NOTICE

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The information contained in this report is regarded as confidential and proprietary. It is provided subject to the provisions regarding confidential, proprietary information contained in the Research Agreement among the Participating Parties.

SOCONY MOBIL OIL COMPANY, INC.

RESEARCH DEPARTMENT

MONTHLY PROGRESS MEMORANDUM

(Covering May 1 to June 15, 1964)

ANVIL POINTS OIL SHALE RESEARCH CENTER

Rifle, Colorado

June 15, 1964

CONFIDENTIALITY RELEASED

CONOCO INC

DATE 2/11/92

CONTRIBUTORS:

Mechanical Engineering
Retorting Group
Analytical Laboratory Group
Engineering Analysis

Signed by:

RH Cramer

R. H. Cramer,
Program Manager

NOTICE

The primary object of the Anvil Points Oil Shale Research Center MONTHLY PROGRESS MEMORANDUM is to advise authorized personnel employed by the Participating Parties[1] that various activities are in progress or that certain significant data have been obtained within the Research Center.

These MONTHLY PROGRESS MEMORANDA have been prepared to provide rapid, on-the-spot reporting of research currently in progress at Anvil Points. The conclusions drawn by project personnel are tentative and may be subject to change as work progresses. The PROGRESS MEMORANDA have not been edited in detail.

(1)Socony Mobil Oil Company, Inc. and Humble Oil & Refining Company

MONTHLY PROGRESS MEMORANDUM

(Covering May 1 to June 15, 1964)

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MONTHLY PROGRESS MEMORANDUM

Anvil Points Oil Shale Research Center
Rifle, Colorado

Covering May 1 to June 15, 1964

This is the first of a series of Monthly Progress Memoranda covering activities relating to the Anvil Points Oil Shale Research Center. The format and distribution of these reports is still tentative. These items will be discussed at the forthcoming meeting of the Technical Advisory Committee.

The general organization of this issue comprises a broad statement of items of general interest followed by more detailed reports from key personnel.

I. TECHNICAL ADVISORY COMMITTEE

The first meeting of the Technical Advisory Committee will be held on June 29, 1964 at the Socony Mobil Building in New York City. At the present time the Committee comprises the following personnel:

Socony Mobil	Humble
S. L. Meisel, Chairman	C. D. Geiger
K. H. Elliott	J. R. Felix

Two additional members will probably be assigned shortly by Sinclair Research, Inc. Sinclair Research has indicated by letter of intent dated June 8, their desire to join the program as a participating party.

II. ADMINISTRATION

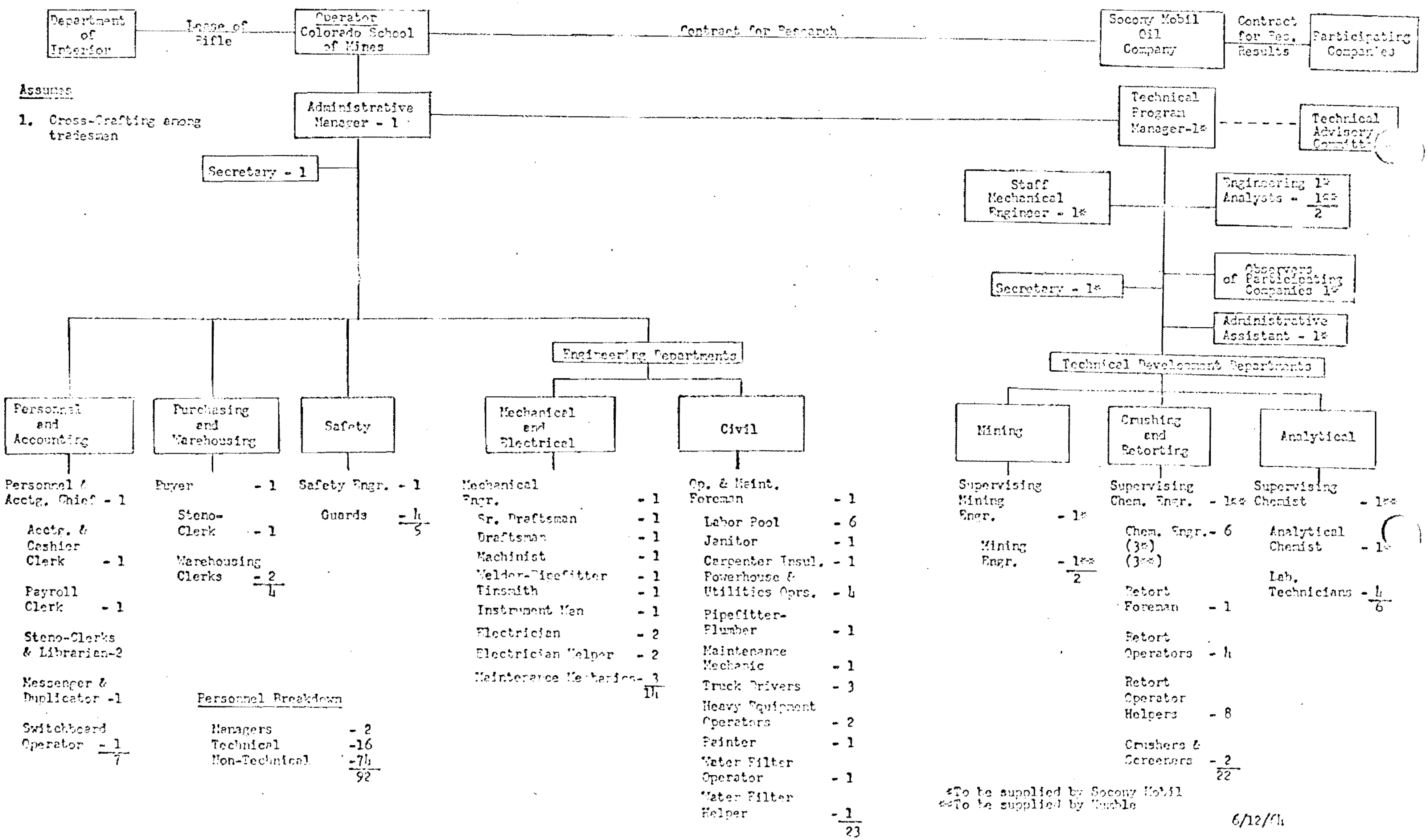
Staffing the Anvil Points Facility has been proceeding according to plan. As of June 15, the Research Foundation personnel on site totaled 39 out of a projected 74. The skills of these personnel were concentrated in the areas of supervision, accounting, purchasing and warehousing, and shops.

