



 Natural Resources Canada Ressources naturelles Canada

DEEP Light Duty Vehicle Project Update

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LDV Project Goals

- To determine the relative contribution of light-duty vehicles to the overall underground diesel particulate matter burden.
- Must therefore test heavy-duty as well as light-duty vehicles.

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Current Status

- DEEP LDV Proposal 1999
- Phase I - Complete 1999-2000
- Phase II – Complete 2001-2002
- Final Report – December 2002

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Phase I Results

- <http://www.deep.org/research.html>
- Selection of mine for field study
- Kidd Creek Mine fleet survey
- Characterization of HD vehicle fleet
- Instrumentation package trials
- Selection of target HD vehicles:
 - 4 LHD's
 - 3 Haulage Trucks

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Phase II Steps

- Development of HD instrument package
- Development of LD instrument package
- Lab testing and validation
- Field trial Part I (Heavy-duty vehicle tests)
- Analysis and selection of LD target vehicles
- Field trial Part II (Light-duty vehicle tests)
- Final Report

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Instrumentation Package

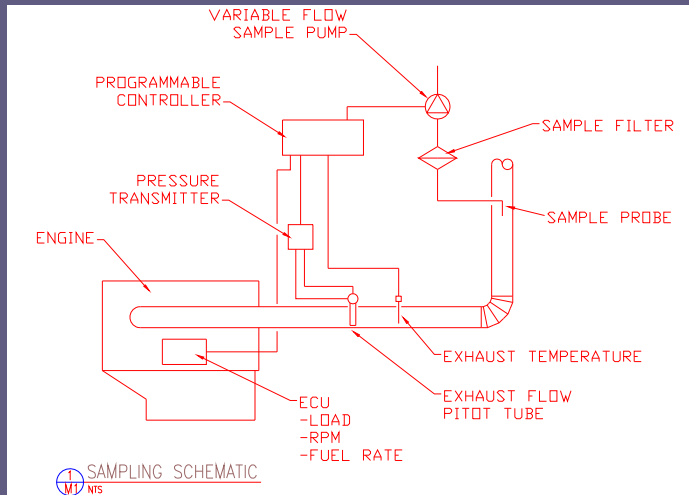
- Monitored parameters:
 - Engine exhaust flowrate (V_{exh})
 - Mass concentration of diesel particulate matter (C_{dpm})
 - Vehicle duty cycle as a percentage of rated load (D_{cyc})

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Sampling System



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Lab Testing and Validation

- Validation of proposed system at CANMET diesel testing facility.
- Flow calibration against ASME venturi meters and AVL 734 fuel meter.
- DPM sampling calibration against Sierra BG-2 Micro-dilution tunnel.
- Validation criteria was met, prototype system was constructed.

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Phase II – Part I HD Test at Kidd Creek

- Haulage trucks
 - 33661 EJC 430
 - 33661 EJC 430 (repeat)
- LHD production vehicles
 - 33635 8 yd Toro 501D
 - 33638 8 yd Toro 501D
 - 33616 6 yd Toro 400D
 - 33626 3.5 yd Wagner

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DPM Sampling Method

- Install DPM sampling system in u/g shop area at the beginning of shift.
- Follow vehicle to its working area.
- Monitor vehicle operation and exchange filters as required.
- Continue sampling until duty cycle was identified and repeated several times. Sampling time was 2 - 3 hours.
- Returned to shop area, removed equipment and released vehicle.

