

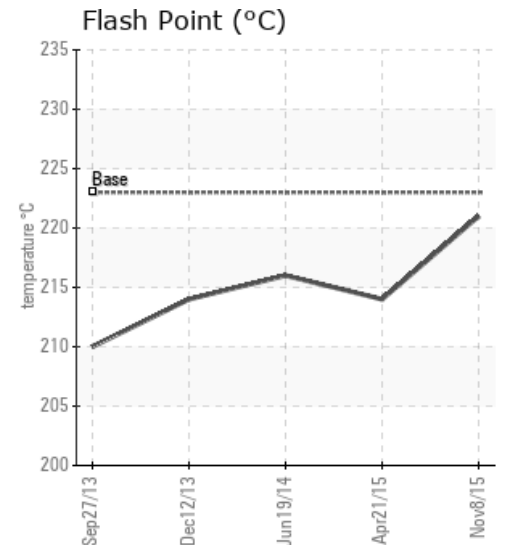
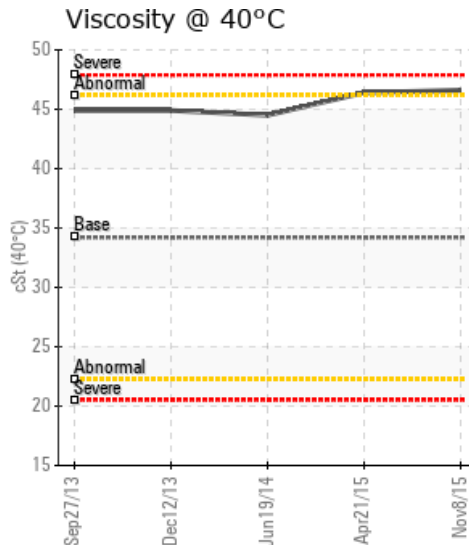
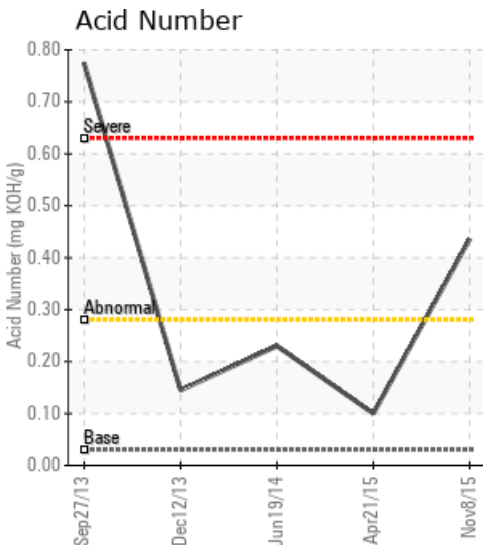
[North River Midstream / LSD 16-11-82-9W6] 4TH CREEK PLANT #1

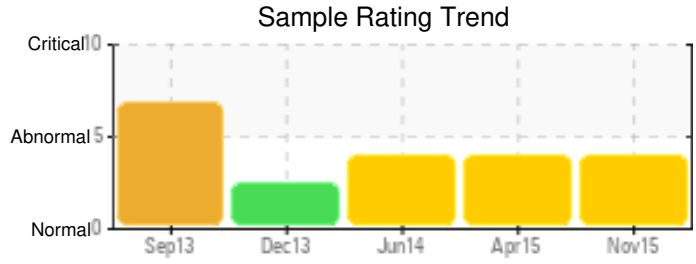
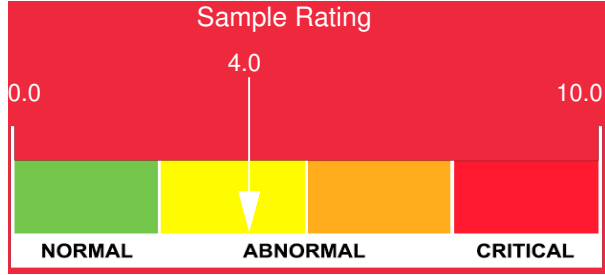
Customer: PTRHTF20127	System Information	Sample Information
SPECTRA ENERGY BAG 6180 FORT ST JOHN, BC V1J 4H7 Canada Attn: Dwayne Potratz Tel: (780)351-2131 E-Mail: dpotratz@spectraenergy.com	System Volume: 30000 ltr Bulk Operating Temp: 383F / 195C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: RUSHTON	Lab No: 02036039 Analyst: Terry Veenstra Sample Date: 11/08/15 Received Date: 11/19/15 Completed: 11/26/15 Terry Veenstra terry.veenstra@petrocanadalsp.com

Recommendation: TAN has greatly increased and pentane insolubles are higher than normal. Viscosity still looks good. Ensure Nitrogen Blanket is functioning and continue to operate. Resample in 6 months.

