

1513015-001

ENGINEERING CENTER

JUN 16 1967

**Mobil Oil Corporation**

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RESEARCH DEPARTMENT  
RIFLE, COLORADO 81650

R. H. CRAMER  
PROGRAM MANAGER  
OIL SHALE RESEARCH CENTER

June 14, 1967

File 108.05

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- K. M. Elliott - Mobil Oil Corporation
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- W. O. Taff - Humble Oil and Refining Company

Gentlemen:

This letter with attachments covers operations on Retort No. 3 from Runs C1035 through C1038-3. Extensive modifications were made to the unit before starting this series of runs. These modifications were made to conform to the recommendations by the Mobil Task Force to achieve operability with the 1/4 to 1 inch shale. The major modifications were:

1. Installation of the roll type spent shale drawoff system in place of the multi-pipe single level drawoff system.
2. Installation of streamlined 36 bayonet type air distributor with headers running east and west, perpendicular to the recycle gas headers. The orifice size in the bayonets were increased to give suitable air port injection velocities at 500 mass rate conditions.
3. Provision for adding dilution gas.
4. Provisions for starting up with an inert material (gravel).
5. Modifications to the oil recovery system to use Tank No. 524 as the oil-water separator.

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6. Modifications to thermocouple layout to conform to new configuration.

Two successful startups with 1/4 to 1 inch shale were made with the gravel and dilution gas techniques. Even though the startups and line out periods were rough the unit lined out and ran satisfactorily at 294 lbs/(hr)(ft<sup>2</sup>) mass rate, 2,460 SCF/T dilution, 10,870 SCF/T recycle and 5,690 SCF/T air rates. Seven 12-hour balances were obtained over a period of four days at these conditions with an average yield of 84% Fischer Assay. An average yield of 83.1% for three 12-hour balance periods were obtained without dilution, although the unit had to be shut down after the third balance due to skewed temperatures. A summary of the operations is given in Table 1. A Log of Operations is given in Table 2.

## C1035 Through PTC1036 (With Dilution Gas)

The unit was started up with a static bed of gravel above the air distributor. After a reservoir of heat had been developed in the gravel, 1/4 to 1 inch shale was fed to the retort and shale and gravel flow was started. The startup with gravel was rough but lined out at 300 lbs/(hr)(ft<sup>2</sup>) mass rate conditions. An eight-hour work-up (C1035) was made during the startup and the introduction of hot dilution gas but the yield results are not meaningful. A 12-hour balance (TRC1036) was made during the transition from 300 to 500 mass rate. The No. 3 screw conveyor failed for a short time just before the transition period balance was completed. Shortly after this, the spread in off-gas temperatures increased and the operations deteriorated. The retort had to be shut down nine hours into PTC1036. The yield data are highly questionable. A clinker was found which extended from the north wall out past the middle air header and covered about three-fourths of the south wall, starting from the east end.

## SUC1037 Through C1037-7 (With Dilution Gas)

The unit was started up for this series of runs with a moving bed of gravel (100 lbs/(hr)(ft<sup>2</sup>)) while accumulating heat in the gravel. The transition from river gravel to 1/4 to 1 inch shale was very rough as experienced in C1035. However, the unit lined out and seven 12-hour material balances were made. The average yield for the seven balances was 84.0% Fischer Assay at average process conditions of 294 lbs/(hr)(ft<sup>2</sup>) mass

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rate, 5,690 SCF/T air, 10,870 SCF/T recycle and 2,460 SCF/T hot dilution gas. The line burner temperature was 900 F. The operations were satisfactory except for the high temperature of the spent shale and the higher temperatures below the air distributor outlet ports as compared to operations without hot dilution gas.

## TRC1038 Through C1038-3

At the end of C1037-7, the line burner and the dilution gas were phased out of the system. The line burner was phased out first followed by the removal of dilution gas with a corresponding increase in recycle gas. This was executed in the first eight hours (approximately) of the transition balance (TRC1038).

