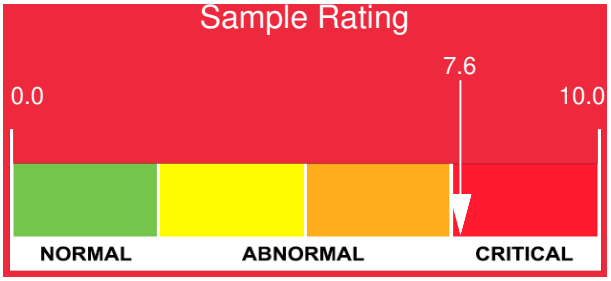
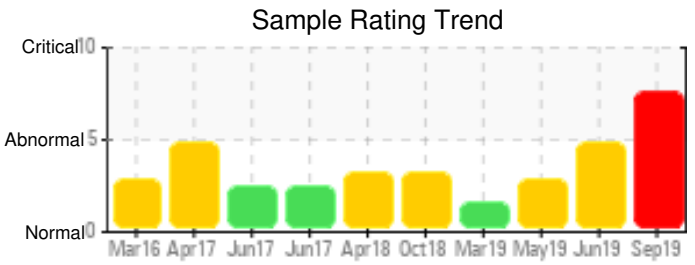




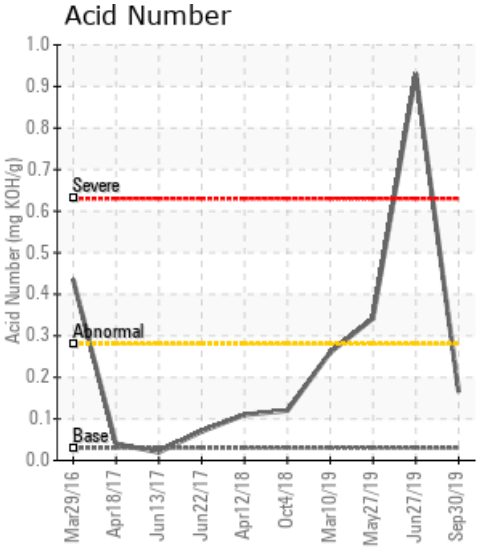
[CNRL 7-36-58-03W6] H5040 CONDENSATE LINE HEATER

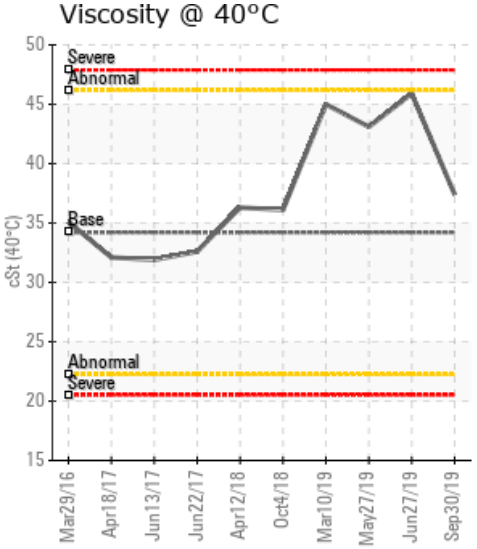
Customer: PTRHTF20103	System Information	Sample Information
CNRL P.O. BOX 6808 EDSON, AB T7E 1L5 Canada Attn: Stewart Rivard Tel: (780)712-9391 E-Mail: stewart.rivard@cnrl.com	System Volume: 16000 ltr Bulk Operating Temp: 374F / 190C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: ALCO	Lab No: 02312938 Analyst: Peter Harteveld Sample Date: 09/30/19 Received Date: 10/07/19 Completed: 10/18/19

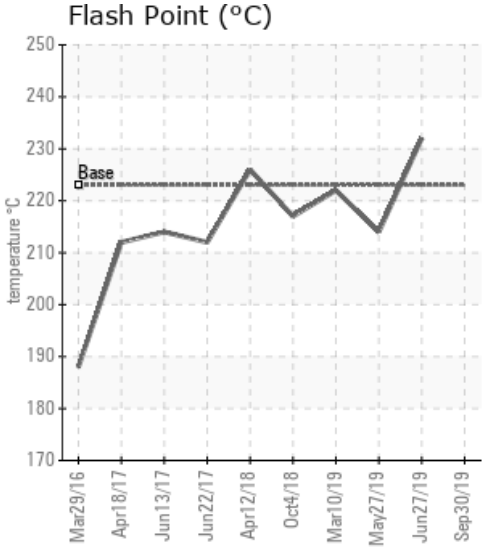
Recommendation: *** NOTE: Could not do flash point as a result of the high water level in sample ***In July a recommendation was made to clean the system and replace the fluid based on poor, non-reversable condition of the fluid. Given 2 weeks fluid service life reported, the cleaning must have taken place recently. The analysis shows that a lot of water (high pressure washing ?) was left behind. This water needs to be boiled off at appr. 105 degrees C to avoid a boil-over. It can also be drained off from a bottom drain valve as free water after letting it settle. Aside from the high water content, the fluid is in good condition and suitable for use. The 90% GCD temperature is high but can be influenced by the high water content. Please re-sample after boiling-off/draining the water.

