

## Influence of Catalytically Active Particulate Trap on the Chemical Composition of Diesel Exhaust Gas

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DCL International Inc.  
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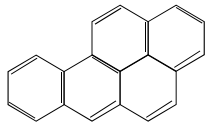


### Background

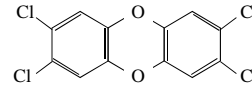
- ❑ Toxic and carcinogenic effects of diesel exhaust gas components (polycyclic aromatic hydrocarbons, PAH)
- ❑ Formation of Nitro-PAH due to reaction between PAH and NO<sub>x</sub>
- ❑ Formation of polychlorinated dibenzodioxins and furans (PCDD/F)



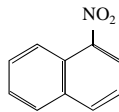
## Background



PAH: Benzo(a)pyrene



PCDD: 2,3,7,8-Tetrachlorodibenzodioxin



Nitro-PAH: 1-Nitro-Naphthalene



## Objective

To determine the effect of DCL's catalyzed particulate trap system (MINE-X<sup>®</sup>) on critical diesel exhaust components such as PCDD/F, PAH, and Nitro-PAH



## Methodology

- Measurement of regulated pollutants
  
- Influence of catalyzed trap system on PAH emission and formation of Nitro-PAH and PCCD/F



## Experimental Setup

- Diesel engine: Liebherr, type 914T, 6.11L, direct injection. Rating 110kW and 2000 RPM
  
