## APPENDIX G  JVOPS Test Oil Specifications and Rheology Analysis Report

### Crude Assay Test Summary

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Whole crude</th>
<th>Kerosene</th>
<th>Middle distillate</th>
<th>Gas oil</th>
<th>Resins</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP Range, °C</td>
<td>IBP-244</td>
<td>243-343</td>
<td>343-521</td>
<td>521</td>
<td></td>
</tr>
<tr>
<td>BP Range, °F</td>
<td>IBP-469</td>
<td>469-649</td>
<td>649-870</td>
<td>970</td>
<td></td>
</tr>
<tr>
<td>Yield, mass %</td>
<td>0.34</td>
<td>8.42</td>
<td>36.01</td>
<td>56.20</td>
<td></td>
</tr>
<tr>
<td>Yield, vol%</td>
<td>0.39</td>
<td>8.45</td>
<td>36.68</td>
<td>63.50</td>
<td></td>
</tr>
<tr>
<td>Position in crude, mass %</td>
<td>0.00-0.34</td>
<td>0.34-8.78</td>
<td>8.76-43.77</td>
<td>43.77-100.0</td>
<td></td>
</tr>
<tr>
<td>Position in crude, vol%</td>
<td>0.00-0.39</td>
<td>0.39-9.84</td>
<td>9.84-46.52</td>
<td>46.52-100.0</td>
<td></td>
</tr>
<tr>
<td>Mid mass %</td>
<td>0.15</td>
<td>4.55</td>
<td>26.30</td>
<td>71.90</td>
<td></td>
</tr>
<tr>
<td>Mid vol%</td>
<td>0.20</td>
<td>5.15</td>
<td>28.25</td>
<td>73.30</td>
<td></td>
</tr>
</tbody>
</table>

### Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>API Gravity</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Relative Density @ 15/15 °C</td>
<td>1.0128</td>
<td>g/cm³</td>
</tr>
<tr>
<td>Absolute Density @ 15°C, kg/m³</td>
<td>1011.7</td>
<td></td>
</tr>
<tr>
<td>Total Sulfur, mass %</td>
<td>5.4298</td>
<td>%</td>
</tr>
<tr>
<td>Mercaptans, mass %</td>
<td>0.016</td>
<td>ppm</td>
</tr>
<tr>
<td>Nitrogen-Total, mass ppm (%)</td>
<td>4493 (0.46)</td>
<td></td>
</tr>
<tr>
<td>Acid Number, mg KOH/g</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Aniline Point, °C/°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash Content, mass %</td>
<td>0.07</td>
<td>%</td>
</tr>
<tr>
<td>Asphaltenes (C₉-Ins), mass %</td>
<td>18.1</td>
<td>%</td>
</tr>
<tr>
<td>Asphaltene (C₉-Ins), mass %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Residue, mass %</td>
<td>14.11</td>
<td>%</td>
</tr>
<tr>
<td>Cetane Index - US</td>
<td>36.2</td>
<td></td>
</tr>
<tr>
<td>Flash Point (PMCC), °C/°F</td>
<td>126/259</td>
<td>°C/°F</td>
</tr>
<tr>
<td>Freeze Point, °C/°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulphide, mass %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K Factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration @ 0°C, tenths of mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration @ 25°C, tenths of mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pour Point, °C/°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sediment &amp; Water, vol fraction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoke Point, mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Content, KF, mass %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper, mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron, mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel, mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanadium, mg/kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. PRODUCT INFORMATION

NAME: BITUMEN

DESCRIPTION AND APPLICATION:
A complex combination of high molecular weight hydrocarbons with proportion having carbon numbers greater than C25 with high carbon to hydrogen ratios and may contain small amount of heavy metals such as Nickel or Vanadium.
CAS #: 8052 - 42 - 4

REGULATORY CLASSIFICATION:
WHMIS:
Class D, Division 2, Subdivision A: Very Toxic Material

Canadian Environmental Protection Act (CEPA):
All components of this material are either on the Domestic Substance List (DSL) or exempt.

