

LABORATORY ANALYSIS SHEET

1513017001

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 0-27-67

Run No. C 1039 START UP

Sample Time: RS \_\_\_\_\_; SS 11:15

RS sample lost

FISCHER ASSAY

RAW SHALE  SPENT SHALE

_____	<u>3.1</u>	Gal/Ton
_____	_____	S.G., g/ml
_____	<u>1.2</u>	Oil, wt %
_____	<u>1.5</u>	Water, wt %
_____	<u>97.0</u>	Sp. Shale, wt %
_____	<u>0.3</u>	Gas & Loss, wt %
_____	<u>None</u>	COKING TENDENCY

RETORT SHALE MOISTURE

\_\_\_\_\_ wt %

RAW SHALE FISCHER ASSAY MOISTURE

\_\_\_\_\_ wt %

MINERAL CO<sub>2</sub>

\_\_\_\_\_  13.2 wt %

ASH (SHALE)

\_\_\_\_\_  83.0 wt %

MOISTURE

\_\_\_\_\_  0.55 wt %

CARBON

\_\_\_\_\_  6.88 wt %

HYDROGEN

\_\_\_\_\_  0.41 wt %

BENZENE EXTRACTABLES

\_\_\_\_\_  \_\_\_\_\_ 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<sub>2</sub>", "Carbon", and "Hydrogen". The "FA Moisture" is for the sample used for the Fischer Assay.

COMMENTS \_\_\_\_\_

DATE COMPLETED MAY 29 1967

CHECKED BY Rep

OSRC-12A  
Revised 6/20/66

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 5-27-67

Run No. C1039-START VI

LIQUID PRODUCTS

D3 PUMPOUT

T3 PUMPOUT

1

2

3

4

1

2

~~R~~ ~~X~~  
~~R~~ ~~X~~  
○

WATER, wt %

37.1

GRAVITY, °API

19.5

OIL ASH, wt %

○

DISTILLATION (See attached sheet - OSRC-24)

VENT PURGE PRODUCT

OIL WT, g \_\_\_\_\_

WATER VOL, ml \_\_\_\_\_

GRAVITY OIL, °API \_\_\_\_\_

VENT GAS

○

MAJOR COMPONENTS

CO<sub>2</sub> \_\_\_\_\_ vol %

O<sub>2</sub> \_\_\_\_\_ "

N<sub>2</sub> \_\_\_\_\_ "

CH<sub>4</sub> \_\_\_\_\_ "

CO \_\_\_\_\_ "

H<sub>2</sub> \_\_\_\_\_ "

Ar \_\_\_\_\_ "

Others \_\_\_\_\_ "

○

C<sub>1</sub> thru C<sub>4</sub>, plus n-Pentane

CH<sub>4</sub> \_\_\_\_\_ vol %

C<sub>2</sub>H<sub>4</sub>-C<sub>2</sub>H<sub>6</sub> \_\_\_\_\_ "

C<sub>3</sub>H<sub>8</sub> \_\_\_\_\_ "

C<sub>3</sub>H<sub>6</sub> \_\_\_\_\_ "

i C<sub>4</sub>H<sub>10</sub> \_\_\_\_\_ "

n C<sub>4</sub>H<sub>10</sub> \_\_\_\_\_ "

∅C<sub>3</sub>H<sub>6</sub> \_\_\_\_\_ "

n C<sub>5</sub>H<sub>12</sub> \_\_\_\_\_ "

○

CARBON, \_\_\_\_\_ lbs/MSCFDG

HYDROGEN, \_\_\_\_\_ lbs/MSCFDG

COMMENTS \_\_\_\_\_

DATE COMPLETED MAY 29 1967

CHECKED BY REP

OSRC-12B

(Revised 5/3/66)