- Emission measurement based on ISO 8178/4 C1 cycle
  
- Sample collection during 2 cycles, 200 min of driving



## Experimental Setup

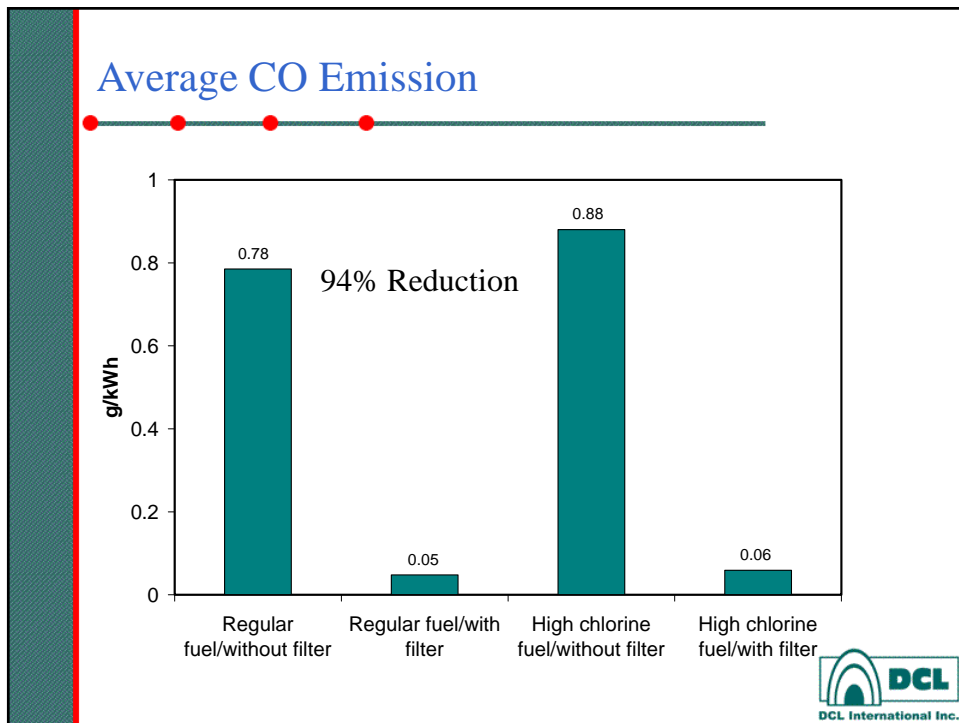
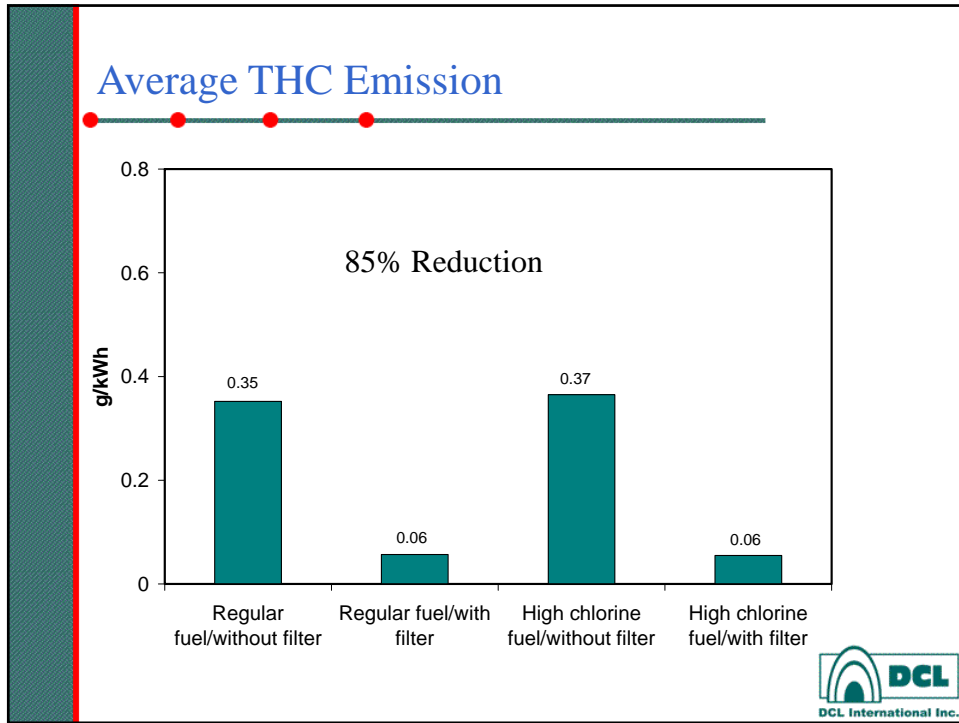
- ❑ Commercially available diesel fuel, 16ppm sulfur content
- ❑ Addition of 1,6-dichlorohexane to increase chlorine to 11ppm

