DOE/FE/05121--T3

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DE82 014623

The Design, Construction, and Operation of a Process-Development Unit for the High-Rate, Entrained-Flow Coal-Gasification Process

Quarterly Technical Progress Report No. 2

July - September 1981

Prepared for

United States Department of Energy

under

Contract No. DE-AC01-81FE05121

MASTER

Submitted by

Mountain Fuel Resources, Inc.
36 South State Street, Suite 1540
Salt Lake City, Utah 84111

DISCLAIMER

PATENT STATUS

TECHNICAL STATUS

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1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

Mountain Fuel Resources, Inc., a subsidiary of Mountain Fuel Supply Company, Salt Lake City, Utah, is under contract with the U. S. Department of Energy for a program to design, construct and operate a high-rate, entrained flow coal gasification process development unit (PDU). The objective of the program is to develop equipment components for gasification of coal to form a clean, intermediate-Btu fuel gas or a synthesis gas that may be converted to methyl alcohol, gasoline, synthetic natural gas or many other desirable products. Ford, Bacon & Davis Utah, Inc., is the principal subcontractor on the program, and will be largely responsible for design, construction and operation of the PDU.

The design of the coal gasification PDU is based on earlier DOE-supported work at the Eyring Research Institute, Provo, Utah. Pulverized coal is fed to an entrained flow reactor where it is gasified by reaction with steam and oxygen. The ash in the coal is removed as an inert slag and the product gas may be cleaned to remove sulfur-containing compounds and carbon dioxide to yield a clean fuel gas with a heating value near 300 Btu/standard cubic foot.

The PDU is to be located adjacent to a brick plant operated by Interstate Brick Company in West Jordan, Utah. Interstate Brick is also a subsidiary of Mountain Fuel Supply Company. Because of the developmental nature of the program, the PDU will contain only those components and features necessary to develop the gasifier and to operate it safely. The PDU will be operated intermittently, with test durations ranging from a few hours up to a maximum of four weeks. During later tests, the gas will be used in firing the brick kilns in the brick plant.

A low-sulfur, Utah bituminous coal will be used for most of the testing. Near the end of the planned effort, several tests up to 100 hours each will be made with alternate coals: a high-sulfur bituminous coal, a low-sulfur subbituminous coal, a lignite, and a coal char or residue.

1.2 Summary

Work on equipment specifications was continued. The Gasifier Radiant Heat Exchanger Transition Pipe and Superheater Design Subcontract to Deutsche Babcock was approved in September. The Site Work Subcontract was approved and the work began in late September. The Site Fencing Subcontract was awarded and work is scheduled to start in October. Permits

were obtained from the Utah Air Conservation Committee and the Utah Water Pollution Control Committee for the construction of the PDU in West Jordan, Utah. An equipment list (Attachment A) and a detailed project schedule (Attachment B) were prepared.

2.0 SITE PLAN AND SITE PREPARATION

The following sections describe all activities related to initiation of the site work during this quarter.

2.1 Site Plan and Specifications

The following site drawings were completed by FB&DU and approved by MFR:

Title	Drawing No.
Site Preparation, Plans & Sections	D-369-C-002
Plot Plan	D-369-C-001
Recycle Water Pump Sump	B-369-C-001

These drawings were issued for construction on September 24, 1981. Figure 1 shows the plot plan.

The site preparation specification, SP-369-C-102, was completed by FB&DU and approved by MFR during this reporting period. This specification was issued for construction on September 30, 1981. The specification outlined the requirement of the site work including the following:

- General grading of the site
- Construction of the waste water pond
- Construction of the recycle pump sump
- Installation of all culverts
- Construction of access roads

2.2 Soil Testing and Legal Survey

During the previous quarter, Chen and Associates was awarded a contract to perform the required soil testing per FB&DU specification.

The report was completed and submitted to FB&DU and MFR for review and inclusion into the Earthwork Subcontract. The report summarized the results of the field tests and outlined the requirement for the construction of the ponds as well as the footing and foundations of the buildings.

A legal survey of the property was performed by Aposhian Consulting during this quarter. The survey work included a legal survey of the property as well as permanent concrete markers of the four corners of the property.

