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"GAS HYDRATE STABILITY MODEL FOR BARROW GAS FIELDS"

(Appendix to Phase 1A Final Technical Report Report)

Characterization and Quantification of the Methane Hydrate Resource Potential Associated with the Barrow Gas Fields

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REPORT

ON

"GAS HYDRATE STABILITY MODEL FOR BARROW GAS FIELDS"
Appendix to Phase 1A Final Technical Report

UNDER

"CHARACTERIZATION AND QUANTIFICATION OF THE METHANE HYDRATE RESOURCE POTENTIAL ASSOCIATED WITH BARROW GAS FIELDS"

(PHASE 1A)

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TABLE OF CONTENTS

LIST OF FIGURES

OBJECTIVE

The objective of this study is to develop a Gas Hydrate Stability Model in order to determine methane hydrate potential associated with East & South Barrow and Walakpa gas fields. Gas analysis data, from recent analysis and literature, were utilized to estimate the three phase (water-hydrate-gas) pressure-temperature equilibrium relationship using CSM-HYD (Colorado School of Mines Hydrate) software. Other inputs like pressure gradient, temperature gradient, water salinity etc. helped in relating hydrate stability zone with reservoir sub-sea depths. This work integrates the available data sets with reservoir information in order to estimate a range of hydrate stability region for all the three fields.

INTRODUCTION

The geologic occurrence of gas hydrate has been known since mid 60s when gas hydrate accumulations were discovered in Russia[7]. Vast amount of hydrocarbon are estimated to be trapped in hydrate deposits around the world[9]. Such deposits exist in distinct geologic formations such as permafrost and deep marine sediments, where the thermodynamic conditions of low temperature and high pressure allow hydrate formation. Inland arctic locations such as the West Siberian Basin in Russia, North Slope of Alaska, and Mackenzie Delta of Canada with offshore locations such as the Gulf of Mexico, Black Sea, Caspian Sea, Sea of Okhotsk, western and eastern margins of Japan, western and eastern coast of India and southeastern coast of the United States provide a wealth of hydrate deposits (Figure 1)

Historically, estimates of the total volume of methane in natural gas hydrate have ranged widely, from roughly 100,000 trillion cubic feet (Tcf) to as much as 270,000,000 Tcf[8]. In recent years, as more information is gained estimates have tended to fall in a narrower range—from 100,000 to 1,000,000 Tcf. Domestically, the current best estimate of the methane-in-place resource is estimated to be in the range of 320,000 Tcf of methane based on various hydrate plays along each coast and in the permafrost regions of Alaska.

Occurrence of methane hydrate resources have been postulated in association with the Walakpa Gas Field, south of the village of Barrow, Alaska[3], and there is sufficient information available to model reservoir conditions to characterize and quantify the postulated methane hydrate resource (Figure 2). This paper develops a Hydrate Stability Model to establish hydrate stability zone associated with Barrow Gas Field (East & South Barrow and Walakpa).

DATA & ASSUMPTIONS

1. Gas Analysis Data

Gas analysis data is the most critical information required to predict gas hydrate phase equilibrium relationship. More than 75 different gas sample analysis data were studied and corresponding P-T relationships were obtained using CSM-HYD. Similar results were obtained by carrying out predictions by changing formation water salinity. Gas samples from East Barrow Wells #14, #15, #21, South Barrow Wells #9, #10, #11 and Walakpa Wells #5, #8 and #10 were collected and analysis was done in March 2007. Other gas analysis data were obtained from literature like, reports by Gruy[4,5], North Slope Borough files, 2005 analysis reports of Petro-Canada Inc., Exxon Company USA gas analysis reports and Holba et. al. paper[6]. For gas analysis data refer Appendix A.

2. Formation Water Salinity Data

The formation water salinity data were acquired for East Barrow Well #14, #15, #17, #19 & #20 from North Slope Borough files. Water salinity data for Walakpa Well #01 was also obtained from North Slope Borough files. No such data was available for South Barrow Gas Field.

After careful evaluation of water data from EB Wells #14, #19 and #20, we conclude that the water salinity data didn't represent the actual formation water properties. Hence, these data were ignored during hydrate phase behavior predictions.

Due to unavailability of formation water data in South Barrow gas fields and limited information from East Barrow and Walakpa, hydrate stability predictions were carried out by assuming salt concentrations of 0%salt (pure water), 2% salt and 4% salt apart from available data. These assumptions provided a range of pressure-temperature relationship for each gas analysis. For Formation Water Salinity Data refer Appendix B

3. Pressure Gradient Data

Pressure Gradient Data for E. Barrow Wells #14, #15 & #19 & S. Barrow Wells #6 & #13 were reported by Allen & Crouch[1] in 1988. Allen & Darkwah[2] reported pressure gradient data for E. Barrow Wells #14 & # 21 & S. Barrow Well #6, #13 after carrying out engineering study of South East and Walakpa gas fields in 1996. Pressure gradient for Walakpa Gas Wells #2, #3, #4, #5, #6, #7, #8, #9 & #10 were also reported by Allen & Darkwah[2] in the same report.

After studying the pressure gradient data for all wells, a gradient of **0.5 psi/ft** was chosen for East and South Barrow Gas Field. Whereas, based on data from Walakpa Wells, a pressure gradient of **0.45 psi/ft** was chosen for Walakpa Gas Field.

Using pressure gradient data, the depth equivalent of pressure for each well was estimated for all three fields. These estimations are followed by correcting reservoir depths with respect to sea level by subtracting the Kelly Bushing elevations (datum) available for each well. Well data are obtained from Alaska Oil and Gas Conservation Commission well history files.

4. Temperature Gradient Data

The static temperature gradient data were acquired for East Barrow Well #15 & #21 in March 2007. Temperature Gradient data for other Barrow Gas Field Wells were obtained from North Slope Borough files. These data include information of E. Barrow Well #14, #19, & #21. S. Barrow temp gradient information includes data from SB Well #6 & #13. Whereas several data sets were obtained for Walakpa Wells #2, #3, #4, #5, #6, #7, #8, #9 & #10. For temperature gradient data refer Appendix C.

Technical limitations like cooling effects, inability to measure the temperature at the bottom of the reservoir resulted that the gradient data obtained for various wells were not a true representation of the actual subsurface temperature profile. Due to this limitation, the actual temperature gradients were not available for each well. Thus, hydrate stability studies were carried out considering composite reservoir rather than individual wells using available ranges of gradient data.

HYDRATE STABILITY MODEL DEVELOPMENT

Algorithm and flowchart representing the methodology followed for estimating gas hydrate stability for each data set is presented below.

