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Summary of Worldwide Underground Mine Diesel Regulations

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- The information in this presentation is provided for general information only, and is not guaranteed for its accuracy or completeness.
- Users should make their own enquiries to obtain relevant information from the proper regulatory authorities prior to taking any decision on the basis of this information.

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Engine Approval Standards

- Canada
 - CSA-M414.1-88 for coal mines
 - CSA-M424.2-M90 for non-gassy mines
- USA - Coal Mines
 - 30 CFR Part 7, Subpart E, MSHA approved
 - Category engines A for gassy areas
 - Category engines B for all other areas
- USA – M/NM Mines
 - Part 7, Subpart E, MSHA approved engines
 - Part 36, MSHA approved engines
 - EPA approved Tier 2 or higher engines

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CANADA - Mining Regulation


- Varies - Provinces & Territories
 - 9 Provinces (No mining in PEI)
 - 3 Territories


Exemption

- Crown Corporation mines and uranium mines are under the jurisdiction of Federal Government

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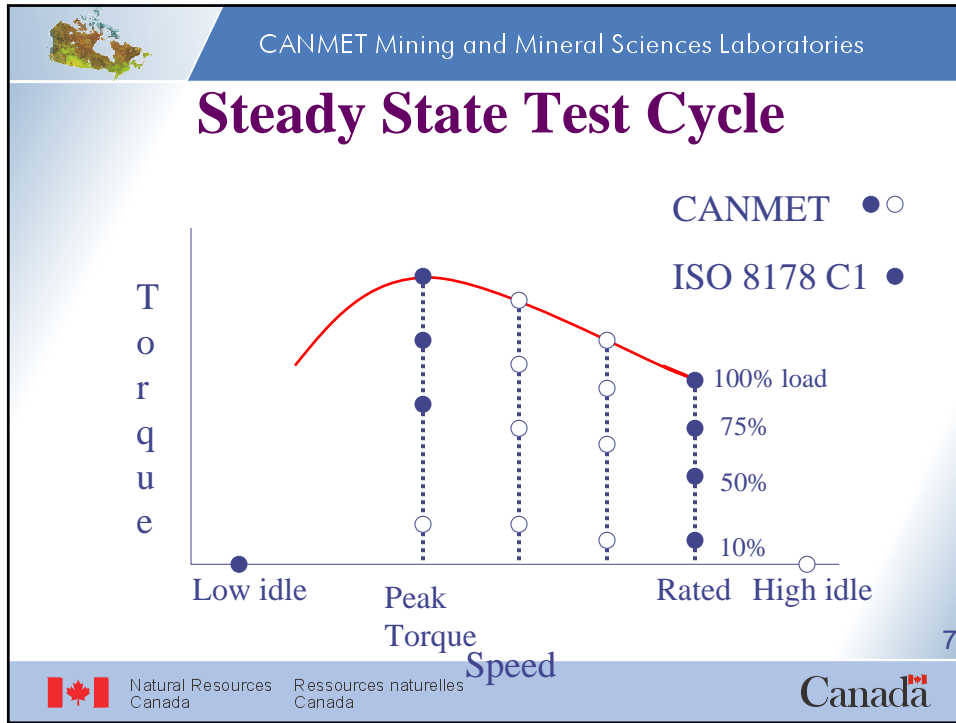
Engine Approval Test- Canada & USA

- Testing of new engines on dynamometer
 - Confirmation of engine power and fuel
 - Use of standard test fuel (CAN/CGSB-3.16, US 40CFR. 86.113)
 - Maximum engine intake restriction
 - Maximum engine backpressure
 - Steady state testing at number of modes
 - Raw exhaust measurement- CO, CO₂, NO, NO₂
 - Measurement of DPM – gravimetric method
 - Calculation of ventilation rates

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Engine Approval - Canada & USA Raw Exhaust-Not To Exceed Limits

	CO ppm	NOx ppm	DPM mg/m ³
CSA (Coal mines) - Canada (1.25% of methane by volume in intake air for dynamometer testing)	2500	1500	150
CSA (non-gassy) - Canada	2500	1500	150
Category A - USA (1% of methane by volume in intake air for dynamometer testing)	3000	2000	--
Category B - USA	2500	2000	--

