



2006
MINING DIESEL
EMISSIONS COUNCIL (MDEC)

Emissions: A Primer - From None To Tier 4

Robin J. Ungar
10-13 Oct 2006

October 2006

2006 MINING DIESEL EMISSIONS CONFERENCE

Why Do We Have Emission Standards?

To Address Air Quality / Pollution Issues

- Health Concerns
- Damage To The Environment
- Property Damage



2006 MINING DIESEL EMISSIONS CONFERENCE

CAA Oge EPA HC CARB Stage 1 Euro CO

SCR CEPA NMHC TERP NRLM

Tier 1 CO₂ ABT CFR

E3 TPEM ppm IMO NCP Tier 3


BECS MOU E2 **EMISSION** VOC BECS AQMD

TA Luft FEL **STANDARDS** A1 Flexibilities

THC MSHA Tier 4 UREA NPRM

DF Stage IIIa NTE C1 AECD PM SEA

SCAQMD SO_x Tier 2 EGR ULSD NO_x Stage II



2006 MINING DIESEL EMISSIONS CONFERENCE

Putting Things Into Perspective:

- Prior to 1996 Diesel Mobile Nonroad Emissions Were Unregulated
- EPA Mobile Nonroad Tier 1 Standards Became Effective January 1996
- EPA Mobile Nonroad Tier 2 Standards Became Effective January 2001 (Approx. 33% Emissions Reduction From Tier 1)
- EPA Mobile Nonroad Tier 3 Standards Became Effective January 2005 (Consent Decree Pull-Ahead), Or January 2006 (Approx. 70% Emissions Reduction From Tier 1)
- EPA Mobile Nonroad Tier 4 Standards Are Scheduled To Be Phased In Starting In 2008 (Approx. 90% Emissions Reduction From Tier 1)



2006 MINING DIESEL EMISSIONS CONFERENCE

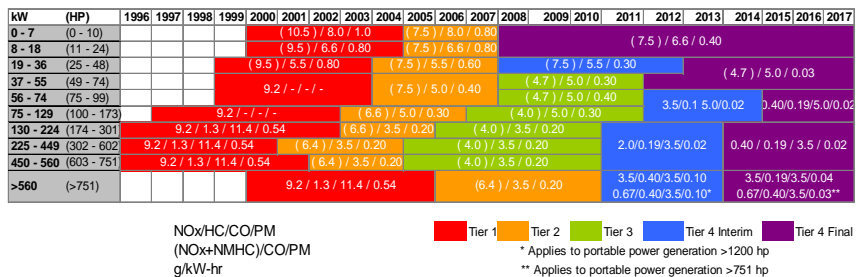
What Does Emission Legislation Mean To Engine Manufacturers?

- Family Selection Criteria
- Definitions
- In-use Testing
- Useful Life
- Engine Rebuild Requirements
- Replacement Engine Requirements
- Recordkeeping
- Labeling
- Selective Enforcement Audits
- Defect Reporting
- Flexibility Provisions
- Recall Testing, Recalls
- Averaging, Banking, Trading
- Emission Warranty
- Tampering
- Not To Exceed Limits
- Durability
- Exemptions
- Penalties



2006 MINING DIESEL EMISSIONS CONFERENCE

EPA Nonroad Standards Compliance Timeline



2006 MINING DIESEL EMISSIONS CONFERENCE

Where We Are Today:

- Engines 130 To 560 kW @ Tier 3
- Engines <129 Or > 560 kW @ Tier 2
- MSHA Certified Engines Are Exempt From EPA Nonroad Standards



2006 MINING DIESEL EMISSIONS CONFERENCE

How Does This Affect Us With Respect To:

- New Engines In New Vehicles Or Equipment
- Rebuilding Of Engines In Existing Equipment
- Remanufactured Engines Installed In Existing Equipment
- Installing New Engines In Existing Equipment

Each Scenario Requires A Somewhat Different Approach



2006 MINING DIESEL EMISSIONS CONFERENCE

- New Nonroad Vehicles Or Equipment Cannot Be Sold Unless They Contain A New Certified Nonroad Engine.
- Reman Or Rebuilt Engines Must Be To A Configuration Of The Same Or Later Model Year As The Original From An Emissions Standpoint
- For Rebuilt Engines, All Critical Emission Related Components Must Be Checked And Cleaned, Adjusted, Repaired, Or Replaced
- Emission Related Codes May Not Be Erased Or Reset Without Diagnosing And Responding Accordingly



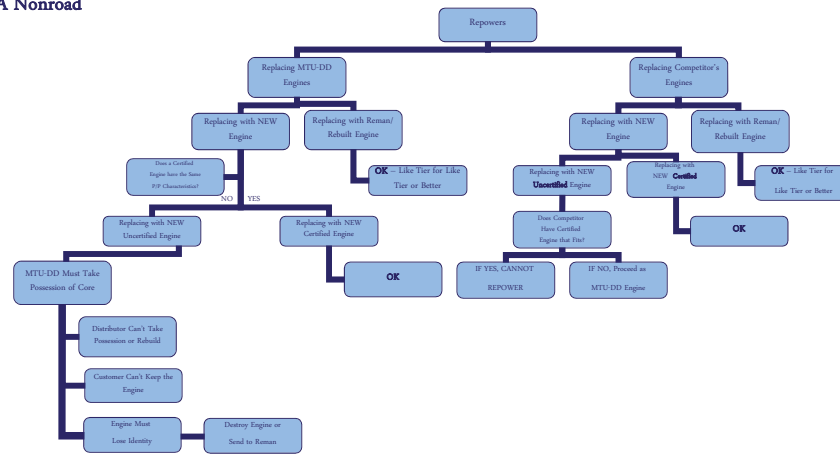
2006 MINING DIESEL EMISSION CONFERENCE

- Repowering Vehicles Or Equipment Has Become More Complex
 - Previous Tier Engines Versus Current Tier Engines
 - Repowering With New Engines
 - Original Engine Manufacture
 - Competitors Engine
 - Repowering With Reman / Rebuilt Engines
 - Original Engine Manufacturer
 - Competitors Engine
 - Issues With Core Engine



