15130150014

GAS COMBUSTION RETORTING
DETAILED RUN SUMMARY SHEET

Date 5-22-67

Purpose: To study operability and yield using [illegible] A/D [illegible] headers, without dilution gas. [illegible] B[illegible] Mines 55 [illegible] Oil [illegible].

GENERAL	
Run No.	R-1 TRC1038
Length, hours	12
Retort Type Number	RC-III
Oil Recovery System Number	C-1
Total Raw Shale Charged, ~~lbs.~~ Tons	99.84
Bed Height above Dist., ft	5½'
Type Air Dist.	AO-X
Bed Below Air Dist., ft	6'
RATES AND QUANTITIES	
Raw Shale, lbs/(hr)(ft^2)	301
Spent Shale, % of RS	79.2
Liquid Product, lbs/hr	1479.3
Oil Collected, gal/ton RS	21.2
Air, SCF/ton RS (dry)	5160
Total Recycle*, SCF/ton RS(wet)	13200
Dilution, SCF/ton RS (wet)	1380
Calc. Vent Gas SCF/ton RS(dry)	6710
Gas Losses, SCF/ton RS(wet)	-65
Propane, SCF/ton RS	11.9
TEMPERATURES AND HEAT BALANCE	
Retort Offgas, °F	138
Spent Shale, F	784
Raw Shale, °F	86
Recycle Gas Inlet, °F	250
Dilution Gas Inlet, °F	250
Air Inlet, °F	155
Retort Air Inlet, F	155
Heat of Comb. MBtu/ton RS	488
Heat Lost, MBtu/ton RS	-97
RAW SHALE PROPERTIES	
Fischer Assay, gal/ton RS	26.0
Oil, Wt %	10.0
Water, Wt %	1.2
Gas, Wt %	1.8
Mineral CO_2, Wt %	17.1
Ash, Wt %	68.1
Moisture, Wt % (Uncrushed)	1.0 Est.
Carbon (Total), Wt %	16.1
Hydrogen (Total), Wt %	1.65
Nominal Size Range, inches	¼"-1"
5 % passing thru	0.263
98 % passing thru	1.05
Da	0.615
Dv	0.725
Line Burner °F Avg.	604

SPENT SHALE PROPERTIES	
Fischer Assay, Gal/ton	0.4
Mineral CO_2, Wt %	12.8
Ash, Wt %	86.0
Carbon (total), Wt %	5.28
Organic Carbon, Wt %	1.79
Hydrogen (total), Wt %	0.18
LIQUID PRODUCT PROPERTIES	
Oil, Wt %	99.6
Density, lb/gal	7.762
Gravity, API	20.3
Ash, Wt %	—
PRODUCT GAS PROPERTIES	
Water Vapor, lbs/MSCF(dry)	7.0
Oil, lbs/MSCF(dry)**	0.079
Analysis (dry)	
CO_2, Vol %	29.0
O_2, Vol %	0.3
N_2 + Argon, Vol %	60.9
CH_4, Vol %	1.5
CO, Vol %	2.9
H_2, Vol %	4.2
Other, Vol %	1.2
Gross Heating Value(calc),Btu/SCF	72.0
Carbon (Total), lbs/MSCF (dry)	12.1
Hydrogen (Total), lbs/MSCF (dry)	0.54
YIELDS AND BALANCES	
Oil Collected, Vol % RSFA	81.5
Oil in Gas**, Vol % RSFA	0.3
Oil in Spent Shale, Vol % RSFA	1.6
Total Oil Meas., Vol % RSFA	83.4
Carbonate Decomposition, %	40.7
Water Recovered, lb/ton RS	741
Ash Balance, % - As Measured	—
Ash Balance, % - Assumed	RS-100
Overall Balance, %	98.3
Carbon Balance, % - Organic	91.5
Carbon Balance, % - Total	94.6
Hydrogen Balance, % - Organic	88.5
Hydrogen Balance, % - Total	92.9
Water Balance, %	103.7
MISCELLANEOUS	
Avg. Retort ΔP, in H_2O/ft	0.43
ΔP Above Air Dist., in H_2O/ft	0.36
NaCl Soln., Wt %	—
NaCl Rate, gal/ton RS	—

Comments: Transition period in which the line burner and dilution gas had phased out. Line burner phased out direct[illegible]. Recycle gas was increased.