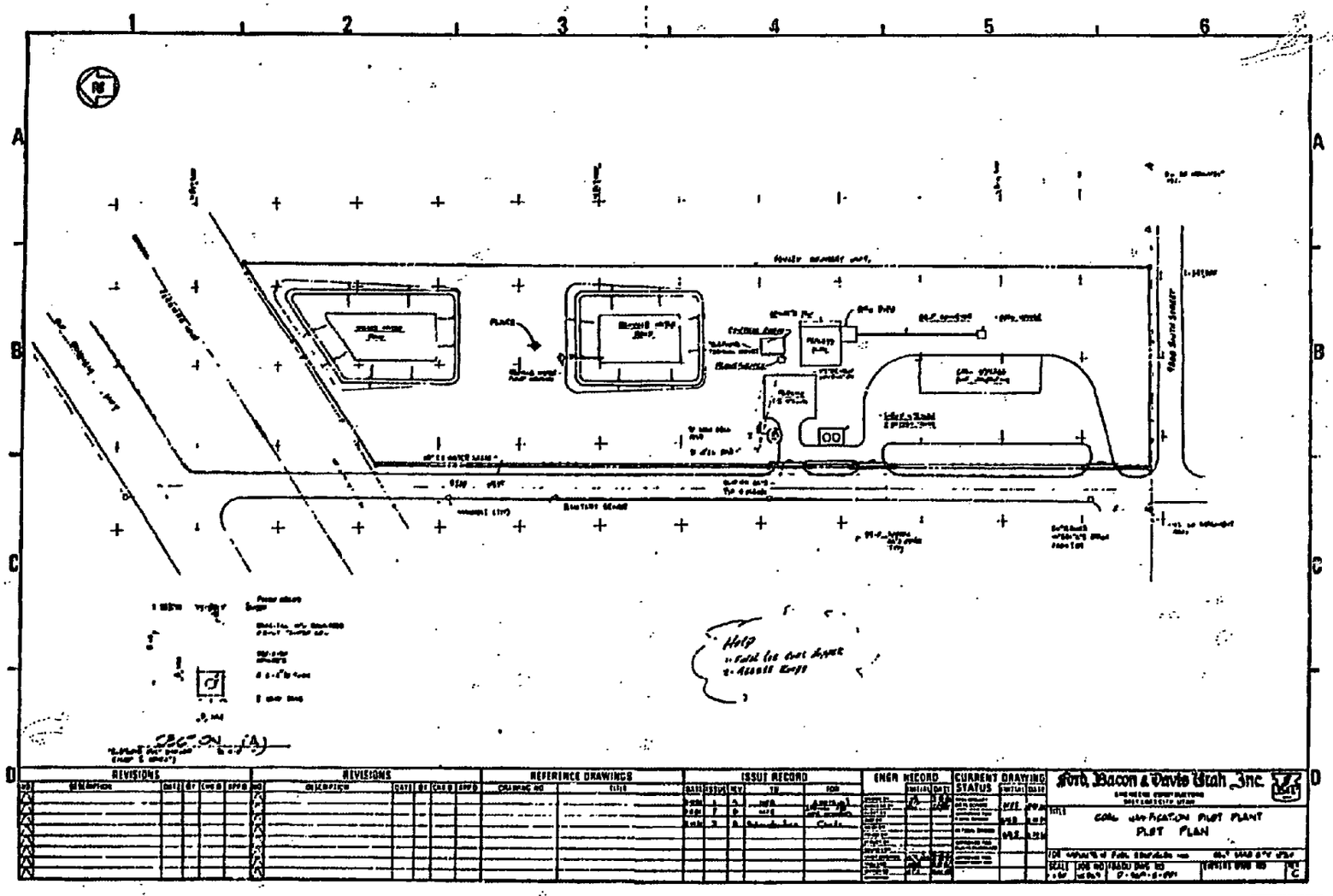

FIGURE 1. Plot Plan

2.3 Site Preparation Subcontract

The Site Work Subcontract package (369-S-015) was completed by FB&DU and approved by MFR during this period. The package was issued for quotes on August 14, 1981. A prebid meeting was held with all bidders on August 20, 1981. The package was awarded to Clegg Construction on September 22, 1981, after receiving approval from DOE.

The actual site work began on September 24, 1981, and continued through the end of this reporting period. It is anticipated that the site work will be completed by the middle of the next quarter.

Clegg Construction was selected as the Contractor for the site work package. Their bid met all the requirements of FB&DU specifications and they were the lowest bidder. FB&DU had worked with Clegg on similar projects and qualifies them for this work as well.

2.4 Site Fencing

The Perimeter Chainlink Fencing and Access Gates (3 total) Subcontract was awarded to Acme Fencing Company. The actual fencing construction is scheduled to begin in early October.

3.0 CONSTRUCTION PERMITS

3.1 State of Utah

In the previous quarterly report, it was reported that application for permits for construction of the PDU was submitted to the Utah Department of Health, Division of Environmental Health. The Notice of Intent was submitted on March 27, 1981.