# SCREEN ANALYSIS DATA SHEET (TY-LAB)

RUN NO. 1039 SAMPLE NO. 2 DATE 5-27-67

UNIT 1/2" - 1" Shale DESCRIPTION 1/2" - 1" Shale

APPROX. SHALE SIZE 1/2" - 1" SHAKING TIME 10 min. ANALYSIS BY C. Lee, M. J. Sauer

TOTAL SAMPLE WT. GROSS 21.0 - TARE 15.3 = NET 5.7

SCREEN SIZE		WEIGHTS			SCREEN SIZE	Di *	% / Di	% RETAINED	CUM. % RETAINED	% PASSING
SCREENS REQD.	OPENING SIZE	MESH	GROSS LBS.	TARE LBS.						
	4.25									
	3.00					(0.3200)				
	2.50					(0.3809) 2.750				
	2.00					0.4444				
	1.50					0.5714				
	1.05		20.4	19.2		(1.037) 1.275	(0.5199) 0.7843			
	0.742		27.4	20.7		0.896	1.116			
	0.525		25.5	18.4		0.634	1.577			
	0.371		22.6	19.2		0.448	2.232			
	0.263	3	27.3	18.3		0.317	3.154			
	0.185	4	21.0	19.3		0.224	4.464			
	0.131	6	17.5	17.5		0.158	6.329			
	0.093	8	—	20.5		0.112	8.928			
	0.065	10	19.4	19.3						
	PAN		22.7	20.9						
TOTAL ON SCREENS AND PAN										
LOSS (BY DIFFERENCE)										
TOTAL SAMPLE WEIGHT										

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

REMARKS:

$\sum_{+8m}^m Di$	$\sum_{+8m}^m Xi$
$\frac{1}{\sum_{+8m}^m Di}$	$\sum_{+8m}^m Xi / Di$
Da	$\sum_{+8m}^m Xi Di$
Dv	

GAS COMBUSTION REPORTING  
DETAILED RUN SUMMARY SHEET

Date 5-27-67

Purpose: To determine operability and yield with short dilution gas  
used type 1 such shale - Mobil Tech. Force recommendations.

GENERAL		SPENT SHALE PROPERTIES	
Run No.	8 C1039-1	Fischer Assay, Gal/ton	1.3
Length, hours	12	Mineral CO <sub>2</sub> , Wt %	12.9
Retort Type Number	RC-VII	Ash, Wt %	84.8
Oil Recovery System Number	C-1	Carbon (total), Wt %	6.06
<b>Tons</b> Total Raw Shale Charged, lbs.	98.30	Organic Carbon, Wt %	2.54
Bed Height above Dist., ft	5 1/2'	Hydrogen (total), Wt %	0.28
Type Air Dist.	A b-X	LIQUID PRODUCT PROPERTIES	
Bed Below Air Dist., ft	6'	Oil, Wt %	98.7
RATES AND QUANTITIES		Density, lb/gal	7.799
Raw Shale, lbs/(hr)(ft <sup>2</sup> )	297	Gravity, API	19.6
Spent Shale, % of RS	80.5	Ash, Wt %	-
Liquid Product, lbs/hr	1513.4	PRODUCT GAS PROPERTIES	
Oil Collected, gal/ton RS	21.3	Water Vapor, lbs/MSCF(dry)	9.6
Air, SCF/ton RS (dry)	5630	Oil, lbs/MSCF(dry)**	0.017
Total Recycle*, SCF/ton RS(wet)	13200	Analysis (dry)	
Dilution, SCF/ton RS (wet)	2470	CO <sub>2</sub> , Vol %	24.5
Calc. Vent Gas SCF/ton RS(dry)	6950	O <sub>2</sub> , Vol %	0.7
Gas Losses, SCF/ton RS(wet)	1456	N <sub>2</sub> + Argon, Vol %	64.1
Propane, SCF/ton RS	18.5	CH <sub>4</sub> , Vol %	1.3
TEMPERATURES AND HEAT BALANCE		CO, Vol %	2.4
Retort Offgas, °F	138	H <sub>2</sub> , Vol %	4.3
Spent Shale, F	786	Other, Vol %	2.7
Raw Shale, °F	72	Gross Heating Value(calc), Btu/SCF	79.2
Recycle Gas Inlet, °F	250	Carbon (Total), lbs/MSCF (dry)	11.1
Dilution Gas Inlet, °F	250	Hydrogen (Total), lbs/MSCF (dry)	0.57
Air Inlet, °F	144	YIELDS AND BALANCES	
Retort Air Inlet, F	144	Oil Collected, Vol % RSFA	81.6
Heat of Comb. MBtu/ton RS	553	Oil in Gas**, Vol % RSFA	0.1
Heat Lost, MBtu/ton RS	-86	Oil in Spent Shale, Vol % RSFA	4.0
RAW SHALE PROPERTIES		Total Oil Meas., Vol % RSFA	85.7
Fischer Assay, gal/ton RS	26.1	Carbonate Decomposition, %	39.6
Oil, Wt %	10.0	Water Recovered, lb/ton RS	114.5
Water, Wt %	0.9	Ash Balance, % - As Measured	-
Gas, Wt %	2.0	Ash Balance, % - Assumed	25100
Mineral CO <sub>2</sub> , Wt %	17.2	Overall Balance, %	99.0
Ash, Wt %	68.3	Carbon Balance, % - Organic	92.8
Moisture, Wt % (Uncrushed)	2.12	Carbon Balance, % - Total	95.8
Carbon (Total), Wt %	16.5	Hydrogen Balance, % - Organic	97.3
Hydrogen (Total), Wt %	1.74	Hydrogen Balance, % - Total	99.0
Nominal Size Range, inches	1/4" - 1"	Water Balance, %	95.7
5 % passing thru	0.065*	MISCELLANEOUS	
98 % passing thru	1.05	Avg. Retort ΔP, in H <sub>2</sub> O/ft	0.47
D <sub>a</sub>	0.585	ΔP Above Air Dist., in H <sub>2</sub> O/ft	0.38
D <sub>v</sub>	0.709	NaCl Soln., Wt %	-
Line Burner °F	820	NaCl Rate, gal/ton RS	-