Algorithm

STEP 1. Obtain Gas Analysis, Water Salinity, Pressure & Temperature Grad. Data

STEP 2 : Call gas analysis and water salinity data in CSM-HYD program

STEP 3 : Run CSM-HYD

STEP 4 : Read Hydrate Equilibrium Pressures for corresponding temperatures

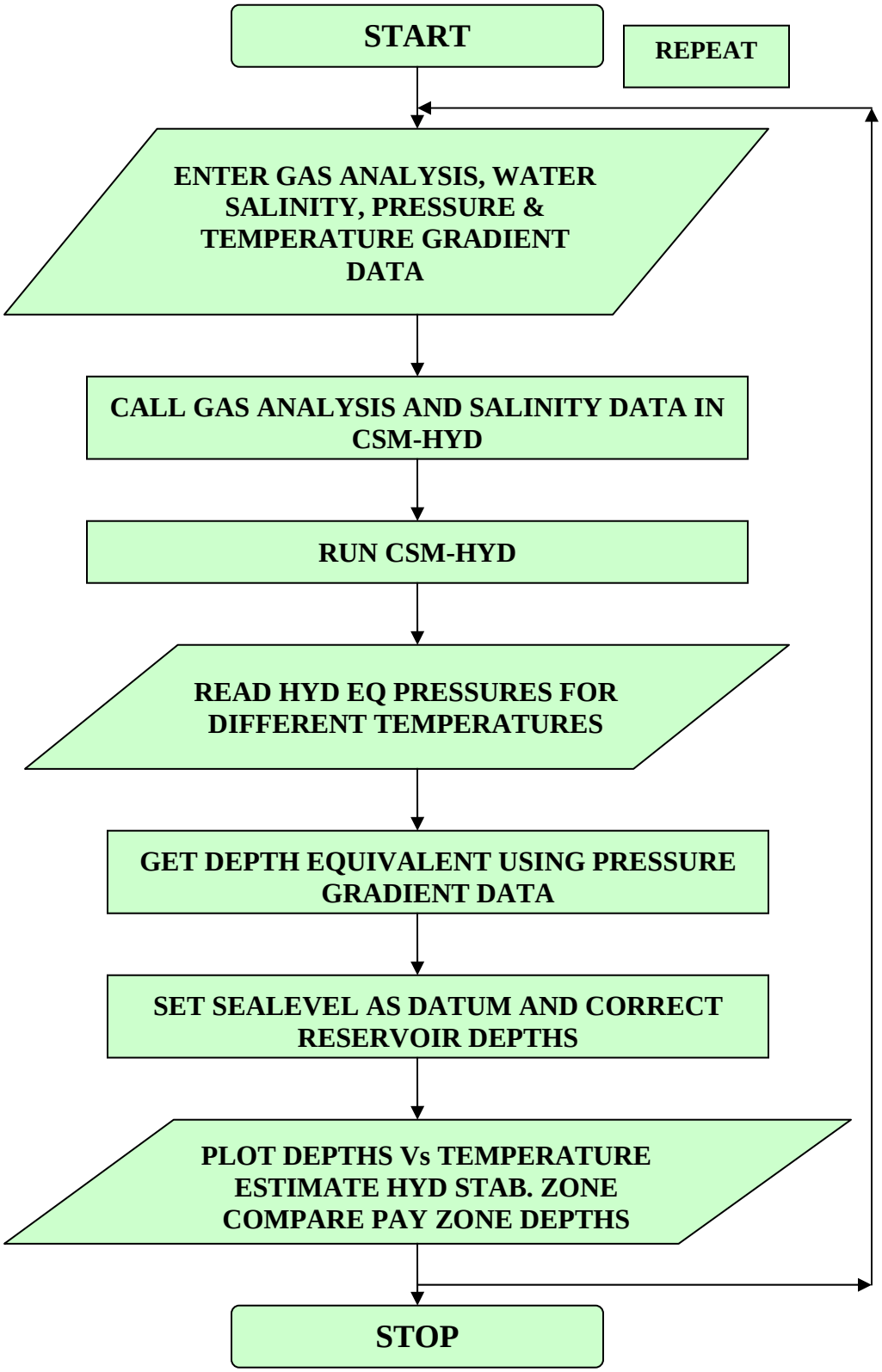
STEP 5 : Get depth equivalent using pressure gradient data

STEP 6 : Set sea level as datum and correct reservoir depths

STEP 7 : Plot Depths Vs Temperature
Estimate Hydrate Stability Zone
Compare Stability Zone with Pay Zone depths

STEP 8 : Repeat STEP 1 through 7 for new data set.

Flowchart


START
REPEAT
ENTER GAS ANALYSIS, WATER SALINITY, PRESSURE & TEMPERATURE GRADIENT DATA
CALL GAS ANALYSIS AND SALINITY DATA IN CSM-HYD
RUN CSM-HYD
READ HYD EQ PRESSURES FOR DIFFERENT TEMPERATURES
GET DEPTH EQUIVALENT USING PRESSURE GRADIENT DATA
SET SEALEVEL AS DATUM AND CORRECT RESERVOIR DEPTHS
PLOT DEPTHS Vs TEMPERATURE
ESTIMATE HYD STAB. ZONE
COMPARE PAY ZONE DEPTHS
STOP

RESULTS AND DISCUSSIONS

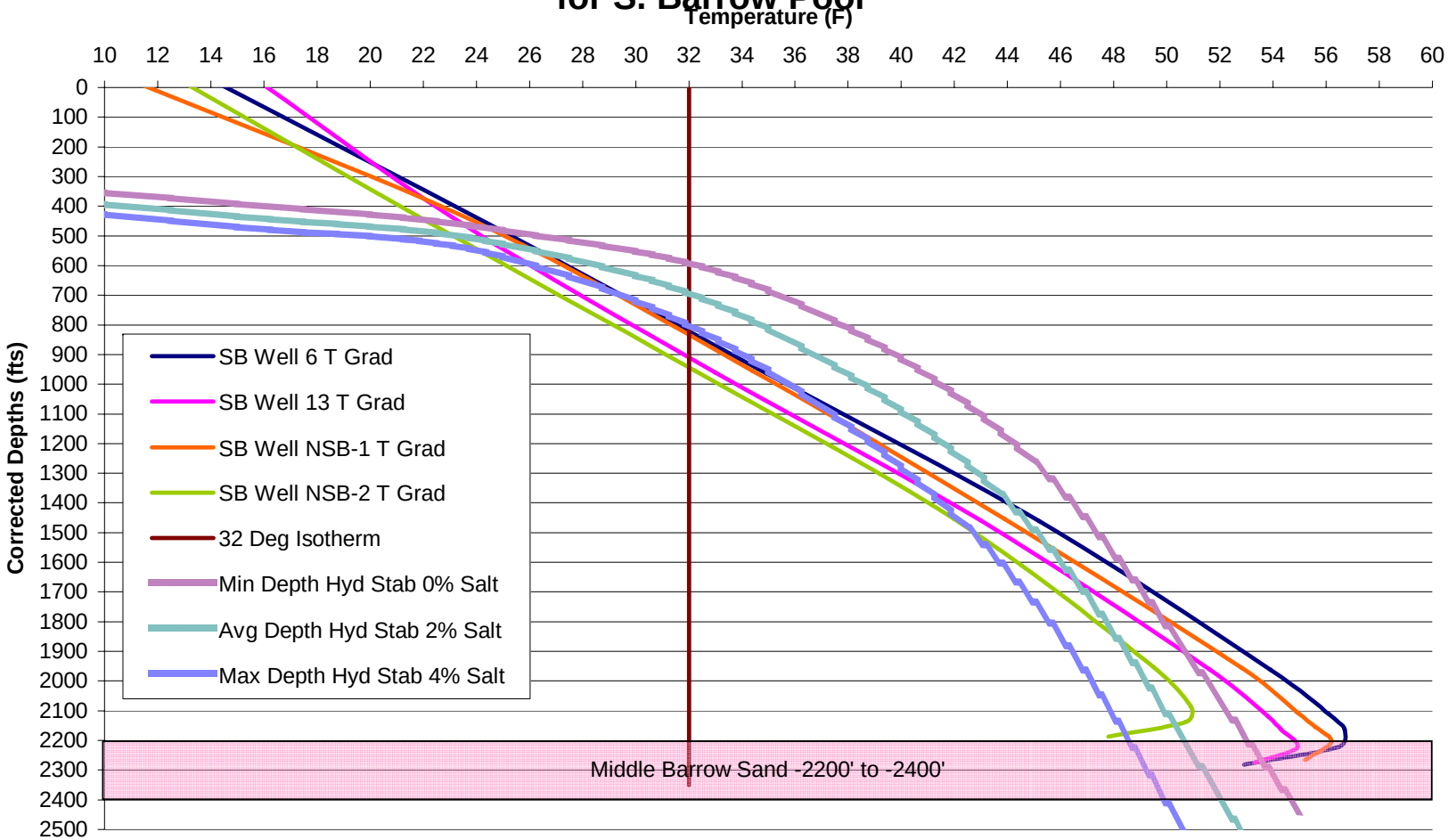
Above methodology was followed for South & East Barrow and Walakpa Gas Field data sets. Due to technical limitations in acquiring accurate temperature gradient data, the results were presented for each reservoir considering available range of temperature data. The CSM-HYD equilibrium data were plotted considering 0% salt, 2% salt and 4% salt concentrations. Available temperature gradient data were also plotted and the range of hydrate stability was estimated.

1. **South Barrow Gas Field :** From the plot we conclude that the hydrate stability zone doesn't exist in the reservoir pay zone depths of (2200' – 2400') for all formation water salinities. Thus, gas hydrates are not associated with South Barrow Gas Field reservoir.