On July 17, 1981, the Utah Air Conservation Committee approved the request to construct the PDU facility and granted an experimental variance for the project. The variance and restrictions are shown in the letter from the Executive Secretary of the Utah Air Conservation Committee dated August 6, 1981 (Attachment C). On August 28, 1981, the Department of Water Pollution also granted a permit for construction of the PDU in West Jordan, Utah (Attachment D). The only other permit which will be required from the State of Utah prior to the operation of the unit is the solid waste disposal. It is anticipated that the request for this permit will be issued during the next period.

3.2 West Jordan City

During the previous reporting period, the City of West Jordan was notified of Mountain Fuel Resources' intention to construct the PDU in West Jordan, Utah.

We were asked to supply design information and drawings to the City Planner and the City Engineer in order to secure the required building permits. It was also required that all applicable fees and dues be paid prior to issuance of the building permits.

On September 22, 1981, the City of West Jordan issued a site development construction permit allowing the initiation of the site work pending the finalization of all permitting requirements before placement of any concrete.

It is anticipated that all required permits from the City of West Jordan will be secured during the next reporting period.

4.0 GASIFIER DESIGN

4.1 Reaction Chamber - The dimensions of the gasification reaction chamber have been selected such that the mass flow of coal through the reactor will be less than 2150 pounds per hour per square foot of reactor cross section and 993 pounds per hour per cubic foot of reactor volume when the coal feed rate is 3000 pounds per hour. The basic dimensions of the reaction chamber are as indicated in Figure 2. Detailed design of the feed injectors and the refractory liner is underway.

4.2 High Temperature Heat Exchanger - Specifications were prepared for the design and fabrication of a high temperature radiant heat exchanger to cool the gasification reactor effluent from 2850°F to a maximum outlet of 1600°F. This exchanger would have a capacity for transferring approximately 3.8 million BTU per hour from the hot reaction products and raising steam with the recovered heat.

Negotiations are underway with Deutsche Babcock Anlagen Aktiengesellschaft, Oberhausen, West Germany, the parent organization of Ford, Bacon & Davis, for the design of this heat exchanger as well as the downstream convective exchangers and superheaters.

A preliminary assembly diagram of the high temperature heat exchanger is presented in Figure 3. The exchanger is to consist of a cylindrical "water-wall" 30 inches in diameter and approximately 13 feet in length. Detailed design of this exchanger is to be completed during the next quarter.