TDG information: Non-Regulated, Transport by land only
TDG shipping name: Not required

Primary TDG: None
Secondary TDG: None
Tertiary TDG: None
P/N: Packing Group: III

EMERGENCY PHONE NUMBERS:
Name of Manufacturer / Supplier
Japan Canada Oil Sands Limited
P.O. Box 5120
Fort McMurray, AB
T9H 3G2

(780) 715 - 9472 Emergency (24hrs)
(780) 799 - 4019 Control Room (24hrs)
(780) 799 - 4000 Main switchboard

2. REGULATED COMPONENTS
The following component are define in accordance with subparagraph 13 (a) (1) to (IV) or paragraph 14(a) of the hazardous act.

COMPONENT: Bitumen

3. TYPICAL PHYSICAL AND CHEMICAL PROPERTIES
PHYSICAL STATUS: Liquid

SPECIFIC GRAVITY: 0.9 - 1.2
ODOR: Tarry odor and associated smell of rotten egg due to presence of hydrogen sulfide
APPEARANCE: Black Viscous Liquid
ODOR TRESHOLD: Not Available
VAPOR PRESSURE: Negligible
VAPOR DENSITY: Not Available
EVAPORATION RATE: Not Available
BOILING POINT: 215 °C
FREEZING / MELTING POINT: 7 to 12 °C
VISCOSITY (Kinematic): 72350 cSt @ 15 °C and 21370 cSt @ 40 °C
pH: Not Available
SOLUBILITY: Insoluble

CO-EFFICIENT OF WATER/OIL DISTRIBUTION:
Not Available

PERCENT VOLATILE: Approximated 73%
MOLECULAR FORMULA: Not Available
MOLECULAR WEIGHT: Not Available

4. HEALTH HAZARD INFORMATION

INHALATION:
High vapor concentrations are irritating to the eyes, nose throat, and lungs. May cause headaches and dizziness. May be anesthetic and may cause other central nervous system effects. Elevated temperature or mechanical action may form vapors, mists, or fumes which may be irritating to the eyes, nose, throat, and lungs. Hydrogen sulfide gas may be released. Hydrogen sulfide gas may cause irritation, breathing failure, coma, and death without necessarily and warming odor being sensed. Avoid breathing vapor or mists.

EYE CONTACT:
Hot splashes will cause burns and permanent eye damage. The gas or vapor form of this material is also irritating.

SKIN CONTACT:
Low toxicity. Exposure to hot material may cause thermal burns. Frequent or prolonged contact may irritate the skin and cause a skin rash. May cause skin sensitivity to ultraviolet light as indicated by repeated skin rashes.

INGESTION:
Low toxicity.

CHRONIC:
Contains polynuclear aromatic hydrocarbons (PNAs). Prolong and / or repeated skin contact with certain PNAs has been shown to cause skin cancer. Prolong and / or repeated exposure by inhalation of certain PNAs may also cause cancer of the lung and other parts of the body.

TOXICITY DATA:
Not available for product.
BITUMEN MATERIAL SAFETY DATA SHEET

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TDG information: Non-Regulated, Transport by land only.
TDG shipping name: Not required

Primary TDG: None
Secondary TDG: None
Tertiary TDG: None

PIN:
Packing Group: III

EMERGENCY PHONE NUMBERS:
Name of Manufacturer / Supplier
Japan Canada Oil Sands Limited
P.O. Box 5120
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EYE CONTACT:
Hot splashes will cause burns and permanent eye damage. The gas or vapor form of this material is also irritating.
BITUMEN MATERIAL SAFETY DATA SHEET

SKIN CONTACT:
Low toxicity. Exposure to hot material may cause thermal burns. Frequent or prolonged contact may irritate the skin and cause a skin rash. May cause skin sensitivity to ultraviolet light as indicated by repeated skin rushes.

INGESTION:
Low toxicity.

CHRONIC:
Contains polynuclear aromatic hydrocarbons (PNAs). Prolonged or repeated skin contact with certain PNAs has been shown to cause skin cancer. Prolonged and/or repeated exposure by inhalation of certain PNAs may also cause cancer of the lung and other parts of the body.

TOXICITY DATA:
Not available for product.