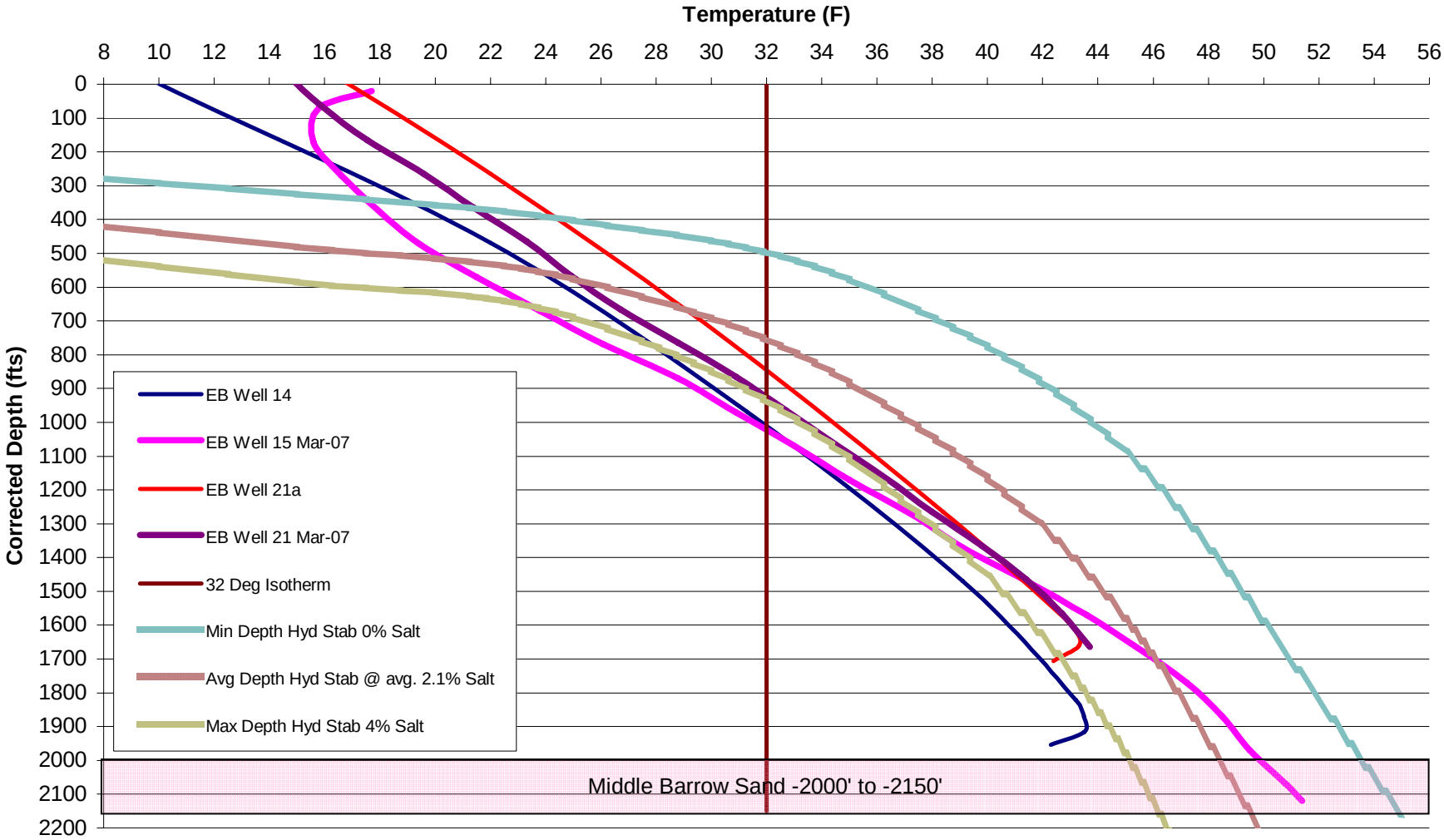
2. **East Barrow Gas Field :** Results for this field are most encouraging as existence of hydrates stability zones within reservoir are predicted for salt concentration ranging from 0% to 4%. Even though the temperature data are scarce and may not be a true representation of reservoir conditions, the plot gives a good picture of the hydrate stability within the pay zone. Hence, we conclude that stable gas hydrates zone exists in East Barrow Gas Field and gas hydrate may be associated with free gas.

3. **Walakpa Gas Field :** The hydrate stability plot for Walakpa field shows promising results. The hydrate stability zone doesn't exist within reservoir depths where wells information is available, but hydrate stability zone exists in updip locations of the reservoir. This means that there is a need to carry out detailed geologic analysis of unexplored regions of the reservoir to ascertain the association of gas hydrates.

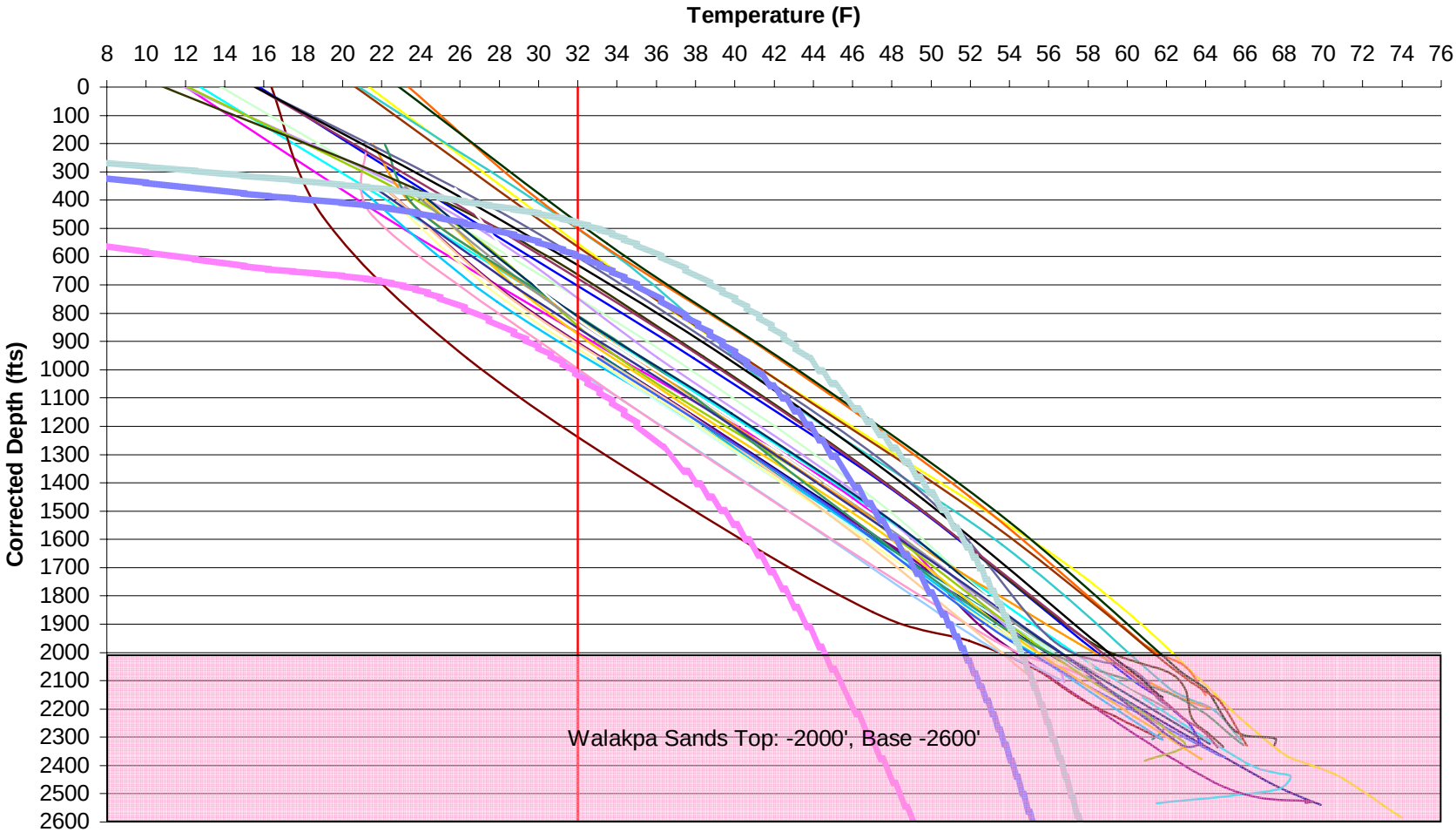
Temp Gradient and Hydrate Stability Zone for S. Barrow Pool



Temp Gradient & Hydrate Stability Zone for E Barrow Wells



Temp Gradient & Hydrate Stability Zone for Walakpa Gas Field



CONCLUSIONS

The data sets were carefully studied and outliers omitted/neglected in order to come up with a model, unique for each field. The results strongly indicate existence of hydrate stable zone within East Barrow Gas reservoir. The temperature and pressure conditions of South Barrow doesn’t support gas hydrates at all. The results for Walakpa Gas Field are promising as they indicate hydrate stable zone existing in up-dip locations within the reservoir.

