J R Conley

Mobil Oil Corporation

RESEARCH DEPARTMENT
PAULSBORO, NEW JERSEY 08066

S. L. MEISEL
MANAGER
APPLIED RESEARCH & DEVELOPMENT

15\06\008\004

PRODUCTION
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June 14, 1967

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K. L. Berry - Pan American Petroleum Corp.
G. A. Blaine - Sinclair Research, Inc.
H. P. Dengler - Esso Research & Engineering Co.
R. T. Ellington, Jr. - Sinclair Gas and Oil Company
K. M. Elliott - Mobil Oil Corporation
W. L. Jensen (4) - Continental Oil Company
R. Mungen - Pan American Petroleum Corp.
D. C. Smith - Phillips Petroleum Company
J. H. Smith - Continental Oil Company
R. V. Smith - Phillips Petroleum Company
W. O. Taff - Humble Oil & Refining Co.

Gentlemen:

Attached is a copy of the minutes of the Second Special Technical Advisory Committee Meeting held in New York City, on May 31, 1967.

S. L. Meisel

S. L. Meisel

ses
Attachment

cc: R. H. Cramer

C to JWH

John W Harry

Mobil Oil Corporation

RESEARCH DEPARTMENT
PAULSBORO, NEW JERSEY 08066

S. L. MEISEL
MANAGER
APPLIED RESEARCH & DEVELOPMENT

June 14, 1967

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cc: R. H. Cramer

15/06/008/004

CONFIDENTIAL

MINUTES OF THE SECOND SPECIAL MEETING OF THE OIL SHALE TECHNICAL ADVISORY COMMITTEE

Mobil Oil Corporation Headquarters
New York, New York

May 31, 1967

The meeting convened at 9:15 a.m. with the following committee members in attendance:

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

R. H. Cramer, Program Manager, was also present.

Chairman Elliott opened the meeting, stating the reasons for calling the Special Meeting. At the May 11 Regular Meeting, it had been agreed that Mobil would send out a letter about May 19 concerning a Stage II extension and requesting a reply by June 6, 1967. Further, the Committee had accepted the retort program proposed by the staff on May 11, which included a 30 day demonstration run to be made in June. Immediately following the May 11 meeting, alternate program proposals were received from Phillips, Sinclair and Continental which required discussion. The questions Mobil wanted to review were:

1. Should the Anvil Points objectives remain as stated at the start of Stage II, which involved scaling up results achieved on Retort No. 2 to Retort No. 3, or should improved retorting performance be sought? How should the current program be modified depending on which objectives were chosen?
2. What should timing on a Stage II extension request be? Elliott indicated that Project Manager would be guided by the desires of a majority of the Participating Parties.

I. Status of Program

Cramer briefly outlined the status of program work and funds as shown on Handouts 1 and 2. The major accomplishment since the May 11 meeting has been the success in operating Retort No. 3, while charging 1/4 to 1 inch shale. This resulted from implementing the Mobil Task Force recommendations at a 300 lbs/(hr)(ft^2) shale rate. Although yields were low, about 84% versus the 94% Fischer Assay anticipated, operability and stability have been good. Two methods of startup were successfully tried - the river gravel technique and a low line burner temperature - raw shale technique. Of these, the latter appears preferable.

Funds are still expected to run out about October 1, 1967 at the present rate of expenditure.

Taff, Mungen, Jensen, D. C. Smith and Ellington offered services of additional personnel (preferably Technical Observers), to assist in data analysis. They all felt that more data analysis is necessary. Cramer took the offer under advisement.

II. Discussion of Stage II Objectives and Future Program

Considerable discussion was held concerning Stage II objectives. Many of the Committee Members indicated that the level of the Gas Combustion Retort yield and performance achieved during Stage I was not now economically attractive even if it could be achieved. Mungen presented a Pan American cost distribution which indicated that retorting represented only 15% of the cost of producing a pipe-lineable shale oil and concluded that even major improvements in retorting would have only a minor effect on the overall picture.

R. V. Smith reviewed the Phillips proposal which essentially comprised a change in Stage II objectives to develop an improved retorting process. This would involve drastic personnel reduction while bench scale retorting studies were carried out. D. C. Smith stated that demonstration of operability at the level attained at the end of Stage I would still leave him with doubts concerning scale-up to commercial operation. For this, and economic reasons he favored development of an improved process.

