

# Air Pollution from Construction

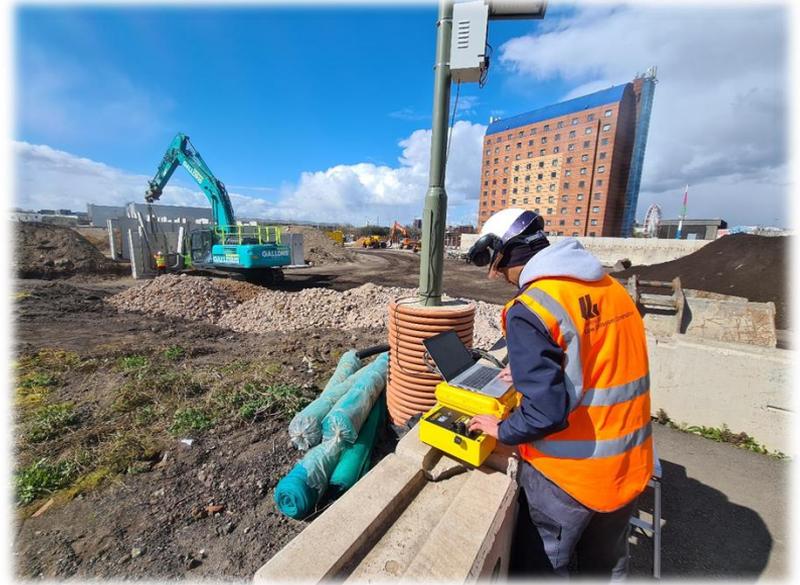
4<sup>th</sup> November 2025

Daniel Marsh, Centre for Low Emission Construction



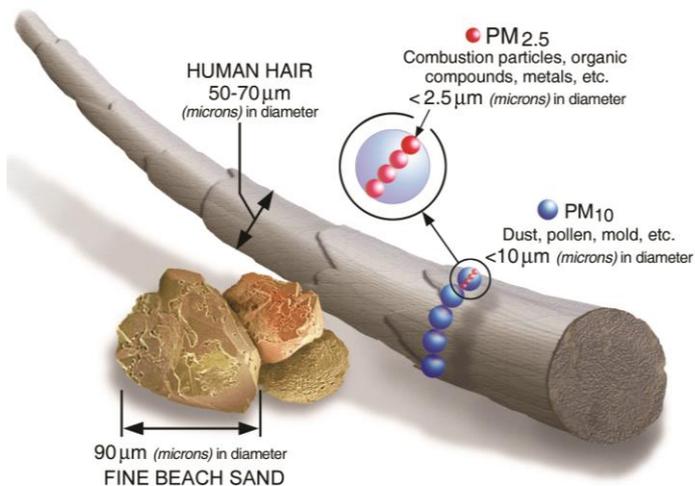
## The Centre for Low Emission Construction

- Raising awareness of air quality impacts from construction and demolition
- Providing high quality scientific research to inform policy development
- Working with manufacturers to develop low emission technologies
- Quantify the health impact of exposure to emissions for the public and people working in the construction sector
- Developing expert guidance for industry, planners and air quality professionals



Environmental Research Group

## Pollutants of concern

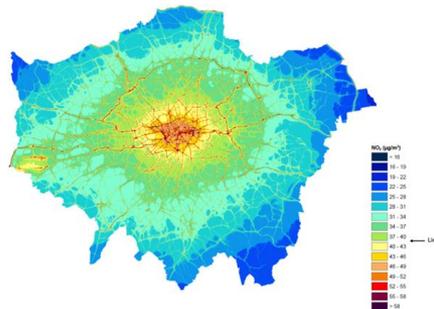


## Particulate Matter (PM)

## Nitrogen Dioxide (NO<sub>2</sub>)

Emitted during combustion, especially from diesel engines, industrial heating, and power generation

Road transport is estimated to be responsible for about 50% of total UK emissions of nitrogen oxides, therefore urban concentrations are higher



