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CONFIDENTIAL

MINUTES OF THE NINETEENTH REGULAR MEETING
OF THE OIL SHALE TECHNICAL ADVISORY COMMITTEE

Anvil Points Oil Shale Research Center
Rifle, Colorado

July 13, 1967

The meeting convened at 8:30 a.m. with the following

members in attendance:

- K. M. Elliott, Chairman, Mobil Oil Corporation
- S. L. Meisel, Mobil Oil Corporation
- W. O. Taff, Humble Oil and Refining Company
- W. L. Jensen, Continental Oil Company
- J. H. Smith, Continental Oil Company
- R. T. Ellington, Sinclair Oil and Gas Company
- G. A. Blaine, Sinclair Research, Inc.
- D. C. Smith, Phillips Petroleum Company
- R. V. Smith, Phillips Petroleum Company
- R. Mungen, Pan American Petroleum Corporation
- K. L. Berry, Pan American Petroleum Corporation

H. P. Dengler of Esso Research and Engineering Company was absent.

I. Old Business

Minutes of the 18th regular meeting (May 11, 1967) and the second special meeting (May 31, 1967) were approved as distributed. There was no other old business.

II. New Business

It was decided not to schedule the next regular meeting until after a decision has been made concerning an extension.

R. H. Cramer reported that the unfavorable variance was \$43,000 and the Stage II funds are estimated to run out about October 1, 1967 assuming the current rate of expenditure. The

current manpower level is 24 from the Participating Parties and 128 from the Research Foundation. It was pointed out that the manpower situation was becoming critical especially in the mine. Skilled mechanics and instrument people were a particular problem.

R. H. Cramer reviewed the objectives of the program and summarized the major conclusions. The members of the staff presented the results of the past two month's work. Detailed write-ups of the presentations including handouts are attached as an appendix.

A. Discussion of Working Hypothesis and Bench-Scale Retorting

It was concluded that the most probable mechanism of failure in Retort No. 3 is the cohesive mass - agglomerate - clinker route described in K. I. Jagel's presentation and handout. No other mechanism is felt to have comparable significance. Four limits to yield with the conventional Gas Combustion process were also presented. First and most important is the limit posed by the minimum temperature and pressure achieved in the recovery train. The other limiting factors are intraparticle temperature gradients, the time-temperature history of the particles, and the possibility of losing yield due to combustion or cracking in the bed.

The bench-scale efforts during the past two months were concerned with disengaging liquid oil from the bed of a 3.6-inch I.D. retort. This unit was operated at mass rates of 500 and 930 lbs/(hr)(ft²) with and without liquid removal.

When the disengager was used, liquid oil was removed from the bed at about 600 F and satisfactory operation was achieved. When the disengager was not used, an agglomerate formed which prevented shale flow.

Yields at 500 lbs/(hr) (ft²) shale rate were 95% Vol raw shale Fischer Assay or higher.

The yield at the 930 lbs/(hr) (ft²) mass rate was about 83% Vol raw shale Fischer Assay with considerable oil left in the spent shale.

Based on this work, a scheme was proposed to test the principle of liquid removal in Retort No. 3. The design is primarily a single level drawoff deck with slotted sides to drain liquid from the bed by gravity. Down spouts below the deck provide the pressure drop to drive the cyclones which remove some of the oil mist and dust. A recommendation was made by the staff that this design be evaluated early in August.

This portion of the technical presentation provoked a lively discussion in several areas. These included: failure mechanisms in general, the presence of liquid pools versus wetted particles under operable and inoperable conditions, the comparison of hardware in Retort No. 3 versus Retort No. 2, and the differences in the temperature profiles in the bench scale retort compared to Retort No. 3. Much of this discussion centered around the question of the applicability of the bench scale results to Retort No. 3.

A suggestion was made to determine the carbon content of the agglomerate sample from the bench-scale retort and compare it with the mass of spent shale. A high carbon would lend credence to the theory.

B. Retort No. 3

The operability experience with 1/4 to 1 inch and 1/4 to 2 1/2 inch shale was discussed from the time the Mobil Task Force recommendations were implemented in May.

The tentative conclusions drawn from the evaluations of 1/4 to 1 inch shale at a mass rate of 300 lbs/(hr)(ft²) were as follows:

- (1) An inert bed is not necessary to obtain a successful startup.
- (2) Dilution gas is not a necessary factor for a successful startup.
- (3) Dilution gas does appear to be desirable as insurance in a sustained operation with this air distributor configuration.
- (4) The richness ceiling appears to be in the order of 32 gallons per ton.
- (5) The open air distributor design appears to be a major factor contributing to the improved operability.
- (6) Current yields with the 1/4 to 1 inch shale are substantially lower than obtained in Retort No. 2.