Three balances were made without dilution gas. The raw shale rate was hard to hold at a constant rate. The unit appeared to have smoothed out during C1038-2 and the recycle rate was increased to 13,000 SCF/T about four hours before the end of the balance. During C1038-3 the center of the retort began to cool off. The retort operations deteriorated rapidly at the end of the balance. The retort was shut down shortly after C1038-3. A clinker was found in the west middle of the retort extending from the west thermocouple well to the center thermocouple well and from the north header to the south header. The average yield for C1038-1 through C1038-3 was 83.1% Fischer Assay at average process conditions of 297 lbs/(hr)(ft<sup>2</sup>) shale rate, 5,000 SCF/T air and 13,140 SCF/T recycle gas.

The C1037 and C1038 balances were averaged together. The yields and carbon balances fluctuated more than desired so it is more realistic to average the balances. Efforts are being made to eliminate these fluctuations.

We plan to continue our study to stabilize operations and improve yields with the 1/4 to 1 inch shale.

We have reviewed the Terrametrics Inc. raw data on the testing of elastic properties and compressive strength of shale. This data has been transmitted to the Bureau of Mines. We have delayed in transmitting this data to the Participating Parties until it has been run through the computer.

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June 14, 1967

The data from the mining section includes the drilling and blasting record sheets, pillar convergence measurements and roof sag measurements brought up-to-date.

Yours truly,



R. H. Cramer  
Program Manager

EETurner:rl  
Attachments

cc: S. L. Meisel w/o attach

TABLE 1

RESULTS FROM RETORT NO. 3  
WITH AND WITHOUT DILUTION GAS - 1/4 to 1 INCH SHALE  
April 29 to May 24, 1967

Run No.	Date	Shale Size	Da, inches	Dv, inches	Fischer Assay, Gal/T	Shale Rate, lbs/(hr) (ft <sup>2</sup> )	Air, SCF/T	Recycle, SCF/T	Dilution, SCF/T	Line Burner Temperature, F	Offgas Temperature, F	Retort Pressures, in/ft	Overall	Above Air Distributor	Yield, %Fischer Assay	CO <sub>3</sub> Decomposition, Wt%	Spent Shale	Gallons per ton	Ash, Wt%	Temperature, F	Material Balances, Wt%	Overall	Organic Carbon	Water	Remarks	
CI035	5/15/67	1/4 to 1	0.608	0.730	26.2	284	6,100	11,200	1,950	870	139	0.46	0.42	(74.1)	85.1	43.5	0.4	336	363	75.1	75.1	75.1	100.7	95.1	149.6	Static bed of gravel above air distributor used in startup. 8 hour balance during start-up and addition of dilution.
TRCI036	5/15/67	1/4 to 1	0.608	0.712	25.9	396	6,000	11,140	2,2,560	870	143	0.76	0.87		85.1	43.5	0.4	336	363	75.1	75.1	75.1	98.0	94.9	68.8	Transition period from 300 to 500 mass rate. Retort had to be shut down after 9 hours due to skewed temperatures. Unit not on conditions.
PTCI036	5/16/67	1/4 to 1	0.599	0.716	25.9	480	5,610	10,840	2,330	800	159	0.93	0.98		75.1	38.8	3.9	363	363	75.1	75.1	75.1	103	105.8	204.9	Moving gravel bed (100 mass rate) used in startup. Operations appeared satisfactory.
SUCI037	5/18/67	1/4 to 1	0.590	0.711	28.3	288	6,000	11,330	2,550	900	139	0.43	0.35		75.1	46.2	8.8	830	830	75.1	75.1	75.1	100.2	95.1	150.4	Transition period in which line burner and dilution gas were phased out of system
CI037 - 1 Through	5/18 to 21/67	1/4 to 1	0.609	0.720	27.4	294	5,690	10,870	2,460	900	137	0.46	0.40		84.0	36.8	0.4	815	815	84.0	84.0	84.0	100.2	95.1	150.4	Transition period in which line burner and dilution gas were phased out of system
TRCI038	5/22/67	1/4 to 1	0.615	0.725	26.0	301	5,160	11,825	1,380	604	138	0.43	0.36		81.5	40.7	0.0	784	784	81.5	81.5	81.5	98.3	91.5	103.7	Transition period in which line burner and dilution gas were phased out of system