RECOMMENDATIONS

1. Temperature gradient data needs to be corrected to account for heat transfer related errors. More data needed to accurately estimate and quantify gas hydrates in the East Barrow Gas field.

2. Formation water salinity data needs to be updated for each field.

3. Gas hydrate phase behavior experiment needs to be carried in the laboratory to support CSM-HYD results.

4. Detailed reservoir characterization required to estimate parameters like distribution of net pay zone thickness in up-dip locations and quality of free gas accumulations in all three fields.

REFERENCES

1. Allen, W. W. & Crouch, W. J., 1988, "*Engineering Study South and East Barrow Fields, North Slope Alaska, Alaska"*, technical report prepared for North Slope Borough Gas Development Project, Alaska

2. Darkwah, S. A., & Allen, W. W., 1996, "*Engineering Study of the South, East and Walakpa Fields, North Slope Borough, Alaska"*, technical report prepared for North Slope Borough, Alaska

3. Glenn R.K. and Allen W.M, 1991, "Geology, Reservoir Engineering and methane hydrate potential of the Walakpa Gas Field, North Slope, Alaska", Final Technical Report, NSB, Barrow Gas Field Development Project.

4. Gruy, H. J., 1978, "*Reservoir Engineering and Geologic Study of the East Barrow Field, National Petroleum Reserves in Alaska"*, under USGS Contract.

5. Gruy, H. J., 1979, "*Reservoir Engineering and Geologic Study of the South Barrow Field, National Petroleum Reserves in Alaska"*, under USGS Contract.

6. Holba, A. G., Lundell, L. L., Dzou, I. L., Bone, R. L., Cooley, M. W. & Kriel, W. A., "*Geochemistry of Natural Gases and Hydrocarbon Liquids from Walakpa Gas Field, North Slope, Alaska"*, in Walakpa Gas Field Geochemistry Report, AEPT, TX, pp. 4-13, May 18, 1994.

7. Kerkar, P.B., 2005, "*Assessment of formation damage from drilling fluids dynamic filtration in gas hydrate reservoirs of the North Slope of Alaska"*, MS Thesis, University of Alaska, Fairbanks Library.

8. National Energy Technology Laboratory (NETL) Website www.netl.doe.gov.

9. Sloan, E.D. Jr., *Clathrate Hydrates of Natural Gases*, Marcel Dekker Inc., New York City (1998).

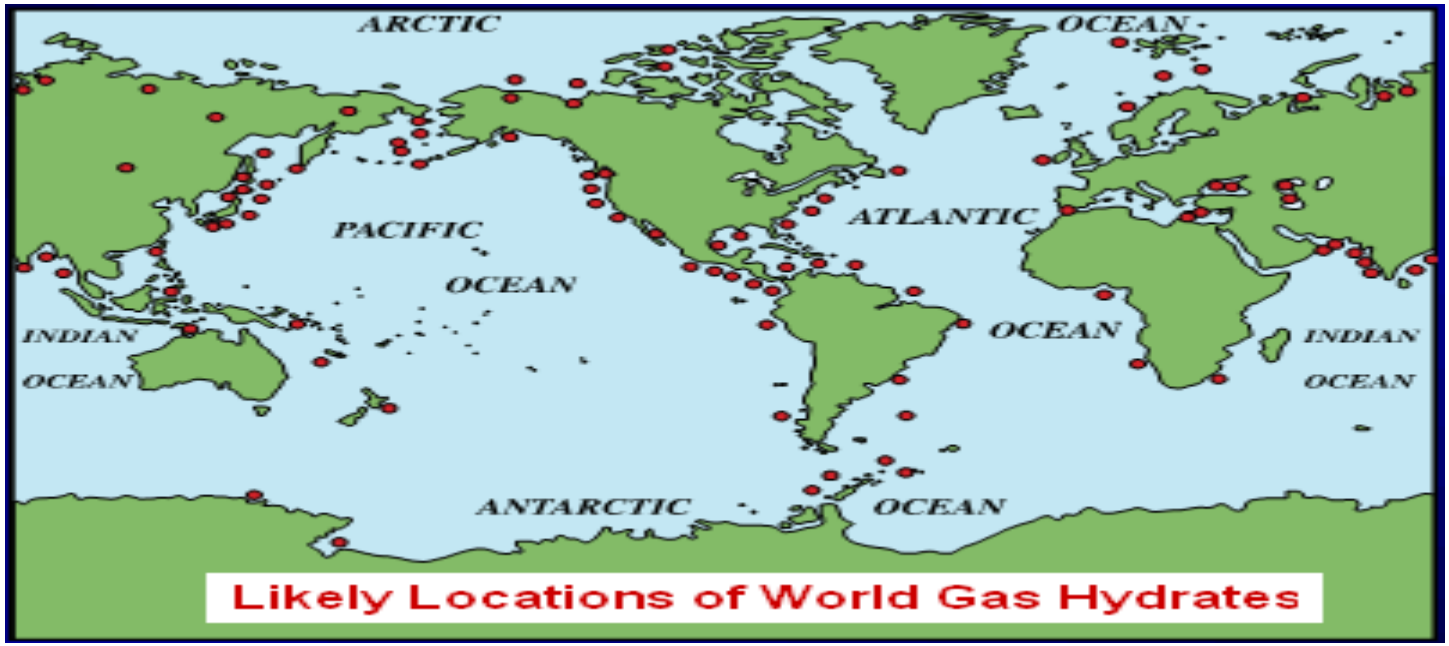


Figure 1. : Known gas hydrate deposits around the world (USGS website 2006)