Comments: Water contamination levels are severely high. Water contamination levels are severely high.. ppm Water contamination levels are severely high. (GCD) 90% Distillation Point is severely high.

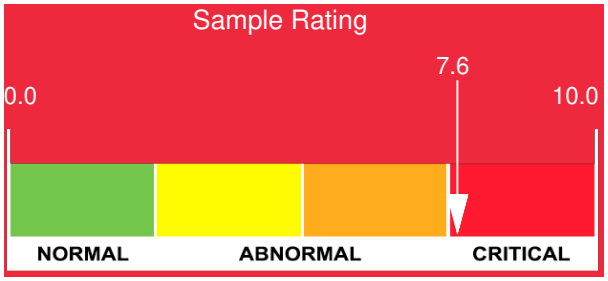
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
09/30/19	10/07/19	2w			3580	37.4	0.165	0.275	744 / 396	835 / 446	936 / 502	0.00
06/27/19	07/05/19	10w	BOTTOM OF HEATER	450 / 232	114.8	45.9	0.930	1.86	710 / 377	802 / 428	901 / 483	1.05
05/27/19	06/07/19	10w	BOTTOM OF HEATER	417 / 214	64.1	43.1	0.342	1.51	720 / 382	806 / 430	904 / 485	0.00
03/10/19	03/20/19	10w	BOTTOW OF HEATER	432 / 222	146.3	45.0	0.26	1.80	710 / 376	804 / 429	900 / 482	1.89
10/04/18	11/15/18	0w		423 / 217	577.4	36.1	0.12	0.401	690 / 366	783 / 417	877 / 470	1.86
04/12/18	04/24/18	0w		439 / 226	414.9	36.3	0.11	0.577	695 / 368	802 / 428	909 / 487	3.57
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00