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Engine Ventilation – CSA/Canada

Exhaust Quality Index (EQI) =



$$\frac{\text{CO}}{50} + \frac{\text{NO}}{25} + \frac{\text{DPM}}{2} + 1.5 \left[\frac{\text{SO}_2}{3} + \frac{\text{DPM}}{2} \right] + 1.2 \left[\frac{\text{NO}_2}{3} + \frac{\text{DPM}}{2} \right]$$

Where, DPM (mg/m³) and gas concentrations (ppm) are measured in raw exhaust gas

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Engine Ventilation - Canada & USA


- CSA – Canada
 - Ventilation rate is based on individual 18 mode testing
 - Dilution air is Calculated at each test mode to reduce EQI to a value of 3.
 - Ventilation rate is the highest dilution air
- MSHA - USA
 - Ventilation is based on individual 8 mode testing
 - Dilution air is calculated at each mode to reduce gaseous emissions: CO₂ to 5000 ppm, CO to 50 ppm, NO to 25 ppm, and NO₂ to 5 ppm
 - Gaseous ventilation rate is the highest dilution air
- Particulate Index (PI) is based on a weighted average of 8 mode testing, and is amount of dilution air to reduce weighted average to 1 mg/m³

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Approved Engines – Ventilation Rate

- CSA - Canada
<https://diesel.nrcan.gc.ca>
- MSHA – USA
<https://lakegovprod3.msha.gov/ReportView.aspx?ReportCategory=EngineAppNumbers>
 - Permissible Engines #:
 - 7E-A001 or 07-EPA030001
 - Non-permissible Engines #:
 - 7E-B001 or 07-ENA030001

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Engine Ventilation Requirement


Mines	Ventilation
British Columbia	Ventilation as per CSA standard, minimum of 0.06 m ³ /kWs.
Alberta	Ventilation as per CSA standard. Minimum air volume of 1.9 m ³ /s at active headings, and minimum air velocity of 0.3 m/s.
Saskatchewan	Ventilation as per CANMET approval, or minimum of 0.06 m ³ /kWs.
Manitoba	Ventilation as per CANMET or MSHA approval, or 0.092 m ³ /kWs for non-approved engine. 100/75/50 rule for multi-engines and minimum ventilation of 0.045 m ³ /kWs.
Ontario	Minimum ventilation of 0.06 m ³ /kWs.
Quebec	Ventilation as per CANMET or MSHA CFR 30 Parts 31 and 32 or 0.092 m ³ /kWs for non-approved engines. 100/75/50 rule for MSHA approved Part 31/32 multi engines, and non-approved multi-engines up to a minimum ventilation of 0.045 m ³ /kWs.

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Engine Ventilation Requirement


Mines	Ventilation
New Brunswick	Engine approval is required for engines above 75 kW. Minimum ventilation of 0.067 m ³ /kWs.
Nova Scotia	Engine approval is required. Minimum air velocity of 0.33 m/s for coal mines.
Newfoundland & Labrador	Engine approval is required from Chief Inspector of mines. Minimum ventilation of 0.047 m ³ /kWs.
Northwest & Nunavut	Requires a permit (engine approval) from Chief Inspector of mines. Ventilation as per CANMET or MSHA engine approval, otherwise a minimum ventilation of 0.06 m ³ /kWs.
Yukon	Requires completion of director prescribed application form and approval. Minimum ventilation of 0.06 m ³ /kWs.
China	Minimum ventilation of 0.067 m ³ /kWs
Australia	Minimum ventilation of 0.06 m ³ /kWs
USA	As per MSHA certificate
South Africa	Minimum of 0.063 m ³ /kWs based on best practice

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Diesel Fuel

	Sulphur Maximum, ppm	Flash Point Minimum, °C
Canada	500 – 5000*	40 - 52
USA	500**	38
Australia	10	61.5
South Africa	No regulation yet	


*Only 15 ppm sulphur fuel available now due to Federal Regulation

** 15 ppm sulphur fuel more common in mines

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Diesel Fuel Regulation - Canada