Several members expressed opinions that achieving the original Stage II objectives was still worthwhile. These included Mungen, Taff, Dengler, Jensen, J. H. Smith, and Ellington. In addition, Taff questioned whether a cooperative project was suitable to attempt development of an improved process because of the need for interaction with engineering design studies. He further stated that proper development of an improved process involved examination of company's entire outlook on oil shale - economic

studies, criteria for attractiveness, timing, land and water position, governmental attitude, etc. None of this information is now exchanged by the Participants. Taff conceded that high yield and throughput could be attained in the laboratory, but that this was not sufficient reason to depart from original objectives.

Alternate program paths were discussed at length with most of the Committee favoring continued experimentation on Retort No. 3 to improve results with 1/4 to 1 inch and 1/4 to 2 1/2 inch shale, while carrying on concurrent bench scale experimentation aimed at achieving major improvements. The program proposed May 11 (attached) provided the basis for discussion.

Elliott summarized consensus Committee advice to the Program Manager as follows:

> Carry out simultaneously a program on Retort No. 3 to achieve Stage II objectives and bench scale experiments to achieve major improvements. The Committee is satisfied that Retort No. 2 results with 1 to 2 1/2 inch shale have been successfully scaled up on Retort No. 3. (D. C. Smith dissented, stating that he was not convinced that the needed operability for future commercial scale-up had been demonstrated.)

Specific experimentation planned would involve the following:

1. Experiment with 1/4 to 1 inch shale at the 300 lbs/(hr)(ft^2) rate to improve yield.

2. Do not study operation at higher shale rates unless and until yield at 300 lbs/(hr)(ft^2) has been improved. (However, an opinion was expressed that perhaps yields might be improved at higher mass rates.)
3. Study briefly 1/4 to 2 1/2 inch shale operation at 300 lbs/(hr)(ft^2) rate, if an experimental impasse is reached with 1/4 to 1 inch shale.
4. Take probe measurements, etc. on Retort No. 3 to substantiate bench scale work if, in the opinion of the staff, it will not interfere with operations.
5. Continue bench scale experimentation on liquid removal to show its effect on yield and operability and carry out other experiments (mist stabilization, etc.) in the 3.6" laboratory retort.

If results are obtained which indicate a need for major change in program, another Special Technical Advisory Committee meeting will be called.

Cramer asked the Committee if they understood that this advice implied that no experimentation with 1 to 2 1/2 inch shale could be attempted in the next 30 days and that there was a major risk that no long demonstration runs could be carried out. This was understood.

Cramer was requested to set up a staff idea discussion group comprising one member from each company. Members of this group, shown below, would be responsible for keeping their Technical Advisory Committee Member informed and feeding company ideas in for discussion.

Membership[1]

J. E. Lawson - Humble Oil and Refining Company

R. L. Clampitt - Phillips Petroleum Company

J. W. Hasz - Continental Oil Company

R. E. Smith - Sinclair Oil and Gas Company

R. L. McGalliard - Pan American Petroleum Corporation

T. C. Lyons - Mobil Oil Corporation

[1] Set up June 1, 1967

III. Stage II Extension

Cramer stated his opinion that major attrition in the Research Foundation staff could be expected after July 1, unless an extension was announced. As pointed out previously, Foundation personnel will strive to obtain jobs for the 1967-68 winter. Contract maintenance and methods of retaining essential personnel were discussed.

Elliott asked if any company wanted to announce having definitely decided against extension at this time. None did.

After much discussion of risks involved by not announcing an extension, most Committee Members indicated that they did not feel it advisable to approach management on the subject at this

time. It was agreed that an extension, if desired, should be requested about August 1 and the decision would be made no later than August 15, 1967. Cramer was requested to communicate this to both the technical staff and the Research Foundation.

IV. Miscellaneous

Berry and Mungen distributed the attached letter indicating that they now feel that particle size segration could be a major cause of the operability problem in Retort No. 3. Berry asked that work be attempted with narrow range shale, i.e. 1/4 to 1/2 inch - be attempted to minimize segregation. Cramer will review mechanical model group data on segregation to determine whether experimentation with 1/4 to 1/2 inch shale on Retort No. 3 should be carried out.