Comments: wet shale in the run - Center and east side running  
rather than west side - Trouble with RS and SS sampler. Moist  
shale, used SS analysis from C1039-2

\*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.

# Very wet shale

Signed Earl S. Jurek

DATE June 20, 1967

OSRC-10

Revised 7/10/66

//A100

2080, C1039-1 B 5-27-67

A. YIELDS

FAY	8.160E 01	DRYGAS	6.945E 03	MISTFA	5.827E-02
H2	2.986E 02	OTHER	1.875E 02	UNRETC	4.027E 00
CH4	9.023E 01	O2	4.861E 01	SSY	8.054E 01
CO	1.667E 02	CO2DEC	3.959E 01	YH2O	1.145E 02
CO2	1.701E 03	OILCOL	2.130E 01		

B. METERED GAS RATES

RECB	1.069E 04	DIL	2.470E 03	WVENTG	6.891E 03
AIR	5.626E 03	TRECG	1.316E 04	TGF	0.0

C. MOL WT & HEATING VALUE OF VENT GAS

MWWG	2.893E 01	HVGT	5.503E 02	YWDG	3.113E 01
GSIU	7.924E 01				

D. COMBUSTION PRODUCTS

CO2C	4.740E 02	COO	1.504E 02	H2OC	5.539E 01
CHR	3.155E 00	COMBOP	8.322E 00		

E. MATERIAL IN

ORGCIN	2.373E 02	RSR	2.967E 02	ORH2IN	3.300E 01
MATIN	2.477E 03				

F. MATERIAL OUT

ORGCVG	4.004E 01	COKEC	3.299E 01	UNRETH	9.475E-01
ORGCOL	1.397E 02	ORH2VG	1.024E 01	COKEH	2.480E 00
UNRETC	7.901E 00	ORH2OL	1.344E 01	ORCOLP	5.374E 01
ORCVGP	1.683E 01	ORCSSP	1.719E 01	HCCVGP	8.512E 00

G. MATERIAL BALANCES

OVALL	9.901E 01	ORH2	9.728E 01	O2BAL	9.919E 01
ASH	0.0	TC	9.581E 01	WATER	9.571E 01
ORGC	9.275E 01	TH2	9.904E 01	GASL	1.456E 03
ASHB	-1.000E 00				

H. HEAT IN

QCOMB	5.534E 05	QH2OC	1.247E 04	QAIR	7.459E 03
QPROP	6.233E 01	QOILC	1.163E 04	QRCYL	4.924E 04
QSUMIN	6.343E 05				

I. HEAT OUT

QMC02D	2.206E 05	QKEROD	9.149E 04	QH2OV	6.730E 04
QLIQO	4.004E 03	QOFGAS	2.378E 04	QSS	2.851E 05
QGASL	2.278E 04	LBLOSS	0.0	HETLOS	-8.582E 04
QSUMOT	5.343E 05				

