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API CJ-4
Two Years Later....

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STLE Toronto Section
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Presentation topics

- Overview of MCC
- Why API CJ-4 category?
- Benefits of API CJ-4
- API CJ-4 Two Years Later
- Summary

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Who is MCC?

A Specialty Chemical Distributor:

Albemarle
BASF
Chevron Oronite

A Manufacturer of:

Corrosion Inhibitors
Diesel Fuel Lubricity Additives
Industrial Oil Additives
Red Dye
Premium Diesel Packages
Viscosity Index Impro

A Reseller for:

Afton Chemical
Baker Hughes
Lubrizol
Rohm & Haas

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Sales & Service Coverage throughout the USA

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Value Chain – Lubes

Refinery

Refined Oil Distribution

Finished Lubricant Blending (Oil + Additive)

Retail Outlet / Aftermarket

MCC Serves the ILMA Segment of Aftermarket & Lubricant Blending

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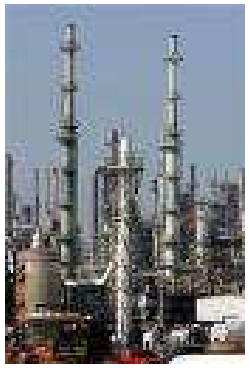
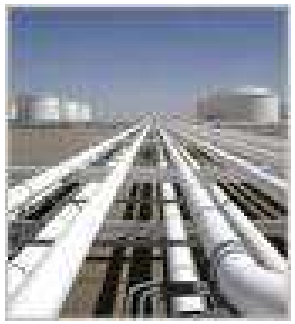
Value Chain – Fuels

Refinery, Ethanol & Biodiesel Plants



Pipelines



Terminals & Distributors (including Biodiesel)

Retail Outlet / Aftermarke

MCC Serves the entire Fuel Value Chain

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Our Product Portfolio

Authorized Chevron/Oronite Distributor in the USA and Canada

- OGA® & ODA® – Gasoline & Diesel detergents
- OLOA® – Oil Additives
- PARATONE® Viscosity Index Improvers
- Aftermarket Additives Components

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Our Product Portfolio

- Distributor for Albemarle Ethanox™ Antioxidants

- MCC branded products
  - Premium Diesel Additive Packages
  - ULSD Lubricity Additives
  - Conductivity Additives
  - Red Dye
  - Biodiesel Additives
  - Ethanol Additives
  - Viscosity Index Improvers

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Industry Involvement

- ASTM
  - Voting Member of D2
- Detroit Advisory Panel
- ILMA
  - Engine & Transmission Committee
  - Supplier Member Committee
- ILTA (International Liquid Terminals Association)
- PPC (Petroleum Packaging Council)
- SAE
- STLE
  - Chairmanship of Kansas City Section 2004 and 2008
  - Lube School planned for 2009

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WHY API CJ-4?

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Why API CJ-4 HDEO?

- Ultra Low Sulfur Diesel (USLD) mandated by the EPA
  - Lower NOx emissions 1.2g/bhp-hr
  - Even lower in 2010 0.2 g/bhp-hr
  - Particulate Matter (PM) 0.01g/bhp-hr
- OEM approach to achieve these limits
  - Exhaust Gas Recirculation (EGR)
  - Diesel Particulate Filters (DPF)
  - Cat ACERT Technology
  - SCR/Urea Traps
  - NOxTraps
- Result: A new generation of engines and emission control devices

CJ-4 Overview

- Industry successfully developed the CJ-4 category for licensing on October 15, 2006
- Performance tests for CJ-4 were a combination of existing CI-4+, CI-4, CH-4 and CG-4 engine tests using low sulfur diesel fuel AND new engine tests using ultra low sulfur diesel fuel
  - Mack T-12: Ring/liner wear, bearing corrosion
  - Caterpillar C-13: Oil consumption and piston deposits control
  - Cummins ISB: Valve train wear
  - Cummins ISM: HT sludge, soot related wear, filter plugging
- The performance of CJ-4 lubricants was designed to be a significant upgrade over CI-4 and CI-4+

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CJ-4 Overview

- CJ-4 was the most comprehensive and most expensive HDEO category in history
- Designed to be backward compatible to CI-4+/CI-4
- Designed to qualify as API SM/SL
- Designed to qualify in all major Heavy Duty Engines
  - Mack/Volvo, Detroit Diesel, Cummins, Cat
- Maximum chemical limits for CJ-4 lubricants were set at:

