

OR-551

Thylacine #2



**CORE LABORATORIES
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***Reservoir Fluid
Analysis of
Surface Samples from
Thylacine #2
Otway Basin, Victoria***

Prepared for
Woodside Energy Limited

March 2002

File: AFL 2001-053

Reservoir Fluid Laboratory
Core Laboratories Australia Pty Ltd
Perth
Western Australia

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**CORE LABORATORIES
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11 March, 2002

Woodside Energy Limited
1 Adelaide Terrace
Perth
Western Australia, 6000

Attention: Mr Werner Ribul

Subject: Reservoir Fluid Analysis
Well: Thylacine #2
Location: Otway Basin, Victoria
File: AFL 2001-053

Dear Werner,

Three sets of separator recombination samples, and four separator gas samples, were collected during DST's on the Thylacine #2 well and shipped to our Perth laboratory for validity checks, composition and a limited reservoir fluid analysis study. Presented in the following report are the results of these analyses.

Core Laboratories Australia Pty Ltd appreciates this opportunity to be of service to Woodside Energy Limited. Should you have any questions regarding this report, or if we may be of any further assistance, please feel free to contact me at your convenience.

Yours Faithfully,
For **CORE LABORATORIES AUSTRALIA PTY LTD**

Kevin R. Daken
Laboratory Supervisor

Woodside Energy Limited
Thylacine #2
AFL 2001-053

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LABORATORY PROCEDURES

Sample Receipt and Validation

Three sets of Zone 2 separator samples and three Zone 1 separator gas samples were received in our Perth laboratory for use in a compositional and PVT analysis study. As a preliminary quality check, the opening pressure and air content of each separator gas sample was measured. Additionally, the room temperature saturation pressure and sample volumes were determined for each separator condensate sample. The results, summarised on page 3, indicated that all samples were reasonably consistent with reported conditions and were selected for compositional analysis.

Compositional Analysis

The composition of each separator gas was analysed by gas chromatography using the GPA 2286 method. The compositions of Zone 1 gases 1.05, 1.06 and 1.07 are presented on pages 4 through 6 with the extra Zone 2 gas 1.25 composition on page 7.

The composition of the separator condensate samples was determined by flash/separation techniques where a fluid sub-sample was flashed at 120°F and separated into liquid and gas phases. The flashed gas was analysed according to the GPA 2286 method and the flashed liquid using temperature programmed capillary chromatography. These compositions were then mathematically recombined at the measured flash gas-oil ratio and the resultant separator oil composition.

The reported field CGR was used, together with measured separator product compositions, to calculate producing wellstream compositions. All Zone 2 volumetric and compositional data are presented on pages 8 through 11 (1.19 & 1.20), pages 12 through 15 (1.21 & 1.22) and pages 16 through 19 (1.23 & 1.24). Based on equilibrium K data and Hoffman-Crump plots, Sample set 1.19 and 1.20 were selected for physical recombination.

Two atmospheric condensate samples (1.11 from Zone 1 and 1.28 from Zone 2) were selected for compositional analysis. Each sample was analysed through C36+ using temperature programmed capillary chromatography. The resultant compositions are presented on pages 24 and 25.

Additional analyses determined H₂S, mercaptans and total sulphur for selected gas samples from Zone 1 and Zone 2, BTEX content of recombination sample set 1.19 and 1.20 and hydrogen and helium content of the recombined sample. These analysis results are summarised on page 21.

Physical Recombination

For the selected set of recombination samples, a known volume of equilibrated separator condensate was charged to a high-pressure laboratory storage cylinder. The appropriate volume of separator gas was added to this cylinder to obtain a reservoir fluid suitable for use in the PVT analyses program. The recombined mixture was equilibrated in single phase and stored at a high laboratory working pressure.

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LABORATORY PROCEDURES (cont. /-)

Pressure Volume Relations

A known volume of recombined reservoir fluid sample was charged to the large volume Sloane-type, high-pressure visual cell and thermally expanded to 114 °C. Once equilibrated in single phase, the fluid was then subjected to the constant composition expansion procedure. During this procedure, a trace of liquid was observed at 2320 psig indicating the dew point for the reservoir gas. The pressure volume relations and a retrograde liquid curve were then completed with resultant volumetric data, pressure volume relation and retrograde liquid measurements presented on page 20. Graphical representations are depicted in figures A-1 through A-3.

Water Sample Analysis

A total of four atmospheric water samples were subjected to a series of standard water analysis tests. The results of these analyses are summarised on page 22.

High Temperature Distillation Analysis

One separator condensate sample (6802-MA) was selected. The sample was flashed under controlled conditions to a cold trap. The resultant atmospheric sample was subjected to a distillation procedure whereby individual carbon number cuts were collected and their molecular weights and densities were measured. The process was continued until the C11 cut was obtained. Properties of the C12+ residue were also measured and all test results are summarised on page 23.

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Thylacine #2

AFL 2001-053

General Well Information

Company.....	Woodside Energy Limited
Well Name.....	Thylacine #2
API Well Number.....	-
File Number.....	AFL 2001-053
Date Sample Collected.....	22-Sep-01
Sample Type.....	Separator
Geographical Location.....	Otway Basin, Victoria
Field.....	Thylacine

Well Description

Formation.....	Upper Waare Sand	
Pool (or Zone).....	*	
Date Completed.....	*	
Elevation.....	*	m
Producing Interval.....	2296-2302	m MDBRT
Total Depth.....	*	m
Tubing Size.....	*	in
Tubing Depth.....	*	m
Casing Size.....	*	in
Casing Depth.....	*	m

Pressure Survey Data

Data from Original Discovery Well

Date.....	*	
Reservoir Pressure.....	*	psig

Data at Sample Collection

Date.....	22-Sep-01	
Reservoir Pressure.....	*	psig
Reservoir Temperature.....	114	°C
Pressure Tool.....	*	
Flowing Bottom-Hole Pressure.....	3048	psig
Flowing Tubing Pressure.....	1722	psig

* Data not forwarded to Core Laboratories.

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Thylacine #2
AFL 2001-053

Production Data

Data from Original Discovery Well

Location.....	*	
Date.....	*	
Oil Gravity @ STP.....	*	°API
Separator Pressure.....	*	psig
Separator Temperature.....	*	°F
Production Rates		
Gas.....	*	Mscf/D
Liquid.....	*	STbbl/D
Gas/Liquid Ratio.....	*	scf/bbl

Separator Conditions

Primary Separator Pressure.....	369	psig
Primary Separator Temperature.....	31	°C
Secondary Separator Pressure.....	-	psig
Secondary Separator Temperature.....	-	°C
Primary Separator Gas Production Rate.....	#	Mscf/D

Gas Factors -

Field Values:

Pressure Base.....	14.696	psia
Temperature Base.....	60	°F
Compressibility Factor (Fpv).....	*	
Gas Gravity Factor (Fg).....	1.1969	

Laboratory Values:

Pressure Base.....	14.696	psia
Temperature Base.....	60	°F
Compressibility Factor (Fpv).....	1.0301	
Gas Gravity Factor (Fg).....	1.2015	

Primary Separator Liquid Rate.....	#	bbl/D	at	31 °C
Stock Tank Liquid Rate.....	#	bbl/D	at	°F
Separator Gas / Separator Liquid Ratio.....	311847	scf/bbl		
Separator Gas / Stock Tank Liquid Ratio.....	333333	scf/bbl		
Stock Tank Liquid / Separator Gas Ratio.....	3.00	bbl/MMscf		
Separator Liquid / Stock Tank Liquid Ratio.....	1.0689	bbl/bbl	at	60 °F

Recombination CGR (3 STB/MMscf) specified by Woodside Energy Limited.