2006 MINING DIESEL EMISSIONS CONFERENCE

Example Of Replacing An Engine Under EPA Nonroad



2006 MINING DIESEL EMISSIONS CONFERENCE

- Today Canadian Standards Are Closely Aligned With US EPA Nonroad Standards For Tier 2 & Tier 3
 - Canadian Regulations Apply To All New Engines Manufactured On And After 1 Jan 06
 - Apply To Persons In The Business Of Manufacturing, Distributing, Or Importing For Sale, Into Canada, Off-Road Diesel Engines And Machines
 - Useful Life Requirements Parallel US EPA Useful Life Requirements
 - Regulations Allow For The Importation And Use Of Engines Participating In The US EPA ABT Program
 - Regulations Permit Importation And Use Of Engines Manufactured In Accordance With US EPA TPEM Provisions
 - Provisions For Replacement Engines And Remanufactured Engines
- Environment Canada Will Issue A Separate Regulation To Address Tier 4 Emission Standards

2006 MINING DIESEL EMISSION CONFERENCE

Historically Engine Manufactures Have Used Engine Design Modification Strategies To Meet Emission Requirements

- Advanced Combustion Chamber
- Retarded Injection Timing
- High Pressure Fuel Injection
- Electronic Controls
- EGR
- Waste-Gated / Variable Geometry Turbocharger
- Charge Air Cooling
- Etc.

Going Forward, Vehicle And Equipment Manufactures Will Necessarily Become More Involved In Meeting Emissions Requirements



2006 MINING DIESEL EMISSIONS CONFERENCE

US EPA Tier 4 Mobile Nonroad

- Final Rule Published Summer 2004
- New Standards Are Technology Driving
 - PM Will Likely Require Filters / Traps
 - NOx Will Likely Require Absorption Catalysts
 - Urea ?
- Responsibilities For Vehicle / Equipment Manufactures Increase
- New Standards Will Be Phased In From 2008 to 2015 Depending On Power Level



2006 MINING DIESEL EMISSIONS CONFERENCE

Tier 4 - General Requirements

- Applicability Remains The Same As Under 40 CFR 89
- Engine Manufacturers Must Provide Engine Installation Instructions To OEMs
- Engine Manufacturers Must Administer An In Use Testing Program
- To Enable Sulfur-Sensitive Control Technologies in Tier 4 Engines – e.g. Particulate Filters And NOx Absorbers – The EPA Has Mandated Reductions In The Sulfur Content Of Nonroad Diesel Fuels:
 - 500 ppm Effective June 2007
 - 15 ppm (ULSD) Effective June 2010
- The Tier 4 Rule Maintains The Same Engine Useful Life Provisions As 40 CFR 89



2006 MINING DIESEL EMISSIONS CONFERENCE

Tier 4 – Transition Program For Equipment Manufacturers

- TPEM Provisions In The Final Rule Include:
 - Percent Of Production Allowance
 - Technical Hardship Allowance
 - Small Volume Allowance
 - Hardship Relief
 - Existing Inventory Allowance
- OEMs Will Be Required To Notify US EPA Prior To The Use Of One Of The TPEM Allowances
- OEMs Will Be Required To Submit An Annual Report To US EPA Of The Number Of Exempted Engines Used
- OEMs Will Have To Apply A Label To The Piece Of Equipment Indicating That It Contains A TPEM Engine



2006 MINING DIESEL EMISSIONS CONFERENCE

Tier 4 – Labeling Requirements

- Labeling Requirements Are Carried Over From 40 CFR 89, With Some Additional Labeling Requirements For Engine Manufacturers
 - Must Include Fuel Information On Label
 - Must Label TPEM Engines
 - Must Label Exempt Stationary Engines
 - Must Label National Security Exempt Engines, Engines Which Are Solely For Export, Engines Used Solely For Competition, Etc.
- OEMs Must Apply A Label At The Fuel Tank Inlet Specifying Fuel Information
- OEMs Are Required To Provide A Written Request For Duplicate Labels And Maintain Documentation



2006 MINING DIESEL EMISSIONS CONFERENCE

Tier 4 – Not To Exceed

- Tier 4 Nonroad Engines Will Have To Meet Not-To-Exceed (NTE) Standards, Which Are Measured Without Reference To Any Specific Test Schedule
- The NTE Standards Become Effective In 2011 For Engines Above 130 kW; In 2012 For 56-130 kW; And In 2013 For Engines Below 56 kW
- In Most Engines, The NTE Limits Are Set At 1.25 Times The Regular Standard For Each Pollutant (In Engines Certified To NOx Standards Below 2.5 g/kWh Or PM Standards Below 0.07 g/kWh, The NTE Multiplier Is 1.5)
- The NTE Standards Apply To Engines At The Time Of Certification, As Well As In Use Throughout The Useful Life Of The Engine
- The Purpose Of The Added Testing Requirements Is To Prevent The Possibility Of “Defeating” The Test Cycle By Electronic Engine Controls And Producing High Off-Cycle Emissions



2006 MINING DIESEL EMISSIONS CONFERENCE

THANK YOU !



2006 MINING DIESEL EMISSIONS CONFERENCE

QUESTIONS?