  - 1.0 % ASH
  - 0.12 % Phosphorus
  - 0.4 % sulfur

SAPS = Sulfated ash, Phosphorus, Sulfur

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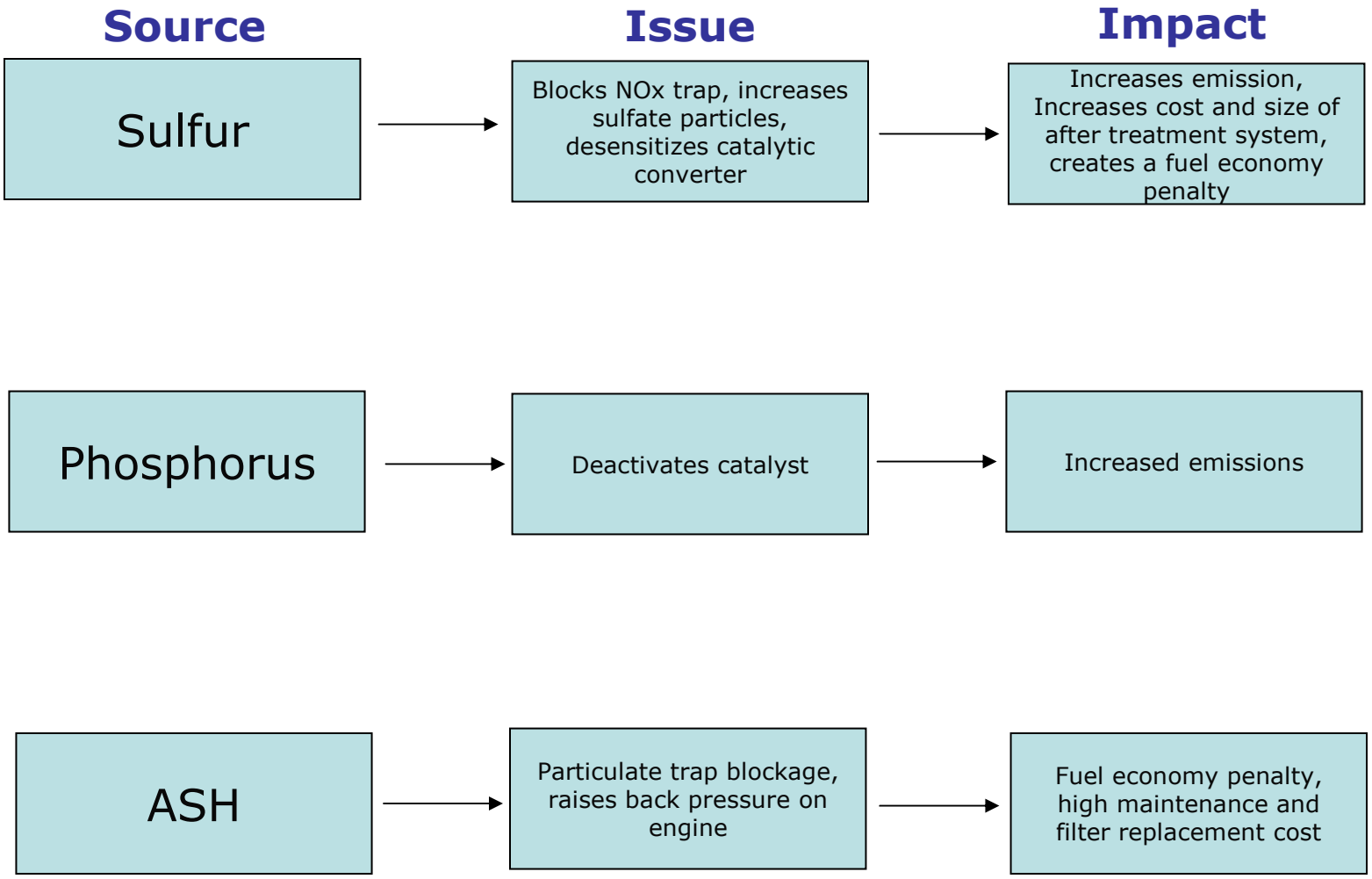
Impact of SAPS on Particulate Filters



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Major Requirement for CJ-4

- API CJ-4
- API CI-4/CI-4+
- API CF
- API SM/SL
- CAT ECF-2
- CAT ECF-3
- ACEA E7 (E9)
- Cummins 20081
- DDC 93K218
- Volvo VDS-4
- MACK EO-O
- MACK EO-N PP03
- MAN 3275
- EMA DHD-1
- MB 228.3