Meisel reviewed Mobil's reply to Sohio concerning exchange of information, which had been discussed in detail at the May 11 meeting. (The reply has been sent to TAC members.) There was a consensus that this letter represented the views of the Committee.

Meisel and Cramer reported that a Life Magazine reporter and a cameraman had visited Anvil Points to interview Cramer and take pictures. No sensitive areas were photographed. The reporter, Chris Welles, Business Editor, agreed to submit text and photos for review. If Mobil feels these require clearance, they will be submitted to the Participating Parties for review. Comment was favorable on this exposure.

Cramer reported that the auditors had questioned deferred reimbursement of the Torkelson construction superintendent for overtime worked during rehabilitation of Retort No. 3. Cramer had approved this payment, which amounted to $1,300, because reimbursement of construction supervision at straight time for overtime worked is standard practice in the area and Torkelson agreed to submit a statement at the time, during summer 1967, that payment to the employee will be made. The Committee concurred in this action.

K. M. Elliott
Chairman

S. L. Meisel
Secretary

6/16/67

STAGE II ESTIMATED EXPENDITURES TO MAY 31, 1967

Actual Cash Disbursements to May 29, 1967	$ 3,481,000
Accrued Costs	181,500
Estimated Total Expenditures to May 31, 1967	$ 3,662,500
Budget to May 31, 1967	3,620,435
Variance - Unfavorable	$ (42,065)

We estimate present Stage II funds to run out approximately October 1.

ESTIMATED MANPOWER MAY 31, 1967

Participating Parties			25
Research Foundation -	Authorized	136	
	Actual	127	127
	Total		152

CJVerdeur
5/29/67

Operation

Conclusions

- Static gravel startup is unsatisfactory.
- It is difficult to conclude as to the stability of the operation at 500 mass rate because of the startup problems.

- The unit operated very well in spite of a poor startup.
- The operation was stable at 300 mass rate with dilution gas and appeared to be equally stable without it.
- Further studies will be required to determine how much (if any) dilution gas is necessary.
- Yields were lower than expected with and without dilution gas. Average yield: C1037-1 thru 7, 83.4% FA; C1038-1 thru 3, 83.6% FA.

- The current retort configuration with dilution gas yields an operation with 1/4 to 1 inch shale that is resistant to failures of the spent shale withdrawal system and power failures.
- The inert gravel startup does not appear to be a necessary part of the Task Force Recommendation.

TCLyons
5/29/67

SUMMARY OF RECENT OPERATIONS WITH 1/4 TO 1 INCH SHALE - RETORT NO. 3
TASK FORCE RECOMMENDATIONS AND MODIFICATIONS

1. River Gravel Startup
2. Open and Streamlined Air Distributors
3. Perpendicular Air/Recycle Distributor Orientation
4. Dilution Gas Plus Line Burner
5. Roll Feeders
6. Recycle Gas Jet Baffles