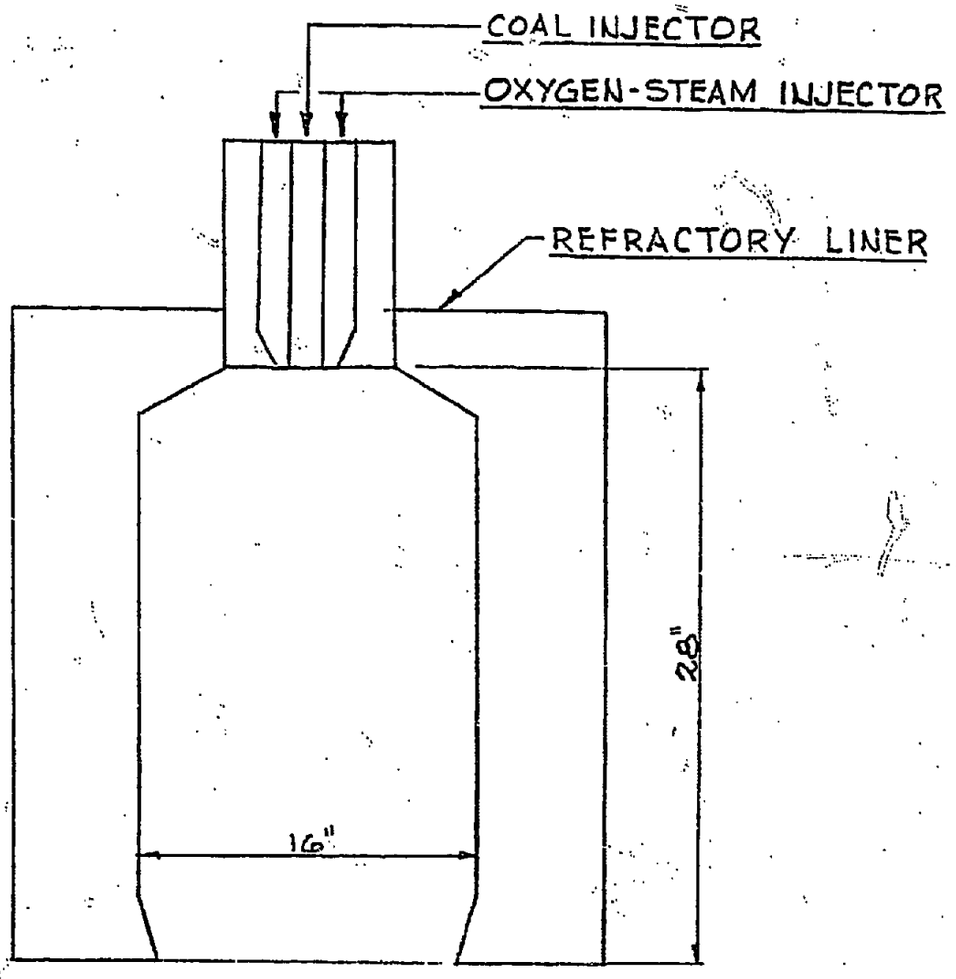

FIGURE 2. Basic Dimensions of the Reaction Chamber

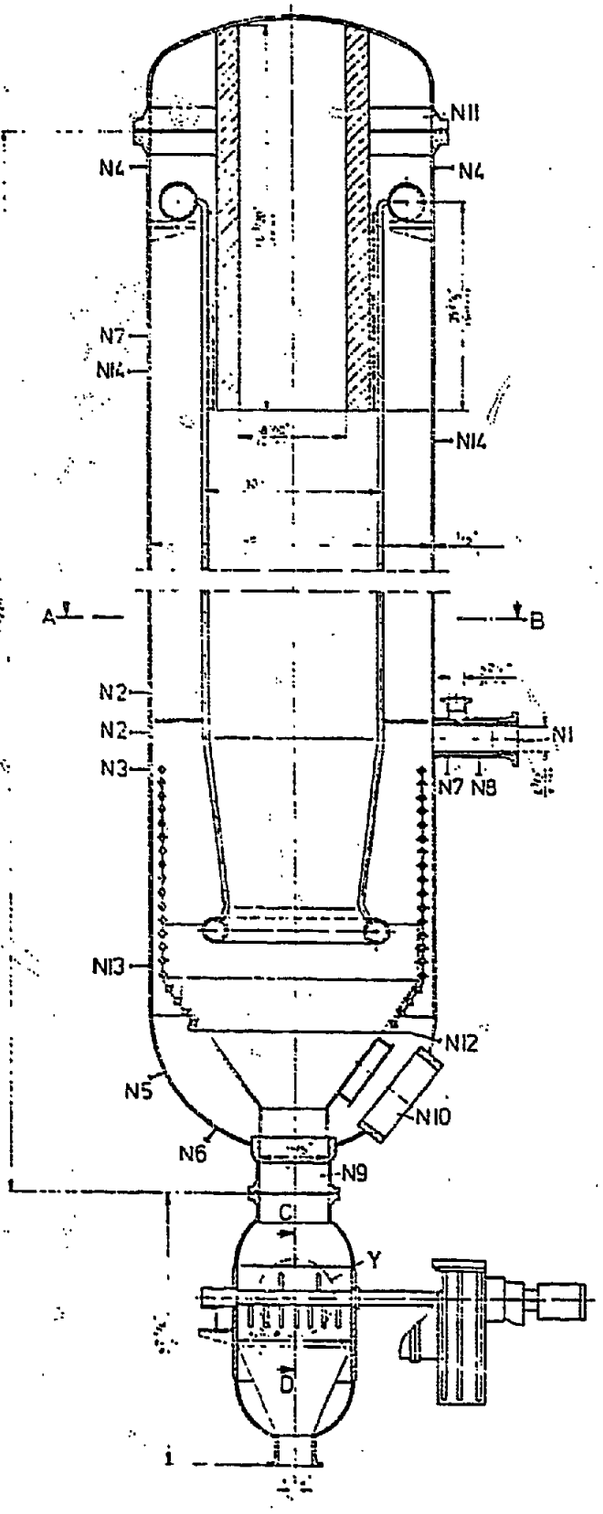

FIGURE 3. Preliminary Assembly Diagram of the High Temperature Heat Exchanger

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ATTACHMENT A

	EQUIPMENT LIST	JOB NO. UC-369-100
F B&D 1894	HIGH RATE ENTRAINED FLOW COAL GASIFICATION PDU SECTION _____ EQUIPMENT TYPE _____	PAGE 1 OF 4 DATE 12/4/81