* Data not forwarded to Core Laboratories.

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**PRELIMINARY CHECKS OF SAMPLE QUALITY
AND SUMMARY OF SAMPLES RECEIVED**

Separator Gas					
Cylinder Number	Sampling Conditions		Laboratory Opening Conditions		
	psig	°C	psig	°C	Air Content (mol %)
4345A (1.20) *	369	31	397	31	0.19
4281A (1.22)	369	32	395	32	0.06
3256A (1.24)	369	33	392	33	0.03
01352 (1.25)	369	33	393	33	0.03

Separator Liquid					
Cylinder Number	Sampling Conditions		Laboratory Bubblepoint		Water Recovered (cc)
	psig	°C	psig	°C	
6802-MA (1.19) *	369	31	326	18.3	0
6097-MA (1.21)	369	32	345	18.3	0
5960-MA (1.23)	369	33	332	19.6	0

* These samples selected for recombination and further analysis.

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COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.05

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	9.16		0.8172	44.010
Nitrogen	1.39		0.8086	28.013
Methane	80.51		0.2997	16.043
Ethane	5.50	1.021	0.3562	30.070
Propane	1.83	0.305	0.5070	44.097
iso-Butane	0.34	0.062	0.5629	58.123
n-Butane	0.43	0.079	0.5840	58.123
iso-Pentane	0.17	0.033	0.6244	72.150
n-Pentane	0.12	0.022	0.6311	72.150
Hexanes	0.16	0.027	0.6850	84.0
Heptanes	0.22	0.046	0.7220	96.0
Octanes	0.15	0.059	0.7450	107
Nonanes	0.02	0.030	0.7640	121
Decanes	Trace	0.005	0.7780	134
Undecanes	Trace			
Totals	100.00	1.689		

SAMPLING CONDITIONS

166 psig

81 °C

Gas Cylinder

5235A

Average Sample Properties

Critical Pressure, psia 699.4

Critical Temperature, °R 385.3

Average Molecular Weight 20.99

Calculated Gas Gravity (air = 1.000) 0.725

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*

Gross 1022

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.39	0.734	61.1	101.5

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

Woodside Energy Limited

Thylacine #2

AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.06

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	9.17		0.8172	44.010
Nitrogen	1.38		0.8086	28.013
Methane	80.52		0.2997	16.043
Ethane	5.50	1.466	0.3562	30.070
Propane	1.80	0.494	0.5070	44.097
iso-Butane	0.34	0.111	0.5629	58.123
n-Butane	0.43	0.135	0.5840	58.123
iso-Pentane	0.17	0.062	0.6244	72.150
n-Pentane	0.12	0.043	0.6311	72.150
Hexanes	0.15	0.058	0.6850	84.0
Heptanes	0.22	0.092	0.7220	96.0
Octanes	0.17	0.077	0.7450	107
Nonanes	0.03	0.015	0.7640	121
Decanes	Trace			
Undecanes	0.00			
Totals	100.00	2.553		

SAMPLING CONDITIONS

166 psig

81 °C

Gas Cylinder

3555A

Average Sample Properties

Critical Pressure, psia 699.6

Critical Temperature, °R 385.4

Average Molecular Weight 21.00

Calculated Gas Gravity (air = 1.000) 0.725

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*

Gross 1023

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.42	0.725	60.8	102.2

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

Woodside Energy Limited

Thylacine #2

AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.07

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	9.09		0.8172	44.010
Nitrogen	1.33		0.8086	28.013
Methane	80.89		0.2997	16.043
Ethane	5.49	1.463	0.3562	30.070
Propane	1.80	0.494	0.5070	44.097
iso-Butane	0.34	0.111	0.5629	58.123
n-Butane	0.41	0.129	0.5840	58.123
iso-Pentane	0.16	0.058	0.6244	72.150
n-Pentane	0.11	0.040	0.6311	72.150
Hexanes	0.12	0.046	0.6850	84.0
Heptanes	0.16	0.067	0.7220	96.0
Octanes	0.09	0.041	0.7450	107
Nonanes	0.01	0.005	0.7640	121
Decanes	Trace			
Undecanes	Trace			
Totals	100.00	2.454		

SAMPLING CONDITIONS

163 psig

71 °C

Gas Cylinder

03711

Average Sample Properties

Critical Pressure, psia 699.8

Critical Temperature, °R 383.8

Average Molecular Weight 20.79

Calculated Gas Gravity (air = 1.000) 0.718

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*

Gross 1014

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.26	0.733	61.4	100.8
Decanes plus				

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

Woodside Energy Limited

Thylacine #2

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COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.25

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.89		0.8172	44.010
Nitrogen	1.23		0.8086	28.013
Methane	84.05		0.2997	16.043
Ethane	3.85	1.026	0.3562	30.070
Propane	1.17	0.321	0.5070	44.097
iso-Butane	0.19	0.062	0.5629	58.123
n-Butane	0.26	0.082	0.5840	58.123
iso-Pentane	0.09	0.033	0.6244	72.150
n-Pentane	0.06	0.022	0.6311	72.150
Hexanes	0.06	0.023	0.6850	84.0
Heptanes	0.09	0.038	0.7220	96.0
Octanes	0.05	0.023	0.7450	107
Nonanes	0.01	0.005	0.7640	121
Decanes	Trace			
Undecanes	Trace			
Totals	100.00	1.635		

SAMPLING CONDITIONS

369 psig
33 °C

Gas Cylinder
01352

Average Sample Properties

Critical Pressure, psia 699.8
Critical Temperature, °R 375.3

Average Molecular Weight 19.99
Calculated Gas Gravity (air = 1.000) 0.690

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*
Gross 978

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.15	0.733	61.4	101.3

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

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Thylacine #2

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COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.20

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.87		0.8172	44.010
Nitrogen	1.40		0.8086	28.013
Methane	83.84		0.2997	16.043
Ethane	3.82	1.018	0.3562	30.070
Propane	1.17	0.321	0.5070	44.097
iso-Butane	0.20	0.065	0.5629	58.123
n-Butane	0.26	0.082	0.5840	58.123
iso-Pentane	0.09	0.033	0.6244	72.150
n-Pentane	0.07	0.025	0.6311	72.150
Hexanes	0.08	0.031	0.6850	84.0
Heptanes	0.12	0.050	0.7220	96.0
Octanes	0.07	0.032	0.7450	107
Nonanes	0.01	0.005	0.7640	121
Decanes	0.00			
Undecanes	0.00			
Totals	100.00	1.662		