J. MISCELLANEOUS

ORCSS	2.533E 00	VPOIL	1.708E-02	TGL	2.975E 03
VPM	9.602E 00	WCG	1.630E 01	PROP	1.345E 01

END MESSAGE

END OUTPUT

0 2080, C1039-1 B 5-27-67

1	WRS 0.98	QLRS 10.0	TRS 72	B -1	MRS 16383.1		RAW SHALE
2	FA 26.1	GRS 2.0	CORS 17.2	XA 55.22			
3	ASRS 68.3	CRS 16.5	HRS 1.74	BP 24.10	TOG 138		
4	CRA 773.4	MFA 1.0	TA 144	PA 131	WA 0.14	LBHL 0	AIR
5	CRRG 1467.5	MFRG 1.0	TRG 250	PRG 78	CRTG 0.0	MFTG 0.0	RECYCLE A TOTAL GAS
6	CRDG 3.5	MFDG 119.4	TDG 250	PDG 65			DILUTION G
7	P 2.9	TP 0.4	PP 132.2	W 354.8	N 0.0		PROPANE A NUCLEATING AGENT
8	WSS 0.6	OLSS 0.5	GSS 0.2	SS 0.0			SPENT SHALE
9	COSS 12.9	ASSS 84.8	CSS 6.06	HSS 0.28	TSS 786		
10	OILLP 1360.7	COL 84.1	HOL 11.1	DOL 7.799	WLP 152.7		LIQUID PRODUCT
11	CRVG 1349.0	MFVG 1.0	TVG 250	WG 0.0	OILM 0.0	M 0	VENT GAS
12	CG 11.1	H 0	COOG 24.5	OG 0.7	NG 64.1		
13	MEG 1.3	COG 2.4	HHG 4.3	OTG 2.7	HG 0.57		
14	CRVP 3.0	VPMF 1.83	TVP 161	PVP 79			VENT PURGE
15	TVPC 80	VPOIL 5.0	VPW 4.9	GL 17.3			

- OPTIONS:
- 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.
  - M Enter "1" to Calculate with Measured Moisture and Mist,  
Or "0" to Calculate from Vent Purge Data.
  - 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 5-27-67

Run No. C 1039-1

Sample Time: RS 18:15; SS 23:15

589g Total Sample  
579m 48  
19m 48

FISCHER ASSAY

RAW SHALE  SPENT SHALE

Approx. <u>23.5</u>	<u>1.3</u>	Gal/Ton
<u>.</u>	<u>1.6</u>	S.G., g/ml
<u>.</u>	<u>0.5</u>	Oil, wt %
<u>.</u>	<u>0.6</u>	Water, wt %
<u>.</u>	<u>28.7</u>	Sp. Shale, wt %
<u>.</u>	<u>0.2</u>	Gas & Loss, wt %
<u>.</u>	<u>None</u>	COKING TENDENCY

RETORT SHALE MOISTURE  
\_\_\_\_\_ wt %

RAW SHALE FISCHER ASSAY MOISTURE  
\_\_\_\_\_ wt %

*IF Possible use Curves To Determine Gal. Per Ton*

MINERAL CO<sub>2</sub>  
 17.2  12.9 wt %

ASH (SHALE)  
 69.4  84.8 wt %

MOISTURE  
 0.44  0.13 wt %

CARBON  
 15.8  6.06 wt %

HYDROGEN  
 1.56  0.28 wt %

BENZENE EXTRACTABLES

.  . 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<sub>2</sub>", "Carbon", and "Hydrogen". The "FA Moisture" is for the sample used for the Fischer Assay.

COMMENTS \_\_\_\_\_

DATE COMPLETED

MAY 31 1967

CHECKED BY

REP

OSRC-12A

Revised 6/20/66

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 5-27-67

Run No. C1039-1

Sample Time: RS 12:15; SS 12:15

Splitter waste  
Sample To Buck  
4P C1039-1 Short Sample

FISCHER ASSAY

RETORT SHALE MOISTURE

R  RAW SHALE  SPENT SHALE

2.12 wt %

25.8 Gal/Ton

RAW SHALE FISCHER ASSAY MOISTURE

.916 S.G., g/ml

1.03 wt %

9.9 Oil, wt %

2.0 Water, wt %

86.1 Sp. Shale, wt %

2.0 Gas & Loss, wt %

Slight COKING TENDENCY

MINERAL CO<sub>2</sub>

17.1  . wt %

ASH (SHALE)

68.1  . wt %

MOISTURE

0.34  . wt %

SHALE RICHNESS DISTRIBUTION  
(See attached graph)

CARBON

16.4  . wt %

SCREEN ANALYSIS  
(See back of this sheet)

HYDROGEN

1.73  . wt %

BENZENE EXTRACTABLES

.  . wt %

All results are "as received" unless noted. "Moisture" designates the moisture content of the -48 mesh material used for "Ash", "Mineral CO<sub>2</sub>", "Carbon", and "Hydrogen". The "FA Moisture" is for the sample used for the Fischer Assay.