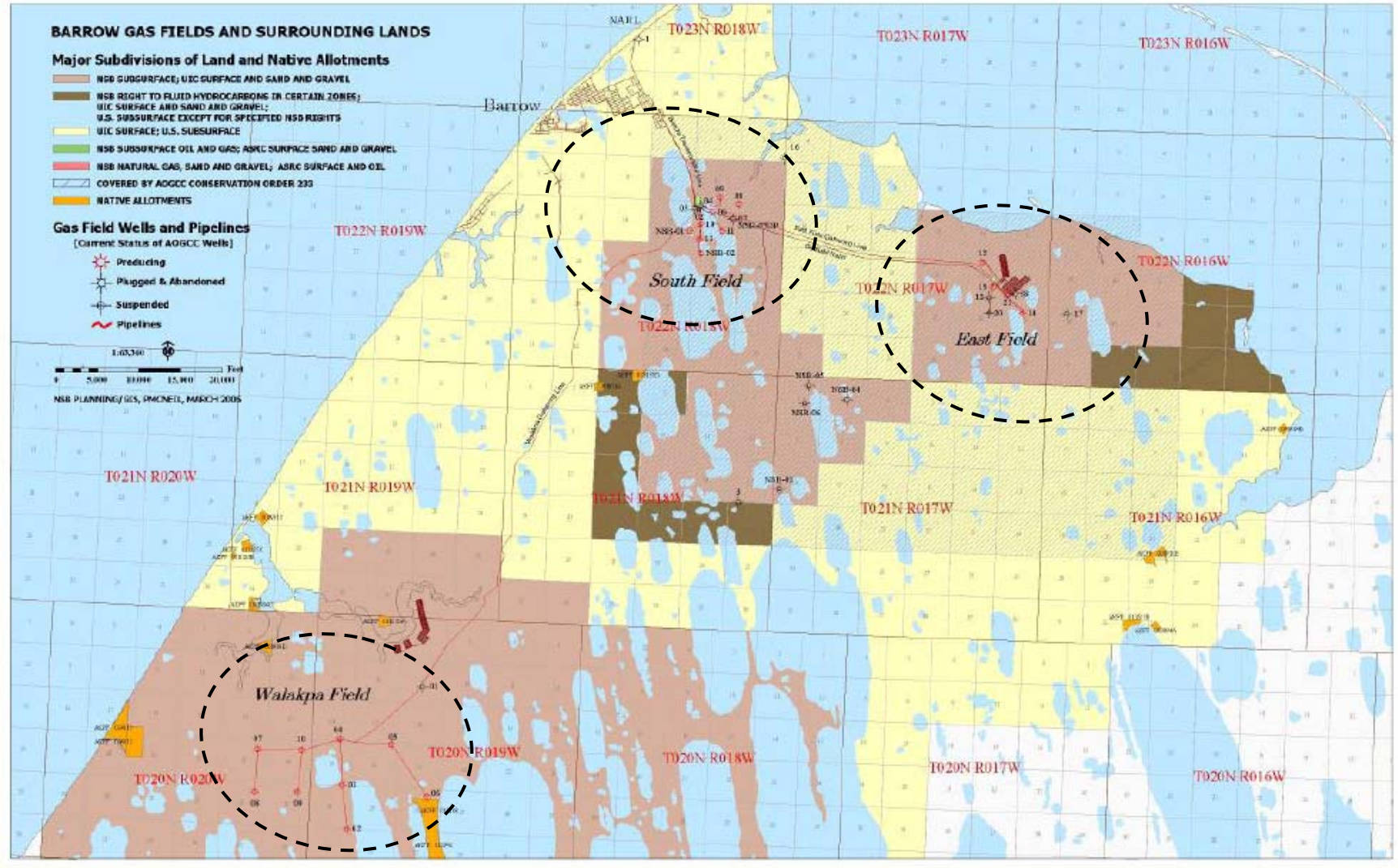


Figure 2 : Barrow Gas Field courtesy NETL Website (www.netl.doe.gov)

APPENDIX A : GAS ANALYSIS DATA

1. SOUTH BARROW GAS ANALYSIS DATA

	SAMPLE DATE	1978	MAR 01, 2007	MAR 01, 2007	1978	MAR 01, 2007	1978
SR. NO.	COMPONENT	S. BARROW WELL #9		SOUTH BARROW WELL #10	S. BARROW WELL #11		S. BARROW WELL #13
1	METHANE	94.510	97.980	97.790	94.220	97.760	97.840
2	ETHANE	1.470	0.934	0.983	1.790	1.300	1.230
3	PROPANE	0.100	0.024	0.029	0.100	0.034	0.100
4	i-BUTANE	0.050	0.025	0.025	0.030	0.025	0.060
5	n-BUTANE	0.050	0.009	0.010	0.030	0.011	0.090
6	i-PENTANE	0.030	0.007	0.008	0.020	0.007	0.030
7	n-PENTANE	0.040	0.003	0.004	0.020	0.003	0.020
8	HEXANE+	0.030	0.018	0.015	0.070	0.015	0.000
9	NITROGEN	3.720	0.820	0.850	3.720	0.650	0.630
10	OXYGEN	0.000	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.000	0.160	0.260	0.000	0.170	0.000
12	HELIUM	0.000	0.022	0.022	0.000	0.010	0.000
13	HYDROGEN	0.000	0.000	0.000	0.000	0.010	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

2. EAST BARROW GAS ANALYSIS DATA

	SAMPLE DATE	1978	FEB 14, 77	MAR 01,2007	SEP 22, 1980	SAMPLE #3	SAMPLE #6
						SEP 24, 1980	SEP 24, 1980
SR. NO.	COMPONENT	E. BARROW WELL #12	E. BARROW WELL #14		EAST BARROW WELL #15		
1	METHANE	91.510	97.110	97.540	98.180	97.840	98.250
2	ETHANE	0.750	0.570	0.568	0.100	0.020	0.080
3	PROPANE	0.000	0.030	0.026	0.020	0.000	0.010
4	i-BUTANE	0.000	0.010	0.006	0.000	0.000	0.000
5	n-BUTANE	0.050	0.140	0.132	0.000	0.000	0.000
6	i-PENTANE	0.050	0.090	0.079	0.000	0.000	0.000
7	n-PENTANE	0.000	0.060	0.045	0.000	0.000	0.000
8	HEXANE+	0.000	0.070	0.065	0.000	0.000	0.000
9	NITROGEN	5.200	1.840	1.350	1.700	2.140	1.660
10	OXYGEN	0.000	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.150	0.050	0.160	0.000	0.000	0.000
12	HELIUM	2.290	0.030	0.025	0.000	0.000	0.000
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

EAST BARROW GAS ANALYSIS DATA contd…

	SAMPLE DATE	MAR 1, 2007	SAMPLE #1	SAMPLE #2	SAMPLE #3	SAMPLE #1	SAMPLE #2
			MAR 15, 1978	MAR 15, 1978	MAR 15, 1978	APR 11, 1978	APR 11, 1978
SR. NO.	COMPONENT	E. BARROW WELL #15	EAST BARROW WELL #17				
1	METHANE	97.920	96.950	96.980	96.900	98.570	98.480
2	ETHANE	1.020	0.500	0.620	0.440	0.350	0.410
3	PROPANE	0.053	0.050	0.040	0.080	0.060	0.040
4	i-BUTANE	0.029	0.020	0.050	0.080	0.010	0.010
5	n-BUTANE	0.016	0.120	0.130	0.140	0.030	0.030
6	i-PENTANE	0.012	0.080	0.030	0.040	0.010	0.010
7	n-PENTANE	0.004	0.050	0.040	0.060	0.010	0.040
8	HEXANE+	0.031	0.030	0.020	0.030	0.000	0.020
9	NITROGEN	0.810	2.100	2.000	2.120	0.920	0.900
10	OXYGEN	0.000	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.081	0.100	0.090	0.110	0.040	0.060
12	HELIUM	0.022	0.000	0.000	0.000	0.000	0.000
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

EAST BARROW GAS ANALYSIS DATA contd…

	SAMPLE DATE	SAMPLE #3	SAMPLE #4	1978	JAN 17, 1980	OCT 13, 1980
		APR 11, 1978	APR 11, 1978			
SR. NO.	COMPONENT	EAST BARROW WELL #17				E. BARROW WELL #18
1	METHANE	98.500	98.230	98.240	94.900	95.110
2	ETHANE	0.310	0.340	0.360	0.900	0.020
3	PROPANE	0.080	0.090	0.090	0.300	0.000
4	i-BUTANE	0.040	0.020	0.020	0.100	0.000
5	n-BUTANE	0.080	0.110	0.100	0.200	0.000
6	i-PENTANE	0.030	0.040	0.030	0.000	0.000
7	n-PENTANE	0.050	0.080	0.050	0.200	0.000
8	HEXANE+	0.010	0.020	0.010	0.200	0.000
9	NITROGEN	0.900	0.990	1.010	3.100	4.870
10	OXYGEN	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.000	0.080	0.090	0.000	0.000
12	HELIUM	0.000	0.000	0.000	0.130	0.000
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000