SAMPLING CONDITIONS

369 psig
31 °C

Gas Cylinder
4345A

Average Sample Properties

Critical Pressure, psia 699.3
 Critical Temperature, °R 375.6
 Average Molecular Weight 20.06
 Calculated Gas Gravity (air = 1.000) 0.693

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*

Gross 980

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.20	0.7328	61.4	101.1

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

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Thylacine #2

AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR LIQUID - 1.19

(by Flash/Extended Chromatography)

Component	Mol %	Wt %	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00		
Carbon Dioxide	2.28	0.87	0.8172	44.010
Nitrogen	0.04	0.01	0.8086	28.013
Methane	8.80	1.23	0.2997	16.043
Ethane	2.15	0.56	0.3562	30.070
Propane	2.00	0.77	0.5070	44.097
iso-Butane	0.72	0.36	0.5629	58.123
n-Butane	1.39	0.70	0.5840	58.123
iso-Pentane	1.14	0.72	0.6244	72.150
n-Pentane	1.12	0.70	0.6311	72.150
Hexanes	3.00	2.19	0.6850	84.0
Heptanes	11.24	9.38	0.7220	96.0
Octanes	21.93	20.41	0.7450	107
Nonanes	13.76	14.48	0.7640	121
Decanes	7.57	8.82	0.7780	134
Undecanes	4.43	5.66	0.7890	147
Dodecanes plus	18.43	33.13	0.8320	207
Totals	100.00	100.00		

SAMPLING CONDITIONS

369 psig
31 °C

Liquid Cylinder
6802-MA

Average Sample Properties

Average Molecular Weight 114.99
Calculated Density at 0 psig and 60 °F 0.7505

Properties of Plus Fractions

Plus Fraction	Mol%	Wt%	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	77.36	91.88	0.7808	49.5	137
Decanes plus	30.43	47.61	0.8162	41.7	180
Dodecanes plus	18.43	33.13	0.8320	38.4	207

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WELLSTREAM RECOMBINATION CALCULATION

(based on field production data)

Conditions for Recombination Calculations

Primary Stage at 369 psig and 68 °F

Stock Tank at 0 psig and 60 °F

Field Gas Rate Correction Factors -

Gas Gravity (air=1.000)	**
Gas Gravity Factor, Fg	**
Gas Deviation Factor, Z	**
Super Compressibility Factor, Fpv	**
Pressure Base, psia	14.696

Field Measured Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D	**
Stock Tank Liquid Flow Rate, bbl/D	**
Field Gas / Oil Ratio, scf/STbbl	333333

Recombination Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D	**
Primary Stage Liquid Flow Rate, bbl/D	**
Primary Stage Gas / Oil Ratio, scf/S*bbl	311847
Stock Tank Liquid Flow Rate, bbl/D	**
Corrected Gas / Oil Ratio, scf/STbbl	333333

Laboratory Gas Rate Correction Factors -

Gas Gravity (air=1.000)	0.693
Gas Gravity Factor, Fg (not applied).....	1.2015
Gas Deviation Factor*, Z	0.942
Supercompressibility Factor, Fpv (not applied).....	1.0301
Pressure Base, psia	14.696

Laboratory Liquid Rate Correction Factors -

Liquid Volume Factor, S*bbl/STbbl @ 60 °F	1.0689
Bitumen, Sediment & Water (BS&W) Factor	1.000

Wellstream Recombination Ratio
mol/mol

360.0373

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

** Data not supplied to Core Laboratories

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COMPOSITION OF RECOMBINED WELLSTREAM

(from calculated recombination of separator products)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.85		0.8172	44.010
Nitrogen	1.40		0.8086	28.013
Methane	83.64		0.2997	16.043
Ethane	3.82	1.017	0.3562	30.070
Propane	1.17	0.322	0.5070	44.097
iso-Butane	0.20	0.066	0.5629	58.123
n-Butane	0.26	0.083	0.5840	58.123
iso-Pentane	0.09	0.034	0.6244	72.150
n-Pentane	0.07	0.026	0.6311	72.150
Hexanes	0.09	0.034	0.6850	84.0
Heptanes	0.15	0.063	0.7220	96.0
Octanes	0.13	0.059	0.7450	107
Nonanes	0.05	0.024	0.7640	121
Decanes	0.02	0.011	0.7780	134
Undecanes	0.01	0.007	0.7890	147
Dodecanes plus	0.05	0.040	0.8320	207
Totals	100.00	1.787		

RECOMBINATION CONDITIONS

369 psig
31 °C

Recombination Parameters

Primary Stage Gas / Oil Ratio, scf/S'bbbl
at recombination conditions 311847
Wellstream Recombination Ratio
moles gas / mole liquid 360.0373

Average Wellstream Properties

Average Molecular Weight 20.3
Gas Gravity (air = 1.000) 0.701

Properties of Plus Fractions

Plus Fraction	Mol%	Plant Products (GPM)	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.41	0.205	0.7601	54.5	119
Decanes plus	0.08	0.059	0.8162	41.7	180
Dodecanes plus	0.05	0.040	0.8320	38.4	207

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Thylacine #2

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COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.22

(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.80		0.8172	44.010
Nitrogen	1.49		0.8086	28.013
Methane	83.93		0.2997	16.043
Ethane	3.81	1.016	0.3562	30.070
Propane	1.15	0.316	0.5070	44.097
iso-Butane	0.19	0.062	0.5629	58.123
n-Butane	0.25	0.079	0.5840	58.123
iso-Pentane	0.09	0.033	0.6244	72.150
n-Pentane	0.07	0.025	0.6311	72.150
Hexanes	0.07	0.027	0.6850	84.0
Heptanes	0.10	0.042	0.7220	96.0
Octanes	0.05	0.023	0.7450	107
Nonanes	0.00			
Decanes	0.00			
Undecanes	0.00			
Totals	100.00	1.623		

SAMPLING CONDITIONS

369 psig

32 °C

Gas Cylinder
4281A

Average Sample Properties

Critical Pressure, psia	699.0
Critical Temperature, °R	374.8
Average Molecular Weight	19.99
Calculated Gas Gravity (air = 1.000)	0.690

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*

Gross 976

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.15	0.7301	62.1	99.7

Note: Component properties assigned from literature.

* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

Woodside Energy Limited

Thylacine #2

AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR LIQUID - 1.21

(by Flash/Extended Chromatography)

Component	Mol %	Wt %	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00		
Carbon Dioxide	2.19	0.83	0.8172	44.010
Nitrogen	0.03	0.01	0.8086	28.013
Methane	8.57	1.19	0.2997	16.043
Ethane	2.05	0.53	0.3562	30.070
Propane	1.90	0.72	0.5070	44.097
iso-Butane	0.70	0.35	0.5629	58.123
n-Butane	1.34	0.67	0.5840	58.123
iso-Pentane	1.11	0.69	0.6244	72.150
n-Pentane	1.09	0.68	0.6311	72.150
Hexanes	2.98	2.16	0.6850	84.0
Heptanes	11.23	9.30	0.7220	96.0
Octanes	21.89	20.21	0.7450	107
Nonanes	13.92	14.53	0.7640	121
Decanes	7.66	8.85	0.7780	134
Undecanes	4.51	5.72	0.7890	147
Dodecanes plus	18.83	33.56	0.8319	207
Totals	100.00	100.00		

SAMPLING CONDITIONS

369 psig
32 °C

Liquid Cylinder
6097-MA

Average Sample Properties

Average Molecular Weight 115.92
Calculated Density at 0 psig and 60 °F 0.7519

Properties of Plus Fractions

Plus Fraction	Mol%	Wt%	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	78.04	92.17	0.7811	49.5	137
Decanes plus	31.00	48.13	0.8162	41.7	180
Dodecanes plus	18.83	33.56	0.8319	38.4	207

Woodside Energy Limited

Thylacine #2

AFL 2001-053

WELLSTREAM RECOMBINATION CALCULATION

(based on field production data)

Conditions for Recombination Calculations

Primary Stage at 369 psig and 68 °F

Stock Tank at 0 psig and 60 °F

Field Gas Rate Correction Factors -

Gas Gravity (air=1.000) **
 Gas Gravity Factor, Fg **
 Gas Deviation Factor, Z **
 Super Compressibility Factor, Fpv **
 Pressure Base, psia 14.696

Laboratory Gas Rate Correction Factors -

Gas Gravity (air=1.000) 0.690
 Gas Gravity Factor, Fg (not applied)..... 1.2038
 Gas Deviation Factor*, Z 0.943
 Supercompressibility Factor, Fpv (not applied)..... 1.0299
 Pressure Base, psia 14.696

Laboratory Liquid Rate Correction Factors -

Liquid Volume Factor, S*bbl/STbbl @ 60 °F 1.0673
 Bitumen, Sediment & Water (BS&W) Factor 1.000

Field Measured Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D **
 Stock Tank Liquid Flow Rate, bbl/D **
 Field Gas / Oil Ratio, scf/STbbl 333333

Recombination Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D **
 Primary Stage Liquid Flow Rate, bbl/D **
 Primary Stage Gas / Oil Ratio, scf/S*bbl 312324
 Stock Tank Liquid Flow Rate, bbl/D **
 Corrected Gas / Oil Ratio, scf/STbbl 333333

Wellstream Recombination Ratio
mol/mol 362.8297

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

** Data not supplied to Core Laboratories

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Thylacine #2

AFL 2001-053

COMPOSITION OF RECOMBINED WELLSTREAM

(from calculated recombination of separator products)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.78		0.8172	44.010
Nitrogen	1.49		0.8086	28.013
Methane	83.73		0.2997	16.043
Ethane	3.81	1.014	0.3562	30.070
Propane	1.15	0.316	0.5070	44.097
iso-Butane	0.19	0.062	0.5629	58.123
n-Butane	0.25	0.080	0.5840	58.123
iso-Pentane	0.09	0.034	0.6244	72.150
n-Pentane	0.07	0.026	0.6311	72.150
Hexanes	0.08	0.030	0.6850	84.0
Heptanes	0.13	0.055	0.7220	96.0
Octanes	0.11	0.050	0.7450	107
Nonanes	0.04	0.019	0.7640	121
Decanes	0.02	0.011	0.7780	134
Undecanes	0.01	0.007	0.7890	147
Dodecanes plus	0.05	0.041	0.8319	207
Totals	100.00	1.746		

RECOMBINATION CONDITIONS

369 psig
32 °C

Recombination Parameters

Primary Stage Gas / Oil Ratio, scf/S'bbbl
at recombination conditions 312324
Wellstream Recombination Ratio
moles gas / mole liquid 362.8297

Average Wellstream Properties

Average Molecular Weight 20.2
Gas Gravity (air = 1.000) 0.697

Properties of Plus Fractions

Plus Fraction	Mol%	Plant Products (GPM)	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.36	0.183	0.7625	53.9	121
Decanes plus	0.08	0.059	0.8162	41.7	180
Dodecanes plus	0.05	0.041	0.8319	38.4	207

Woodside Energy Limited
Thylacine #2
AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR GAS - 1.24
(by Programmed-Temperature, Capillary Chromatography)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.88		0.8172	44.010
Nitrogen	1.24		0.8086	28.013
Methane	83.97		0.2997	16.043
Ethane	3.83	1.021	0.3562	30.070
Propane	1.11	0.305	0.5070	44.097
iso-Butane	0.19	0.062	0.5629	58.123
n-Butane	0.25	0.079	0.5840	58.123
iso-Pentane	0.09	0.033	0.6244	72.150
n-Pentane	0.06	0.022	0.6311	72.150
Hexanes	0.07	0.027	0.6850	84.0
Heptanes	0.11	0.046	0.7220	96.0
Octanes	0.13	0.059	0.7450	107
Nonanes	0.06	0.030	0.7640	121
Decanes	0.01	0.005	0.7780	134
Undecanes	0.00			
Totals	100.00	1.689		

SAMPLING CONDITIONS

369 psig
33 °C

Gas Cylinder
3256A

Average Sample Properties

Critical Pressure, psia 699.3
Critical Temperature, °R 376.2

Average Molecular Weight 20.12
Calculated Gas Gravity (air = 1.000) 0.695

at 14.696 psia and 60 °F

Heating Value, Btu/scf dry gas*
Gross 985

Properties of Plus Fractions

Component	Mol %	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.31	0.7428	58.8	106.7
Decanes plus	0.01	0.7780	50.2	134.0

Note: Component properties assigned from literature.
* ref: Gas Producers & Suppliers Association (GPSA) Engineering Data Book

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Thylacine #2

AFL 2001-053

COMPOSITION OF PRIMARY STAGE SEPARATOR LIQUID - 1.23

(by Flash/Extended Chromatography)

Component	Mol %	Wt %	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00	0.00		
Carbon Dioxide	2.21	0.84	0.8172	44.010
Nitrogen	0.04	0.01	0.8086	28.013
Methane	8.74	1.21	0.2997	16.043
Ethane	2.07	0.54	0.3562	30.070
Propane	1.93	0.73	0.5070	44.097
iso-Butane	0.69	0.35	0.5629	58.123
n-Butane	1.33	0.67	0.5840	58.123
iso-Pentane	1.11	0.69	0.6244	72.150
n-Pentane	1.08	0.67	0.6311	72.150
Hexanes	2.91	2.11	0.6850	84.0
Heptanes	11.02	9.14	0.7220	96.0
Octanes	21.88	20.22	0.7450	107
Nonanes	14.03	14.66	0.7640	121
Decanes	7.60	8.79	0.7780	134
Undecanes	4.51	5.73	0.7890	147
Dodecanes plus	18.85	33.65	0.8320	207
Totals	100.00	100.00		

