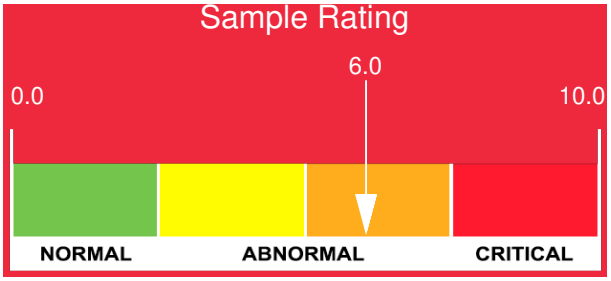
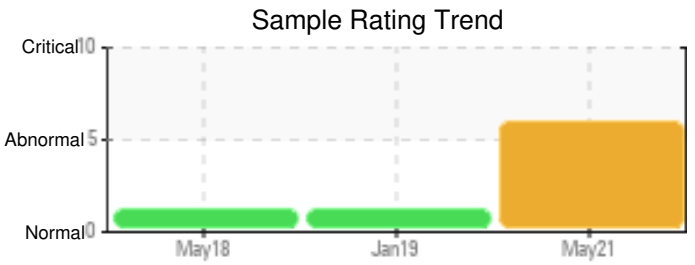




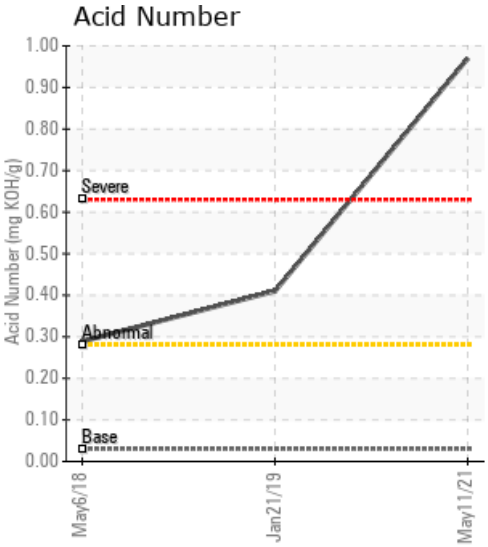
[STORM RESOURCES / D-39-D/94-H-3] H-4030

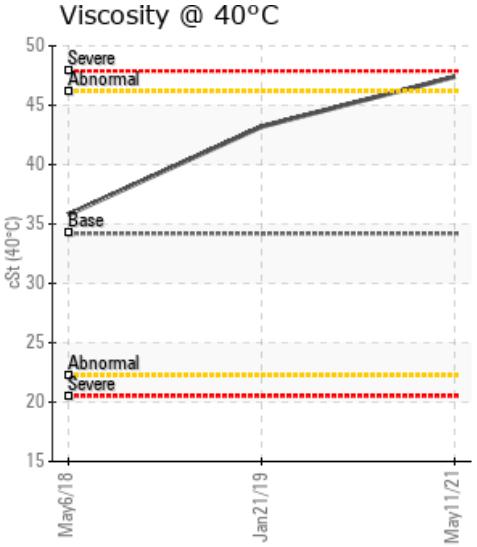
Customer: PTRHTF20175	System Information	Sample Information
QUADRA CHEMICALS 7802 98 STREET CLAIRMONT, AB T0H 0W0 Canada Attn: Quadra Samples Tel: E-Mail: quadra_samples@quadra.ca	System Volume: 14000 ltr Bulk Operating Temp: 518F / 270C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: ALCO	Lab No: 02423513 Analyst: Clinton Buhler Sample Date: 05/11/21 Received Date: 05/26/21 Completed: 05/28/21 Clinton Buhler Clinton.Buhler@hollyfrontier.com

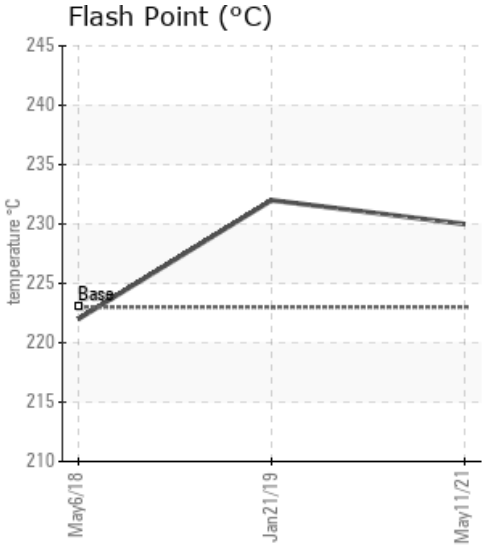
Recommendation: Sample results indicate that the rate of fluid degradation by oxidation has increased since last analysis. Acid Number is at 0.97 (sweetening is recommended ~0.4) and the increase in fluid viscosity, 90% GCD and solids content supports this. It is recommended to make plans to clean system and replace with fresh fluid as oxidation and system fouling can begin to increase exponentially if left.It is critical that blanket gas is properly operation on top of the system's expansion tank to reduce/prevent fluid oxidation.Please contact Petro-Canada's Technical Services to discuss further

Comments:

