

# **Enbridge Condensate Pool (CRW) Specifications**

**Feb 11, 2010**

**COQA meeting, New Orleans**

**Randy Segato (Suncor)**

**....on behalf of Enbridge CRW Committee and CAPP**

- **Background**
- **Processes**
  - Approval Process for New Condensates
  - Monitoring, Enforcement and Consequences
  - Cost recovery
  - Development of Specifications
- **Implementation Timelines**
- **The Specifications**
  - Detail reference for specifications

- **Q1Q2 2008 : CAPP worked on developing proposed Enbridge CRW specifications**
  - To maintain quality of historical (local production) of CRW pool
  - Expedite approval of new condensate streams including imported diluents driven by expanding Heavy production
- **Q4 2008 : based on CAPP recommendation, Enbridge formed an Enbridge led committee to review CRW specifications**
  - Volunteer industry members\*
  - Diverse group representing producers, refiners, Enbridge and CAPP staff
- **Q1 2009 to present: Enbridge CRW Committee met regularly to establish:**
  - Approval process for new condensate stream applications
  - Appropriate CRW quality specifications and their limits
  - Monitoring, enforcement and consequences for specs
  - Appropriate solicitation of feedback from stakeholders
  - Appropriate communication of new specifications

\* *BP, CAPP, CQI, CNRL, Devon, Enbridge, Encana/Cenovus, FHR, IOL, JACOS, MEG, StatOilHydro, Shell, Suncor*

# Approval Process for New Condensate Feeder Streams



- **New components to CRW recommended to follow the same New Commodity Approval Process that is used for new crude stream**
  - Assay/bulk property form to be modified to allow for collection of relevant quality parameters
- **Southern Lights application to CRW pool approved by Enbridge after Industry consultation in September 2009**

- **Specifications apply to all condensate feeders “at the gate” to the blended CRW pool**
- **Rational for choosing which quality parameters become specifications**
  - (see following slides from CRW CAPP update Nov 24 2009)
- **Specifications limits chosen based on:**
  - Extensive committee discussions
  - Production facility considerations
  - Refinery considerations
  - Historical and current measured values
    - Feeder testing program performed
  - Enbridge Tariff, Rules and Regulations, and design requirements

- **Referee Test Method**

- Separate technical team met to choose appropriate test method for each spec to be used for enforcement of specs

- **Testing**

- Frequency chosen based on:
  - Frequency of historical spec testing
  - Economically and logsitically reasonable testing program
  - Probability and impact if violations
- Randomness to ensure accurate results

- **Consequences**

- Similar to existing specifications wanted to give feeder opportunity to correct problem rather than immediate action

- **Proposed NRA (non routine adjustment) as cost recovery mechanism to cover cost of proposed additional testing program**
- **Forecasting testing program costs**

# CRW Spec Implementation Timeline



- 1. COQA update Feb 11, 2010**
- 2. CAPP Enbridge Committee recommendations and confirmation of support - Feb 22, 2010**
- 3. CAPP COC (Crude Oil Committee) presentation and approval - Feb 23, 2010**
- 4. Communicate CRW specifications implementation to Enbridge Shippers at Enbridge Shipper Meeting March 8**
- 5. New CRW Specifications take effect - July 1, 2010**
  - Mercaptan is only exception. RSH spec to be monitored, but not enforced
- 6. Mercaptan specification takes effect – Jan 1, 2011**