The following personnel have been assigned by the Participating Parties:

Socony Mobil		Humble	
R. H. Cramer	Program Manager	J. E. Lawson	Super. Chem. Engr.
W. S. Bergen	Staff Mech. Engr.	P. H. Gifford	Chem. Engr.
P. W. Snyder	Engr. Analyst	C. W. Tyson	Chem. Engr.(Arr.6/22
D. Liederman	Chemist	B. L. Beck	Super. Chemist
Boyd Guthrie	Consultant		
C. J. Verdeur	Adm. Assistant		
T. C. Lyons	Chem. Engr.(Arr.7/1)		
Mrs. Ruth Lawson	Secretary		
To Be Supplied			
2	Chem. Engr.	1	Chem. Engr.
1	Super. Mining Engr.	1	Engr. Analyst
		1	Mining Engr.

An organization chart for the Research Center is attached.

ORGANIZATION CHART FOR STAGE I ANVIL POINTS OIL SHALE RESEARCH CENTER



*To be supplied by Socony Mobil
**To be supplied by Humble

6/12/64

III. MECHANICAL ENGINEERING - W. S. Pergen (Socony Mobil)

Reactivation of the Anvil Points Oil Shale Research Center began May 4, 1964 with the arrival of personnel from the Colorado School of Mines Research Foundation and Socony Mobil at the Bureau of Mines Oil Shale Experiment Station near Rifle. Much progress has been made since that time. Mechanical Engineering assignments and responsibilities have included:

1. Establishment of early plant needs.
2. Survey of rental housing availability, assistance in determining Anvil Points rent schedules, and the determination of Anvil Points housing rehabilitation.
3. Establishment and maintenance of an active PERT schedule for manpower and plant rehabilitation.
4. Redesign and rebuilding of the No. 1 Retort.
5. Coordination and direction of the rehabilitation of the plant to operational status.

SUMMARY

1. The early requirements, such as setting up offices, telephone service, and establishment of a drafting staff and drafting room have been met.
2. Available rental housing was surveyed in a 30 mile radius in an attempt to establish availability of rental units. The Bureau of Mines rental schedules were reviewed for Anvil Points housing. The rehabilitation and maintenance costs for Anvil Points housing were estimated and rent schedules recommended.
3. An active PERT schedule for manpower and plant rehabilitation has been established and weekly review meetings are being conducted to maintain schedules.
4. The No. 1 Retort is in the process of redesign. Draftsmen started work June 1. A tentative flow diagram, proposed piping, layout, and revisions to the shale feed and discharge systems are being drafted. Orders have been written for piping, motor valves, automatic shale feed system, demisters, and recovery equipment.
5. Several meetings have been held with Research Foundation and Project personnel to preplan the rehabilitation of the plant. It has been established that the boiler will be rehabilitated by Research Foundation personnel rather than contracted out to Stearns - Roger Corp.