C1038 - 1  
Through  
C1038 - 3  
22 to 23/67  
1/4 to 1  
0.581  
0.711  
24.5  
297  
5,000  
3,140  
---  
---  
137  
0.43  
0.35  
83.1  
44.2  
0.0  
635  
99.2  
99.1  
109.0  
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eteriorated  
t end of  
1038-3  
linker found  
n west center  
f retort

LOG OF OPERATIONS

April 29 to May 24, 1967

C1035 Through C1038-3

4/29-  
5/6/67

Turnaround to make changes proposed by Mobil's Task Force in memorandum "Recommendations of the Oil Shale Retorting Task Force: Emphasis on Achieving Operability of Retort No. 3 by June 1." dated April 12, 1967. Major changes were:

1. Installation of roll feeder with removal of the original spent shale drawoff system.
2. Installation of streamlined 36 bayonet type air distributor running east and west, perpendicular to the recycle distributor.
3. Provisions for adding dilution gas.
4. Provisions for gravel startup.
5. Modification to thermocouple layout to conform to new configurations.
6. Modifications of the oil recovery system. By-passing decanter and using Tank 524 as an oil-water separator.
7. Normal turnaround items.

5/6/67

1530-

1815 Started gravel to retort - with rolls shut off - could not keep gravel from going through retort. West end of south roll feeders were found to be sheared at 1800.

5/6-  
5/9/67

Repaired roll feeder and modified drawoff system to duplicate Bureau of Mines design.

5/9/67

2230 Started all shale systems. Having difficulties with rolls.

5/10/67

Unable to continue testing roll feeder. Bent frame east and west holding north roll bearing.

- 0245 Retort emptied to allow mechanics to work on rolls.
- 1730 Started roll feeders - to run for approximately one hour without shale to retort.
- 1900 Started feeding shale to retort.
- 2010 Roll feeders kicked off twice due to overload.
- 2030 Chain on roll feeders jumped off a cog.
- 2300 Amps on roll feeder still running too high. Emptied retort. Plates welded on east and west side of retort to restrict roll feeder area. Roll feeder opened 1/4 inch to give 1 1/2 inch opening.
- 2320 Started filling retort.
- 2337 Roll feeder on at 600 RPM.

5/11/67

- 0021 Started drawdown test with rolls set at 150 RPM.
- 0022 Increased to 200 RPM.
- 0050 Rolls turned off.

5/11/67

General cleanup  
Assisting mechanics  
Inspected No. 3 screw conveyer

- 2145 Mechanics completed work. Started filling retort.
- 2215 Amps on rolls still running too high. Rolls opening changed to 1 1/4 inch.
- 2320 Started refilling retort.

5/12/67

- 0015 Started 3 ton drawdown test with rolls set at 900 RPM. Amps = 14 to 15.
- 0020 Reduced RPM to 600. Amps = 12.
- 0024 Reduced RPM to 300. Amps = 12.
- 0034 Refilled retort with 2 tons shale.
- 0045 Started 2 ton drawdown with rolls set at 250 RPM. Amps = 13.

