RHR
APPROVED BY [Signature]

FILTERING, DRYING & BRIQUETTING BUILDING
ELEVATIONS AND SECTIONS
UNIVERSITY OF ALABAMA, MRI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE 1" = 20'
DATE 11-18-88
DRAWING NO. 8820-L10
SHEET 1 OF 1

LEGEND

TPH SOLIDS	% SOLIDS	S.G. PULP
TPH WATER		GPM PULP

12/8/88 PROGRESS MEETING REVIEW 12/12/88 CLIENT COMMENTS & GEN. UPDATE 11/11/88 REVISED PER CLIENT COMMENTS		ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY		MADE BY: J. A. PETERSON CHECKED BY: RHR DIRECTED BY: RHR		FLOW SHEET PROCESS PLANT UNIVERSITY OF ALABAMA, MRI/HYCRUDE OIL SHALE BENEFICIATION PROJECT		SCALE: NTS DATE: 10-20-88	8820-FS2 3
DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

[illegible]

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY		J. A. PETERSON	
CHECKED BY <i>all</i>		DIRECTED BY <i>RHF</i>	
APPROVED <i>Peterson</i>			

FLOW SHEET
PROCESS PLANT
UNIVERSITY OF ALABAMA, MRI/HYCRUDE
SHALE BENEFICIATION PROJECT

SCALE	NTS	DATE	10-20-68
DRAWING NO.			
8820-FS3			

2

LEGEND

TPH SOLIDS	% SOLIDS	S.G. PULP
TPH WATER		GPM PULP

DUST COLLECTION POINT

		12/8/88		PROGRESS MEETING REVIEW		ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY		DRAWN BY J. A. PETERSON		FLOW SHEET		SCALE NTS		DATE 10-20-88		REV 3	
		12/12/88		CLIENT COMMENTS & GEN. UPDATE				CHECKED BY RHR		DIRECTED BY RHR		PROCESS PLANT		DRAWING NO.			
		11/11/88		REVISED PER CLIENT COMMENTS				APPROVED BY [Signature]				UNIVERSITY OF ALABAMA, MRI/HYCRUDE		8820-FS4			
REV		DATE		DESCRIPTION OF REVISION		REV		DATE		DESCRIPTION OF REVISION

- LEGEND**
- DUST COLLECTION POINT
 - DUST SUPPRESSION SPRAY POINT
 - JOB LOCKOUT/STOP CONTROL STATION
 - START/STOP PUSHBUTTONS IN CONTROL ROOM
 - MANUAL OFF-AUTO SWITCH
 - BELT MISALIGNMENT SWITCH
 - PULL CORD SAFETY SWITCH
 - PLUGGED CHUTE PROBE
 - LEVEL SWITCH
 - SPEED SWITCH
 - FLOW ELEMENT
 - FLOW CONTROLLER
 - TEMPERATURE INDICATOR
 - INSTRUMENT AIR SUPPLY
 - WATT HOUR METER

REV	DATE	DESCRIPTION OF REVISION	REV	DATE	DESCRIPTION OF REVISION
1	12/9/88	PROGRESS MEETING REVIEW			

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY: J. A. PETERSON
DIRECTED BY: RHR
APPROVED BY: *[Signature]*

PIPING & INSTRUMENT DIAGRAM
PROCESS PLANT
UNIVERSITY OF ALABAMA, MHI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE: NTS
DATE: 10-20-88
8820-PP2

2

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION
12/9/88	PROGRESS MEETING REVIEW		

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY J. A. PETERSON
CHECKED BY R.H.R.
APPROVED

PIPING & INSTRUMENT DIAGRAM
PROCESS PLANT
UNIVERSITY OF ALABAMA, MRI/HYCRUDE
OIL SHALE BENEFICIATION PROJECT

SCALE NTS
DATE 10-20-88
DRAWING NO. 8820-PP3
REV. 1

<div> <div> <div> <div> <div></div> <div></div> </div> </div> </div> </div>				<div> <div> <div>ROBERTS & SCHAEFER</div> <div>ENGINEERS AND CONTRACTORS</div> <div>CHICAGO - SALT LAKE CITY</div> </div> <div> <div>Company</div> </div> </div>		<div> <div> <div>MADE BY</div> <div>J. A. PETERSON</div> </div> <div> <div>CHECKED BY</div> <div>RHR</div> </div> </div>		<div> <div> <div>PIPING & INSTRUMENT DIAGRAM</div> <div>PROCESS PLANT</div> <div>UNIVERSITY OF ALABAMA, MRI/HYCRUDE</div> <div>OIL SHALE BENEFICIATION PROJECT</div> </div> </div>		<div> <div> <div>SCALE</div> <div>NTS</div> </div> <div> <div>DATE</div> <div>10-20-88</div> </div> </div>		<div> <div> <div>8820-PP4</div> </div> </div>		<div> <div></div> </div>																
<table> <tr> <th>REV</th><th>DATE</th><th>DESCRIPTION OF REVISION</th><th>REV</th><th>DATE</th><th>DESCRIPTION OF REVISION</th></tr> <tr> <td>1</td><td>1-7-88</td><td>PROGRESS MEETING REVIEW</td><td></td><td></td><td></td></tr> </table>				REV	DATE							DESCRIPTION OF REVISION	REV	DATE	DESCRIPTION OF REVISION	1	1-7-88	PROGRESS MEETING REVIEW				<div> <div> <div>MADE BY</div> <div>J. A. PETERSON</div> </div> <div> <div>CHECKED BY</div> <div>RHR</div> </div> </div>								<div> <div> <div>PIPING & INSTRUMENT DIAGRAM</div> <div>PROCESS PLANT</div> <div>UNIVERSITY OF ALABAMA, MRI/HYCRUDE</div> <div>OIL SHALE BENEFICIATION PROJECT</div> </div> </div>
REV	DATE	DESCRIPTION OF REVISION	REV	DATE	DESCRIPTION OF REVISION																									
1	1-7-88	PROGRESS MEETING REVIEW

SYMBOLS

- (50) - Watt-hour Meter
- (AM) - Ammeter
- (AS) - Ammeter Switch (Shunt Trip Operator)
- (VM) - Voltmeter
- (WM) - Wattmeter
- [Symbol: Transformer with ground symbol] - Transformer w/Resistance Ground & Shunt Trip Circuit
- [Symbol: Breaker symbol] - Continuous Current Breaker
- [Symbol: Circle with X] - Motor Circuit Protector
- [Symbol: Two parallel lines] - Fused Disconnect
- [Symbol: Motor symbol] - Motor Starter (Size 0-4)
- [Symbol: Motor symbol with dashed line] - Motor Starter (Size 5 or Larger)
- VSD - Variable Speed Drive
- [Symbol: Wavy line] - Overloads
- [Symbol: Triangle with dot] - Welding Receptacle
- [Symbol: Three horizontal lines] - Ground

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY D. HALLIDAY	BLOCK DIAGRAM	SCALE NONE	DATE 12-8-88
DESIGNED BY RHR	AND SYMBOLS	UNIV. OF ALABAMA HRI/HYCRUDE	8820-E1
APPROVED BY [Signature]		OIL SHALE BENEFICATION PROJECT

CRUSHER AREA POWER LAYOUT

MILL & FLOTATION CIRCUIT "A"
TYPICAL FOR CIRCUITS "B" & "C"

BRIQUETTING & DRYING CIRCUIT "A"
TYPICAL FOR CIRCUITS "B" & "C"

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY T. RASMUSSEN
CHECKED BY [Signature]
APPROVED BY [Signature]

ONE LINE DIAGRAM
7.2 KV DISTRIBUTION
UNIV. OF ALABAMA MRI/HYCRUDE
OIL SHALE BENEFICATION PROJECT

SCALE NONE
DATE 12-2-88
8820-E2

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY T. RASMUSSEN
CHECKED BY RHR
APPROVED BY [Signature]

ONE LINE DIAGRAM
7.2 KV MOTOR CONTROL CENTERS
UNIV. OF ALABAMA MRI/HYCRUDE
OIL SHALE BENEFICATION PROJECT

SCALE NONE
DATE 11-23-88
DRAWING NO. 8820-E3
REV. 0

TO 7.2 KV SWITCHGEAR
#00-S6-05 (DWG. 8820-E2)

TO 7.2 KV SWITCHGEAR
#00-S6-02 (DWG. 8820-E2)

NOTES:
1. MCC'S SHOWN ARE FOR CIRCUIT "A". CIRCUITS "B" & "C" ARE TYPICAL EXCEPT WHERE INDICATED BY DASHED LINES.

TO 7.2 KV SWITCHGEAR
#00-S6-02 (DWG. 8820-E2)

TO 7.2 KV SWITCHGEAR
#00-S6-02 (DWG. 8820-E2)

TO 7.2 KV SWITCHGEAR
#00-S6-02 (DWG. 8820-E2)

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY T. RASMUSSEN

DIRECTED BY RHR

ONE LINE DIAGRAM

7.2 KV MOTOR CONTROL CENTERS

UNIV. OF ALABAMA MRI/HYCRUDE

OIL SHALE BENEFICATION PROJECT

SCALE NONE

DRAWING NO.

8820-E4

DATE 11-18-88

REV.

TO 7.2KV SWITCHGEAR
DWG. 8820-E2

1000KVA TRANSFORMER
7200-480/277V

CRUSHING AREA - MCC #01-MC-02

DATE		DESCRIPTION OF REVISION		DATE		DESCRIPTION OF REVISION	
ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY				MADE BY T. RASMUSSEN DIRECTED BY R.H.R. APPROVED BY [Signature]			
ONE LINE DIAGRAM 480 V MOTOR CONTROL CENTERS UNIV. OF ALABAMA MRI/HYCRUDE OIL SHALE BENEFICIATION PROJECT				SCALE NONE DATE 11-30-88 DRAWING NO. 8820-E5			

TO SECONDARY UNIT
SUBSTATION #05-US-02
(DWG. 8820-E2)

TO SECONDARY UNIT
SUBSTATION #05-US-02
(DWG. 8820-E2)

NOTES:

1. MCC'S SHOWN ARE FOR CIRCUIT "A". CIRCUITS "B" & "C" ARE TYPICAL.

DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY T. RASMUSSEN	DIRECTED BY RHR	ONE LINE DIAGRAM	SCALE NONE	DATE 11-21-88
480 V MOTOR CONTROL CENTERS		UNIV. OF ALABAMA MRI/HYCRUDE		
OIL SHALE BENEFICATION PROJECT		8820-E6		

TO SECONDARY UNIT
SUBSTATION #05-US-02
(DWG. 8820-E2)

TO SECONDARY UNIT
SUBSTATION #05-US-02
(DWG. 8820-E2)

TO SECONDARY UNIT
SUBSTATION #05-US-02
(DWG. 8820-E2)

NOTES:

1. FLOTATION BANK MCC'S SHOWN ARE FOR CIRCUIT "A". CIRCUITS "B" & "C" ARE TYPICAL.

GENERAL PLANT MCC #03-MC-09
CIRCUIT "A" ONLY

REV	DATE	DESCRIPTION OF REVISION	REV	DATE	DESCRIPTION OF REVISION

ROBERTS & SCHAEFER
ENGINEERS AND CONTRACTORS
CHICAGO - SALT LAKE CITY

MADE BY T. RASMUSSEN
DIRECTED BY RHR
APPROVED

ONE LINE DIAGRAM
480 V MOTOR CONTROL CENTERS
UNIV. OF ALABAMA MRI/HYCRUDE
OIL SHALE BENEFICATION PROJECT

SCALE NONE
DATE 11-17-88
DRAWING NO. 8820-E7

2

1. MCC SHOWN IS FOR CIRCUIT "A". CIRCUITS "B" & "C" ARE TYPICAL.

SCALE	NONE	DATE	11-16-88
DRAWING NO.		REV.	
8820-E8

TO SECONDARY UNIT
SUBSTATION #07-US-05
(DWG. 8820-E2)

NOTES:

- MCC SHOWN IS FOR CIRCUIT "A". CIRCUITS "B" & "C" ARE TYPICAL EXCEPT WHERE INDICATED BY DASHED LINES.

ROBERTS & SCHAEFER ENGINEERS AND CONTRACTORS CHICAGO - SALT LAKE CITY		MADE BY: T. RASMUSSEN CHECKED BY: RHR APPROVED BY: <i>[Signature]</i>		ONE LINE DIAGRAM 480 V MOTOR CONTROL CENTERS UNIV. OF ALABAMA WRI/HYCRUDE OIL SHALE BENEFICATION PROJECT		SCALE: NONE DATE: 11-22-88 DRAWING NO: 8820-E9 REV: <i>[Signature]</i>
DATE	DESCRIPTION OF REVISION	DATE	DESCRIPTION OF REVISION			

8.0 PROCESS STREAM CALCULATIONS - MATERIAL AND WATER BALANCE

**MRI/HYCRUDE OIL SHALE BENEFICIATION
ROBERTS & SCHAEFER CONTRACT 8820**

PROCESS STREAM CALCULATIONS - MATERIAL AND WATER BALANCE

RUN-OF-MINE	34,956	AVERAGE TONS PER DAY (DRY BASIS)
	10570	AVERAGE bbl OIL PER DAY
	36" X 0	ROM SIZE
	1620	DESIGN TONS PER HOUR
	12.7	OIL GALLON PER TON (Fischer Assay)
	2.4	SPECIFIC GRAVITY - SOLIDS
CRUSHED PRODUCT	3/8" X 0	PARTICLE SIZE
	(80% @ -3/8")	
	1620	DESIGN TONS PER HOUR
	95%	PERCENT SOLIDS
	2.24	PULP DENSITY (S.G.)
PRIMARY BALL MILL DILUTION	3152	GPM WATER
PRIMARY BALL MILL DISCHARGE	28 MESH X 0"	PARTICLE SIZE
	(80% @ -28 MESH)	
	1620	DESIGN TONS PER HOUR
	65%	PERCENT SOLIDS
	1.61	PULP DENSITY (S.G.)
	6186	GPM
PRIMARY STIRRED BALL MILL DILUTION	2994	GPM WATER
PRIMARY STIRRED BALL MILL DISCHARGE	34,956	AVERAGE TONS PER DAY
	1620	DESIGN TONS PER HOUR
	90% @ -20 MICRON	PARTICLE SIZE
	50%	PERCENT SOLIDS
	1.41	PULP DENSITY (S.G.)
	9180	GPM
PRIMARY FLOTATION FEED WATER	45,948	WATER GPM
PRIMARY FLOTATION FEED	34,956	AVERAGE TONS PER DAY
	1620	DESIGN TONS PER HOUR
	90% @ -20 MICRON	PARTICLE SIZE
	11%	PERCENT SOLIDS
	1.07	PULP DENSITY
	55,128	GPM

PRIMARY FLOTATION CONCENTRATE	22,407	AVERAGE TONS PER DAY
(PRIMARY THICKENER FEED)	10,031	AVERAGE bbl OIL PER DAY
	1037	DESIGN TONS PER DAY
	9%	PERCENT SOLIDS
	2.2	SPECIFIC GRAVITY SOLIDS
	1.05	PULP DENSITY
	43,807	GPM
PRIMARY FLOTATION TAILINGS	12,549	AVERAGE TONS PER DAY
	539	AVERAGE bbl OIL PER DAY
	583	DESIGN TONS PER HOUR
	18.2%	PERCENT SOLIDS
	2.8	SPECIFIC GRAVITY - SOLIDS
	1.13	PULP DENSITY
	11325	GPM
PRIMARY THICKENER FEED	SAME AS PRIMARY FLOTATION CONCENTRATE	
PRIMARY THICKENER UNDERFLOW	22,407	AVERAGE TONS PER DAY
	1037	DESIGN TONS PER HOUR
	35%	PERCENT SOLIDS
	1.24	PULP DENSITY
	9558	GPM
PRIMARY THICKENER OVERFLOW	34,236	GPM WATER
REGRIND STIR MILL DISCHARGE	22,407	AVERAGE TONS PER DAY
	1037	DESIGN TONS PER HOUR
	35%	PERCENT SOLIDS
	1.24	PULP DENSITY
	90 @ -10 MICRON	PARTICLE SIZE
	9558	GPM
CLEANER FLOTATION FEED DILUTION	28,032	GPM WATER
CLEANER FLOTATION FEED	22,407	AVERAGE TONS PER DAY
	1037	DESIGN TONS PER HOUR
	10.4%	PERCENT SOLIDS
	1.06	PULP DENSITY
	37,621	GPM
CLEANER FLOTATION CONCENTRATE	11,702	AVERAGE TONS PER DAY
(CONCENTRATE THICKENER FEED)	9720	AVERAGE bbl OIL PER DAY
	543	DESIGN TONS PER HOUR
	8%	PERCENT SOLIDS
	1.8	SPECIFIC GRAVITY SOLIDS
	1.04	PULP DENSITY
	26,183	GPM

CLEANER FLOTATION TAILINGS	10,705	AVERAGE TONS PER DAY
	311	AVERAGE bbl OIL PER DAY
	494	DESIGN TONS PER HOUR
	15.5%	PERCENT SOLIDS
	2.8	SPECIFIC GRAVITY SOLIDS
	1.11	PULP DENSITY
	11,458	GPM
CLEANER FLOTATION CONCENTRATE THICKENER FEED	SAME AS CLEANER CONCENTRATE ABOVE + FILTRATE	
	26183	GPM + 4527 GPM =
	30710	GPM
CLEANER FLOTATION CONCENTRATE THICKENER UNDERFLOW	11,702	AVERAGE TONS PER DAY
	543	DESIGN TONS PER HOUR
	30%	PERCENT SOLIDS
	1.15	PULP DENSITY
	6275	GPM
CONCENTRATE THICKENER OVERFLOW	19908	GPM WATER + FILTRATE(4527 GPM) =
	24435	GPM WATER
TAILINGS TO POND	23,254	AVERAGE TONS PER DAY
	550	AVERAGE bbl OIL PER DAY
	1077	DESIGN TONS PER HOUR
	16.8%	PERCENT SOLIDS
	1.12	PULP DENSITY
	22,821	GPM
POND OVERFLOW	14,160	GPM WATER
FILTER FEED	SAME AS CONCENTRATE THICKENER UNDERFLOW	
FILTER CAKE DISCHARGE (FEED TO DRYERS)	11,702	AVERAGE TONS PER DAY
	543	DESIGN TONS PER HOUR
	20%	PERCENT MOISTURE
	1.55	PULP DENSITY
FILTRATE	4527	GPM
THERMAL EXHAUST FROM DRYER	348	GPM WATER

THERMAL DRYER PRODUCT		11,702	AVERAGE TONS PER DAY
		34.9	OIL GALLONS/TON (FISCHER ASSAY)
		543	DESIGN TONS PER HOUR
		8	PERCENT MOISTURE
BINDER (2 1/2 %)	ADD:	13.6	TON PER HOUR (LIGNO-SULPHONATE)
		50%	PERCENT SOLIDS
FEED TO AGGLOMERATION W/BINDER		557	DESIGN TON PER HOUR
		10%	PERCENT MOISTURE
AGGLOMERATION	ADD:	292	AVERAGE TONS PER DAY BINDER (2 1/2%)
		11702	AVERAGE TONS PER DAY CONC.
		11994	AVERAGE TONS PER DAY PRODUCT
		34.1	OIL GALLONS PER TON (FISCHER ASSAY)

8820
December 1988

9.0 EQUIPMENT LIST

8820 EQUIPMENT LIST Rev 2

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
1	000		00-5301	Air Compressor	Air Compressor System for Plant Air and Dust Collection	125 PSIG 870 cfm	200		Air cooled with heatless air dryer and 400 gallon receiver
2	001	T-1	01-0001	Primary Crusher Feed Hopper	Dump Hopper for 170 Ton Capacity Trucks	30' X 35' X 28' 350 Ton Live Capacity		Concrete 29,000 ft ³	With 200 Ton Discharge Vault
3	002	G-1	01-3001	Primary Crusher	Nordberg Gyratory	60" x 90"	700	Abrasion Resistant Steel-Manganese	@ 1620 STPH each Crushes ROM 36" to pass 6" opening (6" OSS).
4	003	T-14	01-0002	Primary Crusher Discharge Chute	10" x 0" Crushed Ore to Feeder			Abrasion Resistant Lined Steel	
5	004	F-1	01-4001	Apron Feeder	ROM Feeder	66" X 30' lg	40	Abrasion Resist. Steel	Feeds ROM Ore @1620 STPH from Gyratory Crusher. Var.Speed w/Var.Freq.Controller
6	0041		01-4001A	Apron Feeder Dribble Drag Scraper	Removes dribble from Apron Feeder Dribble Pan		10	Structural Steel Frame	Purchase Integral with Apron Feeder
7	0042		01-0156	Baghouse	Dust Collection Baghouse @ Primary Crushing Station				
8	0043		01-5401	Blower	Blower @ Primary Dust Collection System		30		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
9	0044		01-1254	Sump	Sump for dust at primary crusher dust collection			Mild steel	
10	0045		01-5180	Pump	Centrifugal slurry pump at primary crusher dust collection sump	100 GPM 30' TDH	2	Synthetic rubber lined.	
11	005	F-2	01-1001	Secondary Crusher Feed Conveyor #1	16° Inclined Troughing Belt Conveyor #1	48" X 330' C/C Pulleys	200	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400 FPM, 35° Troughing Idlers 1620 STPH
12	006		01-1201	Surge Bin	Before Secondary Crushers	3200 Ton Live		Steel	Two hour surge capacity
13	007		01-4002	Vibrating Grizzly Feeder	Feeds Crushed Ore from secondary crusher surge bin to secondary crusher	54" wide X 24' long	40	A.R. Lined Steel	8' long Stepped Grizzly with Bars at 3" wide opening. Variable spd.
14	008		01-4003	Vibrating Grizzly Feeder	Feeds Crushed Ore from secondary crusher surge bin to secondary crusher	54" wide X 24' long	40	A.R. Lined Steel	8' long Stepped Grizzly with Grizzly Bars at 3" wide opening. Variable spd.
15	009		01-0003	Grizzly undersize chute	Directs -3" mat'l to secondary crusher collecting conveyor			A.R. Lined Steel	Handles 3" X 0" Material at 180 TPH
16	010		01-0004	Grizzly undersize chute	Directs -3" mat'l to secondary crusher collecting conveyor			A.R. Lined Steel	Handles 3" X 0" Material at 180 TPH

8820 EQUIPMENT LIST Lev 2

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
17	011	T-16	01-0005	Grizzly discharge chute	-10" X 3" Ore to secondary Crusher			A.R. Lined Steel	630 TPH 10" x 0"
18	012	T-16	01-0006	Grizzly discharge chute	-10" X 3" Ore to secondary Crusher			A.R. Lined Steel	630 TPH 10" x 0"
19	013	G-2	01-3002	Secondary Crusher	Symons Std. Hd 7' Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@ 670 STPH capacity Crushes 6" ore to pass 2" opening. 1"CSS
20	014	G-2	01-3003	Secondary Crusher	Symons Std. Hd 7' Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@ 670 STPH capacity Crushes 6" ore to pass 2" opening 1"CSS
21	015	T-17	01-0007	Secondary Crusher Discharge Chute	Directs Ore to Secondary Crusher Collecting Conveyor			A.R. Lined Steel	630 TPH 3" X 0"
22	016	T-17	01-0008	Secondary Crusher Discharge Chute	Directs Ore to Secondary Crusher Collecting Conveyor			A.R. Lined Steel	630 TPH 3" X 0"
23	0161		01-0157	Baghouse	Dust Collection Baghouse @ Secondary Crushing Station				
24	0162		01-5403	Blower	Blower @ Secondary Dust Collection System		100		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
25	0163		01-1255	Sump	Sump for dust at secondary crusher dust collection			Mild steel	
26	0164	P	01-5181	Pump	Centrifugal slurry pump at primary crusher dust collection system	100 GPM 30 FT. TDH	2	Synthetic rubber lined	
27	017	F-4	01-1002	Secondary Crusher Collecting Conveyor#2A	10° Inclined Troughing Belt Conv from Sec'ndary Crusher to Tertiary Crusher Surge Bin	48" X 277' C/C Pulleys	75	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400' Min, 35° Troughing Idlers 810 STPH
28	018	F-5	01-1003	Secondary Crusher Collecting Conveyor #2B	10° Inclined Troughing Belt Conv from Sec'ndary Crusher to Tertiary Crusher Surge Bin	48" X 277' C/C Pulleys	75	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 810 STPH
29	019		01-1202	Tertiary Crusher Surge Bin	Before tertiary crushers	1600 Ton live capacity		Steel	One hour surge capacity
30	020		01-4004	Vibrating Feeder	Feeds crushed ore to vibrating screen	54" wide X 20' long	20	A.R. Lined Steel	765 TPH 3" X 0". Variable speed drive
31	021		01-4005	Vibrating Feeder	Feeds crushed ore to vibrating screen	54" wide X 20' long	20	A.R. Lined Steel	765 TPH 3" X 0". Variable speed drive
32	022		01-4006	Vibrating Feeder	Feeds crushed ore to vibrating screen	54" wide X 20' long	20	A.R. Lined Steel	765 TPH 3" X 0". Variable speed drive

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
33	023		01-4007	Vibrating Feeder	Feeds crushed ore to vibrating screen	54" wide X 20' long	20	A.R. Lined Steel	765 TPH 3" X 0". Variable speed drive
34	024	T-22 to T-25	01-0009	Screen Feed Chute	Directs 3" x 0" ore from feeders to screens			A.R. Lined Steel	765 TPH 3" X 0".
35	025	T-22 to T-25	01-0010	Screen Feed Chute	Directs 3" x 0" ore from feeders to screens			A.R. Lined Steel	765 TPH 3" X 0".
36	026	T-22 to T-25	01-0011	Screen Feed Chute	Directs 3" x 0" ore from feeders to screens			A.R. Lined Steel	765 TPH 3" X 0"
37	027	T-22 to T-25	01-0012	Screen Feed Chute	Directs 3" x 0" ore from feeders to screens			A.R. Lined Steel	765 TPH 3" X 0"
38	028	F-20	01-2001	Vibrating Screen	8' X 24' Double Deck AC Ripple Flow or Equal	8' wide X 24' long	15	Abrasion Resistant Steel	Top Deck: 1" Square opening Bottom Deck: 5/8" Square opening
39	029	F-21	01-2002	Vibrating Screen	8' X 24' Double Deck AC Ripple Flow or Equal	8' wide X 24' long	15	Abrasion Resistant Steel	Top Deck: 1" Square opening Bottom Deck: 5/8" Square opening
40	030	F-22	01-2003	Vibrating Screen	8' X 24' Double Deck AC Ripple Flow or Equal	8 wide X 24' long	15	Abrasion Resistant Steel	Top Deck: 1" Square opening Bottom Deck: 5/8" Square opening

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
41	031	F-23	01-2004	Vibrating Screen	8' X 24' Double Deck AC Ripple Flow or Equal Double Deck	8 wide X 24' long	15	Abrasion Resistant Steel	Top Deck: 1" Square opening Bottom Deck: 5/8" Square opening
42	032	T-34	01-0013	Screen Oversize Chutes	Directs Screen Oversize to Tertiary Crusher			A.R. Lined Steel	360 TPH 3" X 1"
43	033	T-35	01-0014	Screen Oversize Chutes	Directs Screen Oversize to Tertiary Crusher			A.R. Lined Steel	360 TPH 3" X 1"
44	034	T-36	01-0015	Screen Oversize Chutes	Directs Screen Oversize to Tertiary Crusher			A.R. Lined Steel	360 TPH 3" X 1"
45	035	T-37	01-0016	Screen Oversize Chutes	Directs Screen Oversize to Tertiary Crusher			A.R. Lined Steel	360 TPH 3" X 1"
46	036	G-3	01-3004	Tertiary Crusher	Symons Short Head Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@360 STPH cap. Crushes 3" ore to pass 3/4 opening 3/8" CSS
47	037	G-3	01-3005	Tertiary Crusher	Symons Short Head Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@360 STPH cap. Crushes 3" ore to pass 3/4 opening 3/8" CSS
48	038	G-3	01-3006	Tertiary Crusher	Symons Short Head Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@360 STPH cap. Crushes 3" ore to pass 3/4 opening 3/8" CSS

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
49	039	G-3	01-3007	Tertiary Crusher	Symons Short Head Cone Crusher	7'	400	Abrasion Resistant Steel-Manganese	@360 STPH cap. Crushes 3" ore to pass 3/4 opening 3/8" CSS
50	040	T-20 & T-21	01-0017	Tertiary Crusher Discharge Chute	Directs Crushed Ore to first recycle Conveyor			A.R. Lined Steel _____ lbs	
51	041	T-20 & T-21	01-0018	Tertiary Crusher Discharge Chute	Directs Crushed Ore to first recycle Conveyor			A.R. Lined Steel _____ lbs	
52	042	T-20 & T-21	01-0019	Tertiary Crusher Discharge Chute	Directs Crushed Ore to first recycle Conveyor			A.R. Lined Steel	
53	043	T-20 & T-21	01-0020	Tertiary Crusher Discharge Chute	Directs Crushed Ore to first recycle Conveyor			A.R. Lined Steel	
54	0431		01-0158	Baghouse	Dust Collection Baghouse @ Tertiary Crushing Station				
55	0432		01-5402	Blower	Blower @ Tertiary Dust Collection System		250		
56	0433		01-1256	Sump	Sump for dust at tertiary crusher dust collector			Mild steel	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
57	0434	P	01-5182	Pump	Centrifugal slurry pump at tertiary crusher dust collection system	100 GPM 30' TDH	2	Synthetic rubber lined.	
58	044	F-29	01-1004	First Recycle Conveyor #4A	Vertically Curved Troughing Belt Conveyor	36" X 251' C/C Pulleys 31' Lift	50	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 720 TPH
59	045	F-30	01-1005	First Recycle Conveyor #4B	Vertically Cruved Troughing Belt Conveyor	36" X 251' C/C Pulleys 31' Lift	50	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 720 TPH
60	046	T-42	01-0021	Recycle Conveyor Transfer Chute	Directs Material from First Recycle Conveyor to Second Recycle Conveyor			A. R. Lined Steel	
61	047	T-43	01-0022	Recycle Conveyor Transfer Chute	Directs Material from First Recycle Conveyor to Second Recycle Conveyor			A. R. Lined Steel	
62	048	F-31	01-1006	Second Recycle Conveyor #5A	16° Inclined Troughing Belt Conveyor	36" X 51' C/C Pulleys 14' Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 720 TPH
63	049	F-32	01-1007	Second Recycle Conveyor #5B	16° Inclined Troughing Belt Conveyor	36" X 51' C/C Pulleys 14' Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 720 TPH
64	050		01-0162	Head chute	Head chute for recycle conveyor #5A			3/8" mild steel plate (1/8" corr. allowance) with A.R. liner	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
65	051		01-0163	Head chute	Head chute for recycle conveyor #5B			3/8" mild steel plate (1/8" corr. allowance) with A.R. liner	
66	055	T-26 to T-33	01-0023	Screen Undersize Chutes	Directs Ore to Raw Shale Stockpile Conveyors			3/8" Mild Steel Plate (1/8" corr. allowance) with A.R. liner	405 TPH 3/8" X 0"
67	056	T-26 to T-33	01-0024	Screen Undersize Chutes	Directs Ore to Raw Shale Stockpile Conveyors			3/8" Mild Steel Plate (1/8" corr. allowance) with A.R. liner	405 TPH 3/8" X 0"
68	057	T-26 to T-33	01-0025	Screen Undersize Chutes	Directs Ore to Raw Shale Stockpile Conveyors			3/8" Mild Steel Plate (1/8" corr. allowance) with A.R. liner	405 TPH 3/8" X 0"
69	058	T-26 to T-33	01-0026	Screen Undersize Chutes	Directs Ore to Raw Shale Stockpile Conveyors			3/8" Mild Steel Plate (1/8" corr. allowance) with A.R. liner	405 TPH 3/8" X 0"
70	063	F-35	01-1008	Crushed Ore Collecting Conveyor #3A	Horizontal Troughing Belt Conveyor	36" X 48' C/C Pulleys Zero Lift	20	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 810 TPH
71	063	F-35	01-1009	Crushed Ore Collecting Conveyor #3B	Horizontal Troughing Belt Conveyor	36" X 48' C/C Pulleys Zero Lift	20	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 810 TPH
72	066	F-35	01-1010	Crushed Ore Collecting Conveyor #6	Vertically Curved Troughing Belt Conveyor	48" X 230' C/C Pulleys 13' Lift	60	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 1620 TPH