OCCUPATIONAL EXPOSURE LIMITS MANUFACTURER RECOMMENDS:
Although no specific hygiene standard exists, the workplace exposure to total particulate should be controlled well below TWA value of 0.2 mg/m3 polynuclear aromatic hydrocarbon particulate measured as benzene soluble.

ACGIH RECOMMENDS:
For Hydrogen Sulfide, 10 PPM (14 mg/m3). Local Regulated limits may vary.

5. FIRST AID MEASURES:

INHALATION:
In emergency situation use proper respiratory protection to immediately remove the affected victim from exposure. Administer artificial respiration if breathing has stopped. Keep at rest. Call for prompt medical attention.

EYE CONTACT:
Immediately flush eyes with large amounts of water for at Least 15 minutes. Get prompt medical attention.

SKIN CONTACT:
Flush eyes with large amounts of water. Remove severely contaminated clothing (including shoes) and launder before reuse.
If irritation persists seek medical attention. For hot materials immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention. For hot material, no attempt should be made to remove the material from skin or to remove contaminated clothing as the damaged flesh may easily be torn. Transport the individual to a medical facility for treatment.

INGESTION:
If swallowed, DO NOT INDUCE VOMITING. Keep at rest. Get prompt medical attention.

6. PREVENTIVE AND CORRECTIVE MEASURES
PERSONAL PROTECTION:
The selection of personal protective equipment varies, depending upon condition of use. Where skin and eye contact is unlikely, but may occur as a result of short and/or periodic exposures, wear long sleeves, chemical resistant gloves, chemical safety goggles, plus a face shield. Where prolonged and/or repeated skin and eye contact is likely to occur wear chemical resistant gloves, rubber boots, a chemical jacket, chemical safety goggles, and a face shield. Where skin and eye contact with hot material is unlikely, but may occur as a result of short and/or periodic exposures, wear thermal resistant gloves, arm protection and a face shield. Where concentration in air may exceed the occupational exposure limits given in Section 4 and where engineering work practices or other means of exposure reduction are not adequate approved respirators may be necessary to prevent overexposure by inhalation.

ENGINEERING CONTROL:
The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fume hood. Provide mechanical ventilation of confined spaces.

HANDLING, STORAGE AND SHIPPING:
Keep containers closed. Handle and open containers with care. Store in a cool, well ventilated place away from incompatible materials. Empty containers may contain products reside. Do not pressurize, cut, heat, or weld empty containers. Do not reuse empty containers without commercial cleaning or reconditioning. Do not handle or store near an open flame, sources of heat, or sources of ignition. Material will accumulate static charges which may cause spark. Static charge build-up could become an ignition source. Use proper grounding procedure.

SPILL CONTROL AND DISPOSAL:
Consult an expert on disposal of recovered material. Ensure disposal is in compliance with government requirements and ensure conformity to local disposal
BITUMEN MATERIAL SAFETY DATA SHEET

regulations. Notify the appropriate authorities immediately. Take all additional action necessary to prevent and remedy the adverse effects of spill.

LAND SPILLS:
Eliminate sources of ignition. Keep public away. Prevent additional discharge of material. If possible to do so without hazard. Prevent spills from entering sewers, watercourses or low areas. Contain spilled liquid with sand or earth. Recover by pumping or using a suitable absorbent. If liquid is too viscous for pumping, scrape up.

WATER SPILLS:
Keep public and other shipping traffic away. Prevent additional discharge of material, if possible to do without hazard. Material will sink. Remove from surface by skimming or with suitable absorbents. If allowed by local authorities and environmental agencies, sinking and / or suitable dispersants may be use in unconfined waters.

7. FIRE & EXPLOSION HAZARD
Flash point: 126 °C
Auto-ignition: Not Available
Flammable Units (% by Volume):
LEL: na UEL: na

GENERAL HAZARDS:
Low Hazard: liquids may burn upon heating to temperatures at or above the flash points. Decomposes: flammable/toxic gases will form at elevated temperatures (thermal decomposition). Toxic gases will form upon combustion.