Mines	Sulphur, maximum	Flash Point, minimum
British Columbia	CAN/CGSB-3.16-M88, Mining diesel fuel	
Alberta	CAN/CGSB-3.16-99, Mining diesel fuel	
Saskatchewan	0.05% (500 ppm)	52°C
Manitoba	CAN/CGSB-3.16-99, Mining diesel, special-LS, or CAN/CGSB-3.517-93, Automotive diesel, type A-LS	
Ontario	CAN/CGSB-3.16-99, Mining diesel, special-LS, or CAN/CGSB-3.517, Automotive diesel, type A-LS	
Quebec	0.05% (500 ppm)	--
New Brunswick	--	--
Nova Scotia	CAN/CGSB-3.517 Automotive diesel (for above 30°C use CAN/CGSB-3.16-99, Mining, special-LS)	
NFLD & Labrador	3-GP-6 or latest version of CGSB Mining diesel fuel	
Northwest & Nunavut	0.25% (2500 ppm)	43°C
Yukon	CAN/CGSB-3.16-99, Mining diesel fuel, or similar standard acceptable to director	

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DPM Exposure Limits (mg/m³)

British Columbia	1.5
Alberta	ACGIH
Saskatchewan	--
Manitoba	ACGIH
Ontario	0.4 (TC)
Quebec	0.6
New Brunswick	1.5
Nova Scotia	1.5
NFLD & Labrador	ACGIH
Northwest & Nunavut	1.5
Yukon	1.5
USA	0.16 (TC)*
Australia	0.1 (EC)
South Africa	--

*Metal/Non-Metal mines

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USA - DPM Emission Limits for Underground Coal Mines – Part 72.500

- Permissible Equipment
 - 2.5 grams/hour
- Heavy-Duty Equipment (Cuts/Moves Rock/Coal, Drilling or Bolting, Longwall Components, Fuel Transport)
 - 2.5 grams/hour
- Light-Duty Equipment
 - 5 grams/hour

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Gaseous Exposure Limits (ppm)


Mines	CO	CO ₂	NO	NO ₂	SO ₂
British Columbia	25	5,000	25	3	2
Alberta	25	5,000	25	3	2
Saskatchewan	25	5,000	25	3	2
Manitoba	20	5,000	25	3	--
Ontario	25	5,000	25	3	2
Quebec	35	5,000	25	3	2
New Brunswick	25	5,000	25	3	2
Nova Scotia	25	5,000	25	3	--
NFLD & Labrador	25	5,000	25	3	2
Northwest & Nunavut	25	5,000	25	3	2
Yukon	50	5,000	25	5	5
USA	50	5,000	25	5	--
Australia	30	5,000	25	3	2
South Africa	35	9,000	30	5	--
China	17	5,000	12	3	2
Switzerland	30	5,000	30	3	0.5

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Gaseous Short Term Exposure Limits (ppm)


Mines	CO	CO ₂	NO	NO ₂	SO ₂
British Columbia	--	30,000	--	5	5
Alberta	--	30,000	--	5	5
Saskatchewan	190	30,000	38	5	5
Manitoba	--	30,000	--	5	0.25
Ontario	100	30,000	--	5	5
Quebec	200	30,000	--	--	5
New Brunswick	--	30,000	--	5	5
Nova Scotia	--	30,000	--	5	0.25
NFLD & Labrador	--	30,000	--	5	5
Northwest & Nunavut	--	30,000	--	5	5
Yukon	400	15,000	35	--	5
Australia	200	30,000	--	5	5


ACGIH 2009: SO₂ STEL value reduced to 0.25 ppm

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Baseline Engine Testing (Australia)


Raw Exhaust Emissions*	Maximum variance (%)
CO and NO _x < 500 ppm	25%
CO and NO _x > 500 ppm	15%
DPM (cleaner engines)	30%
DPM (dirtier engines)	15%


* As per the required test procedure

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Switzerland (SUVA, 2000)

- Equipment must be equipped with DPF systems
- Meet Suva SAFEL filter list quality requirement
- Some exemptions
 - Equipment Not used for regular work and less than 1 hour per day
 - Engine less than 50 kW, with service less than 2 hours

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Thank You !

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