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
73	067	F-35	01-1011	Crushed Ore Conveyor #7	16° Inclined Troughing Belt Conveyor	48" X 330' C/C Pulleys 91' Lift	200	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 1620 TPH
74	068	F-35	01-1012	Crushed Ore Conveyor #8	Inclined Troughing Belt Conveyor	48" X 96' C/C Pulleys 11' Lift	50	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 1620 TPH
75	069	F-35	01-1013	Crushed Ore Conveyor #9	Horizontal Troughing Belt Conveyor	48" X 95' C/C Pulleys Zero Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 400'/Min, 35° Troughing Idlers 1620 TPH
76	070	T-46 to T-48	01-0027	Crushed Shale Conv. Disc. Chute	Directs Shale into Concrete Stacking Tube			A.R. Lined Steel	With Flop Gate Pneumatic Cyliner Actuated
77	072	T-46 to T-48	01-0028	Crushed Shale Conv. Disc. Chute	Directs Shale into Concrete Stacking Tube			A.R. Lined Steel	With Flop Gate Pneumatic Cyliner Actuated
78	074	T-46 to T-48	01-0029	Crushed Shale Conv. Disc. Chute	Directs Shale into Concrete Stacking Tube			A.R. Lined Steel	
79	076		01-0030	Stacking Tube	Crushed Ore Storage Stacking Tube	14' I.D. X 95' High		Concrete	
80	077		01-0031	Stacking Tube	Crushed Ore Storage Stacking Tube	14' I.D. X 95' High		Concrete	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
81	078		01-0032	Stacking Tube	Crushed Ore Storage Stacking Tube	14' I.D. X 95' High		Concrete	
82	100		03-1101	Crushed Ore Reclaim Tunnel	Below Crushed Ore Storage Piles			Concrete Box	
83	101		03-1102	Crushed Ore Reclaim Tunnel	Below Crushed Ore Storage Piles			Concrete Box	
84	102		03-1103	Crushed Ore Reclaim Tunnel	Below Crushed Ore Storage Piles			Concrete Box	
85	111	P	03-5001	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2" x 3" x 11 Morris	7.5	Abrasion & Corrosion Resist. C.S.	In Crushed Ore Reclaim Tunnel
86	112	P	03-5002	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2" x 3" x 11 Morris0	7.5	Abrasion & Corrosion Resist. C.S.	In Crushed Ore Reclaim Tunnel
87	113	P	03-5003	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2" x 3" x 11 Morris	7.5	Abrasion & Corrosion Resist. C.S.	In Crushed Ore Reclaim Tunnel
88	180	T-49 to T-53	03-0033	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
8 9	181	T-49 to T-53	03-0034	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 0	182	T-49 to T-53	03-0035	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 1	183	T-49 to T-53	03-0036	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 2	184	T-49 to T-53	03-0037	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 3	185	T-49 to T-53	03-0038	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 4	186	T-49 to T-53	03-0039	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 5	187	T-49 to T-53	03-0040	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
9 6	188	T-49 to T-53	03-0041	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
97	189	T-49 to T-53	03-0042	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
98	190	T-49 to T-53	03-0043	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
99	191	T-49 to T-53	03-0044	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
100	192	T-49 to T-53	03-0045	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
101	193	T-49 to T-53	03-0046	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
102	194	T-49 to T-53	03-0047	Shale Feeder Chute	Directs Shale from Stockpile onto Vibrating Feeder			A.R. Lined Steel	
103	211	F-36	03-4008	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
104	212	F-36	03-4009	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
105	213	F-36	03-4010	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
106	214	F-36	03-4011	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
107	215	F-36	03-4012	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
108	216	F-37	03-4013	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
109	217	F-37	03-4014	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
110	218	F-37	03-4015	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
111	219	F-37	03-4016	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
112	220	F-37	03-4017	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
113	221	F-38	03-4018	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
114	222	F-38	03-4019	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
115	223	F-38	03-4020	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
116	224	F-38	03-4021	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
117	225	F-38	03-4022	Vibrating Feeders	Variable Speed Control		7 1/2	Abrasion Resist. Trough Liners (Steel)	Variable Speed Control from Belt Scale M161-Amp Signal
118	227	T-54 to T-58	03-0048	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
119	228	T-54 to T-58	03-0049	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
120	229	T-54 to T-58	03-0050	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
121	230	T-54 to T-58	03-0051	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
122	231	T-54 to T-58	03-0052	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
123	232	T-54 to T-58	03-0053	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
124	233	T-54 to T-58	03-0054	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
125	234	T-54 to T-58	03-0055	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
126	235	T-54 to T-58	03-0056	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
127	236	T-54 to T-58	03-0057	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
128	237	T-54 to T-58	03-0058	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
129	238	T-54 to T-58	03-0059	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
130	239	T-54 to T-58	03-0060	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
131	240	T-54 to T-58	03-0061	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
132	241	T-54 to T-58	03-0062	Vibrating Feeder Disc Chutes	Directs Shale onto Plant Feed Conveyor			3/8" Mild Steel Plate(1/8" corr. allowance) with A.R. Liner	
133	242	F-40	03-1065	Plant Feed Conveyor #10	Vertically Curved Conveyor	36" X 370' C/C Pulleys 17' Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 300'/Min-Per Curves @ 225' Incline @ 145' 540 TPH
134	243	F-40	03-1066	Plant Feed Conveyor #11	Vertically Curved Conveyor	36" X 370' C/C Pulleys 17' Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 300'/Min-Per Curves @ 225' Incline @ 145' 540 TPH
135	244	F-40	03-1067	Plant Feed Conveyor #12	Vertically Curved Conveyor	36" X 370' C/C Pulleys 17' Lift	30	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 300'/Min-Per Curves @ 225' Incline @ 145' 540 TPH
136	245	F-41	03-9001	Belt Scale	Belt Scale for Plant Feed Control	For 36" Wide Conveyor			Model 420. Accuracy to 25%--Will Control Feeders

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
137	246	F-41	03-9002	Belt Scale	Belt Scale for Plant Feed Control	For 36" Wide Conveyor			Model 420. Accuracy to 25%--Will Control Feeders
138	247	F-41	03-9003	Belt Scale	Belt Scale for Plant Feed Control	For 36" Wide Conveyor			Model 420. Accuracy to 25%--Will Control Feeders
139	2471		03-1257	Grinding ball storage	Storage bin for 2" dia. grinding balls for primary ball mills			Concrete	Storage capacity for 7 days 563 ft ³
140	2472		03-1258	Grinding ball storage	Storage bin for 2" dia. grinding balls for primary ball mills			Concrete	Storage capacity for 7 days 563 ft ³
141	2473		03-1259	Grinding ball storage	Storage bin for 2" dia. grinding balls for primary ball mills			Concrete	Storage capacity for 7 days 563 ft ³
142	2474		03-4029	Grinding ball feeder	Feeder for metering replacement grinding balls onto plant feed belt		1		
143	2475		03-4030	Grinding ball feeder	Feeder for metering replacement grinding balls onto plant feed belt		1		
144	2476		03-4031	Grinding ball feeder	Feeder for metering replacement grinding balls onto plant feed belt		1		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
145	248	T-59	03-0063	Feed Conv. Disc. Chutes	Directs 3/8" Plant Feed Material to Primary Ball Mills			3/8" mild steel plate(1/8" corr allowance) with A.R. Liner	
146	249	T-59	03-0064	Feed Conv. Disc. Chutes	Directs 3/8" Plant Feed Material to Primary Ball Mills			3/8" mild steel plate(1/8" corr allowance) with A.R. Liner	
147	250	T-59	03-0065	Feed Conv. Disc. Chutes	Directs 3/8" Plant Feed Material to Primary Ball Mills			3/8" mild steel plate(1/8" corr allowance) with A.R. Liner	
148	2511	P	03-5004	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area
149	2512	P	03-5005	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area
150	2513	P	03-5006	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area
151	2514	P	03-5007	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area
152	2515	P	03-5008	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
153	2516	P	03-5009	Plant Clean-Up Sump Pump	Vertical Centriugal Slurry Pump	100 GPM 90 ft TDH Morris 2" x 3" x 11"	7.5	Abrasion & Corrosion Resist. C.S.	Grinding Area
154	2521		03-1601	Bridge crane	Bridge crane over primary ball mills	30 ton	1@30 2 @1.5 1 @ 1		
155	2522		03-1602	Bridge crane	Bridge crane over stirred ball mills	30 ton	1@30 2 @1.5 1 @ 1		
156	255	G-4	03-3008	Primary Mill	Ball Mill & 295 Ton Ball Charge	Dia 18' x 24' LG	5000	Cast Steel Alloy Liners	540 STPH in open circuit. Grinds 80% passing 3/8" ore to 80% passing 28 M
157	255	G-4	03-3009	Primary Mill	Ball Mill & 295 Ton Ball Charge	Dia 18' x 24' LG	5000	Cast Steel Alloy Liners	540 STPH in open circuit. Grinds 80% passing 3/8" ore to 80% passing 28 M
158	255	G-4	03-3010	Primary Mill	Ball Mill & 295 Ton Ball Charge	Dia 18' x 24' LG	5000	Cast Steel Alloy Liners	540 STPH in open circuit. Grinds 80% passing 3/8" ore to 80% passing 28 M
159	256	T-60	03-0066	Primary Ball Mill Disc Chutes	Directs Primary Ball Mill Discharge to Collecting Sump			3/8" Mild Steel (1/8" corr. allowance) with A.R. liner	
160	257	T-60	03-0067	Primary Ball Mill Disc Chutes	Directs Primary Ball Mill Discharge to Collecting Sump			3/8" Mild Steel (1/8" corr. allowance) with A.R. liner	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
161	258	T-60	03-0068	Primary Ball Mill Disc Chutes	Directs Primary Ball Mill Discharge to Collecting Sump			3/8" Mild Steel (1/8" corr. allowance) with A.R. liner	
162	2590		03-1701	Sampler	Slurry sampler at primary ball mill discharge		1/2		
163	2590		03-1702	Sampler	Slurry sampler at primary ball mill discharge		1/2		
164	2590		03-1703	Sampler	Slurry sampler at primary ball mill discharge		1/2		
165	2591		03-1203	Primary Ball Mill Discharge Sump	Collects discharge from 18' dia. x 24' long Ball Mill	3000 gallon with cone bottom		Mild steel	
166	2592		03-1204	Primary Ball Mill Discharge Sump	Collects discharge from 18' dia. x 24' long Ball Mill	3000 gallon with cone bottom		Mild steel	
167	2593		03-1205	Primary Ball Mill Discharge Sump	Collects discharge from 18' dia. x 24' long Ball Mill	3000 gallon with cone bottom		Mild steel	
168	2594		04-5010	Primary Ball Mill Discharge Sump Pump	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
169	2595	P	04-5011	Primary Ball Mill Discharge Sump Pump	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	
170	2596	P	04-5012	Primary Ball Mill Discharge Sump Pump	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	
171	2597	P	04-5013	Primary Ball Mill Discharge Sump Pump (spare)	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	(spare)
172	2598	P	04-5014	Primary Ball Mill Discharge Sump Pump (spare)	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	(spare)
173	2599	P	04-5015	Primary Ball Mill Discharge Sump Pump (spare)	Centrifugal Slurry Pump pumps to primary stirred ball mill feed distributor	SALA VASA G-459-8" sump pump 3060 GPM	40	Synthetic rubber lined.	(spare)
174	260		04-1236	Primary Stirred Ball Mill Feed Distributor	Self Rotating Distributor. Divides feed 6 ways.			Mild Steel with rubber lining	With overflow to primary ball mill discharge sump
175	261		04-1237	Primary Stirred Ball Mill Feed Distributor	Self Rotating Distributor. Divides feed 6 ways.			Mild Steel with rubber lining	With overflow to primary ball mill discharge sump
176	262		04-1238	Primary Stirred Ball Mill Feed Distributor	Self Rotating Distributor. Divides feed 6 ways.			Mild Steel with rubber lining	With overflow to primary ball mill discharge sump

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
177	2631	P	04-5016	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM Warman 4/3 D/C AH	15	Synthetic rubber lined	
178	2632	P	04-5017	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
179	2633	P	04-5018	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
180	2634	P	04-5019	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
181	2635	P	04-5020	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
182	26351	P	04-5021	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
183	2636	P	04-5022	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	(Spare)
184	2637	P	04-5023	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
185	2638	P	04-5024	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
186	2639	P	04-5025	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
187	2640	P	04-5026	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
188	2641	P	04-5027	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
189	26411	P	04-5028	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
190	2642	P	04-5029	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	(Spare)
191	2643	P	04-5030	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
192	2644	P	04-5031	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
193	2645	P	04-5032	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
194	2646	P	04-5033	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
195	2647	P	04-5034	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
196	26471	P	04-5035	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	
197	2648	P	04-5036	Primary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	510 GPM. Warman 4/3 D/C AH	15	Synthetic rubber lined	(Spare)
198	2651	G-5	04-3011	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
199	2652	G-5	04-3012	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
200	2653	G-5	04-3013	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
201	2654	G-5	04-3014	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
202	2655	G-5	04-3015	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
203	2656	G-5	04-3016	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
204	2657	G-5	04-3017	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
205	2658	G-5	04-3018	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
206	2659	G-5	04-3019	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
207	2660	G-5	04-3020	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
208	2661	G-5	04-3021	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
209	2662	G-5	04-3022	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
210	2663	G-5	04-3023	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
211	2664	G-5	04-3024	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
212	2665	G-5	04-3025	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
213	2666	G-5	04-3026	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
214	2667	G-5	04-3027	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
215	2668	G-5	04-3028	Primary Stirred Ball Mill	2500 Liter Stirred Mill	2500 Liter	2500	Abrasion Resistant Steel Lining	
216	2669		03-0164	Primary stirred ball mill discharge chute/flumes	Directs primary stirred ball mill discharge to sump			1/4" mild steel plate with rubber lining	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
217	2669		03-0165	Primary stirred ball mill discharge chute/flumes	Directs primary stirred ball mill discharge to sump			1/4" mild steel plate with rubber lining	
218	2669		03-0166	Primary stirred ball mill discharge chute/flumes	Directs primary stirred ball mill discharge to sump			1/4" mild steel plate with rubber lining	
219	2671		04-1206	Primary Stirred Ball Mill Discharge Sump	Collects Discharge from 6 Mills	3000 gallon		Steel	
220	2681		04-1207	Primary Stirred Ball Mill Discharge Sump	Collects Discharge from 6 Mills	3000 gallon		Steel	
221	2682		04-1208	Primary Stirred Ball Mill Discharge Sump	Collects Discharge from 6 Mills	3000 gallon		Steel	
222	2691	P	05-5037	Rougher Float Feed Pump	Centrifugal Slurry Pump	3060 GPM. Warman size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corr. Resistant Synthetic Rubber lined	
223	2692	P	05-5038	Rougher Float Feed Pump (spare)	Centrifugal Slurry Pump (spare)	3060 GPM. Warman size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corrosion Resistant	(spare)
224	2693	P	05-5039	Rougher Float Feed Pump	Centrifugal Slurry Pump	3060 GPM. Warman size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corrosion Resistant	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
225	2694	P	05-5040	Rougher Float Feed Pump (spare)	Centrifugal Slurry Pump (spare)	3060 GPM. War- man size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corrosion Resistant	(spare)
226	2695	P	05-5041	Rougher Float Feed Pump	Centrifugal Slurry Pump	3060 GPM. War- man size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corrosion Resistant	
227	2696	P	05-5042	Rougher Float Feed Pump (spare)	Centrifugal Slurry Pump (spare)	3060 GPM. War- man size 200 F/EM . 5 vaned closed impeller	75	Abrasion & Corrosion Resistant	(Spare)
228	2701	T-5	05-1239	Rougher Flotation Feed Distrib.	Self Rotating Distributor/Dilution Tank divides feed 2 ways	18,376 GPM		Corrosion Resist. Steel	
229	2702		05-1241	Rougher Flotation Feed Distributor	Self Rotating Distributor/Dilution Tank divides feed 2 ways	18,376 GPM		Mild steel with rubber lining	
230	2703		05-1243	Rougher Flotation Feed Distributor	Self rotating dist. divides feed 2 ways	18,376 GPM		Mild steel with rubber lining	
231	2704		05-	See entry	No. 926 for flotation reagent	tanks and		feeders.	
232	281	C-5	05-1401 A-H 05-1402 A-H	Flotation Machines	Two Banks of 8 Cells w/ Sixteen Motors Total. (one 75HP motor/cell)	1500 Cu. Ft. Per Cell	16 @ 75	Corrosion resistant for parts in contact with pulp	Rougher Flotation. Outokumpu OK-38

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
233	282	C-5	05-1403 A-H 05-1404 A-H	Flotation Machines	Two Banks of 8 Cells w/ Sixteen Motors Total. (one 75HP motor/cell)	1500 Cu. Ft. Per Cell	16 @ 75	Corrosion resistant for parts in contact with pulp	Rougher Flotation. Outokumpu OK-38
234	283	C-5	05-1405 A-H 05-1406 A-H	Flotation Machines	Two Banks of 8 Cells w/ Sixteen Motors Total. (one 75HP motor/cell)	1500 Cu. Ft. Per Cell	16 @ 75	Corrosion resistant for parts in contact with pulp	Rougher Flotation. Outokumpu OK-38
235	284		05-5407 05-5408 05-5409	Flotation machine blowers			3 @ 300		
236	285		05-1603 thru 05-1614	Monorail hoists			? moto rs each		
237	2911	P	05-5043	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
238	2912	P	05-5044	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
239	2913	P	05-5045	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
240	2914	P	05-5046	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
241	2915	P	05-5047	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
242	2916	P	05-5048	Rougher Flotation Froth Pump	Vertical centrifugal launder pompe pumps	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
243	2917	P	05-5049	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
244	2918	P	05-5050	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
245	2919	P	05-5051	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
246	2920	P	05-5052	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
247	2921	P	05-5053	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener
248	2922	P	05-5054	Rougher Flotation Froth Pump	Vertical centrifugal launder pump	3650 GPM. Sala SPVC-14" vertical pump	125	Abrasion & Corrosion Resist. C.S.	Feeds Primary Thickener

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
249	300		05-1713 thru 1718	Sampler	Sampler for rougher flotation tailings		6 @ 1/2 HP		
250	300		05-1713 thru 1718	Samplr	Sampler for rougher flotation tailings		6 @ 1/2 HP		
251	3131		05-0167	Rougher Flotation Tailings Launderers	6 required to transfer tailings to sump			Steel	
252	3132		05-1257	Flotation Tailings sump	Common tailings sump for rougher and cleaner flotation tailings			Steel	23,000 gallon capacity. One minute retention
253	3133	P	11-5156	Tailings pump	First of two pumps in series. Pump tailings to tailings pond at 22,860 GPM and 191 ft. TDH	22860 GPM 96 ft TDH Warman 20/18 TU-AH	800	Synthetic Rubber lined	
254	3133	P	11-5157	Tailings pump	Second of two pumps in series. Pump tailings to tailings pond at 22,860 GPM and 191 ft. TDH	22860 GPM 96 ft TDH Warman 20/18 TU-AH	800	Synthetic Rubber lined	
255	3133	P	11-5158	Tailings pump (spare)	One of two pumps in series. Pump tailings to tailings pond at 22,860 GPM and 191 ft. TDH	22860 GPM 96 ft TDH Warman 20/18 TU-AH	800	Synthetic Rubber lined	
256	3481	P	05-5067	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2 X 3 x 11 Morris or equal	7.5	Abrasion & Corrosion Resist. C.S.	Flotation Area

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
257	3482	P	05-5068	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2 X 3 x 11 Morris or equal	7.5	Abrasion & Corrosion Resist. C.S.	Flotation Area
258	3483	P	05-5069	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2 X 3 x 11 Morris or equal	7.5	Abrasion & Corrosion Resist. C.S.	Flotation Area
259	351	C-2	06-1301	Primary Thickener	400' Diameter	400' Dia. X10' high	50	Corrosion Resistant Constr.	
260	352	C-2	06-1302	Primary Thickener	400' Diameter	400' Dia. X10' high	50	Corrosion Resistant Constr.	
261	353	C-2	06-1303	Primary Thickener	400' Diameter	400' Dia. X10' high	50	Corrosion Resistant Constr.	
262	3531		06-	See entry	number 9270 (+) for	thickener		reagent tanks	& pumps.
263	354	P	06-5073	Primary Thickener Overflow Pump	Centrifugal Slurry Pump. Primary thickener overflow to mill water storage	11412 GPM Warman 400 ST-L	300	Abrasion & Corr. Resistant C.S.	5 vane closed impeller
264	355	P	06-5074	Primary Thickener Overflow Pump	Centrifugal Slurry Pump. Primary thickener overflow to mill water storage	11412 GPM Warman 400 ST-L	300	Abrasion & Corrosion Resistant C.S.	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
265	356	P	06-5075	Primary Thickener Overflow Pump	Centrifugal Slurry Pump. Primary thickener overflow to mill water storage	11412 GPM Warman 400 ST-L	300	Abrasion & Corrosion Resistant C.S.	
266	3571	P	06-5076	Primary Thickener Overflow Pump (spare)	Centrifugal Slurry Pump. Primary thickener overflow to mill water storage (spare)	11412 GPM Warman 400 ST-L	300	Abrasion & Corrosion Resistant C.S.	(spare)
267	367	P	06-5079	Primary Thickener Underflow Pump	Vertical Slurry Pump	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	
268	368	P	06-5080	Primary Thickener Underflow Pump	Vertical Slurry Pump	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	
269	369	P	06-5081	Primary Thickener Underflow Pump	Vertical Slurry Pump	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	
270	3701	P	06-5082	Primary Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	(spare)
271	3702	P	06-5083	Primary Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	(spare)
272	3703	P	06-5084	Primary Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	3180 GPM. 58 ft TDH. Goulds 8x8 x17 1/4 vert. submersible	100	Abras. & Corrosion Resistant C.S. Synthetic Rubber Lined	(spare)

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
273	384	P	06-5085	Plant Clean-Up Sump Pump	Vertical Centrifugal Slurry Pump	1000 GPM 25 ft TDH Warman 150 SV	15	Abrasion & Corrosion Resist. C.S.	Thickener Area
274	385	P	06-5087	Plant Clean-Up Sump Pump	Vertical Centrifugal Slurry Pump	1000 GPM 25 ft TDH Warman 150 SV	15	Abrasion & Corrosion Resist. C.S.	Thickener Area
275	386	P	06-5089	Plant Clean-Up Sump Pump	Vertical Centrifugal Slurry Pump	1000 GPM 25 ft TDH Warman 150 SV	15	Abrasion & Corrosion Resist. C.S.	Thickener Area
276	391		04-1245	Secondary Stirred Ball Mill Feed Distributor	Self Rotating Dist. divides feed 5 ways			Mild steel with rubber lining	
277	392		04-1246	Secondary Stirred Ball Mill Feed Distributor	Self Rotating Dist. divides feed 5 ways			Mild steel with rubber lining	
278	393		04-1247	Secondary Stirred Ball Mill Feed Distributor	Self Rotating Dist. divides feed 5 ways			Mild steel with rubber lining	
279	3941	P	04-5097	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
280	3942	P	04-5098	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
281	3943	P	04-5099	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
282	3944	P	04-5100	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
283	39441	P	04-5101	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
284	3945	P	04-5102	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	(Spare)
285	3946	P	04-5103	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
286	3947	P	04-5104	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
287	3948	P	04-5105	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
288	3949	P	04-5106	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
289	39491	P	04-5107	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
290	3950	P	04-5108	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	(Spare)
291	3951	P	04-5109	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
292	3952	P	04-5110	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
293	3953	P	04-5111	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
294	3954	P	04-5112	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
295	39541	P	04-5113	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	
296	3955		04-5114	Secondary Stirred Mill Feed Pump (spare)	Centrifugal Slurry Pump (spare)	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
297	3955	P	04-5114	Secondary Stirred Mill Feed Pump	Centrifugal Slurry Pump (Spare)	638 GPM Warman 6/4 E/D AH	20	Synthetic Rubber Lined	(Spare)
298	4011	G-5	04-3029	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
299	4012	G-5	04-3030	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
300	4013	G-5	04-3031	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
301	4014	G-5	04-3032	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
302	4015	G-5	04-3033	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
303	4016	G-5	04-3034	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
304	4017	G-5	04-3035	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
305	4018	G-5	04-3036	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
306	4019	G-5	04-3037	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
307	4020	G-5	04-3038	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
308	4021	G-5	04-3039	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
309	4022	G-5	04-3040	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
310	4023	G-5	04-3041	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
311	4024	G-5	04-3042	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	
312	4025	G-5	04-3043	Secondary Stirred Ball Mill	1500 Liter Stirred Ball Mill	1500 Liter	2000	Abrasion Resistant Steel	

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
313	4031	T-61	04-0069	Secondary Mill Disc Chute/Flume	Directs Secondary Mill Disch to sump			1/4" Plate rubber lined	
314	4032	T-61	04-0070	Secondary Stirred Ball Mill Disc Chute/Flume	Directs Secondary Mill Disch to sump			1/4" Plate rubber lined	
315	4033	T-61	04-0071	Secondary Mill Disc Chute/Flume	Directs Secondary Mill Disch to sump			1/4" Plate rubber lined	
316	4035	T-3	04-1210	Secondary Stirred Ball Mill Discharge Sump	Surge Control Sump	3000 gal w/60" Cone Bot.		3/8" Mild Steel Plate (1/8" Corr. Allowance)	Surge Tanks for Ball Mill Feed Control 3,000 ft^3
317	4036	T-3	04-1211	Secondary Stirred Ball Mill Discharge Sump	Surge Control Sump	3000 gal w/60" Cone Bot.		3/8" Mild Steel Plate (1/8" Corr. Allowance)	Surge Tanks for Ball Mill Feed Control 3,000 ft^3
318	4037	T-3	04-1212	Secondary Stirred Ball Mill Discharge Sump	Surge Control Sump	3000 gal w/60" Cone Bot.		3/8" Mild Steel Plate (1/8" Corr. Allowance)	Surge Tanks for Ball Mill Feed Control 3,000 ft^3
319	4038		04-1704	Sampler	Slurry Sampler at secondary stirred ball mill discharge		1/2		
320	4038		04-1705	Sampler	Slurry Sampler at secondary stirred ball mill discharge		1/2		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
321	4038		04-1706	Sampler	Slurry Sampler at secondary stirred ball mill discharge		1/2		
322	4041	P	05-5115	Cleaner Float Feed Pump	Centrifugal Slurry Pump	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	
323	4042	P	05-5116	Cleaner Float Feed Pump	Centrifugal Slurry Pump (Spare)	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	(Spare)
324	4043	P	05-5117	Cleaner Float Feed Pump	Centrifugal Slurry Pump	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	
325	4044	P	05-5118	Cleaner Float Feed Pump	Centrifugal Slurry Pump (Spare)	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	(Spare)
326	4045	P	05-5119	Cleaner Float Feed Pump	Centrifugal Slurry Pump	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	
327	4046	P	05-5120	Cleaner Float Feed Pump	Centrifugal Slurry Pump (Spare)	3190 GPM. Warman 10/8 ST/F - AH 5 vane	100	Synthetic Rubber lined	(Spare)
328	4061		05-1248	Cleaner Flotation Feed Distributor	Self rotating distrib. divides feed 2 ways			Mild steel with rubber lining	with overflow

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
329	4062		05-1249	Cleaner Flotation Feed Distributor	Self rotating distrib. divides feed 2 ways			Mild steel with rubber lining	with overflow
330	4063		05-1250	Cleaner Flotation Feed Distributor	Self rotating distrib. divides feed 2 ways			Mild steel with rubber lining	with overflow
331	410		05-	See entry	926 plus for	flotation		reagent tanks &	feeders
332	411	C-6	05-1407 A-H 05-1408 A-H	Flotation Machine	Two banks of eight cells w/ 16 motors total (one 75 HP motor/ cell)	1,500 ft ³ per cell & 24,000 ft ³ for total sixteen cells.	16 @ 75	Corrosion resistant for Metal Parts in Contact with Pulp	Cleaner Flotation. Outokumpu OK-38
333	412	C-6	05-1409 A-H 05-1410 A-H	Flotation Machine	Two banks of eight cells w/ 16 motors total (one 75 HP motor/ cell)	1,500 ft ³ per cell & 24,000 ft ³ for total sixteen cells.	16 @ 75	Corrosion resistant for Metal Parts in Contact with Pulp	Cleaner Flotation. Outokumpu OK-38
334	413	C-6	05-1411 A-H 05-1412 A-H	Flotation Machine	Two banks of eight cells w/ 16 motors total (one 75 HP motor/ cell)	1,500 ft ³ per cell & 24,000 ft ³ for total sixteen cells.	16 @ 75	Corrosion resistant for Metal Parts in Contact with Pulp	Cleaner Flotation. Outokumpu OK-38
335	414		05-5410 05-5411 05-5412	Flotation Machine Blowers			3 @ 300		
336	424	P	05-5121	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
337	425	P	05-5122	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
338	426	P	05-5123	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
339	427	P	05-5124	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
340	428	P	05-5125	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
341	429	P	05-5126	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
342	430	P	05-5127	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
343	431	P	05-5128	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
344	432	P	05-5129	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
345	433	P	05-5130	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
346	434	P	05-5131	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
347	435	P	05-5132	Cleaner Flotation Froth Pump	Vertical centrifugal launder pump	2182 GPM . Sala SPV 5010-10"	75	Synthetic rubber lined	Feeds Concentrate Thickener
348	437		05-0168	Cleaner flotation tailings launders	Transports cleaner flotation tailings to common tailings sump			Steel	6 required
349	447		05-1707	Sampler	Slurry Sampler at cleaner flotation tails		1/2		Samples Tails Ahead of Tails Sump
350	447		05-1708	Sampler	Slurry Sampler at cleaner flotation tails		1/2		
351	447		05-1709	Sampler	Slurry Sampler at cleaner flotation tails		1/2		
352	447		05-1719 05-1720 05-1721	Sampler	Sampler for cleaner flotation tailings		3 @ 1/2 HP		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
353	447		05-1719 05-1720 05-1721	Sampler	Sampler for cleaner flotation tailings		3 @ 1/2 HP		
354	554	C-3	06-1304	Concentrate Thickener	350' Diameter	350' Dia. x 8' high	50	Corrosion Resistant Constr.	
355	555	C-3	06-1305	Concentrate Thickener	350' Diameter	350' Dia. x 8' high	50	Corrosion Resistant Constr.	
356	556	C-3	06-1306	Concentrate Thickener	350' Diameter	350' Dia. x 8' high	50	Corrosion Resistant Constr.	
357	557	P	06-5136	Cleaner Conc. Thickener Overflow Pump	Centrifugal Slurry Pump	8244 GPM Warman 14/12 ST AH	200	Synthetic Rubber Lined	
358	558	P	06-5137	Cleaner Conc. Thickener Overflow Pump	Centrifugal Slurry Pump	8244 GPM Warman 14/12 ST AH	200	Synthetic Rubber Lined	
359	559	P	06-5138	Cleaner Conc. Thickener Overflow Pump	Centrifugal Slurry Pump	8244 GPM Warman 14/12 ST AH	200	Synthetic Rubber Lined	
360	5601	P	06-5139	Cleaner Conc. Thickener Overflow Pump (Spare)	Centrifugal Slurry Pump (spare)	8244 GPM Warman 14/12 ST AH (spare)	200	Synthetic Rubber Lined	(spare)

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
361	5604	P	06-5142	Conc. Thickener Underflow Pump	Vertical Slurry Pump	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	
362	5605	P	06-5143	Conc. Thickener Underflow Pump	Vertical Slurry Pump	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	
363	5606	P	06-5144	Conc. Thickener Underflow Pump	Vertical Slurry Pump	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	
364	5607	P	06-5145	Conc. Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	Spare
365	5608	P	06-5146	Conc. Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	Spare
366	5609	P	06-5147	Conc. Thickener Underflow Pump (spare)	Vertical Slurry Pump (spare)	2092 GPM, 58 ft TDH. Goulds 8x8x16 1/8 Vert. submers.	50	Synthetic Rubber Lined	Spare
367	561		07-1710	Sampler	Slurry Sampler ahead of filtration to sample cleaner flotation concentrate		1/2		
368	561		07-1711	Sampler	Slurry Sampler ahead of filtration to sample cleaner flotation concentrate		1/2		

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
369	561		07-1712	Sampler	Slurry Sampler ahead of filtration to sample cleaner flotation concentrate		1/2		
370	567	T-6	07-1251	3-Way Filter Feed Dist.	Self rotating 3-Way Distrib. for Feed to 3 Filters	2500 gallon		Mild steel with rubber lining	
371	568	T-6	07-1252	3-Way Filter Feed Dist.	Self rotating 3-Way Distrib. for Feed to 3 Filters	2500 gallon		Mild steel with rubber lining	
372	569	T-6	07-1253	3-Way Filter Feed Dist.	Self rotating 3-Way Distrib. for Feed to 3 Filters	2500 gallon		Mild steel with rubber lining	
373	570	P	07-5195	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
374	570		07-5195 07-5196 07-5197	Filter feed pump		700 GPM 301' TDH	100	Synthetic rubber lined	
375	570	P	07-5196	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
376	570	P	07-5197	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
377	570	P	07-5198	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
378	570		07-5198 07-5199 07-5200	Filter feed pump		700 GPM 301' TDH	100	Synthetic rubber lined	
379	570	P	07-5199	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
380	570	P	07-5200	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
381	570	P	07-5201	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
382	570		07-5201 07-5202 07-5203	Filter feed pump		700 GPM 301' TDH	100	Synthetic rubber lined	
383	570	P	07-5202	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
384	570	P	07-5203	Filter Feed Pump		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
385	570	P	07-5204	Filter Feed Pump (Spare)		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
386	570		07-5204 07-5205 07-5206	Filter feed pump		700 GPM 301' TDH	100	Synthetic rubber lined	
387	570	P	07-5205	Filter Feed Pump (Spare)		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
388	570	P	07-5206	Filter Feed Pump (Spare)		700 GPM @ 301' TDH	100	Synthetic Rubber Lined	
389	581		07-5302	Air Compressor	Air compressor for pressing and drying filter cake at Larox filters		300		Provides air for three filters
390	582		07-5303	Air Compressor	Air compressor for pressing and drying filter cake at Larox filters		300		Provides air for three filters
391	583		07-5304	Air Compressor	Air compressor for pressing and drying filter cake at Larox filters		300		Provides air for three filters
392	611	C-7	07-6001	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
393	612	C-7	07-6002	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
394	613	C-7	07-6003	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
395	614	C-7	07-6004	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
396	615	C-7	07-6005	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
397	616	C-7	07-6006	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
398	617	C-7	07-6007	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
399	618	C-7	07-6008	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	
400	619	C-7	07-6009	Larox Filter	Model CF-200 Chamber Filter	200 sq. meter	20	Parts in Contact with Pulp -- Corrosion Resistant	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
401	620		07-5207 thru 5215	Back wash pumps	Pump for filter backwash	230 PSI	100		@ Larox filters 9 req'd
402	621		07-5216 07-5218 07-5220	Pump	Filtrate recycle to concentrate thickener	1509 gpm @ 22' TDH			@ Larox filters 3 req'd
403	621		07-5217 07-5219 07-5221	Pump (spare)	Filtrate recycle to concentrate thickener	1509 gpm @ 22' TDH			@ Larox filters 3 req'd
404	631		07-1014	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
405	632		07-1015	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
406	633		07-1016	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
407	634		07-1017	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
408	635		07-1018	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
409	636		07-1019	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
410	637		07-1020	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
411	638		07-1021	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
412	639		07-1022	Filter Cake Conveyor	72" Horizontal Troughing Belt Conveyor. Collects filter cake under filters	72" x 53' C-C pulleys zero lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	Variable speed drive 60 TPH
413	641	F-42	07-1023	Filter Cake Gathering Conveyor	36" Flexwall Conveyor	36" x 160' C-C Pulleys 55' lift	20	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 100' Min, 209 TPH
414	642	F-43	07-1024	Filter Cake Gathering Conveyor	36" Flexwall Conveyor	36" x 160' C-C Pulleys 55' lift	20	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 100' Min, 209 TPH
415	643	F-43	07-1025	Filter Cake Gathering Conveyor	36" Flexwall Conveyor	36" x 160' C-C Pulleys 55' lift	20	Structural Steel Frame, HD Synthetic Rubber Belt	Operating @ 100' Min, 209 TPH
416	6491	T-12	07-1213	Filter Cake Hopper Surge Bin	Steel Bin	200 Ton w/60° Cone Bot.		3/8" Mild Steel Plate (1/8" corr.allowance)	Surge Hopper Ahead of Drying Area with 2 reclaim points

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
417	6492	T-12	07-1214	Filter Cake Hopper Surge Bin	Steel Bin	200 Ton w/60° Cone Bot.		3/8" Mild Steel Plate (1/8" corr.allowance)	Surge Hopper Ahead of Drying Area with 2 reclaim points
418	6493	T-12	07-1215	Filter Cake Hopper Surge Bin	Steel Bin	200 Ton w/60° Cone Bot.		3/8" Mild Steel Plate (1/8" corr.allowance)	Surge Hopper Ahead of Drying Area with 2 reclaim points
419	731	T-71 to T-76	08-0072	Dryer Feed Chute	Directs Filter Cake into Dryer Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	
420	732	T-71 to T-76	08-0073	Dryer Feed Chute	Directs Filter Cake into Dryer Mixing Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	
421	733	T-71 to T-76	08-0074	Dryer Feed Chute	Directs Filter Cake into Dryer Mixing Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	
422	734	T-71 to T-76	08-0075	Dryer Feed Chute	Directs Filter Cake into Dryer Mixing Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	
423	735	T-71 to T-76	08-0076	Dryer Feed Chute	Directs Filter Cake into Dryer Mixing Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	
424	736	T-71 to T-76	08-0077	Dryer Feed Chute	Directs Filter Cake into Dryer Mixing Feeder			Corrosion Resistant A.R. Lined 3,000 lbs	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
425	7371		08-7001	Flash dryer system fan			350		Furnished with dryer
426	7371		08-7002	Flash dryer system fan			350		Furnished with dryer
427	7371		08-7003	Flash dryer system fan			350		Furnished with dryer
428	7371		08-7004	Flash dryer system fan			350		Furnished with dryer
429	7371		08-7005	Flash dryer system fan			350		Furnished with dryer
430	7371		08-7006	Flash dryer system fan			350		Furnished with dryer
431	7372		08-7001A	Flash dryer cage mill			75		Furnished with dryer
432	7372		08-7002A	Flash dryer cage mill			75		Furnished with dryer

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
433	7372		08-7003A	Flash dryer cage mill			75		Furnished with dryer
434	7372		08-7004A	Flash dryer cage mill			75		Furnished with dryer
435	7372		08-7005A	Flash dryer cage mill			75		Furnished with dryer
436	7372		08-7006A	Flash dryer cage mill			75		Furnished with dryer
437	7373		08-7001B	Flash dryer double paddle mixer			40		Furnished with dryer
438	7373		08-7002B	Flash dryer double paddle mixer			40		Furnished with dryer
439	7373		08-7003B	Flash dryer double paddle mixer			40		Furnished with dryer
440	7373		08-7004B	Flash dryer double paddle mixer			40		Furnished with dryer

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
441	7373		08-7005B	Flash dryer double paddle mixer			40		Furnished with dryer
442	7373		08-7006B	Flash dryer double paddle mixer			40		Furnished with dryer
443	7374		08-7001C	Flash dryer rotary air lock			5		Furnished with dryer
444	7374		08-7002C	Flash dryer rotary air lock			5		Furnished with dryer
445	7374		08-7003C	Flash dryer rotary air lock			5		Furnished with dryer
446	7374		08-7004C	Flash dryer rotary air lock			5		Furnished with dryer
447	7374		08-7005C	Flash dryer rotary air lock			5		Furnished with dryer
448	7374		08-7006C	Flash dryer rotary air lock			5		Furnished with dryer

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
449	743	T-83 to T-88	08-0078	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
450	744	T-83 to T-88	08-0079	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
451	745	T-83 to T-88	08-0080	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
452	746	T-83 to T-88	08-0081	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
453	747	T-83 to T-88	08-0082	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
454	748	T-83 to T-88	08-0083	Dryer Disch. Chute	Directs Dried Conc. into dry mat'l distribution bin			Corrosion Resistant	Furnished with dryer
455	749		08-1068 through 1073	Screw conveyor	Dust collecting screw conveyor under flash dryer dust collector	24' long zero lift	6 @ 15	Steel	Assume 45 TPH conveys dust collected back to distribution bins. 6 req'd
456	7491		08-1074 through 1079	Screw conveyor	Dust from dust collecting conveyor to distribution bin	10' long zero lift	6 @ 5		45 TPH. 6 req'd

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
457	750		08-1081 through 1083	Screw conveyor	Recirculates dry material from dry divider to briquette screen feed conveyor	42' long zero lift	6 @ 40	Steel	0-90 TPH variable speed 3 req'd
458	7521		09-1219	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
459	7522		09-1220	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
460	7523		09-1221	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
461	7524		09-1222	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
462	7525		09-1223	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
463	7526		09-1224	Dried Material Distribution Bin		100 Ton Capacity		Steel	3 reclaim points
464	753		09-	For	agglomeration binder	tanks and		pumps see	entry No. 9294.

