Strategic Fuels Blending Management & Technology

Self-Study Training Seminar Manual

SAMPLE

COURSE DIRECTOR

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Strategic Fuel Blending Management and Technology

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Notes: Each topic duration is 20-30 minutes. Total number of slides are 800-
Next enclosed is a sample slides from session-3 of the curriculum.
Fuel Blending
Operations in
Refinery
Overview

- Products Yield
- Types of Blending
- Gasoline Blending
- Diesel Blending
- Kero Blending
- Fuel Oils Blending
- Lube Oils Blending
- Naphtha Blending
### Products Distribution

<table>
<thead>
<tr>
<th>Product</th>
<th>Gallons</th>
<th>% Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Still Gas</td>
<td>1.89</td>
<td>4.26%</td>
</tr>
<tr>
<td>Liquefied Refinery Gas</td>
<td>1.76</td>
<td>3.96%</td>
</tr>
<tr>
<td>Naptha for Feedstocks</td>
<td>0.63</td>
<td>1.42%</td>
</tr>
<tr>
<td>Special Naphthas</td>
<td>0.13</td>
<td>0.29%</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.17</td>
<td>0.38%</td>
</tr>
<tr>
<td>Finished Aviation Gasoline</td>
<td>0.04</td>
<td>0.09%</td>
</tr>
<tr>
<td>Kero-Type Jet Fuel</td>
<td>3.99</td>
<td>8.98%</td>
</tr>
<tr>
<td>Finished Motor Gasoline</td>
<td>19.69</td>
<td>44.34%</td>
</tr>
<tr>
<td>Distillate Fuel Oil</td>
<td>9.7</td>
<td>21.84%</td>
</tr>
<tr>
<td>Other Oils for Feedstocks</td>
<td>0.5</td>
<td>1.13%</td>
</tr>
<tr>
<td>Residual Fuel Oil</td>
<td>1.76</td>
<td>3.96%</td>
</tr>
<tr>
<td>Petroleum Coke</td>
<td>2.14</td>
<td>4.82%</td>
</tr>
<tr>
<td>Asphalt and Road Oil</td>
<td>1.34</td>
<td>3.02%</td>
</tr>
<tr>
<td>Lubricants</td>
<td>0.46</td>
<td>1.04%</td>
</tr>
<tr>
<td>Miscellaneous Products</td>
<td>0.17</td>
<td>0.38%</td>
</tr>
<tr>
<td>Waxes</td>
<td>0.04</td>
<td>0.09%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44.41</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

1 BLS = 42 Gallons gains Volume due to decrease in Densities of Products.
Types of Products Blending

- Gasoline (Mogas)
- Diesel (Middle-Distillate)
- Kerosene
- Fuel Oils
- Lube Oils
Gasoline Blending

- **Stocks**
  - Usually 6-12 in number, e.g. Naphtha, Reformate, FCC, HDS, Isomer, Alkylate, Butane, Isopentane, Merox, MTBE (The stocks are produced by various refinery process units)

- **Products**
  - Leaded and Unleaded (leaded being phased out worldwide)
    - Regular - 78-82
    - Premium - 83-90
    - Super Premium - 91-98 (Octane Grades)

- **Specifications**
  - RON, MON, RDOI, RVP, 10%, 50%, 90%, S, Arom, Ole, Bnz, TOx, VOC, Lead

- **Mode**
  - Tanks-to-Tank Inline Blending (Infeasible to blend in Run-down mode)

- **End Uses**
  - Cars, small vehicles
Example of gasoline Blending

Mogas Blending Overview

1156TA (Reformate)

<table>
<thead>
<tr>
<th>Quality</th>
<th>Current</th>
<th>Target</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E P50</td>
<td>115.44</td>
<td>115.11</td>
<td>deg C</td>
</tr>
<tr>
<td>RON</td>
<td>98.28</td>
<td>98.3</td>
<td></td>
</tr>
<tr>
<td>RVP</td>
<td>48.82</td>
<td>55.67</td>
<td>kPa</td>
</tr>
</tbody>
</table>