SAMPLING CONDITIONS

369 psig
33 °C

Liquid Cylinder
5960-MA

Average Sample Properties

Average Molecular Weight 115.80
Calculated Density at 0 psig and 60 °F 0.7517

Properties of Plus Fractions

Plus Fraction	Mol%	Wt%	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	77.89	92.19	0.7813	49.4	137
Decanes plus	30.96	48.17	0.8164	41.7	180
Dodecanes plus	18.85	33.65	0.8320	38.4	207

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Thylacine #2

AFL 2001-053

WELLSTREAM RECOMBINATION CALCULATION

(based on field production data)

Conditions for Recombination Calculations

Primary Stage at 369 psig and 68 °F

Stock Tank at 0 psig and 60 °F

Field Gas Rate Correction Factors -

Gas Gravity (air=1.000) **
 Gas Gravity Factor, Fg **
 Gas Deviation Factor, Z **
 Super Compressibility Factor, Fpv **
 Pressure Base, psia 14.696

Field Measured Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D **
 Stock Tank Liquid Flow Rate, bbl/D **
 Field Gas / Oil Ratio, scf/STbbl 333333

Recombination Rates and Ratios -

Primary Stage Gas Flow Rate, Mscf/D **
 Primary Stage Liquid Flow Rate, bbl/D **
 Primary Stage Gas / Oil Ratio, scf/S'bbl 314859
 Stock Tank Liquid Flow Rate, bbl/D **
 Corrected Gas / Oil Ratio, scf/STbbl 333333

Laboratory Gas Rate Correction Factors -

Gas Gravity (air=1.000) 0.695
 Gas Gravity Factor, Fg (not applied)..... 1.1998
 Gas Deviation Factor*, Z 0.942
 Supercompressibility Factor, Fpv (not applied)..... 1.0303
 Pressure Base, psia 14.696

Laboratory Liquid Rate Correction Factors -

Liquid Volume Factor, S'bbl/STbbl @ 60 °F 1.0587
 Bitumen, Sediment & Water (BS&W) Factor 1.000

Wellstream Recombination Ratio

mol/mol 365.4782

* From: Standing, M.B., "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems", SPE (Dallas), 1977, 8th Edition, Appendix II.

** Data not supplied to Core Laboratories

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Thylacine #2

AFL 2001-053

COMPOSITION OF RECOMBINED WELLSTREAM

(from calculated recombination of separator products)

Component	Mol %	Plant Products (GPM)	Liquid Density (gm/cc)	MW
Hydrogen Sulfide	0.00			
Carbon Dioxide	8.86		0.8172	44.010
Nitrogen	1.24		0.8086	28.013
Methane	83.77		0.2997	16.043
Ethane	3.83	1.020	0.3562	30.070
Propane	1.11	0.305	0.5070	44.097
iso-Butane	0.19	0.062	0.5629	58.123
n-Butane	0.25	0.079	0.5840	58.123
iso-Pentane	0.09	0.034	0.6244	72.150
n-Pentane	0.06	0.023	0.6311	72.150
Hexanes	0.08	0.030	0.6850	84.0
Heptanes	0.14	0.059	0.7220	96.0
Octanes	0.19	0.086	0.7450	107
Nonanes	0.10	0.049	0.7640	121
Decanes	0.03	0.017	0.7780	134
Undecanes	0.01	0.007	0.7890	147
Dodecanes plus	0.05	0.040	0.8320	207
Totals	100.00	1.811		

RECOMBINATION CONDITIONS

369 psig

33 °C

Recombination Parameters

Primary Stage Gas / Oil Ratio, scf/S'bbl
at recombination conditions 314859
Wellstream Recombination Ratio
moles gas / mole liquid 365.4782

Average Wellstream Properties

Average Molecular Weight 20.4
Gas Gravity (air = 1.000) 0.704

Properties of Plus Fractions

Plus Fraction	Mol%	Plant Products (GPM)	Liquid Density (gm/cc)	Liquid API Gravity	MW
Heptanes plus	0.52	0.258	0.7599	54.5	119
Decanes plus	0.09	0.064	0.8135	42.3	176
Dodecanes plus	0.05	0.040	0.8320	38.4	207

Woodside Energy Limited

Thylacine #2

AFL 2001-053

PRESSURE-VOLUME RELATIONS

(at 114 °C)

Pressure psig	Relative Volume (A)	Liquid Volume Percent (B)	Deviation Factor Z
6000	0.4557		1.062
5500	0.4817		1.029
5000	0.5136		0.998
4500	0.5542		0.969
4000	0.6075		0.945
3600	0.6634		0.929
3200	0.7360		0.916
3000	0.7808		0.912
2800	0.8328		0.908
2700	0.8620		0.906
2600	0.8937		0.905
2500	0.9283		0.904
2400	0.9663		0.904
d>2320	1.0000	0.00	0.904
2200	1.0544	0.00	
2100	1.1048	0.00	
2000	1.1605	0.00	
1900	1.2224	0.00	
1700	1.3690	0.00	
1536	1.5186	0.00	
1394	1.6772	0.00	
1184	1.9826	0.00	
1023	2.3022	0.00	
906	2.6057	0.00	
807	2.9306	0.00	
666	3.5579	0.00	

Note : Liquid volume percent of 0.00 indicates less than 0.005%

(A) Relative Volume: V/V_{sat} or volume at indicated pressure per volume at saturation pressure.

(B) Percent of the total volume of gas and liquid at the indicated pressure and 114 °C

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Thylacine #2

AFL 2001-053

MISCELLANEOUS COMPOSITIONAL ANALYSES

Aromatic Content of Recombination Samples (6802-MA and 4345A)

Component	Flash Gas Mol %	Flash Liquid Mol %	Separator Liquid Mol %	Separator Gas Mol %	Wellstream Mol %
Benzene	0.965	2.471	2.190	0.026	0.032
Toluene	1.170	14.632	12.118	0.021	0.055
Ethyl Benzene	0.028	1.695	1.384	0.000	0.004
Xylenes	0.181	10.570	8.630	0.001	0.025

Hydrogen & Helium in Recombined Sample (6802-MA and 4345A)

Component	Wellstream Mol %
Hydrogen	<0.01
Helium	0.02

Sulphur Compounds in Gas Samples Zone 1 (Cyl 03711) and Zone 2 (Cyl 01352)

Component	Cyl 03711 ppm v/v	Cyl 01352 ppm v/v	Combined ppm v/v
H ₂ S	-	-	<1
Mercaptans	-	-	<1
Total Sulphur	<0.7	<0.7	-

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Thylacine #2

AFL 2001-053

ROUTINE WATER ANALYSIS

Sample	1.09	1.17	1.18	1.26
Dissolved Constituent	mg/L	mg/L	mg/L	mg/L
Ions				
Calcium, Ca	600	74	75	64
Magnesium, Mg	140	24	24	26
Iron, Fe (soluble)	390.0	13.0	21.0	1.4
Sodium, Na	8000	450	440	500
Potassium, K	49000	3300	3300	3500
Strontium, Sr	24	1.2	1.1	0.9
Barium, Ba	4.7	5.2	3.8	0.4
Chloride, Cl	60000	4100	4000	4200
Sulphate, SO4	820	<20	<20	55
Bicarbonate, HCO3	1700	310	350	340
Carbonate, CO3	<1	<1	<1	<1
Hydroxide, OH	<1	<1	<1	<1
Other Properties				
pH	7.4	5.0	5.3	7.8
Resistivity, ohm-m @ 25 °C	0.06	0.75	0.77	0.68
Total Dissolved Solids (grav)	130000	9300	8100	7900
Density, gm/cc @ 20 °C	1.082	1.005	1.005	1.005