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BENEFITS OF API CJ-4

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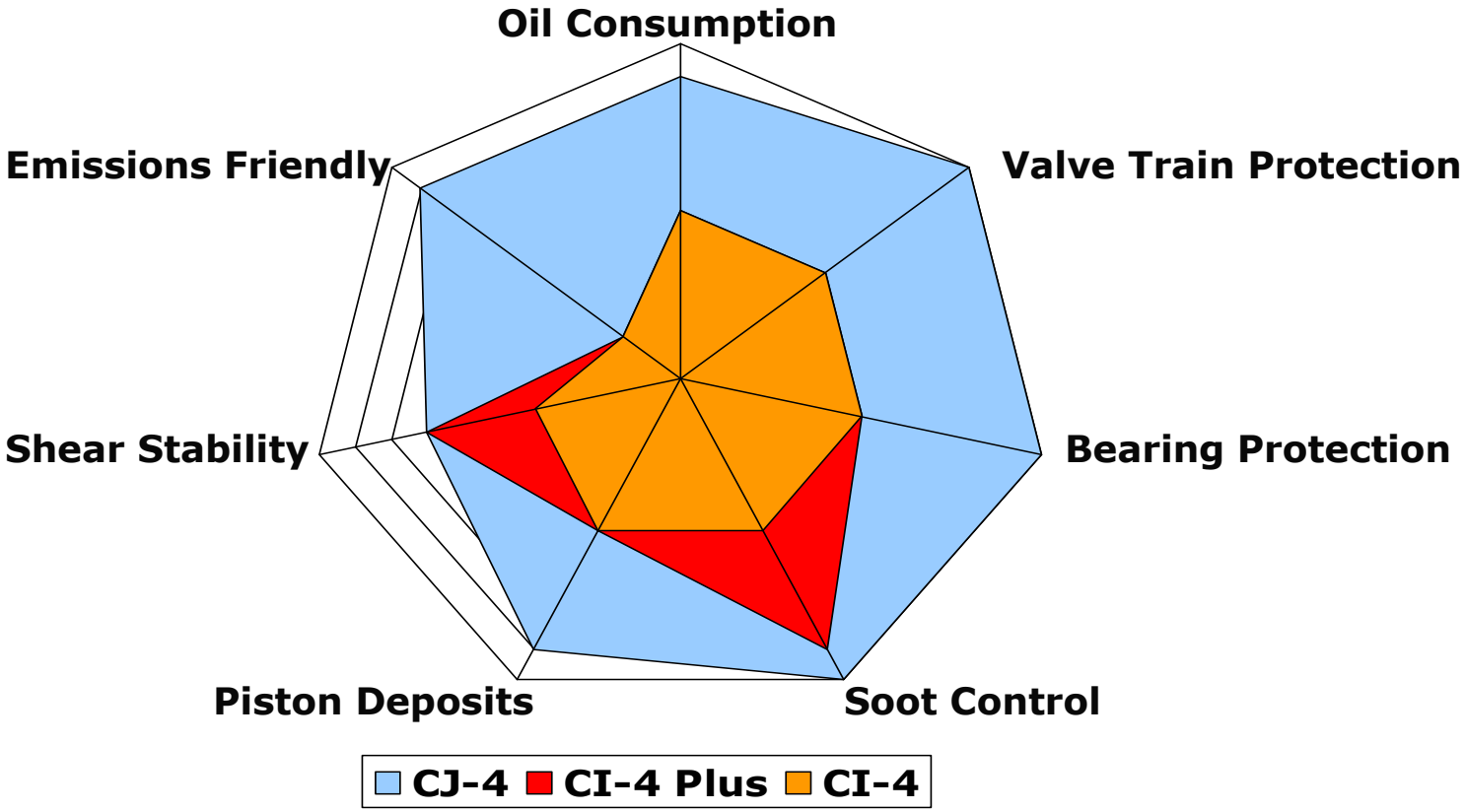
Benefits of API CJ-4 over Previous Categories



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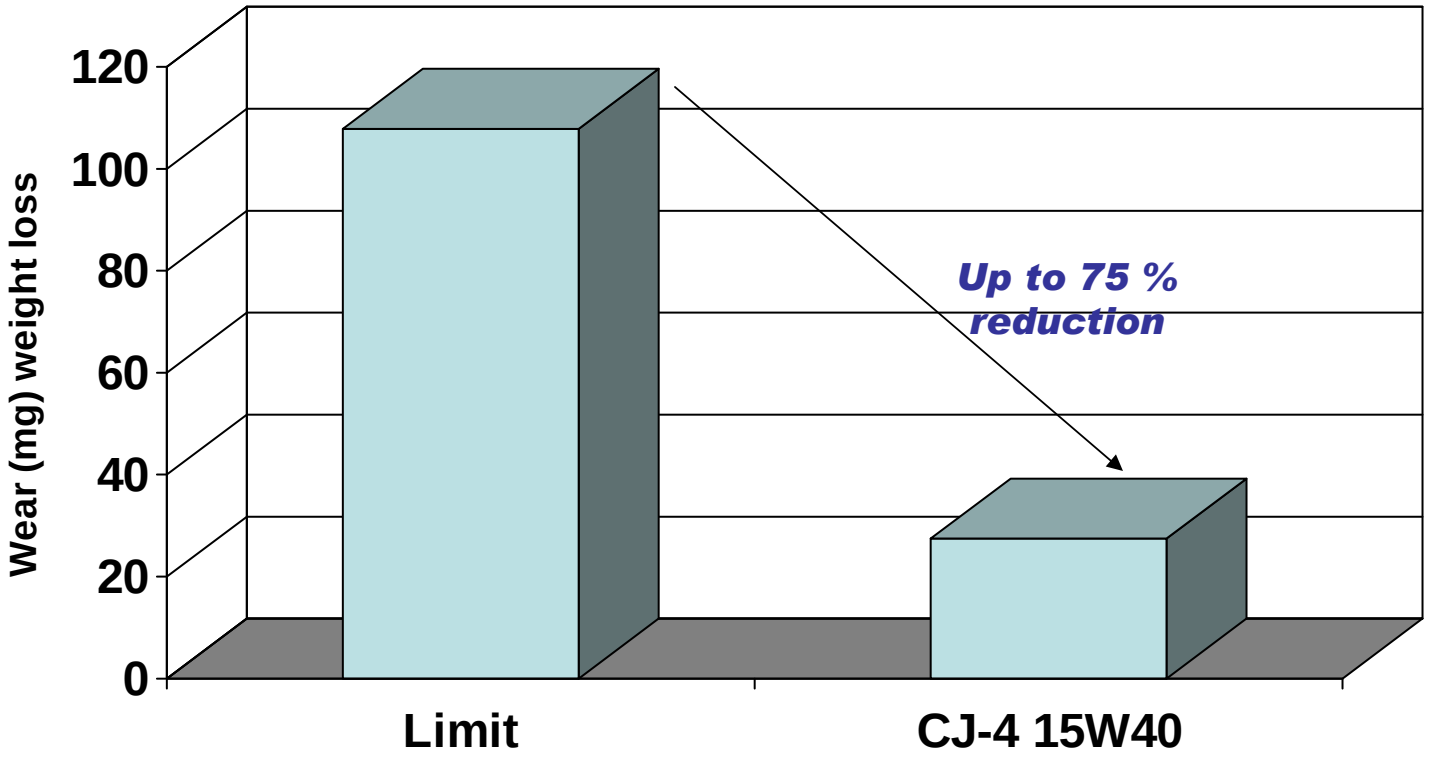
Cummins ISB