DISCUSSION

A. Establishment of Early Plant Needs

Upon arrival at Anvil Points, an immediate need for heating equipment was determined, and electric heaters obtained for all offices.

Initial telephone service was established through Mountain States Telephone and Telegraph. A proposal was then developed for permanent telephone service. This proposal included installation of a PBX switchboard, with TWX, WATS, and Intrastate WATS service capabilities. This proposal was reviewed in detail and the following recommendations made to R. H. Cramer:

1. Establish TWX service with automatic answering or unattended night time service. (TWX No. 303-273-3082)
2. PBX service. Accept Mountain States proposal to establish a 756A PBX switchboard. This unit has a capability of handling ten outside trunks and 70 inter-com stations. At present, four outside trunks will be put into service. (Phone No. Rifle 2311)
3. Intrastate WATS and WATS service. Recommended that we do not initiate either of these services at this time until we are able to determine our costs for long-distance telephone service.

Draftsmen and Drafting Room. Applications were received from several draftsmen. Three draftsmen were interviewed; two were hired. These men were able to come to work within one week of hiring and started work June 1. The drafting room was established and drafting machines purchased. An Ozalid was purchased and is being installed this week Recommendations for drafting paper and Ozalid paper were also made and supplies purchased.

B. Housing

At the request of Mr. E. S. Nicholls of the Socony Mobil Paulsboro Laboratory a comprehensive survey was made of available rental housing in nearby towns. The towns of Rifle, Silt, and Glenwood Springs were surveyed to find three-bedroom rental houses. None is available. The present Bureau of Mines rental schedules for Anvil Points houses were obtained. The background information of the establishment of their rent schedules was also reviewed. A comprehensive inspection of Anvil Points houses assigned to the project was made to determine rehabilitation needs and costs. These data were summarized in a report to Mr. Nicholls dated May 11. Recommendations were made and approved to use the existing Bureau of Mines rental schedule for houses for Project personnel.

A detailed set of specifications for the painting of the houses was developed. Three painting contractors were contacted to obtain prices for interior painting of houses in accordance with these specifications. A contract has been let to low bidder to paint houses for technical personnel of Socony and Humble.

Plumbing and heating needs for all of the Project houses was determined. Houses scheduled for occupancy are having furnaces and plumbing systems repaired by Research Foundation personnel.

C. PERT Schedule

The PERT schedule for plant rehabilitation and man-power hiring has been in constant revision to reflect current needs and thinking. Weekly meetings are being held between R. H. Cramer, W. S. Bergen and J. M. Petty, S. D. Gorsuch, and L. . Lewis of the Research Foundation to insure rehabilitation of the plant as scheduled. To date, no serious difficulties are expected. Man-power hiring has been, if anything, ahead of schedule. A copy of the latest PERT of June 11 is attached.

D. Redesign No. 1 Retort

Meetings were held with J. E. Lawson to review in detail the proposed redesign of No. 1 unit. It will be designed for a shale flow rate of 750 lbs./(Hr)(Ft^2). Recycle gas will be at 16,000 SCF (standard cubic feet) per ton and the air rate at 4,000 SCF per ton. A 15 percent variation from these conditions is being designed into all equipment. The details of the shale flow feed system, the shale discharge system, recovery system, equipment control system, and product recovery systems were reviewed with J. E. Lawson prior to initiation of drafting. The piping has been designed, recovery equipment sized, and control diagram tentatively established. Work is in progress on establishing the details of other parts of the unit.

Since this is essentially a low temperature - low pressure process, Victaulic couplings will be used for most of the piping. This coupling system is adaptable to commercial equipment and should represent a considerable saving in construction if it proves successful in our operations.

A Syntron gravimetric feed system to automatically set rates for shale feed is planned. An automatic shale level control system at the top of the retort will be installed. This control system will activate the spent shale discharge mechanism.

Studies are in progress to design a line burner for preheating combustion air and dilution gas. Since the retort off-gas has a very low BTU heating value, difficulties are expected in the maintenance of flame in the burner. Initially, this gas will be enriched and attempts will be made to maintain combustion with oxidation-promoting catalyst systems. The details of this combustion promoting catalyst system are being developed and hopefully may be patentable.

Present plans indicate that drafting for all equipment for No. 1 Retort will be completed in early July; construction will begin the last week of June. Present schedules indicate reconstruction completion by the week of August 9.