# Quality Specifications for CRW Component Streams (page 1/3)



| Quality                        | Units             | Min | Max | Referee Test Method and Test Frequency                       | Comments   |
|--------------------------------|-------------------|-----|-----|--|--|
| Density (15 C)                 | kg/m <sup>3</sup> | 600 | 799 | ASTM 4052<br>Frequency: AR <sup>2</sup>                      | <p>Industry Equalization and Enbridge Tariff specification.</p> <p>For test results greater than or equal to 600 kg/ m<sup>3</sup>, but less than 650 kg/ m<sup>3</sup> perform RVP and Aromatics test to confirm it meets those specifications. If exceed max charge appropriate toll (i.e. Light Petroleum, etc.).</p> <p>Industry Equalization max has been reduced to 799 kg/m<sup>3</sup> from 815 kg/m<sup>3</sup>.</p> <p>Upon violation warning sent to violating shipper. If violation continues in 2<sup>nd</sup> month stream reclassified and shipper requested to nominate to appropriate stream (i.e. MSW, etc.). Once shipper demonstrates that they are back in spec range they are allowed to nominate to the CRW pool the following month.</p> |
| Viscosity (7.5 C)              | cSt               |     | 2.0 | ASTM D445<br>Frequency: QR+ <sup>4</sup>                     | <p>Enbridge Tariff specification.</p> <p>If exceed max charge appropriate toll (i.e. Light Petroleum, etc.).</p> <p>Upon violation increase monitoring for 1 month. If it continues off spec for that month then notify. If continue off spec in the 2<sup>nd</sup> month you will be reclassified to the appropriate stream (i.e. MSW, etc) for the 3<sup>rd</sup> month. In the case of a violation that is corrected in month 2, more frequent monitoring would continue to confirm compliance.</p>   |
| Sulfur, total                  | wt%               |     | 0.5 | ASTM D5453<br>Frequency: AR <sup>2</sup>                     | <p>Industry Equalization specification.</p> <p>Follow similar procedure to Enbridge Book 5 03-03-21: Maintaining 0.5% Weight Sulphur Standard but modified for CRW. CRW Procedure to be developed.</p>   |
| Olefins, total <sup>1</sup>    | wt%               |     | <1  | PONAOX(U) ASTM 6729 (240 cut)<br>Frequency: QR+ <sup>4</sup> | <p>CAPP Directive specification.</p> <p>Enforcement and Consequence: Apply Olefin Decision Tree (all shippers to be advised of location of document once posted)</p>   |
| Reid Vapour Pressure           | kPa               |     | 103 | ASTM D323M<br>Frequency: MR <sup>3</sup>                     | <p>Rules and Regs. filed with NEB/FERC specification.</p> <p>Enforcement and Consequence: Immediate shut-in<sup>5</sup></p>  |
| BS&W                           | vol%              |     | 0.5 | ASTM D95<br>Frequency: AR <sup>2</sup>                       | <p>Rules and Regs. filed with NEB/FERC specification.</p> <p>Enforcement and Consequence: Immediate shut-in<sup>5</sup></p>  |
| Organic Chlorides <sup>1</sup> | wppm              |     | <1  | ASTM D4929<br>Frequency: QR+ <sup>4</sup>                    | <p>Rules and Regs. filed with NEB/FERC specification.</p> <p>Enforcement and Consequence: Immediate shut-in upon identifying violation.</p> <p>Request 3<sup>rd</sup> party Certificate of Analysis prior to subsequent receipt for period of 1 month.</p>   |