Valve Train Wear



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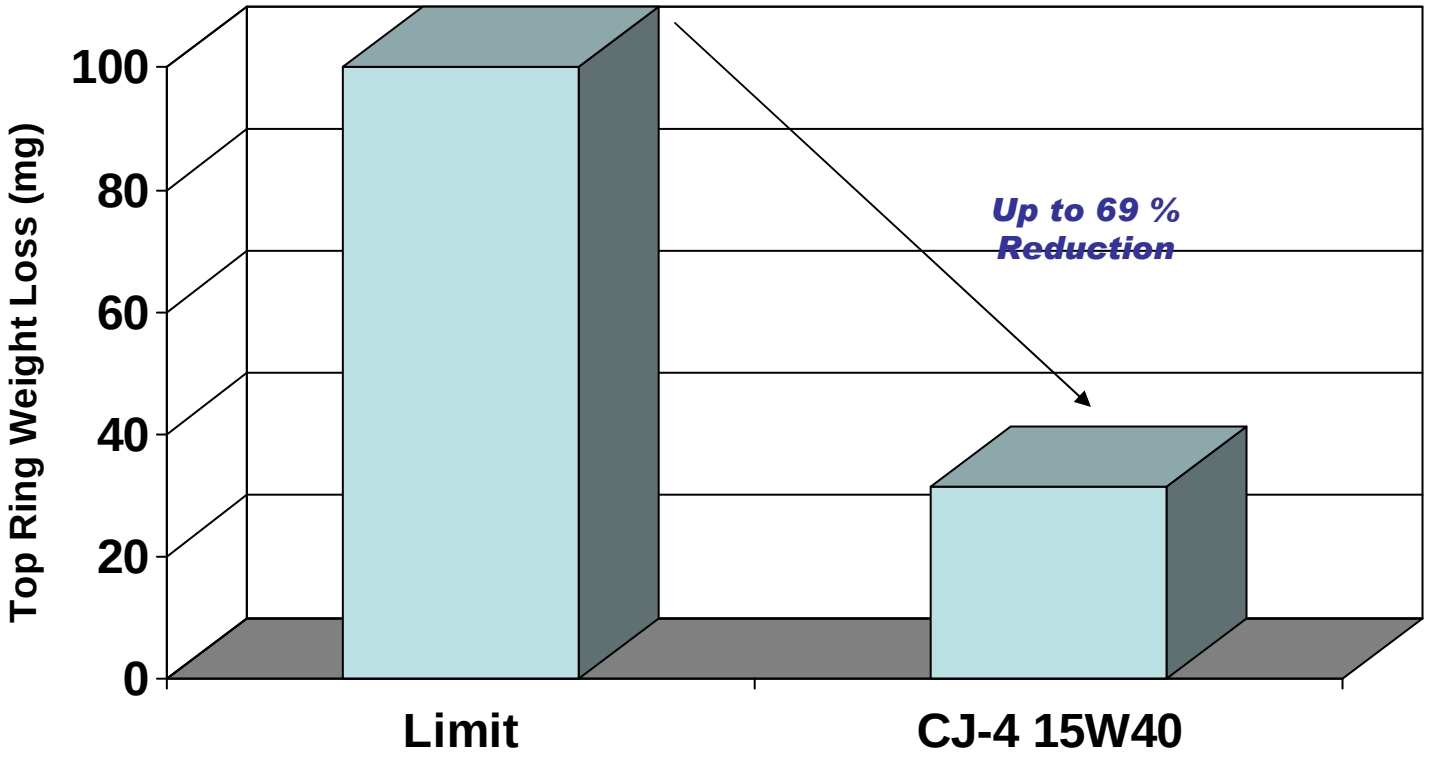
Cummins ISM