E. Plant Rehabilitation

Close coordination is being maintained with the Research Foundation relative to the rehabilitation of the plant in accordance with the predetermined schedule.

The steam boiler proposal from Stearns - Roger Corp. has been reviewed and a decision made to reactivate the boiler with Project personnel. Early hiring of four people for this work was approved. The boiler rehabilitation is scheduled for completion by June 28.

Clean-up of various buildings was started May 20, and is going according to schedule.

The Richardson Scales are being inspected this week to establish repairs. This work was contracted to Richardson Scales Co.

Office needs have been established, and authorization granted to purchase equipment.

Housing rehabilitation was started May 29 with house No. 1 at Anvil Points. Several houses have been occupied to date by Research Foundation personnel. Painting of the houses for technical personnel will start June 15.

Analytical needs have been established by R. L. Beck and much equipment ordered.

IV. RETORTING GROUP - J. E. Lawson (Humble

SUMMARY

This period was mostly spent in planning activities related to rehabilitation, staffing, and start up of the cooperative oil shale research program. Specific activities included:

1. Design work and decisions related to rehabilitation of Retorts Nos. 1 and 2.
2. Interviews with three prospective retort engineers.
3. Preparation of objectives of the retorting program during the remainder of 1964.
4. Establishment of the 1964 operating budget for retorting.
5. Preparation of retort operating schedules consistent with the program objectives..
6. Planning of technical assignments to be executed by retort engineers in order to implement the retort program.

DISCUSSION

Design work accomplished included, primarily, participation in decisions regarding the design basis for rehabilitation of Retorts Nos. 1 and 2 and consultation with W. S. Bergen regarding piping revisions, mist recovery facilities, instrumentation, and purchase of improved raw and spent shale handling facilities. Details of these decisions are reported elsewhere.

Interviews were conducted with Messrs. F. H. Gifford and C. W. Tyson of Esso Research and Engineering Co. and with Mr. T. C. Lyons of Socony Mobil. All of these individuals subsequently accepted assignments as retort engineers with the program.

Specific objectives outlined for the remainder of the year included pilot plant operations to provide operator training, shakedown and testing of new shale handling and mist recovery facilities, demonstration runs to duplicate Bureau of Mines data, studies to determine flow characteristics of the retorts, test runs to establish the maximum shale throughput of the existing retorts, and test runs to determine the effect air preheat, nucleating agents, and gas cooling rate on retorting yields, operability, and oil quality. Also included in the program are tests to establish the operability of the line burner installation and the feasibility of utilizing retort off-gas as fuel for the line burner. Preheating combustion air is expected to permit substantial increases in shale throughput and to result in improved operability. Objectives for mechanical model studies are directed at gathering design information on air and gas distributors and shale feed and drawoff systems.

Pilot retort operating schedules were prepared to implement the above objectives. Also, some forty individual technical assignments were listed and completion dates scheduled for these assignments, in order to implement the retort and mechanical model studies planned. A PERT diagram encompassing the retort schedules, mechanical model studies, and prosecution of related technical assignments was prepared to aid in communicating programed objectives. Finally, retort operating costs and mechanical model operating and construction costs were evaluated, and these costs allocated among the individual phases of the retort and mechanical model programs in order to provide perspective as to costs of the individual objectives.

V. ANALYTICAL LABORATORY GROUP - B. L. Beck (Humble)

SUMMARY

The two technical people from the initial participating companies have arrived at Anvil Points on a temporary basis. A list of proposed initial analytical tests have been prepared. Using this list as a guide, and considering the useable equipment in the laboratory, additional equipment required was itemized, and for this a $14,000 budget for 1964 was estimated. Although no rehabilitation work has been started in the laboratory building, about 95 percent of the initial equipment order has been completed.

DISCUSSION

A. Personnel

The two technical people assigned to the analytical laboratory, B. L. Beck (Supervisor) from Humble Oil and Refining Company and D. Liederman (Chemist) from Socony Mobil Oil Company, Inc. have reported to Anvil Points. B. L. Beck has spent approximately four weeks at Anvil Points, and a day at the Colorado School of Mines Research Foundation at Golden discussing laboratory problems. D. Liederman has spent one week at Anvil Points, and three days at the U. S. Bureau of Mines at Laramie studying oil shale and shale oil analyses.

B. Tests

Shale oil literature, data on Bureau of Mines test runs, and old reports and forms were consulted to obtain an idea of what tests were normally performed on the shale, oil and retort gases. Using these sources and discussions with current Anvil Points personnel, a list of proposed initial analytical tests was prepared and distributed. Initially nine tests on shale, twelve tests on oil, and two tests on gases were proposed.

