

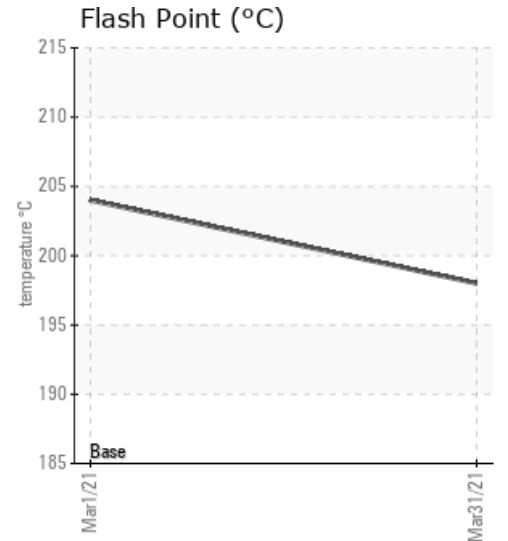
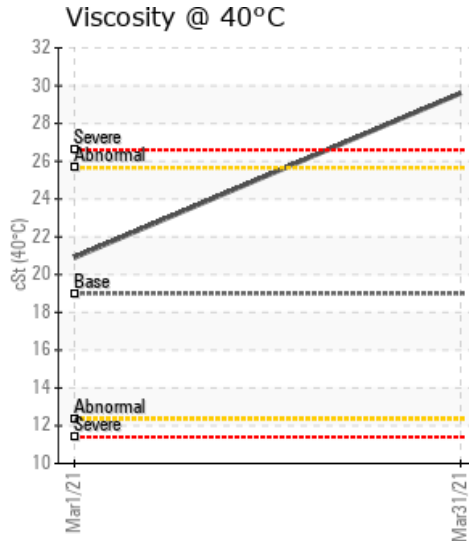
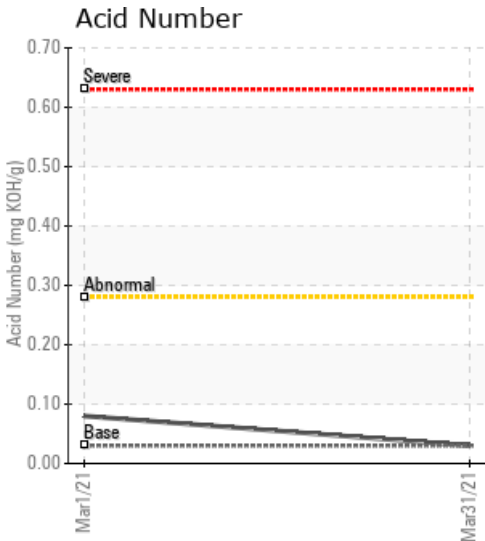
HEAT TRANSFER

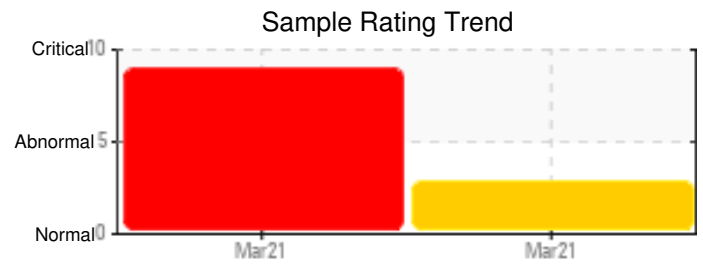
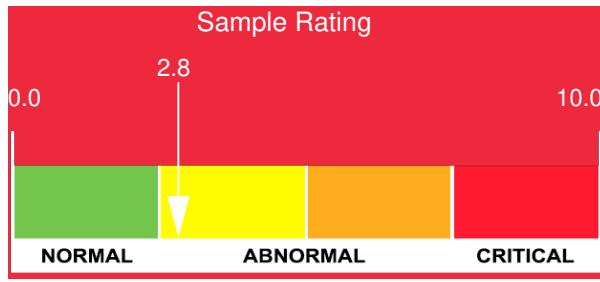
Customer: PTRHTF10244	System Information	Sample Information
Oneok Hydrocarbon 1910 S Broadacres Rd Hutchinson, KS 67501 USA Attn: Jason Henderson Tel: (620)899-1167 E-Mail: jason.henderson@oneok.com	System Volume: 10000 gal Bulk Operating Temp: 485F / 252C Heating Source: Blanket: Fluid: EASTMAN THERMINOL 55 Make: BROACH	Lab No: 02413749 Analyst: Garrett Bapp Sample Date: 03/31/21 Received Date: 04/07/21 Completed: 04/21/21 Garrett Bapp Garrett.Bapp@hollyfrontier.com

Recommendation: Sample rating has been reduced from 9 to 6 based on recent conversations with OneOk team indicating that fouling of the system was not noticed inside any heat exchange piping and that higher heat settings are not being used. Between sampling of 30 days, viscosity has jumped from 20.9 to 29.6. This could be due to where the sample was obtained and that the recent sample is representative of system. Using the high 90% GCD and high viscosity, we recommend that OneOk performs a full system change out of the fluid. System cleaning will depend on inspections made by the OneOk team and Allied. Current conversations and oil analysis is not indicating that system has heavy deposits but has potential.