- 0110 Retort empty - Filled with 3 tons shale.
- 0132 Started rolls. Roll feeder clutch kicked off.
- 0157 Started rolls. (Amps = 13 to 14)
- 0221 Retort empty. The 2 tons of gravel "free fell" through the rolls.
- 0245 Started filling retort with shale from Bin No. 4 at 16 to 17 tons per hour with rolls set at 300 RPM and amps running from 13 to 15.
- 0740 Retort full but west side is flowing good but level is approximately 1 1/2 feet lower than east side. Bed leveled off top.
- 0740-  
1054 East side of rolls opened slightly (1/16 inch) because west side started flowing faster.
- 1045 Started circulation test at 310 RPM on roll feeder. (Amps = 13 to 14)
- 1145 Started string test.
- 1430 Started drawdown test at 330 RPM.
- 1540 North center raw shale feed inlet pipe empty.
- 1545 Southwest raw shale feed inlet pipe empty.
- 1549 Northeast raw shale feed inlet pipe empty.
- 1552 Northwest raw shale feed inlet pipe empty.
- 1615-  
1930 Drawdown test complete. Shale flowing faster on west side of retort.
- 2345 Started putting gravel in retort. (2 tons)

5/13/67

- 0001 Started drawing out gravel at 850 RPM.
- 0005 Turned roll feeders off. Started getting gravel out of Screw Conveyor No. 2.
- 0010 Started pulling gravel out again. Gravel did not free fall through rolls.
- 0016 Retort empty of the 2 tons gravel above roll feeder.
- 0025 Started filling retort with 1/4 to 1 inch shale from Bin No. 4. Rolls set at 600 RPM.

- 0450 Retort full.  
Roll feeder at 850 RPM  
Raw shale rate at 8.3 tons per hour
- 0510 Started circulation with RPM at 680 to 690.
- 0610 Started string test.
- 0725 Roll feed speed changes although shale flow appears to be constant.
- 0815 Started drawdown. String test looked good, northeast pipe was slow.
- 1000 Shale still flowing faster on west side.
- 1000-  
1610 Mechanics installing plates in retort to equalize shale flow.
- 1610 Added 2 tons shale in retort to check new plates in retort.
- 1630 Shale flow looked even on east and west sides. Started filling retort with rolls set at 400 RPM.
- 1945 Retort full.
- 2000 Started 3-hour circulation.
- 2100 Started string test.
- 2340 Started drawdown test.

5/14/67

0045 Order in which inlet pipes emptied.

<u>Pipe location</u>	<u>Time</u>
north center	0045
south center	0047
southwest	0051
southeast	0053
northeast	0054
northwest	0058

- 0200 Roll feeder speed at 1150 RPM.
- 0350 Drawdown test complete - Flow satisfactory.
- 0520 Started refilling retort for startup.  
Roll feeder set at 600 RPM and raw shale rate at 17 to 18 tons per hour.
- 0725 Started air blower. (Tapes removed off of air distributor outlet.)
- 0915 Retort full.

- 0930 Started 3 hours of circulation.
- 1215 Replaced pins on east and west header valves. Started recycle blower.
- 1240 Started feeding gravel to retort.
- 1515 Discovered plug in multiclone - started steaming.  
Sequence of static bed startup with gravel above air distributor.
- 1600 Turned recycle blower off.  
Fired line burner at 400 F  
Started steaming multiclone again
- 1615 Turned off roll feeders and raw shale feed systems. Increased line burner temperature to 1,400 F for startup C1035.

Time	Temperature, F		
	1820	2030	
	<u>Instrument</u>		
	TR1-1 =	1,030	1,175
	TR1-2 =	830	1,130
	TR1-3 =	410	1,060
	TR1-4 =	190	940
	TR1-5 =	120	350
	TR1-6 =	--	125
	TR1-7 =	--	120
	TR1-13 =	1,040	1,195
	TR1-14 =	800	1,140
	TR1-15 =	395	1,060
	TR1-16 =	150	925
	TR1-17 =	120	275
	TR1-18 =	--	125
	TR1-19 =	--	120
	TR2-1 =	1,040	1,190
	TR2-2 =	900	1,160
	TR2-3 =	575	1,110
	TR2-4 =	295	1,030
	TR2-5 =	115	600
	TR2-6 =	--	160
	TR2-7 =	--	110

- 2205 TR1-7 > 200 F - Started raw shale and spent shale systems.  
Raw shale at 8.4 tons per hour; Rolls at 970 RPM.
- 2245 Started recycle blower - Set recycle at 2,170 SCFM.
- 2305 Reduced line burner temperature to 1,100 F.
- 2330 O<sub>2</sub> = 14.1% Increased line burner to 1,400 F.  
Decreased roll feeder to 350 RPM - Shale rate = 3 tons per hour.