C. Budget

Based upon the initial proposal of tests required and a survey of the facilities and equipment in the laboratory building, an estimated laboratory equipment budget of $14,000 for 1964 was prepared. Major items included balances, carbon-hydrogen analysis equipment, distillation assemblies, viscometers, gas chromatograph, and Fischer retort equipment.

D. Equipment

Plans are to use equipment (with modern improvements) similar to that used here under the Bureau of Mines with two major exceptions.

Electrical heating of the Fischer retorts recently developed at the Bureau of Mines at Laramie and more recently adopted by the Colorado School of Mines at Golden will replace the older gas burner heating. The Anvil Points system will be in between the simple manual control system at Golden and the completely automated system at Laramie in both cost and complexity.

Gas chromatography will be used for analysis of the gases from the pilot plant retorts, replacing the older Orsat analysis.

The initial ordering of equipment, which has been hindered by the lack of selection of catalogs, is about 95 percent complete. The remainder should be completed by June 19; although this date is a little behind the PERT diagram, the delivery times are such that no future delay in schedule is anticipated.

E. Laboratory Rehabilitation

Although there has been no rehabilitation or clean-up of the laboratory building to date, this has not seriously hindered the progress of the analytical group. What is required is a good cleaning, discarding much useless trash, and rearrangement of most of the equipment. Many of the tests performed previously by the Bureau of Mines are not required now. One or two of the excess rooms will initially be used for storage of obsolete or unused equipment. A proposed physical arrangement of the tests has been prepared. Work is expected to start on the building the week of June 22.

VI. ENGINEERING ANALYSIS - P. W. Snyder (Socony Mobil)

A. Rehabilitation

Objective: Relocate, establish communications link with Socony Mobil Computer Center, and assist with the design of the retort modifications and the development of the program budget.

DISCUSSION

1. Relocation

The necessary files and reference books for oil shale engineering analyses have been transferred to Anvil Points. Several file drawers of Bureau of Mines retorting and refining reports have been collected. These will be filed in the library as soon as a librarian becomes available.

A file system of new and background technical data will be developed by July 1.

A recommended reading list to aid in orienting new retort engineers has been prepared and sent to J. E. Lawson.

2. Computer links

Arrangements have been made with Socony Engineering Department to use their "Real Time" teletype IBM-1410 computer system to calculate retort material and heat balances. This system will permit the engineers to spend more time at engineering and provide rapid determination and analysis of retorting results. A letter has been sent to the Socony Mobil Computer Center requesting that our teletype be included in the "Real Time Systems". A sample material balance calculation is being developed to send to the Socony Mobil Engineering Department for programing into this system.

The IBM 7040 located at Socony Mobil's Princeton Laboratory will be used, via E. F. Kondis at the Paulsboro Laboratory, to make the mathematical model calculations.

3. Program Budget

The Initial Program objectives and budget for 1964 have been completed cooperatively with J. E. Lawson and R. I. Beck.

B. Engineering Analyses

Objective: Make mathematical process variable studies to establish the conditions which need further experimental definition and develop guidelines for interrelating the economics of mining, crushing, and retorting.

DISCUSSION

1. Process Variable Study with Math Model

A factorial program to analyze the effects of the major variables using the math model has been designed and E. F. Kondis at Paulsboro will expedite it. This program will analyze the following range of conditions:

Shale Size, inches	1 to 3
Shale Rate, lbs./(hr)(Ft^2)	300 to 750
Recycle Gas Rate, SCF/T	13,000 to 18,000
Air Rate, SCF/T	4,000 to 5,000
Air-Dilution Gas Rate, SCF/T	Ambient to 1,000°F.
Height Above Air Distributor, Ft.	6 to 10

2. Economic Guidelines

An analysis of the effect of size reduction on the requirements for a three stage crushing plant has been made. The product distributions reported by the Bureau of Mines (Report of Investigations No. 5563) was used as the basis. This analysis indicates that the requirements are not severe for producing 4" - ¼" or even 3" - ¼" oil shale. However, they go up very steeply when producing 1" - ¼" shale as shown below:

Crushing Requirements for Processing
28,000 T/D of Mined Oil Shale[1]

Product Size, inches	4 - 1/4	3 - 1/4	2 - 1/4	1 - 1/4
Total Crushing Capacity (Including Recycle), T/D	29,000	34,000	40,000	47,000
Power Required, KWH/D	24,000	30,000	40,000	70,000
Fines Loss (<1/4"), Wt. % Mined Shale	5	7	11	22

(1) Bureau of Mines estimated unit mine capacity.