# Quality Specifications for CRW Component Streams (page 2/3)



|   |      |                     |     |  |   |
|---|------|---------------------|-----|--|---|
| Aromatics, total (BTEX)                     | vol% | 2.0                 |     | PONAOX(U) ASTM 6729<br>Frequency: QR+ <sup>4</sup>   | Below min possible with passing Wiehe crude compatibility test.<br>Enforcement and Consequence: Reclassify <sup>6</sup> |
| Mercaptans, volatile (cumulative C1, C2,C3) | wppm |                     | 175 | ASTM D5623<br>Frequency: QR+ <sup>4</sup>            | Enforcement and Consequence: Reclassify <sup>6</sup>  |
| H <sub>2</sub> S (in liquid phase)          | wppm |                     | 20  | ASTM D5623<br>Frequency: QR+ <sup>4</sup>            | Enforcement and Consequence: Reclassify <sup>6</sup>  |
| Benzene <sup>8</sup>                        | vol% |                     | 1.6 | PONAOX(U) ASTM 6729<br>Frequency: QR+ <sup>4</sup>   | Enforcement and Consequence: Delayed shut-in <sup>7</sup>   |
| Mercury <sup>1</sup>                        | wppb |                     | 10  | UOP 938 (CVAA)<br>Frequency: QR+ <sup>4</sup>        | Enforcement and Consequence: Delayed shut-in <sup>7</sup>   |
| Oxygenates                                  | wppm |                     | 100 | PONAOX(U) ASTM 6729<br>Frequency: QR+ <sup>4</sup>   | Enforcement and Consequence: Delayed shut-in <sup>7</sup>   |
| Total Suspended Solids                      | mg/l |                     | 200 | ASTM D4807<br>Frequency: QR+ <sup>4</sup>            | Enforcement and Consequence: Reclassify <sup>6</sup>  |
| Phosphorous, volatile                       | ppm  | Per CAPP guidelines |     | ICP AES D86 (250 cut)<br>Frequency: QR+ <sup>4</sup> | CAPP Guidance. Refer to ERCB Directive 058.<br>Violating test results communicated to the ERCB.                         |
| Selenium                                    | wppb | Application Only    |     | ICP MS   | For new stream applications this information to be provided to Enbridge   |
| Pour Point                                  | C    | Application Only    |     | ASTM D97   | For new stream applications this information to be provided to Enbridge   |
| Salt Content                                | ptb  | Application Only    |     | ASTM 3230  | For new stream applications this information to be provided to Enbridge   |
| Simdist                                     |      | Application Only    |     | ASTM D2887   | For new stream applications this information to be provided to Enbridge   |

- Existing Specification
- New Specification
- New – Application Only
- Existing – Application Only

# Quality Specifications for CRW Component Streams (page 3/3)



## Notes for last 2 specification slides

1. For these properties intent is that blending not occur up to specification limit
2. AR: All Receipts of CRW component streams tested using a weekly composite
3. MR: Monthly Random testing of CRW component streams
4. QR+: Quarterly Random testing plus up to 4 additional tests per CRW component stream. Upon violation perform probational testing at Enbridge discretion
5. Immediate shut-in upon identifying violation. Request 3<sup>rd</sup> party Certificate of Analysis prior to subsequent receipt for period of 1 month.
6. Upon violation increase monitoring for 1 month. If continues off spec for that month then notify. If continue off spec in the 2<sup>nd</sup> month reclassified to the appropriate stream (ie. MSW, etc) for the 3<sup>rd</sup> month. In the case of a violation that is corrected in month 2, more frequent monitoring would continue to confirm compliance.
7. Upon violation increase monitoring for 1 month. If violation continues for 2 consecutive months shut-in stream at end of 2<sup>nd</sup> month. Certificate of Analysis required to get back into pool.
8. Benzene level of the CRW pool to be monitored and if a test result of 1.25 vol % is received the Enbridge CRW Committee will reconvene to discuss appropriateness of benzene spec on CRW component streams.

• Existing Specification

• New Specification

• New – Application Only

• Existing – Application Only

# CRW Update

.....from Nov 24, 2009



## Recall...

- ❑ CAPP developed the initial CRW specifications with the view of establishing a practical premise for new diluent applications required for growing heavy production
- ❑ This process was cascaded to Enbridge to finalize and allow all shippers (producers and refiners) to assist in this specification development

***The specifications for CRW are nearing completion and wider industry communication is now beginning***

## Consider two principal quality groupings in the selection of condensate

1. Characteristics required for the **FUNCTIONAL PERFORMANCE** of condensate as a diluent for heavy crude
2. Characteristics that present **BENEFITS** or **RISKS** in the resulting blended DilBit

## **1. Characteristics required for the FUNCTIONAL PERFORMANCE of condensate as a diluent for heavy crude**

***These are the key factors (existing) that establish overall industry standards for performance as heavy diluent with bitumen***

- 1. Density (API gravity)**
- 2. Viscosity**

## 2. Characteristics that present **BENEFITS** or **RISKS** in the resulting blended DilBit

**Much longer list of characteristics, including:**

- **Physical properties**  
RVP, sediment, BS&W..
- **Chemical properties**  
aromatics (BTEX), olefins, benzene, sulphur compounds, additives/contaminants, compatibility/stability, organic chlorides, mercury, oxygenates...