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
465	755		09-1032	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
466	756		09-1033	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
467	757		09-1034	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
468	758		09-1035	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
469	759		09-1036	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
470	760		09-1037	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
471	761		09-1038	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
472	762		09-1039	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
473	763		09-1040	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
474	764		09-1041	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
475	765		09-1042	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
476	766		09-1043	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
477	767		09-1044	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
478	768		09-1045	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
479	769		09-1046	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
480	7691		09-1047	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
481	7692		09-1048	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
482	7693		09-1049	Screw Conveyor	Dry mat'l distribution bin to briquetter Mixing screw mixes binder with dry feed.	15' Long Zero Lift 30 TPH	7.5		Variable speed
483	7701	T-89 to T-94	09-0084	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
484	7702	T-89 to T-94	09-0085	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
485	7703	T-89 to T-94	09-0086	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
486	7704	T-89 to T-94	09-0087	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
487	7705	T-89 to T-94	09-0088	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
488	7706	T-89 to T-94	09-0089	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
489	7707	T-89 to T-94	09-0090	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
490	7708	T-89 to T-94	09-0091	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
491	7709	T-89 to T-94	09-0092	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
492	7710	T-89 to T-94	09-0093	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
493	7711	T-89 to T-94	09-0094	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
494	7712	T-89 to T-94	09-0095	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
495	7713	T-89 to T-94	09-0096	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
496	7714	T-89 to T-94	09-0097	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
497	7715	T-89 to T-94	09-0098	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
498	7716	T-89 to T-94	09-0099	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
499	7717	T-89 to T-94	09-0100	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
500	7718	T-89 to T-94	09-0101	Feed Chute	From screw conveyor to briquetters mixing screw			3/8" mild steel plate (1/8" corr. allow)	
501	811		09-8001	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
502	811		09-8002	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
503	811		09-8003	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
504	811		09-8004	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
505	811		09-8005	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
506	811		09-8006	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
507	811		09-8007	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
508	811		09-8008	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
509	811		09-8009	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
510	811		09-8010	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
511	811		09-8011	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
512	811		09-8012	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
513	811		09-8013	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
514	811		09-8014	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
515	811		09-8015	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
516	811		09-8016	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
517	811		09-8017	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
518	811		09-8018	Briquetting Machine	Roll press briquetter	36 TPH Capacity	400		K.R. Komarek Inc. Model DH-500 28x27 or equal
519	850	T-101 to T-106	09-0120	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
520	851	T-101 to T-106	09-0121	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
521	852	T-101 to T-106	09-0122	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
522	853	T-101 to T-106	09-0123	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
523	854	T-101 to T-106	09-0124	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
524	855	T-101 to T-106	09-0125	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
525	856	T-101 to T-106	09-0126	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
526	857	T-101 to T-106	09-0127	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
527	858	T-101 to T-106	09-0128	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
528	859	T-101 to T-106	09-0129	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
529	860	T-101 to T-106	09-0130	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
530	861	T-101 to T-106	09-0131	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
531	862	T-101 to T-106	09-0132	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
532	863	T-101 to T-106	09-0133	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
533	864	T-101 to T-106	09-0134	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
534	865	T-101 to T-106	09-0135	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
535	866	T-101 to T-106	09-0136	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	
536	867	T-101 to T-106	09-0137	Briquette Disch. Chute	Directs Briquettes to Collecting Conveyor			Corrosion Resistant A.R. Lined	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
537	870		09-1050	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
538	871		09-1051	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
539	872		09-1052	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
540	873		09-1053	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
541	874		09-1054	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
542	875		09-1055	Briquette Collecting Conveyor	36" Conveyor	36" x 60' 6' lift	7.5	Structural Steel Frame, HD Synthetic Rubber Belt	107 TPH. Collects briquettes from 3 briquetting machines
543	8761		09-1056	Briquette Conveyor	36" Conveyor	30" x 130' 33' lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	213 TPH. Transfers briquettes to screen
544	8762		09-1057	Briquette Conveyor	36" Conveyor	30" x 130' 33' lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	96 TPH. Transfers briquettes to screen

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
545	8763		09-1058	Briquette Conveyor	36" Conveyor	30" x 130' 33' lift	15	Structural Steel Frame, HD Synthetic Rubber Belt	96 TPH. Transfers briquettes to screen
546	877		09-0138	Briquette Screen Feed Chute					
547	878		09-0139	Briquette Screen Feed Chute					
548	879		09-0140	Briquette Screen Feed Chute					
549	890		09-2005	Briquette Screen	4' X 8' Single Deck Vibrating Screen	4' X 8'	10		With 1/4" x 2" slotted wire screen. 28 tph passing.
550	891		09-2006	Briquette Screen	4' X 8' Single Deck Vibrating Screen	4' X 8'	10		With 1/4" x 2" slotted wire screen. 28 tph passing.
551	892		09-2007	Briquette Screen	4' X 8' Single Deck Vibrating Screen	4' X 8'	10		With 1/4" x 2" slotted wire screen. 28 tph passing.
552	896		09-0144	Briquette Screen Discharge Chute					

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
553	897		09-0145	Briquette Screen Discharge Chute					
554	898		09-0146	Briquette Screen Discharge Chute					
555	902		09-1062	Briquette Collecting Conveyor	36" Horizontal Troughing Belt Conveyor	36" x 500' 577 TPH	15	Structural Steel Frame, HD Synthetic Rubber Belt	Collects Briquettes from Three Circuits and conveys to briquette storage pile.
556	9022		09-1064	Deleted					
557	903		09-1050	Briquette Screen Undersize Hopper					
558	904		09-0151	Briquette Screen Undersize Hopper					
559	905		09-0152	Briquette Screen Undersize Hopper					
560	9051		09-1087	Rejected briquette conveyor	Transports rejected briquettes to filter cake conveyor	42' long zero lift	5	Structural steel frame with heavy duty synthetic rubber belt	28 TPH 100 FPM

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
561	9051		09-1088	Rejected briquette conveyor	Transports rejected briquettes to filter cake conveyor	42' long zero lift	5	Structural steel frame with heavy duty synthetic rubber belt	28 TPH 100 FPM
562	9051		09-1089	Rejected briquette conveyor	Transports rejected briquettes to filter cake conveyor	42' long zero lift	5	Structural steel frame with heavy duty synthetic rubber belt	28 TPH 100 FPM
563	906		09-0159	Briquetting area dust collection baghouse					
564	906		09-0160	Briquetting area dust collection baghouse					
565	906		09-0161	Briquetting area dust collection baghouse					
566	907		09-5404	Briquetting dust collection blower			50		
567	907		09-5405	Briquetting dust collection blower			50		
568	907		09-5406	Briquetting dust collection blower			50		

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SI	HP	MATERIAL OF CONSTRUCTION	REMARKS
569	9091	P	09-5148	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM 90 ft TDH 2 X 3 X 11	7.5	Abrasion & Corrosion Resist. C.S.	Filter Area
570	9092	P	09-5149	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM @ 90' TDH MORRIS 2"X 3" X 11"	7.5	Abrasion & Corrosion Resist. C.S.	Filter Area
571	9093	P	09-5150	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM @ 90' TDH MORRIS 2"X 3" X 11"	7.5	Abrasion & Corrosion Resist. C.S.	Filter Area
572	9094	P	09-5151	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM @ 90' TDH MORRIS 2"X 3" X 11"	7.5	Abrasion & Corrosion Resist. C.S.	Agglomeration Area
573	9095	P	09-5152	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM @ 90' TDH MORRIS 2"X 3" X 11"	7.5	Abrasion & Corrosion Resist. C.S.	Agglomeration Area
574	9096	P	09-5153	Plant Clean-Up Sump Pump	Vertigal Centriugal Slurry Pump	100 GPM @ 90' TDH MORRIS 2"X 3" X 11"	7.5	Abrasion & Corrosion Resist. C.S.	Agglomeration Area
575	924	P	00-5154	Plant Make-Up Water Pump	Deep Well Type	7500 GPM, 50 ft TDH	150	C.S.	
576	924	P	00-5189	Plant Make-Up Water Pump (spare)	Deep Well Type	7500 GPM, 50 ft TDH	150	C.S.	(spare)

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
577	9241	P	11-5190	Reclaimed water return pump	Returns reclaimed water from tailings pond to process water storage tankump	7100 GPM 200 ft TDH	450	Abrasion and corrosion resistant C.S.	
578	9241	P	11-5191	Reclaimed water return pump	Returns reclaimed water from tailings pond to process water storage tank	7100 GPM 200 ft TDH	450	Abrasion and corrosion resistant C.S.	
579	9242	P	11-5192	Reclaimed water return pump (spare)	Returns reclaimed water from tailings pond to process water storage tank (spare)	7100 GPM 200 ft TDH (spare)	450 (sp)	Abrasion and corrosion resistant C.S.	(spare)
580	9243		11-1801	Reclaimed water pump barge	Barge to support 3 water reclaim pumps				
581	9244	P	00-5193	Fire water pump	Delivers fire water @ 1000 GPM	1000 GPM 75' TDH 8 X 6	60		
582	9245		00-5194	Fire water pump (spare)	Delivers fire protection water	1000 GPM 75' TDH 8" x 6"	60		
583	9245	P	00-5194	Fire Water Pump (Spare)	Delivers Fire Protection Water	1000 GPM @ 75' TDH - 8"x 6"	60		
584	925	T-7	00-1225	Process Water Storage Tank	Water Supply Tank for Beneficiation System			Corrosion Resist. Steel	Tank Capacity Approx 1.5 Million gal

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	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
585	9251	P	00-5184	Process water pump	Pumps water from process water storage tank to steady head tank	20,000 GPM, 50 ft TDH	400	Abrasion and corrosion resistant C.S.	
586	9252	P	00-5185	Process water pump	Pumps water from process water storage tank to steady head tank	20,000 GPM, 50ft TDH	400	Abrasion and corrosion resistant C.S.	
587	9252	P	00-5186	Process water pump	Pumps water from process water storage tank to steady head tank	20,000 GPM, 50ft TDH	400	Abrasion and corrosion resistant C.S.	
588	9252	P	00-5187	Process water pump	Pumps water from process water storage tank to steady head tank	20,000 GPM, 50ft TDH	400	Abrasion and corrosion resistant C.S.	
589	9252	P	00-5188	Process water pump (spare)	Pumps water from process water storage tank to steady head tank	20,000 GPM, 50 ft TDH	400	Abrasion and corrosion resistant C.S.	(spare)
590	9253		00-1258	Process water steady head tank	Steady head tank to provide 30 sec. of storage ahead of grind'g and flotation plant.	40,000 gal		Steel	With overflow to process water storage tank
591	926	T-8	05-1226	Flotation Reagent Storage Tank	Reagent Storage Tank Ahead of Plant				15 Days Supply
592	9261	T-9	05-1216	Reagent Day Tank	In Plant Use Storage Ahead of Flotation			Mild Steel	1 Day Supply

8820 EQUIPMENT LIST Re. 2

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
593	9261	T-9	05-1217	Reagent Day Tank	In Plant Use Storage Ahead of Flotation			Mild Steel	1 Day Supply
594	9261	T-9	05-1218	Reagent Day Tank	In Plant Use Storage Ahead of Flotation			Mild Steel	1 Day Supply
595	9261		05-5055 thru 05-5066	Reagent Feeder	Clarkson feeder Feeds flotation reagent from day tank to flotation cell.		110 Volt		12 required
596	9270	T-12	06-1230	Flocculant Storage Tank	Tank			Mild Steel	Tanker Trailer supplied by Reagent Distributor
597	9271	T-10	06-1227	Deleted					
598	92711	P	06-5183	Flocculant Transfer pump	Centrifugal pump transfers flocculant from mix tank to day tank		1		
599	9272	T-10	06-1228	Flocculant Mix Tank	Tank	10' dia. x 10'high. 5000 gallon		Mild Steel	For Metering into Thickener Feed
600	929	T-13	06-1231	Coagulant Storage Tank	Tank	14000 gal		Mild Steel	

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
601	9291	T-10	06-1232	Coagulant Day Tank	Day Tank for storage ahead of primary and concentrate thickeners	6' dia x 5'		Mild Steel	For Metering into Thickener Feed
602	9294		09-1260	Binder storage tank		60' dia x 51' high		Mild steel	15 day supply 870,000 gal
603	9295	P	09-5159	Binder transfer pump	Pump to transfer binder from storage tank to steady head tank	50 GPM @ 50' TDH	2		
604	9295	P	09-5160	Binder transfer pump (spare)	Pump to transfer binder from storage tank to steady head tank	50 GPM @ 50' TDH	2		(spare)
605	9296		09-1261 09-1262 09-1263	Binder head tank	Provides constant head ahead of binder mixing	1200 gal 6' dia x 6' high			
606	930	T-11	00-1264	Diesel Fuel Tank	Horizontal Steel Tank	12' X 35.5'		Mild Steel	Diesel fuel Tanks for All Three Units 30,000 gal
607	931	P	06-5162	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Primary Thickener
608	932	P	06-5163	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Primary Thickener

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
609	933	P	06-5164	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Primary Thickener
610	934	P	06-5165	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Secnodary Thickener
611	935	P	06-5166	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Concentrate Thickener
612	936	P	06-5167	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant to Concentrate Thickener
613	937	P	06-5168	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Flocculant (Spare)
614	938	P	06-5169	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Primary Thickener
615	939	P	06-5170	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Primary Thickener
616	940	P	06-5171	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Primary Thickener

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
617	941	P	06-5172	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Concentrate Thickener
618	942	P	06-5173	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Concentrate Thickener
619	943	P	06-5174	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant to Concentrate Thickener
620	944	P	06-5175	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Coagulant (Spare)
621	945	P	09-5176	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Binder to Briquetting Circuit A
622	946	P	09-5177	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Binder to Briquetting Circuit B
623	947	P	09-5178	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Binder to Briquetting Circuit C
624	948	P	09-5179	Reagent Pumps	Metering Pump--Positive Displacement		1	Corrosion Resistant	Binder (Spare)

8820 EQUIPMENT LIST P. 2

	ENTRY No.	REF No.	EQUIP. No.	EQUIP. NAME	EQUIP. DESCRIPTION	SIZE	HP	MATERIAL OF CONSTRUCTION	REMARKS
625	999	M-107	15-	Bulldozers	Caterpillar or Equivalent	D-8			
626	999	M-109	15-	Bulldozers	Caterpillar or Equivalent	D-8			
627	999	M-110	15-	F.E. Loader	Caterpillar or Equivalent	966			With 6 1/2 Yard Bucket
628	999	M-111	15-	Service Truck	With Portable Welder	2 1/2 Ton			
629	999	M-114	15-	Cherry Picker	With Extendable 50' Boom	10 Ton Capacity			
630	CCCCC	CCCCC	CCCCCCCCC	CCCCCCCCCCCCC	CCCCCCCCCCCCCCCCCCCC	CCCCCCCCCCCCC	CCC	CCCCCCCCCCCCCCCC	CCCCCCCCCCCCCCCC

10.0 ESTIMATE TAKE-OFF SHEETS

Project N°: 8820

University of Alabama~MRI/Hy crude Oil Shale Beneficiation Study

Location: Central Alabama

Project Description

Oil shale beneficiation plant to produce 4,380,000 tons per year of concentrated oil shale briquettes with 34.1 gallons per ton (Fischer assay) kerogen content. Plant includes crushing, grinding, flotation, thickening, filtering, drying, briquetting and conveying equipment.

Cost	Description	Material	Labor	Total
00	General	\$9,364,495	\$3,006,395	\$12,370,890
01	Crushing & Ore Storage	\$10,508,045	\$4,894,179	\$15,402,224
03	Ball Mill Grinding	\$6,733,485	\$2,114,917	\$8,848,402
04	Stirred Ball Mill Grinding	\$65,631,593	\$2,318,860	\$67,950,453
05	Flotation	\$9,035,271	\$1,116,515	\$10,151,786
06	Thickening	\$14,137,998	\$1,081,513	\$15,219,511
07	Filtering	\$18,595,689	\$1,405,342	\$20,001,031
08	Drying	\$5,314,266	\$845,526	\$6,159,792
09	Briquetting	\$9,453,846	\$1,444,011	\$10,897,857
11	Tailings Disposal	\$609,037	\$54,269	\$663,306
	Mill Buildings	\$4,939,008	\$6,722,622	\$11,661,630
13	Ancillary Buildings	\$3,475,489	\$620,608	\$4,096,097
14	Site Preparation & Fence	\$0	\$3,710,209	\$3,710,209
15	Mobile Equipment	\$1,745,000	\$0	\$1,745,000
	Subtotals	\$159,543,222	\$29,334,966	\$188,878,188
	Engineering Labor			\$7,555,128
	Engineering Direct Cost			\$188,878
	Engineering Consultants			\$200,000
	Construction Mgmt			\$6,659,250
	Startup			\$1,888,782
	Field Changes			\$586,699
	Sales & Use Tax			\$6,381,729
	Insurance (General Liability)			\$1,227,708
	Contractor Profit			\$9,443,909
	Construction Services			\$1,495,000
	Subtotal			\$224,505,271
	Contingency			\$15,699,654
	Grand Total			\$240,204,925

8920 - University of Alabama Oil Shale Study Capital Cost Estimate Summary

Area/ Cost	Area Description	Mech Equip Mat'l	Mech Equip Labor	Piping Mat'l	Piping Labor	Struct Mat'l	Struct Labor	Platewk Mat'l	Platewk Labor	Concrete Mat'l	Concrete Labor	Earthwk Mat'l	Earthwk Labor	Elect Mat'l	Elect Labor	Total
00	General	534,800	47,800	3,443,937	2,816,118	628,490	0							4,757,268	142,477	12,370,890
01	Crushing & Ore Storage	6,624,557	929,871			2,108,550	1,938,999	307,378	284,745	974,500	1,441,900			493,060	298,664	15,402,224
03	Ball Mill Grinding	5,699,499	1,429,513			127,379	129,092	166,648	143,995					739,959	412,317	8,848,402
04	Stirred Ball Mill Grinding	64,337,500	1,320,855			584,978	601,225	33,197	30,607					675,918	366,173	67,950,453
05	Flotation	8,301,414	422,365			236,111	217,489	186,659	202,166					311,087	274,495	10,151,786
06	Thickening	13,004,200	89,102			263,997	255,491			81,420	52,370			788,381	684,550	15,219,511
07	Filtering	17,870,286	726,330			215,641	217,489	62,487	64,741					447,275	396,782	20,001,031
08	Drying	4,895,286	499,142			192,474	193,359	12,331	12,493					214,175	140,532	6,159,792
09	Briquetting	8,548,379	815,031			358,470	193,359	61,828	62,018					485,169	373,603	10,897,857
11	Tailings Disposal	567,000	39,483											42,037	14,786	663,306
12	Mill Buildings					2,376,231	3,514,316			2,080,313	2,935,192			482,464	273,114	11,661,630
13	Ancillary Buildings					3,057,800	0			311,610	455,430			106,079	165,178	4,096,097
14	Site Preparation & Fence											0	3,710,209			3,710,209
15	Mobile Equipment	1,745,000	0													1,745,000
	Subtotals	132,127,921	6,319,492	3,443,937	2,816,118	10,150,121	7,260,819	830,528	800,765	3,447,843	4,884,892	0	3,710,209	9,542,872	3,542,671	188,878,188
	Engineering Labor	(4% Mat'l & Labor)														7,555,128
	Engineering Direct Cost	(2.5% Eng)														188,878
	Engineering Consultants															200,000
	Construction Mgmt															6,659,250
	Startup	(1% * Mat'l & Labor)														1,888,782
	Field Changes	(2% * Labor)														586,699
	Sales & Use Tax	(4% * Mat'l)														6,381,729
	Insurance (Gen'l Liability)	(.65% * Mat'l & Labor)														1,227,708
	Contractor Profit	(5% Mat'l & Labor)														9,443,909
	Construction Services															1,495,000
	Total															
	Contingency															224,505,271
	Grand Total															240,204,925

8820 Cost 00 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
00-ME-1	Pumps	\$534,800	\$47,800	\$582,600
	Subtotal	\$534,800	\$47,800	\$582,600

DATE: 11/14/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Plant Make-Up Water Pump - Deep well Type (7500 GPM @ 50 ft. TDH) Complete with 150 HP motor. Johnson Model 25 NMC (Item #5154)	ea.	2	37500.00	75,000	54.00	108.0	74.81	8,079			\$83,079
2	Process Water Pump - Pumps from process water storage tank to steady head tank. (20,000 GPM @ 50 ft. TDH) Warman Mod. 550 TUL, Complete with 400 HP Motor. (Item # 5184 thru 5188)	ea.	5	76000.00	380,000	64.00	320.0	74.81	23,939			\$403,939
3	Fire Water Pump - 1000 GPM @ 75' TDH. 8" x 6" - Complete with 60 HP motor. Warman Mod.#150 EL (Item#5193 & 5194)	ea	2	13000.00	26,000	48.00	96.0	45.29	4,348			\$30,348
4	Air Compressor System for Plant Air-200 HP Including heatless air dryer and air receiver tank (00-5301)	ea.	1	42,000	42,000	100.0	100.0	74.81	7,481			\$49,481
		ea.	1	9,600	9,600	48.0	48.0	74.81	3,591			\$13,191
		ea.	1	2,200	2,200	8.0	8.0	45.29	362			\$2,562
Page Total				\$534,800		680.0		\$47,800		\$0	\$582,600	

8820 Cost 00 Piping Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
00-PP-1	Piping	\$2,370,760	\$2,151,179	\$4,521,939
00-PP-2	Piping	\$451,450	\$166,358	\$617,808
00-PP-3	Piping	\$105,384	\$44,440	\$149,824
00-PP-4	Piping	\$314,954	\$313,472	\$628,426
00-PP-5	Piping	\$201,389	\$140,669	\$342,058
	Subtotal	\$3,443,937	\$2,816,118	\$6,260,055

ITEM N°		DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
					UNIT	TOTAL	UNIT	TOTAL	MANHOUR COST		SUBCONTRACT		
									UNIT	TOTAL	UNIT	TOTAL	
0		PROCESS PIPING											
1		Freight on piping materials (7% of cost)				225,304							
1		Portable Hose Rack Assembly	ea.	46	320.00	14,720							\$225,304
2		Sch. 40 Carbon Steel Pipe											\$19,780
		8" Dia.	ft.	2,640	26.98	71,227							
		6" Dia.	ft.	1,400	24.74	34,636			10.40	27,456			\$98,683
		4" Dia.	ft.	2,860	7.53	21,536			16.60	23,240			\$57,876
		3" Dia.	ft.	880	5.17	4,550			8.20	23,452			\$44,988
		2" Dia.	ft.	420	2.88	1,210			7.80	6,864			\$11,414
									5.20	2,184			\$3,394
3		Gate Valves											
		8" Dia.	ea.	2	1330.00	2,660			\$ ea.				
		2" Dia.	ea.	46	140.00	6,440			100.00	200			\$2,860
									40.00	1,840			\$8,280
		Phillips Drisco 1000 Pipe											
4		SDR-26											
		32" Dia.	ft.	5700	41.71	237,747							
		28" Dia.	ft.	29000	32.98	956,420			\$/ft.				
									34.10	194,370			\$432,117
5		SDR-21							32.50	942,500			\$1,898,920
		36" Dia.	ft.	2200	66.82	147,004							
		28" Dia.	ft.	1800	40.42	72,756			36.40	80,080			\$227,084
		24" Dia.	ft.	6000	29.70	178,200			32.50	58,500			\$131,256
		18" Dia.	ft.	18600	16.70	310,620			27.30	163,800			\$342,000
		16" Dia.	ft.	1900	13.20	25,080			23.10	429,660			\$740,280
		8" Dia.	ft.	9200	3.84	35,328			21.90	41,610			\$66,690
									12.40	114,080			\$149,408
6		SDR-15.5											
		21.5" Dia.	ft.	60	36.02	2,161							
		16" Dia.	ft.	310	19.94	6,181			24.80	1,488			\$3,649
		12" Dia.	ft.	860	12.66	10,888			21.90	6,789			\$12,970
		10" Dia.	ft.	200	9.00	1,800			18.50	15,910			\$26,798
		8" Dia.	ft.	740	5.80	4,292			14.60	2,920			\$4,720
									12.40	9,176			\$13,468
Page Total						\$2,370,760		0.0		\$2,151,179		\$0	\$4,521,939

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
7	Butterfly Valves (150# Cast Iron)											
	36" Dia.	ea.	2	6820.00	13,640			720.00	1,440			\$15,080
	28" Dia.	ea.	2	4240.00	8,480			600.00	1,200			\$9,680
	24" Dia.	ea.	12	3640.00	43,680			530.00	6,360			\$50,040
	20" Dia.	ea.	6	2540.00	15,240			460.00	2,760			\$18,000
	18" Dia.	ea.	24	760.00	18,240			360.00	8,640			\$26,880
	16" Dia.	ea.	24	590.00	14,160			270.00	6,480			\$20,640
	14" Dia.	ea.	6	440.00	2,640			220.00	1,320			\$3,960
	12" Dia.	ea.	6	380.00	2,280			180.00	1,080			\$3,360
	8" Dia.	ea.	6	320.00	1,920			140.00	840			\$2,760
8	Butterfly Valve w/ Actuator (150# Cast Iron)											
	8" Dia.	ea.	18	890.00	16,020			160.00	2,880			\$18,900
9	Flanges (Drisco)											
	36" Dia.	ea.	4	460.00	1,840			170.00	680			\$2,520
	28" Dia.	ea.	4	380.00	1,520			140.00	560			\$2,080
	24" Dia.	ea.	24	320.00	7,680			120.00	2,880			\$10,560
	20" Dia.	ea.	12	280.00	3,360			100.00	1,200			\$4,560
	18" Dia.	ea.	48	220.00	10,560			90.00	4,320			\$14,880
	16" Dia.	ea.	48	200.00	9,600			80.00	3,840			\$13,440
	14" Dia.	ea.	12	160.00	1,920			60.00	720			\$2,640
	12" Dia.	ea.	12	120.00	1,440			40.00	480			\$1,920
	8" Dia.	ea.	48	90.00	4,320			30.00	1,440			\$5,760
	PROCESS WATER PIPING											
10	Schedule 40 Black Steel Pipe											
	30" Dia.	ft.	450	110.45	49,703			42.60	19,170			\$68,873
	24" Dia.	ft.	250	96.40	24,100			26.80	6,700			\$30,800
	20" Dia.	ft.	200	79.68	15,936			22.40	4,480			\$20,416
	18" Dia.	ft.	190	72.54	13,783			19.20	3,648			\$17,431
	14" Dia.	ft.	870	58.60	50,982			15.10	13,137			\$64,119
	12" Dia.	ft.	570	46.40	26,448			13.20	7,524			\$33,972
	10" Dia.	ft.	100	40.40	4,040			11.60	1,160			\$5,200
	8" Dia.	ft.	2040	26.98	55,039			10.40	21,216			\$76,255
	4" Dia.	ft.	380	7.53	2,861			8.20	3,116			\$5,977
	3" Dia.	ft.	3460	5.17	17,888			7.80	26,988			\$44,876
	2" Dia.	ft.	3930	2.88	11,318			2.20	8,646			\$19,964
	1-1/2" Dia.	ft.	350	2.32	812			4.15	1,453			\$2,265
Page Total				\$451,450		0.0		\$166,358		\$0		\$617,808

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST				SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
11	Tees											
	30" Dia.	ea.	4	2340.00	9,360							
	24" Dia.	ea.	6	1636.00	9,816			1240.00	4,960			\$14,320
	20" Dia.	ea.	4	1235.00	4,940			880.00	5,280			\$15,096
	18" Dia.	ea.	2	828.00	1,656			740.00	2,960			\$7,900
	12" Dia.	ea.	4	265.00	1,060			660.00	1,320			\$2,976
	10" Dia.	ea.	4	175.00	700			440.00	1,760			\$2,820
								330.00	1,320			\$2,020
12	90 Degree Elbow											
	30" Dia.	ea.	4	1442.00	5,768							
	24" Dia.	ea.	2	940.00	1,880			1240.00	4,960			\$10,728
	20" Dia.	ea.	4	643.00	2,572			880.00	1,760			\$3,640
	18" Dia.	ea.	4	481.00	1,924			740.00	2,960			\$5,532
	14" Dia.	ea.	6	258.00	1,548			660.00	2,640			\$4,564
	10" Dia.	ea.	2	131.00	262			440.00	2,640			\$4,188
								330.00	660			\$922
13	Butterfly Valves (150# Cast Iron)											
	42" Dia.	ea.	2	11400.00	22,800							
	30" Dia.	ea.	3	4680.00	14,040			840.00	1,680			\$24,480
	20" Dia.	ea.	3	2540.00	7,620			640.00	1,920			\$15,960
	18" Dia.	ea.	3	760.00	2,280			460.00	1,380			\$9,000
	8" Dia.	ea.	3	320.00	960			360.00	1,080			\$3,360
	3" Dia.	ea.	19	180.00	3,420			140.00	420			\$1,380
								70.00	1,330			\$4,750
14	Ball Valve (150#)											
	2" Dia.	ea.	56	42.00	2,352							
	1-1/2" Dia.	ea.	10	34.00	340			40.00	2,240			\$4,592
								20.00	200			\$540
15	Check Valve (150#)											
	3" Dia.	ea.	19	394.00	7,486							
								30.00	570			\$8,056
16	Wash Down Hose (50 ft.)											
	1-1/2" Dia.	ea.	40	65.00	2,600			10.00	400			\$3,000
Page Total					\$105,384		0.0		\$44,440		\$0	\$149,824

ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
17	1-1/2" Quick Connection	ea.	56	24.00	1,344			40.00	2,240			\$3,584
18	Reducers (Schedule 40)											
	30" x 24"	ea.	6	828.00	4,968			1240.00	7,440			\$12,408
	24" x 20"	ea.	8	668.00	5,344			880.00	7,040			\$12,384
	30" x 20"	ea.	14	780.00	10,920			1240.00	17,360			\$28,280
	24" x 18"	ea.	12	707.00	8,484			880.00	10,560			\$19,044
19	Flange, (150# W.N.)											
	30" Dia.	ea.	54	924.00	49,896			980.00	52,920			\$102,816
	24" Dia.	ea.	36	773.00	27,828			660.00	23,760			\$51,588
	20" Dia.	ea.	32	589.00	18,848			560.00	17,920			\$36,768
	18" Dia.	ea.	24	495.00	11,880			510.00	12,240			\$24,120
	14" Dia.	ea.	96	236.00	22,656			380.00	36,480			\$59,136
20	Flange, (aSchedule 40 S.O.)											
	30"	ea.	24	621.00	14,904			980.00	23,520			\$38,424
	24"	ea.	16	495.00	7,920			660.00	10,560			\$18,480
	20"	ea.	14	363.00	5,082			560.00	7,840			\$12,922
	18"	ea.	28	302.00	8,456			510.00	14,280			\$22,736
	14"	ea.	48	179.00	8,592			380.00	18,240			\$26,832
	FLOTATION BLOWER											
21	Schedule 10 C.S. Pipe											
	14" Dia.	ft.	360	77.82	28,015			38.20	13,752			\$41,767
	10" Dia.	ft.	270	51.34	13,862			22.00	5,940			\$19,802
	8" Dia.	ft.	240	33.60	8,064			19.10	4,584			\$12,648
	6" Dia.	ft.	180	24.74	4,453			16.60	2,988			\$7,441
	4" Dia.	ft.	1440	9.11	13,118			9.20	13,248			\$26,366
	Ball Valve (150#)											
22	4" Dia.	ea.	96	420.00	40,320			110.00	10,560			\$50,880
Page Total					\$314,954		0.0		\$313,472		\$0	\$628,426

