

# NEW CHEMICAL TRACERS FOR DIESEL SOURCE EMISSION APPORTIONMENT IN AMBIENT FINE PARTICULATE MATTER

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## Tracer Molecules

- Source apportionment in ambient air: chemical mass balance modeling (CMB) with emission profiles from databases (volatile organic compounds (VOCs), semivolatile organics (SVOCs) and inorganics)
- Hopane/sterane correlation between PM and lubricating oil composition profiles
- Hopane/Sterane: Cyclic hydrocabons found in crude
- Contribution from vehicle emissions: hopanes/steranes and EC/OC data

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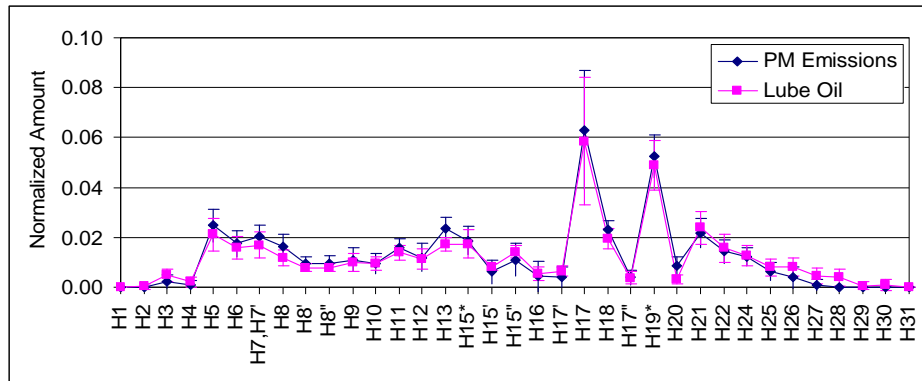


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## Tracer Molecules



Average relative distribution profiles of hopanes in PM and lubricating oil samples.

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## Tracer Molecules

**DOE Gasoline/Diesel PM Split Study (Lawson, Fujita *et al.*) PAHs: indeno[123-cd]pyrene, benzo(ghi)perylene and coronene, as potential gasoline tracers:**

- Used lube oil in gasoline vehicles contains heavier pyrogenic PAHs
- Heavier PAHs undetected in most diesel exhaust samples, fuel and lube oil
- Concentrations increase with the age of the oil

**Forensic fingerprinting for oil spill characterization/source identification:**

- *Drimane-based bicyclic sesquiterpanes* were shown to be ubiquitous in crude oils (Stout, Environmental Forensics, 2005)
- Potential tracers for diesel fuel: *bicyclic sesquiterpanes*, *adamantanes* (Wang, Stout and Fingas, Environmental Forensics, 2006)

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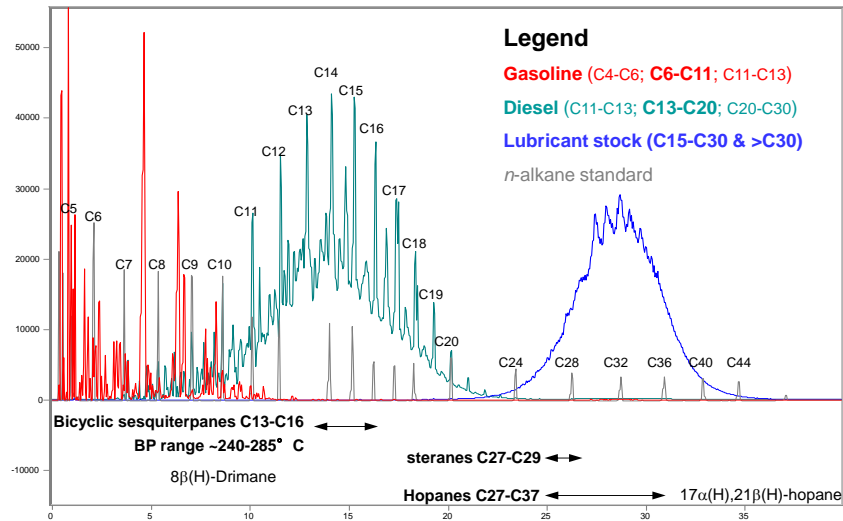


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## Strategy – Diesel Tracers



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## Sampling

### Gasoline vehicle:

Chrysler PT Cruiser (2.4L 4-cyl engine)  
Test cycles: LA4, US06, LA92, NYCC

### Diesel fuel vehicle:

HD truck International 9200i  
(Cummins 8.9L 6-cyl 320 HP/1150 lb-ft);  
B2 diesel fuel; Test cycle: HD UDDS

### Sampling: Filters

Zefluor (Teflon primary; PM 2.5μm )  
Empore (XAD coated secondary; volatiles)

