STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Alaska Geologic Materials Center

Data Report #436

X-ray Diffraction Analysis of: Happy Valley 1 (cuttings 5880’-10720’) and Happy Valley 3 (cuttings 5210’-10650’) wells

Received June 2016

Weatherford
LABORATORIES

WEATHERFORD LABORATORIES
X-RAY DIFFRACTION
(WEIGHT %)

Client: Hilcorp Energy Company
Project: COOK INLET GAS RESERVOIRS XRD
Area: Alaska
Sample Type: Cuttings

File No: HH-70868
Date: ######
Analyst: R. Schulze and G. Torrez

Barcode	Well	Sample	Sample Depth (ft)		CLAYS							CARBONATES				OTHER MINERALS										TOTALS			CALCULATED GRAIN
Number	Name	Number	Top	Bottom	Chlorite^	Kaolinite	Illite/Mica	Mx I/S*	Mx I/S**	Mx I/S***	Mx I/S****	Calcite	Dolomite(Fe/Ca+)[1]	Dolomite[2]	Siderite	Quartz	K-spar	Plag.	Pyrite	Halite[3]	Sylvite	Apatite	Clinoptilolite	Amphibole[4]	Barite	Clays	Carb.	Other	DENSITY g/cc+
6123764786	Happy Valley #1	219 D	5880	5910	13	3	16	2	0	0	0	1	Tr	0	1	43	3	18	Tr	0	0	0	0	0	0	34	2	64	2.68
6123764788	Happy Valley #1	220 D	6510	6570	9	6	11	0	6	0	0	1	1	0	2	43	5	16	Tr	0	0	0	0	0	0	32	4	64	2.67
6123764790	Happy Valley #1	221 D	6780	6810	Tr	4	18	0	4	0	0	2	1	0	3	45	4	19	Tr	0	0	0	0	0	Tr	26	6	68	2.68
6123764792	Happy Valley #1	222 D	7050	7080	5	3	5	0	7	0	0	13	Tr	0	2	42	6	17	Tr	0	0	0	0	0	Tr	20	15	65	2.66
6123764794	Happy Valley #1	223 D	7140	7170	6	4	7	0	0	8	0	Tr	Tr	0	1	52	3	19	Tr	0	0	0	0	0	Tr	25	1	74	2.65
6123764796	Happy Valley #1	224 D	7980	8010	7	5	6	0	8	0	0	Tr	1	0	2	51	5	15	0	0	0	0	0	0	Tr	26	3	71	2.66
6123764798	Happy Valley #1	225 D	9750	9760	3	5	3	0	1	0	0	Tr	1	0	2	68	6	11	Tr	0	0	0	0	0	Tr	12	3	85	2.67
6123764800	Happy Valley #1	226 D	9880	9890	8	12	10	0	8	0	0	Tr	Tr	0	2	42	4	14	Tr	0	0	0	0	0	Tr	38	2	60	2.66
6123764802	Happy Valley #1	227 D	10090	10100	3	3	2	0	0	6	0	Tr	1	0	1	65	7	12	Tr	0	0	0	0	0	Tr	14	2	84	2.64
6123764804	Happy Valley #1	228 D	10270	10280	2	4	1	0	2	0	0	Tr	1	0	0	76	4	10	Tr	0	0	0	0	0	Tr	9	1	90	2.64
6123764806	Happy Valley #1	229 D	10630	10640	2	4	2	1	0	0	0	Tr	Tr	0	0	74	6	11	Tr	0	0	0	0	0	Tr	9	Tr	91	2.64
6123764808	Happy Valley #1	230 D	10710	10720	2	3	2	0	2	0	0	Tr	1	0	1	69	8	12	0	0	0	0	0	0	Tr	9	2	89	2.65
6123764810	Happy Valley #3	231	5210	5240	9	3	9	1	0	0	0	Tr	Tr	0	1	50	3	24	Tr	0	0	0	0	0	Tr	22	1	77	2.67
6123764812	Happy Valley #3	232	6380	6410	4	3	4	0	2	0	0	2	Tr	0	1	62	6	16	Tr	0	0	0	0	0	Tr	13	3	84	2.66
6123764814	Happy Valley #3	233	6860	6890	4	3	5	0	0	7	0	Tr	1	0	1	55	5	19	Tr	0	0	0	0	0	Tr	19	2	79	2.65
6123764816	Happy Valley #3	234	7250	7280	5	3	4	0	0	9	0	1	Tr	0	1	56	5	16	Tr	0	0	0	0	0	Tr	21	2	77	2.64
6123764818	Happy Valley #3	235	8150	8180	4	4	3	0	5	0	0	4	3	0	1	54	6	16	Tr	0	0	0	0	0	Tr	16	8	76	2.65
6123764820	Happy Valley #3	236	9140	9170	4	4	4	0	0	0	17	1	1	0	3	44	7	15	Tr	0	0	0	0	0	Tr	29	5	66	2.64
6123764822	Happy Valley #3	237	9230	9260	4	6	5	0	2	0	0	Tr	Tr	0	2	67	5	9	Tr	0	0	0	0	0	Tr	17	2	81	2.67
6123764824	Happy Valley #3	238	9650	9680	8	11	6	0	5	0	0	Tr	Tr	0	Tr	52	4	14	Tr	0	0	0	0	0	Tr	30	Tr	70	2.65
6123764826	Happy Valley #3	239	9960	9980	2	3	2	0	0	3	0	Tr	1	0	1	67	6	15	0	0	0	0	0	0	Tr	10	2	88	2.65
6123764828	Happy Valley #3	240	10150	10160	2	6	2	1	0	0	0	Tr	1	0	1	71	5	11	0	0	0	0	0	0	0	11	2	87	2.66
6123764830	Happy Valley #3	241	10640	10650	2	4	2	0	0	4	0	1	Tr	0	1	66	7	13	Tr	0	0	0	0	0	Tr	12	2	86	2.64
		AVERAGE			7	3	8	1	2	Tr	Tr	3	1	Tr	1	50	5	19	Tr	Tr	Tr	Tr	Tr	Tr	Tr	21	5	74	2.66

^Chlorite appears to contain the presence of Chamosite (Fe,Al,Mg)6(Si,Al)4O10(OH)8.
* Ordered interstratified mixed-layer illite/smectite; Approximately 10-34% expandable interlayers.
** Ordered interstratified mixed-layer illite/smectite; Approximately 35-55% expandable interlayers.
*** Ordered interstratified mixed-layer illite/smectite; Approximately 56-70% expandable interlayers.
**** 100% Expandable - Montmorillonite.
[1] Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals (which increases with calcium in excess of 50:50 Ca:Mg or subsitution of Fe for Mg).
[2] Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals; other dolomite species may be present.
[3] Samples were not cleaned, halite is possibly from formation water, other indigenous sources, or drilling.
[4] Amphibole - Search match suggested Hornblende.
+Grain Density calculated without barite quantities and TOC integration, may not accurately represent the actual grain density of the sample.