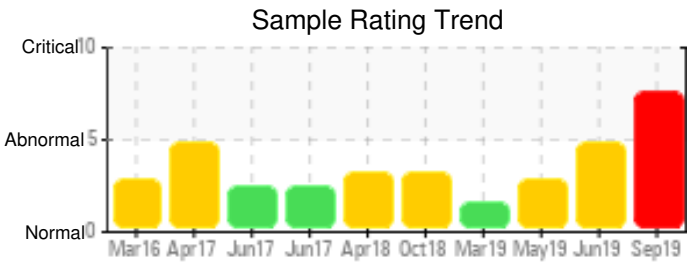






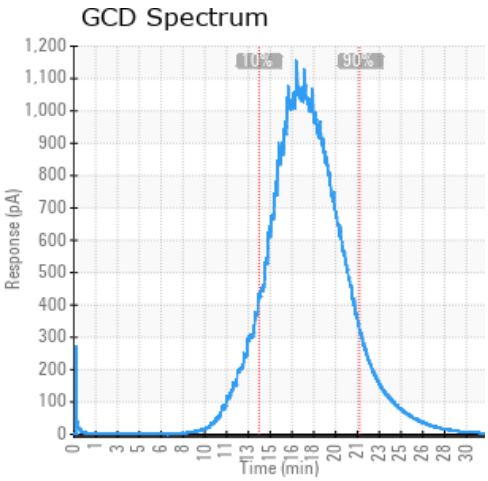
PETRO-CANADA LUBRICANTS

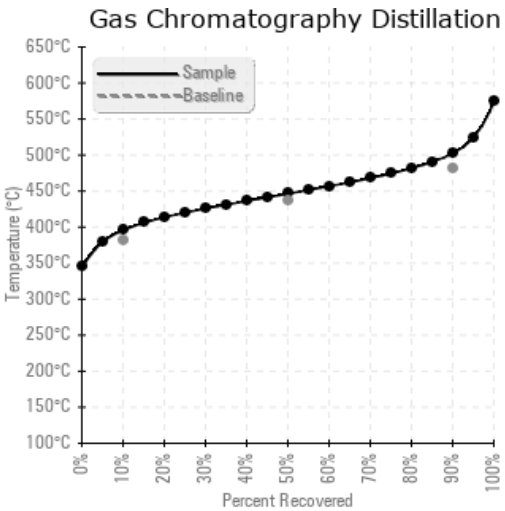


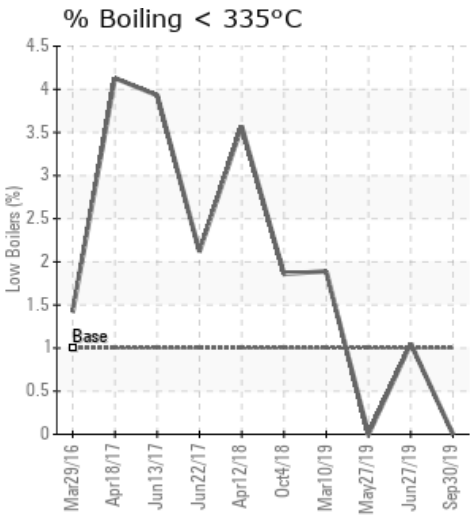


Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
09/30/19	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	8
06/27/19	87	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
05/27/19	64	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03/10/19	101	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
10/04/18	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04/12/18	18	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseline Data			0	0						0			0	0					0				0	

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







Historical Comments

06/27/19	It was reported verbally that the system operated without blanket gas. The results of that can be seen in this analysis. TAN is high at 0.93 which is close the condemning limit of 1. Fe content is elevated. This can be corrosion due to the high acidity of the fluid. These parameters in combination with a somewhat high viscosity indicate degradation of the fluid by oxidation. This happens when the hot fluid comes into contact with oxygen which can occur when the blanket gas is removed. The Pentane Insoluble (solids) content of the fluid is high (1.86%). This is more than 3x the reportable limit of 0.5%. A high solids content like this will cause depositing of carbonaceous material on system internals and reduce efficiency of heat transfer. The condition of the fluid is poor and because of the increasing TAN no longer suitable for further service. It is therefore recommended to clean the system and replace the fluid. For support with cleaning, filling and start-up of the system please contact your Petro-Canada Technical Service Advisor. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high.
05/27/19	Sample results indicate that there are several parameters of concern although some values appear healthy.Distillation levels are not concerning at this point although it may be that they appear healthy because of two opposing degradation modes. The fluid's Acid Number has increased to 0.342 from 0.26 with a corresponding 62 ppm of Iron which can be a result of increased corrosion. Solids content is at 1.51% which is above the 0.5% alarm threshold. Speaking with Rodney Marcichiw, it is understood that the bulk oil temperature was increased some time ago in order to maintain the target condensate temperature (from 145C to 190C). That, and it is understood that operations has been continually venting off vapors and there are noises from around the fire tubes. Water content is very low now, so it is possible that the vapors that are continually being vented may be low boiling vapors as a result of thermal degradation (cracking of the oil molecules). The fluid's viscosity of 43 cSt can be a function of both oxidation (see acid number increase) as well as thermal degradation (vapor formation, solids content and reduced heating efficiency).As discussed, please obtain another sample in 1 month to verify results, after which time further discussions should be had to make a plan to restore system operation.
03/10/19	The fluid is in good condition and suitable for further use but the viscosity is slightly high and the solids content is high. Filtration of the fluid is recommended. Please re-sample in 6 months or after filtration has taken place. (whichever comes first) Pentane Insolubles levels are severely high.
10/04/18	The fluid is in good condition and suitable for further use. The water content of the fluid is slightly high. Please boil-off and vent to atmosphere. Pentane Insoluble (solids) content has decreased compared with the previous sample. It is still close to the reportable limit (0.5%) and therefore it would be good to start filtration of the fluid. The 90% GCD temperature is low and so is the distillation curve as a whole. This is no concern at this time. Please re-sample in 6 months. Pentane Insolubles levels are abnormally high. Water contamination levels are marginally high. Water contamination levels are marginally high.. ppm Water contamination levels are marginally high. (GCD) 90% Distillation Point is marginally low.
04/12/18	Water content is marginally high, however has improved since last sample. Pentane insoluble is also high. Flash point has improved. Consider venting system from high point to eliminate water. Continue to operate and resample in 6 - 8 months Pentane Insolubles levels are severely high. Water contamination levels are marginally high. Water contamination levels are marginally high.. ppm Water contamination levels are marginally high.