Mammoth
Equipment and Exhausts

# Controlling Diesel Particulate Matter thru Filtration

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MDEC 2018

## Global Diesel Emissions Solution Provider

**Office/Warehouse/Production**
- Canada
- Mexico
- Argentina

**Dealer**
- USA / Elko

**Australia**
- Western Australia (HQ)
- Northern Territory
- Queensland Nth
- Queensland Sth
- New South Wales
- Victoria
- South Australia
- Tasmania

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## Field Trial – Vale Ontario Mine

- Developing a strategy to fit diesel equipment with Diesel Particulate Filters
- April 2018 began 1st trial of a Mammoth DPF on an AD30 Haulage Truck
- May 2018 began trial on a Toyota

Field tests to-date (7) Haulage Truck:

- Average CO reduction of 80.2%
- Average NO2 reduction of 38.4%
- Smoke dot colour post filter 0 to 2

Field tests to-date (3) Toyota:

- Average CO reduction of 26.1%
- Average NO2 reduction of 59.1%
- Smoke dot colour post filter 3 to 4

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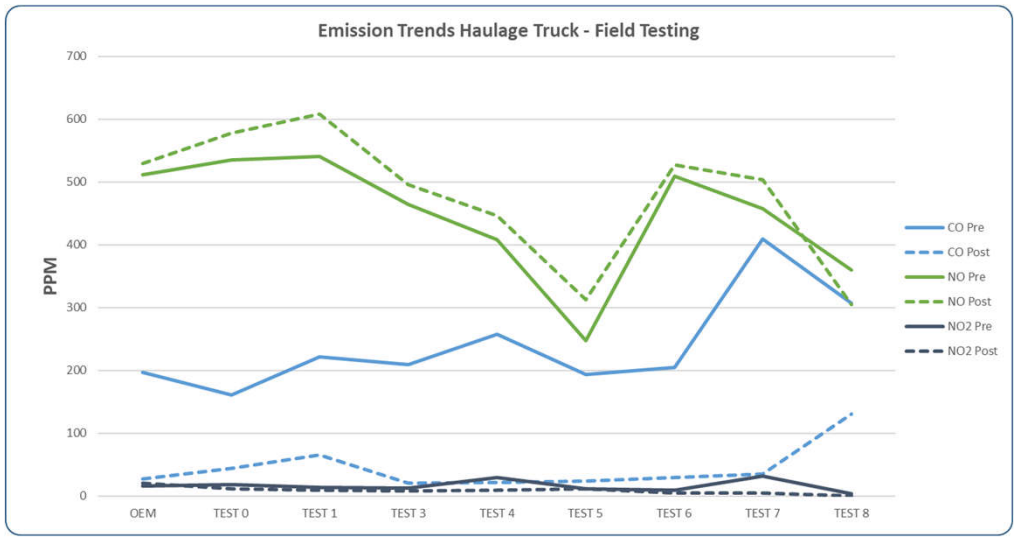
## Field Trial – Vale Ontario Mine

CAT AD3 0 – C15

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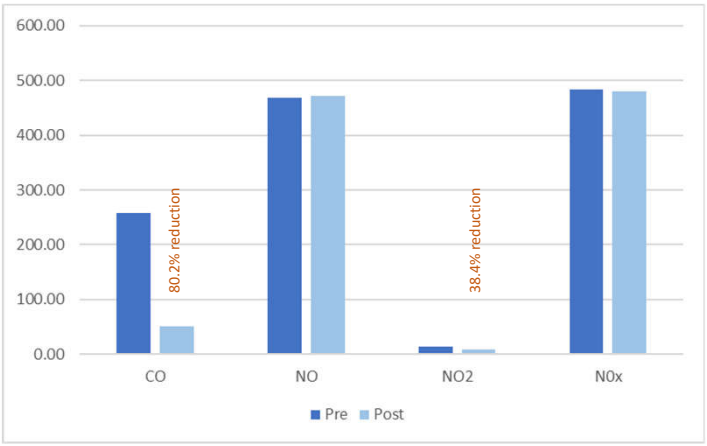
## Field Trial – Vale Ontario Mine
## Average reductions across 6 tests

**DPF installed on CAT AD30 Haul truck (C15)**

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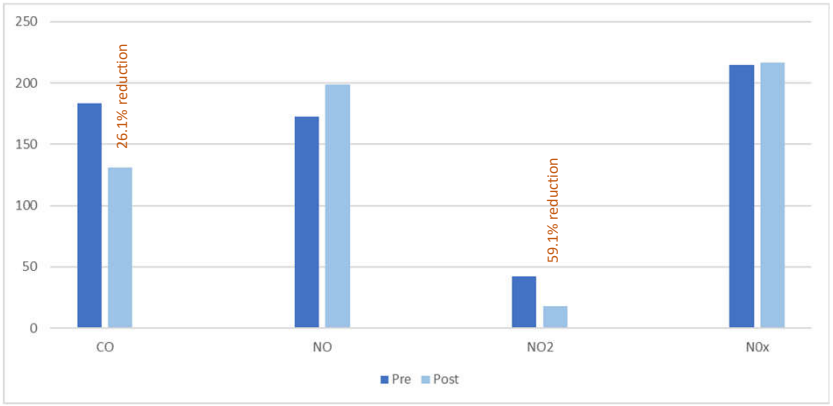
## Field Trial – Vale Ontario Mine
## Average reductions across multiple tests