*Measured Recycle + Dilution Gas

** Oil Mist + Condensibles to 80 °F

*** Rates are for moisture-free raw shale. All shale analyses are on a moisture-free basis.

Signed Earl E. [illegible] DATE June 8, 1967

OSRC-10
Revised 7/19/66

//A100
2080, TRC1033 F-1 5-29-67

A. YIELDS

FAY	8.145E 01	DRYGAS	6.703E 03	MISTRA	2.513E-01
H2	2.817E 02	OTHER	8.049E 01	UNRECO	1.584E 00
CH4	1.006E 02	C2	2.012E 01	SSY	7.919E 01
CO	1.945E 02	CO2REC	4.076E 01	[illegible]	7.414E 01
CO2	1.345E 03	OILCOL	[illegible] 01		

B. METERED GAS RATES

RECC	1.128E 04	DIL	1.37[illegible] 03	VENTC	8.34[illegible] 03
AIR	5.163E 03	TRCOG	1.[illegible] 04	TCF	0.0

C. MOL WT & HEATING VALUE OF VENT GAS

MWUG	2.984E 01	HVCT	4.[illegible] 02	[illegible]	3.15[illegible] 01
GBTU	7.195E 01				

D. COMBUSTION PRODUCTS

CO2C	6.9[illegible] 02	COC	1.[illegible] 02	H2CC	2.554E 01
CHR	9.353E 00	COMBCP	1.213E 01		

E. MATERIAL IN

CRGCIN	2.2[illegible] 02	RSR	3.013E 02	CRH2IN	3.057E 01
MATIN	2.413E 03				

F. MATERIAL OUT

CRGOVG	4.3[illegible] 01	COKEC	2.545E 01	[illegible]	3.[illegible]E-01
CRGCOL	1.33[illegible] 0[illegible]	OTH2[illegible]	[illegible].655E 00	[illegible]	1.7[illegible] 00
UNREC[illegible]	2.330E 00	CRH2OL	1.[illegible] 01	CRCOLP	8.01[illegible] 01
CRCVCP	1.[illegible] 01	CRCSSP	1.251[illegible] 01	H2OVGP	5.[illegible] 00

G. MATERIAL BALANCES

CVALL	9.8[illegible] 01	OTH2	[illegible].147E 01	CRBAL	1.[illegible] 02
ASH	0.0	TC	9.457E 01	MATER	1.037E 02
ORGC	9.146E 01	TH2	9.[illegible] 01	[illegible]BL	-6.505E 02
ASHR	-1.000E 00				

H. HEAT IN

QCOMB	4.876E 05	QH2OC	9.172E 03	QAIR	6.571E 03
QPROP	3.922E 01	QOILC	1.151E 04	QRCYL	4.534E 04
QSUMIN	5.59[illegible] 05				

I. HEAT OUT

[illegible]	2.95[illegible] 05	QKEROD	9.294E 04	QH2OV	5.05[illegible] 04
QLIQO	3.159E 03	QOTGAS	2.347E 04	[illegible]	[illegible].700E 05
QBASL	-1.006E 04	LBLOSS	0.0	NETLOS	-9.553E 04
QSUMOT	5.5[illegible] 05				

J. MISCELLANEOUS

CRCSS	1.7[illegible] 0[illegible]	VPOIL	7.[illegible]E-02	T[illegible]L	3.[illegible] 03
VPM	7.[illegible]	[illegible]	1.[illegible] 01	[illegible]	1.1[illegible] 01

[illegible]

