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HYDROCARBON REPORTS.

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CONGLAD  
TUNA-4.  
19 MAR 1986 2 REPORTS

HYDROCARBON BOX

**Oil and GAS DIVISION**

**19 MAR 1986**

**ESSO AUSTRALIA LIMITED**

**TUNA #4, SET 2**

**RESERVOIR FLUID STUDY**

**PRODUCTION TEST 4  
( 'R' RESERVOIR)**

Petroleum Reservoir Engineering

**CORE**

18th November, 1985

**CORE LABORATORIES**

Petroleum Reservoir Engineering



ESSO AUSTRALIA LIMITED,  
127 Kent Street,  
SYDNEY, N.S.W. 2000

Attention : A.K. Khurana

Subject : Reservoir Fluid Study  
Well : Tuna #4, Set 2  
File : AFL 85035

Dear Sir,

Gas and liquid separator samples were collected from the subject well and submitted to our laboratory for use in a reservoir fluid study. Presented in the following report are the results of this study as requested by Esso Australia Limited.

As requested, a saturation pressure was determined at the separator temperature of 130°F. At 130°F the fluid sample was found to have a bubble point pressure of 95 psig. These results are reported on page two and depicted graphically on page eight.

The hydrocarbon composition of the separator gas sample was measured through undecanes plus using routine gas chromatography. These results are reported on page three.

The hydrocarbon composition of the separator liquid was measured through hexanes plus and further broken down through undecanes plus by high temperature distillation. This compositional analysis, together with the hexanes plus properties, is reported on pages four and five.

The producing gas/liquid ratio was used with the compositions of the separator products to calculate the well stream composition. The calculated well stream through undecanes plus is reported on page six.

The separator gas and liquid were then physically recombined and a portion of the fluid was charged to a high pressure visual cell. The sample was thermally expanded to the reported reservoir temperature of 252°F and subjected to a constant composition expansion during which a bubble point of 3705 psig was observed. The volumetric and pressure data is reported on page seven and depicted graphically on page nine.

We thank Esso Australia Limited for the opportunity to be of service with this report. If you have any questions, please do not hesitate to contact us.

Yours faithfully,

  
Jan Bon,  
Manager.

JB/kd/dc

Company : Esso Australia Limited                      Date Sampled :  
Well     : Tuna #4, Set 2                              State            : Victoria  
Field    : Tuna                                              Country         : Australia

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FORMATION CHARACTERISTICS

Formation Name :  
Date First Well Completed :  
Original Reservoir Pressure :  
Original Produced Gas-Oil Ratio :  
    Production Ratio :  
    Separator Pressure and Temperature :  
    Liquid Gravity @ 60°F :  
Datum :

WELL CHARACTERISTICS

Elevation :  
Total Depth :  
Producing Interval :  
Tubing Size and Depth :  
Open Flow Potential :  
Last Reservoir Pressure :  
    Date :  
    Reservoir Temperature :  
    Status of Well :  
    Pressure Gauge :

SAMPLING CONDITIONS

Flowing Tubing Pressure :  
Flowing Bottom Hole Pressure :  
Primary Separator Pressure :                      100 psig  
Primary Separator Temperature :                      130°F  
Secondary Separator Pressure :  
Secondary Separator Temperature :  
Field Stock Tank Liquid Gravity :  
Primary Separator Gas Production Rate :                      1483 MSCF/Day  
    Pressure Base :                                      14.696  
    Temperature Base :                                      60°F  
    Compressibility Factor (Fpv) :                      1.0099  
    Gas Gravity (Laboratory) :                      0.971  
    Gas Gravity Factor (Fg) :                      1.015  
    Liquid Production Rate @ °F :                      1683 STB/Day  
Primary Separator Gas/ Liquid Ratio :                      881.646  
    or :

Sampled by :  
REMARKS :

QUALITY CHECK OF SAMPLE RECEIVED IN THE LABORATORY

Cylinder #: OT067T  
Opening Pressure: psig @ °F

<u>cm<sup>3</sup> Mercury Injected</u>	<u>Pressure, psig</u>
0	80
1	85
2	88
3	90
4	90
5	93
6	220
7	548
8	862
9	1170
10	1492

Psat = 95 psig @ 130°F

HYDROCARBON ANALYSIS OF SEPARATOR GAS SAMPLE TO UNDECANES PLUS

Cylinder #:

A8638

<u>Component</u>	<u>Mol Percent</u>	<u>GPM</u>
Hydrogen Sulphide	0.00	
Carbon Dioxide	30.03	
Nitrogen	0.07	
Methane	56.02	
Ethane	7.13	1.902
Propane	3.69	1.013
iso-Butane	0.61	0.199
n-Butane	1.11	0.349
iso-Pentane	0.31	0.113
n-Pentane	0.32	0.116
Hexanes	0.23	0.094
Heptanes	0.25	0.217 (C7+)
Octanes	0.19	
Nonanes	0.03	
Decanes	0.01	
Undecanes plus	Trace	
	<u>100.00</u>	<u>4.003</u>

Gas gravity (Air = 1.000):

0.971

Gross heating value (BTU  
 per cubic foot of dry gas  
 @ 14.696 psia and 60°F):

904

HYDROCARBON ANALYSIS OF SEPARATOR LIQUID SAMPLE TO UNDECANES PLUS

<u>Cylinder #:</u>	OT067T	
<u>Component</u>	<u>Mol Percent</u>	<u>Weight Percent</u>
Hydrogen Sulphide	0.00	0.00
Carbon Dioxide	1.54	0.33
Nitrogen	0.01	Trace
Methane	1.41	0.11
Ethane	0.89	0.13
Propane	1.42	0.30
iso-Butane	0.58	0.16
n-Butane	1.52	0.43
iso-Pentane	1.10	0.38
n-Pentane	1.63	0.57
Hexanes	4.72	2.03
Heptanes	4.39	2.05
Octanes	6.44	3.20
Nonanes	5.94	3.21
Decanes	3.80	2.33
Undecanes plus	64.61	84.77
	<u>100.00</u>	<u>100.00</u>