Sequence of Startup

Roll Feeder RPM	Raw Shale T/hr	O <sub>2</sub> Vol%	Air SCFM	Recycle SCFM	Dilution SCFM	Line Burner	Temperatures F			
							TR1-1	TR1-13	TR2	
0010	350	11.3	1,100	2,170	--	1,400	--	--	--	
0020	500	10.2	1,100	2,170	--	1,400	--	--	--	
0025	1,000	8.6	1,100	2,170	--	1,400	--	1,190	--	
0032	1,000	6.7	1,050	2,170	--	1,400	--	--	--	
0035	1,000	5.3	950	2,170	--	1,400	--	--	--	
0040	1,000	4.1	900	2,170	--	1,400	--	--	--	
1050	900	3.1	900	RPM to 1,500	for 5 minutes then back to 900; ESP on.	1,400	--	--	--	
1055	900	2.5	850	2,170	175	1,400	--	--	--	
0100	900	2.0	800	2,170	175	1,300	--	--	--	
0110	900	--	--	2,170	175	1,180	--	--	--	
0113	900	--	--	2,000	300	1,100	--	--	--	
0115	900	1.3	800	1,900	350	1,100	--	--	--	
0122	900	--	800	1,820	350	1,100	--	--	--	
0134	900	1.0	800	1,820	350	1,100	--	--	1,900 Split in offgas temp	
0150	880	--	800	1,820	350	1,000	--	--	--	
0200	860	--	800	1,820	350	900	--	--	--	
0230	860	1.3	850	1,820	350	900	--	--	--	
0249	No. 2 screw feeder went off - back on.									
0250	860	1.5	875	1,820	350	900	--	--	--	
0310	No. 2 screw feeder went off - Improved electrical to keep on.									
0330	860	--	850	1,820	350	900	--	--	--	
0340	860	--	825	1,820	350	900	--	--	--	
0347	860	--	800	1,720	350	900	--	--	--	
0357	860	0.37	775	1,720	350	900	--	--	--	
0415	860	0.27	750	1,620	350	900	--	--	--	
0430	880	--	750	1,520	350	900	--	--	--	
0450	880	--	750	1,420	350	900	--	--	--	
0500	880	--	700	1,420	350	900	--	--	--	
0525	860	0.75	725	1,420	350	900	--	--	--	
0555	880	0.8	750	1,420	350	900	--	--	--	
0609	830	--	750	1,420	350	900	--	--	--	
0610	830	--	800	1,420	350	900	--	--	--	
0640	840	--	800	1,420	350	900	--	--	--	
0655	850	--	800	1,420	350	900	--	--	--	

p. east hot

1  
6  
1

0900 Started PTC1035-1.

1000 TR4-7 in grid section below air distributor still cooling off.

1100 Grid temperatures.  
 TR4-7 = 550  
 TR4-8 = 770  
 TR4-9 = 810  
 TR4-12 = 810

1635-  
 1650 Pressure profile taken above air distributor with special probe.

2030 Installed larger orifice in air line (size = 5.28 inches)

2100 End PTC1035-1  
 Start TRC1036

2100 Started transition to 500 mass rate conditions.

	Shale rate T/hr	Air SCFM	Recycle SCFM	Dilution SCFM	Roll Feeders RPM
2100	8.8	850	1,500	370	--
2200	9.4	900	1,500	395	--
2320	9.9	960	1,700	420	--
<u>5/16/67</u>					
0035	10.5	1,010	1,800	445	--
0150	11.0	1,010	1,800	445	1,180
0210	--	1,060	1,900	465	Offgas temperature still spread
0310	--	1,060	1,900	465	1,210
0320	--	1,060	1,900	465	1,225
0330	--	1,120	2,000	485	1,240
0420	12.1	1,120	2,000	485	1,310
0510	12.7	1,120	2,000	485	1,365
0525	12.7	1,120	2,100	510	1,365
0545	12.7	1,160	2,200	510	1,365
0605	13.2	1,160	2,200	510	--
0700	13.8	1,200	2,370	525	1,480
0715	13.8	1,260	2,370	545	1,480
0725	13.8	1,260	2,400	545	1,480

