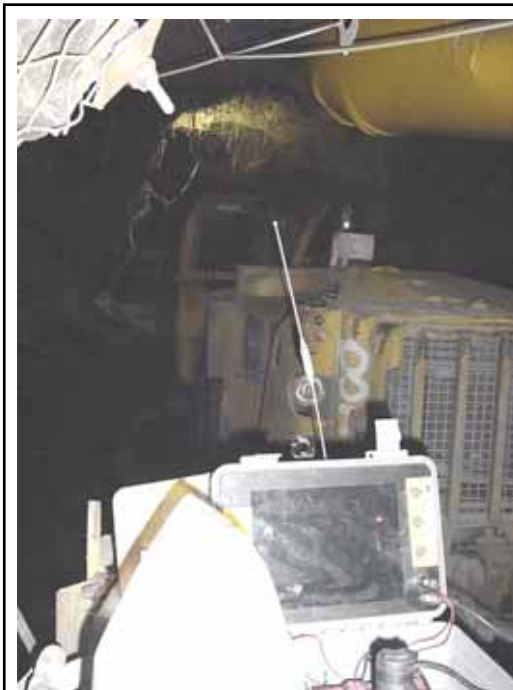


**MDEC 2009 - ROUND TABLE FORUM
ENGINES**



Facilitator: John Vergunst - Ontario Ministry of Labour





CONCERNS

- 1. Tier 4 Emission Control**
- 2. NO₂ Emission Control**
- 3. Maintenance**
- 4. DPM limits & Engines**

Engines

2

<p>MINING DIESEL mdec EMISSIONS COUNCIL</p> <p>15th ANNUAL MDEC CONFERENCE Sheraton Parkway, Toronto North, Canada October 6 - 9, 2009</p>  <p>MDEC WORKSHOP Advanced Diesel Engines and Emission Control Technologies for Underground Mines</p> <p>PRESENTED BY: CEP, Cummins, DCL, ECS, Kubota, NRCan & Toromont CAT</p> <p>COORDINATED BY: Maho Gangal, NRCan</p> <p>OCTOBER 6, 2009</p>	<h2>Tier 4 Engines</h2> <hr/> <p>Roundtable discussion fuelled by 2009 MDEC Diesel Workshop, “Advanced Diesel Engines & Emission Control Technologies for UG Mines”</p> <p>Engine Presenters:</p> <ul style="list-style-type: none">• Cummins• Kubota• Cat <p>Emission Control Presenters</p> <ul style="list-style-type: none">• CEP• DCL• ECS <hr/> <p>gines 3</p>
---	--

	<h2>Tier 4 Engines</h2> <hr/> <p>Tier 4 requires after-treatment technology as part of the engine package, such as</p> <ul style="list-style-type: none">• cooled exhaust gas recirculation (EGR)• staged turbo-charging• diesel particulate filters (DPF) for DPM and / or• selective catalytic reduction (SCR) for NOx / NO2• EPA will have anti-tampering that shuts down the engine <hr/> <p>2009 MDEC Engines 4</p>
---	--



Tier 4 Engines

- 2009 MDEC Diesel Workshop, Both Cummins and the Caterpillar showed concept drawings of their Tier 4 engines
- size of emission package - same size as engine.
- Retrofitting old equipment not an option, new equipment will have to be designed with the system.

2009 MDEC Engines

5

NO₂ Production

- EPA only measures NO_x and not NO₂
- Need to look at Tier 3 & 4 engines for NO₂ slip.
- Even without NO₂ emission control – it is unlikely mines can retrofit new engine packages into existing vehicles and in the existing engine platforms.



2009 MDEC Engines

6

Maintenance



- Engine & emission control systems require a multitude of sensors
- Maintenance will require a high level of training
- Suggested that a mine purchase a Tier 4 engine to determine the issues

2009 MDEC Engines 7

Maintenance

Tier 4i engines now available are not suitable for UG


A few are approved for coal.

Difficulty in obtaining replacement Tier 2 engines

If manufacturer replaces a Tier 2 with a Tier 3 or 4, they must certify that the old engine is destroyed.




2009 MDEC Engines 8




Maintenance

- MSHA & CANMET list obsolete engines that can no longer be purchased
- should be a separate list of available & approved engines.
- One Solution: look at the scrapped equipment and rebuild Tier 2 engines




2009 MDEC Engines 9



DPM

- many Canadian jurisdictions still use fixed ventilation rates (i.e. 100 cfm/bhp)
- These ventilation rates do consider the relative cleanliness of a new engine.
- U.S. Mines must meet a DPM standard of 160 $\mu\text{g}/\text{m}^3$ (therefore Tier 3 & 4 engines)
- Ontario is planning a 400 $\mu\text{g}/\text{m}^3$ standard

2009 MDEC Engines 10



DPM

- One Canadian mine stated DPM sampling shows they are 85% compliant with a 160 $\mu\text{g}/\text{m}^3$ standard - without using DPFs
- Other mines with older equipment may have problems in 100% compliance with a 400 $\mu\text{g}/\text{m}^3$ standard.
- In US coal mines, MSHA samples
- In Canada, the mines do their own sampling.

2009 MDEC Engines 11

ROUND TABLE RECOMMENDATIONS

1. Equipment manufacturers were not present at the Roundtable to listen to industry concerns and offer possible solutions.
MDEC had informed the OEMs of this conference
2. Mining companies stated that there should be a separate list of currently available and approved engines
3. Participants suggested that the mines try a Tier 4 engine and report on any special issues with maintenance or suitability

2009 MDEC Engines 12

ROUND TABLE RECOMMENDATIONS

- 4. Participants suggested that the Conference spend a whole day on engines.**

The 2010 workshop focused on Advanced Diesel Engines and Biodiesel)

- 5. Proposed that a field trip be organized to an engine manufacturing plant.**

Preconference field trip to the Cummins Diesel Engine Plant in Jamestown, NY, Oct 4/10