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## Filter Analysis

Thermal Desorption Gas Chromatography Mass Spectrometry (TD-GC/MS) to analyze filter punches for new tracers



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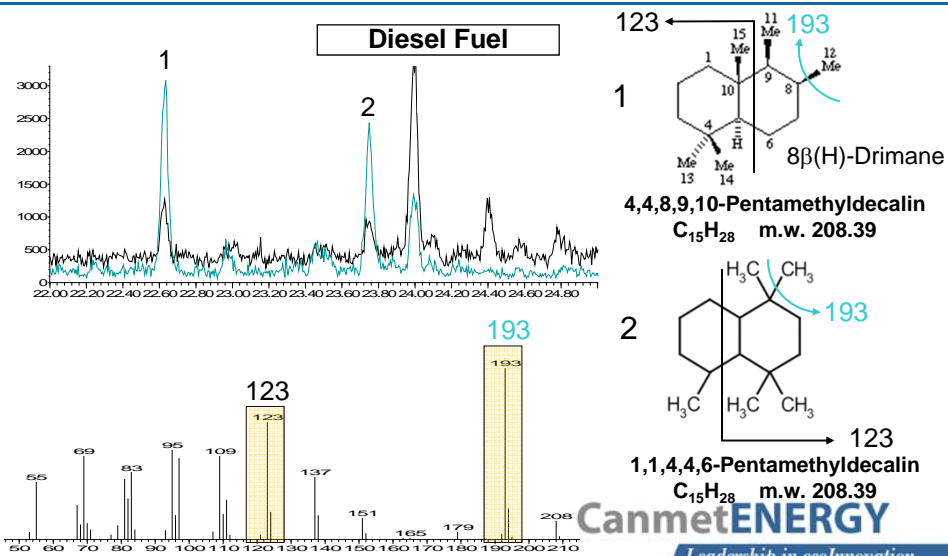
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## GC/MS Analysis of Drimanes