Declining NO<sub>2</sub> due to cleaner engine technology and low emission zones

NO<sub>x</sub> contributes to ozone (O<sub>3</sub>) and particulate matter (PM<sub>2.5</sub>) formation through (secondary) atmospheric reactions

## South Bank construction boom sends London air pollution soaring

JONATHAN PERRY | Monday 8 May 2017 10:07 BST | 132 comments



132

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### Pollutionwatch Pollution

## Building works responsible for 18% of UK large particle pollution

Experts call for tighter regulation as construction accounts for more than 30% of PM10 pollution in London



For a long time, construction was overlooked as an air pollution problem by both government and scientists. Photograph: Geoffrey Swaine/Rex/Shutterstock

or a long time, construction was overlooked as an air pollution

## How to stop the construction industry choking our cities



London's mayor Sadiq Khan has said he intends to fine construction firms using polluting machinery. Photograph: AP

Building firms need to start treating diesel emissions in the same way as asbestos, says air pollution expert

Poor air quality, with diesel the biggest culprit, is now thought to be the cause of 40,000 deaths in the UK each year.

But while cars and lorries have attracted most attention, less reported is the contribution of other pollutants to the problem, particularly construction sites.

According to the most detailed air-quality study in the UK, the [London Atmospheric Emissions Inventory](#), construction sites are responsible for approximately 7.5% of damaging nitrogen oxide (NOx) emissions, 8% of large particle emissions (PM10) and 14.5% of emissions of the most dangerous fine particles (PM2.5).

While a small amount of this (about 1%) is dust from site activities like demolition, the vast majority comes from the thousands of diesel diggers, generators and other machines operating on sites.

## Letters: blame construction, not cars, for London's poor air

Extending the Ultra Low Emission Zone will adversely affect poorer households and fails to address the real problem



Construction cranes in London. Photograph: Kirsty Wigglesworth/AP

Miles Brignall's article was a surprise since, bearing in mind it affects so many, there has been little information or comment on the extension of the ultra low emission zone ("Final countdown: Londoners have a year to ditch their old polluting cars", Cash). A "public consultation" attracted around 40,000 responses - in an area affecting 8 million residents. A petition on change.org against the extension has attracted more than 120,000 signatures, and comments often reflect the views expressed by the AA - namely that it will adversely affect poorer households.

Urging everyone to walk and cycle is not practical unless you are fit, and relying on public transport that is expensive and unreliable is not attractive in bad weather. Additionally, I have yet to understand - in terms of ecology and biodiversity - how the electricity to power vehicles will be generated or how the batteries will be disposed of.

# Construction air pollution sources

## **Fugitive Dust**

- Generated from demolition, earthworks, vehicle movement on unpaved surfaces, and material handling
- Activities like concrete batching, cutting and grinding release fine dust and silica particles

## **Non-Road Mobile Machinery (NRMM)**

- Diesel-powered equipment including power generators

## **Trackout dust**

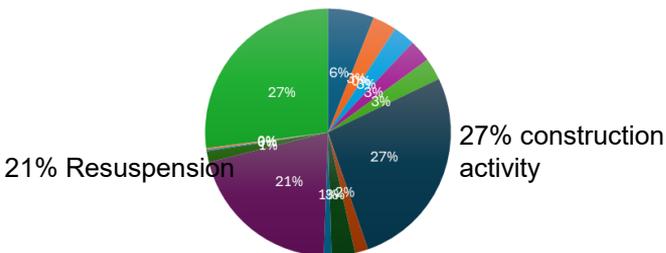
- Resuspended particles that were transported onto the public highway

## **Construction Logistics and Transport**

- Road transport used for material delivery and waste collection

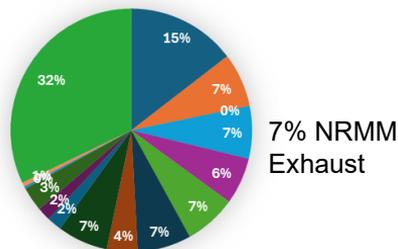
# How polluting is the construction industry?