FIRE FIGHTING:
Use water spray to cool fire exposed surfaces and to protect personnel. Shut off fuel to fire. Use foam, dry chemical or water spray to extinguish fire. Avoid spraying water directly into storage containers due to danger of boil over. Respiratory and eye protection required for fire fighting personnel. A self-contained breathing apparatus (SCBA) should be used for all indoor fires, which may easily be extinguished with a portable fire extinguisher, use of SCBA may not be required.

HAZARDOUS COMBUSTION PRODUCTS:
Oxides of carbon; Hydrogen Sulfide; Oxides of sulfur

8. REACTIVITY DATA:
This material is stable. Hazardous Polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID:
Heat; ignition sources; oxidizing agents, oxides of carbon; hydrogen sulfide

9. NOTES:
Equipment handling hydrogen sulfide rich materials can accumulate black deposits of iron sulfide which, if dry, burn on exposure to air. Hazardous concentrations of hydrogen sulfide gas may build-up in the vapor space in hot bitumen storage tanks or vessels. Appropriate precautions must be taken when opening or entering tanks, vessels or other containers to avoid inhalation of hydrogen sulfide.

LAST UPDATE: August 27, 2002
Test Product Supply Contractor

Breco Innovation, Inc. 350 Boul, Ford, Suite 130 Chateauguay, Quebec J6J4Z2
(450) 698 2810
navenko@sympatico.ca
POC: Todd Mitchell

Marketer for Test Product

Foundation Energy, Inc.
1000 520 5th Ave. S.W.
Calgary, Alberta
T2P 3R7
POC: Terry Kemp

Source of Test Product

Japan Canada Oil Sands Ltd.
Suite 2400, Standard Life Building
639-5th Avenue S.W.
Calgary, Alberta
T2P 0M9

Plant Address:

JCOS Field Office Hangingstone
P.O. Box 5120
Fort MacMurray, Alberta
T9H 3G2
APPENDIX G SECTION 2

RHEOLOGICAL PROPERTIES OF THE JAPAN CANADA OIL SANDS BITUMEN CRUDE OIL USED DURING THE JVOPS OIL PUMPING TESTS IN HOUMA LA 2003
By Craig Moffat, GPC

The following graphs and charts completely summarize the test results performed on the Canadian Tar Sands Bitumen that was used in the testing of the JVOPS viscous oil pumping exercise in Houma LA 2003. The oil arrived on the test site in October 2003 with an average temperature of between 100 F and 190 F. The oil had been shipped from Canada via rail, and reheated and transported to trucks for delivery at the site. Once on site, the oil was placed in three separate tanks and with cooling aids applied it was cooled until late November when the testing began. The samples used in the rheological analysis enclosed in this report were taken as follows:

Sample labeled October ‘03 was taken from the bulk oil (Baker Tank) and represents the condition of oil used during the testing before introducing any outside water or heat sources.
Sample labeled CCG Tank 12-10-03 was taken from the CCG tank before testing started.
Test 0 & 00 sample was taken on 12-10-03 from the USCG tank before testing started.
Test #1 sample was taken on 12-11-03 from the USCG tank before testing started.
Test #2 & 3 sample was taken on 12-12-03 from the USCG tank before testing started.
Test #6 & 7 sample was taken on 12-12-03 from the CCG tank before testing started.
Test #4-3 & 4-4 sample was taken on 12-14-03 from the USCG tank before testing started.

All samples were taken using a dipping ladle that was plunged into the on-site oil tanks to a depth of approximately 2 feet. Any water found in the sample ladle was poured out prior to pouring (or scraping) oil into a sample jar. Samples were shipped to ESSM Base Cheatham Annex in Virginia where they were analyzed using a Brookfield RV-DVII+ Rotary Viscometer to develop viscosity temperature curves. In June 2004, the samples were sent to Intertek Caleb Brett to have water content by distillation (ASTM D95) and single point viscosity (ASTM D445) tests conducted on each available sample. These methods are common practice for measuring water and viscosity in commercial residual oils. The results of these tests are shown in Figures 1 & 2.

Also in June, two new sets of viscosity tests using the Brookfield Viscometer at Cheatham Annex were conducted to test for the following:

1. Constant rpm/constant temperature over time to test for oil thinning or thickening (Thixotropy, Rheopecticity).
2. Viscosity verification at 122 F using the Rotary Viscometer to compare to viscosity derived using outside laboratory ASTM methods.