Run No.	Startup Procedure	Target Run Conditions	Remarks
C1035 and C1036	Static bed of river gravel while accumulating heat. Move bed at 300 mass rate and bring in shale.	300 Mass Rate (C1035): Air - 5,800 SCF/T Recycle - 10,500 SCF/T Dilution - 2,500 SCF/T Line Burner - 900 F 500 Mass Rate (C1036): Air - 5,500 SCF/T Recycle - 10,500 SCF/T Dilution - 2,500 SCF/T Line Burner - 900 F	Serious distortion in rock flow occurred as soon as bed was moved. This caused erratic and unsymmetrical temperatures - a 12-hour line-out at 300 mass rate preceded a smooth 10-hour transition to 500 mass rate (Run C1036) - General deterioration of the operation took place after reaching the 500 mass rate conditions. Unit shutdown with large clinker.
C1037 and C1038	Move river gravel at 100 mass rate during heat accumulation period. Increase mass rate to 300 as shale is brought in.	300 Mass Rate With Dilution Gas (C1037): Air - 5,500 to 5,800 SCF/T Recycle - 10,000 to 10,500 SCF/T Dilution - 2,500 SCF/T Line Burner - 900 F 300 Mass Rate Without Dilution Gas (C1038)	Serious flow distortion of gravel occurred again and temperatures were very erratic as in the previous start-up - Shutdown appeared imminent when unit made a spectacular recovery and lined out at 300 mass rate - Unit operation was extremely stable for four days - Line Burner and dilution gas then were phased out slowly (Run C1038) - Unit operated very smoothly for 36 hours - With no further warning than a slow, general heating-up, the combustion zone temperatures "shot up" quickly and the unit clinkered.
C1039	Conventional shale startup but with low line burner temperature. Two hours - 700 F to accumulate heat in bed. Increase to 900 F for remainder of startup.	300 Mass Rate Air - 5,500 SCF/T Recycle - 10,500 to 11,000 SCF/T Dilution - 2,500 SCF/T Line Burner - 900 F	Startup was very smooth - Unit lined out for 24 hours at 300 mass rate - Spent shale system failure required that unit be "locked in" for 2 1/2 hours with no shale or gas flow - Unit appeared to recover from this upset completely - A subsequent failure of the shale feed system required a second "lock in" for two hours. Following this, it was decided to shut unit down to inspect the internals - Unit was clean which confirmed the complete recovery.

FORM 950 4-64

PAN AMERICAN PETROLEUM CORPORATION

RESEARCH CENTER

4502 EAST 41ST STREET P. O. BOX 591

TULSA, OKLAHOMA—74102

May 29, 1967

File: RM-67-25
551.123

Re: Retort 3 Operability Problem

RHC 5/31/67

Mr. R. H. Cramer
Program Manager
Mobil Oil Corporation
Anvil Points Oil Shale Research Center
Rifle, Colorado - 81650

Dear Bob:

We wish to direct your attention to a basic difference between Retorts 2 and 3 which may be an important factor in the Retort 3 operability problem, especially on small and wide range shale (1/4 x 1 and 1/4 x 2-1/2 inch). Retort 2 has a single-entry feed chute centered on the retort cross-section. As a result, coarser shale tends to segregate at the retort walls which would cause gas channeling up the walls. However, this was compensated for to some extent by the air distributor geometry which tended to generate heat near the center of the retort. (See page 9 of Technical Memorandum 67-7 which states that 50% of the heat was generated in 30% of the area for the four-bayonet distributor.)

Retort 3 has a six-pipe anti-segregation feed system arranged as shown on the attached sketch. This is the first time that a multiple-entry feed system has been used for the gas combustion process. (The USBM used a single-entry feed chute centered on the Retort 3 cross-section, the same system we used on Retort 2.) Also shown on the attached sketch is the position of the new 36-bayonet air distributor with respect to the feed pipes.

It is most likely that the middle air distributor will be in a coarser solids stream then the two outside headers. Gas will tend to channel up the middle causing oil impingement and overheating. The tendency to gas channel could be calculated based on Tom Lyons' model work on pile segregation. We suggest that particle-size segregation coupled with lack of air distributor orientation with respect to such segregation may be the cause of poor operability in Retort 3. It may also have been a cause of inoperability in Retort 2 whenever we tried to achieve uniform air distribution such as with the horizontal distributors and with 10 and 12 bayonets.

We could obtain directional information by removing the present center air distributor and perhaps increasing the percentage of air flow through the 12 bayonets that are directly under the feed pipes, but we

don't think this would be a very good solution, especially when it comes to designing scaled-up operations. We suggest that the top of the unit be redesigned in such a way as to provide true anti-particle segregation by random distribution. We suggest development of a mechanical spreader such as the rotating bell-and-hopper used in blast furnaces, rotating throwers and rakes used in gas producers, spreaders for stokers, etc. After achieving uniform distribution of solids, then it might be possible to achieve operability with uniform, closely-spaced air distribution hardware.