PM10 Emissions by Source Type - LAEI 2022



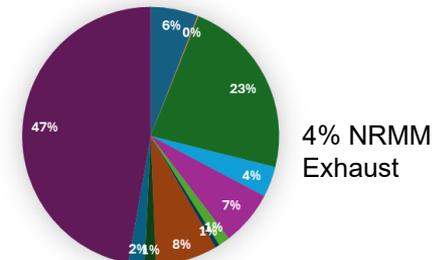
- Wood Burning
- Heat and Power (domestic)
- Machinery (domestic)
- Cooking (domestic)
- Heat and Power (commercial)
- Cooking (commercial)
- Construction
- Industrial Processes
- Waste
- Misc.
- Resuspension
- Aviation
- Rail
- River
- Road Transport

PM2.5 Emissions by Source - LAEI 2022



- Wood Burning
- Heat and Power (domestic)
- Machinery (domestic)
- Cooking (domestic)
- Heat and Power (commercial)
- Cooking (commercial)
- Construction
- Industrial Processes
- Waste
- Misc.
- Resuspension
- Aviation
- Rail
- River
- Road Transport

NOx Emissions by Source Type - LAEI 2022



- Heat and Power (domestic)
- Machinery (domestic)
- Heat and Power (industrial)
- Construction
- Industrial Processes
- Waste
- Misc.
- Aviation
- Rail
- River
- Road Transport

## Occupational exposure



Diesel exhaust fumes were classified as "probable carcinogens" back in 1988, but the International Agency for Research on Cancer, part of the World Health Organization, has recently upgraded them to a Group 1 carcinogen, so these emissions are now treated as a definite cause of cancer in humans. The IARC has said that people regularly exposed to diesel exhaust fumes at work can be up to 40 per cent more likely to develop lung cancer.

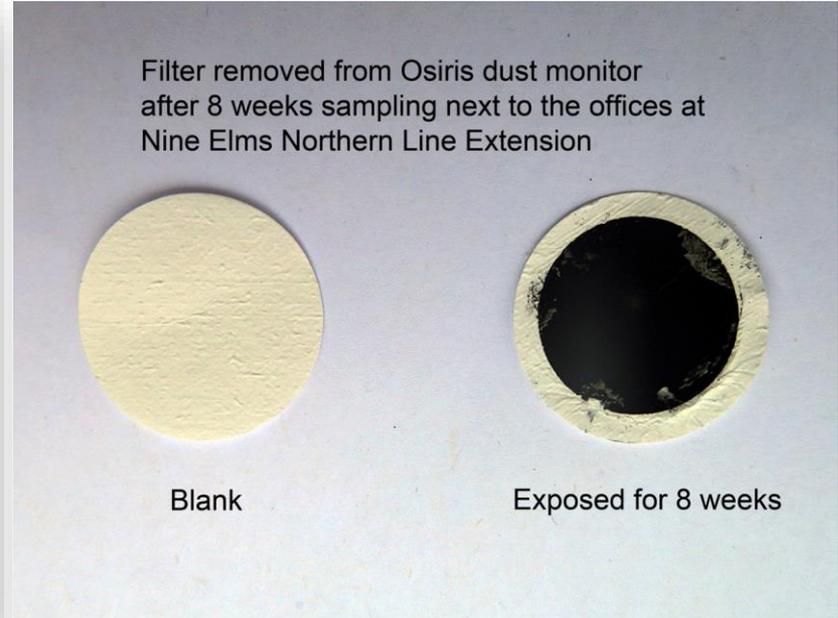
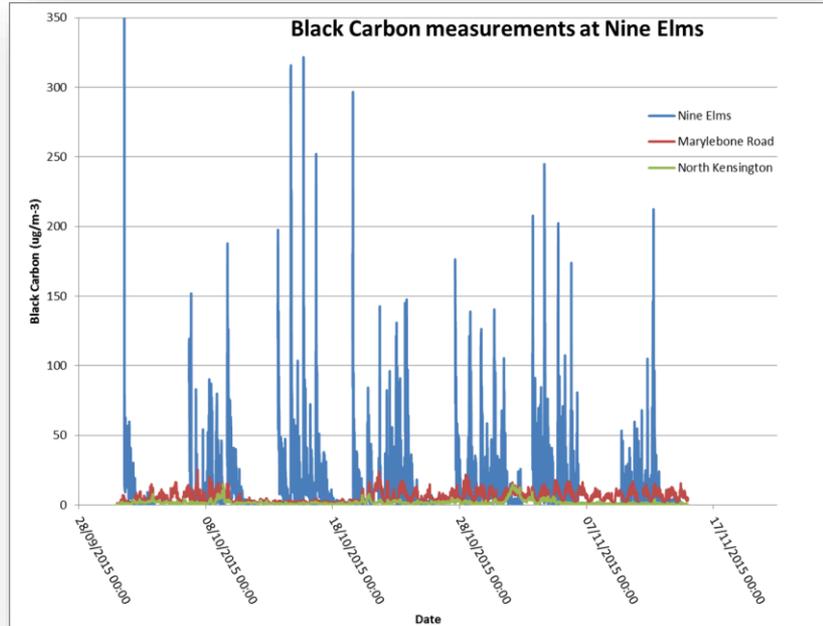
... people regularly exposed to exhaust fumes are 40% more likely to develop lung cancer...

