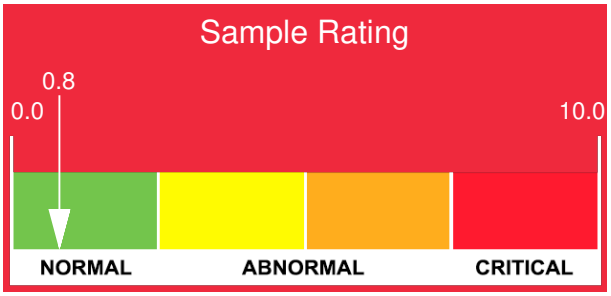
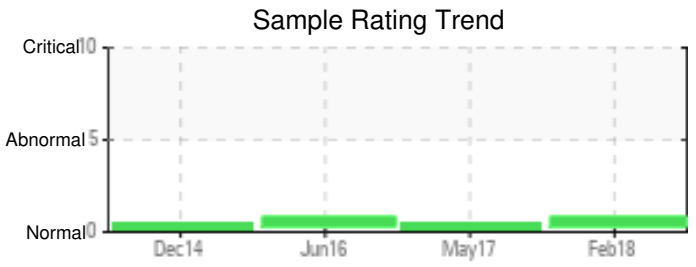




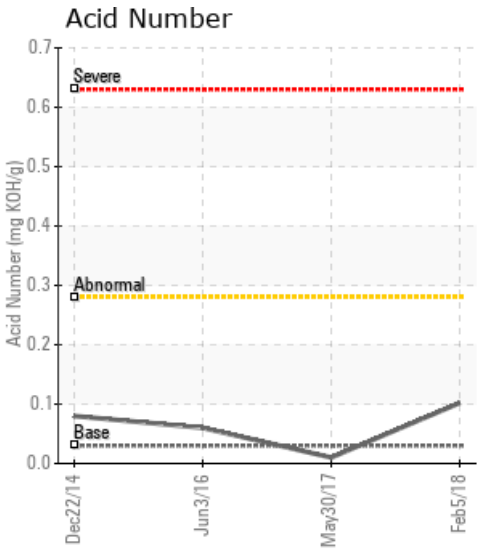
[TOLKO ATHABASCA] HOT OIL

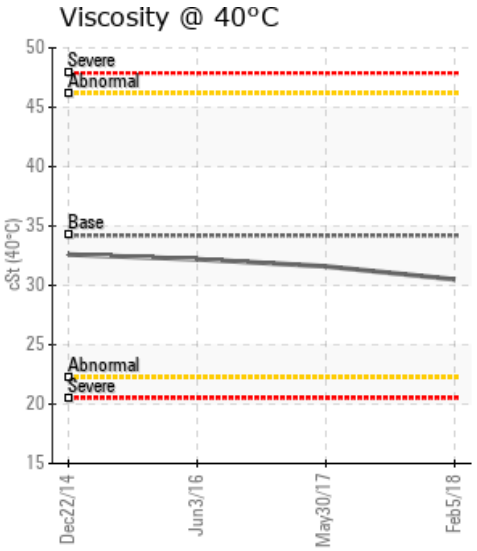
Customer:	System Information	Sample Information
TOM FRYTERS 2130 LAKESHORE RD MISSISSAUGA, ON L5J 1K2 Canada Attn: Tom Fryters Tel: E-Mail: thomas.fryters@petrocanadalsp.com	System Volume: 223000 ltr Bulk Operating Temp: 482F / 250C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: GTS	Lab No: 02199484 Analyst: Gordon Susinski Sample Date: 02/05/18 Received Date: 02/20/18 Completed: 02/26/18 To discuss this report contact Gordon Susinski at (587)582-4118