Properties of Hexanes plus

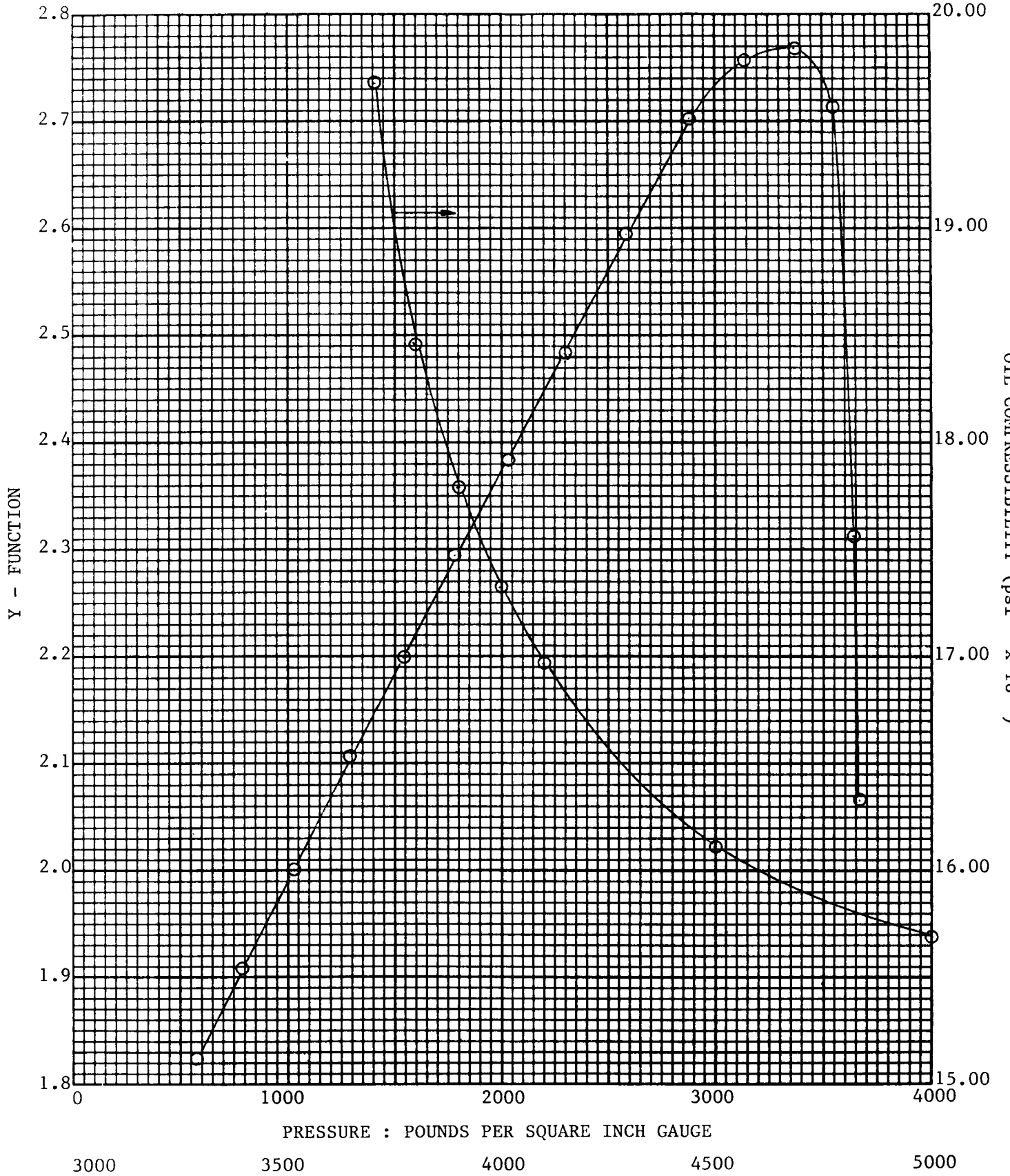
API gravity @ 60°F	39.1
Density, gm/cc @ 60°F	0.8288
Molecular weight	225

HIGH TEMPERATURE DISTILLATION OF HEXANES PLUS  
FRACTION OF RESERVOIR FLUID SAMPLE TO UNDECANES PLUS

<u>Component</u>	<u>Cut Temp °C</u>	<u>Mol Percent</u>	<u>Weight Percent</u>	<u>Volume Percent</u>	<u>Density, gm/cc @ 60°F</u>	<u>°API @ 60°F</u>	<u>Mol Weight</u>
	IBP 49						
Hexanes	84	5.25	2.08	2.39	0.7202	64.8	89
Heptanes	112	4.88	2.10	2.29	0.7630	53.8	97
Octanes	138	7.16	3.28	3.45	0.7888	47.7	103
Nonanes	162	6.61	3.29	3.40	0.8031	44.5	112
Decanes	185	4.23	2.39	2.47	0.8018	44.8	127
Undecanes plus	FBP 185	71.87	86.86	86.00	0.8370	37.4	272
		<u>100.00</u>	<u>100.00</u>	<u>100.00</u>			



Company Esso Australia Limited Formation \_\_\_\_\_  
 Well Tuna #4, Set 2 State Victoria  
 Field Tuna Country Australia



