

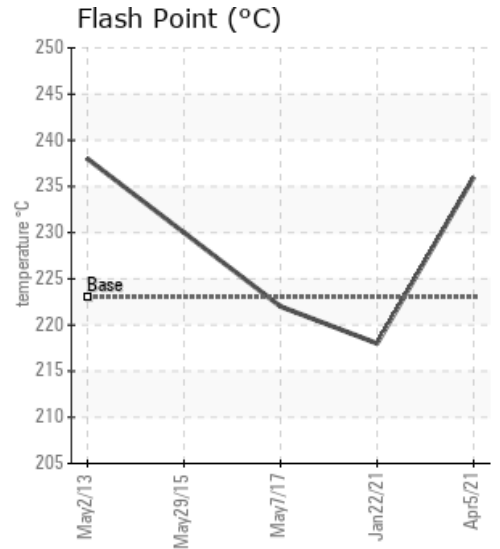
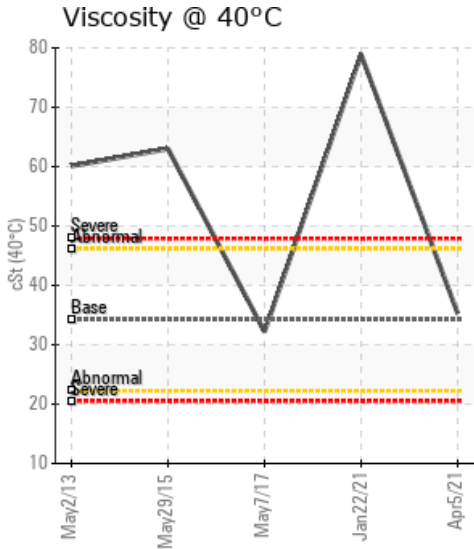
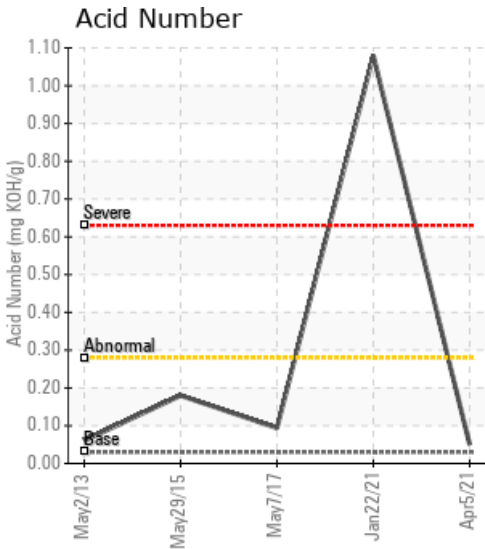
[7-27-51-19W5] HEAT MEDIUM

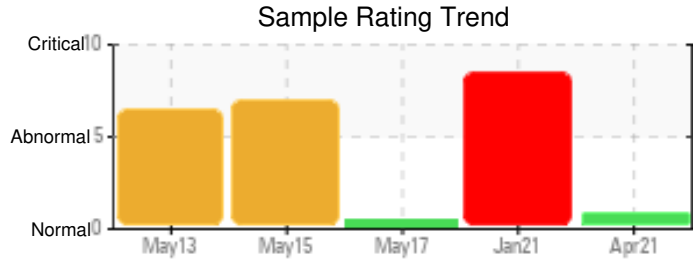
Customer: PTRHTF20103	System Information	Sample Information
CANADIAN NATURAL RESOURCES (CNRL) P.O. BOX 6808 EDSON, AB T7E 1L5 Canada Attn: Rodney Marcichiw Tel: (780)517-3542 E-Mail: rodney.marcichiw@cnrl.com	System Volume: 14200 ltr Bulk Operating Temp: 446F / 230C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: PRESSON	Lab No: 02413101 Analyst: Clinton Buhler Sample Date: 04/05/21 Received Date: 04/06/21 Completed: 07/06/21 Clinton Buhler Clinton.Buhler@hollyfrontier.com

Recommendation: Sample results indicate that the fluid is in suitable condition for continued service. Please re-sample in 6 months.

Comments:

