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MDEC 2007 Roundtable Forum Summary: Lubricants and Fuels

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October 2008



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Diesel Fuels For Mining


- CGSB Diesel Fuels In Canada
 - CAN/CGSB-3.16-99 (Mines Diesel)
 - CAN/CGSB-3.517 A-LS (Hwy fuel)
- Regulatory Framework
 - Three provinces require mines fuel.
 - Two allow mines or highway fuel.
 - Six specify flash and sulphur only.
 - One does not specify fuel at all.
- More information
 - CANMET Divisional Report MMSL 02-043

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Flashpoint and Safety

- Mines Fuel flashpoint is 52°C
- Highway fuel is ~38°C
- Some concern about suitability of highway fuel for use in very deep mines where ambient temperatures can reach 40°C.
- In addition, modern engines use circulating fuel to cool injection systems. This, combined with longer shifts (lower fuel levels in vehicle tanks), could create a possible risk.

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Diesel-Related Fires


- Most diesel-related fires in Ontario occur due to spilled or leaking fuel igniting on a hot surface (exhaust system, etc.)


Figure 1: Fuel Related Fires in Ontario Underground Mines (1)

Cause of Fires	1987	1988	1989	1990	1991	2004	2005	2006	2007
Refuelling – spill on engine, vent spray from fast fill systems	5	2	1	3	1	1	1	2	1 (3)
Fuel lines – loose fittings, worn hoses, rupture	2	3	3	1			8 (2)	1	
Fuel Tank – cracked, cap leak	1				1		1		
Fuel Pump – loose connection				1		1			
Fuel Filter – cracked					1				
	Information gathered when looking at on highway fuels with lower flash					Information from reports submitted by mines			

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Fuel Spray Ignition Flashpoint vs. Ignition Temperature

- Flashpoint adjustment does not help here since there is no vapour explosion.
- In fact, the ignition temperature of diesel is quite low (lower than gasoline) which makes it an excellent fuel for compression ignition engines.
- More work needs to be done to protect against fuel spray fires. Physical barriers, encapsulation, etc.

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Availability of Fuels

- May become difficult to secure a supply of high flashpoint fuel.
- Currently, refiners monitor product flash and divert high flash product to tanks for mines use. Highly dependant on feeds.
- Mines need to negotiate high flash supply.
- More research needs to be done on raising flash artificially with additives.

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Biodiesel and Alternative Fuels


- The degree of “carbon-neutrality” of biodiesel depends on the transportation of fuel to the mine.
- Local sourcing is best, but small, local suppliers may not be able to meet the fuel quality specs.
- ASTM-6751-07a standard for B100 blend component only. CAN/CGSB-3.520 for B1 to B5. No standard currently exists for B6 and up!
- Use of common blends like B20 are at the engine manufacturer’s discretion for warranty coverage!
- Other alternatives including synthetic diesel are still in the research phase.
- In particular, avoid ethanol-diesel or any alcohol based fuels, as there is a significant flashpoint reduction.

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Property	Value	Test Method
Flash point, min	> 40°C	D 93 or D 3828
Water and sediment, max	0.05% vol	D 1796 (mod.) or D 2709
Distillation T90, max	Type A: 290.0°C Type B: 360.0°C	D 86
Kinematic viscosity	Type A: 1.30 - 3.60 mm ² /s Type B: 1.70-4.10 mm ² /s	D 445
Ash, max	0.010% wt	D 482
Sulfur, max	0.05% wt	D2622 or D5453 or CAN/CGSB-3.0 No. 16.0
Cooper strip corrosion, max	No. 1	D 130
Cetane number, min	40.0	D 613
Electrical conductivity, min	25 pS/m	D 2624
Low-temperature flow, one of: - cloud point - wax appearance point - LTFT	Location & season dependant	D 2500 or D 5773 D 3117 CAN/CGSB-3.0 No. 140.1
Carbon residue, max	Type A: 0.10% wt Type B: 0.16% wt	D 4530
Acid number, max	0.10 mg KOH/g	D 974
Lubricity	When operability temp. < -20°C min. lubricity requirement must be met. Several options are available to measure lubricity.	SAE952370 or SAE981363 or SAE961944 or D6079 or D6078

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Additives

- Most bulk fuel does not routinely require additives.
- Additives are used to deal with specific handling or operability problems.
 - Anti-gel for biodiesel compatibility.
 - Biocides / anti-foaming, etc.
 - Lubricity additives
 - ULSD should comply with ASTM D6078 and D6079 methods.
 - New engines should be fine.

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Engine Lubricating Oils

- Biodiesel is hard on existing oils. When biodiesel gets into the oil, it can form sludge. Need for more monitoring.
- Water and glycerine in poor quality biodiesel can be an issue. Requires rigid fuel spec and compliance testing.
- Note that CJ-4 oil is now required for all 2007-8 engines. Its backward compatible to four-strokes, but should not be used in two-strokes.

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Further information

- Please review the session summary in your 2008 proceedings.
- Worldwide Fuel Charter
- <http://www.autoalliance.org/archives/000090.html>

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