11.8 inches H<sub>2</sub>O bottom pressure - on 500 mass rate.  
 Spread in offgas temperatures

0810 Reduced line burner temperature from 900 to 800 F. to prevent dilution from burning before it gets into retort.

0820 No. 3 screw feeder bucked off. Improvised electrical circuit to put back in service (penny in switch)

- 0900 End TRC1036  
Start PTC1036
- 1150 Roll Feeder  
RPM = 1,510  
Amps = 5.5
- 1300 Offgas temperatures, F  
TR5-2 = 168 TR1-1 = 1,720  
TR5-3 = 140 TR1-2 = 1,050  
TR5-4 = 140 TR2-1 = 1,480  
TR5-5 = 158 TR2-2 = 1,140  
TR1-13 = 1,390  
TR1-14 = 840
- 1510 Retort looking worse. Offgas temperatures climbing and O<sub>2</sub> = 1.4%
- 1525 No. 2 screw conveyor kicked off again. Improvised again to put back on.
- 1635 Offgas temperatures, TR5-2 = 204 F  
Grid temperatures  
TR4-4 = 530  
TR4-7 = 750  
TR4-9 = 750  
TR2-1 = 1,780 F
- 1640 LR-3 dropped to zero.
- 1755 O<sub>2</sub> = 4% Electrostatic precipitator turned off.
- 1815 Started shutting down. Ended PTC1036 at 1800.

5/17/67

Retort empty. Large hard clinker on south center and southwest section of retort. Extended on middle and south air header to south wall covering 10 bayonets on south header and 9 on middle header.

Normal turnaround.

- 1650 Started raw shale to unit at 16 to 17 tons per hour. Rolls at 400 RPM.
- 1915 Started air blower.
- 2100 Started circulation period at 300 mass rate conditions 1,200 SCFM air, 145 SCFM recycle and 8.3 tons per hour raw shale

5/18/67

- 0001 Started gravel to unit at same conditions 300 (pseudo) 12 tons per hour shale.

- 0315 Fired line burner at 400 F.
  - 0330 Decreased mass rate to 100 (pseudo) to about 4 tons per hour shale - Roll feeders at 300 RPM.
  - 0345 Air blower accidentally shut off - back on.
  - 0400 Increased line burner temperature to 1,400 F for startup C1037.
  - 0500 Started feeding raw shale to unit at same setting on roll feeder. (Set for 100 mass rate for gravel.)
  - 0600 East and west sides of retort hotter than center of retort.
  - 0630 Offgas temperatures have 6 F split.
  - 0700 Approximately 30% gravel in spent shale.
- Startup sequence with air equivalent oxygen consumption rate.

	O <sub>2</sub> Vol %	Raw Shale Rate T/hr	Rolls RPM	Air SCFM	Recycle SCFM	Dilution SCFM	Line Burner Temperature, F
0725	--	--	300	1,200	2,170	--	1,400
0805	--	--	300	1,200	1,550	--	1,400
0900	--	--	300	1,100	1,550	--	1,400
0904	7.7	--	--	1,000	1,550	--	1,400
0912	--	--	--	900	1,550	--	1,400
0913	4.7	--	--	850	1,550	--	1,400
0922	2.1	--	--	800	1,550	--	1,400
0930	New oil-water separator cut in.						
0925	Started adding dilution and adjusting recycle.						
0950	0.75	--	--	775	1,820	350	--
1020	--	--	500	775	1,820	350	--
1100	Started bringing up Roll RPM to give 300 mass rate.						
1200	0.35	--	--	775	1,710	350	1,050
1215	--	--	--	775	1,600	350	1,000
1230	--	--	--	775	1,490	350	950
1300	0.3	8.3	--	720	1,490	350	950
	Started 3-hour line out period.						
1410	--	8.3	--	760	1,400	350	950