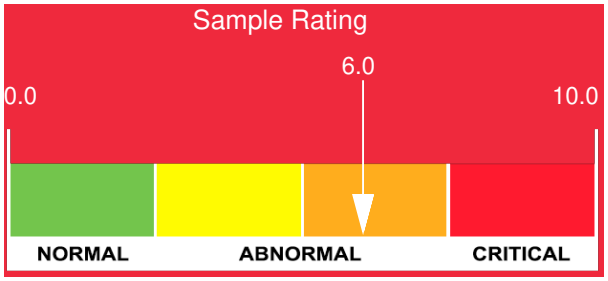
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
05/11/21	05/26/21	5.0m	Reboiler	446 / 230	51.4	47.4	0.97	1.40	701 / 372	798 / 426	922 / 494	3.38
01/21/19	02/01/19	12.0m		450 / 232	157.0	43.2	0.410	0.241	706 / 375	792 / 422	892 / 478	0.36
05/06/18	07/10/18	18.0m		432 / 222	159.7	35.8	0.289	0.210	718 / 381	810 / 432	907 / 486	1.33
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00

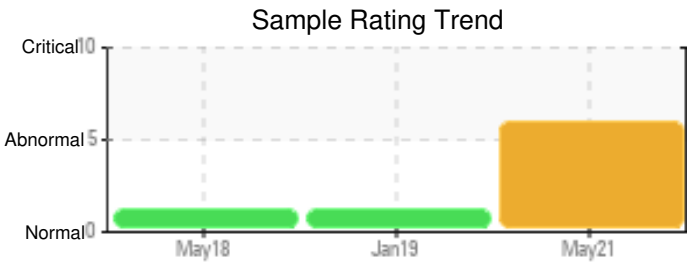






PETRO-CANADA LUBRICANTS

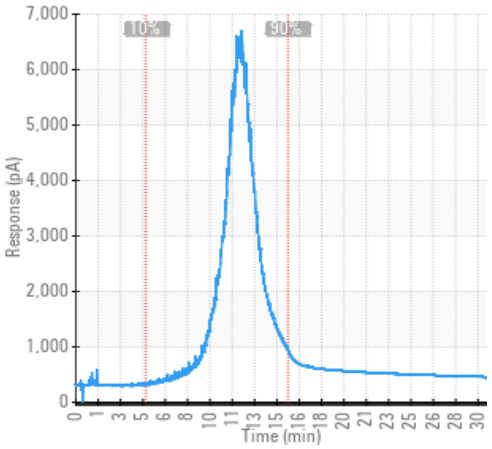




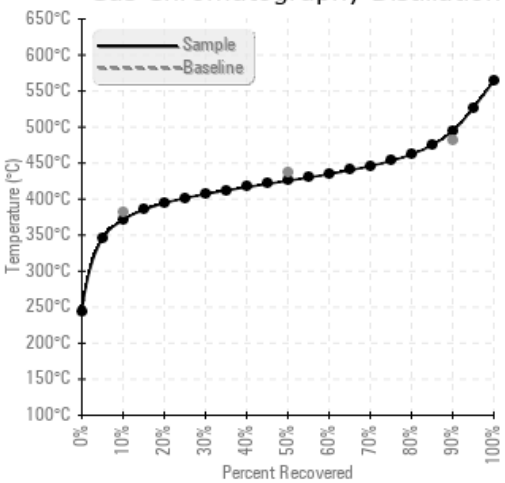
Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
05/11/21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01/21/19	96	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
05/06/18	11	0	0	0	0	0	0	0	0	0	20	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%]

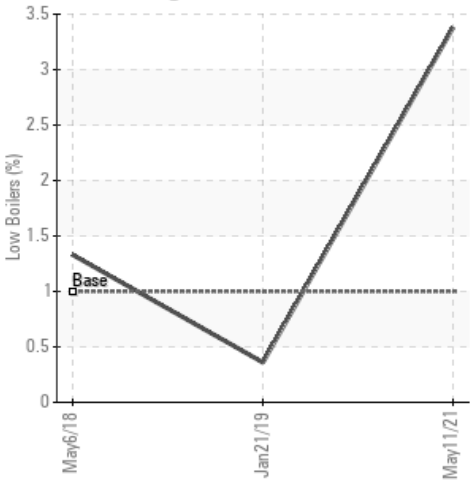
GCD Spectrum



Gas Chromatography Distillation



% Boiling < 335°C



Historical Comments

01/21/19	Sample results indicate that the fluid's acidity is increasing as evidenced by the increase in Acid Number as well as the increased viscosity. These two values may indicate ongoing oxidation. The increase in Iron levels may also indicate that corrosion is ongoing. Consider sweetening of the system to reduce the level of acidity and possible related system corrosion. Ensure blanket gas is operational to reduce the rate of oxidation.Re-sample once sweetening completed. Acid Number (AN) is abnormally high.
05/06/18	sample results indicate that the heat transfer fluid is suitable for continued service. Please note Acid Number at 0.289. This can be an indication of oxidation. Please ensure blanket gas is operational. Iron at 11 ppm can be associated to Acid Number (possible corrosion). Silicon at 20 ppm; this can be from dirt/dust in the system. Please ensure system is sealed from outside contaminants and that fluid transfer devices and hoses are clean. % boil off <335C can be an indication of thermal degradation. As part of a sound maintenance program, periodic venting of low boiling vapors is beneficial.Re-sample in 6-12 months