

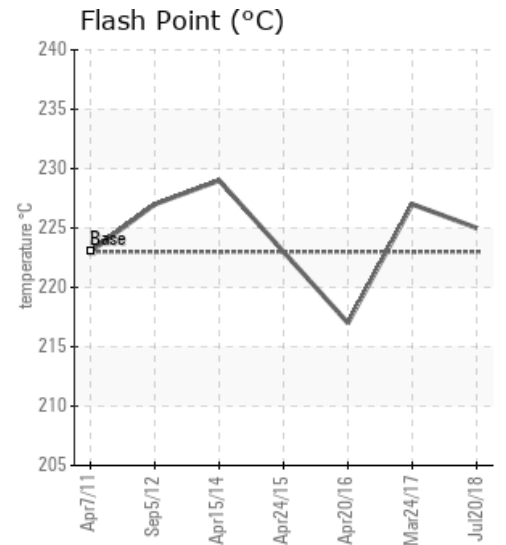
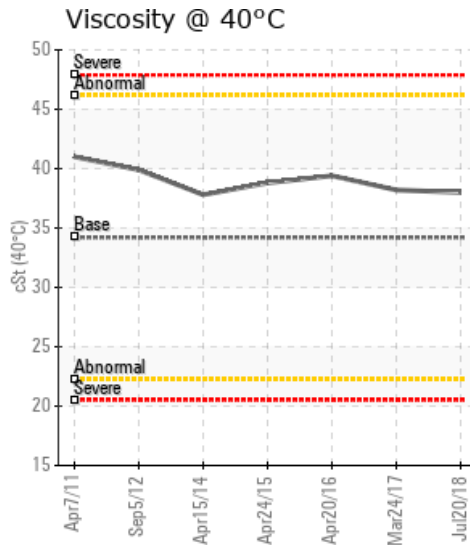
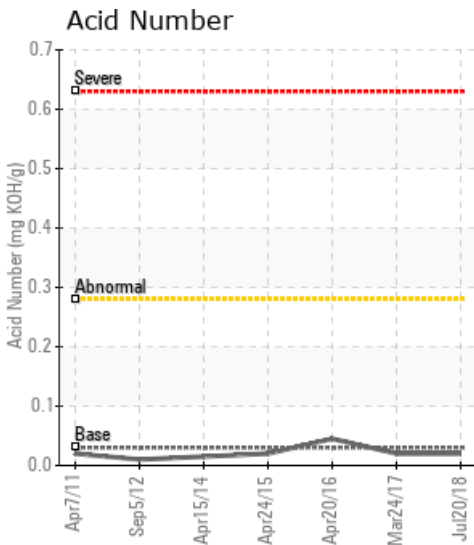
[CNRL KNOPCIK / LSD 09-10-74-1146] CNRL KNOPCIK

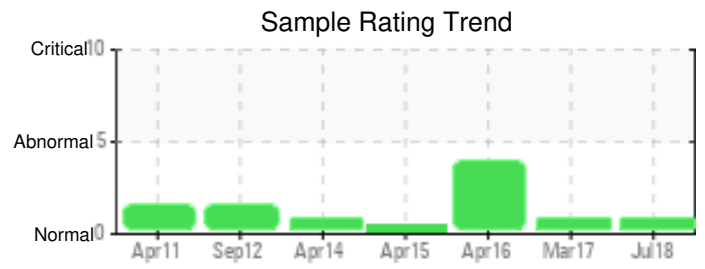
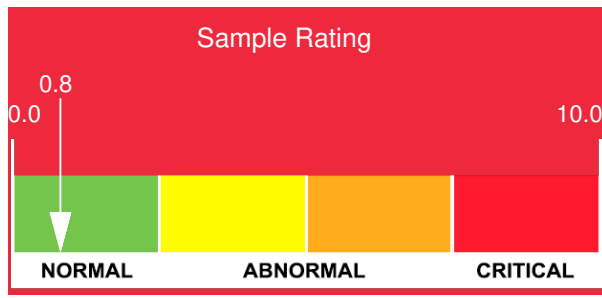
Customer: PTRHTF20048	System Information	Sample Information
CANADIAN NATURAL RESOURCES BOX 125 HYTHE, AB T0H 0C0 CANADA Attn: Ken Moon Tel: (280)831-0623 E-Mail: ken.moon@cnrl.com	System Volume: 30000 ltr Bulk Operating Temp: 437F / 225C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: BORN/HEATEC	Lab No: 02235064 Analyst: Clinton Buhler Sample Date: 07/20/18 Received Date: 08/22/18 Completed: 08/27/18 To discuss this report contact Clinton Buhler at 780-516-9920

Recommendation: Sample results indicate that the fluid is suitable for continued service. 90% GCD value is lower than previous samples; continue to monitor. Please pull another sample in 12 months.