- 1410-
- 2100 Adjusting for 300 mass rate conditions.
- 2100 End SU1037 startup and lineout.  
Start C1037-1
- 2245 TR2-1 peaked at 1,710 F. Offgas temperatures have 5 F split.  
TR5-2 = 142 F; others = 137 F.

5/19/67

- 0120 Reduced air from 750 to 720 SCFM. Roll feeder on manual control.
- 0350 CO<sub>2</sub> starting to decrease; O<sub>2</sub> starting to increase.
- 0620 Rolls' RPM = 850 - Hand control. Bottom pressure = 5.3 inches H<sub>2</sub>O.
- 0645 Raw shale belts went off - due to buildup on LR-3 - Back on.
- 0900 End C1037-1  
Start C1037-2
- 1200 Started taking raw shale sample. Sampler was plugged in splitter and had backed up into crusher.
- 1800 Recycle gas to headers were 2.6 inches, 2.5 inches, and 1.9 inches H<sub>2</sub>O. Adjusted to give 2.4 inches H<sub>2</sub>O on all headers.
- 2100 End C1037-2  
Start C1037-3
- 2205-  
2305 Made splitter waste test.

5/20/67

- 0120 Unit running satisfactorily.
- 0615 Raw shale sampler plugged.
- 0900 End C1037-3  
Start C1037-4
- 0930 Switched to plant air for instrument use. Instrument air compressor running too hot.
- 1100 Mechanics turned hammers around on raw shale sample crusher and unplugged raw shale splitter. Started taking raw shale sample again.
- 1145 Instrument air compressor satisfactory now.
- 1425 Temperatures above air distributor.  
TR1-1 = 1,200 - 1,400 F  
TR1-13 = 1,100 - 1,300 F  
TR2-1 = 1,100 - 1,300 F
- 1520 Changed orifice in air line to 4.75 inches.

1650 String tests indicate shale flow somewhat slower in north center and northwest pipes than other pipes.

2100 End C1037-4  
Start C1037-5

5/21/67

0030 Unit running good - Offgas temperatures are equal;  $O_2 = 0.5\%$  and bottom pressure = 4.5  $H_2O$ .

0315 LR-3 level spiked and sounded high level alarm.

0328 Gamm-O-Tron shut off belts.

0400 High level on LR-3. Unit looked satisfactory.

0630 Conveyor No. 20 failed. Belt torn in two.

0900 End C1037-5  
Start C1037-6

2000 High level alarm on LR-3.

2100  $O_2 + A = 1.5\%$  -  $O_2$  probably leaking into retort from top of the retort.