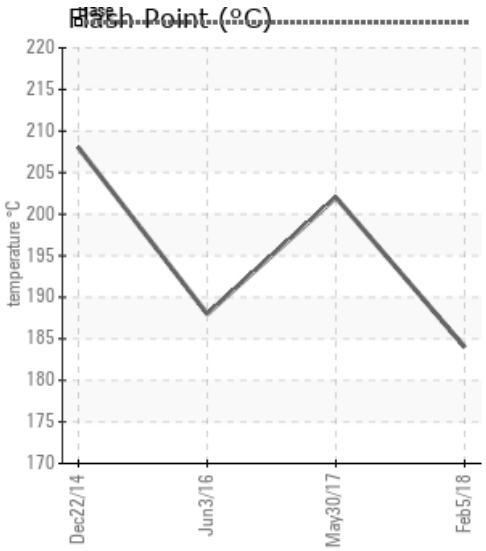
Recommendation: Service on the oil is greater than 10 years. Note the flash point is marginally low. The flash point is the lowest temperature at which the fluids vapor will momentarily ignite when contacted by an ignition source. Reduction is typically associated with thermal degradation of the heat transfer oil or possibly contamination. This test result should not be the single determinant in the oils suitability for continued use, but should be interpreted using other results as well. For example, although the viscosity is within acceptable limits, it is reduced from new oil values. A decrease in viscosity may be due to a lower viscosity oil being added, or can indicate that low boilers are present as a result of thermal degradation which can be supported by the marginally lower flash point. Thermal degradation is, in the presence of excess heat, where the hydrocarbon molecules reach the breaking point of normally stable C-C covalent bonds and crack into lighter hydrocarbons chains. These chains, when formed may have lower viscosities, lower flash points and start to boil before normal fresh oil would thus, affecting the overall fluid efficiency in a negative way by requiring greater amounts of energy to produce the same amount of heat. As the oil thermally degrades it may deposit heavy carbonaceous material by baking it on the tubes and then act as an insulation layer. These carbonaceous layers can flake away and produce hot spots on the tubes possibly resulting in a tube rupture. The carbon residues that get carried away can settle downstream and obstruct the flow in small lines. At this stage, at the levels present, this system can be treated by increasing the makeup oil rate. Conversely, note the reducing acid number indicating that the fluid is combating acids that normally form in an heat transfer system. Iron in the system is also reducing indicating that system components are not wearing. Pentane Insolubles are the analysis for the determination of contaminants in used heat transfer oils, and is to determine the amount of insoluble materials such as oxidation by products, dirt, carbonaceous material, and system wear components. These contaminants as a group are called pentane Insolubles and over time are reducing in the system.In fact if we wanted to compare the first sample in the sequence from 2014 we notice that the iron, silicon, water, acid number and pentane Insolubles are better today in 2018 than they were in 2014. We do see the noted reductions listed above however, we expect to see some degradation after 10 years of service.

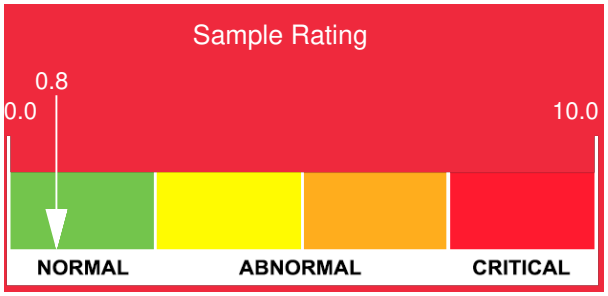
Comments: COC Flash Point is marginally low.

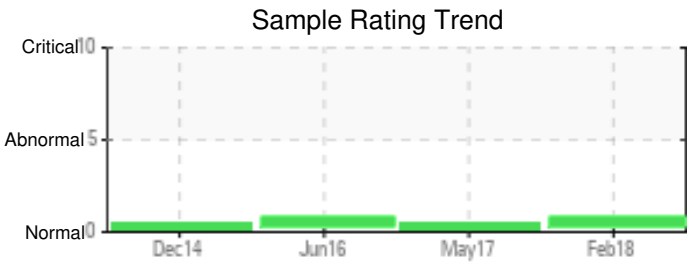
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
02/05/18	02/20/18	10y		363 / 184	0.00	30.5	0.102	0.020	704 / 373	798 / 425	892 / 478	2.44
05/30/17	06/02/17	10y	PRIMARY PUMPS	396 / 202	22.2	31.6	0.01	0.221	696 / 369	807 / 431	908 / 486	3.43
06/03/16	06/16/16	0y	HOT OIL PUMPS	370 / 188	15.4	32.2	0.06	0.059	704 / 374	809 / 432	900 / 482	2.06
12/22/14	12/24/14	2y	HOT OIL PUMPS	406 / 208	27.3	32.6	0.080	0.087	698 / 370	786 / 419	907 / 486	0.00
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00