Anyone who works with or around diesel-powered equipment or vehicles may be concerned about diesel exhaust emissions

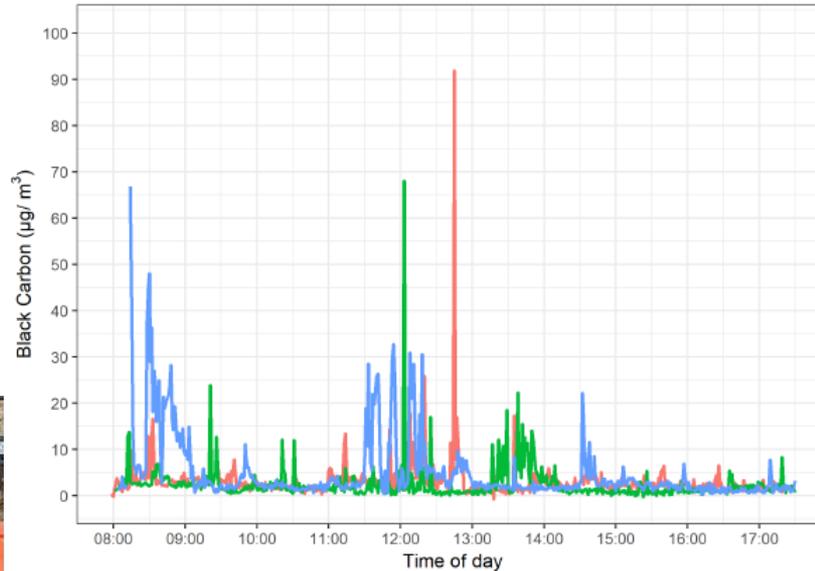
Diesel exhaust emissions may contain more than **10 times** the amount of black carbon (soot) particles than petrol exhaust fumes, and the mixture includes several carcinogenic substances, meaning they are classified as a carcinogen