HYDROCARBON ANALYSES OF SEPARATOR PRODUCTS  
AND CALCULATED WELL STREAM TO UNDECANES PLUS

<u>Cylinder #:</u>	OT067T	A8638	
<u>Component</u>	<u>Separator Liquid Mol Percent</u>	<u>Separator Gas Mol Percent</u>	<u>Well Stream Mol Percent</u>
Hydrogen Sulphide	0.00	0.00	0.00
Carbon Dioxide	1.54	30.03	19.15
Nitrogen	0.01	0.07	0.05
Methane	1.41	56.02	35.16
Ethane	0.89	7.13	4.75
Propane	1.42	3.69	2.82
iso-Butane	0.58	0.61	0.60
n-Butane	1.52	1.11	1.27
iso-Pentane	1.10	0.31	0.61
n-Pentane	1.63	0.32	0.82
Hexanes	4.72	0.23	1.94
Heptanes	4.39	0.25	1.83
Octanes	6.44	0.19	2.58
Nonanes	5.94	0.03	2.29
Decanes	3.80	0.01	1.46
Undecanes plus	64.61	Trace	24.67
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

Properties of Heptanes plus

API gravity @ 60°F	39.1	39.4
Density, gm/cc @ 60°F	0.8288	0.827
Molecular weight	225	224

Calculated separator gas gravity (air = 1.000) = 0.971  
Calculated gross heating value for separator gas  
per cubic foot of dry gas @ 14.696 psia and 60°F = 904 BTU

Primary separator gas collected @ 100 psig and 130°F  
Primary separator liquid collected @ 100 psig and 130°F

Primary separator gas/separator liquid ratio : 833 SCF/Bbl @ 130°F  
Primary separator liquid/stock tank liquid ratio : 1.058 Bbls @ 130°F/Bbl  
Primary separator gas/well stream ratio : 618.11 MSCF/MMSCF  
Stock tank liquid/well stream ratio : 701.6 Bbls/MMSCF

PRESSURE - VOLUME RELATIONS @ 252°F

<u>Pressure,</u> <u>psig</u>	<u>Relative</u> <u>Volume (1)</u>	<u>Compressibility</u> <u>x 10<sup>-6</sup> (2)</u>	<u>Y</u> <u>Function (3)</u>
5000	0.9786	15.69	
4500	0.9864	16.11	
4100	0.9929	16.97	
4000	0.9946	17.32	
3900	0.9964	17.79	
3800	0.9982	18.44	
<u>3705</u> *	1.0000	19.68	
3684	1.0028		
3669	1.0047		2.067
3640	1.0077		2.312
3550	1.0160		2.713
3370	1.0357		2.769
3142	1.0647		2.757
2882	1.1052		2.701
2589	1.1651		2.595
2299	1.2446		2.484
2029	1.3439		2.384
1781	1.4671		2.293
1546	1.6289		2.199
1294	1.8746		2.106
1028	2.2833		2.000
794	2.8852		1.909
577	3.8991		1.823