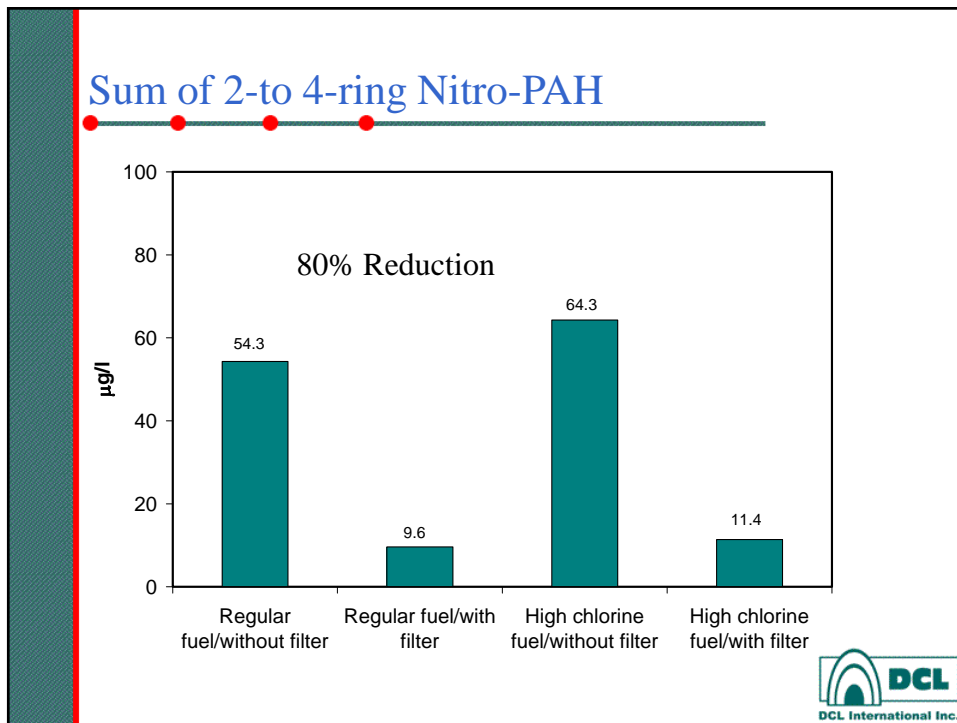
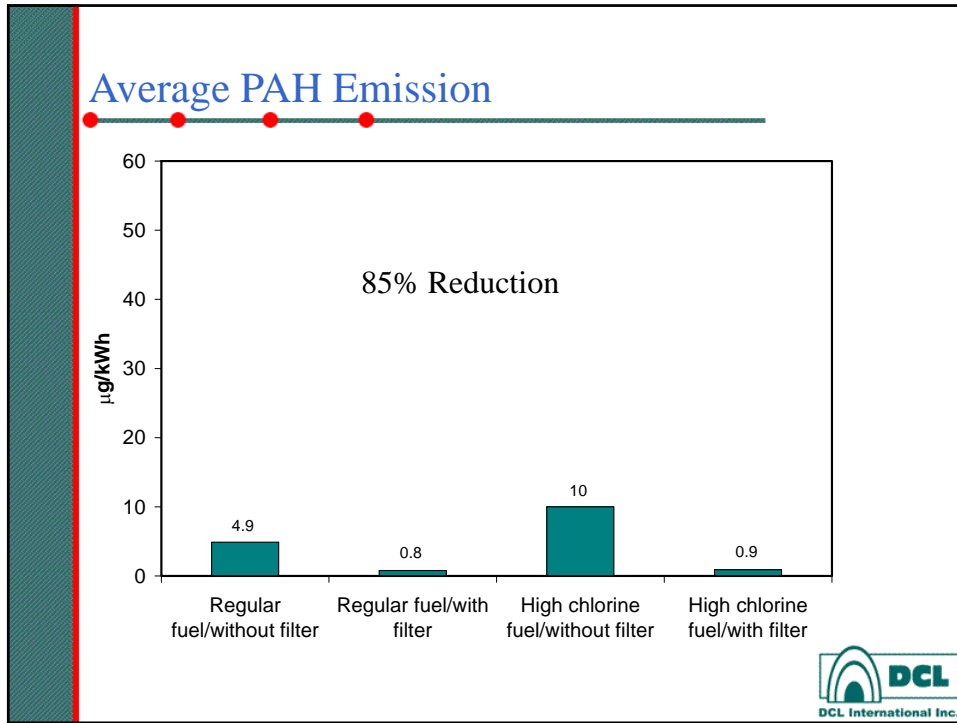


## Measurement Techniques

- Unregulated pollutants samples from undiluted exhaust gas
- ❑ PCDD/F isomers separation by capillary gas chromatography, detection by mass spectrometry
  - ❑ PAH and Nitro-PAH detection by electron impact ionization mass spectrometry (EI-MS)