Comments: Pentane Insolubles levels are severely high. Acid Number (AN) is abnormally high. (GCD) 90% Distillation Point is abnormally high. Visc @ 40°C is abnormally 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	%
11/08/15	11/19/15	12y		430 / 221	125.2	46.6	0.436	1.36	696 / 369	804 / 429	929 / 498	2.89
04/21/15	05/01/15	14y	SHORT LOOP BYPASS	417 / 214	78.0	46.4	0.10	1.80	711 / 377	812 / 433	942 / 506	0.00
06/19/14	06/27/14	4500y	PIPING TO HEATER	421 / 216	17.5	44.5	0.23	1.22	706 / 374	817 / 436	944 / 507	2.26
12/12/13	12/23/13	15y	DRAIN ON Y STRAINER	417 / 214	45.5	44.9	0.145	1.55	704 / 373	813 / 434	935 / 502	2.38
09/27/13	10/04/13	10y		410 / 210	27.2	44.9	0.774	2.01	707 / 375	825 / 441	983 / 528	2.45
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00

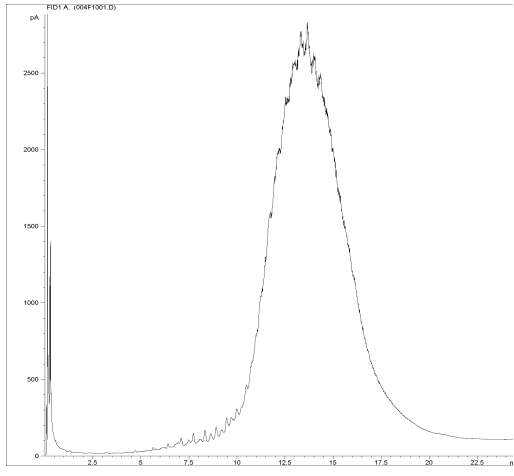




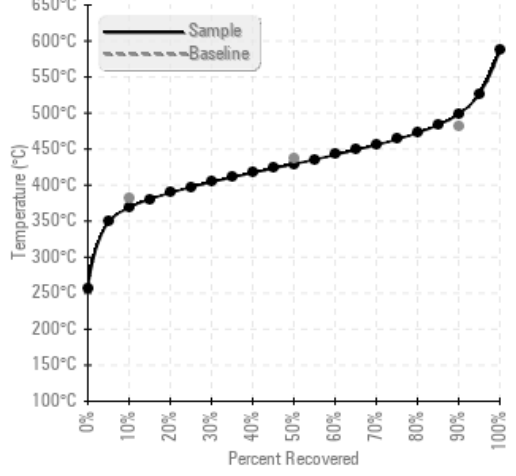
Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
11/08/15	16	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0
04/21/15	18	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0
06/19/14	12	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0
12/12/13	14	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0
09/27/13	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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%]

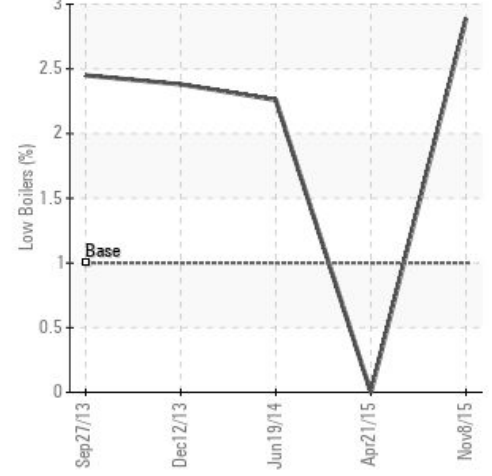
GCD Spectrum



Gas Chromatography Distillation



% Boiling < 335°C



Historical Comments

04/21/15	Pentane Insolubles and GCD 90% Distillation point are severely high. Continue to operate and resample in 6 months. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely high. Visc @ 40°C is abnormally high. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely high. Visc @ 40°C is abnormally high.
06/19/14	(GCD) 90% Distillation Point is severely high. Visc @ 40°C is abnormally high. Pentane Insolubles levels are high. TAN is elevated. Resample in 4-6 Months. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely high. Visc @ 40°C is abnormally high.
12/12/13	The 90% GCD temperature is high which indicates fluid oxidation is taking place. Please check blanket gas system. The Pentane Insoluble (solids) content is high. 1.55% is 3x higher than the warning limit of 0.5%. This can result in heat transfer efficiency problems, plugging of heat exchangers bundles and leakage of heat medium pump mechanical seals over time. Filtration of the fluid is recommended. For information about filtration please contact your Petro-Canada Tech Service Advisor. Re-sample after filtration has taken place. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is abnormally high.
09/27/13	This system is quite the contrast to Plant #2. The oil in this system has a very high Acid Number. If this was a bad sample from a sampling valve improperly flushed, the Acid Number as well as the water amount and iron would be high. In this case, only the Acid Number is high which leads us to think the sample is representative and the oil is severely oxidized. We suggest to send a confirmation sample from this system and if results match, a system cleaning and flushing will be suggested or else the oil may eventually reach an oxidation level where it starts to plug smaller lines and greatly affect productivity and force a shut down. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. (GCD) 90% Distillation Point is severely high.

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