3. Viscosity check at constant temperature and varying shear rate (varying spindle speed) to check for plasticity or dilatancy of product and to compare the viscosity of the sample that has had all free water removed to pre-water removal viscosity.

OBSERVATIONS AND RESULTS

The graphs in Figures 1 and 2 show the standard viscosity vs. temperature chart with both the actual data points and trend line plotting the viscosity. The trend lines that were applied to these graphs (blue line connecting the data points) were added using ‘curve fit’ software within Excel© and are a power type curve. The curves vary slightly between the high temperature end and the lower temperature end. The latest high temperature points are added to the upper range curve, which did not change it from curves produced prior to June.

The graph shown in Figure 3 is a bar graph showing results of the high temperature, single point viscosity conducted by Intertek Labs. If one ignores the CCG 12-10-03 sample, it is obvious that the viscosities of the samples taken in the later tests were slightly higher than the viscosities of the earlier samples. In Figure 4, it can be seen that these later samples also have the higher water content. The average viscosity of the higher water content samples was greater than that of the lower water content samples. It must be noted that the CCG sample has a higher viscosity than the others but that with respect to overall viscosity range, it is a fairly small difference. The difference between the highest and the lowest viscosity was only 938 centistokes, which is about 14%. The difference between the highest viscosity and the average viscosity was only 2.6%. The rotary viscometer testing at CAX, done in comparison with the ASTM method resulted in viscosities of 8000 cSt (low shear/low rpm) and 7275 cSt at higher shear (higher rpm). If had continued to step up the spindle speed, the viscosity may have come down into the 6500 cSt range. This is important in that it confirms that the tests close to being on par with each other, albeit the ASTM test results result in a higher shear rate than the .07 sec⁻¹ rate at which we have done for all previous JVOPS test samples.

The water content results shown in Figure 4 clearly show the chronologic increase in water uptake from test to test. The highest figures are the last test sample (12-14-03) that was 9.5% water before free water removal and 8% after removal. Based on the viscosity testing, however, the viscosities slightly increased as the water content increased, indicating that the non-free water level found in the oil was in the form of an emulsion and resulted in a slightly higher viscosity. That is based on the results from the rotary viscometer. The effect that this had on a higher rpm rotating pump screw may not be the same but intuitively it would be the same. The difference in viscosity between samples with higher water content and those without water was only on the order of +2% for the ASTM tests and about +3.5% for the rotary viscometer tests. Thus, the most important result of this information is the fact that there was not a decrease in measured viscosity as a result of the water uptake from AWI.
Figure 5 shows the results of the constant shear rate-constant temperature testing. The purpose of these tests was to determine if the bitumen test product would thin out over time or thicken over time while undergoing a constant shear rate (rpm). Many oils will show a gradual decrease in viscosity over time in these conditions, which makes them thixotropic. The bitumen, however, not only did not lower in viscosity but slightly increased in viscosity over time. This increase would be a called Rheopectic tendency, but the increase was so small that we will consider this a “no change” in viscosity result.

The shear rate increase tests (Figures 7 and 8) were done to determine if the oil exhibited shear thinning or thickening. As would be expected, the oil thinned as shear rate increased similar to the behavior of common residual oils. Following these charts as the spindle speed increased, the oil viscosity decreased and then stabilized at the new shear rate. Thus, as one increases the speed of the pump, the oil will reduce in viscosity to a slightly lower level, but will then maintain that relative viscosity so long as the rpm is constant.

SUMMARY OF RESULTS
The Japan Canada Oil Sands (JCOS) Bitumen Crude Oil properties as tested are as follows:

1. The Bitumen has normal (as in residual oil normal) pseudo-plastic characteristics (its viscosity decreases proportionally to an increase in shear rate).
2. The Bitumen tested at JVOPS took on water and bound it in emulsion within the oil in linear proportion to the quantity of water injected in the form of AWI over time. Water content began at (0.1%) for base oil and increased over testing time to 8.20% for the last test series sampled.
3. The increase in bound water content from the base sample to the final average of Bitumen samples resulted in a 1% average viscosity increase in the measured oil samples.
4. The Bitumen does not display any thixotropic characteristics (it does not decrease viscosity at constant shear rate and temperature).
5. The Bitumen shows only marginal rheopectic characteristics (it increases viscosity over time when subjected to constant shear rate).
Bitumen Viscosity vs. Temperature

Analysis performed on Brookfield DVII+ Rotary Viscometer with Small Sample Adaptor spindle #27 @ shear rate of .07 sec^(-1).