## *Looking Forward*

**Industry, in co-operation with regulated pipeline, is establishing specifications (and mitigation procedures) for *ALL* condensate feeders “at the gate” to the blended Enbridge CRW pool**

- Will require ongoing feeder quality testing program and mitigation procedures
- Will require routine (Enbridge supported) panel review of parameters & limits

**Industry has wide consensus that CRW specifications should cascade to other sources of diluent supply destined for Western Canadian diluent use (CAPLINE, Southern Lights) due to the interdependence of this commodity**

**CAPP, through Crudemonitor, is operating an expanded section for CRW condensate to support existing baseline data used to establish this ongoing specification**



# Quality Specifications for Component Streams to the CRW Pool

The above results are the average values based on the analyses of multiple samples over the period between 1Q2008 and 2Q2009. The results include both analyses performed specifically for the Enbridge CRW Committee as well as additional testing performed for various projects undertaken by CAPP and other industry partners.



| Quality                                      | Units             | Min | Max                 | CRW typical | Test Method                       | Referee Test Method           | Comments  |
|--|-------------------|-----|---------------------|-------------|-----------------------------------|-------------------------------|---|
| Density (15C)                                | kg/m <sup>3</sup> | 650 | 799                 | 709.7       | ASTM D4052                        | ASTM D4052                    | Pipeline Rules and Regs - <b>no change</b>  |
| Viscosity                                    | cSt               |     | 2.0                 | 0.8         | ASTM D445                         | ASTM D445                     | Pipeline Rules and Regs - <b>no change</b>  |
| Sulphur, total                               | wt%               |     | 0.5                 | 0.19        | ASTM D4294                        | ASTM D5453                    | Pipeline Rules and Regs - <b>no change</b>  |
| Reid Vapour Pressure                         | kPa               |     | 103                 | 76          | ASTM D323                         | ASTM D323M                    | Pipeline Rules and Regs - <b>no change</b>  |
| BS&W   | vol%              |     | 0.5                 | 0.003       | ASTM D2709                        | ASTM D95                      | Pipeline Rules and Regs - <b>no change</b>  |
| Organic Chlorides                            | wppm              |     | < 1.0               | <2          | ASTM D4929<br>(detection limit=2) | ASTM D4929                    | Pipeline Rules and Regs - <b>no change</b>  |
| Olefins, total                               | wt%               |     | < 1.0               | <0.03       | H NMR                             | PONAOX(U) ASTM 6729 (240 cut) | per CAPP - <b>no change</b>   |
| Phosphorus, volatile                         | ppm               |     | Per CAPP guidelines | -           | -                                 | ICP AES on D86 250 cut        | per CAPP - <b>no change</b>   |
| Total Suspended Solids                       | mg/L              |     | 200                 | 110         | ASTM D4807                        | ASTM D5452 with 0.45 micron   | SAGD water separation performance (emulsion concern)                              |
| Aromatics, total BTEX                        | vol%              | 2.0 |                     | 4.01        | GC/ FID, PONAOX(U)                | PONAOX(U) ASTM 6729           | Bitumen Blending Stability Requirement (a proxy derived from accurate Wiehe test) |
| Benzene                                      | vol%              |     | 1.6                 | 0.89        | GC/ FID, PONAOX(U)                | PONAOX(U) ASTM 6729           | Refining Valuation - prevention of dumping (BENSAT2 legislation issue)            |
| Oxygenates                                   | wppm              |     | 100                 | <100        | GC/ FID, PONAOX(U)                | PONAOX(U) ASTM 6729           | Refining Valuation - prevention of dumping (Refining and Marketing stop)          |
| Mercaptans, volatile (cumulative C1, C2, C3) | wppm              |     | 175                 | 125         | ASTM D5623                        | ASTM D5623                    | Environmental odour governance and Safety   |
| H2S (in liquid phase)                        | wppm              |     | 20                  | 2.9         | ASTM D5623                        | ASTM D5623                    | Environmental odour governance and Safety   |
| Mercury                                      | wppb              |     | 10                  | <10         | Cold Vapor A.A.                   | UOP 938 (CVAA)                | Water environmental concern   |
| Selenium                                     | wppm              |     | Application Only    | 1.0         | ICP/ ASTM D5807A                  | ICP MS                        | Water environmental concern (primarily in U.S.A.)                                 |
| Pour Point                                   | C                 |     | Application Only    | -           | -                                 | ASTM D97                      | standard industry parameter - info only - <b>no change</b>                        |
| Salt Content                                 | ptb               |     | Application Only    | -           | -                                 | ASTM D3230                    | standard industry parameter - info only - <b>no change</b>                        |
| SIMDIS                                       | vol%              |     | Application Only    | -           | -                                 | ASTM D86                      | standard industry parameter - info only - <b>no change</b>                        |

