Asphalt and Lubricant Refining
A Brief Summary

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Meeting Objectives

- **Purpose**: To create an understanding of what Re-Refined Engine Oil Vacuum Distillation Bottoms Are and How They Affect Bitumen Performance

- **Agenda**:
  - Understanding the Manufacture of Asphalt, Lubricants and Re-Refined Engine Oil Vacuum Distillation Bottoms (REOBs)
  - Performance Aspects of REOB Asphalt blends
  - Practical Implications of an Ad Hoc Decision to Ban REOBs

- **Payoff**: A comprehensive plan forward that addresses performance issues on a rational, scientific basis
Some Simple Truths

• REOBs have been used in paving applications for over 30 years in NA as a soft asphalt component to enhance low temperature and aging properties of binders
• Not a single failure has been conclusively shown to be due to REOBs
• Approximately 160KT of REOBs are produced in NA – that is $\approx 0.5\%$ of total asphalt and less than $\approx 0.4\%$ of the paving asphalt
  – Generally it is used between 2% and 6% by weight of binder making up less than 0.2% by weight of total mix
  – The average mix in NA contains 25 times more RAP binder than REOBs!
• REOBs cut greenhouse gas emissions by 85% relative to asphalt produced from crude oil and are domestically made
• It is a low toxicity, non-carcinogen crude-derived hydrocarbon
The Law of Unintended Consequences

• If this non-toxic, non-carcinogenic, high-performance primarily aliphatic stream is banned then suppliers will have to look for other sources of soft components:
  – Aromatic Extracts
    • Generally red labeled, lowest cost substitute, readily available
  – VGOs which are a blend of the lube components in the REOBs, naphthenic and aromatic polar components and waxes, high-cost FCC feed
  – Cracked residue (generally red labeled, instable)
  – Vegetable oils
  – Bright stock (the primary component of REOBs) the best, highest cost substitute

• Many asphalts would have to be labeled as potential carcinogens, properties could deteriorate and asphalt could become costlier because of the use of fuel streams
Refinery Feedstocks and Vacuum Tower Bottoms

**Refiner**

- **Crude Oil**
  - Contains: Water, wide range of hydrocarbons, H2S, salt
  - Highly variable

- **Vacuum Tower Bottoms (VTBs)**
  - Contains: Bright stock, polar aromatics, naphthenics, waxes and asphaltenes

**Re-Refiner**

- **PFO**
  - Contains: Water, lightends, H2S, ethylene glycol, wear metals, polymers and a blend of lube stocks
  - Very consistent

- **Re-Refined Engine Oil Vacuum Distillation Bottoms**
  - Contains: Bright stock and bright stock derivatives, asphaltenes, polymers and wear metals
Myth: Used Engine Oil Can Is Added Into Asphalt

- Used Engine Oil (PFO) is dehydrated and screened (like crude oil)
- If it is not used as feed for a re-refinery it goes into the marine fuel oil market where it commands pricing significantly higher than wholesale asphalt
- Since it contains fuel (diesel and gasoline) it is combustible and cannot be used in hot mix plants
  - Putting PFO into asphalt would be like pouring a heavy crude oil into asphalt

Used Engine Oil is NEVER added to asphalt.
How Is Asphalt Made?

Note: Numbers in parentheses refer to typical product process flow routes. Source: OSHA 1996.
Simplified Schematic

Atmospheric Distillation

- LPG
- LSR/Naphtha
- Jet
- Diesel
- Heating Oil

Long residue

Vacuum Distillation

- LVGO
- VGO
- HVGO

Short residue or VTBs

Crude Oil
Asphalt and Lube Production

HVGO  VGO  RREOVDVBs (Wax-Free Oil)

VTBs

Solvent De-Asphalting

Bright Stock Feed

PDA Bottoms or Pitch

Solvent Extraction

Raffinate

Aromatic Extract

De-Waxing

Wax

Asphalt

Wax-Free Oil
Re-refining Process
Conclusions

• REOB is a highly refined product with a set of most desirable properties:
  – It is non-toxic and non-carcinogenic.
  – It is extremely consistent product with a well defined pedigree.
  – Its primary components are non-waxy bright stock and its derivatives as well as polymers
  – It is generally used at levels between 2% and 6% to enhance low temperature and intermediate temperature properties and not used at levels exceeding 15% as advertised in some references.
  – Banning it will increase the cost of the asphalt, eliminate competition and lead force the suppliers to cut their asphalt with much less desirable products which can worker exposure issues
Conclusions

• We are looking forward to sponsor research - no strings attached - to fast track testing of binders.
• We are happy to work with all the agencies in providing performance data that further supports our claims.