Figure 1. Viscosity vs. temperature graph, low to mid range temperature in °F.
Analysis performed on Brookfield DV II+ Rotary Viscometer w/ Small Sample Adaptor spindle #27 @ Shear Rate of .07 sec\(^{-1}\)

\[ y = 4 \times 10^{16}x^{-0.09} \]

\[ R^2 = 0.9982 \]

Figure 2. Viscosity vs. temperature graph, high range in F.
Figure 3. Results of the viscosity tests conducted by Intertek Test Services using ASTM D445 @ 122 F.
Figure 4. Results of water content analysis showing content both before and after removal of all free water.
All available oil samples from the JVOPS 2003 tests in Houma were sent out to an outside laboratory to be tested for water content and viscosity in June 2004. The lab could only test for viscosity at one temperature and due to the high viscosity of the product they had to use the highest standard temperature listed in the test procedure, which was 50 °C (122 °F). The lab report information was transcribed onto the table shown below for comparison.

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Water Content % Before Draining Free Water</th>
<th>Water Content % After Draining Free Water</th>
<th>Viscosity cSt @ 122 degrees F Before Draining Free Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample From Oil Delivered in October 2003</td>
<td>(0.10) No Free Water</td>
<td></td>
<td>6089</td>
</tr>
<tr>
<td>Canadian Coast Guard Tank 12-10-03</td>
<td>(1.60) (0.90)</td>
<td></td>
<td>6865</td>
</tr>
<tr>
<td>Test 0 &amp; 00 USCG 12-10-03</td>
<td>(0.80) (0.50)</td>
<td></td>
<td>6299</td>
</tr>
<tr>
<td>Test #1 USCG 12-11-03</td>
<td>(2.40) (1.20)</td>
<td></td>
<td>5927</td>
</tr>
<tr>
<td>Test 2 &amp; 3 USCG 12-12-03</td>
<td>(5.8) (5.9)</td>
<td></td>
<td>6551</td>
</tr>
<tr>
<td>Test 6 &amp; 7 CCG Tank 12-12-03</td>
<td>(3.80) (3.10)</td>
<td></td>
<td>6456</td>
</tr>
<tr>
<td>Test 4-3 &amp; 4-4 USCG 12-14-03</td>
<td>(9.50) (8.20)</td>
<td></td>
<td>6535</td>
</tr>
</tbody>
</table>

Intertek Testing Services, Caleb Brett, 11872 Canon Blvd., Suite E, Newport News, VA, 23606 performed lab analysis. Their phone number is 757-873-0133. Contact Aziz Khawaja at PO number 52021/v 6/17/04.
Bitumen Sample of Oil from delivery in October 03'
Test Conducted @ Constant Shear Rate & Temperature of .07 sec^(-1) and 68 deg F

Graph Summary:
Viscosity Testing shows that oil is not Thixotropic and only very slightly Rheopectic (oil does not thin over time but remains relatively constant with a very slight thickening). Oil maintains @ almost constant viscosity at constant shear rate (constant rpm) with only slight increase in viscosity over time.

Figure 5. Result of Constant Shear/Constant Temperature Test.
Figure 6. Viscosity Scatter Plot Comparison.
Figure 7. Varying Shear Rate at Constant Temperature Test to Check for Shear Thinning and Shear Thickening.
Figure 8. Varying Shear Rate Test Presented in Line and Bar Graph Format (Test Conducted at 122 F).
Figure 9. Viscosity vs. Water Content Comparison, Where Viscosity Points Are Shown on the Line and Water Content on the Bars; Viscosity Was Measured for the Red Bars (with Free Water for This Test).