Soot Related Wear



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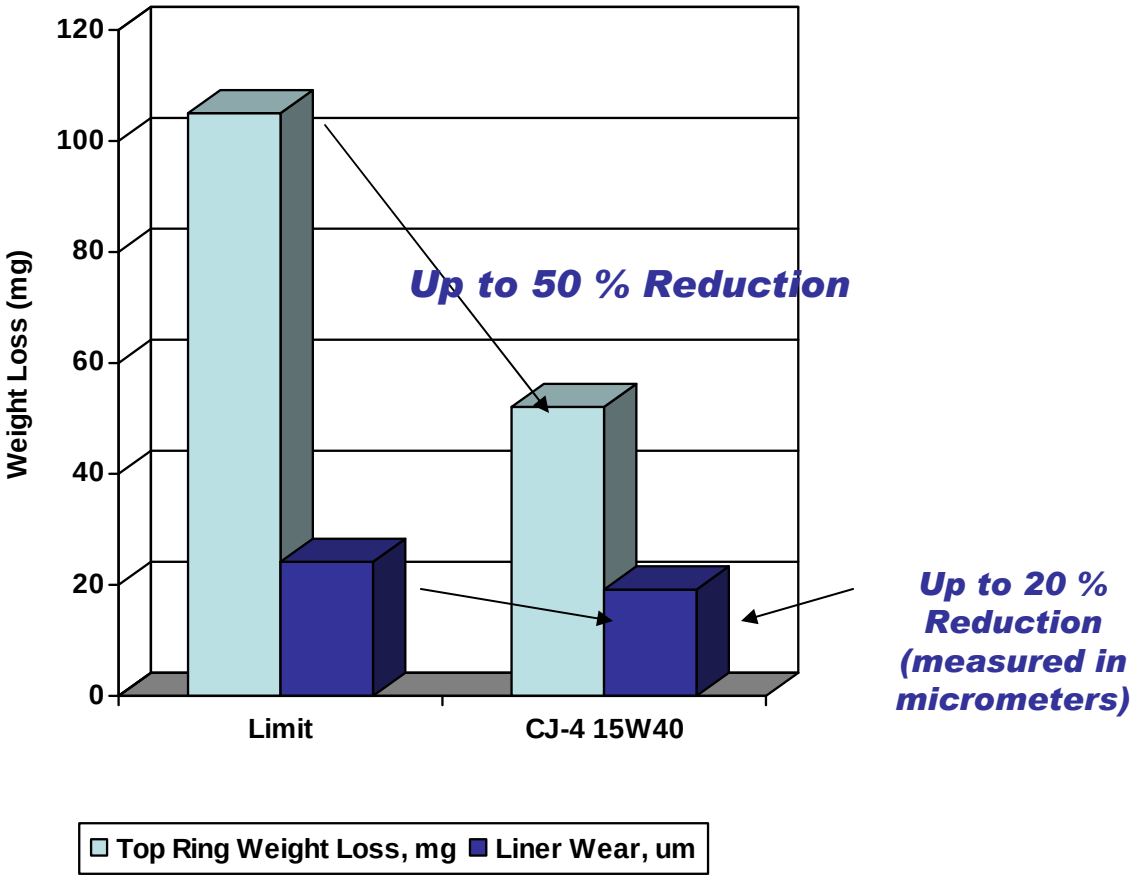
Mack T-12

Ring and Liner Wear



Up to 20 % Reduction (measured in micrometers)

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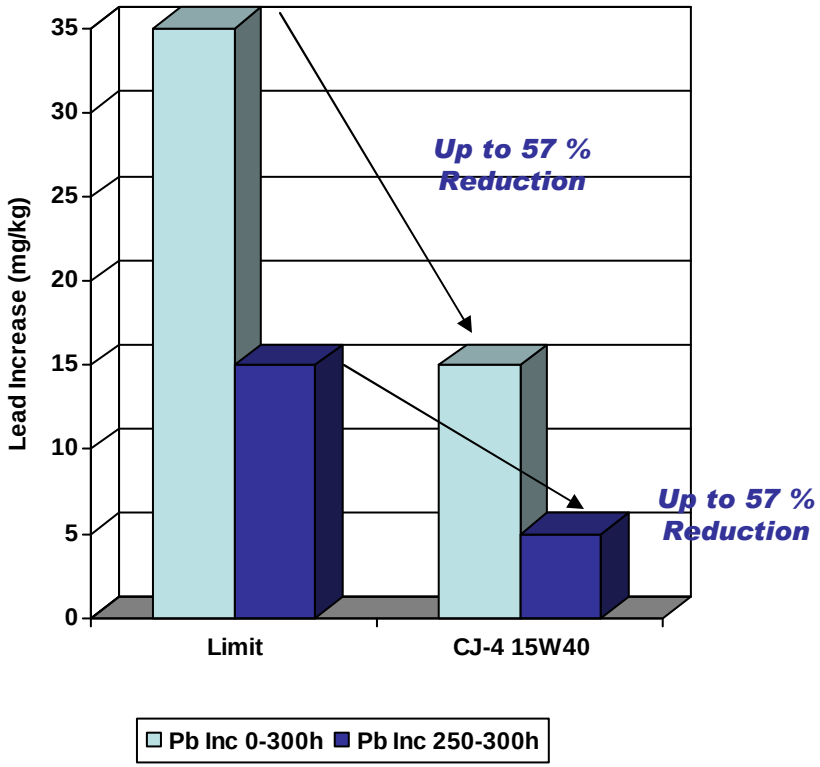
Mack T-12