Comments:

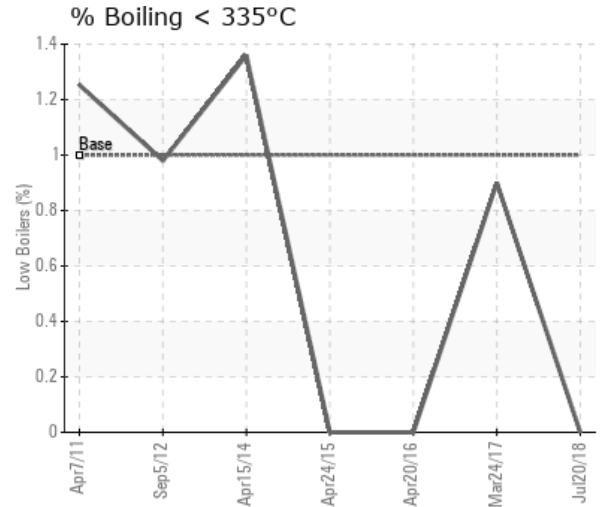
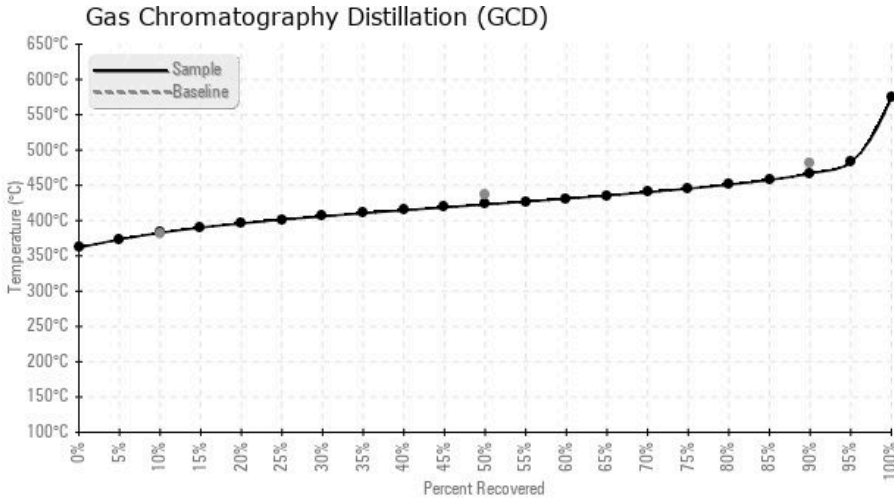
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
07/20/18	08/22/18	10y	PUMP	437 / 225	10.8	38.0	0.02	0.027	721 / 383	793 / 423	872 / 467	0.00
03/24/17	04/27/17	0y		441 / 227	11.6	38.2	0.02	0.030	727 / 386	832 / 444	927 / 497	0.90
04/20/16	05/09/16	5y	PURGE LINE OFF TOP	423 / 217	9.2	39.4	0.045	0.086	760 / 404	845 / 452	976 / 525	0.00
04/24/15	05/01/15	27y	AFTER OIL COOLER	433 / 223	5.6	38.8	0.020	0.032	735 / 391	837 / 447	920 / 493	0.00
04/15/14	04/22/14	26y	PUMP DISCHARGE	444 / 229	25.3	37.8	0.015	0.022	725 / 385	835 / 446	919 / 493	1.36
09/05/12	09/07/12			441 / 227	8	39.9	0.01	0.014	733 / 389	831 / 444	915 / 491	0.98
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
07/20/18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03/24/17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
04/20/16	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
04/24/15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
04/15/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
09/05/12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	6	0
Baseline Data			0	0						0			0	0					0				0	

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



Historical Comments	
03/24/17	sample results indicates that the fluid is suitable for continued service. 90% GCD is high. This can indicate heavier ends in the fluid which can be caused by mixing with a different fluid which is also related to the higher viscosity. Oxidation of the fluid can also cause increased 90% GCD and viscosity levels, but the low AN of the fluid doesn't suggest oxidation. Ensuring a functioning blanket gas system on the expansion tank helps to minimize oxidation. Continue to operate and re-sample in 12 months. (GCD) 90% Distillation Point is abnormally high.
04/20/16	GCD@ 90% has increased to 524.4 DEG C indicating some heavier ends in the fluid. This can be caused by contamination or by thermal cracking of fluid. Flash Point has dropped slightly but is still OK. Continue to operate and resample in 6 months. (GCD) 90% Distillation Point is severely high. Visc @ 40°C is abnormally high. (GCD) 10% Distillation Point is marginally high. (GCD) 50% Distillation Point is marginally high.
04/24/15	(GCD) 90% Distillation Point is marginally high. Continue to operate and resample in 12 months (GCD) 90% Distillation Point is marginally high.
04/15/14	This oil sample indicates that the oil is still in good condition and acceptable for continued use. Resample in 12 months. (GCD) 90% Distillation Point is marginally high.
09/05/12	The results indicate no major changes since the April 2011 sample. Re-sample in about 12 months to monitor fluid & system condition.

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