EQUIPMENT NUMBER	DESCRIPTION	SIZE AND/OR CAPACITY	SHIPPING WEIGHT	VENDOR	COST
1BC-1	BELT CONVEYOR				
1BN-2	18 TON PULVERIZED COAL STORAGE BIN				
1CR-1	CRUSHER				
1CY-1	CYCLONE SEPARATOR				
1F-1	BAGHOUSE DUST COLLECTOR				
1FN-1	AIR FAN				
1FN-2	PULVERIZER FAN				
1FN-3	VENT FAN				
1H-1	AIR HEATER				
1HP-1	COAL GRIZZLY/RECEIVING HOPPER				
1HP-2	CRUSHER FEED HOPPER				
1VF-1	FEEDER (PULVERIZED COAL STORAGE BIN)				
1VF-2	FEEDER (RECEIVING HOPPER)				
1X-1	PULVERIZER				
1X-2	DENSE PHASE PUMP & WEIGHING UNIT				
2C-1	PACKED TOWER				
2CY-1	BIN VENT FILTER				
2D-1	STEAM DRUM				
2D-2	COAL LOCK HOPPER				

EQUIPMENT LIST

JOB NO. UC-369-100

HIGH RATE ENTRAINED FLOW COAL GASIFICATION PDU

PAGE 2 OF 4

SECTION

EQUIPMENT TYPE

DATE 12/4/81

EQUIPMENT NUMBER	DESCRIPTION	SIZE AND/OR CAPACITY	SHIPPING WEIGHT	VENDOR	COST
2D-3	COAL FEED TANK				
2D-4	ASH LOCK HOPPER				
2D-5	SLURRY DISCHARGE TANK				
2D-7	RECYCLE GAS SURGE TANK				
2D-8	SOOT BLOWING SURGE TANK				
2D-9	RECYCLE GAS SEPARATOR				
2D-10	START-UP NATURAL GAS SURGE TANK				
2E-1	RADIANT HEAT EXCHANGER				
2E-2	TRANSITION PIPE				
2E-3	STEAM SUPERHEATER				
2E-5	RECYCLE GAS COOLER				
2E-6	OXYGEN PREHEATER				
2E-7	OXYGEN SUPERHEATER (ELEC)				
2K-1	RECYCLE GAS COMPRESSOR				
2K-2	NATURAL GAS COMPRESSOR				
2P-1	DRUM RECIRCULATION PUMP				
2P-3	SLURRY PUMP				
2P-4	SCRUBBER RECIRCULATION PUMP				
2R-1	REACTOR				
2S-1	VENTURI SCRUBBER				
2X-1	AUGER & INTROMITER				

EQUIPMENT LIST

JOB NO. UC-369-100

HIGH RATE ENTRAINED FLOW COAL GASIFICATION PDU

PAGE 3 OF 4

SECTION

EQUIPMENT TYPE

DATE 12/4/81

EQUIPMENT NUMBER	DESCRIPTION	SIZE AND/OR CAPACITY	SHIPPING WEIGHT	VENDOR	COST
2X-2	DELUMPER				
2X-3	STEAM SILENCER				
2X-4	STATIC MIXER				
3C-1	WATER SOFTENER				
3C-2	INSTRUMENT AIR DRYER				
3CY-1	HYDROCLONE				
3D-1	DEAERATOR				
3D-3	AIR RECEIVER				
3F-1	SLURRY FILTER				
3K-1	PLANT AIR COMPRESSOR				
3P-1A,B	DEAERATOR FEED PUMP				
3P-2	DRUM FEED PUMP				
3P-3	CAUSTIC (NaOH) PUMP				
3P-6	RECYCLE WATER PUMP				
3P-7	BOILER CHEMICAL PUMP				
3P-8	CORROSION INHIBITOR PUMP				
3T-1	DEAERATOR FEED TANK				
3T-2	CAUSTIC (NaOH) TANK				
3T-3	SALT SOLUTION TANK				

EQUIPMENT LIST

JOB NO. UC-369-100

HIGH RATE ENTRAINED FLOW COAL GASIFICATION PDU

PAGE 4 OF 4

DATE 12/4/81

SECTION

EQUIPMENT TYPE

EQUIPMENT NUMBER	DESCRIPTION	SIZE AND/OR CAPACITY	SHIPPING WEIGHT	VENDOR	COST
3T-4	BLOWDOWN TANK				
3T-5	BOILER CHEMICALS TANK				
3T-6	CORROSION INHIBITOR TANK				
3X-1	WASTE WATER POND				
3X-2	FLARE				
3X-3	RECYCLE WATER POND				
3P-11	EMERGENCY COOLING PUMP				
3T-	HOLDING TANK				
3P-10	RECYCLE WATER SPRAY PUMP				