Woodside Energy Limited

Thylacine #2

AFL 2001-053

HIGH TEMPERATURE DISTILLATION OF HEXANES PLUS FRACTION
(Condensate flashed from Cylinder 6802-MA)

Component Cut Fraction	Cut Temp °C	Mol Percent	Weight Percent	Volume Percent	Density gm/cc @60°F	°API @ 60°F	Molecular Weight
	IBP	36					
Hexanes	69	4.43	2.86	3.36	0.6978	71.1	82
Heptanes	99	16.00	11.26	12.10	0.7612	54.2	90
Octanes	126	25.72	20.05	20.72	0.7920	47.0	99
Nonanes	151	16.86	14.61	14.67	0.8149	42.0	111
Decanes	174	10.17	10.18	10.30	0.8083	43.4	128
Undecanes	197	7.61	9.04	8.79	0.8412	36.6	151
Dodecanes plus	FPB	197	19.21	32.00	0.8709	30.8	212
		<u>100.00</u>	<u>100.00</u>	<u>100.00</u>			

Woodside Energy Limited

Thylacine #2

AFL 2001-053

COMPOSITION BY CAPILLARY GAS CHROMATOGRAPHY - Sample 1.11

Component	Mol%	Weight%
Methane	0.01	0.00
Ethane	0.12	0.02
Propane	0.33	0.08
i-Butane	0.18	0.06
n-Butane	0.32	0.10
neo-Pentane	0.02	0.01
i-Pentane	0.32	0.13
n-Pentane	0.30	0.12
Hexanes	0.78	0.37
M-C-Pentane	0.41	0.19
Benzene	0.29	0.13
Cyclohexane	1.01	0.47
Heptanes	1.21	0.67
M-C-Hexane	2.11	1.14
Toluene	1.72	0.88
Octanes	2.13	1.34
E-Benzene	0.21	0.12
M/P-Xylene	1.97	1.16
O-Xylene	0.72	0.42
Nonanes	2.63	1.86
T-M-Benzene	0.41	0.27
Decanes	5.16	4.05
Undecanes	6.80	5.53
Dodecanes	9.45	8.41
Tridecanes	13.81	13.37
Tetradecanes	12.77	13.43
Pentadecanes	11.52	13.12
Hexadecanes	7.44	9.13
Heptadecanes	4.86	6.37
Octadecanes	4.29	5.95
Nonadecanes	2.38	3.46
Eicosanes	1.44	2.18
Heneicosanes	0.91	1.46
Docosanes	0.56	0.95
Tricosanes	0.36	0.63
Tetracosanes	0.21	0.38
Pentacosanes	0.12	0.23
Hexacosanes	0.10	0.20
Heptacosanes	0.05	0.11
Octacosanes	0.04	0.08
Nonacosanes	0.06	0.12
Triacotanes	0.03	0.06
Hentriacotanes	0.04	0.11
Dotriacotanes	0.02	0.05
Tritriacotanes	0.02	0.05
Tetratriacotanes	0.04	0.09
Pentatriacotanes	0.02	0.05
Hexatriacotanes plus	0.30	0.89
Totals	100.00	100.00

Calculated Properties		
Whole Sample Density	0.8169	g.cc-1 @ 60°F
Whole Sample Mol.Wt.	180.9	g.mol-1

Measured Properties		
Whole Sample Density	0.8365	g.cc-1 @ 60°F
Whole Sample Mol.Wt.	174.7	g.mol-1

Plus Fraction	Density	Mole Weight
Calculated Properties	g.cc-1 @ 60°F	g.mole-1
Heptanes Plus	0.8195	183.7
Undecanes Plus	0.8290	201.3
Eicosanes Plus	0.8787	321.6
Triacotanes Plus	0.9209	509.0
Hexatriacotanes Plus	0.9262	543.4

Subtotals	Mole %	Weight %
Heptanes	2.92	1.46
Octanes	5.96	3.36
Nonanes	5.53	3.56
Decanes	5.57	4.32

Notes
Calculated properties derived from Katz & Firoozabadi data.

Woodside Energy Limited

Thylacine #2

AFL 2001-053

COMPOSITION BY CAPILLARY GAS CHROMATOGRAPHY - Sample 1.28

Component	Mol%	Weight%
Methane	0.02	0.00
Ethane	0.18	0.04
Propane	0.84	0.30
i-Butane	0.59	0.28
n-Butane	1.36	0.64
neo-Pentane	0.03	0.02
i-Pentane	1.50	0.88
n-Pentane	1.54	0.90
Hexanes	4.09	2.87
M-C-Pentane	2.37	1.63
Benzene	2.97	1.89
Cyclohexane	5.02	3.44
Heptanes	5.48	4.47
M-C-Hexane	8.64	6.90
Toluene	12.25	9.17
Octanes	6.75	6.28
E-Benzene	0.57	0.49
M/P-Xylene	7.41	6.40
O-Xylene	2.00	1.73
Nonanes	5.64	5.89
T-M-Benzene	0.64	0.62
Decanes	6.84	7.92
Undecanes	4.55	5.44
Dodecanes	3.73	4.89
Tridecanes	3.75	5.33
Tetradecanes	2.74	4.23
Pentadecanes	2.30	3.85
Hexadecanes	1.53	2.76
Heptadecanes	1.02	1.98
Octadecanes	0.98	2.00
Nonadecanes	0.68	1.45
Eicosanes	0.50	1.12
Heneicosanes	0.37	0.87
Docosanes	0.28	0.70
Tricosanes	0.21	0.55
Tetracosanes	0.16	0.43
Pentacosanes	0.11	0.32
Hexacosanes	0.08	0.23
Heptacosanes	0.05	0.17
Octacosanes	0.03	0.11
Nonacosanes	0.02	0.08
Triacotanes	0.02	0.05
Hentriacotanes	0.01	0.03
Dotriacotanes	0.01	0.02
Triacotanes	0.01	0.02
Tetratriacotanes	0.00	0.02
Pentatriacotanes	0.00	0.02
Hexatriacotanes plus	0.13	0.57
Totals	100.00	100.00

Calculated Properties		
Whole Sample Density	0.7834	g.cc-1 @ 60°F
Whole Sample Mol.Wt.	122.9	g.mol-1

Measured Properties		
Whole Sample Density	0.7995	g.cc-1 @ 60°F
Whole Sample Mol.Wt.	122.8	g.mol-1

Plus Fraction	Density	Mole Weight
Calculated Properties	g.cc-1 @ 60°F	g.mole-1
Heptanes Plus	0.7963	128.7
Undecanes Plus	0.8265	196.6
Eicosanes Plus	0.8798	325.4
Triacotanes Plus	0.9209	509.6
Hexatriacotanes Plus	0.9247	533.7

Subtotals	Mole %	Weight %
Heptanes	15.84	11.43
Octanes	27.64	22.35
Nonanes	15.62	14.51
Decanes	7.48	8.54

Notes
Calculated properties derived from Katz & Firoozabadi data.

