MINICUT ASSAY SYSTEM OVERVIEW

Crude Oil Quality Group Meeting
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Minicut Assay System Background

HPI Consultants, Inc.

- Minicut Assay System founded upon work of HPI Consultants, Inc.
  - Developed the Assay Simulator in 2002

NEXIDEA, Incorporated

- Minicut Assay Library developed through a three-year effort between NEXIDEA and HPI Consultants

Nexidea Systems, Inc.

- HPI Consultants acquired by Nexidea Systems in 2008
Minicut Assay System Concept

An assay management system that allows easy cutting, blending, modeling, reporting and updating of crude oil information.
Minicut Assay Library

Overview

• Minicut assays present crude oil assay data in standardized Excel® files with properties reported in small “minicuts”

• Assays created by NEXIDEA using Nexidea Systems’ Minicut Creator

• 2009 Library:
  • Over 330 crude oils
  • Over 90 assays – 2006 or newer

• Updated and expanded regularly

• Client assays can be minicut for client-confidential libraries
<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravity</td>
<td>33.0</td>
</tr>
<tr>
<td>Vanadium ppm wt</td>
<td>2</td>
</tr>
<tr>
<td>Specific Gravity (60 F/60 F)</td>
<td>0.8600</td>
</tr>
<tr>
<td>Nickel ppm wt</td>
<td>1</td>
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<tr>
<td>Total Sulfur wt. pct.</td>
<td>1.11</td>
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<tr>
<td>Zinc ppm wt</td>
<td>2.3162</td>
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<tr>
<td>Neutralization Number, mg KOH/g</td>
<td>0.48</td>
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<tr>
<td>Salt (as NaCl), lbs/1000 bbls</td>
<td>0</td>
</tr>
<tr>
<td>Asphaltenes wt. pct.</td>
<td>0.00</td>
</tr>
<tr>
<td>C9 Paraffins</td>
<td>4.22</td>
</tr>
<tr>
<td>C10 Paraffins</td>
<td>2.03</td>
</tr>
<tr>
<td>C11 Paraffins</td>
<td>1.03</td>
</tr>
<tr>
<td>Naphthenes</td>
<td>33.22</td>
</tr>
<tr>
<td>C1 -258</td>
<td>100.00</td>
</tr>
<tr>
<td>C3 -44</td>
<td>100.00</td>
</tr>
<tr>
<td>neo C5</td>
<td>100.00</td>
</tr>
<tr>
<td>97-120</td>
<td>100.00</td>
</tr>
<tr>
<td>200-220</td>
<td>100.00</td>
</tr>
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<td>220-240</td>
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<td>280-300</td>
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<tr>
<td>1020-1040</td>
<td>100.00</td>
</tr>
<tr>
<td>1140+</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Minicut Assay System Overview**

**Minicut Assay Library**

**Example Minicut Assay**

**Whole Crude Properties**

**Resid Viscosities**

**Minicut (20°F Cuts) Yields and Properties**
Creating Reliable Assays

We do the work!

- NEXIDEA uses the Minicut Creator to model yields/properties and create minicuts which match the original assay.

- The Minicut Creator relies on HPI’s Crude Cut Property Prediction CCPP correlations developed from neural network analysis presented to COQG.

- Quality Control Measures
  - Assembly of good team
  - Checks on base assay
  - Checks during minicutting process
  - QC sheet created on completion
  - Follow-up checks on overall library
Creating Reliable Assays

Base Assay Considerations

• “Garbage In – Garbage Out”
• Units of Measure

• Material Balance Checks
  • Specific Gravity Checks
    - Sum of cuts adds to 100% using calculated Whole Crude Gravity
    - Look for slight increase in API between Reported and Calculated
  • Contaminant Checks (Sulfur, Nitrogen, Concarbon, Metals)
    - Reported Whole Crude Value Versus Calculated (Sum of Cuts)

• Completeness of Assay – Number of Cuts and Properties Analyzed
• Comparison of Whole Crude Properties with Current Production
Creating Reliable Assays

Crude Oil Updater

- Updates MC assays based upon changes in whole crude properties
  - API gravity
  - Light ends composition
  - Contaminants

- HPI Consultants Crude Oil Quality Group Meeting Presentation
  The Assay Simulator – Crude Assay Modeling based on Simple Whole Crude Properties (January 2003 Meeting)

- Uses offsets to CCPP predictions established from a base assay

- Appropriate for changes to the same production field
Minicut Assay System Overview

Assay Viewer

Provides crude oil assay properties in user-defined cuts and Excel® formats

Functions:
• Select – List, sort, and select assays
• Setup – Specify cuts, temperatures and property codes
• Format – Create new or use an existing assay format of user-defined functions
• View – View, print, or copy results

Example user-defined function (wt% sulfur of 400-450°F cut):

\[=\text{CutProp}(\text{StartCut}, \text{EndCut}, \text{Property})\]

\[=\text{CutProp}(400, 450, \text{Sulf})\]

\[= 0.1136\]
Minicut Assay System Overview

Assay Manager

Functions

• Select – List, sort, view, and select from available assays
• Blend – Blend up to 20 crude oils by weight or volume
• Create Blend Assay – Save a Minicut assay representing the blend
• Compare Assays – Compare properties of blend and other crudes
• View – View, print, or copy assay in any “view” (Assay Viewer)
• Report – Report property cut information in a side-by-side table
• Graph – Graph component properties of the blend and other crudes
Conclusion

• The Minicut Assay System makes assay management simple.
• Reliable Minicut Assay Library currently covers over 330 crude oils.
• Thanks to
  • Previous owners of HPI Consultants, Inc.
    • Mr. Cud Baird
    • Mr. Ward Davis
  • NEXIDEA Team
• Next Steps
  • Receiving your feedback!
  • Adding your assays to the Minicut Library.