

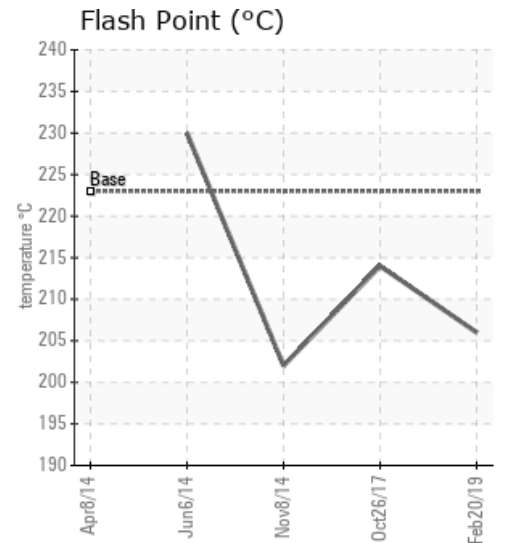
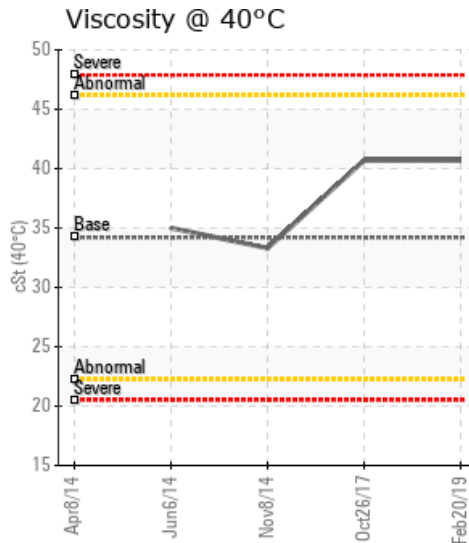
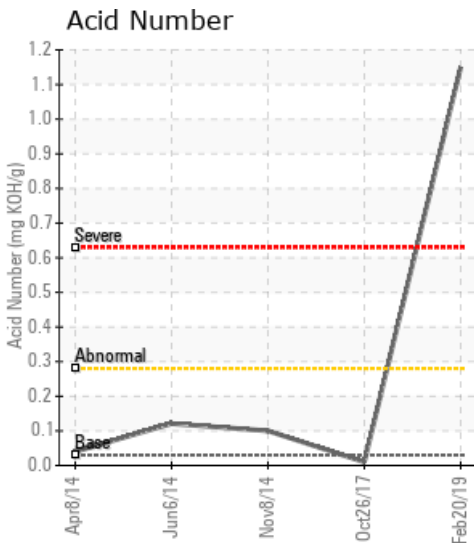
[LSD-13-35-47-10W5] LODGEPOLE

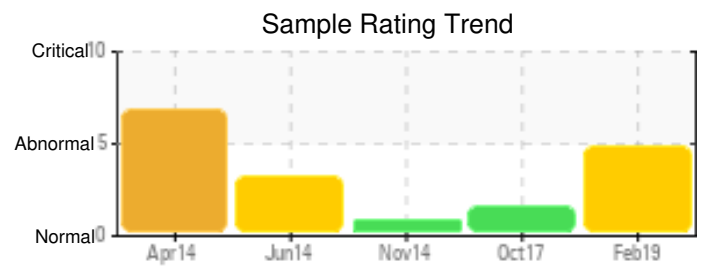
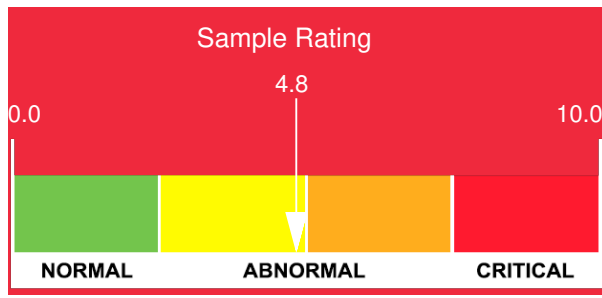
Customer: PTRHTF20136	System Information	Sample Information
CENOVUS ENERGY 13-35-47-10W5 DRAYTON VALLEY, AB Canada Attn: Kevin Spiker Tel: (780)514-4635 E-Mail: kevin.spiker@cenovus.com	System Volume: 23000 ltr Bulk Operating Temp: 446F / 230C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make:	Lab No: 02269700 Analyst: Terry Veenstra Sample Date: 02/20/19 Received Date: 02/25/19 Completed: 03/07/19

Recommendation: TAN is significantly higher than normal and Pentane Insolubles is elevated. As part of a regular maintenance program, the system should be vented to eliminate light ends from the system. Resample in 6 months.

Comments: Pentane Insolubles levels are severely high. Acid Number (AN) is severely high.

Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
02/20/19	02/25/19	56m	PUMP DISC HI POINT	403 / 206	54.7	40.7	1.15	0.777	709 / 376	809 / 432	912 / 489	2.22
10/26/17	11/02/17	40m	PUMP DISCHARGE HIPNT	417 / 214	73.9	40.7	0.01	0.944	717 / 381	809 / 432	901 / 483	0.51
11/08/14	11/14/14	5m	LOW PRESS BUILD HEAT	396 / 202	37.2	33.3	0.10	0.296	706 / 374	812 / 434	927 / 497	3.44
06/06/14	10/24/14	8m	DOWNSTREAM PUMP	446 / 230	2084.7	35.0	0.121	0.035	714 / 379	811 / 433	910 / 488	0.94
04/08/14	04/09/14	5m					0.04	6.68	712 / 378	832 / 444	918 / 492	4.01
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00

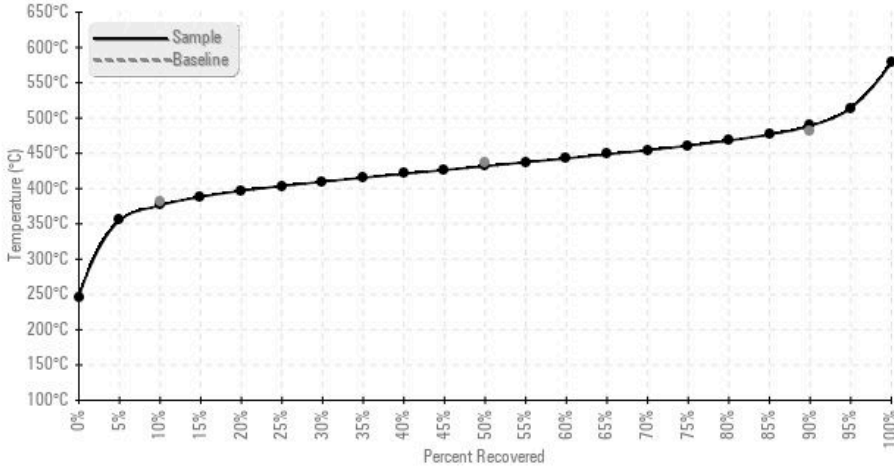




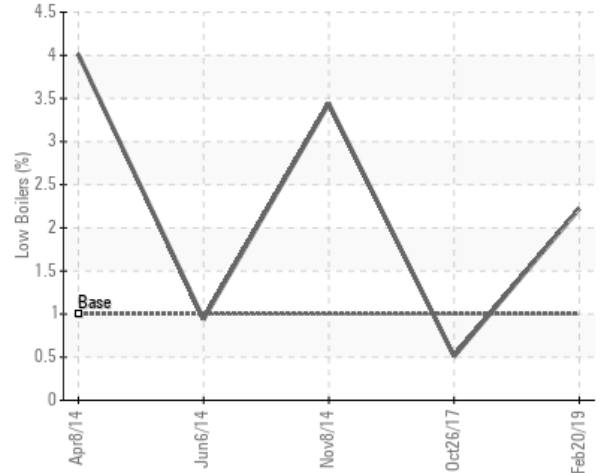
Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
02/20/19	22	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	3	0
10/26/17	26	0	0	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	4	0
11/08/14	9	0	0	1	0	0	0	0	0	0	4	2	7	0	0	0	0	0	2	0	4	0	3	1
06/06/14	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1
04/08/14	47	0	1	3	1	0	2	1	0	0	0	32	0	0	0	0	1	2	4	0	4	0	3	3
Baseline Data			0	0						0			0	0					0				0	

Elemental analysis results (above) in parts per million (ppm). [10,000 ppm = 1.0%]

Gas Chromatography Distillation (GCD)



% Boiling < 335°C



Historical Comments

10/26/17	The fluid is in a good condition and suitable for further use. Viscosity and Pentane Insoluble (solids) content has increased. It is recommended to consider filtration of the fluid to lower the solids content. The above comments assume that the sample has been taken from the discharge side of a heat medium pump with the pump running. If this is not the case the sample may not be representative for the fill of the system. Pentane Insolubles levels are severely high.
11/08/14	The fluid is in good condition and suitable for further use. Please re-sample in 6 months. Fill out the sample label including location and system volume. (GCD) 90% Distillation Point is marginally high.
06/06/14	The new fill is Petro-Canada Petro-Therm. The system was cleaned and flushed prior to adding the fresh fill of heat transfer fluid. The fluid has been in service for 8 hours. Water content is high. This is the remainder of the system cleaning. This sample could have been taken during the water boil-off phase of the system start-up. The solids content of the fluid is low. This is an indication of system cleanliness. The sample was taken on the 6th of June and received by the lab on the 24th of October. It is advised to ship samples to the lab immediately after sampling. The fluid is in good condition and suitable for further use. Please re-sample in 6 months Water contamination levels are severely high. Water contamination levels are severely high.. ppm Water contamination levels are severely high.
04/08/14	Sample arrived at the lab as a solid. As a result of the extremely high viscosity, Flash Point and viscosity at 40 and 100 degrees C could not be measured. Sodium content is high. The Pentane Insoluble content (solids) is extremely high with 6.68% (0.5% is alert limit). The GCD 10% temperature has decreased but overall the distillation curve of the fluid is fairly normal. The low boiler content (GCD% <335C) is moderate with 4%. There is no combination of parameters to indicate thermal cracking of the fluid and despite the extremely high viscosity and solids content there is no indication of severe oxidation of the fluid. TAN is normal with 0.04. Since the analysis results do not show an apparent reason for fluid degradation, the condition of the fluid could be related to outside contamination like fluid top-up or process fluid leaks via a heat exchanger. Let's discuss fluid history and steps to move forward during the on-site meeting on Monday April 14. Please note that the fluid was too thick to perform some of the normal laboratory tests. Pentane Insolubles levels are severely high. The oil is a solid at room temperature. Sodium ppm levels are abnormally high. (GCD) 10% Distillation Point is marginally low.

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