HEAT AND MATERIAL BALANCE FOR PILOT RETORTS - DATA SHEET

LINE #	PROGRAM ID	USER IDENTIFICATION						
0	2080,	TRC 1038 R-1 5-22-67						
	WRS	OLRS	TRS	B	MRS			RAW SHALE
1	1.2	10.0	86	-1	16637.4			
	FA	GRS	CORS	XA				
2	26.0	1.8	17.1	55.22				
	ASRS	CRS	HRS	BP	TOG			
3	68.1	16.1	1.65	24.40	138			
	CRA	MFA	TA	PA	WA	LBHL		AIR
4	716.4	1.0	155	128	0.14	0		
	CRRG	MFRG	TRG	PRG	CRTG	MFTG		RECYCLE A TOTAL GAS
5	1662.8	1.0	250	75	0.0	0.0		
	CRDG	MFDG	TDG	PDG				DILUTION G
6	1.9	129.5	250	37				
	P	TP	PP	W	N			PROPANE A NUCLEATIN AGENT
7	1.9	0.4	178.2	168.1	0.0			
	WSS	OLSS	GSS	SS				SPENT SHALE
8	0.4	0.2	0.03	0.0				
	COSS	ASSS	CSS	HSS	TSS			
9	12.8	86.0	5.28	0.18	78.4			
	OILLP	COL	HOL	DOL	WLP			LIQUID PRODUCT
10	1367.5	84.1	11.1	7.762	111.7			
	CRVG	MFVG	TVG	WG	OILM	M		VENT GAS
11	1402.3	1.0	250	0.0	0.0	0		
	CG	H	COOG	OG	NG			
12	12.1	0	27.0	0.3	60.9			
	MEG	COG	HHG	OTG	HG			
13	1.5	2.9	4.2	1.2	0.54			
	CRVP	VPMF	TVP	PVP				VENT PURGE
14	1.6	1.83	139	69				
	TVPC	VPOIL	VPW	GL				
15	80	16.9	2.4	23.8				

OPTIONS:

1. B *Enter "1" to Calculate with Spent Shale Rate and Ash Analyses,*
   Or "0" to Calculate with Measured Rates,
   Or "-1" to Calculate with Raw Shale Rate and Ash Analyses.
2. M *Enter "1" to Calculate with Measured Moisture and Mist,*
   Or "0" to Calculate from Vent Purge Data.
3. H *Enter "1" to Calculate using Retort #2,*
   Or "0" to Calculate using Retort #3.

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 5-22-67 Run No. ~~C-16378~~ TRC 1038

Sample Time: RS 1815; SS 2315

FISCHER ASSAY RAW SHALE	FISCHER ASSAY SPENT SHALE	
25.8	0.4	Gal/Ton
.914	~~0.901~~	S.G., g/ml
9.9	~~0.17~~ 0.17	Oil, wt %
1.8	0.4	Water, wt %
86.5	99.4	Sp. Shale, wt %
1.8	0.03	Gas & Loss, wt %
Slight	None	COKING TENDENCY
MINERAL CO_2 17.1	12.8	wt %
ASH (SHALE) 28.0	26.0	wt %
MOISTURE 0.22	0.09	wt %
CARBON 16.1	5.28	wt %
HYDROGEN 1.65	0.18	wt %
BENZENE EXTRACTABLES .	.	wt %

~~RETORT SHALE MOISTURE~~

Est 1.0 wt %

RAW SHALE FISCHER ASSAY MOISTURE

0.61 wt %

○ SHALE RICHNESS DISTRIBUTION (See attached graph)

○ SCREEN ANALYSIS (See back of this sheet)

All results are "as received" unless noted. "Moisture" designates the moisture content of the -48 mesh material used for "Ash", "Mineral CO_2", "Carbon", and "Hydrogen". The "FA Moisture" is for the sample used for the Fischer Assay.