ITEM N°				DESCRIPTION		UNIT MEAS	QTY	MATERIAL COST		LABOR COST						SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL			
FIRE PROTECTION																		
23	Portable Hose Rack	ea.	46	320.00	14,720					110.00	5,060					\$19,780		
24	Schedule 40 Carbon Steel Pipe																	
	8" Dia.	ft.	2,640	26.98	71,227					10.40	27,456					\$98,683		
	6" Dia.	ft.	1,400	24.74	34,636					16.60	23,240							
	4" Dia.	ft.	2,860	7.53	21,536					8.20	23,452							
	3" Dia.	ft.	880	5.17	4,550					7.80	6,864							
	2" Dia.	ft.	420	2.88	1,210					5.20	2,184							
25	Gate Valve															\$3,394		
	8" Dia.	ea.	2	1330.00	2,660					100.00	200							
	2" Dia.	ea.	46	140.00	6,440					40.00	1,840					\$2,860		
COAGULANT, FLOCULANT PIPING																		
26	CPVC Pipe - Sched. 80															\$8,280		
	3/4"	ft.	5,560	1.52	8,451					3.61	20,072							
COMPRESSED AIR																		
27	Schedule 40 C.S. Pipe															\$10,748		
	6" Dia	ft.	260	24.74	6,432					16.60	4,316							
	4" Dia	ft.	1420	9.11	12,936					9.20	13,064							
	2" Dia.	ft.	890	2.76	2,456					5.20	4,628							
	1-1/2" Dia.	ft.	680	2.03	1,380					4.14	2,815							
	1" Dia.	ft.	460	1.39	639					3.47	1,596							
	3/4" Dia.	ft.	120	0.97	116					3.02	362							
28	3/4" Quick Connection	ea.	40	35.00	1,400					20.00	800					\$2,200		
29	3/4" Hose - 50 ft.	ea.	40	60.00	2,400					10.00	400							
30	Ball Valve - 150 #															\$2,800		
	6"	ea.	6	860.00	5,160					120.00	720							
	4"	ea.	4	430.00	1,720					80.00	320							
	1"	ea.	24	30.00	720					20.00	480							
	3/4"	ea.	40	15.00	600					20.00	800							
Page Total				\$201,389		0.0		\$140,669		\$0		\$342,058						

8820 Cost 00 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
00-ST-1	General	\$628,490	\$0	\$628,490
	Subtotal	\$628,490	\$0	\$628,490

GENERAL STRUCTURAL						COST: 00		PAGE: 0-ST-1		DATE: 11/9/88		
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Process water storage tank (installed) 80'Øx40'-0, Capacity:1,500,000 Gal Equip Nº00-1225	EA	1	326410.00	326,410							\$326,410
2	Process water steady head tank (Installed) 20'Øx17'-0, Capacity:40,000 Gal, Elevated Equip Nº00-1258	EA	1	264000.00	264,000							\$264,000
3	Diesel fuel tank (installed) 12'Øx35'-0, Capacity:30,000 Gal Equip Nº00-1262	EA	1	38080.00	38,080							\$38,080
Page Total					\$628,490		0.0		\$0		\$0	\$628,490

8820 Cost 00 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
00-EL-1		\$4,757,268	\$142,477	\$4,899,745
	Subtotal	\$4,757,268	\$142,477	\$4,899,745

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	T	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
00	MAIN POWER DISTRIBUTION											
	MAIN SUBSTATION DISTRIBUTION SWITCH GEAR											
	69 KV #00-SG-00	ea	1	384,300	\$384,300	120.	120.0	\$28.00	\$3,360			\$387,660
	PRIMARY TRANSFORMERS 69-7.2 KV											
	5 MVA #00-SS-01	ea	1	95,000	\$95,000	120.	120.0	\$28.00	\$3,360			\$98,360
	40 MVA #00-SS-02	ea	1	369,000	\$369,000	360.	360.0	\$28.00	\$10,080			\$379,080
	40 MVA #00-SS-03	ea	1	369,000	\$369,000	360.	360.0	\$28.00	\$10,080			\$379,080
	40 MVA #00-SS-04	ea	1	369,000	\$369,000	360.	360.0	\$28.00	\$10,080			\$379,080
	10 MVA #00-SS-05	ea	1	138,000	\$138,000	240.	240.0	\$28.00	\$6,720			\$144,720
	10 MVA #00-SS-06	ea	1	138,000	\$138,000	240.	240.0	\$28.00	\$6,720			\$144,720
	10 MVA #00-SS-07	ea	1	138,000	\$138,000	240.	240.0	\$28.00	\$6,720			\$144,720
	2500 KVA #00-SS-08	ea	1	78,000	\$78,000	60.	60.0	\$28.00	\$1,680			\$79,680
	PRIMARY TRANSFORMERS 69 KV-480V											
	500 KVA #00-SS-09	ea	1	35,000	\$35,000	40.	40.0	\$28.00	\$1,120			\$36,120
	300 KVA #00-SS-10	ea	1	27,500	\$27,500	40.	40.0	\$28.00	\$1,120			\$28,620
	TESTING & CALIBRATION OF SUBS	ea	1	160,000	\$160,000							\$160,000
	PRIMARY DISTRIBUTION SWITCHGEAR											
	69 KV #00-SG-01	ea	1	514,000	\$514,000	24.	24.0	\$28.00	\$672			\$514,672
	69 KV #00-SG-02	ea	1	368,000	\$368,000	60.	60.0	\$28.00	\$1,680			\$369,680
	69 KV #00-SG-03	ea	1	368,000	\$368,000	48.	48.0	\$28.00	\$1,344			\$369,344
	69 KV #00-SG-04	ea	1	368,000	\$368,000	48.	48.0	\$28.00	\$1,344			\$369,344
	69 KV #00-SG-05	ea	1	200,000	\$200,000	24.	24.0	\$28.00	\$672			\$200,672
	69 KV #00-SG-06	ea	1	200,000	\$200,000	24.	24.0	\$28.00	\$672			\$200,672
	69 KV #00-SG-07	ea	1	200,000	\$200,000	24.	24.0	\$28.00	\$672			\$200,672
	480 V #00-SG-08	ea	1	85,000	\$85,000	36.	36.0	\$28.00	\$1,008			\$86,008
	480 V #00-SG-09	ea	1	23600.00	\$23,600	36.00	36.0	\$28.00	\$1,008			\$24,608
TOTALS THIS SHEET					\$4,627,400		2504		\$70,112			\$4,697,512
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$4,627,400		2504		\$70,112			\$4,697,512

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	CABLE TRENCHES											
	30" wide Fibercast w/ covers	ft	1350	24.00	\$32,400	0.15	202.5	\$28.00	\$5,670			\$38,070
	Fibercast Traffic Crossing	ft	30	147.00	\$4,410	0.20	6.0	\$28.00	\$168			\$4,578
	TRENCHING & BACKFILL	ft	1350	3.00	\$4,050.00	0.02	27.0	\$28.00	\$756			\$4,806
	CRUSHER ELECTRIC BUILDING & SUB											
	16' x 20' bldg complete	ea	1	7000.00	\$7,000	40.00	40.0	\$72.00	\$2,880			\$9,880
	XFMR Concrete Pad	lot	1	90.00	\$90	3.00	3.0	\$28.00	\$84			\$174
	Gravel	lot	1	25.00	\$25	4.00	4.0	\$28.00	\$112			\$137
	Fence	ft	200	3.50	\$700	0.05	10.0	\$28.00	\$280			\$980
	CRUSHER SUBSTATION GROUNDING											
	#2/0 SDBC Ground Cable	ft	50	0.55	\$27.50	0.03	1.5	\$28.00	\$42			\$70
	#4/0 SDBC Ground Cable	ft	200	0.80	\$160.00	0.04	7.6	\$28.00	\$213			\$373
	#2/0 Ground Lug	ea	5	4.35	\$21.75	0.45	2.3	\$28.00	\$64			\$86
	#4/0 Ground Lug	ea	2	9.50	\$19.00	0.5	1.0	\$28.00	\$28			\$47
	#6 Bare Copper wire in fence	ea	50	0.20	\$10.00	0.02	1.0	\$28.00	\$28			\$38
	Misc Clamps	ea	18	1.75	\$31.50	0.05	0.9	\$28.00	\$25			\$57
	CADWELD Shots	ea	12	2.75	\$33.00	0.25	3.0	\$28.00	\$84			\$117
	CADWELD Molds	ea	2	40.00	\$80.00	skip						\$80
	5/8"x10' Copperweld Rod	ea	8	17.50	\$140.00	1.5	12.0	\$28.00	\$336			\$476
	TRENCHING & BACKFILL	ft	200	3.00	\$600.00	0.02	4.0	\$28.00	\$112			\$712
	TEST WELL	ea	1	30.00	\$30.00	6	6.0	\$28.00	\$168			\$198
TOTALS THIS SHEET					\$49,828		332		\$11,050			\$60,879
BROUGHT FWD. FROM PREV. SHEET					\$4,627,400		2504		\$70,112			\$4,697,512
TOTALS					\$4,677,228		2836		\$81,162			\$4,758,391

ITEM N°	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	WAREHOUSE SUBSTATION											
	XFMR Concrete Pad	lot	1	90.00	\$90	3.00	3.0	\$28.00	\$84			\$174
	WAREHOUSE SUBSTATION GROUNDING											
	#2/0 SDBC Ground Cable	ft	25	0.55	\$13.75	0.03	0.8	\$28.00	\$22			\$36
	#4/0 SDBC Ground Cable	ft	100	0.80	\$80.00	0.04	3.8	\$28.00	\$106			\$186
	#2/0 Ground Lug	ea	2	4.35	\$8.70	0.45	0.9	\$28.00	\$25			\$34
	#4/0 Ground Lug	ea	2	9.50	\$19.00	0.5	1.0	\$28.00	\$28			\$47
	CADWELD Shots	ea	8	2.75	\$22.00	0.25	2.0	\$28.00	\$56			\$78
	CADWELD Molds	ea	1	40.00	\$40.00	skip						\$40
	5/8"x10' Copperweld Rod	ea	4	17.50	\$70.00	1.5	6.0	\$28.00	\$168			\$238
	TRENCHING & BACKFILL	ft	100	3.00	\$300.00	0.02	2.0	\$28.00	\$56			\$356
	MILL BUILDING SUBSTATIONS (3) REQ'D											
	XFMR Concrete Pad	lot	3	90.00	\$270	3.00	9.0	\$28.00	\$252			
	Gravel	lot	3	25.00	\$75	4.00	12.0	\$28.00	\$336			
	Fence	ft	450	3.50	\$1,575	0.05	22.5	\$28.00	\$630			
	MILL BUILDING SUBSTATION GROUNDING											
	#2/0 SDBC Ground Cable	ft	150	0.55	\$82.50	0.03	4.5	\$28.00	\$126			\$209
	#4/0 SDBC Ground Cable	ft	600	0.80	\$480.00	0.04	22.8	\$28.00	\$638			\$1,118
	#2/0 Ground Lug	ea	15	4.35	\$65.25	0.45	6.8	\$28.00	\$190			\$255
	#4/0 Ground Lug	ea	6	9.50	\$57.00	0.5	3.0	\$28.00	\$84			\$141
	#6 Bare Copper wire in fence	ea	150	0.20	\$30.00	0.02	3.0	\$28.00	\$84			\$114
	Misc Clamps	ea	60	1.75	\$105.00	0.05	3.0	\$28.00	\$84			\$189
	CADWELD Shots	ea	36	2.75	\$99.00	0.25	9.0	\$28.00	\$252			\$351
	CADWELD Molds	ea	3	40.00	\$120.00	skip						\$120
	5/8"x10' Copperweld Rod	ea	24	17.50	\$420.00	1.5	36.0	\$28.00	\$1,008			\$1,428
	TRENCHING & BACKFILL	ft	450	3.00	\$1,350.00	0.02	9.0	\$28.00	\$252			\$1,602
TOTALS THIS SHEET					\$5,372		160		\$4,481			\$6,716
BROUGHT FWD. FROM PREV. SHEET					\$4,677,228		2836		\$81,162			\$4,758,391
TOTALS					\$4,682,600		2996		\$85,643			\$4,765,107

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	BRIQUETTING BUILDING SUBSTATIONS (3) REQ'D											
	XFMR Concrete Pad	lot	3	90.00	\$270	3.00	9.0	\$28.00	\$252			\$522
	Gravel	lot	3	25.00	\$75	4.00	12.0	\$28.00	\$336			\$411
	Fence	ft	450	3.50	\$1,575	0.05	22.5	\$28.00	\$630			\$2,205
	BRIQUETTING BUILDING SUBSTATION GROUNDING											
	#2/0 SDBC Ground Cable	ft	150	0.55	\$82.50	0.03	4.5	\$28.00	\$126			\$209
	#4/0 SDBC Ground Cable	ft	600	0.80	\$480.00	0.04	22.8	\$28.00	\$638			\$1,118
	#2/0 Ground Lug	ea	15	4.35	\$65.25	0.45	6.8	\$28.00	\$190			\$255
	#4/0 Ground Lug	ea	6	9.50	\$57.00	0.5	3.0	\$28.00	\$84			\$141
	#6 Bare Copper wire in fence	ea	150	0.20	\$30.00	0.02	3.0	\$28.00	\$84			\$114
	Misc Clamps	ea	60	1.75	\$105.00	0.05	3.0	\$28.00	\$84			\$189
	CADWELD Shots	ea	36	2.75	\$99.00	0.25	9.0	\$28.00	\$252			\$351
	CADWELD Molds	ea	3	40.00	\$120.00	skip						\$120
	5/8"x10' Copperweld Rod	ea	24	17.50	\$420.00	1.5	36.0	\$28.00	\$1,008			\$1,428
	TRENCHING & BACKFILL	ft	450	3.00	\$1,350.00	0.02	9.0	\$28.00	\$252			\$1,602
TOTALS THIS SHEET					\$4,729		141		\$3,936			\$8,665
BROUGHT FWD. FROM PREV. SHEET					\$4,682,600		2996		\$85,643			\$4,765,107
TOTALS					\$4,687,329		3137		\$89,579			\$4,773,772

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	69 KV DESTRICTION POWER LINE TO TAILINGS POND.											
	15000 feet long											
	1 (ea) Dead end pole assembly											
	1 (ea) Power drop pole assemblies											
	48 (ea) Line Pole Assemblies											
	2) DEAD END / POWER DROP POLES											
	35) ft Class 3 pole	ea	2	350.00	\$700	6.0	12.0	\$28.00	\$336			\$1,036
	2) Cross Arm	ea	4	22.00	\$88	2.0	8.0	\$28.00	\$224			\$312
	1) Grounding & molding	ea	2	20.00	\$40	1.00	2.0	\$28.00	\$56			\$96
	1) Hardware	lot	2	20.00	\$40	3.00	6.0	\$28.00	\$168			\$208
	2) Guy Assembly	ea	4	50.00	\$200	2.00	8.0	\$28.00	\$224			\$424
	6) String Insulator	ea	12	30.00	\$360	2.00	24.0	\$28.00	\$672			\$1,032
	6) Conductor Shoe	ea	12	6.00	\$72	1.00	12.0	\$28.00	\$336			\$408
	6) Line Clamp	ea	12	8.00	\$96	0.50	6.0	\$28.00	\$168			\$264
	3) Cutouts	ea	6	150.00	\$900	3.00	18.0	\$28.00	\$504			\$1,404
	3) Arrestors	ea	6	42.00	\$252	2.5	15.0	\$28.00	\$420			\$672
	1) Weatherhead	ea	2	25.00	\$50	1	2.0	\$28.00	\$56			\$106
	30") 2" GRC conduit w/ straps	ea	60	2.75	\$165	0.16	9.6	\$28.00	\$269			\$434
	48) LINE POLES											
	35) ft Class 3 pole	ea	48	350.00	\$16,800	6.0	288.0	\$28.00	\$8,064			\$24,864
	1) Cross Arm	ea	48	22.00	\$1,056	2.0	96.0	\$28.00	\$2,688			\$3,744
	1) Grounding & molding	ea	18	20.00	\$360	1.00	18.0	\$28.00	\$504			\$864
	3) Pin Insulator	ea	144	18.00	\$2,592	2.00	288.0	\$28.00	\$8,064			\$10,656
	3) Line Tie	ea	144	1.50	\$216	1.00	144.0	\$28.00	\$4,032			\$4,248
	1) Hardware	lot	48	20.00	\$960	3.00	144.0	\$28.00	\$4,032			\$4,992
	4/0 ACSR Conductor	ft	47500	0.65	\$30,875	0.01	475.0	\$28.00	\$13,300			\$44,175
	Line Truck Rental 30 days	lot	1	4250.00	\$4,250							\$4,250
	TOTALS THIS SHEET				\$60,072		1576		\$44,117			\$104,189
	BROUGHT FWD. FROM PREV. SHEET				\$4,687,329		3137		\$89,579			\$4,773,772
	TOTALS				\$4,747,401		4713		\$133,696			\$4,877,961

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	69 KV DESTRICTION POWER LINE TO CRUSHER SUB 2000 feet long 1 (ea) Dead end pole assembly 1 (ea) Power drop pole assemblies 6 (ea) Line Pole Assemblies											
	2) DEAD END / POWER DROP POLES											
	35) ft Class 3 pole	ea	2	350.00	\$700	6.0	12.0	\$28.00	\$336			\$1,036
	2) Cross Arm	ea	4	22.00	\$88	2.0	8.0	\$28.00	\$224			\$312
	1) Grounding & molding	ea	2	20.00	\$40	1.00	2.0	\$28.00	\$56			\$96
	1) Hardware	lot	2	20.00	\$40	3.00	6.0	\$28.00	\$168			\$208
	2) Guy Assembly	ea	4	50.00	\$200	2.00	8.0	\$28.00	\$224			\$424
	6) String Insulator	ea	12	18.00	\$216	2.00	24.0	\$28.00	\$672			\$888
	6) Conductor Shoe	ea	12	6.00	\$72	1.00	12.0	\$28.00	\$336			\$408
	6) Line Clamp	ea	12	8.00	\$96	0.50	6.0	\$28.00	\$168			\$264
	3) Cutouts	ea	6	150.00	\$900	3.00	18.0	\$28.00	\$504			\$1,404
	3) Arrestors	ea	6	42.00	\$252	2.5	15.0	\$28.00	\$420			\$672
	1) Weatherhead	ea	2	25.00	\$50	1	2.0	\$28.00	\$56			\$106
	30") 2" GRC conduit w/ straps	ea	60	2.75	\$165	0.16	9.6	\$28.00	\$269			\$434
	6) LINE POLES											
	35) ft Class 3 pole	ea	6	350.00	\$2,100	6.0	36.0	\$28.00	\$1,008			\$3,108
	1) Cross Arm	ea	6	22.00	\$132	2.0	12.0	\$28.00	\$336			\$468
	1) Grounding & molding	ea	6	20.00	\$120	1.00	6.0	\$28.00	\$168			\$288
	3) Pin Insulator	ea	18	18.00	\$324	2.00	36.0	\$28.00	\$1,008			\$1,332
	3) Line Tie	ea	18	1.50	\$27	1.00	18.0	\$28.00	\$504			\$531
	1) Hardware	lot	6	20.00	\$120	3.00	18.0	\$28.00	\$504			\$624
	4/0 ACSR Conductor	ft	6500	0.65	\$4,225	0.01	65.0	\$28.00	\$1,820			\$6,045
	TOTALS THIS SHEET				\$9,867		314		\$8,781			\$18,648
	BROUGHT FWD. FROM PREV. SHEET				\$4,747,401		4713		\$133,696			\$4,877,961
	TOTALS				\$4,757,268		5027		\$142,477			\$4,896,609

8820 Cost 01 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
01-ME-1	Mechanical Equipment	\$2,938,382	\$375,615	\$3,313,997
01-ME-2	Conveyors	\$3,031,488	\$415,738	\$3,447,226
01-ME-3	Conveyors	\$654,687	\$138,518	\$793,205
	Subtotal	\$6,624,557	\$929,871	\$7,554,428

PROJECT: University of Alabama - Oil Shale Beneficiation Study
DESCRIPTION: Area 01 (Crushing and ore storage)

BY: JMA

PROJECT N#: 8820

COST: 01

PAGE: 1-ME-1
DATE: 11/23/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Primary Crusher - Nordberg 60" x 90" 700 HP, 514 RPM (01-3001)	ea.	1	1,490,200	1,490,200	2000.00	2,000.0	99.51	199,020			\$1,689,220
2	ROM Apron Feeder- 66' X 30' lg.- Var. Spd. w/ Var. Freq. Controller (01-4001)	ea.	1	85,000	85,000	72.00	72.0	74.81	5,386			\$90,386
	Including variable speed drive: Apron Feeder Dribble Drag Scraper Purchase integral w/ apron feeder (01-4001A)	ea.	1	59,250	59,250	8.00	8.0	74.81	598			\$59,848
3	Primary crusher dust collector with exhaust fan, rotary airlock 6000 CFM @ 16" W.G. (01-0156 & 01-5401)	EA	1	18548.00	18,548	70.00	70.0	74.81	5,237			\$23,785
4	Ductwork (10 GA steel, ells, transitions, blast gates, supports)	LB	3,750	1.75	6,563	0.016	60.0	74.81	4,489			\$11,052
5	Centrifugal Slurry Pump at crusher dust col- lection system. 100 GPM @ 30"TDH, 2HP War. 2/1.5 BAH (01-5180 thru 01-5182)	ea.	3	3,700	11,100	24.00	72.0	45.29	3,261			\$14,361
6	Secondary Crusher Feed Conveyor #1 16° inclined 400 fpm, 35° troughing idlers 1620 STPH - 48" x 330' C/C Pulleys, 200 HP (01-1001)	ea.	1	176,411	176,411	304.00	304.0	99.51	30,251			\$206,662
7	Vibrating Grizzly Feeder - 54" W x 24'L 8' long stepped grizzly w/ bars at 3" opening 40 HP (01-4002 & 01-4003)	ea.	2	70,895	141,790	100.00	200.0	99.51	19,902			\$161,692
8	7' Stand. Symons Cone Crusher w/ 400 HP 670 STPH - 6"ore to pass 2" opening, 1"css (01-3002 & 01-3003)	ea.	2	474,760	949,520	540.00	1,080.0	99.51	107,471			\$1,056,991
Page Total				\$2,938,382		3,866.0		\$375,615		\$0		\$3,313,997

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Area 01 (Crushing and ore storage)

BY: JMA

PROJECT N°: 8820

COST: 01

PAGE: 1-ME-2
 DATE: 11/23/88

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
9	Secondary crusher dust collector with exhaust fan, rotary airlock 30,000 CFM @ 16" W.G. (01-0157 & 01-5403)	EA	1	55770.00	55,770	92.00	92.0	74.81	6,883			\$62,653
10	Ductwork (10 GA steel, ells, transitions, blast gates, supports)	LB	8,800	1.75	15,400	0.016	140.8	74.81	10,533			\$25,933
11	Secondary Crusher Collecting Conveyor #2A & #2B -16° inclined - 400 fpm, 35° troughing idlers, 810 STPH, 48" x 227' C/C Pulleys - 75 HP (01-1002 & 01-1003)	ea.	2	121349.00	242,698	223.00	446.0	99.51	44,381			\$287,079
12	Vibrating Feeder - 54"W x 20' L 20 HP 765 TPH - 3" X 0" A.R. lined steel (01-4004 thru 01-4007)	ea.	4	64615.00	258,460	80.00	320.0	99.51	31,843			\$290,303
13	Vibrating Screen 8' x 24' Double deck AC Ripple Flow or eq. 1" sq. top & 5/8" bottom 15 HP, (01-2001 thru 01-2004)	ea.	4	55870.00	223,480	110.00	440.0	99.51	43,784			\$267,264
14	7' Short Head Symons Cone Crusher with 400 STPH - 3"ore to pass 3/4"opening, 3/8"css (01-3004 & 01-3007)	ea.	4	493440.00	1,973,760	505.00	2,020.0	99.51	201,010			\$2,174,770
15	Tertiary crusher dust collector with exhaust fan, rotary airlock 66,400 CFM @ 16" W.G. (01-5402 & 01-0158)	EA	1	109277.00	109,277	120	120.0	74.81	8,977			\$118,254
16	Ductwork (10 GA steel, ells, transitions, blast gates, supports)	LB	36,300	1.75	63,525	0.016	580.8	74.81	43,450			\$106,975
17	Second Recycle Conveyor #5A & #5B 14 ft. lift, 400 fpm, 35° troughing idlers 720 STPH - 36" x 51' C/C Pulleys - 30 HP (01-1006 & 01-1007)	ea.	2	20846.00	41,692	65.00	130.0	99.51	12,936			\$54,628
18	Crushed Ore Collect. Conveyor #3A & #3B Zero Lift, 400 fpm, 35° troughing idlers 810 STPH - 36" x 48' C/C Pulleys - 20 HP (01-1008 & 01-1009)	ea.	2	23713.00	47,426	60.00	120.0	99.51	11,941			\$59,367
Page Total					\$3,031,488		4,409.6		\$415,738		\$0	\$3,447,226

PAGE: 1-ME-3 DATE: 11/23/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
19	Crushed Ore Collect. Conveyor #6 13' Lift, 400 fpm, 35° troughing idlers 1620 STPH - 48"x 230' C/C Pulleys - 60 HP Vertically Curved (01-1010)	ea.	1	77415.00	77,415	226.00	226.0	99.51	22,489			\$99,904
20	Crushed Ore Conveyor #7 400 fpm, 35° troughing idlers, 1620 STPH, 48" x 330' C/C Pulleys, 91' lift - 200 HP (01-1011)	ea.	1	151103.00	151,103	304.00	304.0	99.51	30,251			\$181,354
21	Crushed Ore Conveyor #8 400 fpm, 35° troughing idlers, 1620 STPH, 48" x 126' C/C Pulleys, 11' lift - 50 HP (01-1012)	ea.	1	47947.00	47,947	121.00	121.0	99.51	12,041			\$59,988
22	Crushed Ore Conveyor #9 400 fpm, 35° troughing idlers, 1620 STPH, 48" x 126' C/C Pulleys, zero lift - 30 HP (01-1013)	ea.	1	44676.00	44,676	113.00	113.0	99.51	11,245			\$55,921
23	First Recycle Conveyors #4A & #4B 31' Lift, 400 fpm 35° troughing idlers, vertically curved, 720 STPH, 36"x251' C/C Pulleys, 50 HP (01-1004 & 01-1005)	ea.	2	77376.00	154,752	314.00	628.0	99.51	62,492			\$217,244
24	Freight on items above except conveyors	lot	1	178794.00	178,794							\$178,794
Page Total					\$654,687		1,392.0		\$138,518		\$0	\$793,205

8820 Cost 01 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
01-ST-1	Truck Dump/Primary Crushing	\$115,078	\$116,142	\$231,220
01-ST-2	Secondary Crushing Station	\$1,021,161	\$894,649	\$1,915,810
01-ST-3	Tertiary Crushing Station	\$892,204	\$846,794	\$1,738,998
01-ST-4	Transfer Stations (3)	\$31,428	\$30,800	\$62,228
01-ST-5	Stacking Tube Platforms	\$48,679	\$50,614	\$99,293
	Subtotal	\$2,108,550	\$1,938,999	\$4,047,549

DATE: 11/9/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Heavy Steel	LB	18,735	0.83	15,550	0.008	149.9	74.81	11,214			\$26,764
2	Medium Steel	LB	13,698	0.87	11,917	0.013	178.1	74.81	13,324			\$25,241
3	Light Steel	LB	49,491	0.91	45,037	0.015	742.4	74.81	55,539			\$100,576
4	Handrail	LF	213	23.00	4,899	0.330	70.3	45.29	3,184			\$8,083
5	Handrail w/Toe Plate	LF	425	27.00	11,475	0.500	212.5	45.29	9,624			\$21,099
6	Grating	SF	3,862	5.80	22,400	0.075	289.7	74.81	21,672			\$44,072
7	Stairtreads	EA	100	38.00	3,800	0.350	35.0	45.29	1,585			\$5,385
Page Total					\$115,078	1,677.9		\$116,142		\$0		\$231,220

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Secondary Crushing & Screening ~ Structural

BY: CH

PROJECT N°: 8820

COST: 01

PAGE: 1-ST-2
 DATE: 11/9/88

DATE: 11/10/00												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Heavy Steel	LB	752,272	0.83	624,386	0.008	6,018.2	74.81	450,222			\$1,074,608
2	Medium Steel	LB	29,212	0.87	25,414	0.013	379.8	74.81	28,413			\$53,827
3	Light Steel	LB	103,056	0.91	93,781	0.015	1,545.8	74.81	115,641			\$209,422
4	Handrail	LF	285	23.00	6,555	0.330	94.1	45.29	4,262			\$10,817
5	Handrail w/Toe Plate	LF	475	27.00	12,825	0.500	237.5	45.29	10,756			\$23,581
6	Grating	SF	3,160	5.80	18,328	0.075	237.0	74.81	17,730			\$36,058
7	Stairtreads	EA	134	38.00	5,092	0.350	46.9	45.29	2,124			\$7,216
8	3/4" Plate	LB	273,000	0.86	234,780	0.013	3,549.0	74.81	265,501			\$500,281

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Tertiary Screening & Crushing ~ Structural

BY: CH

PROJECT N°: 8820

COST: 01

PAGE: 1-ST-3
 DATE: 11/9/88

Secondary Screening & Crushing ~ Structural				PROJECT N° 8820				COST: 01		PAGE: 1-ST-3		DATE: 11/9/88	
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL	
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT			
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL		
1	Heavy Steel	LB	449,600	0.83	373,168	0.008	3,596.8	74.81	269,077				
2	Medium Steel	LB	151,070	0.87	131,431	0.013	1,963.9	74.81	146,919				\$642,245
3	Light Steel	LB	204,179	0.91	185,803	0.015	3,062.7	74.81	229,121				\$278,350
4	Handrail	LF	402	23.00	9,246	0.330	132.7	45.29	6,010				\$414,924
5	Handrail w/Toe Plate	LF	1,091	27.00	29,457	0.500	545.5	45.29	24,706				\$15,256
6	Grating	SF	8,786	5.80	50,959	0.075	659.0	74.81	49,300				\$54,163
7	Stairtreads	EA	190	38.00	7,220	0.350	66.5	45.29	3,012				\$100,259
8	3/4" Plate	LB	122,000	0.86	104,920	0.013	1,586.0	74.81	118,649				\$10,232
													\$223,569
Page Total													
				\$892,204		11,613		\$846,794		\$0		\$1,738,998	

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Transfer Stations (3) ~ Structural

BY: CH

PROJECT N#: 8820

COST: 01

PAGE: 1-ST-4
 DATE: 11/9/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Heavy Steel	LB										
2	Medium Steel	LB	9,270	0.87	8,065	0.013	120.5	74.81	9,015			\$17,080
3	Light Steel	LB	10,001	0.91	9,101	0.015	150.0	74.81	11,222			\$20,323
4	Handrail	LF	154	23.00	3,542	0.330	50.8	45.29	2,301			\$5,843
5	Handrail w/Toe Plate	LF	168	27.00	4,536	0.500	84.0	45.29	3,804			\$8,340
6	Grating	SF	588	5.80	3,410	0.075	44.1	74.81	3,299			\$6,709
7	Stairtreads	EA	73	38.00	2,774	0.350	25.6	45.29	1,159			\$3,933

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Stacking Tube Platforms ~ Structural

BY: CH

PROJECT N#: 8820

COST: 01

PAGE: 1-ST-5
 DATE: 11/9/88

Erecting Tower Platforms - Structural												PAGE: 1-51-5	
												DATE: 11/9/88	
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL	
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT			
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL		
1	Heavy Steel	LB											
2	Medium Steel	LB	13,311	0.87	11,581	0.013	173.0	74.81	12,942			\$24,523	
3	Light Steel	LB	17,151	0.91	15,607	0.015	257.3	74.81	19,249			\$34,856	
4	Handrail	LF	68	23.00	1,564	0.330	22.4	45.29	1,014			\$2,578	
5	Handrail w/Toe Plate	LF	345	27.00	9,315	0.500	172.5	45.29	7,813			\$17,128	
6	Grating	SF	1,620	5.80	9,396	0.075	121.5	74.81	9,089			\$18,485	
7	Stairtreads	EA	32	38.00	1,216	0.350	11.2	45.29	507			\$1,723	
Page Total					\$48,679		757.9		\$50,614		\$0	\$99,293	

8820 Cost 01 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
01-PW-01	Truck Dump & Primary Crusher	\$22,390	\$10,803	\$33,193
01-PW-02	Secondary Crushing	\$53,132	\$47,591	\$100,723
01-PW-03	Secondary Crusher Transfer	\$27,634	\$27,609	\$55,243
01-PW-04	Tertiary Crushing & Screening	\$173,454	\$169,622	\$343,076
01-PW-05	Conv N's 6 & 7 Chutes	\$12,806	\$13,032	\$25,838
01-PW-06	Stacking Tube Chutes	\$17,962	\$16,088	\$34,050
				\$0
				\$0
				\$0
	Subtotal	\$307,378	\$284,745	\$592,123

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Truck Dump & Primary Crusher Platework

BY: MB

PROJECT N#: 8820

COST: 01

PAGE: 1-PW-1
 DATE: 11/21/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	3/8" A36 plate	LB	7336	0.96	7,043	0.013	95.4	45.29	4,321			\$11,364
2	Light steel	LB	400	0.91	364	0.015	6.0	45.29	272			\$636
3	1"x3" AR bar	LB	650	1.56	1,014	0.013	8.5	45.29	385			\$1,399
4	Skirtboard steel	LB	1,434	0.91	1,305	0.015	21.5	45.29	974			\$2,279
5	12 Ga plate	LB	306	0.99	303	0.015	4.6	45.29	208			\$511
6	1/2" rubber, 60 durometer	SF	26	9.80	255	0.050	1.3	45.29	59			\$314
7	3/4" AR liner	LB	7,700	1.56	12,012	0.013	100.1	45.29	4,534			\$16,546
8	Pipe, 6"Ø	LB	60	1.20	72	0.015	0.9	45.29	41			\$113
9	1/4" rubber, 60 durometer	SF	4	5.50	22	0.050	0.2	45.29	9			\$31

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Secondary Crusher Platework

BY: MB

PROJECT N°: 8820

COST: 01

PAGE: 1-PW-2
 DATE: 11/21/88

DATE: 11/21/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Head Chutework 3/8" plate	LB	1,650	0.96	1,584	0.013	21.5	74.81	1,608			\$3,192
2	Light steel	LB	76	0.91	69	0.015	1.1	74.81	82			\$151
3	Lower Chutework 3/8" plate	LB	36,800	0.96	35,328	0.013	478.4	74.81	35,789			\$71,117
4	1"x3" AR bar	LB	380	1.56	593	0.013	4.9	74.81	367			\$960
5	3/4" AR liner	LB	7,900	1.56	12,324	0.013	102.7	74.81	7,683			\$20,007
6	Skirtboard	LB	2,200	0.91	2,002	0.015	33.0	45.29	1,495			\$3,497
7	1/2" rubber, 60 durometer	SF	40	9.80	392	0.050	2.0	45.29	91			\$483
8	6" Ø pipe	LB	700	1.20	840	0.015	10.5	45.29	476			\$1,316
Page Total					\$53,132		654.1		\$47,591	\$0		\$100,723