Bearing Protection as measured by Lead(Pb) Decrease



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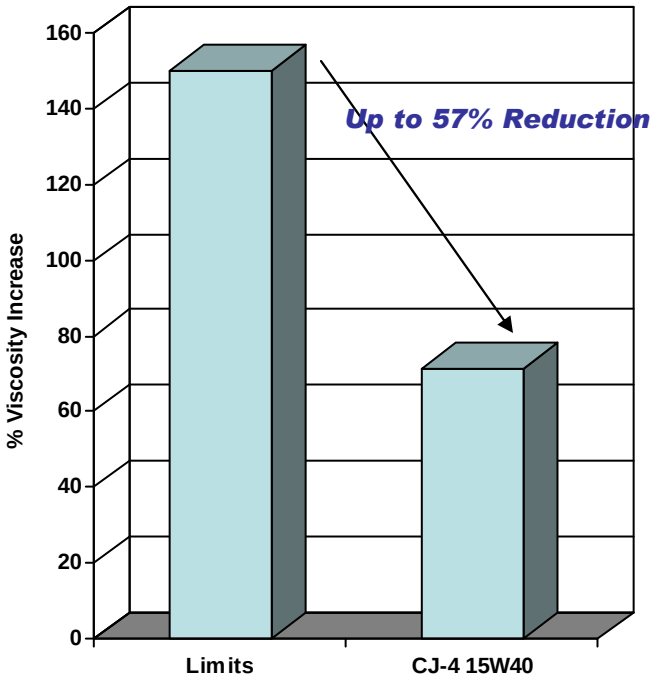
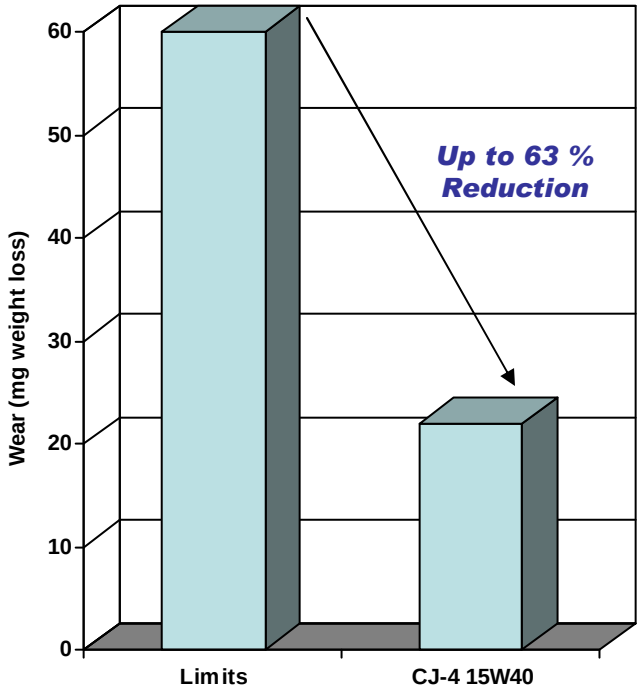
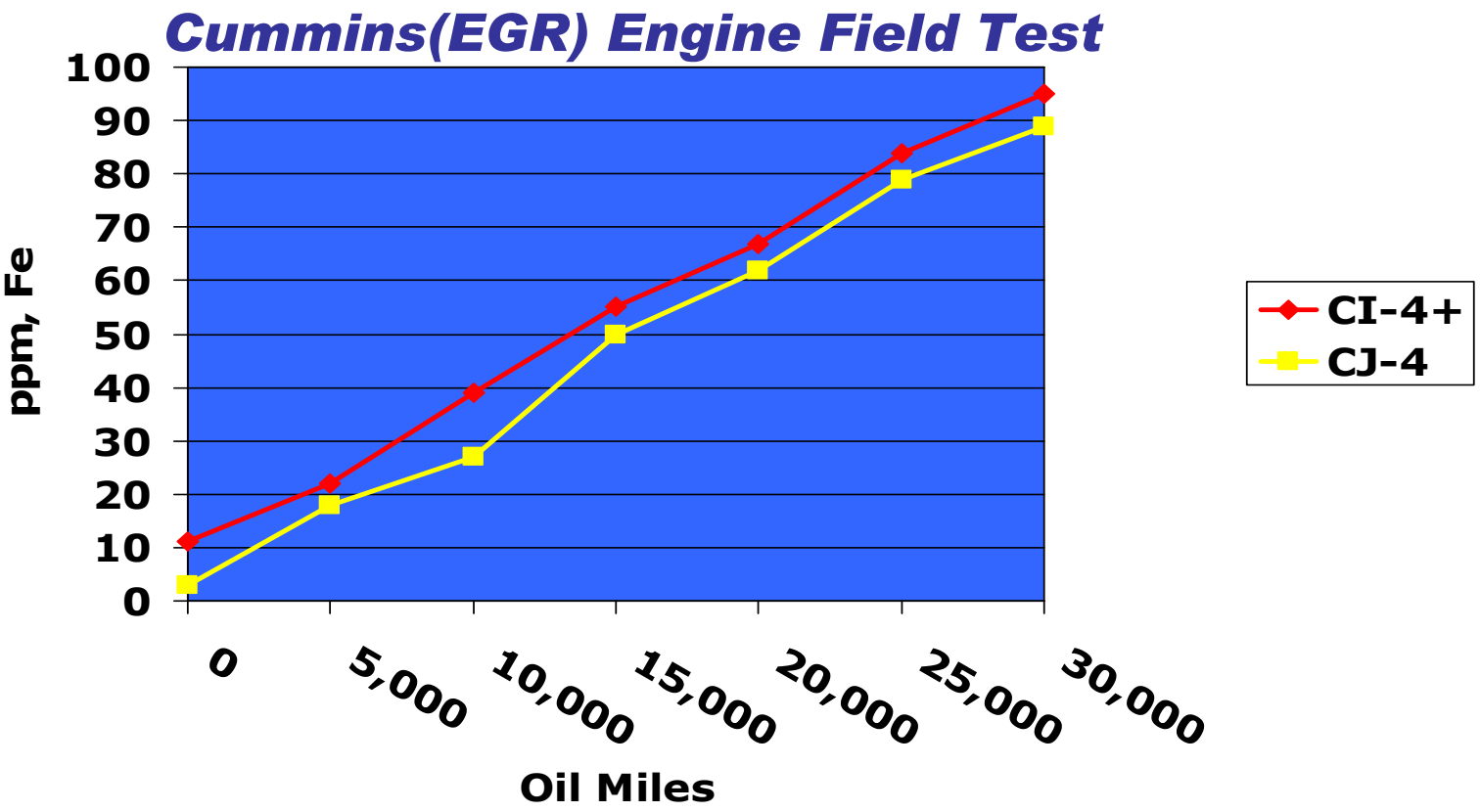
Sequence IIIG

Gasoline engine required for API SM service category. Measures oil thickening and valve train wear





Iron Levels



Fleets like to monitor their engine life through wear metal analysis. Wear protection of CJ-4 is better than CI-4+

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API CJ-4
TWO YEARS LATER...