COMMENTS

DATE COMPLETED MAY 26 1967 CHECKED BY RES

OSRC-12A
Revised 6/20/66

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

TRC1038

Date Sampled 5-22-67 Run No. ~~G-1037-S~~ (3100)

LIQUID PRODUCTS

	D3 PUMPOUT				T3 PUMPOUT	
	1	2	3	4	1	2
WATER, wt %	0.4					
GRAVITY, °API	20.3					
OIL ASH, wt %						

DISTILLATION (See attached sheet - OSRC-24)

VENT PURGE PRODUCT

OIL WT, g 203.8

WATER VOL, ml 2.0

GRAVITY OIL, °API 42.4

VENT GAS

MAJOR COMPONENTS

CO_2	29.0	vol %
O_2	1.3	"
N_2	60.2	"
CH_4	1.5	"
CO	2.9	"
H_2	4.2	"
Ar	0.7	"
Others	1.2	"

C_1 thru C_4, plus n-Pentane

CH_4	.	vol %
C_2H_4-C_2H_6	.	"
C_3H_8	.	"
C_3H_6	.	"
i C_4H_{10}	.	"
n C_4H_{10}	.	"
$\emptyset C_3H_6$	.	"
n C_5H_{12}	.	"

CARBON, 12.1 lbs/MSCFDG HYDROGEN, 1.53 lbs/MSCFDG

COMMENTS

DATE COMPLETED MAY 24 1967 CHECKED BY

OSRC-12B

SCREEN ANALYSIS D'TA SHEET (TY-LAB)

RUN NO. ~~C-1037~~ [illegible] TRC [illegible] SAMPLE NO. ______ DATE 5-2[illegible]-67

UNIT [illegible] DESCRIPTION [illegible]

APPROX. SHALE SIZE ¼-1" SHAKING TIME [illegible] ANALYSIS BY [illegible]

TOTAL SAMPLE WT. GROSS 94.8 - TARE 6.5 = NET 88.3

SCREEN SIZE			WEIGHTS								
SCREENS REQD.	OPENING SIZE	MESH	GROSS LBS.	TARE LBS.	NET WT. RETAINED	SCREEN SIZE	Di *	1/Di	% RETAINED	CUM. % RETAINED	% PASSING
	4.25					4.25					
	3.00					3.00	(3.125)	(0.3200)			
	2.50					2.50	(2.625) 2.750	(0.3809) 0.3636			
	2.00					2.00	2.250	0.4444			
	1.50					1.50	1.750	0.5714			
	1.05		26.1	19.2	6.9	1.05	(1.087) 1.275	(0.9199) 0.7843	7.88		92.12
	0.742		59.5	20.5	39.0	0.742	0.896	1.116	44.52		47.60
	0.525		36.5	18.5	18.0	0.525	0.634	1.577	20.55		27.05
	0.371		31.9	19.3	12.6	0.371	0.448	2.232	14.38		12.67
	0.263	3	25.2	18.4	6.8	0.263	0.317	3.154	7.76		4.91
	0.185	4	21.5	19.4	2.1	0.185	0.224	4.464	2.40		2.51
	0.131	6	19.6	19.4	.2	0.131	0.158	6.329	0.23		2.28
	0.093	8	20.6	20.5	.1	0.093	0.112	8.928	0.11	97.83	2.17
	0.065	10	19.4	19.2	.2	0.065			0.23		1.94
	PAN		22.7	21.0	1.7	PAN			1.94		0.00
TOTAL ON SCREENS AND PAN					87.6	LOSS			—	—	—
LOSS (BY DIFFERENCE)					.7	TOTAL			100.00	—	—
TOTAL SAMPLE WEIGHT					~~88.3~~				—	—	—

* NUMBERS IN PARENTHESES SHOULD BE USED WHEN THESE SCREEN SIZES REPRESENT THE TOP OF THE SHALE SIZE RANGE.

$\sum_{+8m}^{m} D_i$	0.70973	$\sum_{+8m}^{m} X_i$	
$1/\sum_{+8m}^{m} D_i$	1.59063	$\sum_{+8m}^{m} X_i / D_i$	
Da	0.61503	$\sum_{+8m}^{m} X_i D_i$	
Dv	0.72546		

REMARKS: ______

OSRC-4
REV. 9/66