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Secondary Crusher Transfer Platework

BY: MB

PROJECT N°: 8820

COST: 01

PAGE: 1-PW-3
 DATE: 11/21/88

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	3/8" plate	LB	21000	0.96	20,160	0.013	273.0	74.81	20,423			\$40,583
2	1"x3" AR bar	LB	250	1.56	390	0.013	3.3	45.29	149			\$539
3	1/4" rubber, 40 durometer	SF	30	5.50	165	0.050	1.5	45.29	68			\$233
4	Skirtboard	LB	4,620	0.91	4,204	0.015	69.3	74.81	5,184			\$9,388
5	1/2" rubber, 60 durometer	SF	84	9.80	823	0.050	4.2	45.29	190			\$1,013
6	6" Ø pipe	LB	120	1.20	144	0.015	1.8	45.29	82			\$226
7	12"x18" rubber door	EA	4	150.00	600	4.000	16.0	45.29	725			\$1,325
8	12 Ga deck plate	LB	1,160	0.99	1,148	0.015	17.4	45.29	788			\$1,936

Secondary Crushing & Screening Platework													PAGE: 1-PW-4				
PROJECT N° 8820													COST: 01				
DATE: 11/21/88																	
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL					
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT							
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL						
1	Head Chutework 3/8" plate	LB	3,400	0.96	3,264	0.013	44.2	74.81	3,307								
2	1/4" plate	LB	348	1.31	456	0.013	4.5	74.81	337				\$6,571				
3	12"x18" rubber door	EA	2	150.00	300	4.000	8.0	45.29	362				\$793				
	Lower Chutework (Feeder Chute)												\$662				
4	3/8" plate	LB	13,500	0.96	12,960	0.013	175.5	74.81	13,129				\$26,089				
5	1"x3" AR bar	LB	2,000	1.56	3,120	0.013	26.0	74.81	1,945				\$5,065				
6	3/4" AR liner	LB	11,000	1.56	17,160	0.013	143.0	74.81	10,698				\$27,858				
7	3/8" plate, hopper	LB	66,280	0.96	63,629	0.013	861.6	74.81	64,456				\$128,085				
8	Light steel	LB	8,708	0.91	7,924	0.015	130.6	74.81	9,770				\$17,694				
9	Skirtboard	LB	4,620	0.91	4,204	0.015	69.3	74.81	5,184				\$9,388				
10	1/4" rubber, 40 durometer	SF	5	5.50	28	0.050	0.3	45.29	14				\$42				
11	1/2" rubber, 60 durometer	SF	84	9.80	823	0.050	4.2	45.29	190				\$1,013				
12	12 Ga deck plate	LB	430	0.99	426	0.015	6.5	74.81	486				\$912				
	Crusher Feed Chute																
13	3/8" plate	LB	40390	0.96	38,774	0.013	525.1	74.81	39,283				\$78,057				
14	AR pipe	LB	1400	1.56	2,184	0.013	18.2	74.81	1,362				\$3,546				
	Crusher Discharge Chute																
15	3/8" plate	LB	15832	0.96	15,199	0.013	205.8	74.81	15,396				\$30,595				
16	Skirtboard	LB	3,300	0.91	3,003	0.015	49.5	74.81	3,703				\$6,706				
Page Total													\$173,454	2,272.3	\$169,622	\$0	\$343,076

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Conv N's 6 & 7 Platework

BY: MB

PROJECT N°: 8820

COST: 01

PAGE: 1-PW-5
 DATE: 11/21/88

DATE: 1/12/88

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Conveyor N°6 Feed Chute 3/8" plate	LB	6,800	0.96	6,528	0.013	88.4	74.81	6,613			\$13,141
2	Skirtboard	LB	1,320	0.91	1,201	0.015	19.8	74.81	1,481			\$2,682
3	1/2" rubber, 60 durometer	SF	24	9.80	235	0.050	1.2	45.29	54			\$289
4	Conveyor N°7 Feed Chute 3/8" plate	LB	3,090	0.96	2,966	0.013	40.2	74.81	3,007			\$5,973
5	1/4"plate	LB	514	1.31	673	0.013	6.7	74.81	501			\$1,174
6	1/4" rubber, 40 durometer	SF	10	5.50	55	0.050	0.5	45.29	23			\$78
7	Skirtboard	LB	1,100	0.91	1,001	0.015	16.5	74.81	1,234			\$2,235
8	6" Ø pipe	LB	60	1.20	72	0.015	0.9	74.81	67			\$139
9	1'x3" AR bar	LB	48	1.56	75	0.015	0.7	74.81	52			\$127

				LABOR COST								
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	12"x18" rubber door	EA	3	150.00	450	4.000	12.0	45.29	543			\$993
2	3/8" plate	LB	5,000	0.96	4,800	0.013	65.0	74.81	4,863			\$9,663
3	1/4" plate	LB	1,542	1.31	2,020	0.013	20.0	74.81	1,496			\$3,516
4	1"x3" AR bar	LB	150	1.56	234	0.013	2.0	74.81	150			\$384
	Diverter Chute											
5	3/8" plate	LB	5,100	0.96	4,896	0.013	66.3	74.81	4,960			\$9,856
6	Flop gate	LB	1,700	1.56	2,652	0.013	22.1	74.81	1,653			\$4,305
7	Hydraulic cylinder	EA	3									
8	Skirtboard	LB	1,100	0.91	1,001	0.015	16.5	74.81	1,234			\$2,235
9	1/2" AR liner	LB	1,224	1.56	1,909	0.013	15.9	74.81	1,189			\$3,098

8820 Cost 01 Concrete Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
01-CN-1	Crushing Circuit Footings	\$974,500	\$1,441,900	\$2,416,400
	Subtotal	\$974,500	\$1,441,900	\$2,416,400

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Crushing Circuit Concrete

BY: CH

PROJECT Nº: 8820

COST: 01

PAGE: 1-CN-1
 DATE: 11/16/88

DATE: 11/10/00												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Truck Dump/Primary Crusher Fdn Walls	CY	660	140.00	92,400					210.00	138,600	\$231,000
2	Elevated Slabs	CY	475	160.00	76,000					230.00	109,250	\$185,250
3	Slab on Grade	CY	187	130.00	24,310					190.00	35,530	\$59,840
4	Secondary Crushing Station Ftgs	CY	577	130.00	75,010					190.00	109,630	\$184,640
5	Tertiary Crushing Station Ftgs	CY	609	130.00	79,170					190.00	115,710	\$194,880
6	Transfer Stations (3) Ftgs	CY	18	130.00	2,340					190.00	3,420	\$5,760
7	Baghouse Fdns (2)	CY	50	130.00	6,500					190.00	9,500	\$16,000
8	Stacking Tubes (3)											
8	Tubes & Vault	CY	548	160.00	87,680					230.00	126,040	\$213,720
9	Drilled Piers	CY	189	160.00	30,240					230.00	43,470	\$73,710
10	Reclaim Tunnels (3)	CY	3,480	140.00	487,200					210.00	730,800	\$1,218,000
11	Conveyor Bent Footings	CY	105	130.00	13,650					190.00	19,950	\$33,600
</												

8820 Cost 01 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
01-EL-1		\$493,060	\$298,664	\$791,724
	Subtotal	\$493,060	\$298,664	\$791,724

ITEM N °	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
0 1	CRUSHING & ORE STORAGE											
	1000 KVA Sec. Sub. #01-US-01	ea	1	27500.00	\$27,500	60.00	60.0	\$28.00	\$1,680			\$29,180
	7.2 KV MCC #01-MC-01	sect	8	9950.00	\$79,600	6.00	48.0	\$28.00	\$1,344			\$80,944
	480 V MCC #01-MC-02	sect	15	2850.00	\$42,750	3.00	45.0	\$28.00	\$1,260			\$44,010
	40HP VSD Drive Controller	ea	1	2750.00	\$2,750	8.00	8.0	\$28.00	\$224			\$2,974
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	250	7.50	\$1,875	0.33	82.5	\$28.00	\$2,310			\$4,185
	Wire #500 THHN w/ termination	ft	900	2.75	\$2,475	0.07	63.0	\$28.00	\$1,764			\$4,239
	PLC COLOR GRAPHICS SYSTEM	ea	1	18500.00	\$18,500	50.00	50.0	\$28.00	\$1,400			\$19,900
	CONTROL PANEL #01-CP-01	ea	1	4500.00	\$4,500	12.00	12.0	\$28.00	\$336			\$4,836
	I/O PANEL #01-CP-02	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
	PLC Data Highway w/ Trenching	ft	500	5.45	\$2,725	0.05	25.0	\$28.00	\$700			\$3,425
	CRUSHER AREA GROUNDING											
	#2/0 SDBC Ground Cable	ft	550	0.55	\$303	0.03	16.5	\$28.00	\$462			\$765
	#4/0 SDBC Ground Cable	ft	3300	0.80	\$2,640	0.04	125.4	\$28.00	\$3,511			\$6,151
	#4/0 Ground Lug	ea	15	9.50	\$143	0.5	7.5	\$28.00	\$210			\$353
	#2/0 Mech. Lug	ea	18	1.05	\$19	0.5	9.0	\$28.00	\$252			\$271
	CADWELD Shots	ea	80	2.75	\$220	0.25	20.0	\$28.00	\$560			\$780
	CADWELD Molds	ea	4	40.00	\$160	skip						\$160
	5/8"x10" Copperweld Rod	ea	12	17.50	\$210	1.5	18.0	\$28.00	\$504			\$714
	TRENCHING & BACKFILL	ft	3650	3.00	\$10,950	0.02	73.0	\$28.00	\$2,044			\$12,994
TOTALS THIS SHEET					\$200,070		6 6 9		\$18,729			\$218,799
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$200,070		6 6 9		\$18,729			\$218,799

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	7.2 KV CRUSHER MOTOR											
	700 HP 7.2 KV Motor Sealtite Conn	ea	1	140.00	\$140	1.60	1.6	\$28.00	\$45			\$185
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	700	5.75	\$4,025	0.30	210.0	\$28.00	\$5,880			\$9,905
	Wire #6 8KV w/ termination	ft	2250	1.60	\$3,600	0.06	135.0	\$28.00	\$3,780			\$7,380
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	700	1.05	\$735	0.12	84.0	\$28.00	\$2,352			\$3,087
	Wire #14 THHN w/ termination	ft	6500	0.03	\$195	0.01	65.0	\$28.00	\$1,820			\$2,015
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	"SS" Speed Switch w/mount	ea	1	245.00	\$245	2.50	2.5	\$28.00	\$70			\$315
	"PP" Plugged chute Probe w/mn	ea	1	240.00	\$240	3.50	3.5	\$28.00	\$98			\$338
	7.2 KV SECONDARY CRUSHER MOTORS (6) REQ'D											
	400 HP 7.2 KV Motor Sealtite Conn	ea	6	140.00	\$840	1.60	9.6	\$28.00	\$269			\$1,109
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	1500	5.75	\$8,625	0.30	450.0	\$28.00	\$12,600			\$21,225
	Wire #6 8KV w/ termination	ft	5000	1.60	\$8,000	0.06	300.0	\$28.00	\$8,400			\$16,400
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1500	1.05	\$1,575	0.12	180.0	\$28.00	\$5,040			\$6,615
	Wire #14 THHN w/ termination	ft	14500	0.03	\$435	0.01	145.0	\$28.00	\$4,060			\$4,495
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	"SS" Speed Switch w/mount	ea	6	245.00	\$1,470	2.50	15.0	\$28.00	\$420			\$1,890
	"PP" Plugged chute Probe w/mn	ea	6	240.00	\$1,440	3.50	21.0	\$28.00	\$588			\$2,028
TOTALS THIS SHEET					\$32,440		1633		\$45,716			\$78,156
BROUGHT FWD. FROM PREV. SHEET					\$200,070		669		\$18,729			\$218,799
TOTALS					\$232,510		2302		\$64,445			\$296,955

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	250 HP 7.2 KV Motor Sealtite Conn	ea	1	175.00	\$175	1.60	1.6	\$28.00	\$45			\$220
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	150	3.30	\$495	0.22	33.0	\$28.00	\$924			\$1,419
	Wire #8 8KV w/ termination	ft	500	1.40	\$700	0.05	25.0	\$28.00	\$700			\$1,400
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	150	1.05	\$158	0.12	18.0	\$28.00	\$504			\$662
	Wire #14 THHN w/ termination	ft	1400	0.03	\$42	0.01	14.0	\$28.00	\$392			\$434
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	"SS" Speed Switch w/mount	ea	1	245.00	\$245	2.50	2.5	\$28.00	\$70			\$315
	"PP" Plugged chute Probe w/mn	ea	1	240.00	\$240	3.50	3.5	\$28.00	\$98			\$338
	480 VOLT CRUSHER AREA MOTORS											
	200 HP MOTOR (2) REQ'D											
	200 HP Motor &/or Sealtite Conn.	ea	2	175.00	\$350	1.60	3.2	\$28.00	\$90			\$440
	1) Motor Wiring											
	Conduit 3" GRC w/ fittings	ft	800	7.50	\$6,000	0.33	264.0	\$28.00	\$7,392			\$13,392
	Wire #350 THHN w/ termination	ft	2500	1.80	\$4,500	0.06	150.0	\$28.00	\$4,200			\$8,700
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1300	1.05	\$1,365	0.12	156.0	\$28.00	\$4,368			\$5,733
	Wire #14 THHN w/ termination	ft	17500	0.03	\$525	0.01	175.0	\$28.00	\$4,900			\$5,425
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	TOTALS THIS SHEET				\$15,170		850		\$23,809			\$38,979
	BROUGHT FWD. FROM PREV. SHEET				\$232,510		2302		\$64,445			\$296,955
	TOTALS				\$247,680		3152		\$88,254			\$335,934

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	100 HP MOTOR (1) REQ'D											
	100 HP Motor &/or Sealtite Conn.	ea	1	40.00	\$40	1.00	1.0	\$28.00	\$28			\$68
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	150	3.30	\$495	0.22	33.0	\$28.00	\$924			\$1,419
	Wire #2/0 THHN w/ termination	ft	450	0.80	\$360	0.03	13.5	\$28.00	\$378			\$738
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	150	1.05	\$158	0.12	18.0	\$28.00	\$504			\$662
	Wire #14 THHN w/ termination	ft	500	0.03	\$15	0.01	5.0	\$28.00	\$140			\$155
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	75 HP MOTOR (2) REQ'D											
	75 HP Motor &/or Sealtite Conn.	ea	2	38.00	\$76	0.90	1.8	\$28.00	\$50			\$126
	1) Motor Wiring											
	Conduit 1-1/2" GRC w/ fitting	ft	800	2.30	\$1,840	0.18	144.0	\$28.00	\$4,032			\$5,872
	Wire #1/0 THHN w/ termination	ft	2500	0.70	\$1,750	0.03	75.0	\$28.00	\$2,100			\$3,850
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	800	1.05	\$840	0.12	96.0	\$28.00	\$2,688			\$3,528
	Wire #14 THHN w/ termination	ft	2500	0.03	\$75	0.01	25.0	\$28.00	\$700			\$775
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	60 HP MOTOR (1) REQ'D											
	60 HP Motor &/or Sealtite Conn.	ea	1	22.00	\$22	0.80	0.8	\$28.00	\$22			\$44
	1) Motor Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	200	1.80	\$360	0.16	32.0	\$28.00	\$896			\$1,256
	Wire #2 THHN w/ termination	ft	650	0.40	\$260	0.03	19.5	\$28.00	\$546			\$806
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #14 THHN w/ termination	ft	650	0.03	\$20	0.01	6.5	\$28.00	\$182			\$202
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			
	TOTALS THIS SHEET				\$7,021		501		\$14,030			\$20,884
	BROUGHT FWD. FROM PREV. SHEET				\$247,680		3152		\$88,254			\$335,934
	TOTALS				\$254,701		3653		\$102,284			\$356,818

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
50 HP MOTOR (3) REQ'D												
50 HP Motor &/or Sealtite Conn.	ea	3		9.50	\$29	0.60	1.8	\$28.00	\$50			\$79
1) Motor Wiring												
Conduit 1" GRC w/ fittings	ft	1700		1.35	\$2,295	0.14	238.0	\$28.00	\$6,664			\$8,959
Wire #4 THHN w/ termination	ft	5200		0.25	\$1,300	0.02	104.0	\$28.00	\$2,912			\$4,212
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	1700		1.05	\$1,785	0.12	204.0	\$28.00	\$5,712			\$7,497
Wire #14 THHN w/ termination	ft	5200		0.03	\$156	0.01	52.0	\$28.00	\$1,456			\$1,612
3) Control Devices												
Jog / Stop Station w/ mounting	ea	3		125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
40 HP MOTOR (3) REQ'D												
40 HP Motor &/or Sealtite Conn.	ea	3		9.50	\$29	0.60	1.8	\$28.00	\$50			\$79
1) Motor Wiring												
Conduit 1" GRC w/ fittings	ft	1200		1.35	\$1,620	0.14	168.0	\$28.00	\$4,704			\$6,324
Wire #6 THHN w/ termination	ft	3750		0.14	\$525	0.02	75.0	\$28.00	\$2,100			\$2,625
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	1200		1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
Wire #14 THHN w/ termination	ft	3750		0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
3) Control Devices												
Jog / Stop Station w/ mounting	ea	3		125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
30 HP MOTOR (4) REQ'D												
30 HP Motor &/or Sealtite Conn.	ea	4		9.50	\$38	0.60	2.4	\$28.00	\$67			\$105
1) Motor Wiring												
Conduit 1" GRC w/ fittings	ft	1800		1.35	\$2,430	0.14	252.0	\$28.00	\$7,056			\$9,486
Wire #8 THHN w/ termination	ft	5500		0.10	\$550	0.02	110.0	\$28.00	\$3,080			\$3,630
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	1800		1.05	\$1,890	0.12	216.0	\$28.00	\$6,048			\$7,938
Wire #14 THHN w/ termination	ft	5500		0.03	\$165	0.01	55.0	\$28.00	\$1,540			\$1,705
3) Control Devices												
Jog / Stop Station w/ mounting	ea	4		125.00	\$500	1.50	6.0	\$28.00				
TOTALS THIS SHEET					\$15,435		1677		\$46,773			\$61,708
BROUGHT FWD. FROM PREV. SHEET					\$254,701		3653		\$102,284			\$356,818
TOTALS					\$270,136		5330		\$149,057			\$418,526

ITEM N°	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
20 HP MOTOR (6) REQ'D												
20 HP Motor &/or Sealtite Conn.	ea	6		9.50	\$57	0.60	3.6	\$28.00	\$101			\$158
1) Motor Wiring												
Conduit 1" GRC w/ fittings	ft	900		1.35	\$1,215	0.14	126.0	\$28.00	\$3,528			\$4,743
Wire #8 THHN w/ termination	ft	3150		0.10	\$315	0.02	63.0	\$28.00	\$1,764			\$2,079
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	900		1.05	\$945	0.12	108.0	\$28.00	\$3,024			\$3,969
Wire #14 THHN w/ termination	ft	3150		0.03	\$95	0.01	31.5	\$28.00	\$882			\$977
3) Control Devices												
Jog / Stop Station w/ mounting	ea	6		125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
15 HP MOTOR (4) REQ'D												
15 HP Motor &/or Sealtite Conn.	ea	4		5.50	\$22	0.50	2.0	\$28.00	\$56			\$78
1) Motor Wiring												
Conduit 3/4" GRC w/ fittings	ft	600		1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
Wire #10 THHN w/ termination	ft	2100		0.06	\$126	0.02	42.0	\$28.00	\$1,176			\$1,302
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	600		1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
Wire #14 THHN w/ termination	ft	2100		0.03	\$63	0.01	21.0	\$28.00	\$588			\$651
3) Control Devices												
Jog / Stop Station w/ mounting	ea	4		125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
10 HP MOTOR (1) REQ'D												
10 HP Motor &/or Sealtite Conn.	ea	1		5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
1) Motor Wiring												
Conduit 3/4" GRC w/ fittings	ft	700		1.05	\$735	0.12	84.0	\$28.00	\$2,352			\$3,087
Wire #12 THHN w/ termination	ft	2200		0.04	\$88	0.01	22.0	\$28.00	\$616			\$704
2) Control Wiring												
Conduit 3/4" GRC w/ fittings	ft	700		1.05	\$735	0.12	84.0	\$28.00	\$2,352			\$3,087
Wire #14 THHN w/ termination	ft	2200		0.03	\$66	0.01	22.0	\$28.00	\$616			\$682
3) Control Devices												
Jog / Stop Station w/ mounting	ea	1		125.00	\$125	1.50	1.5	\$28.00				
TOTALS THIS SHEET					\$7,103		770		\$21,521			\$28,499
BROUGHT FWD. FROM PREV. SHEET					\$270,136		5330		\$149,057			\$418,526
TOTALS					\$277,239		6100		\$170,578			\$447,025

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	2 HP MOTOR (3) REQ'D											
	2 HP Motor &/or Sealtite Conn.	ea	3	5.50	\$17	0.50	1.5	\$28.00	\$42			\$59
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #12 THHN w/ termination	ft	3750	0.04	\$150	0.01	37.5	\$28.00	\$1,050			\$1,200
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
	MISC EQUIPMENT & CONVEYOR CONTROLS											
	"MS" Misalignment Sw w/mount	ea	32	90.00	\$2,880	2.00	64.0	\$28.00	\$1,792			\$4,672
	"PC" Pullcord Switch w/mount	ea	36	140.00	\$5,040	2.50	90.0	\$28.00	\$2,520			\$7,560
	"SS" Speed Switch w/mount	ea	15	245.00	\$3,675	2.50	37.5	\$28.00	\$1,050			\$4,725
	"PP" Plugged chute Probe w/mn	ea	13	240.00	\$3,120	3.50	45.5	\$28.00	\$1,274			\$4,394
	"ZS" Position Switch w/mount	ea	2	90.00	\$180	2.50	5.0	\$28.00	\$140			\$320
	"LS" Level Switch w/mount	ea	7	240.00	\$1,680	3.50	24.5	\$28.00	\$686			\$2,366
	"FS" Flow Switch w/mount	ea	1	240.00	\$240	3.50	3.5	\$28.00	\$98			\$338
	"SOV" Solenoid Valve	ea	1	145.00	\$145	2.50	2.5	\$28.00	\$70			\$215
	TOTALS THIS SHEET				\$20,135		642		\$17,962			\$38,097
	BROUGHT FWD. FROM PREV. SHEET				\$277,239		6100		\$170,578			\$447,025
	TOTALS				\$297,374		6742		\$188,540			\$485,122

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	CRUSHER AREA LIGHTING											
	480/120 30KVA XFMR#01-TR-01	ea	1	750.00	\$750	16.00	16.0	\$28.00	\$448			\$1,198
	480 V Panel #01-PP-01	ea	1	700.00	\$700	16.00	16.0	\$28.00	\$448			\$1,148
	120 V Panel #01-PP-02	ea	1	375.00	\$375	12.00	12.0	\$28.00	\$336			\$711
	Building & Substation Area											
	2x4x40W Industrial Fluorescent	ea	4	45.00	\$180	1.5	6.0	\$28.00	\$168			\$348
	Duplex Receptacle w/ box & cover	ea	2	22.00	\$44	1.5	3.0	\$28.00	\$84			\$128
	Outdoor Recept. w/ box & WP cover	ea	62	27.00	\$1,674	1.5	93.0	\$28.00	\$2,604			\$4,278
	Conveyor Drive Area											
	1000 W HPS Floodlight w/ pole bkt	ea	9	560.00	\$5,040	6.0	54.0	\$28.00	\$1,512			\$6,552
	400 W HPS Floodlight w/ pole bkt	ea	10	480.00	\$4,800	5.0	50.0	\$28.00	\$1,400			\$6,200
	250 W HPS Ceiling or Wall Fixture	ea	180	580.00	\$104,400	5.0	900.0					\$104,400
	150 W HPS Ceiling or Wall Fixture	ea	84	370.00	\$31,080	3.5	294.0	\$28.00	\$8,232			\$39,312
	100 W HPS Stanchion Fixture	ea	60	355.00	\$21,300	3.5	210.0	\$28.00	\$5,880			\$27,180
	Conduit 3/4" GRC w/ fittings	ft	13600	1.05	\$14,280	0.12	1632.0	\$28.00	\$45,696			\$59,976
	Conduit 1" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Conduit 1-1/4" GRC w/ fittings	ft	2600	1.76	\$4,576	0.16	416.0	\$28.00	\$11,648			\$16,224
	Wire #12 THHN w/ termination	ft	11700	0.04	\$468	0.01	117.0	\$28.00	\$3,276			\$3,744
	Wire #10 THHN w/ termination	ft	32400	0.06	\$1,944	0.02	648.0	\$28.00	\$18,144			\$20,088
	Wire # 6 THHN w/ termination	ft	2500	0.14	\$350	0.02	50.0	\$28.00	\$1,400			\$1,750
	Wire # 4 THHN w/ termination	ft	12800	0.25	\$3,200	0.02	256.0	\$28.00	\$7,168			\$10,368
	TOTALS THIS SHEET				\$195,686		4833		\$110,124			\$305,810
	BROUGHT FWD. FROM PREV. SHEET				\$297,374		6742		\$188,540			\$485,122
	TOTALS				\$493,060		11575		\$298,664			\$790,932

8820 Cost 03 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
03-ME-1	Ball Mill Grinding	\$5,699,499	\$1,429,513	\$7,129,012
	Subtotal	\$5,699,499	\$1,429,513	\$7,129,012

ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
0	Freight on Items 2,4,&9	lot	1	21,052	21,052							\$21,052
1	Plant Clean-Up Sump Pump. 100 GPM @ 90' TDH Complete with 7.5 HP motor. Warman Mod. 65 QVSP (Item # 5001 thru 5009)	ea.	9	5,100	45,900	24.00	216.0	45.29	9,783			\$55,683
2	Vibrating Feeder - Nordberg 7-1/2 HP 765 TPH - Horizontal, A.R. Trough Liners Variable Speed Control (01-4008 thru 01-4022)	ea.	15	18,150	272,250	50.00	750.0	74.81	56,108			\$328,358
3	Plant Feed Conveyor #10, 11 & 12 300 fpm, 35° troughing idlers, 540 STPH, 36" x 370' C/C Pulleys, 17' lift - 30 HP vertically curved (03-1065 thru 03-1067)	ea.	3	64,904	194,712	462.00	1,386.0	99.51	137,921			\$332,633
4	Belt Scale for 36" wide conveyor Model 420. Accuracy to 25%-- will control feeders. (03-9001 thru 03-9003)	ea.	3	3,500	10,500	10.00	30.0	74.81	2,244			\$12,744
5	Grinding Ball Feeder - 1 HP (03-4029 thru 03-4031)	ea.	3	3,949	11,847	40.00	120.0	74.81	8,977			\$20,824
6	Bridge Crane set at primary ball mills 1 @ 30 HP; 2 @ 1.5 HP & 1 @ 1 HP Installation included w/bldg	set	1	91,369	91,369							\$91,369
7	Bridge Crane set at stirred ball mills 1 @ 30 HP; 2 @ 1.5 HP & 1 @ 1 HP Installation included w/bldg	set	1	91,369	91,369							\$91,369
8	Primary Ball Mill w/ 295 Ton Charge 540 STPH in open circuit. Grinds 80% passing 3/8" ore to 80% passing 28 mesh 5000 HP (03-3008 thru 03-3010)	ea.	3	1,500,000	4,500,000	4000.00	12,000.0	99.51	1,194,120			\$5,694,120
9	Slurry Sampler at primary ball mill discharge 1/2 HP (03-1701 thru 03-1703)	ea.	3	6,000	18,000	10.00	30.0	74.81	2,244			\$20,244
10	Initial Ball Charge for Primary Ball Mills. 295 Tons per mill w/ three mills.	Ton	885	500	442,500		400.0	45.29	18,116			\$460,616
Page Total				\$5,699,499		14,932.0		\$1,429,513		\$0		\$7,129,012

University of Alabama Oil Shale Study

-191-

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Ball Mill Grinding ~ Structural

BY: CH

PROJECT N^o: 8820

COST: 03

PAGE: 3-ST-1
 DATE: 11/9/88

ION: Ball Mill Grinding ~ Structural												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Reclaim Tunnels w/ (15) Hoppers Light Steel	LB	29,250	0.91	26,618	0.015	438.8	74.81	32,827			\$59,445
2	3/8" Mild Steel Plate	LB	10,950	0.96	10,512	0.013	142.4	74.81	10,653			\$21,165
3	3/16" AR Plate	LB	4,950	1.56	7,722	0.013	64.4	74.81	4,818			\$12,540
4	60" Ø, 16 Ga CMP Escape Tunnels (3)	LF	180	58.00	10,440	0.335	60.3	74.81	4,511			\$14,951
	Ball Mill Access Platforms											
5	Heavy Steel	LB		0.83		0.008		74.81				
6	Medium Steel	LB		0.87		0.013		74.81				
7	Light Steel	LB	43,089	0.91	39,211	0.015	646.3	74.81	48,350			\$87,561
8	Handrail	LF	90	23.00	2,070	0.330	29.7	45.29	1,345			\$3,415
9	Handrail w/Toe Plate	LF	672	27.00	18,144	0.500	336.0	45.29	15,217			\$33,361
10	Grating	SF	1908	5.80	11,066	0.075	143.1	74.81	10,705			\$21,771
11	Stairtreads	EA	42	38.00	1,596	0.350	14.7	45.29	666			\$2,262
Page Total					\$127,379	1,875.7		\$129,092		\$0		\$256,471

8820 Cost 03 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
03-PW-01	Reclaim Tunnel Platework	\$52,008	\$58,551	\$110,559
03-PW-02	Ball Mill Grinding Platework	\$114,640	\$85,444	\$200,084
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$166,648	\$143,995	\$310,643

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Reclaim Tunnel Platework

BY: MB

PROJECT N°: 8820

COST: 03

PAGE: 3-PW-1
 DATE: 11/21/88

DATE: 11/21/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Feeder skirt	LB	6930	0.91	6,306	0.015	104.0	74.81	7,780			\$14,086
2	3/8" plate	LB	17,226	0.91	15,676	0.013	223.9	74.81	16,750			\$32,426
3	Reclaim skirtboard	LB	29,700	0.91	27,027	0.015	445.5	74.81	33,328			\$60,355
4	1/2" rubber, 60 durometer	SF	306	9.80	2,999	0.050	15.3	45.29	693			\$3,692

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Ball Mill Grind Platework

BY: MB

PROJECT N#: 8820

COST: 03

PAGE: 3-PW-2
 DATE: 11/22/88

DATE: 11/22/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Ball Mill Feed 1/4" plate	LB	1,623	1.14	1,850	0.013	21.1	74.81	1,578			\$3,428
2	3/8" plate	LB	7,725	0.96	7,416	0.013	100.4	74.81	7,511			\$14,927
3	1/2" AR liner	LB	3,427	1.56	5,346	0.013	44.6	74.81	3,337			\$8,683
4	1"x3" AR bar	LB	320	1.56	499	0.013	4.2	74.81	314			\$813
5	1/4" rubber (60 durometer)	SF	24	5.50	132	0.050	1.2	45.29	54			\$186
6	Seal plate	LB	150	1.14	171	0.013	2.0	74.81	150			\$321
7	Light steel	LB	2,880	0.91	2,621	0.015	43.2	74.81	3,232			\$5,853
8	1/2" AR liner	LB	24,000	1.56	37,440	0.013	312.0	74.81	23,341			\$60,781
9	Ball Mill Sump 3/8" plate	LB	18,500	0.96	17,760	0.013	240.5	74.81	17,992			\$35,752
10	Light steel	LB	2,880	0.91	2,621	0.015	43.2	74.81	3,232			\$5,853
11	1/2" AR liner	LB	24,000	1.56	37,440	0.013	312.0	74.81	23,341			\$60,781
12	Ball Mill Discharge 3/8" plate	LB	1,400	0.96	1,344	0.013	18.2	74.81	1,362			\$2,706
Page Total					\$114,640	1,142.6		\$85,444		\$0		\$200,084

8820 Cost 03 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
03-EL-1		\$739,959	\$412,317	\$1,152,276
	Subtotal	\$739,959	\$412,317	\$1,152,276

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
03	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
	BALL MILL GRINDING CIRCUIT #A											
	5000 KVA Sec. Sub #03-US-02	ea	1	63500.00	\$63,500	60.00	60.0	\$28.00	\$1,680			\$65,180
	7.2 KV MCC #03-MC-01	sect	1	17150.00	\$17,150	16.00	16.0	\$28.00	\$448			\$17,598
	480 V MCC #03-MC-05	sect	10	2850.00	\$28,500	3.00	30.0	\$28.00	\$840			\$29,340
	480 V MCC #03-MC-09	sect	5	2850.00	\$14,250	3.00	15.0	\$28.00	\$420			\$14,670
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	1250	7.50	\$9,375	0.33	412.5	\$28.00	\$11,550			\$20,925
	Wire #500 THHN w/ terminati	ft	3750	2.75	\$10,313	0.07	262.5	\$28.00	\$7,350			\$17,663
	PLC COLOR GRAPHICS SYSTEM	ea	1	28500.00	\$28,500	80.00	80.0	\$28.00	\$2,240			\$30,740
	CONTROL PANEL #03-CP-01	ea	1	4500.00	\$4,500	12.00	12.0	\$28.00	\$336			\$4,836
	I/O PANEL #03-CP-02	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
	PLC Data Highway w/ Trenching	ft	2500	5.45	\$13,625	0.05	125.0	\$28.00	\$3,500			\$17,125
	7.2 KV BALL MILL MOTOR (1) REQ'D											
	5000 HP 7.2 KV Motor Sealtite Con	ea	1	235.00	\$235	2.70	2.7	\$28.00	\$76			\$311
	1) Motor Wiring											
	Conduit 4" GRC w/ fittings	ft	300	10.80	\$3,240	0.45	135.0	\$28.00	\$3,780			\$7,020
	Wire #500 8KV w/ terminati	ft	1000	10.50	\$10,500	1.00	1000.0	\$28.00	\$28,000			\$38,500
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	300	1.05	\$315	0.12	36.0	\$28.00	\$1,008			\$1,323
Wire #14 THHN w/ termination	ft	2850	0.03	\$86	0.01	28.5	\$28.00	\$798			\$884	
3) Control Devices												
Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167	
"SS" Speed Switch w/mount	ea	1	245.00	\$245	2.50	2.5	\$28.00	\$70			\$315	
"PP" Plugged chute Probe w/mn	ea	1	240.00	\$240	3.50	3.5	\$28.00	\$98			\$338	
TOTALS THIS SHEET					\$207,448		2229		\$62,404			\$269,852
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$207,448		2229		\$62,404			\$269,852