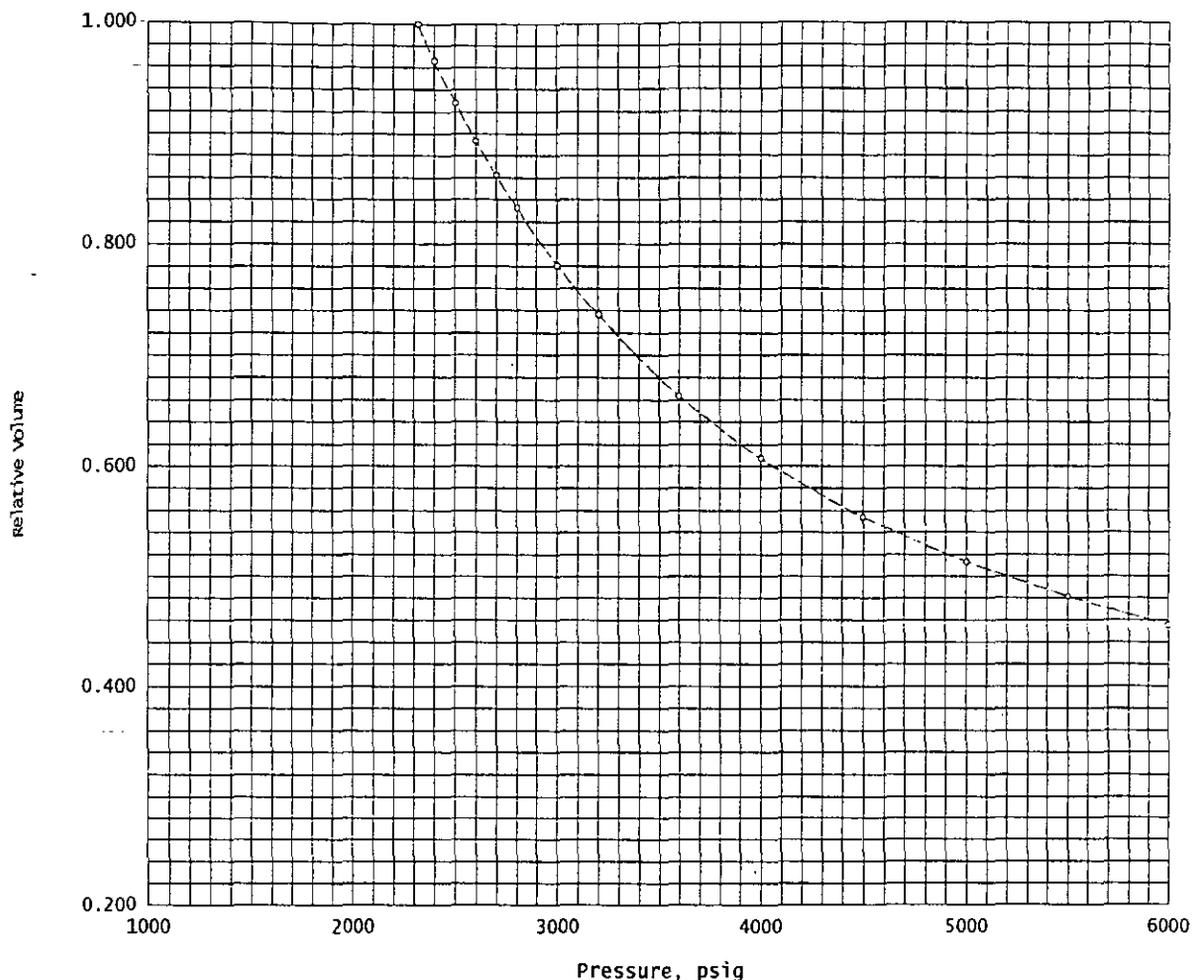
Woodside Energy Limited

Thylacine #2

AFL 2001-053

RELATIVE VOLUME

(at 114°C)



Relative Volume Expression: $y = a + b (Xd)^i + c (Xd)^j + d (\log(Xd))^k$		LEGEND	
where: a= -8.55596e+ 00 i= 0.500 b= 1.43453e+ 01 j= 0.750 c= -4.78934e+ 00 k= 0.995 d= -1.03519e+ 01		○ Laboratory Data --- Confidence Limits - - - Analytical Expression	Saturation Pressure: 2320 psig
Note: Xd (dimensionless 'x') = P_i / P_{sat} , psig		Pressure-Volume Relations Figure A-1	
Confidence level:	99 %		
Confidence interval:	+/- 0.0001		
'r squared':	1		

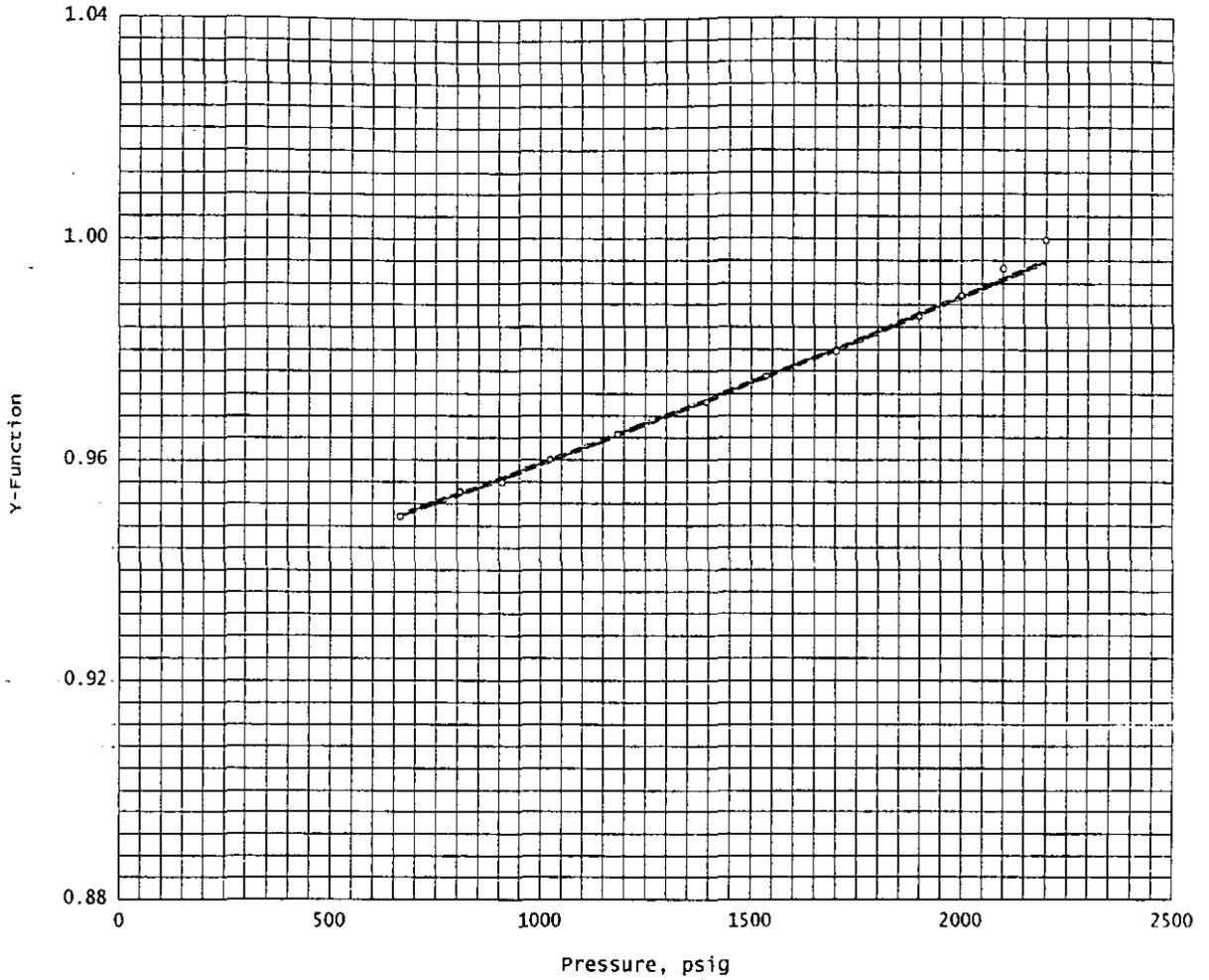
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Thylacine #2