EAST BARROW GAS ANALYSIS DATA contd…

	SAMPLE DATE	SAMPLE #3	SAMPLE #1	SAMPLE #2	SAMPLE #3	SAMPLE #4	1978
		MAY 05, 1978	**MAY 12, 1978**	**MAY 12, 1978**	**MAY 13, 1978**	**MAY 13, 1978**	
SR. NO.	**COMPONENT**	**EAST BARROW WELL #19**					
1	METHANE	91.450	87.670	87.760	86.950	86.880	87.300
2	ETHANE	1.520	0.350	0.330	0.390	0.410	0.370
3	PROPANE	0.220	0.080	0.070	0.050	0.050	0.060
4	i-BUTANE	0.040	0.010	0.010	0.020	0.020	0.020
5	n-BUTANE	0.130	0.110	0.100	0.090	0.100	0.100
6	i-PENTANE	0.050	0.060	0.060	0.050	0.050	0.060
7	n-PENTANE	0.080	0.010	0.010	0.010	0.010	0.010
8	HEXANE+	0.100	0.000	0.000	0.000	0.000	0.000
9	NITROGEN	6.230	11.650	11.600	12.350	12.390	12.000
10	OXYGEN	0.000	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.180	0.060	0.060	0.090	0.090	0.080
12	HELIUM	0.000	0.000	0.000	0.000	0.000	0.000
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

EAST BARROW GAS ANALYSIS DATA contd…

	SAMPLE DATE	SAMPLE #1 FEB 14, 1979	SAMPLE #2 FEB 14, 1979	SAMPLE #3 FEB 14, 1979	JAN 17, 1980	MAY 05, 1980	MAR 01, 2007
SR. NO.	COMPONENT	EAST BARROW WELL #19				E. BARROW WELL #20	E. BARROW WELL #21
1	METHANE	95.650	95.400	95.420	86.100	98.280	95.880
2	ETHANE	0.030	0.040	0.040	0.500	0.050	0.381
3	PROPANE	0.000	0.020	0.040	0.000	0.000	0.034
4	i-BUTANE	0.000	0.000	0.000	0.000	0.000	0.007
5	n-BUTANE	0.000	0.000	0.000	0.100	0.000	0.105
6	i-PENTANE	0.000	0.000	0.000	0.100	0.000	0.054
7	n-PENTANE	0.000	0.000	0.000	0.000	0.000	0.019
8	HEXANE+	0.000	0.000	0.000	0.000	0.000	0.022
9	NITROGEN	4.320	4.540	4.500	11.800	1.670	3.250
10	OXYGEN	0.000	0.000	0.000	0.000	0.000	0.000
11	CARBON DIOXIDE	0.000	0.000	0.000	0.100	0.000	0.170
12	HELIUM	0.000	0.000	0.000	1.220	0.000	0.061
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.00580
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.009
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

3. WALAKPA GAS ANALYSIS DATA

	SAMPLE DATE	SAMPLE #3 JAN 30, 1980	SAMPLE #4 JAN 30, 1980	FEB 14, 1980	FEB 26, 1981	JAN 1994	MAY 20, 2005
SR. NO.	COMPONENT	WALAKPA WELL #1			WALAKPA WELL # 2		
1	METHANE	99.720	99.700	98.720	97.08	96.200	96.360
2	ETHANE	0.000	0.000	0.010	2.13	1.870	2.110
3	PROPANE	0.000	0.000	0.000	0.48	0.330	0.530
4	i-BUTANE	0.000	0.000	0.000	0.08	0.042	0.090
5	n-BUTANE	0.000	0.000	0.000	0.09	0.040	0.080
6	i-PENTANE	0.000	0.000	0.000	0.000	0.010	0.030
7	n-PENTANE	0.000	0.000	0.000	0.000	0.011	0.010
8	HEXANE+	0.000	0.000	0.000	0.000	0.000	0.010
9	NITROGEN	0.280	0.300	1.270	0.140	0.450	0.650
10	OXYGEN	0.000	0.000	0.000	0.000	0.130	0.000
11	CARBON DIOXIDE	0.000	0.000	0.000	0.000	0.046	0.110
12	HELIUM	0.000	0.000	0.000	0.000	0.100	0.020
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

WALAKPA GAS ANALYSIS DATA contd…

	SAMPLE DATE	MAR 14, 1991	APR 22, 1991	JAN 1994	MAY 20, 2005	APR 30, 1991	JAN 1994
SR. NO.	COMPONENT	WALAKPA WELL #3				WALAKPA WELL #4	
1	METHANE	97.290	99.173	94.500	97.440	99.780	96.700
2	ETHANE	1.777	1.919	1.860	1.760	1.911	1.800
3	PROPANE	0.432	0.291	0.360	0.360	0.288	0.370
4	i-BUTANE	0.051	0.004	0.045	0.060	0.004	0.045
5	n-BUTANE	0.058	0.006	0.056	0.060	0.006	0.048
6	i-PENTANE	0.011	0.020	0.016	0.020	0.001	0.015
7	n-PENTANE	0.006	0.000	0.100	0.010	0.000	0.012
8	HEXANE+	0.024	0.000	0.000	0.030	0.000	0.000
9	NITROGEN	0.241	0.600	1.090	0.160	0.550	0.750
10	OXYGEN	0.010	0.000	0.380	0.000	0.000	0.260
11	CARBON DIOXIDE	0.093	0.001	0.095	0.080	0.006	0.120
12	HELIUM	0.000	0.000	0.013	0.020	0.000	0.011
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

WALAKPA GAS ANALYSIS DATA contd…

	SAMPLE DATE	MAY 20, 2005	APR 27, 1991	JAN 1994	MAY 20, 2005	APR 1991	JAN 1994
SR. NO.	COMPONENT	WALAKPA WELL #4	WALAKPA WELL #5			WALAKPA WELL #6	
1	METHANE	97.520	98.101	95.300	97.740	96.440	95.600
2	ETHANE	1.720	0.000	1.710	1.620	2.689	1.610
3	PROPANE	0.380	0.000	0.260	0.260	0.119	0.230
4	i-BUTANE	0.060	0.000	0.031	0.030	0.000	0.026
5	n-BUTANE	0.050	0.000	0.044	0.040	0.000	0.044
6	i-PENTANE	0.020	0.000	0.014	0.010	0.000	0.013
7	n-PENTANE	0.010	0.000	0.011	0.010	0.000	0.009
8	HEXANE+	0.030	0.000	0.000	0.010	0.000	0.000
9	NITROGEN	0.080	1.900	0.480	0.150	1.250	0.740
10	OXYGEN	0.000	0.000	0.160	0.000	0.000	0.250
11	CARBON DIOXIDE	0.120	0.000	0.120	0.120	0.000	0.027
12	HELIUM	0.010	0.000	0.010	0.010	0.000	0.011
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.017

WALAKPA GAS ANALYSIS DATA contd…

	SAMPLE DATE	MAY 20, 2005	MAR 01, 2007	JAN 1994	JAN 1994	MAR 2, 2007	JAN 1994
SR. NO.	COMPONENT	WALAKPA WELL #6		WALAKPA WELL #7	WALAKPA WELL #8		WALAKPA WELL #9
1	METHANE	97.420	97.76	95.500	96.800	97.22	97.200
2	ETHANE	1.760	1.62	1.980	2.030	1.91	2.060
3	PROPANE	0.360	0.278	0.420	0.280	0.446	0.440
4	i-BUTANE	0.050	0.0346	0.056	0.037	0.0620	0.058
5	n-BUTANE	0.060	0.0470	0.070	0.043	0.0749	0.065
6	i-PENTANE	0.020	0.0138	0.021	0.013	0.0223	0.018
7	n-PENTANE	0.010	0.0099	0.015	0.008	0.0130	0.010
8	HEXANE+	0.010	0.0256	0.000	0.000	0.0441	0.000
9	NITROGEN	0.170	0.094	0.670	0.560	0.11	0.670
10	OXYGEN	0.000	0.000	0.250	0.180	0.000	0.210
11	CARBON DIOXIDE	0.120	0.11	0.027	0.093	0.086	0.090
12	HELIUM	0.020	0.0095	0.012	0.012	0.0121	0.014
13	HYDROGEN	0.000	0.000	0.000	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000	0.000	0.000	0.000