Comments: (GCD) 90% Distillation Point is severely high. Visc @ 40°C is severely high.

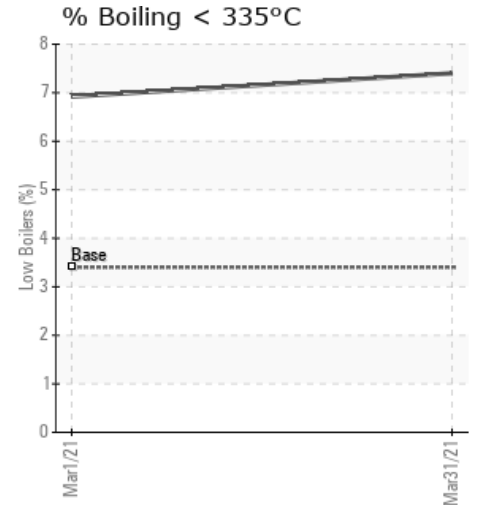
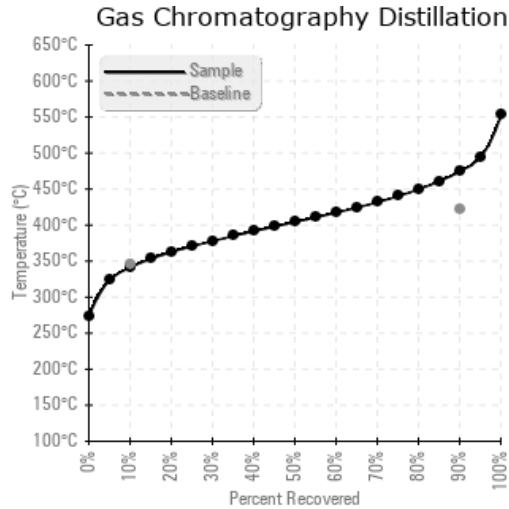
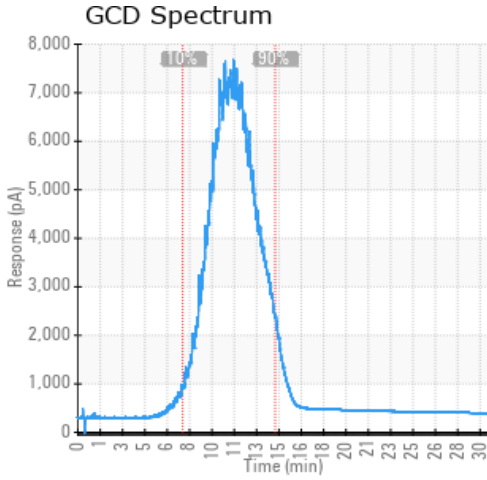
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
03/31/21	04/07/21	0.0y	low point outlet	388 / 198	10.8	29.6	0.03	0.049	646 / 341	760 / 404	886 / 474	7.40
03/01/21	03/09/21	0.0y	dischg of fltr scree	399 / 204	8.0	20.9	0.08	0.037	649 / 343	762 / 406	879 / 471	6.92
Baseline Data				349 / 176		19.0	0.03		655 / 346		790 / 421	3.40





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
03/31/21	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
03/01/21	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	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

03/01/21

Fluid is severely elevated at the GCD 90% distillation point. This is due to the fluid being thermally cracked. This revolving process occurs due to fluid breakdown that causes heat transfer surfaces to get fouled with insulating layers of residues. To get the same efficiency from the system, the heater is required to produce more energy to maintain outlet temps. This excessive heat (energy) creates more thermal cracking of the fluid and the cycle continues. It's likely that the system efficiency is severely compromised due to carbonaceous deposits being deposited from the heavy ends of the fluid. The formation of heavy insoluble compounds can be found by looking in smaller lines, elbows, settling at the bottom of the tank and low flow areas. Deposits will also be noticeable in cool heat exchange surfaces. The correct way to improve system efficiency is to bring the system down to clean and flush the system and introduce new heat transfer fluid into the system. Petro-Canada has a vast array of heat transfer products that coupled with our heat transfer fluid analysis program will aid the facility in maintaining healthy and efficient system for years to come. Fluid shows no signs of wear metals. Fluid shows no signs of foreign contamination. All fluid contamination is from the heavy ends of the fluid being thermally oxidized. (GCD) 90% Distillation Point is severely high.