Line-Up Details

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Flow</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input From</td>
<td>HDR REF</td>
<td>0.1 t/hr</td>
<td></td>
</tr>
</tbody>
</table>

Max Tank Volume: 18517.0 m³
Current Tank Volume: 9650.0 m³
Percentage Filled: 52.1 %
Diesel Blending

• Stocks
  Usually 3-6 in number, e.g. CDU middle distillates, Hydrocracking streams, (The stocks are produced by mainly by CDU and Hydrocracking units)

• Products
  Light middle distillate fuel for special and general purpose, marine diesel, heavy distillate fuel

• Specifications
  Cetane Index, Pour Point, Cloud Point, Sulfur, Viscosity, 90% pt

• Mode
  Run-down to Tanks or Tanks-to-Tank Inline Blending

• End Uses
  Commercial vehicles, Construction equipments
Example of Diesel Blending
Kero Blending

- **Stocks**: Usually 3-6 in number, e.g. CDU Kero, Hydrocracker Kero, light Diesel
- **Products**: JET and JP products
- **Specifications**: Freeze pt, Flash pt
- **Mode**: Rundown-to-Tank Inline Blending
  \textit{(Impractical to blend in tank-to-tank mode)}
- **End Uses**: Aviation and home fuel
Example of Kero Blending

Kero Rundown Blending Systems Overview

<table>
<thead>
<tr>
<th>Quality</th>
<th>Current</th>
<th>Target</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLASHPT</td>
<td>39</td>
<td>38.8</td>
<td>deg C</td>
</tr>
<tr>
<td>FREEZEPT</td>
<td>-52.5</td>
<td>-52.5</td>
<td>deg C</td>
</tr>
</tbody>
</table>

Line-Up Details

- Input From: HDR-JET 290.9 h/hr

Max Tank Volume: 12939.0 m³
Current Tank Volume: 2912.0 m³
Percentage Filled: 22%
Fuel Oils Blending

- **Stocks**
  - Usually 3-6 in number
  - Light Cycle Oil (LCO), Slurry,
  - Base Fuel Oil (BFO) mostly from Vacuum Distillation Unit

- **Products**
  - LSFO, HSFO, Marine FO, Bunker FO, Boiler

- **Specifications**
  - Viscosity, API, Sulfur, Flash pt, Pour pt

- **Mode**
  - Tanks-to-Tank Inline Blending
    *(Infeasible to blend in Run-down mode)*

- **End Uses**
  - Ships, Boilers, Furnaces
Lube Oils Blending

- **Stocks**
  - Refined Base Oils (6-9 for a recipe)
  - Additives
  - Synthetic base Oils

- **Products**
  - 300-400 Grade formulations for all kinds of end uses

- **Specifications**
  - Viscosity, Insolubles, water, Total base Number (TBN), Salt, Total Acid Number (TAN)

- **Mode**
  - Tanks-to-Tank Inline Blending
    - *(Infeasible to blend in Run-down mode)*

- **End Uses**
  - Vehicles, machines
Example of stationary batch tank Lub inline-Blending

- Large number of formulations 300-400
- Up to 10,000 Batches per year
- Each batch size maximum 2-3 tons or
- Contamination is a big hazard issue
- Inline blender is economical only for lube plant capacity greater than 20,000 Tons/year
- Shorter blending hours
- Can meet product demands quickly as hold time is low
- Batch tank is stationary and requires lots of pipings and control valves
Example of Moving Batch Tank Lube-inline Blending

- It has moving batch tank
- Requires less number of pipings and valves
- Reduced labour requirement
- Better quality control
Naphtha Blending

- Blending of feed tanks to produce a feed of constant density.

- Blending of feed tanks to produce a feed of constant density to process units.
Summary

- Products blending is an important part of refining industry

- It offers flexibility to use stocks efficiently to meet product specs

- Gasoline blending is complex compared to others.

- Lube blending is characterized by large number of batches, formulations and smaller batch size, complex piping and valves