COMMENTS \_\_\_\_\_

DATE COMPLETED

MAY 29 1967

CHECKED BY

REP

OSRC-12A

Revised 6/20/66

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled S-77-67

Run No. C1039-1

LIQUID PRODUCTS

D3 PUMPOUT

T3 PUMPOUT

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>2</u>
<input checked="" type="checkbox"/> WATER, wt %	<u>1.3</u>	<del>_____</del>	<del>_____</del>	<del>_____</del>	<del>_____</del>	<del>_____</del>
<input checked="" type="checkbox"/> GRAVITY, °API	<u>19.6</u>	<del>_____</del>	<del>_____</del>	<del>_____</del>	<del>_____</del>	<del>_____</del>
<input type="checkbox"/> OIL ASH, wt %	_____	_____	_____	_____	_____	_____

DISTILLATION (See attached sheet - OSRC-24)

VENT PURGE PRODUCT

<input checked="" type="checkbox"/> OIL WT, g	<u>60</u>
<input checked="" type="checkbox"/> WATER VOL, ml	<u>38</u>
<input checked="" type="checkbox"/> GRAVITY OIL, °API	<u>34.7</u>

VENT GAS

<input checked="" type="checkbox"/> MAJOR COMPONENTS	<input type="checkbox"/> C <sub>1</sub> thru C <sub>4</sub> , plus n-Pentane
CO <sub>2</sub> <u>24.5</u> vol %	CH <sub>4</sub> _____ vol %
O <sub>2</sub> <u>0.7</u> "	C <sub>2</sub> H <sub>4</sub> -C <sub>2</sub> H <sub>6</sub> _____ "
N <sub>2</sub> <u>63.3</u> "	C <sub>3</sub> H <sub>8</sub> _____ "
CH <sub>4</sub> <u>1.3</u> "	C <sub>3</sub> H <sub>6</sub> _____ "
CO <u>2.4</u> "	i C <sub>4</sub> H <sub>10</sub> _____ "
H <sub>2</sub> <u>4.3</u> "	n C <sub>4</sub> H <sub>10</sub> _____ "
Ar <u>0.8</u> "	∅C <sub>3</sub> H <sub>6</sub> _____ "
Others <u>2.7</u> "	n C <sub>5</sub> H <sub>12</sub> _____ "

CARBON, 11.1 lbs/MSCFDG

HYDROGEN, 0.57 lbs/MSCFDG

COMMENTS \_\_\_\_\_

DATE COMPLETED JUN 5 1967

CHECKED BY SEP

OSRC-12B

(Revised 5/3/66)

# SCREEN ANALYSIS DATA SHEET (TY-LAB)

RUN NO. 01039-1 SAMPLE NO. 5-27-61 DATE 5-27-61  
 UNIT 7261 DESCRIPTION 7261  
 APPROX. SHALE SIZE 1/2 - 1 SHAKING TIME 10 min ANALYSIS BY Keiffer & Coyle  
 TOTAL SAMPLE WT. GROSS 46.1 TARE 6.6 = NET 39.5

004075

SCREEN SIZE		WEIGHTS			SCREEN SIZE	Di *	1/Di	% RETAINED	CUM. % RETAINED	% PASSING
SCREENS REQD.	OPENING SIZE	GROSS LBS.	TARE LBS.	NET WT. RETAINED						
	4.25									
	3.00				(3.125)	(0.3200)				
	2.50				(2.625) 2.750	(0.3809) 0.3636				
	2.00				2.250	0.4444				
	1.50				1.750	0.5714				
	1.05	24.6	19.2	5.4	(1.037) 1.275	(0.9199) 0.7843	6.74		93.25	
	0.742	53.0	20.5	31.5	0.896	1.116	39.33		53.92	
	0.525	37.1	18.5	18.6	0.634	1.577	23.22		30.70	
	0.371	26.9	19.3	7.6	0.448	2.232	9.49		21.21	
	0.263	25.5	18.3	7.2	0.317	3.154	8.99		12.22	
	0.185	22.3	19.7	2.9	0.224	4.464	3.62		8.60	
	0.131	19.9	19.4	0.5	0.158	6.329	0.62		7.98	
	0.093	20.6	20.5	0.1	0.112	8.928	0.12	92.13	7.86	
	0.065	19.3	19.2	0.1			0.12		7.74	
	PAN	27.2	21.0	6.2			7.74		0.00	
TOTAL ON SCREENS AND PAN		80.1								
LOSS (BY DIFFERENCE)		0								
TOTAL SAMPLE WEIGHT		80.1								

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

REMARKS: (Lot of fines) Due to wt  
 Shale decided to clean screens every  
 Two hrs instead of every 4 hrs.

$\sum^m D_i$	0.65311	$\sum^{+8m} X_i$	
$1/\sum^{+8m} D_i$	1.5740	$\sum^{+8m} X_i / D_i$	
D <sub>a</sub>	0.58532	$\sum^{+8m} X_i D_i$	
D <sub>v</sub>	0.70890		