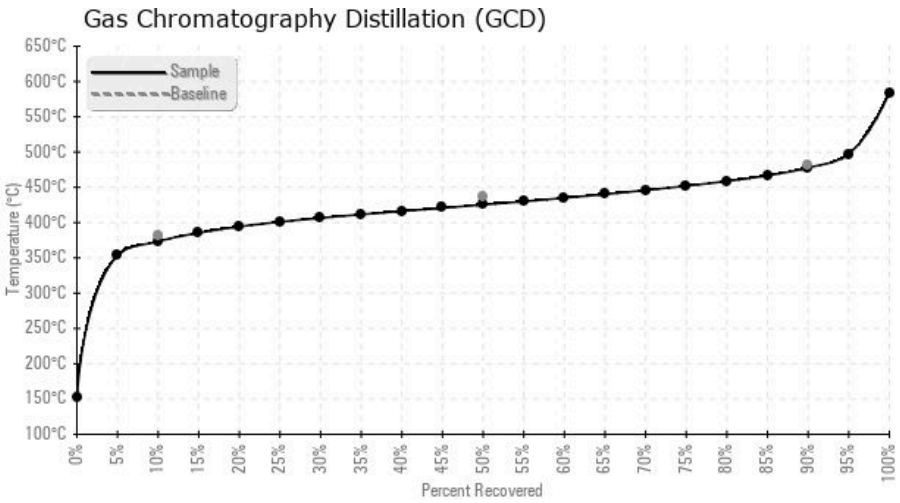


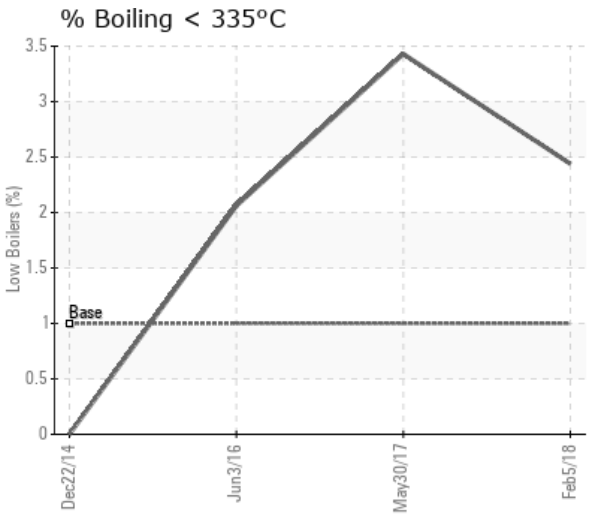




Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
02/05/18	12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
05/30/17	19	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
06/03/16	16	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
12/22/14	30	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1
Baseline Data			0	0						0			0	0					0				0	

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





Historical Comments

05/30/17	Although the sample results are within acceptable guidelines, subtle changes in the some of the results should be noted. There is a small reduction in the initial boiling point (IBP). A low initial boiling point indicates that low boilers may be present. This result can lead to pump cavitation. There is also a slight increase in the Final Boil Point (FBP). High boilers are normally associated with carbonaceous deposits in the system that can foul heat exchanger surfaces or plug small lines and are corroborated with an increase in pentane Insolubles. The pentane Insolubles are used to determine the amount of contaminants in used heat transfer oils. It measures the amount of insoluble materials such as oxidation by products, dirt, carbonaceous material, and system wear components. These contaminants as a group are called pentane Insolubles. Resample at mid interval and continue to monitor the system.
06/03/16	Flash Point reduction is typically associated with thermal degradation of the heat transfer oil. Based on the information supplied we are unable to determine the amount of service life on the fluid. As such, the comments below are independent of the oil service life. The flash point is reduced by approximately 20C. In an open system (where the fluid comes in contact directly with the atmosphere) the COC flash point should be approximately 25c above maximum operating temperature. Supporting the flash point result is the reduction in IBP (reduced from the previous sample by 77C). Both of these results reductions are indicative of thermal degradation of the oil. Thermal degradation starts at the heat source and is due to the oil receiving more energy (heat) that it can absorb and take away at that particular time. Thermal degradation is a function of: (1) Heat flux (BTU/time), (2) Residence time in the heat source (flow rate). In the presence of excess heat, the hydrocarbon molecules reach the breaking point of normally stable C-C covalent bonds. The lighter hydrocarbons formed have lower viscosity, flash point and start boiling before normal fresh oil, affecting the overall fluid. As the heavy carbonaceous deposits bake on they act as an insulation layer. The carbon residues that get carried away can settle downstream and obstruct the flow in small lines. Depending on the service life of the oil, this process may be the first step in indicating the oil may be in need of a change in the future.The Pentane Insolubles analysis is for the determination of contaminants in used heat transfer oils, is to determine the amount of insoluble materials such as oxidation by products, dirt, carbonaceous material, and system wear components. These contaminants as a group are called pentane insoluble and have reduced since the last sample. The particle count analysis results interpretation is subjective because we don't have a trend history to follow, nor do we have any expectations from the OEM or the filtration manufacturers on what to expect for a result. This result can also be altered by way of sample handing and practices and system sample points where contamination may settle. Until a trend history is established (over the next 3-5 samples) Pentane insoluble will be the more reliable method to determine system contamination. In addition, the iron level has been reduced by 50% indicating that wear is no longer occurring or the system has been subjected to additional filtration. COC Flash Point is marginally low.
12/22/14	Sample is is good condition, re-sample at next maitenance interval.