The discussion of the 1/4 to 2 1/2 inch shale experience centered around the continuous 17 1/2 day run which is the longest sustained operation to date in Retort No. 3. It was pointed out that this operation was impressive by

the ability of the process to adapt to changing conditions. At 300 mass rate the yield reached about 86% Vol raw shale Fischer Assay with an assay of 29 gallons per ton. At 400 mass rate, the yield was roughly 83% Vol raw shale Fischer Assay at a 29.5 assay. At 500 mass rate, the maximum yield level appeared to be in the order of 82% Vol raw shale Fischer Assay with an assay of about 26 to 27 gallons per ton. After completing the 17th day of operation, the gas rates were increased to force a shutdown. The conclusions concerning 1/4 to 2 1/2 inch shale are outlined below:

- (1) The low line burner temperature startup procedure is satisfactory.
- (2) The operability is entirely satisfactory at 300, 400 and 500 mass rates.
- (3) Dilution gas is not necessary.
- (4) The yields at the 500 mass rate are some four volume percent lower than in Retort No. 2. This is because of the lower gas rate limit in Retort No. 3 compared to Retort No. 2. However, at the same gas rate the yields are comparable based on the regression analysis.

C. Mining

The mining presentation was limited to hitting the technical "high spots" in an effort to speed up the session. The status of the mining program is summarized below:

- (1) Our heading operation is now 95% complete.
- (2) The benching has been started and we hope to complete it in the early part of September.

- (3) The roof appears to be stable, even in the crosscut areas at the northwest end of the mine.
- (4) The pillars are also in a stable condition, our instrumental and visual observation shows that they are supporting the load.
- (5) The bench scale test work is approximately 90% complete.
- (6) Our drilling and blasting development work is drawing to a close, there are still some short experiments to be run on bench blasting.

D. Other - Visit of Ex-Senator Paul Douglas (D-Ill)
and Entourage on July 11, 1967

Mr. Paul Douglas and party, including press, visited Anvil Points on July 11. The group was taken on a tour of the old and new mine, the crusher, Retort No. 3 and the refinery.

In discussions the following points were stressed:

- (1) Recovery of oil from shale is complex and must be performed on a large scale to be economic.
- (2) Anvil Points deals only with the technical aspects of oil shale.

Nothing of a confidential nature was disclosed.

The visit was pleasant and appeared to have gone about as well as could have been expected.

A memorandum is being prepared on the visit.

III. Executive Session

Program planning and final reporting were deferred until the executive session because of the interaction with discussion of the proposed Stage II extension.

A. Immediate Program Plans

The study in progress was directed toward increasing the yield on 1/4 to 1 inch shale by improving the heat distribution in the retort through the use of a yoked air distributor (36 bayonets). The major question is whether operability suffers as a result of the more complicated design.

Regarding the program beyond the current study, two alternatives were discussed. The first involved modifying the process to explore the benefits of removing oil from the retort bed. The second involved demonstrating the existing process for about 30 days on 1/4 to 2-1/2 inch shale. The great majority of the staff recommended the alternate of exploring the concept of oil removal.

After much discussion, the consensus advice from the Committee was to explore the oil removal technique. Taff dissented, being in favor of either shutting the operation down immediately or working on the existing process to improve operation with 1/4 to 2-1/2 inch shale.

B. Extension Program Alternates

The alternates available during a six month extension were discussed. On one extreme, the existing process can be considered economically acceptable therefore, an extension could be used to further define and demonstrate it. On the other extreme, the existing process can be considered unacceptable on the basis of economics or

operability; therefore, a maximum effort should be directed toward modifying the process to improve operability and yield.

Consensus advice from the Committee indicated no interest in further demonstration of the unmodified Gas Combustion Retort during an extension and that future activities should be directed toward modifying the process to make major improvements in operability and yield.

C. Stage II Extension

Mobil will send a letter out before August 1 proposing a six month, \$1.2 million extension. A reply will be requested by August 15, 1967. (Date for reply was changed later to August ²²~~21~~, 1967.)

Cramer reviewed briefly contingency planning which will be implemented in the event that Stage II is not extended. Experimental work would cease about September 1 and Research Foundation staff would be cut back. Report writing, restoration of facilities and property transfer would commence. Sufficient funds should be made available for these activities by thus curtailing experimentation.

D. Final Reporting

Cramer reviewed the plan for final reporting which had been discussed at the November 8, 1966 meeting. Essentially, three levels of reporting will be implemented:

- (1) Top Management - a single volume summary report covering the entire project.
- (2) Middle Management - Six or seven reports, each summarizing the work in a specific area, i.e. mining, retorting, etc. Outlines

for these reports had been distributed and discussed in some depth at the Technical Observer's meeting on July 7. Cramer distributed the outlines to the Committee also.

- (3) Technical - The mass of data transmissions, Monthly Progress Memoranda, Technical Memoranda, Weekly Newsletters, Technical Advisory Committee and Technical Observers presentations comprise reporting for this level.

The Committee consensus was that the proposed reporting was very complete. Several members indicated concern that it may be over-ambitious. All companies offered assistance, if it is needed to complete the reporting. In addition, some offered to make Technical Observers available to assist with the reporting.

K. M. Elliott
Chairman

S. L. Meisel
Secretary

8/7/67