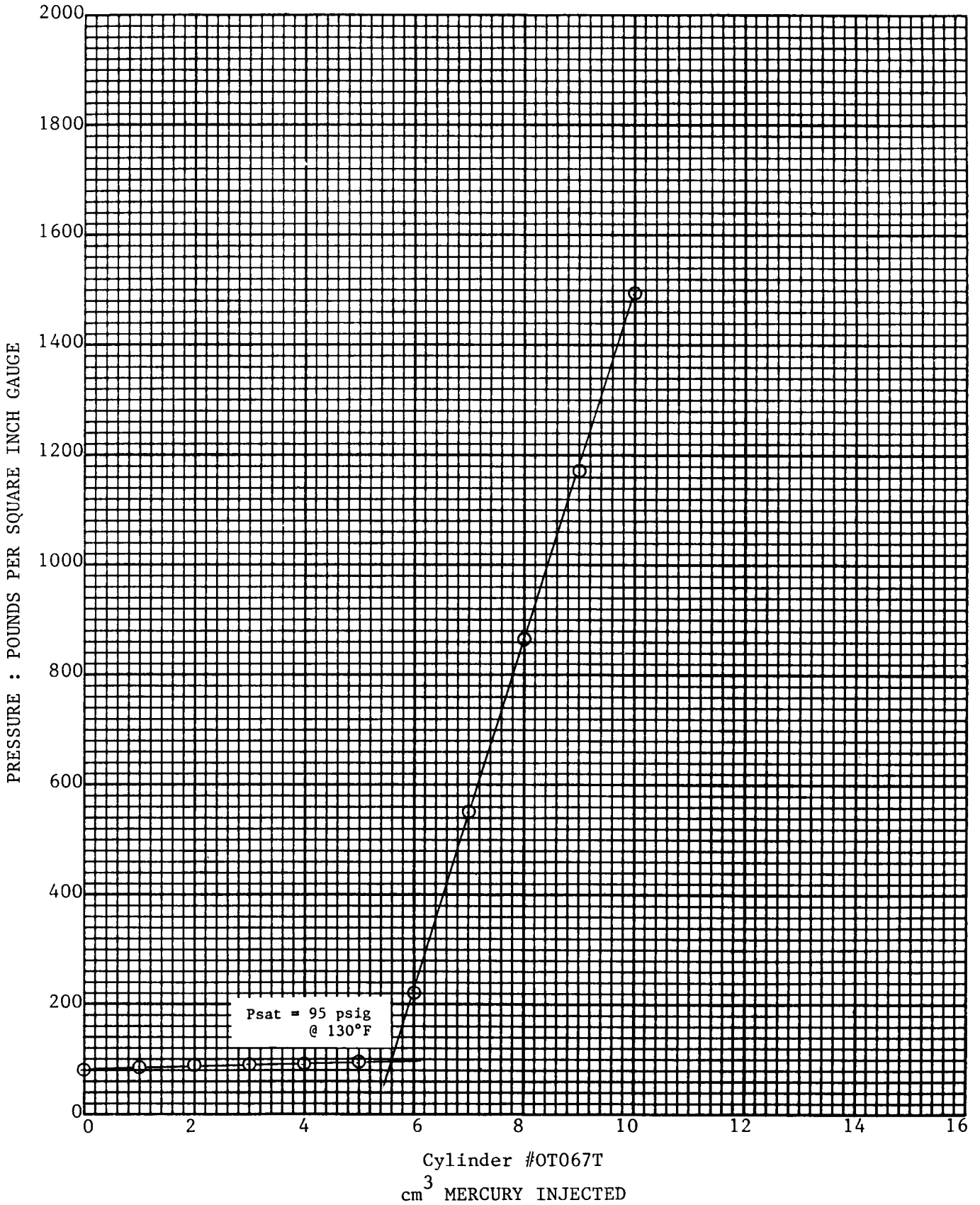
\* Saturation Pressure

(1) Relative volume:  $V/V_{sat}$  is barrels @ indicated pressure per barrel @ saturation pressure.

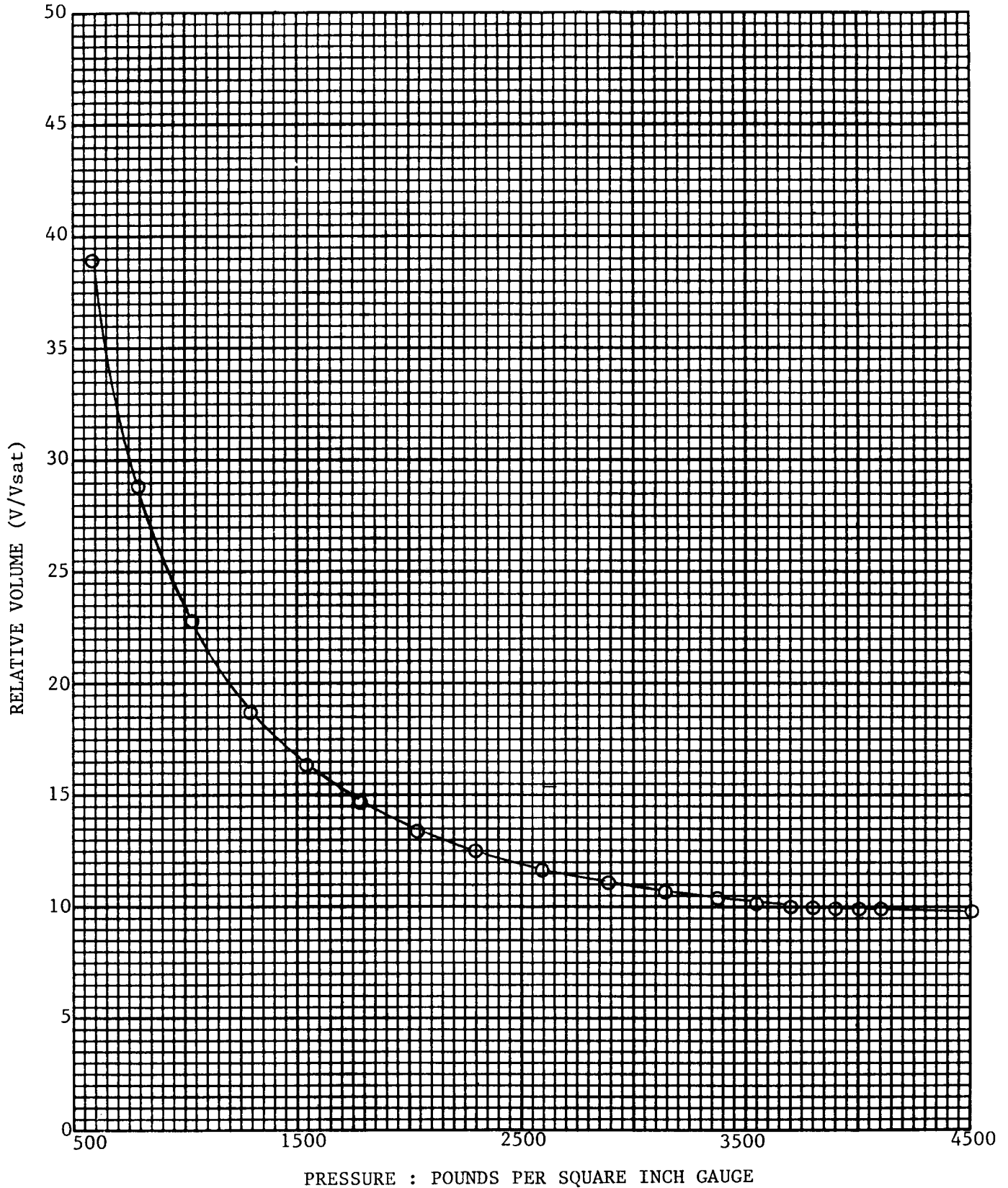
(2) Instantaneous Compressibility =  $-\frac{dV}{VdP}$

(3) Y Function =  $\frac{(P_{sat} - P)}{(P_{abs})(V/V_{sat}-1)}$

Company Esso Australia Limited Formation \_\_\_\_\_  
Well Tuna #4, Set 2 State Victoria  
Field Tuna Country Australia



Company Esso Australia Limited Formation \_\_\_\_\_  
Well Tuna #4, Set 2 State Victoria  
Field Tuna Country Australia



19 MAR 1986

ESSO AUSTRALIA LIMITED

TUNA #4, SET 3

RESERVOIR FLUID STUDY

PRODUCTION TEST 4  
( 'R' RESERVOIR)

18th November, 1985

**CORE LABORATORIES**

Petroleum Reservoir Engineering



ESSO AUSTRALIA LIMITED,  
127 Kent Street,  
SYDNEY, N.S.W. 2000

Attention : A.K. Khurana

Subject : Reservoir Fluid Study  
Well : Tuna #4, Set 3  
File : AFL 85036

Dear Sir,

Gas and liquid separator samples were collected from the subject well and submitted to our laboratory for use in a reservoir fluid study. Presented in the following report are the results of this study as requested by Esso Australia Limited.