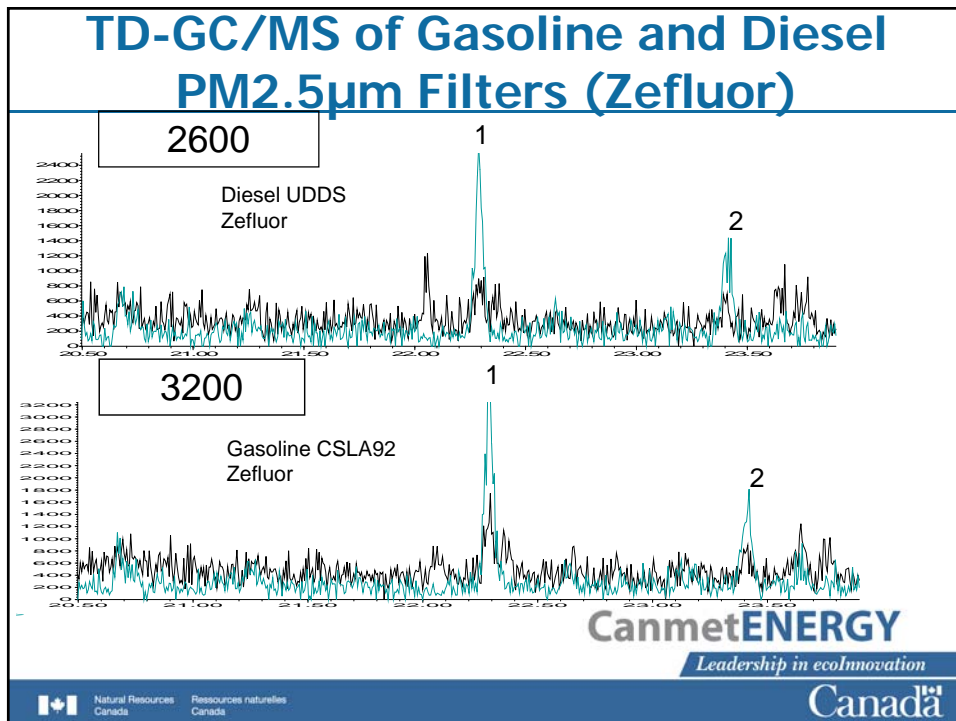
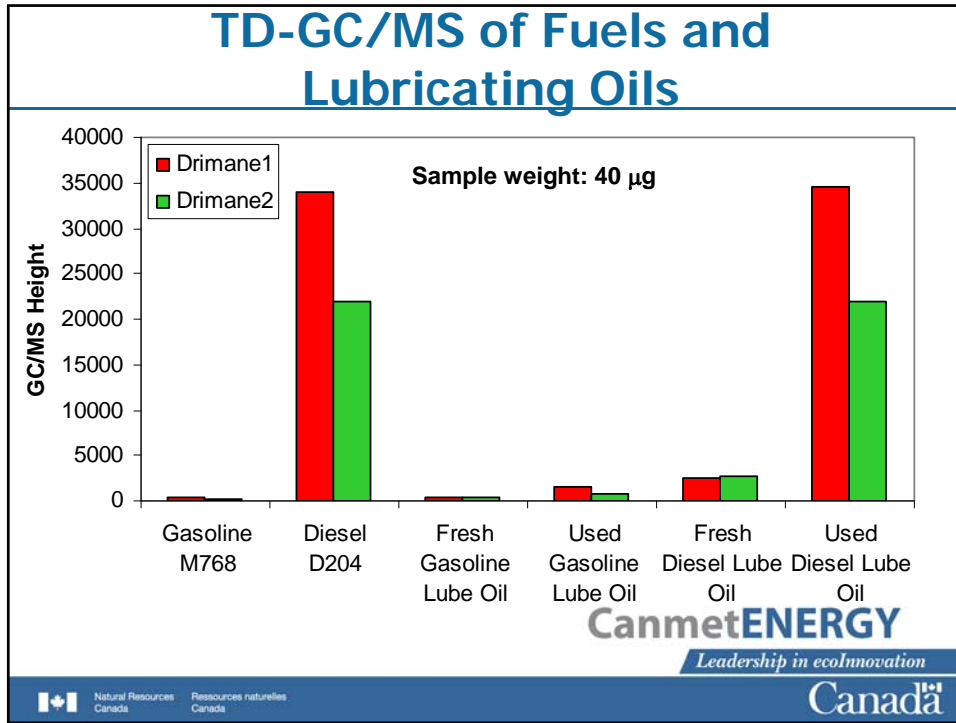
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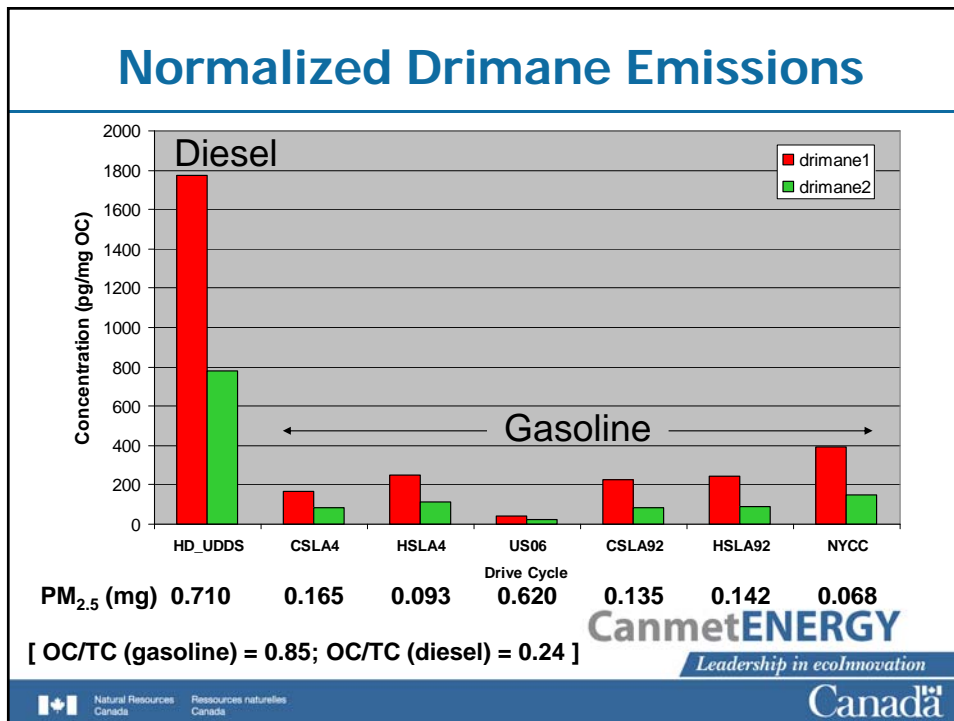
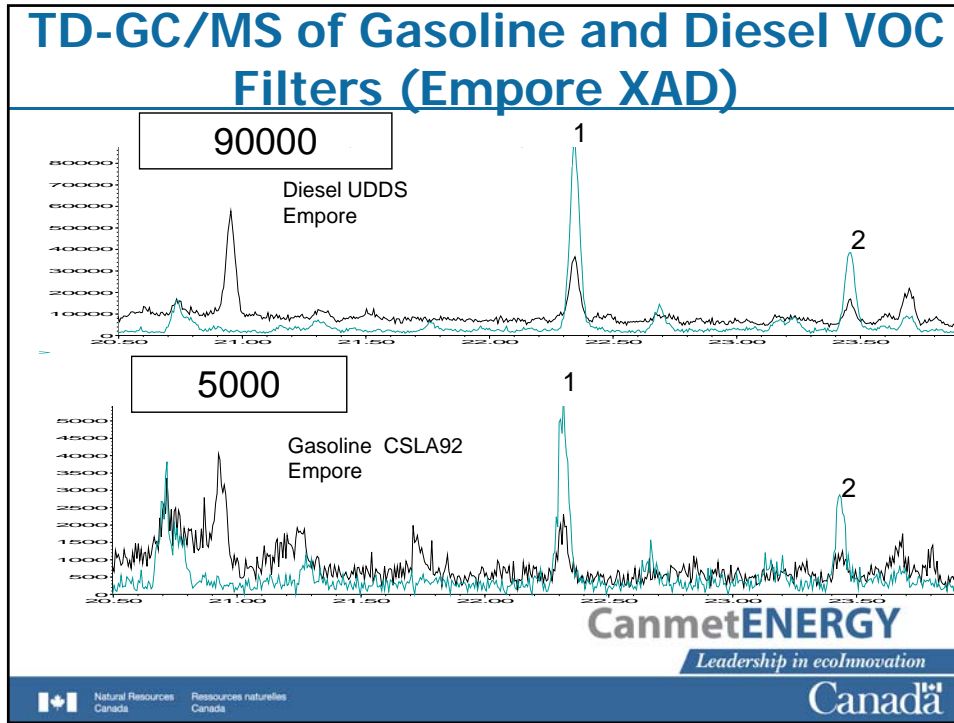
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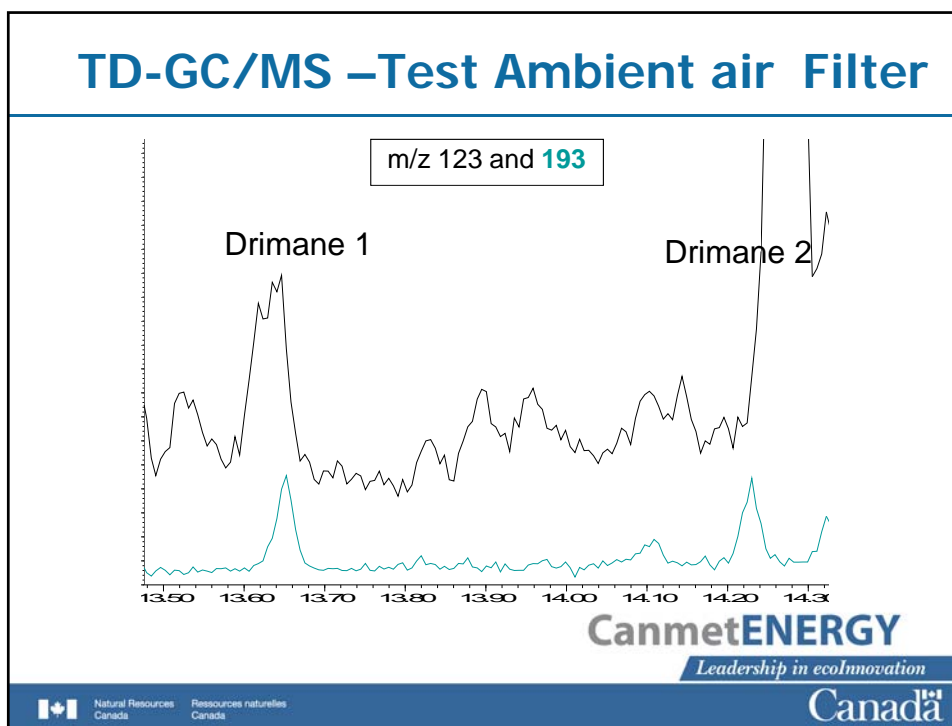


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## Summary - Conclusions

- Analysis of drimanes in fuels, lubricating oils and emissions by TD-GC/MS
- First attempt at ambient aerosol filters
- Combination of drimane tracers with gasoline PAHs to provide a method to apportion gasoline and diesel emissions
- Apportionment done in conjunction with a transportation profile based on the hopane/sterane distribution in PM collected on filters

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## Future work

- Decomposition issues of XAD filters using TD-GC/MS
- Testing other alternatives. (liquid extraction of XAD filters or use of other sorbents)
- Field sampling study (Montreal) to obtain more ambient air samples.
- Expanding list of source samples for analysis of drimanes. (Other gasoline and diesel engines)

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Thank you for your attention; questions?

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