API CJ-4 Two Years Later

- Market Penetration
  - Approx. 20% of total HDEO
  - Mostly on-highway use
  - Over 100 licenses granted by API
- Product Extension
  - 10w30 grade
  - 5w40 synthetic grade
  - Monograde requests for CF, CF-2
- Some issues remain
  - TBN values
  - Biodiesel Fuel
  - EPA 2010 Emission Standards for Diesel Engines

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TBN

- TBN values of CJ-4 oils are lower than CI-4 Plus oils.
  - ULSD fuel
  - Ash limit required to prevent plugging of DPF
  - Less acidity from blow-by gases due to ULSD fuel
  - Less nitric acid formation from improved antioxidant system
  - i.e. Rate of TBN depletion is less for CJ-4 oils
- Used oil analysis protocols have been changed to reflect the lower TBN values.
  - TAN values need to measured

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Field Test Data

- Test Program
  - Mack Aset EGR's - 350HP, 2005 model year
  - 80,000 GVW, avg. load ~75%
  - ~275,00 - 300,000+ mile/year accumulation
  - Fuel consumption ~5.5-6.0 mpg
  - At idle: ~10%
  - Drain interval: 60,000 miles

SAE Paper: 2007-01-3999

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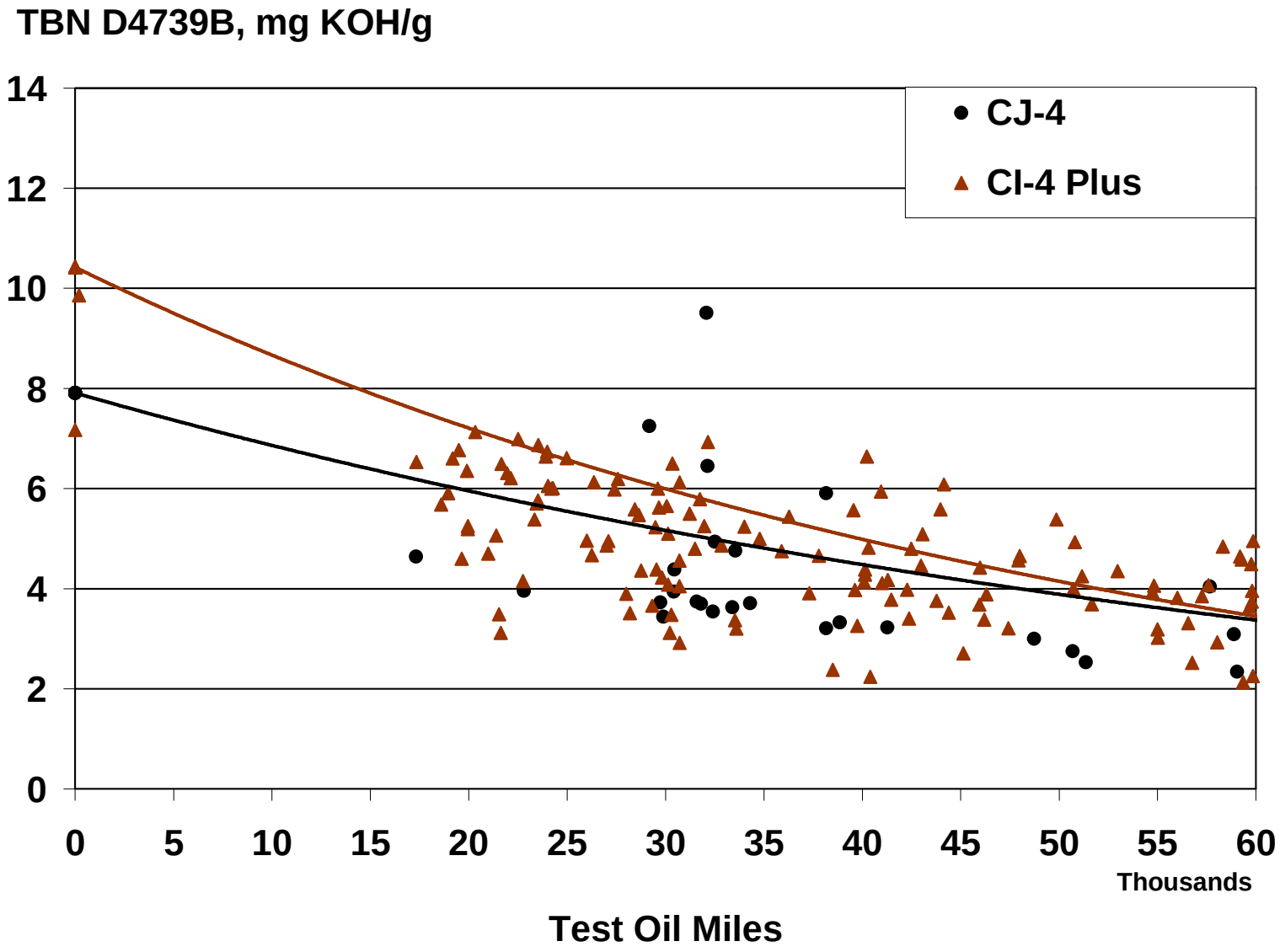