As requested, a saturation pressure was determined at the separator temperature of 139°F. At 139°F the fluid sample was found to have a bubble point pressure of 82 psig. These results are reported on page two and depicted graphically on page eight.

The hydrocarbon composition of the separator gas sample was measured through undecanes plus using routine gas chromatography. These results are reported on page three.

The hydrocarbon composition of the separator liquid was measured through hexanes plus and further broken down through undecanes plus by high temperature distillation. This compositional analysis, together with the hexanes plus properties, is reported on pages four and five.

The producing gas/liquid ratio was used with the compositions of the separator products to calculate the well stream composition. The calculated well stream through undecanes plus is reported on page six.

The separator gas and liquid were then physically recombined and a portion of the fluid was charged to a high pressure visual cell. The sample was thermally expanded to the reported reservoir temperature of 252°F and subjected to a constant composition expansion during which a bubble point of 3558 psig was observed. The volumetric and pressure data is reported on page seven and depicted graphically on page nine.

We thank Esso Australia Limited for the opportunity to be of service with this report. If you have any questions, please do not hesitate to contact us.

Yours faithfully,



Jan Bon,  
Manager.

JB/kd/dc

Company : Esso Australia Limited                      Date Sampled :  
Well     : Tuna #4, Set 3                              State             : Victoria  
Field    : Tuna                                              Country          : Australia

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FORMATION CHARACTERISTICS

Formation Name :  
Date First Well Completed :  
Original Reservoir Pressure :  
Original Produced Gas-Oil Ratio :  
    Production Ratio :  
    Separator Pressure and Temperature :  
    Liquid Gravity @ 60°F :  
Datum :

WELL CHARACTERISTICS

Elevation :  
Total Depth :  
Producing Interval :  
Tubing Size and Depth :  
Open Flow Potential :  
Last Reservoir Pressure :  
    Date :  
    Reservoir Temperature :  
    Status of Well :  
    Pressure Gauge :

SAMPLING CONDITIONS

Flowing Tubing Pressure :  
Flowing Bottom Hole Pressure :  
Primary Separator Pressure :                      100 psig  
Primary Separator Temperature :                      139°F  
Secondary Separator Pressure :  
Secondary Separator Temperature :  
Field Stock Tank Liquid Gravity :  
Primary Separator Gas Production Rate :                      1490 MSCF/Day  
    Pressure Base :                                      14.696  
    Temperature Base :                                      60°F  
    Compressibility Factor (Fpv) :  
    Gas Gravity (Laboratory) :                              0.979  
    Gas Gravity Factor (Fg) :                              1.011  
    Liquid Production Rate @ °F :                              1683 STB/Day  
Primary Separator Gas/ Liquid Ratio :                      885.324  
    or :

Sampled by :  
REMARKS :



QUALITY CHECK OF SAMPLE RECEIVED IN THE LABORATORY

Cylinder #:

OT054T

<u>cm<sup>3</sup> Mercury Injected</u>	<u>Pressure, psig</u>
0	80
1	82
2	82
3	82
4	82
5	93
6	372
7	670
8	960
9	1252
10	1530
11	1815

Psat = 82 psig @ 139°F

HYDROCARBON ANALYSIS OF SEPARATOR GAS SAMPLE TO UNDECANES PLUS

<u>Cylinder #:</u>	A11572	
<u>Component</u>	<u>Mol Percent</u>	<u>GPM</u>
Hydrogen Sulphide	0.00	
Carbon Dioxide	30.07	
Nitrogen	0.11	
Methane	55.64	
Ethane	7.11	1.897
Propane	3.71	1.018
iso-Butane	0.62	0.202
n-Butane	1.15	0.362
iso-Pentane	0.33	0.121
n-Pentane	0.37	0.134
Hexanes	0.28	0.114
Heptanes	0.30	0.276 (C7+)
Octanes	0.24	
Nonanes	0.05	
Decanes	0.01	
Undecanes plus	0.01	
	<u>100.00</u>	<u>4.124</u>
Gas gravity (Air = 1.000):	0.979	
Gross heating value (BTU per cubic foot of dry gas @ 14.696 psia and 60°F):	915	

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgement of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

HYDROCARBON ANALYSIS OF SEPARATOR LIQUID SAMPLE TO UNDECANES PLUS

Cylinder #:

OT054T

<u>Component</u>	<u>Mol Percent</u>	<u>Weight Percent</u>
Hydrogen Sulphide	0.00	0.00
Carbon Dioxide	1.45	0.30
Nitrogen	Trace	Trace
Methane	1.32	0.10
Ethane	0.84	0.12
Propane	1.32	0.27
iso-Butane	0.54	0.15
n-Butane	1.41	0.38
iso-Pentane	0.90	0.30
n-Pentane	1.28	0.43
Hexanes	3.47	1.38
Heptanes	4.98	2.23
Octanes	5.74	2.79
Nonanes	6.01	3.17
Decanes	4.99	3.00
Undecanes plus	65.75	85.38
	<u>100.00</u>	<u>100.00</u>