**DPF installed on Toyota Landcruiser**

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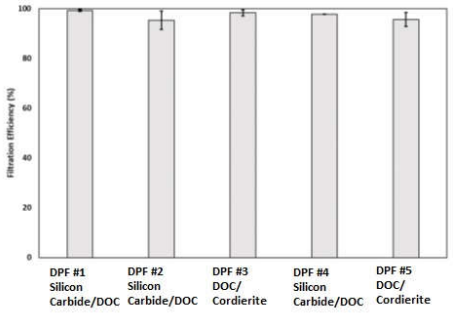
## Impact of Bio Diesel with and without DPFs

Content to be submitted by Barrick USA.
- To be presented by Kevin Gallio

## Curtin University Collaboration – Can Nanoparticles be trapped using a Monolithic substrate

- Based on the presentation by J.Schiltknecht MD at the 2017 conference, Mammoth have performed gravimetric mass and particle count testing across a variety of filter types and substrates

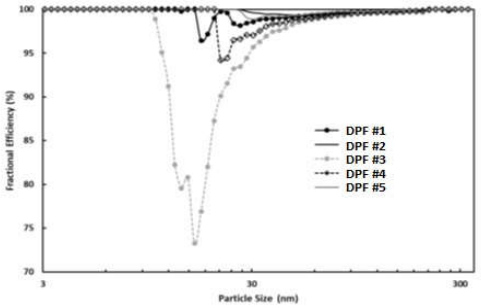
## Nanoparticle Count and Size vs Mass Based Filter Efficiency




**NIOSH 5040 compliant testing of filtration efficiency**

**(Gravimetric Mass of Elemental Carbon)**

Note all filters show between 95-99% Mass Filtration Efficiency




**Fractional Efficiency by Particle Size**

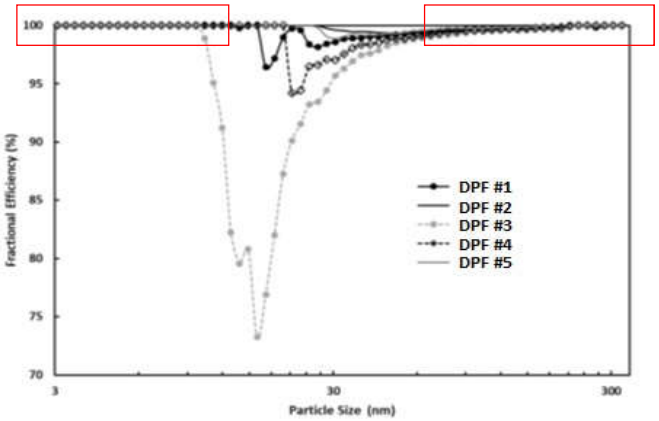
Tested at the same time – note: the fractional efficiency drops as low as 73% for particles 15-30nm the variations are far greater

*'This highlights a disconnect can exist between mass-based (gravimetric) efficiency and nanoparticle removal efficiency due to the former being biased towards large particles' – Curtin University 2018*



## Do Filters capture nano-particles?

- Curtin University tested 5 full wall flow DPFs (various types age and manufacturer)
- Particle capturing efficiency in the size range 1-15nm were still captured at 98-99.5% efficiency as were particles 50nm – 300nm
- MPPS (Most Penetrating Particle Size was in the range 15-30nm) showed a filtration performance dip down 73%

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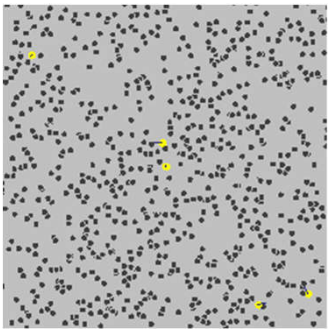
## Deep-bed Filtration the myth of Nanoparticles and filter pore size

- Deep bed filtration means the mean pore size of the filter media is **bigger** than the **mean diameter of collected particles.**
- Understanding only this half of the story had led to some of the myths in the industry that wall flow DPFs cannot capture nanoparticles (particle smaller than the pore assumes ultrafine particles will slip through)
- This is not the case as particles in this range are embedded at high efficiency due to physics force factors i.e **Brownian Motion**
- The particles in this range are small enough to be impacted by each other and the gaseous molecules within the gas they are suspended causing a large range of rapid and randomised movement that leads them to be captured within the filter media.





## Current research project – currently incomplete

- **What deterioration to filter substrate occurs through thermal cleaning?**
- **To receive the results of this testing, please visit the Mammoth booth and sign up for the information once available.**

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