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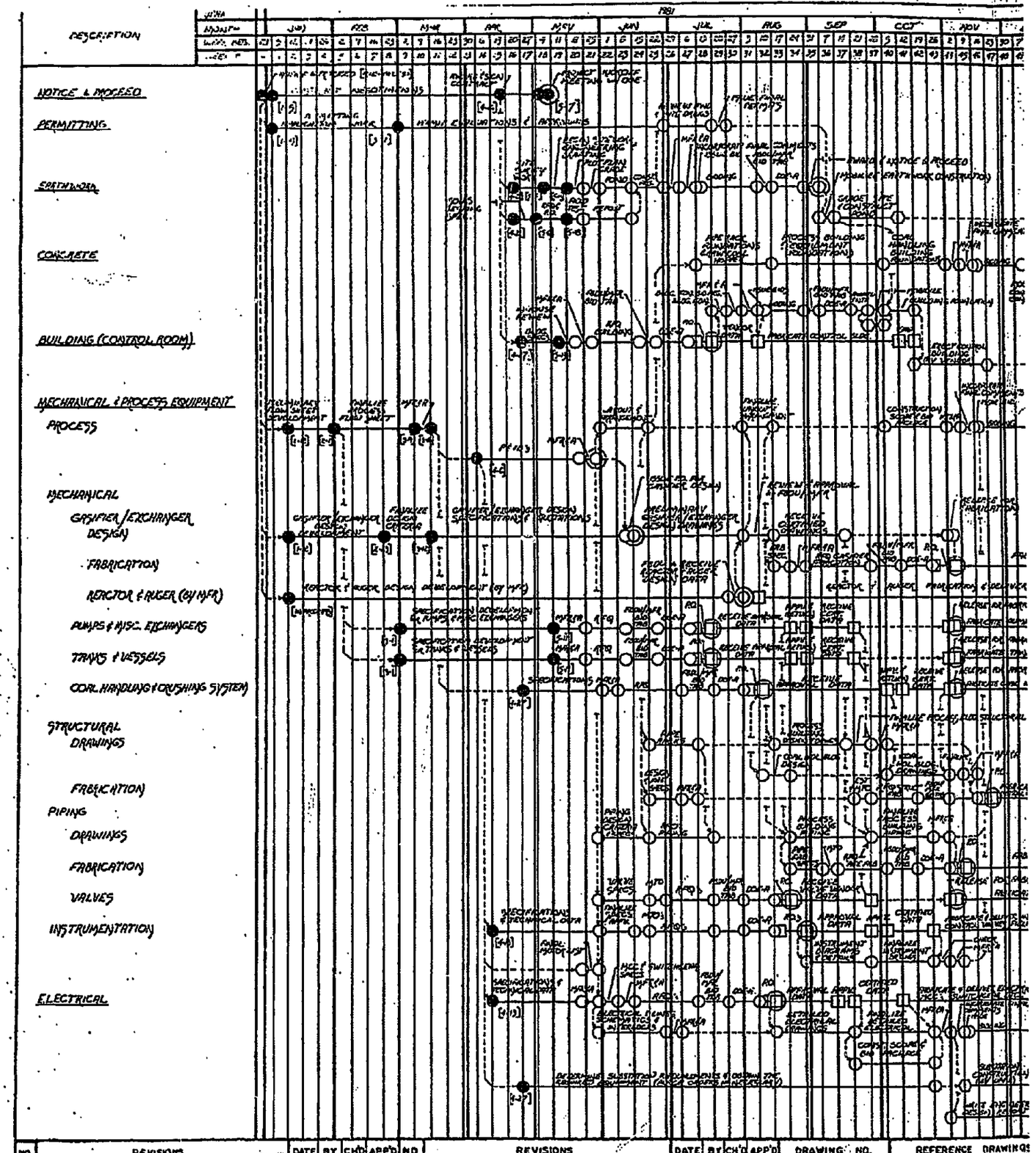
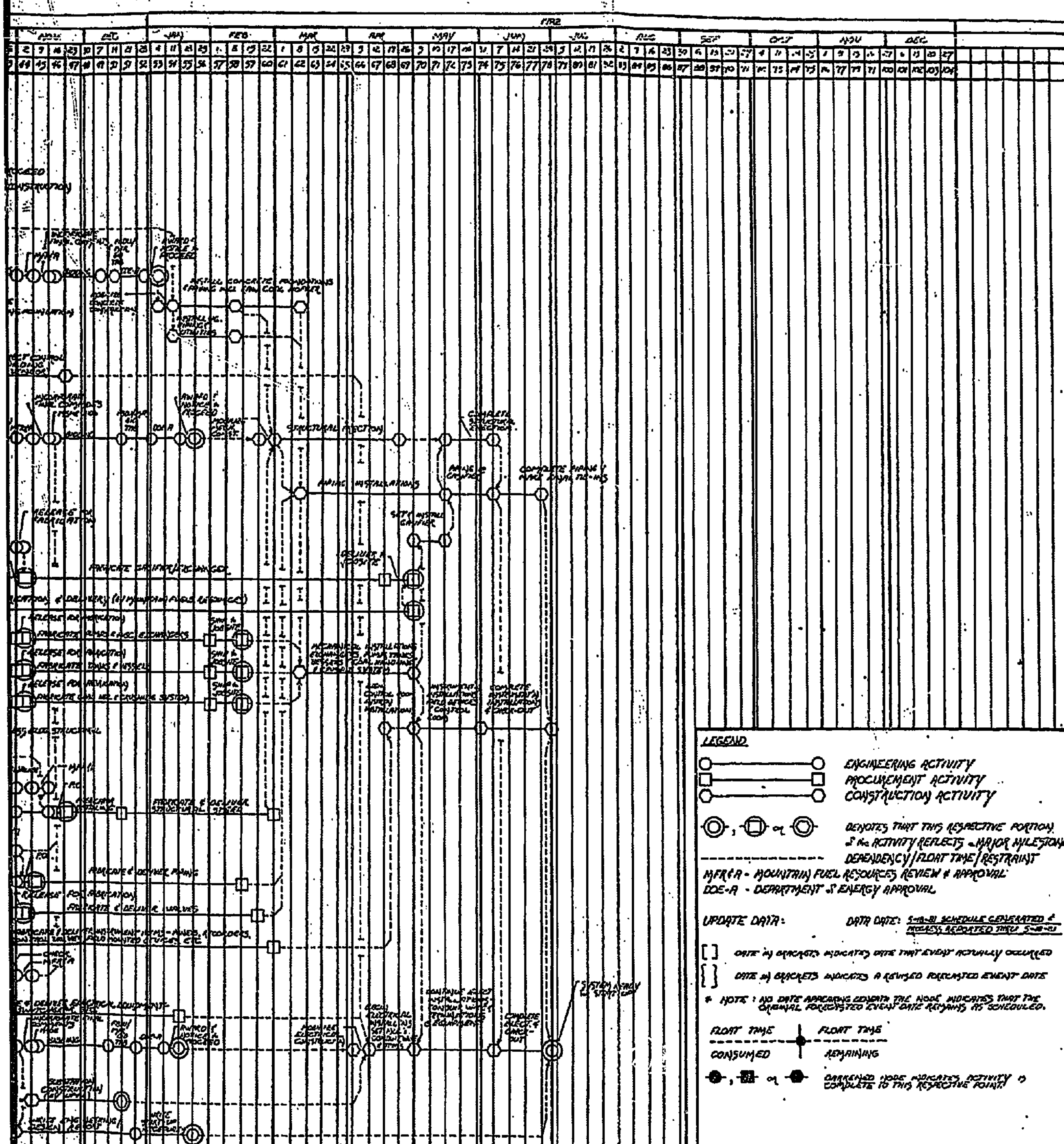
ATTACHMENT B