## **Some additional comments on CRW specifications**

## Physical Properties

- **Density**
  - An equalization and “performance” parameter
  - bounds stream components to alternative conventional sweet alternative
  - Explicitly influences value as heavy diluent
- **Viscosity**
  - A “performance” parameter
  - Explicitly influences value as heavy diluent
- **RVP (Reid Vapour Pressure)**
  - High concentrations of “light” molecules increases RVP, potentially beyond DilBit pipeline specifications
  - Generally balanced off against density
  - Pipeline and tankage design consideration
  - note that Butane (C4-) is managed separately as part of equalization (no change)

## Physical Properties

- **Sediment**
  - Sedimentation, deposition in low flow zones and tankage
  - Problematic small particles cause refinery desalting problems due to emulsions
  - Similar problematic emulsion problems can exist in around water/diluent management in SAGD operations
  - No benefits, only liabilities → MAX limits
- **BS&W**
  - Traditional, “non-oil” measurement
  - Important in crude accounting, no benefits → MAX limits

## Chemical Properties

- **Sulfur**
  - An equalization parameter
  - bounds stream components to alternative conventional sweet alternative
  - No explicit hard constraint for DilBit use
- **Olefins**
  - Native only at miniscule levels in WCSB production
  - Consumes H<sub>2</sub> and can form gums/deposits in refineries
  - No benefits, valuation & operational liability → MAX limit
- **Organic Chlorides**
  - Not native in crude oils naphtha fractions
  - Causes severe corrosion and fouling in Refineries
  - No benefits, valuation & operational liability → MAX limit
- **Aromatics**
  - Sum of vol% Benzene, Toluene, Ethyl benzene, Xylenes
  - Normally present at 2 – 10 vol% in WCSB condensates
  - Positively stabilizes condensate – bitumen blends
  - Real benefits, limited liability → MIN limit

## Chemical Properties (cont ...)

- **Benzene (component of BTEX)**
  - Negative valuation implications in mogas
    - Negatives shared with Me-cycloC5, nC6, cycloC6
    - Negatives not generally shared with TEX portion of BTEX
  - → MAX limit
- **Oxygenates**
  - Not naturally present, sources include biodiesel (FAME), reformulated mogas, chemical production, methanol
  - Some pipeline rules & regulations prohibit oxygenates
  - No benefit, value and operational liability → MAX limit
- **Phosphorus**
  - Not naturally present, sources include fract fluids, slops
  - Forms deposits in refinery distillation towers resulting in refinery outages
  - CAPP has adopted a specification limiting phosphorus content (2006)
  - No benefit, value and operational liability → MAX limit

## Test Methods

- When evaluating condensates, or when establishing specifications, one **MUST** specify the test method
- Test methods should be representative of the stream being evaluated
- Test methods must be widely available at reasonable costs
- ASTM methods provides inter-lab comparisons

## For Further information...

- **Enbridge**

- Patrick Keogh, P. Eng.  
Shipper Services Coordinator  
Enbridge Pipelines Inc.  
Ph: (403) 231-7383  
[patrick.keogh@enbridge.com](mailto:patrick.keogh@enbridge.com)

- **Crude Monitor Inc (Bill Lywood)**

- **CAPP (Krista Nelson or Randy Segato (Suncor))**