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
04 a	480 VOLT MILL MOTORS											
	125 HP MOTOR (4) REQ'D											
	125 HP Motor &/or Sealtite Conn.	ea	4	40.00	\$160	1.00	4.0	\$28.00	\$112			\$272
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	800	3.30	\$2,640	0.22	176.0	\$28.00	\$4,928			\$7,568
	Wire #4/0 THHN w/ termination	ft	2550	1.00	\$2,550	0.04	102.0	\$28.00	\$2,856			\$5,406
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	800	1.05	\$840	0.12	96.0	\$28.00	\$2,688			\$3,528
	Wire #14 THHN w/ termination	ft	2550	0.03	\$77	0.01	25.5	\$28.00	\$714			\$791
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	4	125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
	40 HP MOTOR (2) REQ'D											
	40 HP Motor &/or Sealtite Conn.	ea	2	9.50	\$19	0.60	1.2	\$28.00	\$34			\$53
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	400	1.35	\$540	0.14	56.0	\$28.00	\$1,568			\$2,108
	Wire #6 THHN w/ termination	ft	1350	0.14	\$189	0.02	27.0	\$28.00	\$756			\$945
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	400	1.05	\$420	0.12	48.0	\$28.00	\$1,344			\$1,764
	Wire #14 THHN w/ termination	ft	1350	0.03	\$41	0.01	13.5	\$28.00	\$378			\$419
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
TOTALS THIS SHEET					\$8,225		558		\$15,630			\$23,855
BROUGHT FWD. FROM PREV. SHEET					\$207,448		2229		\$62,404			\$269,852
TOTALS					\$215,673		2787		\$78,033			\$293,706

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	30 HP MOTOR (1) REQ'D											
	30 HP Motor &/or Sealtite Conn.	ea	1	9.50	\$10	0.60	0.6	\$28.00	\$17			\$26
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	200	1.35	\$270	0.14	28.0	\$28.00	\$784			\$1,054
	Wire #8 THHN w/ termination	ft	700	0.10	\$70	0.02	14.0	\$28.00	\$392			\$462
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #14 THHN w/ termination	ft	700	0.03	\$21	0.01	7.0	\$28.00	\$196			\$217
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	15 HP MOTOR (7) REQ'D											
	15 HP Motor &/or Sealtite Conn.	ea	7	5.50	\$39	0.50	3.5	\$28.00	\$98			\$137
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1400	1.05	\$1,470	0.12	168.0	\$28.00	\$4,704			\$6,174
	Wire #10 THHN w/ termination	ft	4300	0.06	\$258	0.02	86.0	\$28.00	\$2,408			\$2,666
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1400	1.05	\$1,470	0.12	168.0	\$28.00	\$4,704			\$6,174
	Wire #14 THHN w/ termination	ft	4300	0.03	\$129	0.01	43.0	\$28.00	\$1,204			\$1,333
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	7	125.00	\$875	1.50	10.5	\$28.00	\$294			\$1,169
	TOTALS THIS SHEET				\$4,946		55.4		\$15,515			\$20,461
	BROUGHT FWD. FROM PREV. SHEET				\$215,673		2787		\$78,033			\$293,706
	TOTALS				\$220,619		3341		\$93,548			\$314,167

ITEM N°	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.5 HP MOTOR (8) REQ'D											
	7.5 HP Motor &/or Sealtite Conn.	ea	8	5.50	\$44	0.50	4.0	\$28.00	\$112			\$156
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1600	1.05	\$1,680	0.12	192.0	\$28.00	\$5,376			\$7,056
	Wire #12 THHN w/ termination	ft	4900	0.04	\$196	0.01	49.0	\$28.00	\$1,372			\$1,568
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1600	1.05	\$1,680	0.12	192.0	\$28.00	\$5,376			\$7,056
	Wire #14 THHN w/ termination	ft	4900	0.03	\$147	0.01	49.0	\$28.00	\$1,372			\$1,519
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	8	125.00	\$1,000	1.50	12.0	\$28.00	\$336			\$1,336
	1 HP MOTOR (1) REQ'D											
	1 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #12 THHN w/ termination	ft	700	0.04	\$28	0.01	7.0	\$28.00	\$196			\$224
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #14 THHN w/ termination	ft	700	0.03	\$21	0.01	7.0	\$28.00	\$196			\$217
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	1/2 HP MOTOR (1) REQ'D											
	1/2 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #12 THHN w/ termination	ft	700	0.04	\$28	0.01	7.0	\$28.00	\$196			\$224
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	200	1.05	\$210	0.12	24.0	\$28.00	\$672			\$882
	Wire #14 THHN w/ termination	ft	700	0.03	\$21	0.01	7.0	\$28.00	\$196			\$217
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	TOTALS THIS SHEET				\$5,946		626		\$17,528			\$23,474
	BROUGHT FWD. FROM PREV. SHEET				\$220,619		3341		\$93,548			\$314,167
	TOTALS				\$226,565		3967		\$111,076			\$337,641

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	MISC EQUIPMENT & CONTROLS											
	"PC" Pullcord Switch w/mount	ea	13	140.00	\$1,820	2.50	32.5	\$28.00	\$910			\$2,730
	"SS" Speed Switch w/mount	ea	12	245.00	\$2,940	2.50	30.0	\$28.00	\$840			\$3,780
	"PP" Plugged chute Probe w/mn	ea	12	240.00	\$2,880	3.50	42.0	\$28.00	\$1,176			\$4,056
	"LS" Level Switch w/mount	ea	2	240.00	\$480	3.50	7.0	\$28.00	\$196			\$676
	"FS" Flow Switch w/mount	ea	12	240.00	\$2,880	3.50	42.0	\$28.00	\$1,176			\$4,056
TOTALS THIS SHEET					\$11,000		154		\$4,298			\$15,298
BROUGHT FWD. FROM PREV. SHEET					\$226,565		3967		\$111,076			\$337,641
TOTALS					\$237,565		4121		\$115,374			\$352,939

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
03b	BALL MILL GRINDING CIRCUIT #B				\$237,565				\$115,374			\$352,939
03c	BALL MILL GRINDING CIRCUIT #C				\$237,565				\$115,374			\$352,939
03	BALL MILL GRINDING GENERAL POWER & EQUIPMENT											
	200 HP MOTOR (1) REQ'D											
	200 HP Motor &/or Sealtite Conn.	ea	1	175.00	\$175	1.60	1.6	\$28.00	\$45			\$220
	1) Motor Wiring											
	Conduit 3" GRC w/ fittings	ft	100	7.50	\$750	0.33	33.0	\$28.00	\$924			\$1,674
	Wire #350 THHN w/ termination	ft	350	1.80	\$630	0.06	21.0	\$28.00	\$588			\$1,218
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	100	1.05	\$105	0.12	12.0	\$28.00	\$336			\$441
	Wire #14 THHN w/ termination	ft	350	0.03	\$11	0.01	3.5	\$28.00	\$98			\$109
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	150 HP MOTOR (2) REQ'D											
	150 HP Motor &/or Sealtite Conn.	ea	2	40.00	\$80	1.00	2.0	\$28.00	\$56			\$136
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	800	3.30	\$2,640	0.22	176.0	\$28.00	\$4,928			\$7,568
	Wire #4/0 THHN w/ termination	ft	2600	1.00	\$2,600	0.04	104.0	\$28.00	\$2,912			\$5,512
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	800	1.05	\$840	0.12	96.0	\$28.00	\$2,688			\$3,528
	Wire #14 THHN w/ termination	ft	2600	0.03	\$78	0.01	26.0	\$28.00	\$728			\$806
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
TOTALS THIS SHEET					\$483,414		480		\$244,177			\$727,590
BROUGHT FWD. FROM PREV. SHEET					\$237,565		4121		\$115,374			\$352,939
TOTALS					\$720,979		4600		\$359,551			\$1,080,529

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	60 HP MOTOR (2) REQ'D											
	60 HP Motor &/or Sealtite Conn.	ea	2	22.00	\$44	0.80	1.6	\$28.00	\$45			\$89
	1) Motor Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	1200	1.80	\$2,160	0.16	192.0	\$28.00	\$5,376			\$7,536
	Wire #2 THHN w/ termination	ft	3750	0.40	\$1,500	0.03	112.5	\$28.00	\$3,150			\$4,650
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	30 HP MOTOR (1) REQ'D											
	30 HP Motor &/or Sealtite Conn.	ea	1	9.50	\$10	0.60	0.6	\$28.00	\$17			\$26
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	600	1.35	\$810	0.14	84.0	\$28.00	\$2,352			\$3,162
	Wire #8 THHN w/ termination	ft	1900	0.10	\$190	0.02	38.0	\$28.00	\$1,064			\$1,254
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #14 THHN w/ termination	ft	1900	0.03	\$57	0.01	19.0	\$28.00	\$532			\$589
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	15 HP MOTOR (1) REQ'D											
	15 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #10 THHN w/ termination	ft	1900	0.06	\$114	0.02	38.0	\$28.00	\$1,064			\$1,178
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #14 THHN w/ termination	ft	1900	0.03	\$57	0.01	19.0	\$28.00	\$532			\$589
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	TOTALS THIS SHEET				\$8,710		9 0 9		\$25,444			\$34,153
	BROUGHT FWD. FROM PREV. SHEET				\$720,979		4 6 0 0		\$359,551			\$1,080,529
	TOTALS				\$729,688		5 5 0 9		\$384,994			\$1,114,682

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	2 HP MOTOR (2) REQ'D											
	2 HP Motor &/or Sealtite Conn.	ea	2	5.50	\$11	0.50	1.0	\$28.00	\$28			\$39
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #12 THHN w/ termination	ft	3750	0.04	\$150	0.01	37.5	\$28.00	\$1,050			\$1,200
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	1 HP MOTOR (1) REQ'D											
	1 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #12 THHN w/ termination	ft	1900	0.04	\$76	0.01	19.0	\$28.00	\$532			\$608
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #14 THHN w/ termination	ft	1900	0.03	\$57	0.01	19.0	\$28.00	\$532			\$589
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
TOTALS THIS SHEET					\$4,567		551		\$15,428			\$19,995
BROUGHT FWD. FROM PREV. SHEET					\$729,688		5509		\$384,994			\$1,114,682
TOTALS					\$734,255		6060		\$400,422			\$1,134,677

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	BRIDGE CRANE FEEDERS (2) REQ'D											
	Sealtite Conn.	ea	2	22.00	\$44	0.80	1.6	\$28.00	\$45			\$89
	1) Power Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	600	1.80	\$1,080	0.16	96.0	\$28.00	\$2,688			\$3,768
	Wire #2 THHN w/ termination	ft	3800	0.40	\$1,520	0.03	114.0	\$28.00	\$3,192			\$4,712
	WELDING RECEPTACLES (4) REQ'D											
	WELDING RECEPTACLES	ea	4	115.00	\$460	0.80	3.2	\$28.00	\$90			\$550
	1) Power Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	600	1.80	\$1,080	0.16	96.0	\$28.00	\$2,688			\$3,768
	Wire #2 THHN w/ termination	ft	3800	0.40	\$1,520	0.03	114.0	\$28.00	\$3,192			\$4,712
TOTALS THIS SHEET					\$5,704		425		\$11,894			\$17,598
BROUGHT FWD. FROM PREV. SHEET					\$734,255		6060		\$400,422			\$1,134,677
TOTALS					\$739,959		6485		\$412,317			\$1,152,276

8820 Cost 04 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
04-ME-1	Pumps Steel Ball Mill Grinding	\$64,337,500	\$1,320,855	\$65,658,355
	Subtotal	\$64,337,500	\$1,320,855	\$65,658,355

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Primary Ball Mill Discharge Sump Pump 3060 GPM & 40 HP. Warman Model # 250 SV-AHU. (04-5010 thru 04-5015)	ea.	6	23,000	138,000	32.00	192.0	45.29	8,696			\$146,696
2	Primary Stirred Mill Feed Pump; 510 GPM Warman 4/3 DAH Complete with 15 HP motor. (04-5016 thru 04-5036)	ea.	21	5,500	115,500	32.00	672.0	45.29	30,435			\$145,935
3	Primary Stirred Ball Mill - 2500 HP 2500 Liter - Abrasion resistant Steel Lining (04-3011 thru 04-3028)	ea.	18	2,200,000	39,600,000	400.00	7,200.0	99.51	716,472			\$40,316,472
4	Secondary Stirred Mill Feed Pump 638 GPM; Warman 6/4 EAH Complete with 20 HP motor. (04-5098 thru 04-5114)	ea.	17	8,000	136,000	32.00	544.0	45.29	24,638			\$160,638
5	Secondary Stirred Ball Mill - 2000 HP 1500 Liter - Abrasion resistant Steel Lining (04-3011 thru 04-3028)	ea.	15	1,600,000	24,000,000	350.00	5,250.0	99.51	522,428			\$24,522,428
6	Slurry Sampler at secondary stirred ball mill discharge 1/2 HP (04-1704 thru 04-1706)	ea.	3	6,000	18,000	10.00	30.0	77.81	2,334			\$20,334
7	Initial Ball Charge for Stirred Ball Mills 10,000 lbs. per mill & 33 mills	lbs.	330,000	1	330,000	350.00	350.0	45.29	15,852			\$345,852
Page Total					\$64,337,500		14,238.0		\$1,320,855		\$0	\$65,658,355

8820 Cost 04 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
04-ST-1	Flotation ~ Structural	\$584,978	\$601,225	\$1,186,203
	Stirred Ball Mill Grinding			
	Subtotal	\$584,978	\$601,225	\$1,186,203

PROJECT N°: 8820				COST: 04		PAGE: 4-ST-1						
DATE: 12/1/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	MANHOUR COST		SUBCONTRACT		
								UNIT	TOTAL	UNIT	TOTAL	
1	Light Steel	LB	221,826	0.91	201,862	0.015	3,327.4	74.81	248,923			
2	Handrail	LF	957	23.00	22,011	0.330	315.8	45.29	14,303			\$450,785
3	Handrail w/Toe Plate	LF	3036	27.00	81,972	0.500	1,518.0	45.29	68,750			\$36,314
4	Grating	SF	7920	5.80	45,936	0.075	594.0	74.81	44,437			\$150,722
5	Stairtreads	EA	462	38.00	17,556	0.350	161.7	45.29	7,323			\$90,373
												\$24,879
1	Heavy Steel	LB	58,288	0.83	48,379	0.008	466.3	74.81	34,884			\$83,263
2	Medium Steel	LB	42,432	0.87	36,916	0.013	551.6	74.81	41,265			\$78,181
3	Light Steel	LB	88,689	0.91	80,707	0.015	1,330.3	74.81	99,520			\$180,227
4	Handrail	LF	250	23.00	5,750	0.330	82.5	45.29	3,736			\$9,486
5	Handrail w/Toe Plate	LF	548	27.00	14,796	0.500	274.0	45.29	12,409			\$27,205
6	Grating	SF	4243	5.80	24,609	0.075	318.2	74.81	23,805			\$48,414
7	Stairtreads	EA	118	38.00	4,484	0.350	41.3	45.29	1,870			\$6,354
Page Total												
				\$584,978		8981		\$601,225		\$0	\$1,186,203	

8820 Cost 04 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
04-PW-01	Stirred Ball Mill Platework	\$33,197	\$30,607	\$63,804
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$33,197	\$30,607	\$63,804

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Ball Mill Platework

BY: MB

PROJECT Nº: 8820

COST: 04

PAGE: 4-PW-1

DATE: 11/22/88

LABOR COST												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	(6) Float cell feed sump, 10' Ø, 45° cone 3/8" plate	LB	27,780	0.96	26,669	0.013	361.1	74.81	27,014			\$53,683
2	Screen	SF	480	5.00	2,400	0.050	24.0	45.29	1,087			\$3,487
3	Duraline liner	LB	2,580	1.60	4,128	0.013	33.5	74.81	2,506			\$6,634

8820 Cost 04 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
04-EL-1		\$675,918	\$366,173	\$1,042,091
	Subtotal	\$675,918	\$366,173	\$1,042,091

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
0 4	BALL MILL GRINDING CIRCUIT #A											
	7.2 KV MCC #04-MC-02	sect	3	9950.00	\$29,850	6.00	18.0	\$28.00	\$504			\$30,354
	7.2 KV MCC #04-MC-03	sect	3	9950.00	\$29,850	6.00	18.0	\$28.00	\$504			\$30,354
	7.2 KV MCC #04-MC-04	sect	5	9950.00	\$49,750	6.00	30.0	\$28.00	\$840			\$50,590
	480 V MCC #04-MC-06	sect	6	2850.00	\$17,100	3.00	18.0	\$28.00	\$504			\$17,604
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	1250	7.50	\$9,375	0.33	412.5	\$28.00	\$11,550			\$20,925
	Wire #500 THHN w/ termination	ft	3750	2.75	\$10,313	0.07	262.5	\$28.00	\$7,350			\$17,663
	PLC SYSTEM											
	I/O PANEL #04-CP-01	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
TOTALS THIS SHEET					\$148,988		7 6 5		\$21,420			\$170,408
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$148,988		7 6 5		\$21,420			\$170,408

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.2 KV PRIMARY BALL MILL MOTORS (6) REQ'D											
	2500 HP 7.2 KV Motor Sealtite Con	ea	6	140.00	\$840	1.60	9.6	\$28.00	\$269			\$1,109
	1) Motor Wiring											
	Conduit 3" GRC w/ fittings	ft	1200	7.50	\$9,000	0.33	396.0	\$28.00	\$11,088			\$20,088
	Wire #2/0 8KV w/ termination	ft	3700	3.75	\$13,875	0.08	296.0	\$28.00	\$8,288			\$22,163
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	11500	0.03	\$345	0.01	115.0	\$28.00	\$3,220			\$3,565
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	"SS" Speed Switch w/mount	ea	6	245.00	\$1,470	2.50	15.0	\$28.00	\$420			\$1,890
	"PP" Plugged chute Probe w/mn	ea	6	240.00	\$1,440	3.50	21.0	\$28.00	\$588			\$2,028
	7.2 KV SECONDARY BALL MILL MOTORS (5) REQ'D											
	2000 HP 7.2 KV Motor Sealtite Con	ea	5	140.00	\$700	1.60	8.0	\$28.00	\$224			\$924
	1) Motor Wiring											
	Conduit 3" GRC w/ fittings	ft	1000	7.50	\$7,500	0.33	330.0	\$28.00	\$9,240			\$16,740
	Wire #1/0 8KV w/ termination	ft	3150	2.95	\$9,293	0.07	220.5	\$28.00	\$6,174			\$15,467
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1000	1.05	\$1,050	0.12	120.0	\$28.00	\$3,360			\$4,410
	Wire #14 THHN w/ termination	ft	10000	0.03	\$300	0.01	100.0	\$28.00	\$2,800			\$3,100
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	5	125.00	\$625	1.50	7.5	\$28.00	\$210			\$835
	"SS" Speed Switch w/mount	ea	5	245.00	\$1,225	2.50	12.5	\$28.00	\$350			\$1,575
	"PP" Plugged chute Probe w/mn	ea	5	240.00	\$1,200	3.50	17.5	\$28.00	\$490			\$1,690
	TOTALS THIS SHEET				\$50,873		1822		\$51,005			\$101,877
	BROUGHT FWD. FROM PREV. SHEET				\$148,988		765		\$21,420			\$170,408
	TOTALS				\$199,860		2587		\$72,425			\$272,285

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.2 KV BLOWER MOTORS (2) REQ'D											
	350 HP 7.2 KV Motor Sealtite Conn	ea	2	140.00	\$280	1.60	3.2	\$28.00	\$90			\$370
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	600	5.75	\$3,450	0.30	180.0	\$28.00	\$5,040			\$8,490
	Wire #6 8KV w/ termination	ft	1950	1.60	\$3,120	0.06	117.0	\$28.00	\$3,276			\$6,396
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	600	1.05	\$630	0.12	72.0	\$28.00	\$2,016			\$2,646
	Wire #14 THHN w/ termination	ft	1950	0.03	\$59	0.01	19.5	\$28.00	\$546			\$605
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
0 4	480 VOLT MILL MOTORS											
	100 HP MOTOR (2) REQ'D											
	100 HP Motor &/or Sealtite Conn.	ea	1	40.00	\$40	1.00	1.0	\$28.00	\$28			\$68
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	180	3.30	\$594	0.22	39.6	\$28.00	\$1,109			\$1,703
	Wire #2/0 THHN w/ termination	ft	600	0.80	\$480	0.03	18.0	\$28.00	\$504			\$984
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	180	1.05	\$189	0.12	21.6	\$28.00	\$605			\$794
	Wire #14 THHN w/ termination	ft	600	0.03	\$18	0.01	6.0	\$28.00	\$168			\$186
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
TOTALS THIS SHEET					\$9,235		4 8 2		\$13,507			\$22,742
BROUGHT FWD. FROM PREV. SHEET					\$199,860		2 5 8 7		\$72,425			\$272,285
TOTALS					\$209,095		3 0 6 9		\$85,932			\$295,027

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	75 HP MOTOR (6) REQ'D											
	75 HP Motor &/or Sealtite Conn.	ea	6	38.00	\$228	0.90	5.4	\$28.00	\$151			\$379
	1) Motor Wiring											
	Conduit 1-1/2" GRC w/ fittings	ft	1080	2.30	\$2,484	0.18	194.4	\$28.00	\$5,443			\$7,927
	Wire #1/0 THHN w/ termination	ft	3400	0.70	\$2,380	0.03	102.0	\$28.00	\$2,856			\$5,236
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1080	1.05	\$1,134	0.12	129.6	\$28.00	\$3,629			\$4,763
	Wire #14 THHN w/ termination	ft	3400	0.03	\$102	0.01	34.0	\$28.00	\$952			\$1,054
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	20 HP MOTOR (6) REQ'D	96										
	20 HP Motor &/or Sealtite Conn.	ea	6	9.50	\$57	0.60	3.6	\$28.00	\$101			\$158
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	1080	1.35	\$1,458	0.14	151.2	\$28.00	\$4,234			\$5,692
	Wire #8 THHN w/ termination	ft	3500	0.10	\$350	0.02	70.0	\$28.00	\$1,960			\$2,310
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1080	1.05	\$1,134	0.12	129.6	\$28.00	\$3,629			\$4,763
	Wire #14 THHN w/ termination	ft	3500	0.03	\$105	0.01	35.0	\$28.00	\$980			\$1,085
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	7.5 HP MOTOR (1) REQ'D											
	7.5 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	180	1.05	\$189	0.12	21.6	\$28.00	\$605			\$794
	Wire #12 THHN w/ termination	ft	600	0.04	\$24	0.01	6.0	\$28.00	\$168			\$192
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	180	1.05	\$189	0.12	21.6	\$28.00	\$605			\$794
	Wire #14 THHN w/ termination	ft	600	0.03	\$18	0.01	6.0	\$28.00	\$168			\$186
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	TOTALS THIS SHEET				\$11,483		930		\$26,040			\$37,523
	BROUGHT FWD. FROM PREV. SHEET				\$209,095		3069		\$85,932			\$295,027
	TOTALS				\$220,577		3999		\$111,972			\$332,549

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	1/2 HP MOTOR (6) REQ'D											
	1/2 HP Motor &/or Sealtite Conn.	ea	6	5.50	\$33	0.50	3.0	\$28.00	\$84			\$117
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1080	1.05	\$1,134	0.12	129.6	\$28.00	\$3,629			\$4,763
	Wire #12 THHN w/ termination	ft	3400	0.04	\$136	0.01	34.0	\$28.00	\$952			\$1,088
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1080	1.05	\$1,134	0.12	129.6	\$28.00	\$3,629			\$4,763
	Wire #14 THHN w/ termination	ft	3400	0.03	\$102	0.01	34.0	\$28.00	\$952			\$1,054
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	MISC EQUIPMENT & CONTROLS											
	"LS" Level Switch w/mount	ea	6	240.00	\$1,440	3.50	21.0	\$28.00	\$588			\$2,028
TOTALS THIS SHEET					\$4,729		360		\$10,086			\$14,815
BROUGHT FWD. FROM PREV. SHEET					\$220,577		3999		\$111,972			\$332,549
TOTALS					\$225,306		4359		\$122,058			\$347,364

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
03b	BALL MILL GRINDING CIRCUIT #B				\$225,306				\$122,058			\$347,364
03c	BALL MILL GRINDING CIRCUIT #C				\$225,306				\$122,058			\$347,364
TOTALS THIS SHEET					\$450,612		0		\$244,115			\$694,727
BROUGHT FWD. FROM PREV. SHEET					\$225,306		4359		\$122,058			\$347,364
TOTALS					\$675,918		4359		\$366,173			\$1,042,091

8820 Cost 05 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
05-ME-1	Pumps - Area 05 (FLOTATION)	\$7,439,298	\$379,274	\$7,818,572
05-ME-2	Pumps - Area 05 (FLOTATION)	\$862,116	\$43,091	\$905,207
	Subtotal	\$8,301,414	\$422,365	\$8,723,779

DATE: 11/14/88												
ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Rougher Float Feed Pump - 3060 GPM Warman size 200 FM, 5 vaned closed imp Complete with 75 HP motor. (05-5037 thru 05-5042)	ea.	6	21000.00	126,000	48.00	288.0	74.81	21,545			\$147,545
2	Flotation Machines - Two Banks of 8 Cells w/ Sixteen Motors Total per circuit (one 75 HP motor per cell) - Rougher - Outokumpu OK -38 (05-1401 A-H thru 05-1406 A-H)	lot	3	1066666.00	3,199,998	400.00	1,200.0	99.51	119,412			\$3,319,410
3	Flotation Machine Blower System - Spencer Model 503EE. Includes Filter/Silencer, Inlet/outlet Sleeves & Clamps, Blast Gates, CheckValves, Low Load Safety Switch and 300 HP Motor. (05-5407 thru 05-5409) (*For both rougher & cleaner flotation)	ea.	6	45000.00	270,000	40.00	240.0	99.51	23,882			\$293,882
4	Rougher Flotation Froth Pump - 3650 GPM Vertical Launder Pump. Warman 250 SV- AHU. Complete with 125 HP motor. (05-5043 thru 05-5054)	ea.	12	32000.00	384,000	54.00	648.0	74.81	48,477			\$432,477
5	Plant Clean-Up Sump Pump - 100 GPM @ 90' TDH - 2" X 3" X 11". Morris 65 QVSP Complete with 7.5 HP motor. Item # 5067 thru 5069	ea.	3	5100.00	15,300	24.00	72.0	45.29	3,261			\$18,561
6	Cleaner Float Feed Pump - 3190 GPM 100 HP Warman 10/8 STAH 5 vane. Synthetic Rubber Lined. (05-5115 thru 05 5120)	ea.	6	32000.00	192,000	48.00	288.0	74.81	21,545			\$213,545
7	Flotation Machines - Two Banks of 8 Cells w/ Sixteen Motors Total (one 75 HP motor per cell) - Cleaner - Outokumpu OK -38 (05-1407 A-H thru 05-1412)	lot	3	1060000.00	3,180,000	400.00	1,200.0	99.51	119,412			\$3,299,412
8	Slurry Sampler for rougher flotation tailings discharge 1/2 HP (05-1713 thru 05-1718)	ea.	6	6000.00	36,000	40.00	240.0	45.29	10,870			\$46,870
9	Slurry Sampler for cleaner flotation tailings discharge 1/2 HP (05-1719 thru 05-1721 & 05-1707 thru 05-1709)	ea.	6	6000.00	36,000	40.00	240.0	45.29	10,870			\$46,870
Page Total \$7,439,298 4,416.0 \$379,274 \$0 \$7,818,572												

ITEM N°		DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
					UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
							UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
10		Cleaner Float Froth Pump - 2182 GPM 75 HP Vertical Centrifugal Launder Pump Warman Mod. 200 SV-AHU (05-5121 thru 05-5132)	ea.	12	23000.00	276,000	48.00	576.0	74.81	43,091			\$319,091
12		Monorail Hoists - 2 motors each Installation included with building (05-1603 thru 05-1614)	ea.	12	9748.00	116,976							\$116,976
13		Freight on items 2,3,7,8&9	lot	1	469140.00	469,140							\$469,140
Page Total						\$862,116		576.0		\$43,091		\$0	\$905,207

8820 Cost 05 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
05-ST-1	Floatation ~ Structural	\$236,111	\$217,489	\$453,600
	Subtotal	\$236,111	\$217,489	\$453,600

DATE: 11/29/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Flotation reagent storage tank (installed) 12'Øx15'-0, Capacity:12,000 Gal Equip Nº05-1226	EA	1	20470.00	20,470							\$20,470
2	Heavy Steel	LB	58,288	0.83	48,379	0.008	466.3	74.81	34,884			\$83,263
3	Medium Steel	LB	42,432	0.87	36,916	0.013	551.6	74.81	41,265			\$78,181
4	Light Steel	LB	88,689	0.91	80,707	0.015	1,330.3	74.81	99,520			\$180,227
5	Handrail	LF	250	23.00	5,750	0.330	82.5	45.29	3,736			\$9,486
6	Handrail w/Toe Plate	LF	548	27.00	14,796	0.500	274.0	45.29	12,409			\$27,205
7	Grating	SF	4243	5.80	24,609	0.075	318.2	74.81	23,805			\$48,414
8	Stairtreads	EA	118	38.00	4,484	0.350	41.3	45.29	1,870			\$6,354
Page Total					\$236,111		3,064.2		\$217,489		\$0	\$453,600

8820 Cost 05 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
05-PW-01	Flotation Platework	\$186,659	\$202,166	\$388,825
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$186,659	\$202,166	\$388,825

DATE: 11/22/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	(3) 16' Ø Distributors Light steel	LB	75,000	0.91	68,250	0.015	1,125.0	74.81	84,161			\$152,411
2	3/8" rubber liner	SF	1,224	7.65	9,364	0.050	61.2	45.29	2,772			\$12,136
3	(3) 14' Ø Distributors Light steel	LB	55,500	0.91	50,505	0.015	832.5	74.81	62,279			\$112,784
4	3/8" rubber liner	SF	1,224	7.65	9,364	0.050	61.2	45.29	2,772			\$12,136
5	(3) 8' Ø Distributors Light steel	LB	38,874	0.91	35,375	0.015	583.1	74.81	43,622			\$78,997
6	3/8" rubber liner	SF	1,224	7.65	9,364	0.050	61.2	45.29	2,772			\$12,136
7	(3) Float Cell Reagent Day Tank 3/8" plate	LB	2,900	0.91	2,639	0.015	43.5	74.81	3,254			\$5,893
8	Light steel	LB	235	7.65	1,798	0.050	11.8	45.29	534			\$2,332

8820 Cost 05 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
05-EL-1		\$311,087	\$274,495	\$585,582
	Subtotal	\$311,087	\$274,495	\$585,582

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MAN HOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
0 5	FLOTATION CIRCUIT #A											
	480 V MCC #05-MC-07	sect	7	2850.00	\$19,950	3.00	21.0	\$28.00	\$588			\$20,538
	480 V MCC #05-MC-08	sect	7	2850.00	\$19,950	3.00	21.0	\$28.00	\$588			\$20,538
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	1250	7.50	\$9,375	0.33	412.5	\$28.00	\$11,550			\$20,925
	Wire #500 THHN w/ termination	ft	3750	2.75	\$10,313	0.07	262.5	\$28.00	\$7,350			\$17,663
	PLC SYSTEM											
	I/O PANEL #05-CP-01	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
0 5	480 VOLT FLOTATION MOTORS											
	75 HP MOTOR (32) REQ'D											
	75 HP Motor &/or Sealtite Conn.	ea	32	38.00	\$1,216	0.90	28.8	\$28.00	\$806			\$2,022
	1) Motor Wiring											
	Conduit 1-1/2" GRC w/ fitting	ft	6840	2.30	\$15,732	0.18	1231.2	\$28.00	\$34,474			\$50,206
	Wire #1/0 THHN w/ termination	ft	7600	0.70	\$5,320	0.03	228.0	\$28.00	\$6,384			\$11,704
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	6840	1.05	\$7,182	0.12	820.8	\$28.00	\$22,982			\$30,164
	Wire #14 THHN w/ termination	ft	7600	0.03	\$228	0.01	76.0	\$28.00	\$2,128			\$2,356
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	32	125.00	\$4,000	1.50	48.0	\$28.00	\$1,344			\$5,344
	"LS" Level Sw w/ mounting	ea	32	240.00	\$7,680	3.50	112.0	\$28.00	\$3,136			\$10,816
TOTALS THIS SHEET					\$103,696		3 2 6 8		\$91,498			\$195,194
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$103,696		3 2 6 8		\$91,498			\$195,194

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
03b	BALL MILL GRINDING CIRCUIT #B				\$103,696				\$91,498			\$195,194
03c	BALL MILL GRINDING CIRCUIT #C				\$103,696				\$91,498			\$195,194
TOTALS THIS SHEET					\$207,391		0		\$182,997			\$390,388
BROUGHT FWD. FROM PREV. SHEET					\$103,696		3268		\$91,498			\$195,194
TOTALS					\$311,087		3268		\$274,495			\$585,582

8820 Cost 06 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
06-ME-1	Thickening	\$13,004,200	\$89,102	\$13,093,302
	Subtotal	\$13,004,200	\$89,102	\$13,093,302

DATE: 11/14/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Transfer Flocculant Pump 1 HP, 2/1.5 BAH 06-5183 Centrifugal Pump Transfers Flocculant from Mix Tank to day tank	EA	1	3700.00	3,700	24.00	24.0	45.29	1,087			\$4,787
2	Reagent Metering Pump-Milton Roy Diaphragm Pump, 06-5162 Thru 06-5175	EA	14	2000.00	28,000	16.00	224.0	45.29	10,145			\$38,145
3	Primary Thickener Centrifugal Overflow Pump 11412 GPM Warman 400 ST-L, 400 HP 06-5073 Thru 06-5076 (3 operating plus 1 spare)	EA	4	54000.00	216,000	64.00	256.0	74.81	19,151			\$235,151
4	Primary Thickener Vertical Underflow Slurry Pump, 3180 GPM, 58 ft TDH. Warman 250 SV-AHU 06-5079 Thru 06-5085 (3 operating plus 3 spares)	EA	6	31000.00	186,000	32.00	192.0	99.51	19,106			\$205,106
5	Vertical Centrifugal Plant Clean-Up Slurry sump pump 1000 GPM, 25 ft TDH 15 HP. Warman 150 SV-AHU 06-5085, 06-5087, & 06-5089 Thickener Area	EA	3	10500.00	31,500	32.00	96.0	45.29	4,348			\$35,848
6	Cleaner Conc. Thickener Centrifugal Over- flow Pump, 8244 GPM Warman 14/12 ST AH, 200 HP 06-5136 Thru 06-5139 (3 operating plus 1 spare)	EA	4	45500.00	182,000	54.00	216.0	74.91	16,159			\$198,159
7	Cleaner Conc. Thickener Vertical Underflow Slurry Pump, 3180 GPM, 58 ft TDH. Warman 250 SV-AHU 06-5142 Thru 06-5147 (3 operating plus 3 spares)	EA	6	22000.00	132,000	32.00	192.0	99.51	19,106			\$151,106
8	Primary Thickener 400' Dia., 50 HP 06-1301, 06-1302 & 06-1303 Complete including installation	EA	3	2225000.00	6,675,000							\$6,675,000
9	Concentrate Thickener 350' Dia., 50 HP 06-1304, 06-1305 & 06-1306 Complete including installation	EA	3	1850000.00	5,550,000							\$5,550,000
Page Total \$13,004,200 1,200.0 \$89,102 \$0 \$13,093,302												