## Measuring black carbon (soot)

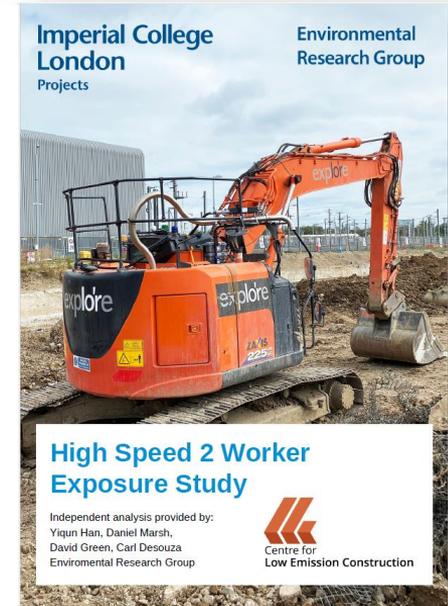


## Worker exposure research

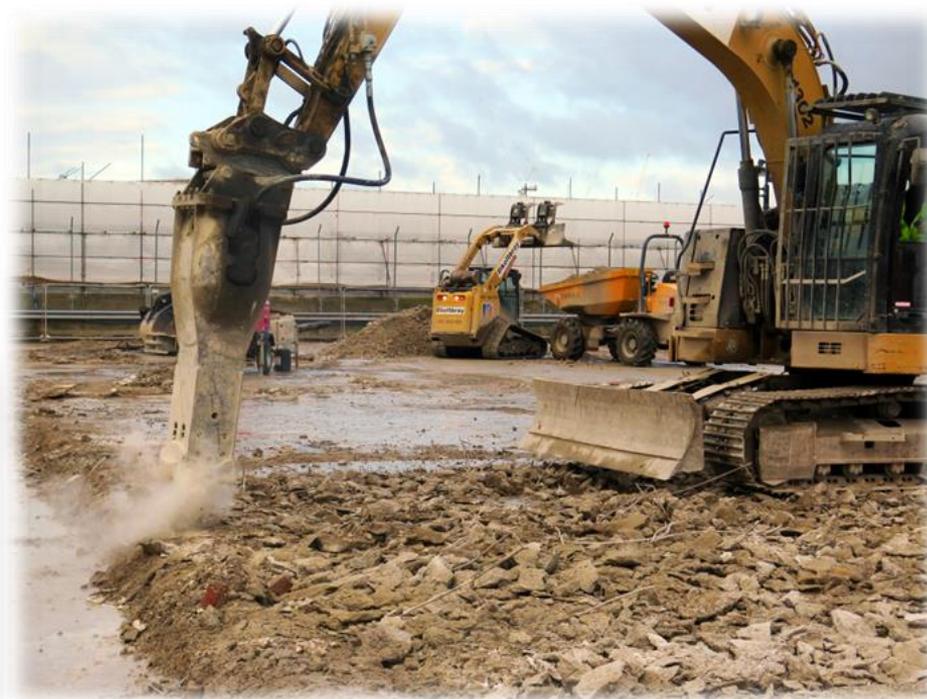
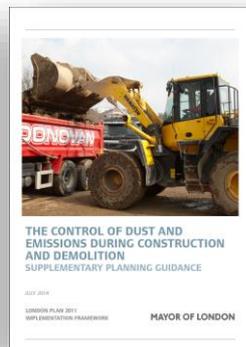
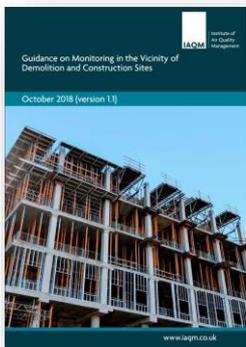


Participant

- HS2001
- HS2003
- HS2004



# Control of Fugitive Dust



## Mitigation measures



## Mitigation measures



## Construction Dust Monitoring



Continuous dust monitoring is often required as a **planning condition** and is included in **environmental or dust management plans**

- Lack of quality control for siting and operation
- Often faulty monitors, no power or tampering
- No action taken when site exceedance alerts issued
- Poor communication with regulators, no reporting standard
- Lack of construction expertise within local authorities
- Change in MCERTS and increase in low-cost sensors
- Lack of site awareness of dust issues and health risks

Monitoring and mitigation cost money, so who is watching?

## Construction Compliance Officers

Supported by

Impact  
on **Urban  
Health**



Specialist training in 'Construction compliance and environmental monitoring' delivered by Imperial College London.