NO	REVISIONS	DATE	BY	CH'D	APP'D	NO	REVISIONS	DATE	BY	CH'D	APP'D	DRAWING NO.	REFERENCE DRAWINGS
A	SCHEDULE GENERATED & PROCESS ADOPTED	5/8/81	MHE										



THE PROJECT SCHEDULE REPRESENTED ABOVE IS BASED UPON TWO SEPARATE DOE FUNDING ALLOCATION PERIODS FOR THE FY80-81 AND FY81-82 FISCAL YEARS. MAJOR MECHANICAL CONSTRUCTION IS CONTINGENT UPON FUNDING ALLOCATION FOR THE FY81-82 FISCAL YEAR.

Ford, Bacon & Davis Utah Inc.
ENGINEERS-CONSTRUCTORS
SALT LAKE CITY, UTAH

PROPOSED PROJECT SCHEDULE FOR
30 TON PER DAY COAL GASIFICATION PLANT
PHASE I-ENGINEERING & CONSTRUCTION
FORD, BACON & DAVIS UTAH & MOUNTAIN FUELS RESOURCES

SCALE	JOB NO.	DRAWING NO.	OWNER DWG NO	REV.
NONE	UC-319-100	D—367-SCH-004		A

REFERENCE DRAWINGS

ISSUE RECORD				
DATE	ISSUE	REV	TO	FOR
5/21/81	1	A	MOUNTAIN FUELS RESOURCES	APPROVAL

ENGR. RECORD		
DRAWN BY	WE	5/81
CHECKED BY		
ISSUE JOB		
PROJ. ENGR.	WAS	5/22/81
APPROVED	STC	
APPROVED		

ATTACHMENT C

AUG 12 1981

Attachment C (Page 1 of 2)