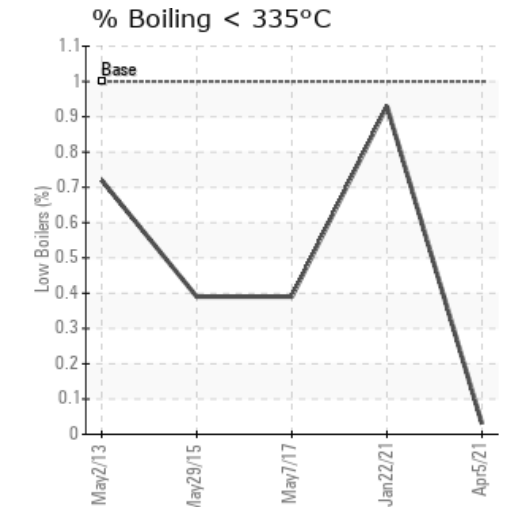
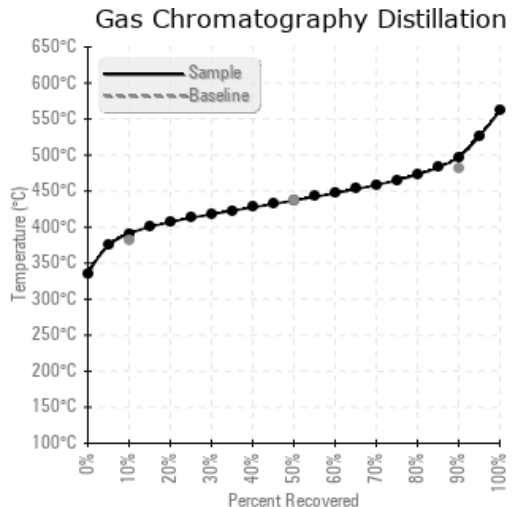
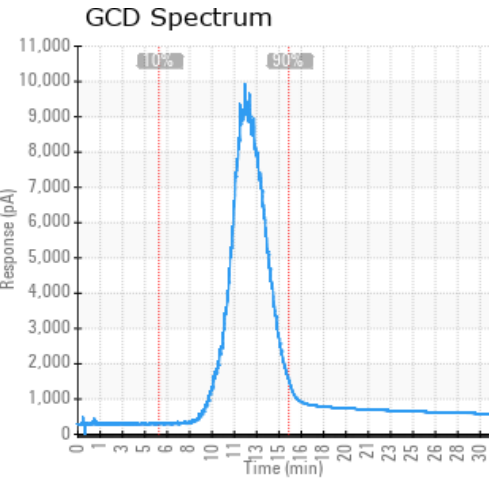
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
04/05/21	04/06/21	0.0y	Pump dischard	457 / 236	67.7	35.3	0.05	0.162	735 / 391	818 / 437	927 / 497	0.03
01/22/21	01/27/21	0.0y	Pump Discharge	424 / 218	27.0	78.9	1.08	2.79	727 / 386	814 / 434	911 / 488	0.93
05/07/17	05/24/17	0.0y		432 / 222	21.2	32.2	0.094	0.180	726 / 385	816 / 436	913 / 490	0.39
05/29/15	06/05/15	0.0y	PUMP DISCHARGE	446 / 230	48.5	63.0	0.18	1.23	735 / 391	838 / 448	970 / 521	0.39
05/02/13	05/22/13	5.0y	PUMP DISCHARGE	460 / 238	99.1	60.1	0.06	0.918	725 / 385	827 / 442	960 / 515	0.72
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
04/05/21	18	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	4	0	2	1
01/22/21	154	0	0	0	0	0	0	0	0	0	0	4	3	0	0	0	2	0	0	0	0	0	1	0
05/07/17	20	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0
05/29/15	202	0	0	0	0	0	0	0	0	0	4	27	3	0	0	0	4	0	0	6	9	0	10	0
05/02/13	67	0	0	0	0	0	2	0	0	0	6	32	2	0	0	0	1	0	0	6	10	0	53	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

01/22/21	The fluid viscosity and AN are high. Fe content is high. Corrosion is ongoing within the system. Pentane Insoluble (solids) content of the fluid is very high. Oxidation of the fluid is the likely cause of this. Since the AN has exceeded the limit it is recommended to replace the fluid. The high solids content of the fluid is an indication that system cleaning/flushing may be required prior to filling with fresh fluid. Please consult with your Petro-Canada Tech Service Advisor. PQ levels are abnormal. Iron ppm levels are abnormal. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Visc @ 40°C is severely high.
05/07/17	The fluid is in good condition and suitable for further use. Please re-sample in 12 months. (List system volume and fluid service hours when sending in the next sample)
05/29/15	Viscosity at 40 degrees C is high. TAN is elevated. The GCD 90% temperature is high. These are indications of fluid degradation by oxidation. Sodium (Na) is high. This in combination with oxidative degradation has resulted in some corrosion. (Fe is at 202 ppm.) The solids content (pentane insolubles) is very high. 1.23% is almost 2.5x over the limit. It is recommended to replace the fluid. The system possibly needs cleaning and flushing. For info on fluid change-out, please contact your Petro-Canada Technical Service Advisor. PQ levels are severe. Iron ppm levels are abnormal. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely high. Sodium ppm levels are abnormally high. Visc @ 40°C is abnormally high.
05/02/13	The oil as tested does not appear to be Petro-Therm, please let me know via email what you believe is currently in the system. The oil is showing signs of oxidation. There is an increase in the insoluble solids and it appears that the additives have been significantly depleted. There also is a high concentration of sodium, which may be coming from the process. We recommend that you investigate the source of the sodium before considering changing the oil. Please contact your local technical advisor to discuss change-out and cleaning procedures. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely high. Visc @ 40°C is severely high. Sodium ppm levels are abnormally high. (GCD) 50% Distillation Point is marginally high.

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