8820 Cost 06 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
06-ST-1	Thickening	\$263,997	\$255,491	\$519,488
	Subtotal	\$263,997	\$255,491	\$519,488

						COST: 06		PAGE: 6-ST-1		DATE: 11/29/88		
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Flocculant storage tank (installed) 20'Øx12'-0, Capacity:28,000 Gal Equip Nº06-1230	EA	1	33680.00	33,680							\$33,680
2	Flocculant mix tank (installed) 10'Øx10'-0, Capacity:5,000 Gal Equip Nº06-1228	EA	1	11750.00	11,750							\$11,750
3	Coagulant storage tank (installed) 12'Øx17'-0, Capacity:14,000 Gal, FRP Equip Nº06-1231	EA	1	11380.00	11,380							\$11,380
4	Pipe Racks (Light Steel)	LB	227,678	0.91	207,187	0.015	3,415.2	74.81	255,491			\$462,678

8820 Cost 06 Concrete Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
06-CN-1	Wet Wells	\$81,420	\$52,370	\$133,790
	Subtotal	\$81,420	\$52,370	\$133,790

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Wet Wells

BY: DLY

PROJECT N^o: 8820

COST: 06

PAGE: 6-CN-1
 DATE: 11/16/88

				PROJECT Nº: 8820		COST: 06		PAGE: 6-CN-1				
				BY: DLY				DATE: 11/16/88				
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Walls	CY	139	140.00	19,460							
2	Slab on Grade	CY	92	130.00	11,960					210.00	29,190	\$48,650
3	36" Ø Inlet nozzles with flanges	EA	2	1000.00	2,000					190.00	17,480	\$29,440
4	28" Ø Outlet nozzles with flanges	EA	8	6000.00	48,000					450.00	900	\$2,900
										600.00	4,800	\$52,800

8820 Cost 06 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
06-EL-1		\$788,381	\$684,550	\$1,472,931
	Subtotal	\$788,381	\$684,550	\$1,472,931

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
06	THICKENING AREA											
	7.2 KV MCC #06-MC-01	sect	5	9950.00	\$49,750	6.00	30.0	\$28.00	\$840			\$50,590
	7.2 KV MCC #06-MC-02	sect	3	9950.00	\$29,850	6.00	18.0	\$28.00	\$504			\$30,354
	480 V MCC #06-MC-05	sect	8	3250.00	\$26,000	3.00	24.0	\$28.00	\$672			\$26,672
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	500	7.50	\$3,750	0.33	165.0	\$28.00	\$4,620			\$8,370
	Wire #500 THHN w/ termination	ft	2250	2.75	\$6,188	0.07	157.5	\$28.00	\$4,410			\$10,598
	PLC SYSTEM											
	I/O PANEL #06-CP-01	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
	7.2 KV 450HP WATER PUMPS MOTORS (3) REQ'D											
	450 HP 7.2 KV Motor Sealtite Conn	ea	3	140.00	\$420	1.60	4.8	\$28.00	\$134			\$554
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	3600	5.75	\$20,700	0.30	1080.0	\$28.00	\$30,240			\$50,940
	Wire #6 8KV w/ termination	ft	11000	1.60	\$17,600	0.06	660.0	\$28.00	\$18,480			\$36,080
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	3600	1.05	\$3,780	0.12	432.0	\$28.00	\$12,096			\$15,876
	Wire #14 THHN w/ termination	ft	11000	0.03	\$330	0.01	110.0	\$28.00	\$3,080			\$3,410
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
TOTALS THIS SHEET					\$161,493		2692		\$75,370			\$236,863
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$161,493		2692		\$75,370			\$236,863

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.2 KV 400HP WATER PUMPS MOTORS (5) REQ'D											
	400 HP 7.2 KV Motor Sealtite Conn	ea	5	140.00	\$700	1.60	8.0	\$28.00	\$224			\$924
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	6000	5.75	\$34,500	0.30	1800.0	\$28.00	\$50,400			\$84,900
	Wire #6 8KV w/ termination	ft	19000	1.60	\$30,400	0.06	1140.0	\$28.00	\$31,920			\$62,320
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	6000	1.05	\$6,300	0.12	720.0	\$28.00	\$20,160			\$26,460
	Wire #14 THHN w/ termination	ft	19000	0.03	\$570	0.01	190.0	\$28.00	\$5,320			\$5,890
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	5	125.00	\$625	1.50	7.5	\$28.00	\$210			\$835
06	480 VOLT THICKENING AREA MOTORS											
	200 HP MOTOR (2) REQ'D											
	200 HP Motor &/or Sealtite Conn.	ea	2	175.00	\$350	1.60	3.2	\$28.00	\$90			\$440
	1) Motor Wiring											
	Conduit 3" GRC w/ fittings	ft	500	7.50	\$3,750	0.33	165.0	\$28.00	\$4,620			\$8,370
	Wire #350 THHN w/ termination	ft	1600	1.80	\$2,880	0.06	96.0	\$28.00	\$2,688			\$5,568
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #14 THHN w/ termination	ft	1600	0.03	\$48	0.01	16.0	\$28.00	\$448			\$496
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
TOTALS THIS SHEET					\$80,898		4209		\$117,844			\$198,742
BROUGHT FWD. FROM PREV. SHEET					\$161,493		2692		\$75,370			\$236,863
TOTALS					\$242,391		6901		\$193,214			\$435,605

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	100 HP MOTOR (2) REQ'D											
	100 HP Motor &/or Sealtite Conn.	ea	2	40.00	\$80	1.00	2.0	\$28.00	\$56			\$136
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	500	3.30	\$1,650	0.22	110.0	\$28.00	\$3,080			\$4,730
	Wire #2/0 THHN w/ termination	ft	1750	0.80	\$1,400	0.03	52.5	\$28.00	\$1,470			\$2,870
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #14 THHN w/ termination	ft	1750	0.03	\$53	0.01	17.5	\$28.00	\$490			\$543
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	50 HP MOTOR (4) REQ'D											
	50 HP Motor &/or Sealtite Conn.	ea	4	9.50	\$38	0.60	2.4	\$28.00	\$67			\$105
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	1250	1.35	\$1,688	0.14	175.0	\$28.00	\$4,900			\$6,588
	Wire #4 THHN w/ termination	ft	3900	0.25	\$975	0.02	78.0	\$28.00	\$2,184			\$3,159
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1250	1.05	\$1,313	0.12	150.0	\$28.00	\$4,200			\$5,513
	Wire #14 THHN w/ termination	ft	3900	0.03	\$117	0.01	39.0	\$28.00	\$1,092			\$1,209
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	4	125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
TOTALS THIS SHEET					\$8,588		695		\$19,471			\$28,059
BROUGHT FWD. FROM PREV. SHEET					\$242,391		6901		\$193,214			\$435,605
TOTALS					\$250,978		7596		\$212,685			\$463,663

ITEM N°	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
1	HP MOTOR											
1	HP Motor &/or Sealtite Conn.	ea	6	5.50	\$33	0.50	3.0	\$28.00	\$84			\$117
1)	Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1500	1.05	\$1,575	0.12	180.0	\$28.00	\$5,040			\$6,615
	Wire #12 THHN w/ termination	ft	4750	0.04	\$190	0.01	47.5	\$28.00	\$1,330			\$1,520
2)	Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1500	1.05	\$1,575	0.12	180.0	\$28.00	\$5,040			\$6,615
	Wire #14 THHN w/ termination	ft	4750	0.03	\$143	0.01	47.5	\$28.00	\$1,330			\$1,473
3)	Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
	MISC EQUIPMENT & CONTROLS											
	"SS" Speed Switch w/mount	ea	22	245.00	\$5,390	2.50	55.0	\$28.00	\$1,540			\$6,930
	"PP" Plugged chute Probe w/mn	ea	4	240.00	\$960	3.50	14.0	\$28.00	\$392			\$1,352
	"LS" Level Switch w/mount	ea	5	240.00	\$1,200	3.50	17.5	\$28.00	\$490			\$1,690
07b	DRYING, BRIQUETTING & FILTERING CIRCUIT #B				\$262,794				\$228,183			\$9,090
07c	DRYING, BRIQUETTING & FILTERING CIRCUIT #C				\$262,794				\$228,183			\$9,090
TOTALS THIS SHEET					\$537,403		554		\$471,864			\$45,493
BROUGHT FWD. FROM PREV. SHEET					\$250,978		7596		\$212,685			\$463,663
TOTALS					\$788,381		8149		\$684,550			\$509,156

8820 Cost 07 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
07-ME-1	Filtering	\$17,870,286	\$726,330	\$18,596,616
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$17,870,286	\$726,330	\$18,596,616

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Slurry Sampler ahead of filtration to sample cleaner flotation concentrate 1/2 HP 07-1710 Thru 07-1712	EA	3	6000.00	\$18,000	10	30.0	74.81	\$2,244			\$20,244
2	Air compressor for pressing and drying filter cake at Larox filters 300 HP 07-5302 Thru 07-5304 Provides air for three filters with Air Dryer Reciever	EA	3	58000.00	\$174,000	150	450.0	74.81	\$33,665			\$207,665
3	Larox Filter Model CF-200 Chamber Filter 200 sq. Meters, 20 HP 07-6001 Thru 07-6009	EA.	9	1785445.00	\$16,069,005	500	4,500.0	99.51	\$447,795			\$16,516,800
4	Filter Feed Pump 700 GPM @ 301' TDH 100 HP. 4/3 RHH 07-5195 Thru 07-5206	EA	12	19500.00	\$234,000	48	576.0	45.29	\$26,087			\$260,087
5	Filter Cake Conveyor 72"x53' Zero Lift Horizontal Troughing Belt Conveyor, 15 HP 60 TPH, 07-1014 Thru 07-1022	EA	9	53561.00	\$482,049	131	1,179.0	99.51	\$117,322			\$599,371
6	Filter Cake Gathering Conveyor 36"x160' 55' Lift Flexwall 20 HP, 209 TPH 07-1023 *Thru 07-1025	EA	3	208144.00	\$624,432	141	423.0	99.51	\$42,093			\$666,525
7	Plant clean-up Sump & Pump Vertical Centrifugal Slurry Pump 7.5 HP 07-5148 Thru 07-5150	EA.	3	5100.00	\$15,300	24	72.0	45.29	\$3,261			\$18,561
8	Filtrate Recycle Pump, 230psi, 100 HP 07-5216 Thru 07-5220 1509 GPM, 60 HP	EA.	6	13000.00	\$78,000	48	288.0	74.81	\$21,545			\$99,545
9	Filter Back Wash Pump, 1509 GPM, 60 HP 07-5207 Thru 07-5215 230 PSI, 100 HP	EA.	9	19500.00	\$175,500	48	432.0	74.81	\$32,318			\$207,818
Page Total												
				\$17,870.286		7,950.0		\$726,330		\$0	\$18,596,616	

8820 Cost 07 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
07-ST-1	Flotation ~ Structural	\$215,641	\$217,489	\$433,130
	Filtration			
	Subtotal	\$215,641	\$217,489	\$433,130

DATE: 12/1/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Heavy Steel	LB	58,288	0.83	48,379	0.008	466.3	74.81	34,884			\$83,263
2	Medium Steel	LB	42,432	0.87	36,916	0.013	551.6	74.81	41,265			\$78,181
3	Light Steel	LB	88,689	0.91	80,707	0.015	1,330.3	74.81	99,520			\$180,227
4	Handrail	LF	250	23.00	5,750	0.330	82.5	45.29	3,736			\$9,486
5	Handrail w/Toe Plate	LF	548	27.00	14,796	0.500	274.0	45.29	12,409			\$27,205
6	Grating	SF	4243	5.80	24,609	0.075	318.2	74.81	23,805			\$48,414
7	Stairtreads	EA	118	38.00	4,484	0.350	41.3	45.29	1,870			\$6,354
Page Total												
				\$215,641	3064		\$217,489		\$0		\$433,130	

8820 Cost 07 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
07-PW-01	Filtering Platework	\$62,487	\$64,741	\$127,228
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$62,487	\$64,741	\$127,228

				PROJECT N°: 8820				COST: 07		PAGE: 7-PW-1		DATE: 11/22/88	
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL	
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT			
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL		
1	(3) 6'Ø x 3' Distributors Light steel	LB	10,638	0.91	9,681	0.015	159.6	74.81	11,940			\$21,621	
2	1/4" rubber liner	SF	460	5.50	2,530	0.050	23.0	45.29	1,042			\$3,572	
3	Filter disharge skirt	LB	19,800	0.91	18,018	0.015	297.0	74.81	22,219			\$40,237	
4	1/2" 60 durometer rubber	SF	360	9.80	3,528	0.050	18.0	45.29	815			\$4,343	
5	Filter disharge chute	LB	22,000	0.96	21,120	0.013	286.0	74.81	21,396			\$42,516	
6	Flex Belt Headchute 1/4" plate	LB	2,570	1.14	2,930	0.013	33.4	74.81	2,499			\$5,429	
7	3/8" plate	LB	4406	0.96	4,230	0.013	57.3	74.81	4,287			\$8,517	
8	12"x18" rubber door	EA	3	150.00	450	4.000	12.0	45.29	543			\$993	
Page Total					\$62,487		886.3		\$64,741		\$0	\$127,228	

8820 Cost 07 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
07-EL-1		\$447,275	\$396,782	\$844,057
	Subtotal	\$447,275	\$396,782	\$844,057

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
07	FILTERING AREA											
	2500 KVA Sec. Sub. #07-US-05	ea	1	34500.00	\$34,500	60.00	60.0	\$28.00	\$1,680			\$36,180
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	500	7.50	\$3,750	0.33	165.0					\$3,750
	Wire #500 THHN w/ termination	ft	2250	2.75	\$6,188	0.07	157.5					\$6,188
	PLC COLOR GRAPHICS SYSTEM	ea	1	28500.00	\$28,500	80.00	80.0	\$28.00	\$2,240			\$30,740
	CONTROL PANEL #07-CP-01	ea	1	4500.00	\$4,500	12.00	12.0	\$28.00	\$336			\$4,836
	I/O PANEL #07-CP-02	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
	PLC Data Highway w/ Trenching	ft	1500	5.45	\$8,175	0.05	75.0	\$28.00	\$2,100			\$10,275
	7.2 KV 300HP THICKENER / COMPRESSOR MOTORS (3) REQ'D											
	300 HP 7.2 KV Motor Sealtite Conn	ea	3	140.00	\$420	1.60	4.8	\$28.00	\$134			\$554
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	1200	5.75	\$6,900	0.30	360.0	\$28.00	\$10,080			\$16,980
	Wire #6 8KV w/ termination	ft	3750	1.60	\$6,000	0.06	225.0	\$28.00	\$6,300			\$12,300
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
TOTALS THIS SHEET					\$103,430		1331		\$28,246			\$131,676
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					103,430		1331		\$28,246			\$131,676

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
7	480 VOLT FILTERING MOTORS											
	100 HP MOTOR (4) REQ'D											
	100 HP Motor &/or Sealtite Conn.	ea	4	40.00	\$160	1.00	4.0	\$28.00	\$112			\$272
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	1000	3.30	\$3,300	0.22	220.0	\$28.00	\$6,160			\$9,460
	Wire #2/0 THHN w/ termination	ft	3200	0.80	\$2,560	0.03	96.0	\$28.00	\$2,688			\$5,248
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1000	1.05	\$1,050	0.12	120.0	\$28.00	\$3,360			\$4,410
	Wire #14 THHN w/ termination	ft	3200	0.03	\$96	0.01	32.0	\$28.00	\$896			\$992
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	4	125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
	75 HP MOTOR (2) REQ'D											
	75 HP Motor &/or Sealtite Conn.	ea	2	38.00	\$76	0.90	1.8	\$28.00	\$50			\$126
	1) Motor Wiring											
	Conduit 1-1/2" GRC w/ fitting	ft	500	2.30	\$1,150	0.18	90.0	\$28.00	\$2,520			\$3,670
	Wire #1/0 THHN w/ termination	ft	1600	0.70	\$1,120	0.03	48.0	\$28.00	\$1,344			\$2,464
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #14 THHN w/ termination	ft	1600	0.03	\$48	0.01	16.0	\$28.00	\$448			\$496
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
TOTALS THIS SHEET					\$10,835		697		\$19,510			\$30,345
BROUGHT FWD. FROM PREV. SHEET					\$103,430		1331		\$28,246			\$131,676
TOTALS					\$114,265		2028		\$47,757			\$162,022

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	50 HP MOTOR (1) REQ'D											
	50 HP Motor &/or Sealtite Conn.	ea	1	9.50	\$10	0.60	0.6	\$28.00	\$17			\$26
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	250	1.35	\$338	0.14	35.0	\$28.00	\$980			\$1,318
	Wire #4 THHN w/ termination	ft	800	0.25	\$200	0.02	16.0	\$28.00	\$448			\$648
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	250	1.05	\$263	0.12	30.0	\$28.00	\$840			\$1,103
	Wire #14 THHN w/ termination	ft	800	0.03	\$24	0.01	8.0	\$28.00	\$224			\$248
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	40 HP MOTOR (4) REQ'D											
	40 HP Motor &/or Sealtite Conn.	ea	4	9.50	\$38	0.60	2.4	\$28.00	\$67			\$105
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	1000	1.35	\$1,350	0.14	140.0	\$28.00	\$3,920			\$5,270
	Wire #6 THHN w/ termination	ft	3100	0.14	\$434	0.02	62.0	\$28.00	\$1,736			\$2,170
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1000	1.05	\$1,050	0.12	120.0	\$28.00	\$3,360			\$4,410
	Wire #14 THHN w/ termination	ft	3100	0.03	\$93	0.01	31.0	\$28.00	\$868			\$961
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	4	125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
	TOTALS THIS SHEET				\$4,424		453		\$12,670			\$17,094
	BROUGHT FWD. FROM PREV. SHEET				\$14,265		2028		\$47,757			\$162,022
	TOTALS				18,689		2481		\$60,427			\$179,115

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	20 HP MOTOR (4) REQ'D											
	20 HP Motor &/or Sealtite Conn.	ea	4	9.50	\$38	0.60	2.4	\$28.00	\$67			\$105
	1) Motor Wiring											
	Conduit 1" GRC w/ fittings	ft	1000	1.35	\$1,350	0.14	140.0	\$28.00	\$3,920			\$5,270
	Wire #8 THHN w/ termination	ft	3100	0.10	\$310	0.02	62.0	\$28.00	\$1,736			\$2,046
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1000	1.05	\$1,050	0.12	120.0	\$28.00	\$3,360			\$4,410
	Wire #14 THHN w/ termination	ft	3100	0.03	\$93	0.01	31.0	\$28.00	\$868			\$961
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	4	125.00	\$500	1.50	6.0	\$28.00	\$168			\$668
	15 HP MOTOR (7) REQ'D											
	15 HP Motor &/or Sealtite Conn.	ea	7	5.50	\$39	0.50	3.5	\$28.00	\$98			\$137
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1750	1.05	\$1,838	0.12	210.0	\$28.00	\$5,880			\$7,718
	Wire #10 THHN w/ termination	ft	5400	0.06	\$324	0.02	108.0	\$28.00	\$3,024			\$3,348
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1750	1.05	\$1,838	0.12	210.0	\$28.00	\$5,880			\$7,718
	Wire #14 THHN w/ termination	ft	5400	0.03	\$162	0.01	54.0	\$28.00	\$1,512			\$1,674
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	7	125.00	\$875	1.50	10.5	\$28.00	\$294			\$1,169
	10 HP MOTOR (1) REQ'D											
	10 HP Motor &/or Sealtite Conn.	ea	1	5.50	\$6	0.50	0.5	\$28.00	\$14			\$20
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	250	1.05	\$263	0.12	30.0	\$28.00	\$840			\$1,103
	Wire #12 THHN w/ termination	ft	850	0.04	\$34	0.01	8.5	\$28.00	\$238			\$272
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	250	1.05	\$263	0.12	30.0	\$28.00	\$840			\$1,103
	Wire #14 THHN w/ termination	ft	850	0.03	\$26	0.01	8.5	\$28.00	\$238			\$264
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	1	125.00	\$125	1.50	1.5	\$28.00	\$42			\$167
	TOTALS THIS SHEET				\$9,131		1036		\$29,019			\$38,150
	BROUGHT FWD. FROM PREV. SHEET				18,689		2481		\$60,427			\$179,115
	TOTALS				27,819		3517		\$89,446			\$217,265

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.5 HP MOTOR (10) REQ'D											
	7.5 HP Motor &/or Sealtite Conn.	ea	10	5.50	\$55	0.50	5.0	\$28.00	\$140			\$195
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	2500	1.05	\$2,625	0.12	300.0	\$28.00	\$8,400			\$11,025
	Wire #12 THHN w/ termination	ft	7650	0.04	\$306	0.01	76.5	\$28.00	\$2,142			\$2,448
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	2500	1.05	\$2,625	0.12	300.0	\$28.00	\$8,400			\$11,025
	Wire #14 THHN w/ termination	ft	7650	0.03	\$230	0.01	76.5	\$28.00	\$2,142			\$2,372
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	10	125.00	\$1,250	1.50	15.0	\$28.00	\$420			\$1,670
	5 HP MOTOR (5) REQ'D											
	5 HP Motor &/or Sealtite Conn.	ea	5	5.50	\$28	0.50	2.5	\$28.00	\$70			\$98
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1250	1.05	\$1,313	0.12	150.0	\$28.00	\$4,200			\$5,513
	Wire #12 THHN w/ termination	ft	3900	0.04	\$156	0.01	39.0	\$28.00	\$1,092			\$1,248
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1250	1.05	\$1,313	0.12	150.0	\$28.00	\$4,200			\$5,513
	Wire #14 THHN w/ termination	ft	3900	0.03	\$117	0.01	39.0	\$28.00	\$1,092			\$1,209
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	5	125.00	\$625	1.50	7.5	\$28.00	\$210			\$835
	1 HP MOTOR											
	1 HP Motor &/or Sealtite Conn.	ea	2	5.50	\$11	0.50	1.0	\$28.00	\$28			\$39
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #12 THHN w/ termination	ft	1750	0.04	\$70	0.01	17.5	\$28.00	\$490			\$560
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #14 THHN w/ termination	ft	1750	0.03	\$53	0.01	17.5	\$28.00	\$490			\$543
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	TOTALS THIS SHEET				\$12,075		1320		\$36,960			\$49,035
	BROUGHT FWD. FROM PREV. SHEET				\$127,819		3517		\$89,446			\$217,265
	TOTALS				\$139,894		4837		\$126,406			\$266,300

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	MISC EQUIPMENT & CONTROLS											
	"SS" Speed Switch w/mount	ea	22	245.00	\$5,390	2.50	55.0	\$28.00	\$1,540			\$6,930
	"PP" Plugged chute Probe w/mn	ea	4	240.00	\$960	3.50	14.0	\$28.00	\$392			\$1,352
	"LS" Level Switch w/mount	ea	5	240.00	\$1,200	3.50	17.5	\$28.00	\$490			\$1,690
07b	DRYING, BRIQUETTING & FILTERING CIRCUIT #B				\$147,444				\$128,828			\$62,477
07c	DRYING, BRIQUETTING & FILTERING CIRCUIT #C				\$147,444				\$128,828			\$62,477
	BRIDGE CRANE FEEDERS (2) REQ'D											
	Sealtite Conn.	ea	2	22.00	\$44	0.80	1.6	\$28.00	\$45			\$89
	1) Power Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	600	1.80	\$1,080	0.16	96.0	\$28.00	\$2,688			\$3,768
	Wire #2 THHN w/ termination	ft	1900	0.40	\$760	0.03	57.0	\$28.00	\$1,596			\$2,356
	WELDING RECEPTACLES (4) REQ'D											
	WELDING RECEPTACLES	ea	4	115.00	\$460	0.80	3.2	\$28.00	\$90			\$550
	1) Power Wiring											
	Conduit 1-1/4" GRC w/ fitting	ft	600	1.80	\$1,080	0.16	96.0	\$28.00	\$2,688			\$3,768
	Wire #2 THHN w/ termination	ft	3800	0.40	\$1,520	0.03	114.0	\$28.00	\$3,192			\$4,712
TOTALS THIS SHEET					\$307,381		454		\$270,376			\$150,167
BROUGHT FWD. FROM PREV. SHEET					\$139,894		4837		\$126,406			\$266,300
TOTALS					\$447,275		5291		\$396,782			\$416,467

8820 Cost 08 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
08-ME-1	Drying	\$4,895,286	\$499,142	\$5,394,428
	Subtotal	\$4,895,286	\$499,142	\$5,394,428

DATE: 11/14/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Flash dryer, with 350 H.P. system fan 08-7001 thru 08-7006, size #20, 75 H.P. cage mill 08-7001A thru 08-7006A, double paddle mixer 08-7001B thru 08-7006B and rotary air lock 08-7001C thru 08-7006C.	EA	6	800000.00	4,800,000	800	4,800.0	99.51	477,648			\$5,277,648
2	15 H.P. Dust collecting screw conveyor, 24 ft. long, zero lift 45 tph. 08-1068 thru 08-1073	EA	6	5894.00	35,364	16	96.0	99.51	9,553			\$44,917
3	5 H.P. Dust collecting screw conveyor, 10 ft. long, zero lift 45 tph. 08-1074 thru 08-1079.	EA	6	3691.00	22,146	8	48.0	99.51	4,776			\$26,922
4	40 H.P. Recirculating screw conveyor, 42 ft. long, zero lift, 0-90 tph. 08-1081 thru 08-1086.	EA	3	12592.00	37,776	24	72.0	99.51	7,165			\$44,941

8820 Cost 08 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
08-ST-1	Floatation ~ Structural	\$192,474	\$193,359	\$385,833
	Drying			
	Subtotal	\$192,474	\$193,359	\$385,833

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Drying ~ Structural

BY: CH

PROJECT N°: 8820

COST: 08

PAGE: 8-ST-1
 DATE: 12/1/88

DATE: 12/1/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Heavy Steel	LB	56250	0.83	46,688	0.008	450.0	74.81	33,665			\$80,353
2	Medium Steel	LB	35100	0.87	30,537	0.013	456.3	74.81	34,136			\$64,673
3	Light Steel	LB	71780	0.91	65,320	0.015	1,076.7	74.81	80,548			\$145,868
4	Handrail	LF	104	23.00	2,392	0.330	34.3	45.29	1,553			\$3,945
5	Handrail w/Toe Plate	LF	435	27.00	11,745	0.500	217.5	45.29	9,851			\$21,596
6	Grating	SF	5,850	5.80	33,930	0.075	438.8	74.81	32,827			\$66,757
7	Stairtreads	EA	49	38.00	1,862	0.350	17.2	45.29	779			\$2,641

8820 Cost 08 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
08-PW-01	Drying Platework	\$12,331	\$12,493	\$24,824
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
				\$0
	Subtotal	\$12,331	\$12,493	\$24,824

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Ball Mill Platework

BY: MB

PROJECT N^o: 8820

COST: 08

PAGE: 8-PW-1
 DATE: 11/22/88

				PROJECT N°: 8820				COST: 08		PAGE: 8-PW-1		
										DATE: 11/22/88		
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Screw Feed Chutes 3/8" plate	LB	1,600	0.96	1,536	0.013	20.8	74.81	1,556			\$3,092
2	Dryer Feed Chutes 3/8" plate	LB	2,800	0.96	2,688	0.013	36.4	74.81	2,723			\$5,411
3	Dryer Feed 3/8" plate	LB	8,445	0.96	8,107	0.013	109.8	74.81	8,214			\$16,321

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
0 8	DRYING AREA											
	480 V MCC #08-MC-04	sect	15	2850.00	\$42,750	3.00	45.0	\$28.00	\$1,260			\$44,010
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	500	7.50	\$3,750	0.33	165.0	\$28.00	\$4,620			\$8,370
	Wire #500 THHN w/ termination	ft	2250	2.75	\$6,188	0.07	157.5	\$28.00	\$4,410			\$10,598
	PLC SYSTEM											
	I/O PANEL #08-CP-01	ea	1	2750.00	\$2,750	6.00	6.0	\$28.00	\$168			\$2,918
	100 HP MOTOR (3) REQ'D											
	100 HP Motor &/or Sealtite Conn.	ea	3	40.00	\$120	1.00	3.0	\$28.00	\$84			\$204
	1) Motor Wiring											
	Conduit 2" GRC w/ fittings	ft	1500	3.30	\$4,950	0.22	330.0	\$28.00	\$9,240			\$14,190
	Wire #2/0 THHN w/ termination	ft	4650	0.80	\$3,720	0.03	139.5	\$28.00	\$3,906			\$7,626
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1500	1.05	\$1,575	0.12	180.0	\$28.00	\$5,040			\$6,615
	Wire #14 THHN w/ termination	ft	4650	0.03	\$140	0.01	46.5	\$28.00	\$1,302			\$1,442
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
TOTALS THIS SHEET					\$66,317		1077		\$30,156			\$96,473
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$66,317		1077		\$30,156			\$96,473

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	15 HP MOTOR (7) REQ'D											
	15 HP Motor &/or Sealtite Conn.	ea	7	5.50	\$39	0.50	3.5	\$28.00	\$98			\$137
	1) Motor Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1750	1.05	\$1,838	0.12	210.0	\$28.00	\$5,880			\$7,718
	Wire #10 THHN w/ termination	ft	5400	0.06	\$324	0.02	108.0	\$28.00	\$3,024			\$3,348
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1750	1.05	\$1,838	0.12	210.0	\$28.00	\$5,880			\$7,718
	Wire #14 THHN w/ termination	ft	5400	0.03	\$162	0.01	54.0	\$28.00	\$1,512			\$1,674
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	7	125.00	\$875	1.50	10.5	\$28.00	\$294			\$1,169
07b	DRYING, BRIQUETTING & FILTERING CIRCUIT #B				\$71,392				\$46,844			\$11,202
07c	DRYING, BRIQUETTING & FILTERING CIRCUIT #C				\$71,392				\$46,844			\$11,202
TOTALS THIS SHEET					\$147,858		596		\$110,376			\$44,167
BROUGHT FWD. FROM PREV. SHEET					\$66,317		1077		\$30,156			\$96,473
TOTALS					\$214,175		1673		\$140,532			\$140,640

8820 Cost 09 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
09-ME-1	Briquetting	\$8,423,492	\$761,540	\$9,185,032
09-ME-2	Briquetting	\$124,887	\$53,491	\$178,378
	Subtotal	\$8,548,379	\$815,031	\$9,363,410

PROJECT: University of Alabama - Oil Shale Beneficiation Study
DESCRIPTION: Briquetting

BY: DPL

PROJECT N°: 8820

COST: 09

PAGE: 9-ME-1
DATE: 11/14/88

DATE: 11/14/88												
ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Screw Conv 15' Long x 14"Ø 0' Lift 30 TPH 09-1032 Thru 09-1049 From Bin to Briquetter	EA	18	3865.00	69,570	16.00	288.0	99.51	28,659			\$98,229
2	36 TPH, Roll press briquetting machine 400 H.P. 09-8001 Thru 09-8018 K.R. Komarek Inc., Model DH -500 28 x 27	EA	18	383000.00	6,894,000	310	5,580.0	99.51	555,266			\$7,449,266
3	Reagent Metering Pump-Positive Displacement ,1 Hp 09-5176 Thru 09-5179 Binder Head Tank to Briquetting Circuit	EA	4	2000.00	8,000	16.00	64.0	45.29	2,899			\$10,899
4	Briquette Collecting Conveyor 36" x 60' 6' Lift , 7.5 HP ,107 TPH , 09-1050 Thru 09-1055 Collects Briquettes From 3 Briquetting Machines	EA	6	106596.00	639,576	136	816.0	74.81	61,045			\$700,621
5	Flex Wall Conv. 36" x 130' , 33' Lift ,15 Hp 213TPH ,09-1056 Thru 09-1058 Transfers Briquettes to Screen	EA	3	154463.00	463,389	158	474.0	99.51	47,168			\$510,557
6	4' x 8' Single Deck Briquette Vibrating Screen,10 HP,09- 2005 Thru 09-2007	EA	3	12465.00	37,395	40.00	120.0	74.81	8,977			\$46,372
7	Briquetting Collecting Conveyor 36" x 500' Horiz.Troughing Belt Conv. 15 HP., 577 TPH 09-1062 Collects Briquettes from 3 Circuits	EA	1	277500.00	277,500	410	410.0	99.51	40,799			\$318,299
8	Deleted											
9	Briquetting dust collector with exhaust fan, rotary airlock 4,000 CFM @ 14" W.G. (09-0159 thru 09-0161) and (09-5404 thru 09-5406)	EA	3	6254.00	18,762	60.00	180.0	74.81	13,466			\$32,228
10	Vertigal Centrifugal Plant Clean-up Slurry Sump Pump ,100GPM ,90FT TDH 7.5 HP 65QV SP , 09-5151 Thru 09-5153 Agglomeration Area	EA	3	5100.00	15,300	24.00	72.0	45.29	3,261			\$18,561
Page Total				\$8,423,492		8,004.0		\$761,540		\$0		\$9,185,032

DATE: 11/14/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
12	Rejected Briquette Conveyor 36" x 42' Lg, Zero ft. lift,5 HP ,28TPH,100FPM, 09-1087 Thru 09-1089, Transports Briquettes to Filter Cake Conveyor	EA	3	23759.00	71,277	68.00	204.0	99.51	20,300			\$91,577
13	Blinder Transfer Pump 50GPM @ 50'TDH, 2 HP 1.5/1 BAH ,09-5159 & 09-5160 transfers Blinder from Storage tank to steady head tank	EA	2	3600.00	7,200	16.00	32.0	45.29	1,449			\$8,649
14	Ductwork (10 GA steel, ells, transitions, blast gates, supports)	LB	26,520	1.75	46,410	0.016	424.3	74.81	31,742			\$78,152
Page Total				\$124,887		660		\$53,491		\$178,378		

8820 Cost 09 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
09-ST-1	Briquetting	\$358,470	\$193,359	\$551,829
	Subtotal	\$358,470	\$193,359	\$551,829