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3.5 yd Wagner LHD



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8 yd Toro 501D LHD



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EJC 430 Truck



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Operator Exposure

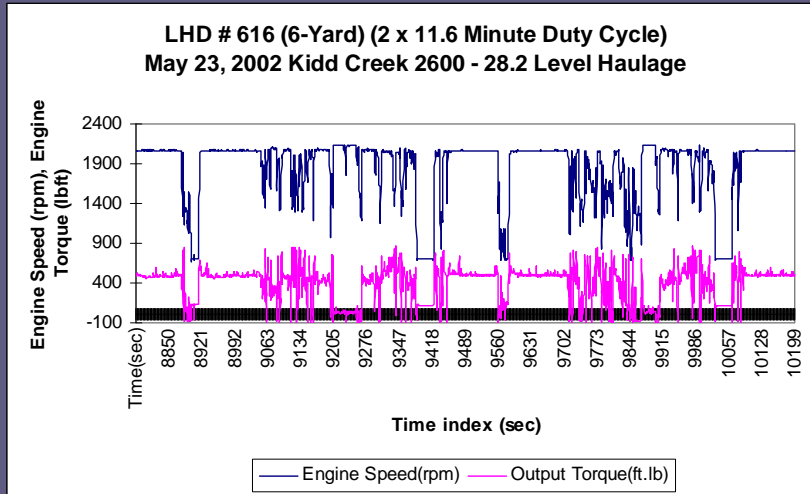


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Mining Duty Cycles

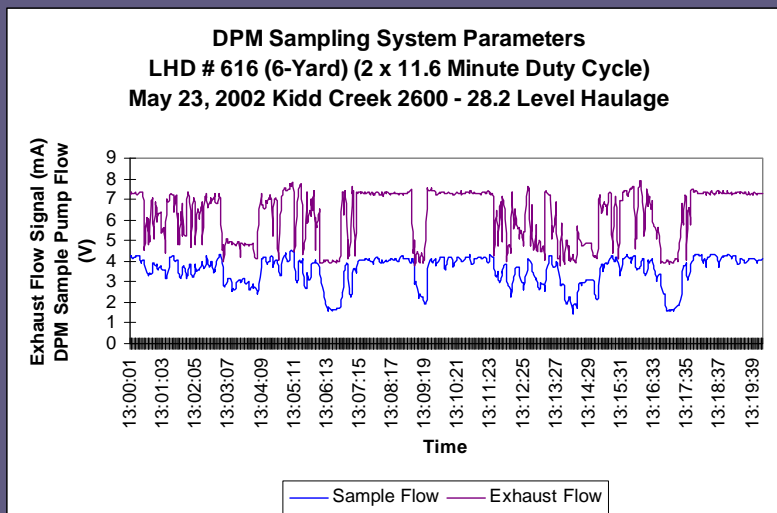


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Sampling System Response



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DPM Emission Data

Toro 400D 6-yd LHD						
DPM Mass Emissions						
Filter Cassette	Start Time	End Time	Sample Time	DPM (mg)	Cycle Description	Notes
GF-108-02	10:56	11:32	0:36	3.92	Up ramp 4800-3000	Traffic
GF-107-02	11:33	12:10	0:37	4.27	Up ramp 3000-2800	
GF-106-02	12:11	12:30	0:19	2.79	Up ramp turn on fan	
GF-103-02	12:31	12:42	0:11	1.94	One cycle 28-2 - 2600	
SM-147-02	12:43	12:53	0:10	1.77	One cycle 28-2 - 2600	
QZ-173-02	12:53	13:05	0:12	1.78	One cycle 28-2 - 2600	Traffic
GF-104-02	13:05	13:16	0:11	1.75	One cycle 28-2 - 2600	
SM-148-02	13:16	13:26	0:10	1.82	One cycle 28-2 - 2600	
QZ-185-02	13:26	13:36	0:10	1.70	One cycle 28-2 - 2600	
GF-105-02	13:36	13:46	0:10	1.53	One cycle 28-2 - 2600	No load

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System Durability



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Phase II – Part II LD Tests at Kidd Creek

- Observation of fleet and discussions with operators and supervisors
- Kidd Creek LDV fleet very complex
 - Diesel pick-ups
 - Drills/Bolters/Scalers
 - Utility trucks (construction/maintenance)
 - Tractors
 - Misc. (pumps/generators/lift trucks)

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LD Vehicle Testing

- Testing of 6-8 LD vehicles targeted by characterization team as representative of fleet
 - #33348 - Chevrolet Pick-up - 4600 Shop service vehicle (Service)
 - #33325 - Ford Pick up - 4600 Shop (Mobile Maintenance)
 - #33336 - Dodge Pick-up - "D" Mine (Development)
 - #33966 - Kubota 5030 Tractor - Ore & Waste, #3 Mine (Supervisory)
 - #33952 - Kubota 5030 Tractor - Upper Mine # 1 (Construction)
 - #33973 - Driftec Shotcrete Sprayer - (Lateral Development)
 - #33872 - Getman Scissor lift - (Supply and Sanitation_
 - #33899 - Getman A64 Boom Truck - Upper Mine(Construction)

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Pick-Up Trucks



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Kubota Tractors



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Utility Vehicles



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Final Report

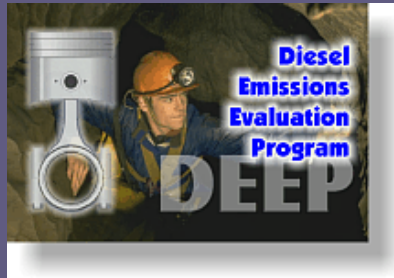
- Determination of duty-cycle resolved DPM mass emission rates for light and heavy-duty vehicles.
- Extrapolation of emission rates to entire Kidd Creek Fleet.
- Determination of contribution of light-duty vehicles to underground DPM burden.
- Issue final report to DEEP in December 2002.

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Questions?



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