Properties of Hexanes plus

API gravity @ 60°F	38.6
Density, gm/cc @ 60°F	0.8312
Molecular weight	233

HIGH TEMPERATURE DISTILLATION OF HEXANES PLUS  
FRACTION OF RESERVOIR FLUID SAMPLE TO UNDECANES PLUS

<u>Component</u>	<u>Cut</u> <u>Temp °C</u>	<u>Mol</u> <u>Percent</u>	<u>Weight</u> <u>Percent</u>	<u>Volume</u> <u>Percent</u>	<u>Density,</u> <u>gm/cc @ 60°F</u>	<u>°API</u> <u>@ 60°F</u>	<u>Mol</u> <u>Weight</u>
	IBP 49						
Hexanes	84	3.82	1.41	1.60	0.7332	61.3	86
Heptanes	112	5.48	2.28	2.47	0.7665	52.9	97
Octanes	138	6.31	2.84	3.00	0.7890	47.7	105
Nonanes	162	6.60	3.23	3.35	0.8020	44.8	114
Decanes	185	5.49	3.06	3.17	0.8027	44.6	130
Undecanes plus	FBP 185	72.30	87.18	86.41	0.8385	37.1	281
		<u>100.00</u>	<u>100.00</u>	<u>100.00</u>			

HYDROCARBON ANALYSES OF SEPARATOR PRODUCTS  
AND CALCULATED WELL STREAM TO UNDECANES PLUS

<u>Cylinder #:</u>	OT054T		A11572	
	<u>Component</u>	<u>Separator Liquid Mol Percent</u>	<u>Separator Gas Mol Percent</u>	<u>Well Stream Mol Percent</u>
	Hydrogen Sulphide	0.00	0.00	0.00
	Carbon Dioxide	1.45	30.07	19.57
	Nitrogen	0.00	0.11	0.07
	Methane	1.32	55.64	35.71
	Ethane	0.84	7.11	4.81
	Propane	1.32	3.71	2.83
	iso-Butane	0.54	0.62	0.59
	n-Butane	1.41	1.15	1.25
	iso-Pentane	0.90	0.33	0.54
	n-Pentane	1.28	0.37	0.70
	Hexanes	3.47	0.28	1.45
	Heptanes	4.98	0.30	2.02
	Octanes	5.74	0.24	2.26
	Nonanes	6.01	0.05	2.24
	Decanes	4.99	0.01	1.84
	Undecanes plus	65.75	0.01	24.12
		<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

Properties of Heptanes plus

API gravity @ 60°F	38.6	
Density, gm/cc @ 60°F	0.8312	0.829
Molecular weight	233	231

Calculated separator gas gravity (air = 1.000) = 0.979  
 Calculated gross heating value for separator gas  
 per cubic foot of dry gas @ 14.696 psia and 60°F = 915 BTU

Primary separator gas collected @ 100 psig and 139°F  
 Primary separator liquid collected @ 100 psig and 139°F

Primary separator gas/separator liquid ratio : 819 SCF/Bbl @ 139°F  
 Primary separator liquid/stock tank liquid ratio : 1.080 Bbls @ 139°F/Bbl  
 Primary separator gas/well stream ratio : 633.24 MSCF/MMSCF  
 Stock tank liquid/well stream ratio : 715.3 Bbls/MMSCF

PRESSURE - VOLUME RELATIONS @ 252°F

<u>Pressure,</u> <u>psig</u>	<u>Relative</u> <u>Volume (1)</u>	<u>Compressibility</u> <u>x 10<sup>-6</sup> (2)</u>	<u>Y</u> <u>Function (3)</u>
5000	0.9769	14.67	
4500	0.9842	15.21	
4000	0.9921	16.63	
3900	0.9938	17.12	
3800	0.9955	17.68	
3700	0.9973	18.36	
3600	0.9992	19.12	
<u>3558</u> *	1.0000	19.54	
3534	1.0024		
3513	1.0045		
3401	1.0160		2.879
3218	1.0374		2.812
2989	1.0694		2.728
2748	1.1110		2.642
2448	1.1781		2.530
2169	1.2619		2.428
1892	1.3751		2.329
1658	1.5065		2.242
1438	1.6755		2.160
1198	1.9385		2.073
952	2.3613		1.980
726	3.0122		2.899
527	4.0626		1.826