Compliance officers:

- Conduct full environmental audits of sites in LB Lambeth and Southwark, focusing on fugitive dust and machine emissions
- Raise site awareness of air quality issues and potential health risks
- Connect both environmental protection and planning teams to allow for rapid intervention and potential regulatory action

This is part of an exciting programme that will help improve communication between developers, contractors and local authority regulators, and reduce the amount of air pollution that is emitted from construction activity and machinery used in urban areas.

Project funded by Impact on Urban Health



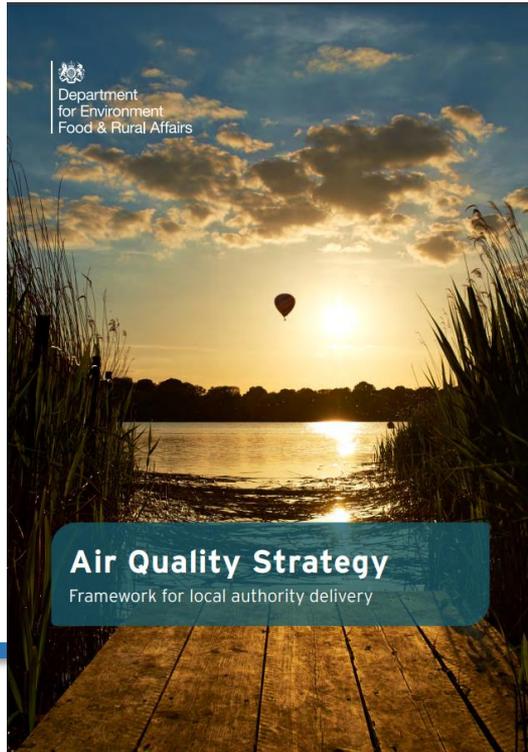
## Non-Road Mobile Machinery

The NRMM challenge:

- The UK government has committed to be carbon 'NetZero' by 2050
- It is estimated that there are > 300,000 items of NRMM in use across the UK
- In 2020 the UK construction sector used 2.5 million tonnes of diesel
- Burning diesel has an impact on local air, public health and the environment



## UK National NRMM regulation

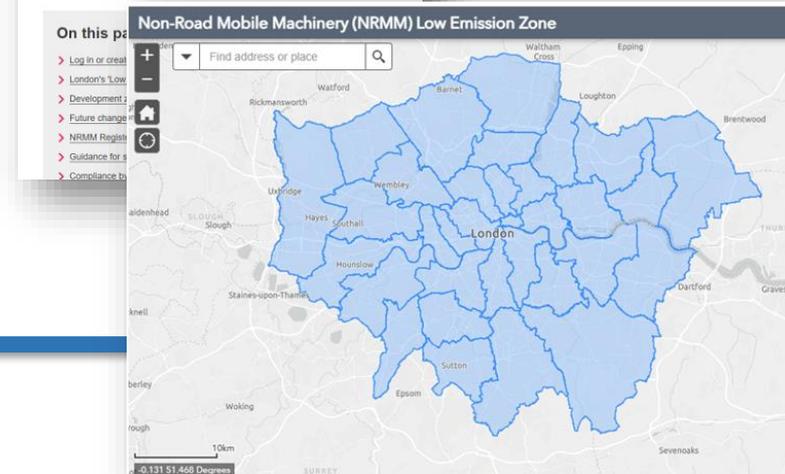
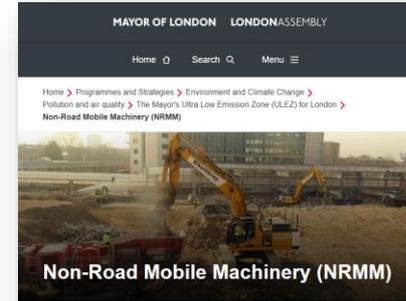


*“Local authorities are **encouraged** to promote the use of cleaner non-road mobile machinery as part of construction and environment management plans for development they grant planning permission for and consider incentivising cleaner construction equipment through tendering processes where there is clear evidence of air quality issues”*