2100 End C1037-6  
Start C1037-7

2230 LR level still low. Time tape print out indicates erratic operation of weigh bin.

2310 Increased raw shale rate to hold retort level. Instrument man called in to check raw shale accounting system.

5/22/67

0130 Retort looking good -  $O_2 = 0.6\%$  - Instrument man repaired raw shale integrator system.

0710 First high level on shift.

0900 End C1037-7  
Start TRC1038

0925 Line burner kicked off.

0945 Line burner back on at 800 F for first step in phasing line burner and dilution out of system.

0950  $O_2 = A = 1.5\%$

- 1100 Reduced line burner temperature to 700 F.  $O_2 = A = 1.1\%$ .  
Air system control valves causing wide fluctuations in  
retort top pressure and vent rate.
- 1200 Reduced line burner temperature to 600 F.
- 1300 Reduced line burner temperature to 500 F.
- 1400 Reduced line burner temperature to 400 F.
- 1435 Line burner off and reduced air to 730 SCFM.
- 1520 Reduced air to 705 SCFM.  
Reduced dilution to 300 SCFM.  
Increased recycle to 1,550 SCFM.
- 1520-  
1730 Dilution reduced about 70 SCFM every 30 minutes with  
corresponding increase in recycle and decreases in air rates.
- 1945 Combustion zone temperatures load good; offgas temperatures  
split about 3 F. Grid couples TR4-7, 8 and 9 are somewhat  
colder than other grid couples.
- 1945 Conditions:  
Recycle rate: 1,750 SCFM = 12,500 SCF/T  
Air rate: 680 SCFM = 4,900  
300 mass rate
- 2100 End TRC1038  
Start C1038-1

5/23/67

- 0030 Raw shale integrator appears to fluctuate; offgas temperatures  
have 4 F split.  
TR5-2 = 136 F  
TR5-3 = 136 F  
TR5-4 = 136 F  
TR5-5 = 140 F
- 0450 High level on LR-3. Adjusted raw shale rate.
- 0725 Have had trouble maintaining constant shale rate. High  
level on LR-3 shutoff belts. Feeder No. 6 failed to start.  
No. 6 feeder finally started by repeated pushing of reset  
buttons inside electric box.
- 0900 End C1038-1  
Start C1038-2
- 0915 Put spent shale system on semiautomatic - minimum = 840 RPM  
Ratio set at minimum - prop. band at 100

- 1010 Difficulty setting raw shale rate.
- 1030 O<sub>2</sub> up to 0.5% - raised top pressure slightly. Offgas temperature now has 2 F split.
- 1045 Raw shale sampler improperly set at 1.09; changed to proper setting of 15 seconds.
- 1715 Increased recycle rate = 1,800 SCFM; 13,000 SCF/T.
- 1830 Lost vent seal - replaced seal liquid.
- 2100 End C1038-2  
Start C1038-3

5/24/67

- 0010 Retort looks good.  
O<sub>2</sub> + A = 1.0%  
Offgas temperatures split only 2 F.  
Bottom pressure = 5.2 inches H<sub>2</sub>O  
Air - 685 SCFM  
Recycle - 1,800 SCFM
- 0140 Tape printer shows increase in raw shale rate. East and center of retort colder than west but running steady. With raw shale increase, the level has increased on LR-3 thereby causing rolls to run at maximum. Increased roll speed 5 to 10 RPM to try and get level down.
- 0305 Retort still running cooler in center and east side.  
O<sub>2</sub> + A = 1.0%.
- 0330 Rolls still on maximum - Decreased raw shale rate again.
- 0430 Cleaned screems. Switched from No. 3 to No. 1 bin  
TR1-1 = 1,240; TR1-13 = 1,040; TR2-1 = 1,780  
TR1-2 = 730; TR1-14 = 640; TR2-2 = 1,060  
O<sub>2</sub> + A = 1.0%
- 0550 Reset shale rate at 0540 - got high level - may have been a bridge.
- 0630 Shut off raw shale belts to decrease level on LR-3.  
Temperatures still satisfactory. O<sub>2</sub> + A = 0.85%  
Offgas temperatures are even.
- 0800 Combustion zone getting hotter and TR2-1 and TR2-2 getting closer together.
- 0805 Reduced air to 650 SCFM  
TR1-1 = 1,795; TR1-13 = 1,705; TR2-1 = 1,650  
TR1-2 = 1,060; TR1-14 = 925; TR2-2 = 1,610

- 0810 Reduced recycle to 1,750 SCFM.  
Offgas temperatures are split 4 F.
- 0830 No. 2 screw conveyor kicked off.
- 0845 Retort operations deteriorating at a rapid rate. Heat moving high in bed and temperatures are skewing.
- 0900 End C1038-3  
Start C1038-4
- 0920 Started shutdown - Pulled spent shale sample for C1038-3.
- 1600 Clinker found in west middle of retort. Extended from west thermocouple well to center thermocouple well and from north header to south header.