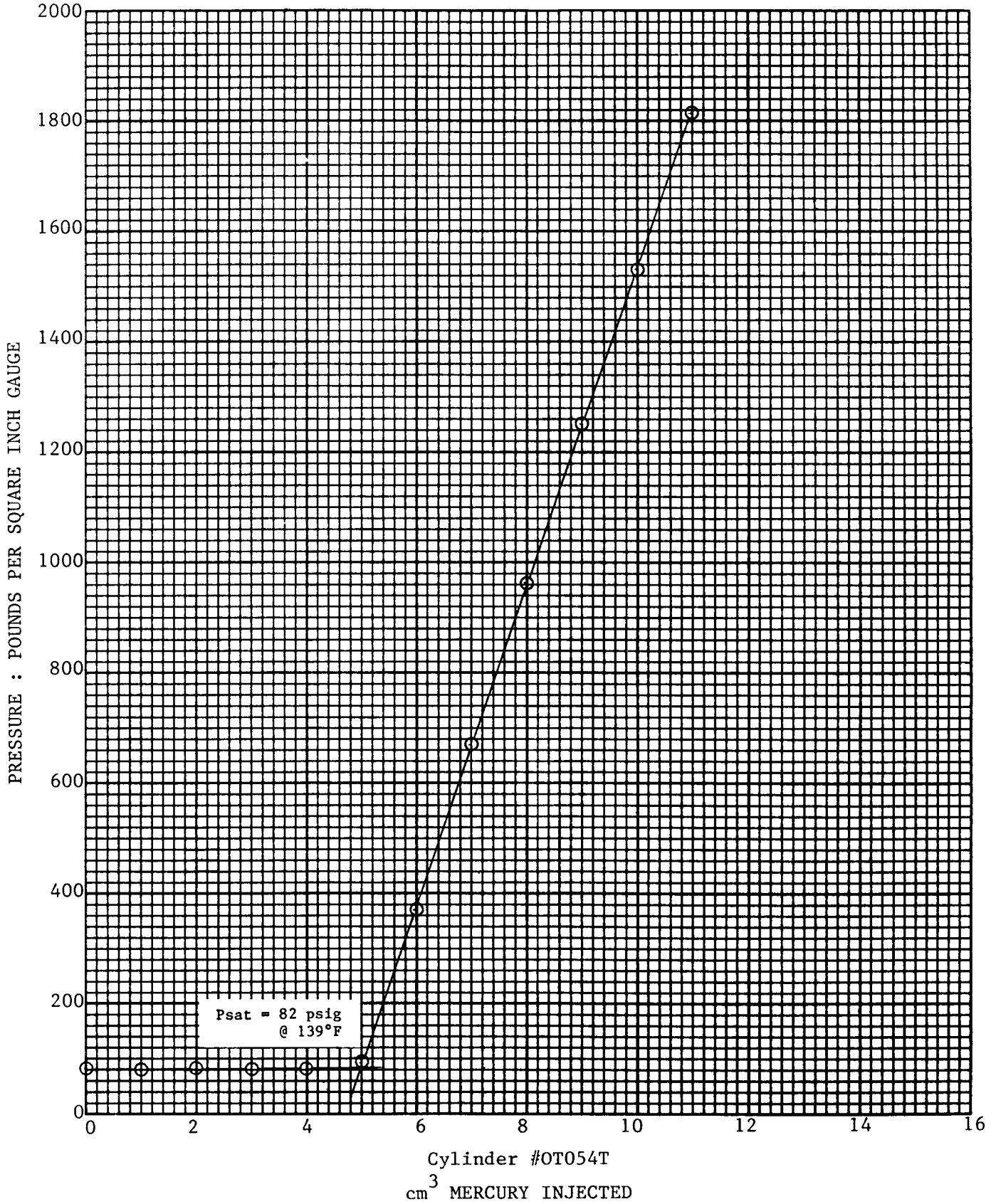
\* Saturation Pressure

(1) Relative volume:  $V/V_{sat}$  is barrels @ indicated pressure per barrel @ saturation pressure.

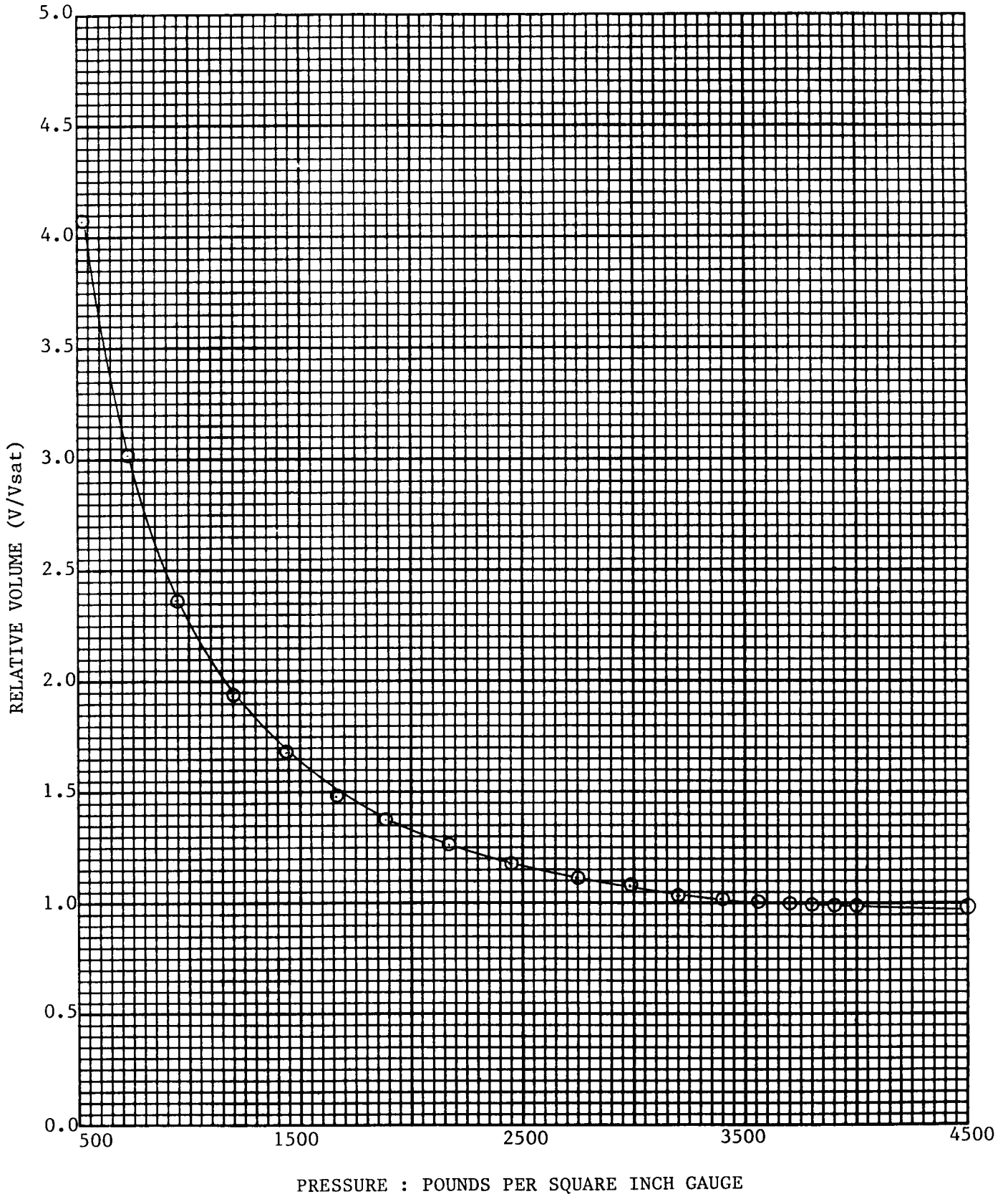
(2) Instantaneous Compressibility =  $-\frac{dV}{VdP}$