AFL 2001-053

Y-FUNCTION

(at 114 °C)



Y-Function Expression: $y = a + b (X_d)^{i_i}$		LEGEND	
where: a= 9.34745e- 01 i= 1.164 b= 6.49744e- 02		○ Laboratory Data - - - - - Confidence Limits _____ Analytical Expression	
Note: X_d (dimensionless 'X') = P_i / P_{sat} , psig		Saturation Pressure: 2320 psig	
Confidence level: 99 % Confidence interval: +/- 0 'r squared': .999481		Pressure-Volume Relations Figure A-2	

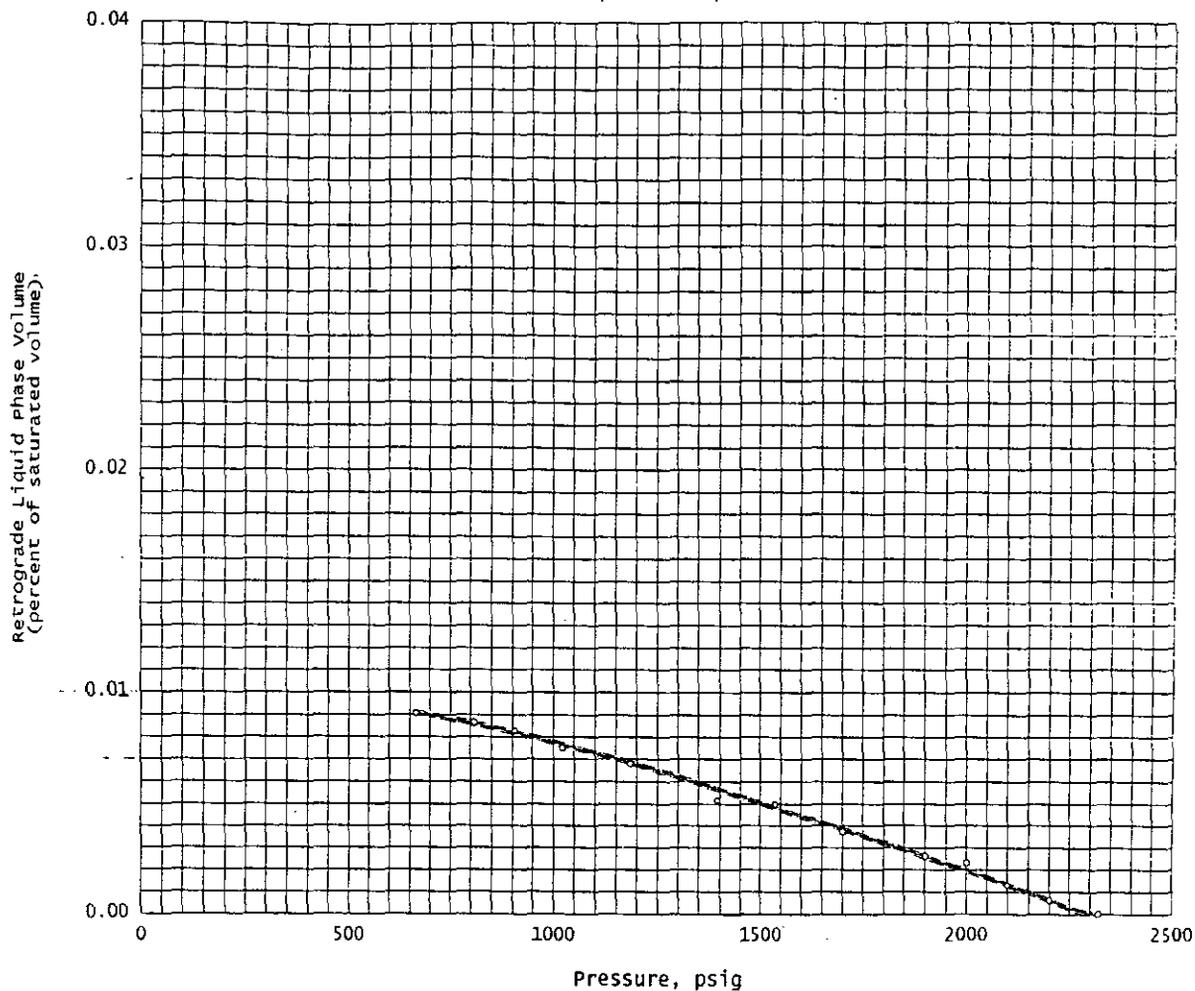
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Thylacine #2

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LIQUID PHASE VOLUME

(at 114 °C)



<p>Retrograde Liquid Curve Expression:</p> $\text{sqrt } y = a + b (x_d)^i + c (x_d)^j$	<p>LEGEND</p>
<p>where:</p> <p>a= 1.00462e- 01 i= 2.163</p> <p>b= -7.57714e- 02 j= 20.166</p> <p>c= -2.46913e- 02</p> <p>Note: x_d (dimensionless 'x') = P_i / P_{sat}, psig</p>	<p>○ Laboratory Data</p> <p>--- Confidence Limits</p> <p>— Analytical Expression</p> <p>Saturation Pressure: 2320 psig</p>
<p>Confidence level: 99 %</p> <p>Confidence interval: +/- 0</p> <p>'r squared': .999268</p>	<p>Pressure-Volume Relations</p> <p>Figure A-3</p>