WALAKPA GAS ANALYSIS DATA contd…

	SAMPLE DATE	JAN 1994	MAY 20, 2005	MAR 02, 2007
SR. NO.	COMPONENT	WALAKPA WELL #10		
1	METHANE	96.600	97.350	97.45
2	ETHANE	1.960	1.800	1.79
3	PROPANE	0.340	0.370	0.383
4	i-BUTANE	0.045	0.060	0.0510
5	n-BUTANE	0.052	0.060	0.0592
6	i-PENTANE	0.016	0.020	0.0165
7	n-PENTANE	0.009	0.010	0.0091
8	HEXANE+	0.000	0.030	0.0329
9	NITROGEN	0.330	0.170	0.10
10	OXYGEN	0.100	0.000	0.000
11	CARBON DIOXIDE	0.095	0.110	0.10
12	HELIUM	0.013	0.020	0.0109
13	HYDROGEN	0.000	0.000	0.000
14	ARGON	0.000	0.000	0.000
15	HYDROGEN SULFIDE	0.000	0.000	0.000

APPENDIX B : WATER SALINITY DATA

WELL NAME	TDS mg/lit	TDS WEIGHT %	SAMPLE DATE	COMMENTS
ALL S. BARROW WELLS	0	0.00		ASSUMED
	20400	2.00		ASSUMED
	41650	4.00		ASSUMED
E. BARROW WELL #14	0	0.00		ASSUMED
	41650	4.00		ASSUMED
E. BARROW WELL #15	0	0.00		ASSUMED
	24475	2.39	SEP 12, 1980	
	24120	2.36	SEP 13, 1980	
	24298	2.37		ASSUMED
	41560	4.00		ASSUMED
E. BARROW WELL #17	0	0.00		ASSUMED
	21569	2.11	APR 21, 1978	SAMPLE #1
	21640	2.12	APR 21, 1978	SAMPLE #2
	21589	2.11	APR 21, 1978	SAMPLE #3
	21577	2.11	APR 21, 1978	SAMPLE #4
	21594	2.11		AVERAGE
	41650	4.00		ASSUMED
E. BARROW WELL #19	0	0.00		ASSUMED
	41650	4.00		ASSUMED
E. BARROW WELL #20	0	0.00		ASSUMED
	41650	4.00		ASSUMED
OTHER E. BARROW WELLS #12, #18, #21	0	0.00		ASSUMED
	20400	2.00		ASSUMED
	41650	4.00		ASSUMED
WALAKPA WELL #1	0	0.00		ASSUMED
	14800	1.46	JAN 22, 1980	
	15400	1.52	FEB 8, 1980	
	15100	1.49		AVERAGE
OTHER WALAKPA WELLS, #2, #3, #4, #5, #6, #7, #8, #9, #10	0	0.00		ASSUMED
	15100	1.49		ASSUMED
	41650	4.00		ASSUMED

APPENDIX C : TEMPERATURE GRAD DATA

1. SOUTH BARROW TEMP GRAD

S BARROW WELL #6	*FEB 21, 1996*

KB ELEVATION	38	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	35	-3	14.5
2	500	462	24.5
3	1000	962	34.9
4	1500	1462	45.2
5	2000	1962	53.9
6	2150	2112	56.1
7	2200	2162	56.7
8	2260	2222	56.5
9	2320	2282	52.9

S BARROW WELL #13	*FEB 25, 1996*

KB ELEVATION	40	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-15	15.9
2	500	460	23.5
3	1000	960	33.0
4	1500	1460	43.0
5	2000	1960	51.6
6	2158	2118	53.8
7	2202	2162	54.3
8	2264	2224	54.9
9	2315	2275	53.3

SOUTH BARROW TEMP GRAD DATA contd…

S BARROW WELL NSB-1	FEB 20, 1996

KB ELEVATION	45	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-20	11.1
2	500	455	24.0
3	1000	955	34.4
4	1500	1455	43.9
5	2000	1955	52.8
6	2150	2105	54.9
7	2200	2155	55.6
8	2250	2205	56.2
9	2310	2265	55.2

S BARROW WELL NSB-2	FEB 19, 1996

KB ELEVATION	46	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-21	12.9
2	500	454	22.2
3	1000	954	32.2
4	1500	1454	42.0
5	2000	1954	49.5
6	2133	2087	50.9
7	2183	2137	50.7
8	2233	2187	47.8

2. EAST BARROW TEMP GRAD

	E BARROW WELL #14	*FEB 22, 1996*	
	KB ELEVATION	**31**	**fts**
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	30	-1	10.00
2	500	469	22.00
3	1000	969	31.30
4	1500	1469	39.10
5	1852	1821	43.20
6	1903	1872	43.50
7	1948	1917	43.50
8	1985	1954	42.30

	E BARROW WELL #15	*MAR 2007*	
	KB ELEVATION	**30**	**fts**
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	50	20	17.70
2	100	70	15.80
3	200	170	15.60
4	300	270	16.60
5	400	370	17.90
6	500	470	19.40
7	600	570	21.50
8	700	670	23.80
9	800	770	26.10
10	900	870	28.80
11	1000	970	30.90
12	1100	1070	33.00
13	1200	1170	35.00
14	1300	1270	37.20
15	1400	1370	39.10
16	1500	1470	41.40
17	1600	1570	43.60
18	1700	1670	45.50
19	1800	1770	47.20
20	1900	1870	48.50
21	2000	1970	49.50
22	2100	2070	50.80
23	2150	2120	51.40

EAST BARROW TEMP GRAD DATA contd…

E BARROW WELL #21 **FEB 23, 1996**

KB ELEVATION	235	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	30	-205	12.80
2	500	265	22.00
3	1000	765	30.70
4	1500	1265	38.40
5	1800	1565	42.60
6	1852	1617	43.20
7	1896	1661	43.30
8	1941	1706	42.40

E BARROW WELL #21 **MAR 2007**

KB ELEVATION	235	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	50	-185	14.90
2	100	-135	14.10
3	200	-35	14.60
4	300	65	15.90
5	400	165	17.55
6	500	265	19.60
7	600	365	21.40
8	700	465	23.30
9	800	565	24.90
10	900	665	26.70
11	1000	765	28.80
12	1100	865	30.90
13	1200	965	32.70
14	1300	1065	34.50
15	1400	1165	36.30
16	1500	1265	38.00
17	1600	1365	39.80
18	1700	1465	41.40
19	1800	1565	42.70
20	1900	1665	43.70

3. WALAKPA GAS TEMP GRAD

WALAKPA WELL #2

KB ELEVATION	47	fts

			MAY 11, 1991
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	1000	953	33.22
2	1500	1453	44.32
3	2000	1953	54.8
4	2500	2453	67.05
5	2586	2539	69.86

			JUN 15, 1990
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	0	-47	11
2	500	453	22
3	1000	953	34
4	1500	1453	46
5	1900	1853	52

			DEC 7, 1993
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	28	-19	21
2	800	753	36
3	1316	1269	47.5
4	1792	1745	58
5	2296	2249	66
6	2408	2361	68
7	2450	2403	69.5
8	2492	2445	71
9	2632	2585	74

WALAKPA TEMP GRAD DATA contd…

			APR 4, 1996
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	40	-7	12.6
2	500	453	23.5
3	1000	953	35.1
4	1500	1453	46.2
5	2000	1953	56.3
6	2436	2389	66
7	2484	2437	68.3
8	2533	2486	67.6
9	2581	2534	61.5

			MAR 23, 2005
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	400.00	353.00	22.08
2	800.00	753.00	28.80
3	1200.00	1153.00	37.66
4	1600.00	1553.00	46.40
5	1750.00	1703.00	49.68
6	2000.00	1953.00	53.35
7	2505.73	2458.73	64.40
8	2574.00	2527.00	69.36
9	2578.00	2531.00	69.09

WALAKPA WELL #3		
KB ELEVATION	41.6	fts

			APR 22, 1991
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	20	-21.6	16.27
2	500	458.4	19.02
3	1000	958.4	26.35
4	1500	1458.4	37.01
5	1900	1858.4	47.04
6	2000	1958.4	51.94
7	2100	2058.4	55.28
8	2200	2158.4	57.49
9	2300	2258.4	60.27
10	2349	2307.4	61.77

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #3

			APR 24, 1991
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	1000	958.4	33.36
2	1500	1458.4	44.05
3	2300	2258.4	61.77
4	2349	2307.4	61.29