*Defra AQS – April 2023*

## London's Low Emission Zone for NRMM

- The NRMM Low Emission Zone uses the Mayor and London Borough's planning powers to control emissions from NRMM used on construction sites.
- In a similar way to the [Ultra Low Emission Zone](#) the NRMM Low Emission Zone requires that all engines with a power rating between 37 kW and 560 kW meet an emission standard based on the engine emission "stage"
- **The current standards are stage IV for construction machinery throughout Greater London**
  - **The requirement for generators is Stage V**
  - From 1 of January 2030 standards will be stage V throughout London
  - From 1 of January 2040 only **zero emission** machinery will be allowed



## Delivering diesel-free construction



The **Construction Leadership Council's** CO2nstruct Zero campaign, has set a target to cut diesel used in construction by 78% by 2035

### **Improving efficiency:** Using best practice

- Anti-idling, telematics, operator training, energy efficient solutions (retrofit, energy management)

### **Transition to cleaner fuels**

- Biofuels, Hydrogen, other fuels, policy and independent testing of emerging fuels

### **Transition to electric**

- Early site electrification, electric NRMM, removing diesel generators

### **Wider industry support**

- Industry wide policy, zero diesel strategies, industry-government collaboration, involving the supply chain

## ‘Soft Measures’

Adopting behavioural change

- Anti-idling & eco-operator training
- Better understanding of engine telematics
- Using AI and machine learning



 AIR QUALITY

HS2 Anti Idling Video

VIDEO

★★★★★

In this video you will find out about why idling is an issue for cons  
HS2 have done to reduce vehicle idling.

SUPPLY CHAIN SUSTAINABILITY  
**SCHOL**

HS2

### Anti-Idling Toolkit

In collaboration with partners across the construction industry, this anti-idling toolkit is aimed to remind site teams on the importance of anti-idling.

    Imperial College London 



## Transition to cleaner fuels

Multiple trials carried out to test the potential air quality benefits of using alternative fuels to reduce diesel use and introduce low-carbon solutions

The results showed **limited air quality benefits** when compared to diesel in NRMM with efficient after-exhaust emission reduction technology; however, there is potential for carbon reduction through the **sustainable sourcing** of alternative fuels

Alternative fuels **are not** as effective as using cleaner machinery, or retrofitting existing plant



## So, is it all just ‘green wash’?



- The UK government is currently investigating claims that HVO diesel may contain virgin palm oil instead of waste materials
- It is alleged that virgin palm oil is being fraudulently relabelled as waste materials, which undermines the fuel's environmental benefits
- Analysis suggests that more palm sludge waste is being used in biofuels than the world can produce
  - Using virgin palm oil contributes to deforestation and climate change, harming endangered species like orangutans
- The EU is considering a temporary ban on certain biofuel certifications, and the Irish authorities have restricted incentives for fuels made from palm waste



## Retrofit technology

- Retrofitting the latest NOx and particulate emission reduction technology to older machines
- Targeted at NRMM with long 'first life' usage
- Installed on pneumatic and rotatory piling rigs as part of HS2 trial that demonstrated emissions reduced below EU Stage V NRMM standards
- Full carbon life-cycle benefits through retaining high value assets on NRMM fleet vs renewal
- Energy Saving Trust NRMM retrofit certification allows for industry-wide roll-out for machines with large engines
- Helping to 'clean up' UK rental fleet used outside low emission zones and on projects without minimum standards



## Better Energy Management



Battery storage units

**High-speed flywheel technology** adopted from Formula 1 used to capture and store energy from an engine that is normally wasted



**Intelligent power distribution** actively manages energy demand and switches off non-essential assets when energy demand spikes



**Down-sizing generators reduces hire and fuel costs whilst reducing emissions and noise**

## Hydrogen for Power



Multi-fuel generators – LPG/H<sub>2</sub> Combustion  
95% cleaner than diesel equivalent



Green H<sub>2</sub> Fuel Cell  
Zero emission technology

## Electric NRMM



## Autonomous NRMM

## Hydrogen NRMM



Thank you



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