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Biodiesel Fuel

- Potential Impact on Lubricant Performance
  - Fuel Dilution
  - Corrosion
  - Viscosity Increase
  - Oxidation
  - Piston Deposits
  - Sludge Deposits
  - Wear

Reference: Chevron "Lubrication": Biodiesel & Engine Lubrication Part 1, October 2007

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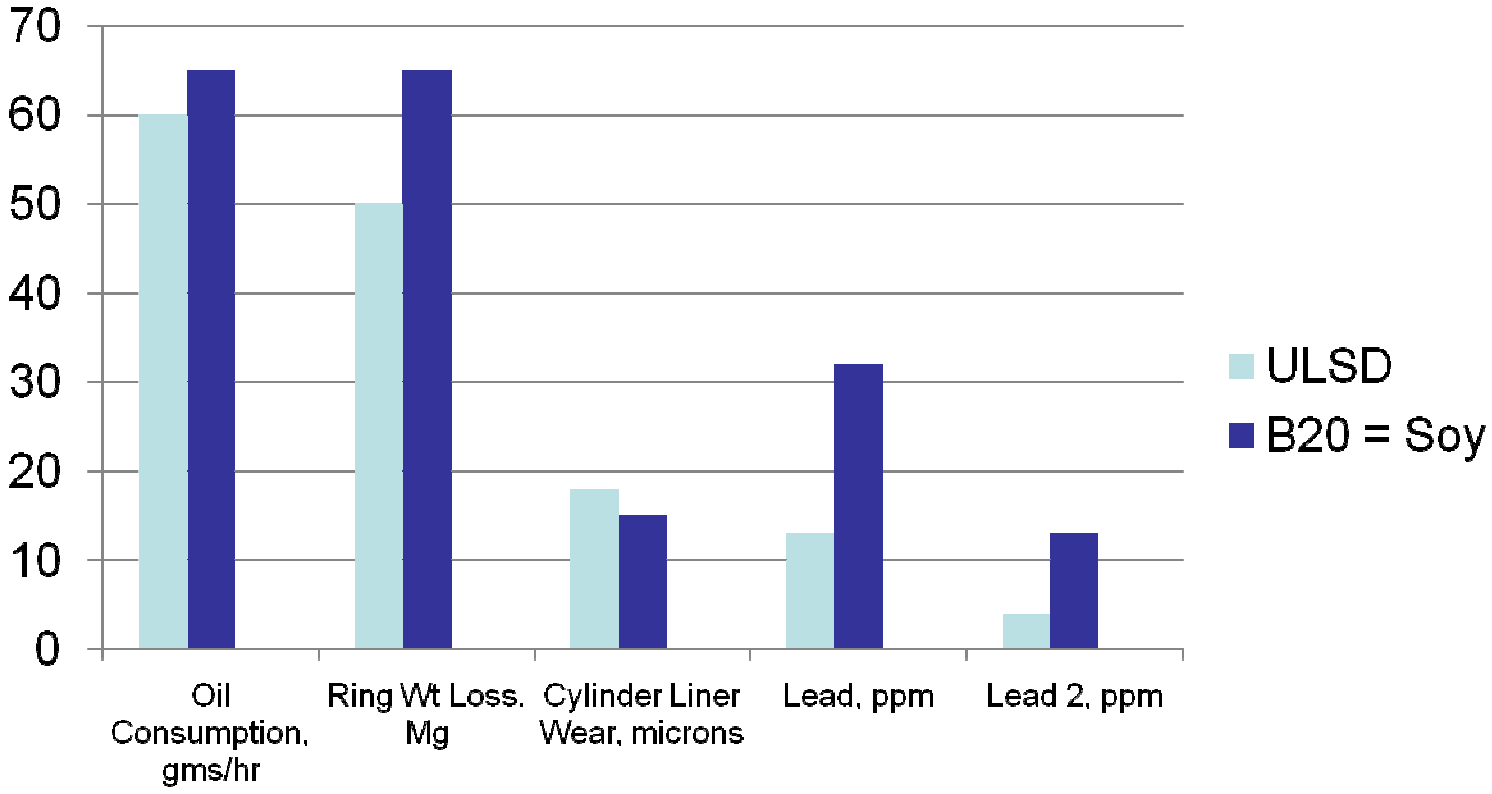
Mack T-12 Parameter Comparison



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Summary

- API CJ-4 is here to stay! These HDEO oils contain < 1.0 % Ash and are lower in sulfur & phosphorus (SAPS)
- Benefits of CJ-4 include:
  - Less oil consumption
  - Improved valve train and bearing wear protection
  - Better soot control
  - Improved deposit control
- TBN/Drain intervals may be an issue with the truck fleets, if they use CI-4 drain interval recommendations.
- 2007 and beyond engines can only run on CJ-4 oils and ULSD fuel.
- Use Biodiesel fuel may be an issue in the future