			APR 8, 1996
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	30.00	-11.60	15.50
2	500.00	458.40	26.30
3	1000.00	958.40	37.90
4	1500.00	1458.40	48.70
6	2000.00	1958.40	57.70
7	2150.00	2108.40	60.50
8	2200.00	2158.40	61.60
9	2250.00	2208.40	62.40
10	2300.00	2258.40	63.20
11	2360.00	2318.40	63.70

			MAR 30, 2005
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	400	358.4	20.84
2	800	758.4	27.858
3	1200	1158.4	37.259
4	1600	1558.4	46.176
6	2000	1958.4	54.285
7	2350	2308.4	61.796

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #4

KB ELEVATION	42.6	fts

APR 27, 1991

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	1000	957.4	32.68
2	1500	1457.4	43.65
3	2000	1957.4	55.21
4	2138	2095.4	58.08

APR 14, 1996

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-17.6	13.4
2	500	457.4	25.1
3	1000	957.4	36.8
4	1500	1457.4	47.1
5	2000	1957.4	55.4
6	2055	2012.4	57.7
7	2100	2057.4	58.3
8	2140	2097.4	59

MAR 21, 2005

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	400	357.4	21.809
2	800	757.4	28.35
3	1200	1157.4	37.301
4	1600	1557.4	45.753
5	2000	1957.4	54.29
6	2140	2097.4	58.734
7	2138	2095.4	58.945

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #5

KB ELEVATION	41.9	fts

SR. NO.	MEASURED DEPTH (fts)	APR 30, 1991 CORRECTED SUBSEA DEPTH (fts)	APR 30, 1991 TEMPERATURE (F)
1	1000	958.1	30.99
2	1500	1458.1	41.88
3	2000	1958.1	52.49
4	2100	2058.1	55.48
5	2146	2104.1	56.78

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	JUN 9, 1992 TEMPERATURE (F)
1	250	208.1	21.19
2	500	458.1	21.59
3	1000	958.1	31.21
4	1500	1458.1	41.81
5	2000	1958.1	53.26
6	2100	2058.1	56.89
7	2145	2103.1	58.38

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	APR 12, 1996 TEMPERATURE (F)
1	25	-16.90	11.40
2	500	458.10	25.90
3	1000	958.10	36.10
4	1500	1458.10	46.60
5	1954	1912.10	53.90
6	2004	1962.10	54.90
7	2052	2010.10	55.60
8	2100	2058.10	56.50
9	2147	2105.10	56.80

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #5

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAR 11, 2005 TEMPERATURE (F)
1	400	358.1	22.174
2	800	758.1	28.818
3	1200	1158.1	37.689
4	1600	1558.1	45.658
5	2000	1958.1	52.851
6	2150	2108.1	55.418

WALAKPA WELL #6

KB ELEVATION	41	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAY 07, 1991 TEMPERATURE (F)
1	1000	959	33.02
2	1500	1459	44.26
3	2000	1959	54.05
4	2400	2359	64.51
5	2410	2369	64.99

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	DEC 7, 1993 TEMPERATURE (F)
1	25	-16	20.5
2	640	599	34
3	1140	1099	42.5
4	1660	1619	53.6
5	2160	2119	62
6	2200	2159	63
7	2250	2209	64.5
8	2350	2309	65.8

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #6

			APR 22, 1996
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	25	-16	11.7
2	500	459	25.2
3	1000	959	34.1
4	1500	1459	45.5
5	2000	1959	55.1
6	2270	2229	61.1
7	2325	2284	62.2
8	2375	2334	62.9
9	2425	2384	60.9

			MAR 25, 2005
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	400	359	23.661
2	800	759	29.767
3	1200	1159	38.192
4	1600	1559	47.124
5	2000	1959	54.589
6	2418	2377	63.775
7	2414	2373	63.754

WALAKPA WELL #7

KB ELEVATION	**48.4**	**fts**

			JUN 06, 1992
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	250	201.6	21.52
2	500	451.6	24.17
3	1000	951.6	34.8
4	1500	1451.6	45.42
5	2000	1951.6	57.1
6	2200	2151.6	62.42
7	2245	2196.6	64.17

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #7

			DEC 5, 1993
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	25	-23.4	23
2	500	451.6	31
3	1000	951.6	42
4	1500	1451.6	52
5	2000	1951.6	60.5
6	2050	2001.6	61.5
7	2100	2051.6	63
8	2200	2151.6	64

			MAR 5, 1996
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	25	-23.4	14.9
2	500	451.6	28.3
3	1000	951.6	39.8
4	1500	1451.6	49.8
5	2000	1951.6	56.1
6	2100	2051.6	60.0
7	2150	2101.6	61.0
8	2208	2159.6	61.5
9	2255	2206.6	62.4

			MAR 19, 2005
SR. NO.	**MEASURED DEPTH (fts)**	**CORRECTED SUBSEA DEPTH (fts)**	**TEMPERATURE (F)**
1	400	351.6	23.195
2	800	751.6	30.36
3	1200	1151.6	39.336
4	1600	1551.6	47.709
5	2000	1951.6	55.437
6	2247	2198.6	62.029

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #8

KB ELEVATION	46.4	fts

			JUN 06, 1992
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	250	203.6	22.18
2	500	453.6	24.17
3	1000	953.6	35.14
4	1500	1453.6	44.55
5	2000	1953.6	54.68
6	2200	2153.6	62.42
7	2374	2327.6	65.93

			DEC 6, 1993
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-21.4	22.50
2	600	553.6	33.50
3	1085	1038.6	44.00
4	1585	1538.6	54.00
5	2100	2053.6	62.50
6	2175	2128.6	64.00
7	2325	2278.6	65.50
8	2350	2303.6	67.50
9	2375	2328.6	67.50

			MAR 14, 1996
SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	TEMPERATURE (F)
1	25	-21.4	10.2
2	500	453.6	26.6
3	1000	953.6	38.4
4	1500	1453.6	48.7
5	2000	1953.6	57.9
6	2130	2083.6	62.4
7	2280	2233.6	63.3
8	2330	2283.6	64.1
9	2380	2333.6	64.9

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #8

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAR 19, 2005 TEMPERATURE (F)
1	400	353.6	23.59
2	800	753.6	30.791
3	1200	1153.6	39.817
4	1600	1553.6	48.386
5	2000	1953.6	55.566
6	2370	2323.6	64.214

WALAKPA WELL #9

KB ELEVATION	44.5	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	DEC 6, 1993 TEMPERATURE (F)
1	25	-19.5	20.30
2	600	555.5	31.80
3	1100	1055.5	42.60
4	1600	1555.5	53.30
5	2100	2055.5	62.30
6	2175	2130.5	63.80
7	2225	2180.5	64.80
8	2375	2330.5	66.10

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	APR 16, 1996 TEMPERATURE (F)
1	25	-19.5	15.10
2	500	455.5	26.80
3	1000	955.5	38.30
4	1500	1455.5	48.70
5	2000	1955.5	57.90
6	2230	2185.5	62.10
7	2280	2235.5	62.90
8	2330	2285.5	64.00
9	2380	2335.5	64.60

WALAKPA TEMP GRAD DATA contd…

WALAKPA WELL #9

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAR 15, 2005 TEMPERATURE (F)
1	400	355.5	21.6
2	800	755.5	29.9
3	1200	1155.5	38.9
4	1600	1555.5	47.5
5	2000	1955.5	55.7
6	2370	2325.5	62.7
7	2366	2321.5	63.8

WALAKPA WELL #10

KB ELEVATION	42.1	fts

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAR 1, 1996 TEMPERATURE (F)
1	25	-17.1	15.1
2	500	457.9	27.8
3	1000	957.9	39.6
4	1500	1457.9	49.6
5	2000	1957.9	58.3
6	2075	2032.9	59.6
7	2135	2092.9	60.7
8	2185	2142.9	61.5
9	2200	2157.9	61.8

SR. NO.	MEASURED DEPTH (fts)	CORRECTED SUBSEA DEPTH (fts)	MAR 20, 2005 TEMPERATURE (F)
1	400	357.9	25.7
2	800	757.9	30.8
3	1200	1157.9	39.5
4	1600	1557.9	48.0
5	2000	1957.9	55.9
6	2200	2157.9	60.7

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