Very truly yours,

Richard Mungen

Attachment

cc: All TAC Members

FORM 371 2-57

PAN AMERICAN PETROLEUM CORPORATION

ENGINEERING CHART

SHEET NO. OF

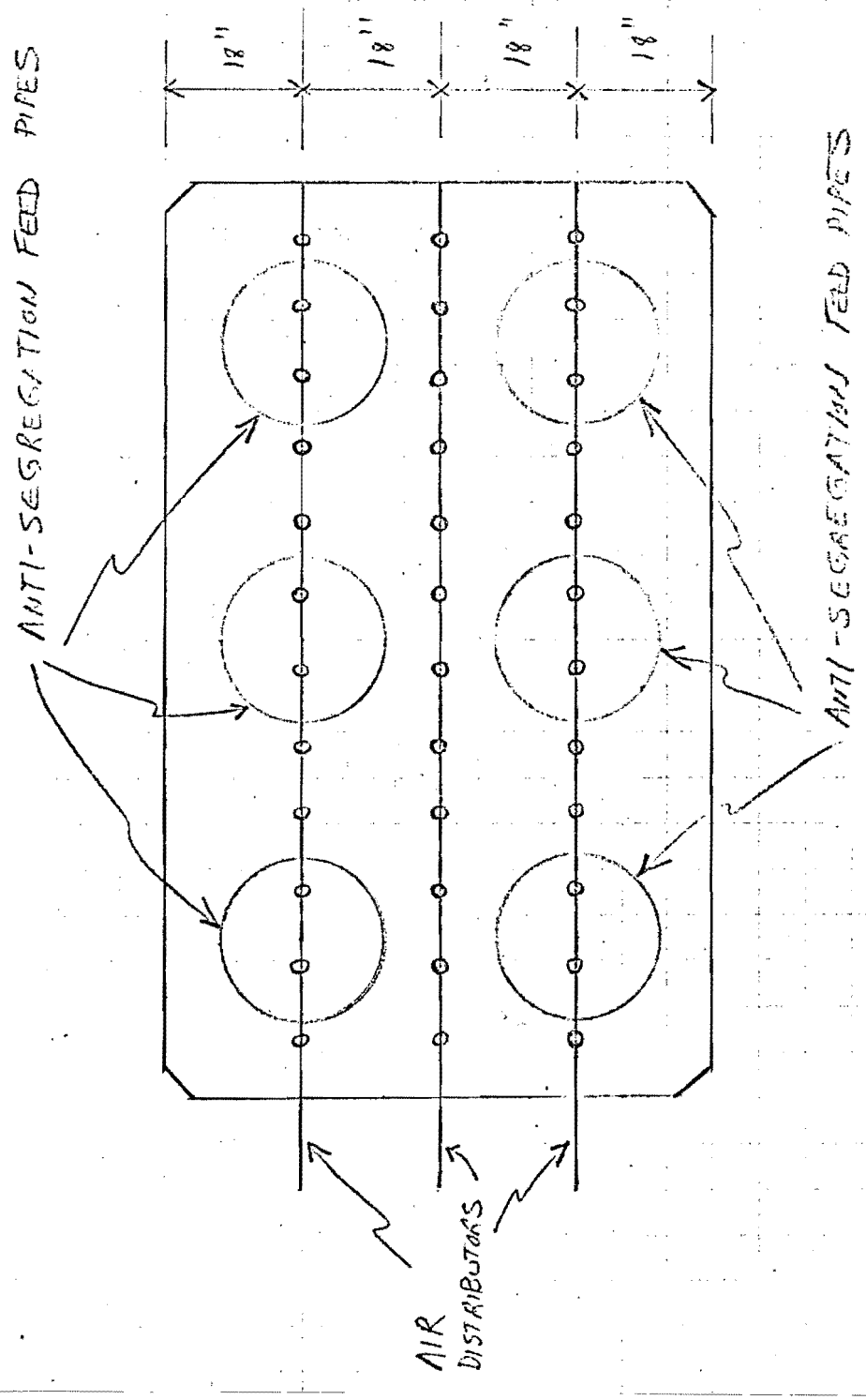
FILE

APP.