(3) Y Function =  $\frac{(P_{sat} - P)}{(P_{abs})(V/V_{sat}-1)}$

Company Esso Australia Limited Formation \_\_\_\_\_  
Well Tuna #4, Set 3 State Victoria  
Field Tuna Country Australia

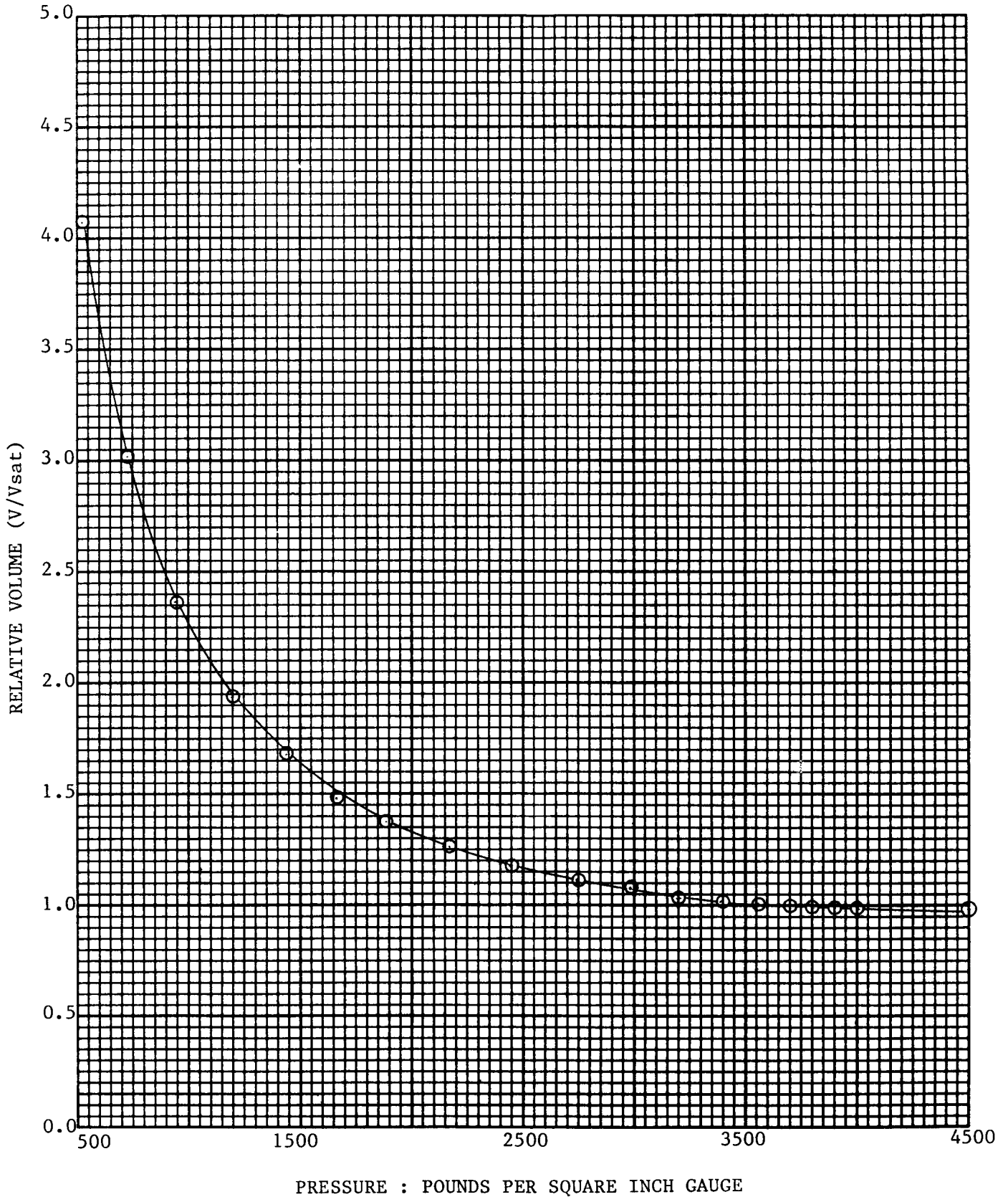


Company Esso Australia Limited Formation \_\_\_\_\_  
Well Tuna #4, Set 3 State Victoria  
Field Tuna Country Australia





Company Esso Australia Limited Formation \_\_\_\_\_  
Well Tuna #4, Set 3 State Victoria  
Field Tuna Country Australia



Company Esso Australia Limited Formation \_\_\_\_\_  
 Well Tuna #4, Set 3 State Victoria  
 Field Tuna Country Australia

