ACC IIIG investigations

• At June 26\textsuperscript{th} ILSAC/Oil meeting, ACC was given time to investigate several options to improve IIIG test precision

• Since then, we have confirmed that oil consumption variation can explain much of the \%VIS and MRV variation within an oil
  – Matrix data & candidate data to follow

• ACC is now pooling IIIG data for both reference and candidate oils to derive a correction equation for kinematic viscosity and MRV, accounting for oil consumption and volatility
Sequence IIIG Matrix Oil Consumption

• Oil consumption variation can explain much of the PVIS and MRV variation within an oil
  • Higher oil consumption results in lower oil levels which increase the severity of the test

![Graphs showing log(PVIS) versus Oil Cons. by Oil and 1/sqrt(MRV) versus Oil Cons. by Oil]
Typical Oil Level for Oil 433-1: IIIF versus IIIG (ml low)

Oil make-up in the Sequence IIIG is less than ½ that in the Sequence IIIF resulting in lower oil levels during the test.
While oil consumption in the Sequence IIIG is similar to that found for GF-3 quality reference oils in the Sequence IIIF, the impact on oil evaluation is more sensitive in the Seq. IIIG because:

- Oil make-up in the IIIG is approximately ½ that in the IIIF.
- Viscosity increase limits are tighter in the IIIG.
- No MRV limit in the IIIF.

The image shows a chart titled "Oil Cons. by Test/ Oil/Lab" with data points for IIIF and IIIG. Every two boxes (pair) correspond to one oil, with box 1 being lab A and box 2 being lab G for each pair.
Because of higher oil levels in the IIIF, oil consumption variation has a smaller impact on used oil properties. For comparable oils:

- Slope of PVIS vs OC is higher for the IIIG.
Inclusion of a used oil MRV limit in the Sequence IIIG introduces another parameter that is sensitive to oil consumption variation.
Increase in rate of OC in IIIG in late May into June has made it very difficult to determine true performance of an oil.
Formulations exactly the same except Formulation B (EOT 6/19/03) contains 35% higher AO vs Formulation A (EOT 6/3/03)

Sequence IIIG at Independent Lab-
mls low and % Vis Increase
Sequence IIIG – Oil Consumption

III G Viscosity Grade Comparison
(% Vis Increase vs mls Low)

Same base stock, VM, and additive

- % VIS, 5W-30
- % Vis 5W-20
- MLS LOW, 5W-30
- MLS LOW 5W-20

American Chemistry Council
Good Chemistry Makes it Possible
ACC Proposal for Seq IIIG Registration

• ACC agrees to begin IIIG registration on July 31, 2003 with the following caveats:
  – ACC TAG completes compilation of pooled reference and candidate data to derive correction equation and/or test validity criteria; data collected for each oil includes:
    • EOT kV, EOT MRV, volatility (D6417 and D5800), and vis grade
    • also cumulative milliliters lost at 20, 40, 60, 80, and 100 hours.
    • target date for correction equation is by July 23, 2003
  – TAG will make recommendation to IIIG SP
  – %VIS & MRV proposed limits are adjusted to account for poor precision and severity of the operating conditions of the test.
Comments on ILSAC Package Deal

• ACC PAPTG agreed that all limits proposed by ILSAC in the ‘package deal’ were reasonable with the exception of the limits proposed for the Sequence IIIG and the Sequence VIB.

• PAPTG members had varying responses to the IIIG and VIB limits but reached consensus on the following range of limits:
  – Viscosity Increase (kV 40C): 150-200 %
  – Low Temp Viscosity: Either 2-vis grade higher or 100Kcp
  – Hot Stuck Pistons Rings/Cam plus lifter wear: as is.
  – WPD—see next slide…
Comments on ILSAC Package Deal

- ACC could not reach consensus on a WPD- Fuel Economy proposal.
- The individual company responses ranged from - accept the proposed WPD/Fuel Economy offered - to - counter propose the following WPD/FEI trade-offs:

<table>
<thead>
<tr>
<th>Vis Grade</th>
<th>Options for WPD &amp; FEI1/FEI2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEQ IIIG WPD</td>
<td>3.5/3.3</td>
</tr>
<tr>
<td>0W/5W-20</td>
<td>2.2/1.9</td>
</tr>
<tr>
<td>0W/5W-30</td>
<td>1.7/1.4</td>
</tr>
<tr>
<td>10W-30</td>
<td>1.0/0.7</td>
</tr>
</tbody>
</table>