DATE 5-17-57

BY JCB

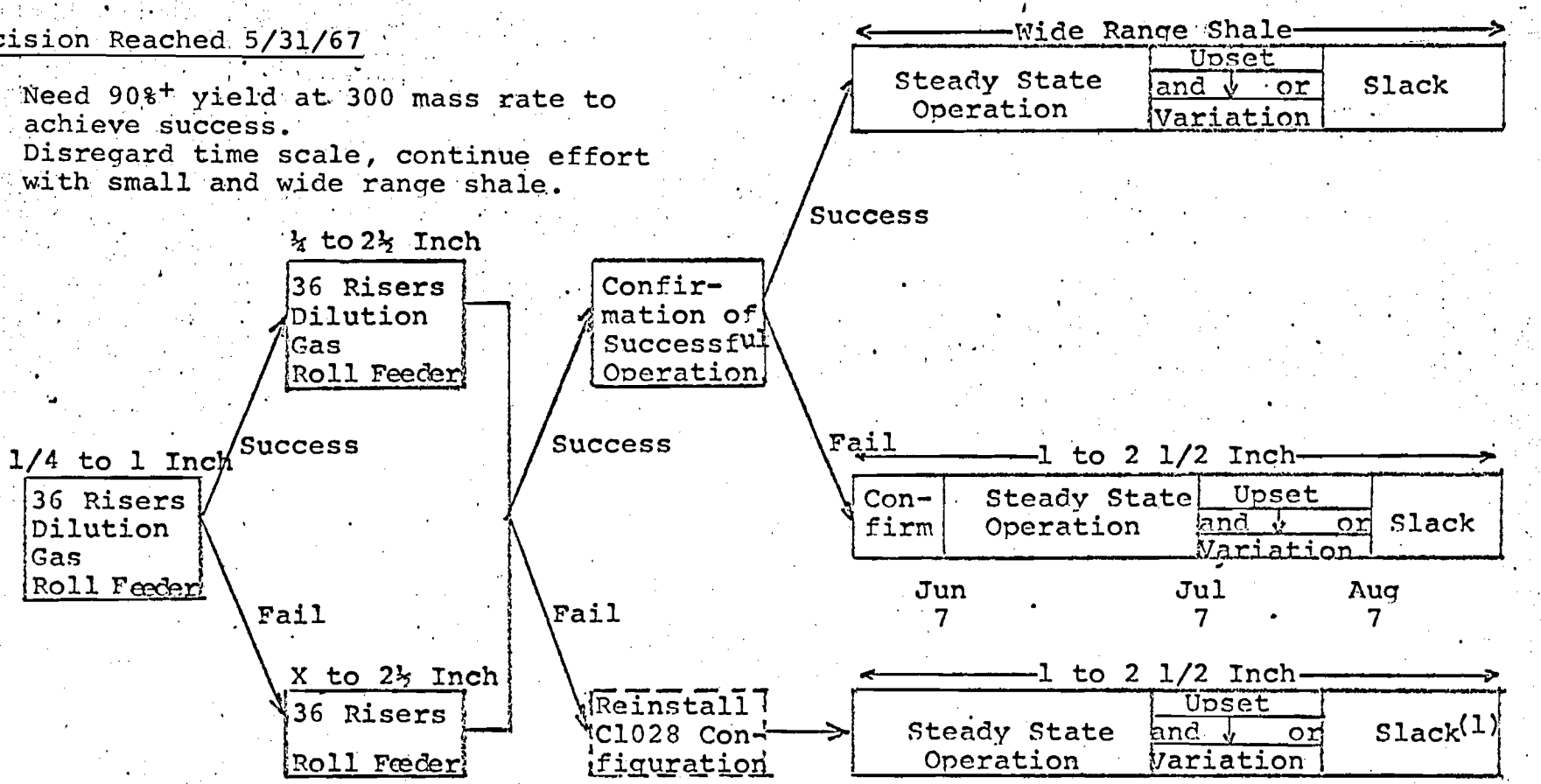
SUBJECT



RETORTING PROGRAM - NO EXTENSION

Decision Reached 5/31/67

1. Need 90%+ yield at 300 mass rate to achieve success.
2. Disregard time scale, continue effort with small and wide range shale.



Bench Scale Exploratory Study of Methods of Improving Operability With Small Shale

(1) Slack time periods at end of program may be used to (a) further define size and size range limits, (b) carry out Retort No. 3 experiments to reduce oil accumulation, and (c) continue demonstration run if desirable.

KIJaqel
5/8/67