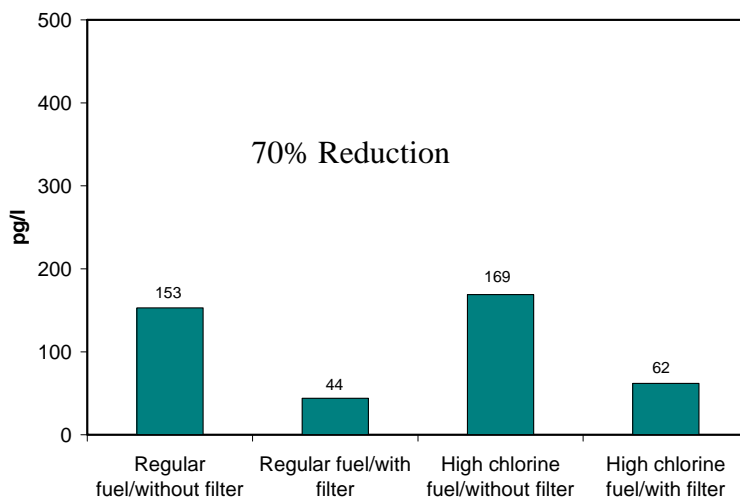


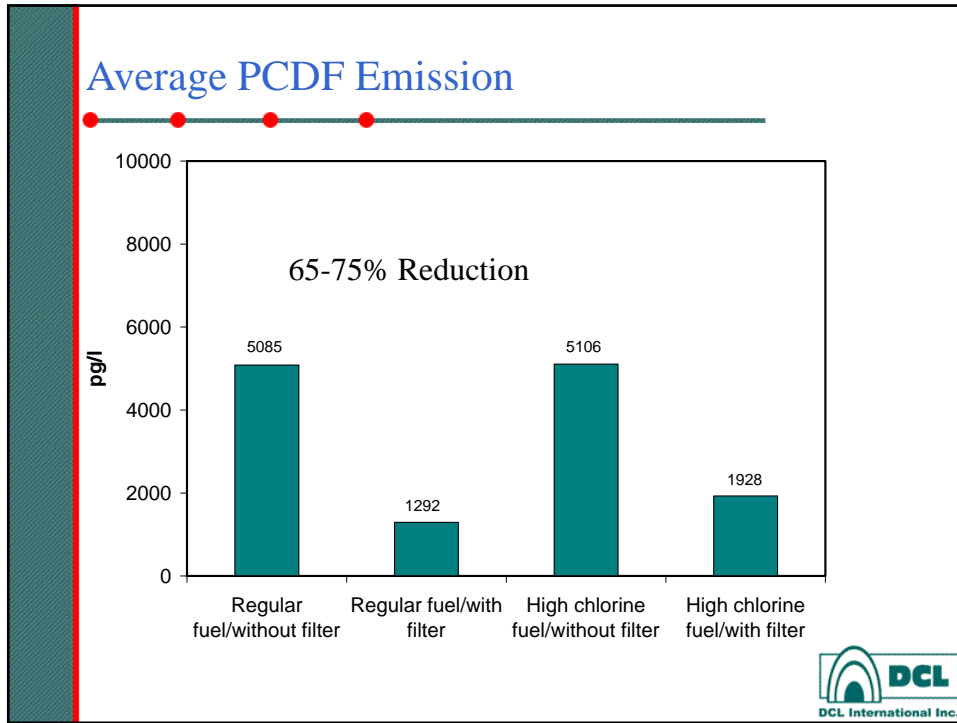
### Nitro-PAH Compounds Reduction

Compounds	Reduction (%)
1-Nitro-Naphthalene	75
3-Nitro-Phenanthrene	45
1-Nitro-Pyrene	55



### Average PCDD/F Emission





### Summary of PCDD/F Emissions

**No significant increase in PCDD/F emission**  
even at the worst case scenario with  
high chlorine content

DCL International Inc.



## Summary

- Influence of DCL's MINE-X<sup>®</sup> particulate trap system on chemical composition of diesel exhaust gas
- 85 and 94% reduction of THC and CO emissions, respectively
- 60-70% reduction of carcinogenic PAH



## Summary

- Reduction rates of Nitro-PAH
- Reduction of 1-nitro-pyrene by more than 50%
- No increase in PCDD/F emission  
Reduction by a factor of 3 at standard and worst conditions



## Acknowledgement

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