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Briquetting ~ Structural

BY: CH

PROJECT N°: 8820

COST: 09

PAGE: 9-ST-1
 DATE: 11/29/88

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Binder storage tank (installed) 60'Øx41'-0, Capacity:870,000 Gal Equip N°09-1260	EA	1	153081.00	153,081							\$153,081
2	Binder head tank (installed) 6'Øx6'-0, Capacity:1,200 Gal Equip N°09-1261	EA	3	4305.00	12,915							\$12,915
3	Heavy Steel	LB	56250	0.83	46,688	0.008	450.0	74.81	33,665			\$80,353
4	Medium Steel	LB	35100	0.87	30,537	0.013	456.3	74.81	34,136			\$64,673
5	Light Steel	LB	71780	0.91	65,320	0.015	1,076.7	74.81	80,548			\$145,868
6	Handrail	LF	104	23.00	2,392	0.330	34.3	45.29	1,553			\$3,945
7	Handrail w/Toe Plate	LF	435	27.00	11,745	0.500	217.5	45.29	9,851			\$21,596
8	Grating	SF	5,850	5.80	33,930	0.075	438.8	74.81	32,827			\$66,757
9	Stairtreads	EA	49	38.00	1,862	0.350	17.2	45.29	779			\$2,641
Page Total					\$358,470		2,690.8		\$193,359		\$0	\$551,829

8820 Cost 09 Platework Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
09-PW-01	Briquetting Chutes	\$54,824	\$54,887	\$109,711
09-PW-02	Briquetting Chutes	\$7,004	\$7,131	\$14,135
	Subtotal	\$61,828	\$62,018	\$123,846

PROJECT: University of Alabama - Oil Shale Beneficiation Study
DESCRIPTION: Briquetting Platework

BY: MB

PROJECT N#: 8820

COST: 09

PAGE: 9-PW-1
DATE: 11/22/88

DATE: 1/22/00												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOURLY COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Flex Conveyor Feed Chute 3/8" plate	LB	5,450	0.96	5,232	0.013	70.9	74.81	5,304			\$10,536
2	12"x18" rubber door	EA	6	150.00	900	4.000	24.0	45.29	1,087			\$1,987
3	1/4" plate	LB	2,723	1.14	3,104	0.013	35.4	74.81	2,648			\$5,752
4	Briquette Coll Conveyor Skirtboard	LB	3,114	0.91	2,834	0.015	46.7	74.81	3,494			\$6,328
5	1/2" 60 durometer rubber	SF	90	9.80	882	0.050	4.5	45.29	204			\$1,086
6	Undersize Screen Hopper 3/8" plate	LB	5,462	0.96	5,244	0.013	71.0	74.81	5,312			\$10,556
7	Light steel	LB	1,785	0.91	1,624	0.015	26.8	74.81	2,005			\$3,629
8	24"x24" rubber door	EA	3	150.00	450	4.000	12.0	45.29	543			\$993
9	Skirtboard	LB	1,335	0.91	1,215	0.015	20.0	74.81	1,496			\$2,711
10	1/2" 60 durometer rubber	SF	39	9.80	382	0.050	2.0	45.29	91			\$473
11	Briquette Reclaim Chutes 3/8" plate	LB	10534	0.96	10,113	0.013	136.9	74.81	10,241			\$20,354
12	12"x18" rubber door, (2) per chute	EA	6	150.00	900		4.0	45.29	181			\$1,081
13	Briquette Discharge Chutes (18) 3/8" plate	LB	8520	0.96	8,179	0.013	110.8	74.81	8,289			\$16,468
14	Skirtboard	LB	9758	0.91	8,880	0.015	146.4	74.81	10,952			\$19,832
15	1/2" 60 durometer rubber	SF	282	9.80	2,764	0.050	14.1	45.29	639			\$3,403
16	12 Ga plate	LB	2142	0.99	2,121	0.015	32.1	74.81	2,401			\$4,522
Page Total					\$54,824		757.6		\$54,887		\$0	\$109,711

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Briquetting Platework

BY: MB

PROJECT N^o: 8820

COST: 09

PAGE: 9-PW-2
 DATE: 11/22/88

ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
						MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Briquette Screen Feed 1/4" plate	LB	775	1.14	884	0.013	10.1	74.81	756			\$1,640
2	3/8" plate	LB	1438	0.96	1,380	0.013	18.7	74.81	1,399			\$2,779
3	12"x18" rubber door	EA	3	150.00	450	4.000	12.0	45.29	543			\$993
4	Briquette Screen Feed 3/8" plate	LB	4,000	0.96	3,840	0.013	52.0	74.81	3,890			\$7,730
5	24"x24" rubber door	EA	3	150.00	450	4.000	12.0	45.29	543			\$993

8820 Cost 09 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
09-EL-1		\$485,169	\$373,603	\$858,772
	Subtotal	\$485,169	\$373,603	\$858,772

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
09	BRIQUETTING AREA											
	7.2 KV MCC #09-MC-03	sect	12	9950.00	\$119,400	6.00	72.0	\$28.00	\$2,016			\$121,416
	7.2 KV 400HP BRIQUETTING MOTORS (6) REQ'D											
	400 HP 7.2 KV Motor Sealtite Conn	ea	6	140.00	\$840	1.60	9.6	\$28.00	\$269			\$1,109
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	1200	5.75	\$6,900	0.30	360.0	\$28.00	\$10,080			\$16,980
	Wire #6 8KV w/ termination	ft	3750	1.60	\$6,000	0.06	225.0	\$28.00	\$6,300			\$12,300
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	6	125.00	\$750	1.50	9.0	\$28.00	\$252			\$1,002
TOTALS THIS SHEET					\$135,263		857		\$23,999			\$159,261
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$135,263		857		\$23,999			\$159,261

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	TOTAL
	7.2 KV 350HP DRYER FAN MOTORS		(2) REQ'D									
	350 HP 7.2 KV Motor Sealtite Conn	ea	2	140.00	\$280	1.60	3.2	\$28.00	\$90			\$370
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	500	5.75	\$2,875	0.30	150.0	\$28.00	\$4,200			\$7,075
	Wire #6 8KV w/ termination	ft	1600	1.60	\$2,560	0.06	96.0	\$28.00	\$2,688			\$5,248
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	500	1.05	\$525	0.12	60.0	\$28.00	\$1,680			\$2,205
	Wire #14 THHN w/ termination	ft	1600	0.03	\$48	0.01	16.0	\$28.00	\$448			\$496
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	2	125.00	\$250	1.50	3.0	\$28.00	\$84			\$334
	7.2 KV 300HP THICKENER / COMPRESSOR MOTORS		(3) REQ'D									
	300 HP 7.2 KV Motor Sealtite Conn	ea	3	140.00	\$420	1.60	4.8	\$28.00	\$134			\$554
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	1200	5.75	\$6,900	0.30	360.0	\$28.00	\$10,080			\$16,980
	Wire #6 8KV w/ termination	ft	3750	1.60	\$6,000	0.06	225.0	\$28.00	\$6,300			\$12,300
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	1200	1.05	\$1,260	0.12	144.0	\$28.00	\$4,032			\$5,292
	Wire #14 THHN w/ termination	ft	3750	0.03	\$113	0.01	37.5	\$28.00	\$1,050			\$1,163
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
	TOTALS THIS SHEET				\$21,606		1104		\$30,912			\$52,518
	BROUGHT FWD. FROM PREV. SHEET				\$135,263		857		\$23,999			\$159,261
	TOTALS				\$156,868		1961		\$54,911			\$211,779

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOURLY COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	MISC EQUIPMENT & CONTROLS											
	"SS" Speed Switch w/mount	ea	11	245.00	\$2,695	2.50	27.5	\$28.00	\$770			\$3,465
	"PP" Plugged chute Probe w/mn	ea	4	240.00	\$960	3.50	14.0	\$28.00	\$392			\$1,352
	"LS" Level Switch w/mount	ea	5	240.00	\$1,200	3.50	17.5	\$28.00	\$490			\$1,690
07b	DRYING, BRIQUETTING & FILTERING CIRCUIT #B				\$161,723				\$158,520			\$320,243
07c	DRYING, BRIQUETTING & FILTERING CIRCUIT #C				\$161,723				\$158,520			\$320,243
TOTALS THIS SHEET					\$328,301		59		\$318,692			\$646,993
BROUGHT FWD. FROM PREV. SHEET					\$156,868		1961		\$54,911			\$211,779
TOTALS					\$485,169		2020		\$373,603			\$858,772

8820 Cost 11 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
11-ME-1	Tailings	\$567,000	\$39,483	\$606,483
	Subtotal	\$567,000	\$39,483	\$606,483

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Tailings

BY: DBW

PROJECT N^o: 8820

COST: 11

PAGE: 11-ME-1
 DATE: 11/14/88

TOWN: Tailings													DATE: 11/14/88	
ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL		
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT				
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL			
1	Tailings Pump, 22860 GPM, 96' TDH Warman 20/18 TU-AH 800 HP 11-5156 Thru 11-5158 (2 operating plus 1 spare)	EA	3	132000.00	396,000	80.00	240.0	74.81	17,954			\$413,954		
2	Reclaimed Water Pump, 7100 GPM 50' TDH 11-5190 Thru 11-5192 450 HP Warman 300 SL (2 operating plus 1 spare)	EA	3	47000.00	141,000	64.00	192.0	74.81	14,364			\$155,364		
3	Pump barge for reclaimed water pumps	EA	1	30000.00	30,000	72.00	72.0	99.51	7,165			\$37,165		

8820 Cost 11 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
11-EL-1		\$42,037	\$14,786	\$56,823
	Subtotal	\$42,037	\$14,786	\$56,823

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
1 1	TAILINGS POND AREA											
	7.2 KV MCC #11-MC-01	sect	3	9950.00	\$29,850	6.00	18.0	\$28.00	\$504			\$30,354
	69KV/120 30KVA XFMR#11-TR-02	ea	1	1150.00	\$1,150	16.00	16.0	\$28.00	\$448			\$1,598
	Panel PP-01-2 208Y/120 V	ea	1	375.00	\$375	12.00	12.0	\$28.00	\$336			\$711
	7.2 KV TAILINGS PUMP MOTORS (3) REQ'D											
	800 HP 7.2 KV Motor Sealtite Conn.	ea	3	140.00	\$420	1.60	4.8	\$28.00	\$134			\$554
	1) Motor Wiring											
	Conduit 2-1/2" GRC w/ fitting	ft	450	5.75	\$2,588	0.30	135.0	\$28.00	\$3,780			\$6,368
	Wire #6 8KV w/ termination	ft	1500	1.60	\$2,400	0.06	90.0	\$28.00	\$2,520			\$4,920
	2) Control Wiring											
	Conduit 3/4" GRC w/ fittings	ft	450	1.05	\$473	0.12	54.0	\$28.00	\$1,512			\$1,985
	Wire #14 THHN w/ termination	ft	1500	0.03	\$45	0.01	15.0	\$28.00	\$420			\$465
	3) Control Devices											
	Jog / Stop Station w/ mounting	ea	3	125.00	\$375	1.50	4.5	\$28.00	\$126			\$501
	Level switch w/ mounting	ea	3	245.00	\$735	2.50	7.5	\$28.00	\$210			\$945
	Pressure switch w/ mounting	ea	3	145.00	\$435	2.00	6.0	\$28.00	\$168			\$603
	LIGHTING											
	400 W HPS Floodlight w/ pole bkt	ea	3	375.00	\$1,125	5.0	15.0	\$28.00	\$420			\$1,545
	100 W HPS Stanchion Fixture	ea	3	320.00	\$960	3.5	10.5	\$28.00	\$294			\$1,254
	Conduit 3/4" GRC w/ fittings	ft	900	1.05	\$945	0.12	108.0	\$28.00	\$3,024			\$3,969
	Conduit 1-1/4" GRC w/ fittings	ft	30	1.76	\$53	0.16	4.8	\$28.00	\$134			\$187
	Wire #12 THHN w/ termination	ft	2700	0.04	\$108	0.01	27.0	\$28.00	\$756			\$864
TOTALS THIS SHEET					\$42,037		528		\$14,786			\$56,823
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$42,037		528		\$14,786			\$56,823

8820 Cost 12 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
12-ST-01	Structures in Mill Buildings	\$2,376,231	\$3,514,316	\$5,890,547
	Subtotal	\$2,376,231	\$3,514,316	\$5,890,547

DATE: 11/29/88												
ITEM N°	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		MANHOURS		LABOR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Filtering, Drying & Briquetting Bldg Pre-Engineered Building	EA	1	808585.00	808,585				1,210,720			\$2,019,305
2	Building Insulation	LOT	1	78160.00	78,160				59,136			\$137,296
3	Grinding & Flotation Building Pre-Engineered Building	EA	1	1380488.00	1,380,488				2,149,612			\$3,530,100
4	Install. Includes crane Installation Building Insulation	LOT	1	108998.00	108,998				94,848			\$203,846
Page Total				\$2,376,231		0		\$3,514,316		\$0		\$5,890,547

8820 Cost 12 Concrete Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
12-CN-1	Mill Buildings Footings	\$2,080,313	\$2,935,192	\$5,015,505
	Subtotal	\$2,080,313	\$2,935,192	\$5,015,505

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Mill Buildings Concrete

BY: DLY

PROJECT N°: 8820

COST: 12

PAGE: 12-CN-1
 DATE: 11/29/88

DATE: 11/29/88

ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Grinding & Flotation Building Spread Footings	CY	661	130.00	85,930					190.00	125,590	\$211,520
2	Grade Slabs	CY	5,827	130.00	757,510					190.00	1,107,130	\$1,864,640
3	Ball Mill Fdns (3)	CY	5,220	130.00	678,600					190.00	991,800	\$1,670,400
4	8" Masonry Units	SF	19,950	3.60	71,820					1.55	30,923	\$102,743
5	Filtering, Drying & Briquetting Bldg Spread Footings	CY	87	130.00	11,310					190.00	16,530	\$27,840
6	Grade Slabs	CY	3,422	130.00	444,860					190.00	650,180	\$1,095,040
7	8" Masonry Units	SF	8,412	3.60	30,283					1.55	13,039	\$43,322

University of Alabama Oil Shale Study

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ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1 2	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
	MILL BUILDING LIGHTING											
	480V PANEL #05-PP-01	ea	1	700.00	\$700	16.00	16.0	\$28.00	\$448			\$1,148
	480/120 45KVA XFMR#05-TR-01	ea	1	750.00	\$750	16.00	16.0	\$28.00	\$448			\$1,198
	120V PANEL #05-PP-02	ea	1	375.00	\$375	12.00	12.0	\$28.00	\$336			\$711
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	50	7.50	\$375	0.33	16.5	\$28.00	\$462			\$837
	Wire #500 THHN w/ termination	ft	175	2.75	\$481	0.07	12.3	\$28.00	\$344			\$825
	Conduit 2" GRC w/ fittings	ft	20	3.30	\$66	0.22	4.4	\$28.00	\$123			\$189
	Wire #2/0 THHN w/ termination	ft	75	0.80	\$60	0.03	2.3	\$28.00	\$64			\$124
	Conduit 1" GRC w/ fittings	ft	10	1.35	\$14	0.14	1.4	\$28.00	\$39			\$53
	Wire #6 THHN w/ termination	ft	40	0.14	\$6	0.02	0.8	\$28.00	\$22			\$28
	2x8x40W Industrial Flourescent	ea	84	70.00	\$5,880	1.5	126.0	\$28.00	\$3,528			\$9,408
	2x4x40W Industrial Flourescent	ea	38	55.00	\$2,090	1.5	57.0	\$28.00	\$1,596			\$3,686
	Emergency Light N4	ea	12	350.00	\$4,200	3.5	42.0	\$28.00	\$1,176			\$5,376
	Emergency Light	ea	5	100.00	\$500	2.0	10.0	\$28.00	\$280			\$780
	Emergency Exit N4	ea	17	310.00	\$5,270	3.0	51.0	\$28.00	\$1,428			\$6,698
	Emergency Exit	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Duplex Recpt or Sw w/ box & cover	ea	58	20.00	\$1,160	1.0	58.0	\$28.00	\$1,624			\$2,784
	Outdoor Recept. w/ box & WP cover	ea	35	35.00	\$1,225	1.5	52.5	\$28.00	\$1,470			\$2,695
	400 W HPS Highbay w/ Reflector	ea	256	700.00	\$179,200	5.0	1280.0	\$28.00	\$35,840			\$215,040
150 W HPS Ceiling or Wall Fixture	ea	11	320.00	\$3,520	3.5	38.5	\$28.00	\$1,078			\$4,598	
400 W HPS Floodlight	ea	6	700.00	\$4,200	5.0	30.0	\$28.00	\$840			\$5,040	
1000 W HPS Floodlight	ea	3	700.00	\$2,100	5.0	15.0	\$28.00	\$420			\$2,520	
Conduit 3/4" GRC w/ fittings	ft	18400	1.05	\$19,320	0.12	2208.0	\$28.00	\$61,824			\$81,144	
Wire #12 THHN w/ termination	ft	56100	0.04	\$2,244	0.01	561.0	\$28.00	\$15,708			\$17,952	
Wire #10 THHN w/ termination	ft	10800	0.06	\$648	0.01	108.0	\$28.00	\$3,024			\$3,672	
TOTALS THIS SHEET					\$234,984		4731		\$132,458			\$367,442
BROUGHT FWD. FROM PREV. SHEET												
TOTALS					\$234,984		4731		\$132,458			\$367,442

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1 2	MILL BUILDING GROUNDING											
	#2/0 SDBC Ground Cable	ft	500	0.55	\$275.00	0.03	15.0	\$28.00	\$420			\$695
	#4/0 SDBC Ground Cable	ft	1250	0.80	\$1,000.00	0.04	47.5	\$28.00	\$1,330			\$2,330
	#2/0 Ground Lug	ea	40	4.35	\$174.00	0.45	18.0	\$28.00	\$504			\$678
	#4/0 Ground Lug	ea	9	9.50	\$85.50	0.45	4.1	\$28.00	\$115			\$201
	CADWELD Shots	ea	65	2.75	\$178.75	0.25	16.3	\$28.00	\$456			\$635
	CADWELD Molds	ea	5	40.00	\$200.00	skip						\$200
	5/8"x10' Copperweld Rod	ea	12	17.50	\$210.00	1.5	18.0	\$28.00	\$504			\$714
	TRENCHING & BACKFILL	ft	1500	3.00	\$4,500.00	0.02	30.0	\$28.00	\$840			\$5,340
1 2	BRIQUETTING BUILDING LIGHTING											
	480V PANEL #07-PP-01	ea	1	700.00	\$700	16.00	16.0	\$28.00	\$448			\$1,148
	480/120 45KVA XFMR#07-TR-01	ea	1	750.00	\$750	16.00	16.0	\$28.00	\$448			\$1,198
	120V PANEL #07-PP-02	ea	1	375.00	\$375	12.00	12.0	\$28.00	\$336			\$711
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	50	7.50	\$375	0.33	16.5	\$28.00	\$462			\$837
	Wire #500 THHN w/ termination	ft	175	2.75	\$481	0.07	12.3	\$28.00	\$344			\$825
	Conduit 2" GRC w/ fittings	ft	20	3.30	\$66	0.22	4.4	\$28.00	\$123			\$189
	Wire #2/0 THHN w/ termination	ft	75	0.80	\$60	0.03	2.3	\$28.00	\$64			\$124
	Conduit 1" GRC w/ fittings	ft	10	1.35	\$14	0.14	1.4	\$28.00	\$39			\$53
	Wire #6 THHN w/ termination	ft	40	0.14	\$6	0.02	0.8	\$28.00	\$22			\$28
TOTALS THIS SHEET					\$9,450		231		\$6,455			\$15,906
BROUGHT FWD. FROM PREV. SHEET					\$234,984		4731		\$132,458			\$367,442
TOTALS					\$244,434		4962		\$138,913			\$383,348

ITEM N ^o	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	2x8x40W Industrial Flourescent	ea	84	70.00	\$5,880	1.5	126.0	\$28.00	\$3,528			\$9,408
	2x4x40W Industrial Flourescent	ea	38	55.00	\$2,090	1.5	57.0	\$28.00	\$1,596			\$3,686
	Emergency Light N4	ea	12	350.00	\$4,200	3.5	42.0	\$28.00	\$1,176			\$5,376
	Emergency Light	ea	5	100.00	\$500	2.0	10.0	\$28.00	\$280			\$780
	Emergency Exit N4	ea	17	310.00	\$5,270	3.0	51.0	\$28.00	\$1,428			\$6,698
	Emergency Exit	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Duplex Recpt or Sw w/ box & cove	ea	58	20.00	\$1,160	1.0	58.0	\$28.00	\$1,624			\$2,784
	Outdoor Recept. w/ box & WP cove	ea	35	35.00	\$1,225	1.5	52.5	\$28.00	\$1,470			\$2,695
	400 W HPS Highbay w/ Reflector	ea	256	700.00	\$179,200	5.0	1280.0	\$28.00	\$35,840			\$215,040
	150 W HPS Ceiling or Wall Fixture	ea	11	320.00	\$3,520	3.5	38.5	\$28.00	\$1,078			\$4,598
	400 W HPS Floodlight	ea	6	700.00	\$4,200	5.0	30.0	\$28.00	\$840			\$5,040
	1000 W HPS Floodlight	ea	3	700.00	\$2,100	5.0	15.0	\$28.00	\$420			\$2,520
	Conduit 3/4" GRC w/ fittings	ft	18400	1.05	\$19,320	0.12	2208.0	\$28.00	\$61,824			\$81,144
	Wire #12 THHN w/ termination	ft	56100	0.04	\$2,244	0.01	561.0	\$28.00	\$15,708			\$17,952
	Wire #10 THHN w/ termination	ft	10800	0.06	\$648	0.01	108.0	\$28.00	\$3,024			\$3,672
12	BRIQUETTING BUILDING GROUNDING											
	#2/0 SDBC Ground Cable	ft	500	0.55	\$275.00	0.03	15.0	\$28.00	\$420			\$695
	#4/0 SDBC Ground Cable	ft	1250	0.80	\$1,000.00	0.04	47.5	\$28.00	\$1,330			\$2,330
	#2/0 Ground Lug	ea	40	4.35	\$174.00	0.45	18.0	\$28.00	\$504			\$678
	#4/0 Ground Lug	ea	9	9.50	\$85.50	0.45	4.1	\$28.00	\$115			\$201
	CADWELD Shots	ea	65	2.75	\$178.75	0.25	16.3	\$28.00	\$456			\$635
	CADWELD Molds	ea	5	40.00	\$200.00	skip						\$200
	5/8"x10' Copperweld Rod	ea	12	17.50	\$210.00	1.5	18.0	\$28.00	\$504			\$714
	TRENCHING & BACKFILL	ft	1250	3.00	\$3,750.00	0.02	25.0	\$28.00	\$700			\$4,450
TOTALS THIS SHEET					\$238,030		4793		\$134,201			\$372,232
BROUGHT FWD. FROM PREV. SHEET					\$244,434		4962		\$138,913			\$383,348
TOTALS					\$482,464		9755		\$273,114			\$755,580

8820 Cost 13 Structural Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
13-ST-01	Ancillary Buildings	\$3,057,800	\$0	\$3,057,800
	Subtotal	\$3,057,800	\$0	\$3,057,800

PROJECT: University of Alabama - Oil Shale Beneficiation Study
 DESCRIPTION: Ancillary Buildings

BY: CH

PROJECT N^o: 8820

COST: 13

PAGE: 13-ST-1
 DATE: 11/29/88

DATE: 11/29/88

ITEM N ^o	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Electrical & Mechanical Shop 150'x200' (installed)	EA	1	600000.00	600,000							\$600,000
2	Administration Building 110'x250' (installed)	EA	1	1925000.00	1,925,000							\$1,925,000
3	Lunch & Restrooms in Filter/Dry Bldg 22'x60' (installed)	EA	1	52800.00	52,800							\$52,800
4	Offices in Filter/Drying Bldg 30'x40' (installed)	EA	1	48000.00	48,000							\$48,000
5	Lab, Change Rooms & Offices Etc in Grinding & Flootation Bldg (installed) Upstairs 30'x180' Downstairs 30'x180'	EA	1	432000.00	432,000							\$432,000

8820 Cost 13 Concrete Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
13-CN-1	Misc Tank Foundations	\$311,610	\$455,430	\$767,040
	Subtotal	\$311,610	\$455,430	\$767,040

PROJECT: University of Alabama - Oil Shale Beneficiation Study
DESCRIPTION: Misc Concrete

BY: DLY

PROJECT N°: 8820

COST: 13

PAGE: 13-CN-1
DATE: 11/29/88

DATE: 11/29/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Administration Bldg Slab on Grade	CY	812	130.00	105,560					190.00	154,280	\$259,840
2	Shop Bldg Slab on Grade	CY	1,112	130.00	144,560					190.00	211,280	\$355,840
3	Water Tank Fdn	CY	155	130.00	20,150					190.00	29,450	\$49,600
4	Head tank Fdn	CY	28	130.00	3,640					190.00	5,320	\$8,960
5	Pipe Rack Fdns	CY	20	130.00	2,600					190.00	3,800	\$6,400
6	Sumps	CY	45	130.00	5,850					190.00	8,550	\$14,400
7	Floc Storage Tank Fdns (2)	CY	25	130.00	3,250					190.00	4,750	\$8,000
8	Floatation Reagent Tank Fdn	CY	15	130.00	1,950					190.00	2,850	\$4,800
9	Flocculant Mix Tank Fdn	CY	10	130.00	1,300					190.00	1,900	\$3,200
10	Binder Storage Tank Fdn	CY	125	130.00	16,250					190.00	23,750	\$40,000
11	Misc Tanks Fdns	CY	50	130.00	6,500					190.00	9,500	\$16,000

8820 Cost 13 Electrical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
13-EL-1		\$106,079	\$165,178	\$271,257
	Subtotal	\$106,079	\$165,178	\$271,257

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	Composit "Electrical Crew" labor rate, Including tools, equipment, fuel & supervision							\$28.00				
13	ADMINISTRATION BUILDING LIGHTING											
	480V PANEL #00-PP-02	ea	1	700.00	\$700	16.00	16.0	\$28.00	\$448			\$1,148
	480/120 45KVA XFMR#00-TR-02	ea	2	750.00	\$1,500	16.00	32.0	\$28.00	\$896			\$2,396
	120V PANEL #00-PP-03	ea	2	375.00	\$750	12.00	24.0	\$28.00	\$672			\$1,422
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	150	7.50	\$1,125	0.33	49.5	\$28.00	\$1,386			\$2,511
	Wire #500 THHN w/ termination	ft	480	2.75	\$1,320	0.07	33.6	\$28.00	\$941			\$2,261
	Conduit 2" GRC w/ fittings	ft	40	3.30	\$132	0.22	8.8	\$28.00	\$246			\$378
	Wire #2/0 THHN w/ termination	ft	150	0.80	\$120	0.03	4.5	\$28.00	\$126			\$246
	Conduit 1" GRC w/ fittings	ft	20	1.35	\$27	0.14	2.8	\$28.00	\$78			\$105
	Wire #6 THHN w/ termination	ft	80	0.14	\$11	0.02	1.6	\$28.00	\$45			\$56
	2x4x40W Fluorescent troffer	ea	460	55.00	\$25,300	1.5	690.0	\$28.00	\$19,320			\$44,620
	Emergency Light	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Emergency Exit	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Duplex Recpt or Sw w/ box & cover	ea	320	20.00	\$6,400	1.0	320.0	\$28.00	\$8,960			\$15,360
	400 W HPS Floodlight	ea	2	700.00	\$1,400	5.0	10.0	\$28.00	\$280			\$1,680
	150 W HPS Wallpack	ea	4	320.00	\$1,280	3.5	14.0	\$28.00	\$392			\$1,672
	Conduit 3/4" GRC w/ fittings	ft	13800	1.05	\$14,490	0.12	1656.0	\$28.00	\$46,368			\$60,858
	Wire #12 THHN w/ termination	ft	78500	0.04	\$3,140	0.01	785.0	\$28.00	\$21,980			\$25,120
TOTALS THIS SHEET					\$58,895		3672		\$102,810			\$161,705
BROUGHT FWD. FROM PREV. SHEET					\$58,895		3672		\$102,810			\$161,705
TOTALS					\$58,895		3672		\$102,810			\$161,705

ITEM N°	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1 3	ADMINISTRATION BUILDING GROUNDING											
	#2/0 SDBC Ground Cable	ft	50	0.55	\$27.50	0.03	1.5	\$28.00	\$42			\$70
	#4/0 SDBC Ground Cable	ft	750	0.80	\$600.00	0.04	28.5	\$28.00	\$798			\$1,398
	#2/0 Ground Lug	ea	6	4.35	\$26.10	0.45	2.7	\$28.00	\$76			\$102
	CADWELD Shots	ea	12	2.75	\$33.00	0.25	3.0	\$28.00	\$84			\$117
	CADWELD Molds	ea	1	40.00	\$40.00	skip						\$40
	5/8"x10' Copperweld Rod	ea	8	17.50	\$140.00	1.5	12.0	\$28.00	\$336			\$476
	TRENCHING & BACKFILL	ft	750	3.00	\$2,250.00	0.02	15.0	\$28.00	\$420			\$2,670
1 3	ELEC/MECHANICAL SHOP BUILDING LIGHTING											
	480V PANEL #00-PP-03	ea	2	700.00	\$1,400	16.00	32.0	\$28.00	\$896			\$2,296
	480/120 45KVA XFMR#00-TR-04	ea	2	750.00	\$1,500	16.00	32.0	\$28.00	\$896			\$2,396
	120V PANEL #00-PP-04	ea	2	375.00	\$750	12.00	24.0	\$28.00	\$672			\$1,422
	Power Wiring											
	Conduit 3" GRC w/ fittings	ft	300	7.50	\$2,250	0.33	99.0	\$28.00	\$2,772			\$5,022
	Wire #500 THHN w/ termination	ft	960	2.75	\$2,640	0.07	67.2	\$28.00	\$1,882			\$4,522
	Conduit 2" GRC w/ fittings	ft	40	3.30	\$132	0.22	8.8	\$28.00	\$246			\$378
	Wire #2/0 THHN w/ termination	ft	150	0.80	\$120	0.03	4.5	\$28.00	\$126			\$246
	Conduit 1" GRC w/ fittings	ft	20	1.35	\$27	0.14	2.8	\$28.00	\$78			\$105
	Wire #6 THHN w/ termination	ft	80	0.14	\$11	0.02	1.6	\$28.00	\$45			\$56
TOTALS THIS SHEET					\$11,947		335		\$9,369			\$21,316
BROUGHT FWD. FROM PREV. SHEET					\$58,895		3672		\$102,810			\$161,705
TOTALS					\$70,842		4007		\$112,179			\$183,021

ITEM Nº	DESCRIPTION	UNIT MEA	QTY	MATERIAL COST		MANHOURS		MANHOUR COST		SUBCONTRACT		TOTAL
				UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
	2x8x96W Industrial Flourescent	ea	240	70.00	\$16,800	1.5	360.0	\$28.00	\$10,080			\$26,880
	Emergency Light	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Emergency Exit	ea	6	100.00	\$600	2.0	12.0	\$28.00	\$336			\$936
	Duplex Recpt or Sw w/ box & cove	ea	50	20.00	\$1,000	1.0	50.0	\$28.00	\$1,400			\$2,400
	400 W HPS Floodlight	ea	2	700.00	\$1,400	5.0	10.0	\$28.00	\$280			\$1,680
	150 W HPS Wallpack	ea	4	320.00	\$1,280	3.5	14.0	\$28.00	\$392			\$1,672
	Conduit 3/4" GRC w/ fittings	ft	9000	1.05	\$9,450	0.12	1080.0	\$28.00	\$30,240			\$39,690
	Wire #12 THHN w/ termination	ft	29500	0.04	\$1,180	0.01	295.0	\$28.00	\$8,260			\$9,440
13	ELEC/MECHANICAL SHOP BUILDING GROUNDING											
	#2/0 SDBC Ground Cable	ft	50	0.55	\$27.50	0.03	1.5	\$28.00	\$42			\$70
	#4/0 SDBC Ground Cable	ft	700	0.80	\$560.00	0.04	26.6	\$28.00	\$745			\$1,305
	#2/0 Ground Lug	ea	6	4.35	\$26.10	0.45	2.7	\$28.00	\$76			\$102
	CADWELD Shots	ea	12	2.75	\$33.00	0.25	3.0	\$28.00	\$84			\$117
	CADWELD Molds	ea	1	40.00	\$40.00	skip						\$40
	5/8"x10' Copperweld Rod	ea	8	17.50	\$140.00	1.5	12.0	\$28.00	\$336			\$476
	TRENCHING & BACKFILL	ft	700	3.00	\$2,100.00	0.02	14.0	\$28.00	\$392			\$2,492
TOTALS THIS SHEET					\$35,237		1893		\$52,999			\$88,236
BROUGHT FWD. FROM PREV. SHEET					\$70,842		4007		\$112,179			\$183,021
TOTALS					\$106,079		5900		\$165,178			\$271,257

University of Alabama Oil Shale Study

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DATE: 11/29/88

ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOURLY COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Reinforced Earth Retaining Wall Retaining Wall	SF	14,000							10.50	147,000	\$147,000
2	Excavation	CY	38,044							1.90	72,284	\$72,284
3	Backfill & Compaction	CY	38,044							1.90	72,284	\$72,284
4	Reclaim Tunnel Engineered Fill	CY	38,324							1.90	72,816	\$72,816
5	Perimeter Security 6'-0 Chainlink Fence	LF	43,000							7.20	309,600	\$309,600
6	Guard House	EA	2							10000.00	20,000	\$20,000
7	Tailings Pond (1st 2 years) Excavation	CY	412,445							1.90	783,646	\$783,646
8	Engineered Fill	CY	556,802							1.90	1,057,924	\$1,057,924
9	Tailings Pond (23 years) Engineered Fill (In operating cost estimate)	CY	19,376,500									
10	Reagent Tanks Berm Engineered Fill	CY	474							1.90	901	\$901
11	Drainage At Thickener Area 18" CMP	LF	230							15.40	3,542	\$3,542
12	Thickener Area Berm Engineered Fill	CY	18176							1.90	34,534	\$34,534
13	Paving Roads & Parking	SF	312000							3.64	1,135,680	\$1,135,680
Page Total					\$0		0.0		\$0		\$3,710,211	\$3,710,211

8820 Cost 15 Mechanical Recap Sheet

University of Alabama Oil Shale Study

Sheet	Description	Material	Labor	Total
15-ME-1	Mobile Equipment	\$1,745,000	\$0	\$1,745,000
	Subtotal	\$1,745,000	\$0	\$1,745,000

DATE: 11/14/88												
ITEM Nº	DESCRIPTION	UNIT MEAS	QTY	MATERIAL COST		LABOR COST						TOTAL
				UNIT	TOTAL	MANHOURS		MANHOUR COST		SUBCONTRACT		
						UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	
1	Bulldozer - D8 Caterpillar or Equal	EA	3	300000.00	900,000							\$900,000
2	Front end loader - 966 Caterpillar or Equal with a 6.5 Cu.Yd. bucket	EA	2	350000.00	700,000							\$700,000
3	2.5 ton service truck with portable welder and air compressor.	EA	1	38000.00	38,000							\$38,000
4	10 Ton Capacity mobile crane, rubber tire mounted with 50 foot extendable boom	EA	1	70000.00	70,000							\$70,000
5	Pick-up Truck	EA	2	10000.00	20,000							\$20,000
6	Flatbed Truck	EA	1	17000.00	17,000							\$17,000