Scott M. Matheson
Governor

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

FORD BACON & DAVIS UTAH INC
SALT LAKE CITY UTAH

Alvin E. Rickers, Director
Room 426 801-533-6121

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Community Health Services
Environmental Health
Family Health Services
Health Care Financing and Standards

OFFICES
Administrative Services
Health Planning and Policy Development
Medical Examiner
State Health Laboratory

August 6, 1981
533-6108

Ralph Coates
Director of Research
Mountain Fuel Resources Inc.
Suite 1540
36 South State Street
Salt Lake City, UT 84111

Dear Mr. Coates:

At its regular meeting held on July 17, 1981, the Utah Air Conservation Committee approved the Mountain Fuel Resources Inc. request to construct an experimental coal gasification process development unit in West Jordan, Utah and granted an experimental variance for the project.

The project may proceed under the following conditions:

1. The project may run for a maximum of three years from the date of initial operation.

2. This variance is not renewable.

3. No emissions offset credit will be allowed to Mountain Fuel Resources upon shutdown of the pilot unit.

4. All emission control equipment shall be maintained in good operating condition according to the manufacturer's recommendations.

5. No visible emissions from any source, including the flare, shall exceed 20% opacity as per Section 4.1.2, Utah Air Conservation Regulations (UACR), except as permitted in Section 4.7 (unavoidable breakdowns), UACR. Visible emissions from diesel engines shall not exceed 20% opacity, except for starting motion no farther than 100 yards or for stationary operation not exceeding three minutes in any hour as per Section 4.1.4, UACR.

6. The 1800 ton coal pile shall be compacted and sprayed with water or chemical seals as dry conditions warrant or as determined necessary by the Executive Secretary.

7. Emissions produced from loading of scrape coal into the initial hopper shall be controlled by water sprays at the hopper entrance.

8. All coal handling after the initial hopper shall be inside enclosures as proposed.

9. The baghouse on the coal handling system shall have an outlet grain loading not exceeding .010 grains/dscf. This source shall be stack tested as determined necessary by the Executive Secretary using EPA test methods 1-5.

10. The product gas shall be passed through a venturi scrubber and packed column scrubber for control of particlates as proposed.

11. The Executive Secretary shall be notified when start-up occurs as an initial compliance inspection is required.

In addition, it will be necessary for you to submit, after the conclusion of the project, a summary report to the Air Conservation Committee indicating the environmental and air emission conclusions drawn from conducting this experiment.

Any additional units proposed for construction as a part of this project beyond the initial phase which has been proposed in your current submittal, must be submitted for review and approval to the Executive Secretary, Utah Air Conservation Committee.

Sincerely,

Brent C. Bradford
Executive Secretary
Utah Air Conservation Committee

jw
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ATTACHMENT D

Attachment D

Claim - for your files

Scott M. Matheson
Governor

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Community Health Services
Environmental Health
Family Health Services
Health Care Financing and Standards

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Medical Examiner
State Health Laboratory

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

Alvin E. Rickers, Director
Room 426 801-533-6121

533-6146
August 28, 1981

Mr. Carl L. Oberg, Director of Research
Mountain Fuel Resources, Inc.
36 South State Street
Salt Lake City, Utah 84111

RE: Construction Permit Wastewater Containment and Handling Facilities, Coal Gasification Pilot Plant Located Near Interstate Brick off the Bingham Highway in Salt Lake County

Dear Mr. Oberg:

We have reviewed the plans, specifications and drawings submitted on 20 August 1981, and hereby issue a construction permit for the zero discharge containment ponds and ancillary equipment to contain process wastewater and storm drainage from coal storage areas.

It is our understanding that all process waters will be placed in a sealed pond for desilting and recycle to the process. All ash from the gasification will be sluiced to a second lined containment pond using blowdown water from the recycle system. There will be no discharge from either pond during the life of the pilot plant operation. The ponds are sized for containment of the 10 year 24 hour storm event for the process and coal storage areas. The containment pond will be approximately 117 ft X 60 ft X 5 ft deep with 2 foot freeboard above the design volume of 1.2 acre ft. The recycle pond will be 100 ft X 60 ft X 5 ft and used as interim storage for process recycle water. Both ponds will have emergency overflow devices provided with sufficient riprap to prevent erosion.

Should you have any further questions, please contact us at the above listed number.

Sincerely,

UTAH WATER POLLUTION CONTROL COMMITTEE

Gary B. Pitkin

Calvin K. Sudweeks
Executive Secretary

BLN:drb
cc: Salt Lake County Health Department
Ford Bacon and Davis, Consultants
Attention: Shahab Shary

RECEIVED
AUG 31 1981
MOUNTAIN FUEL RESOURCES, INC.