

Protecting Air Quality in Pavement Works National Highways SDF

16 October 2023 – 12pm to 1pm

Daniel Marsh, Centre for Low Emission Construction



Please Participate!



Please use your microphones and cameras – just switch the mics off when not speaking



If you have **QUESTIONS**, feel free to use the **CHATBOX**



Join in with the Mentimeter activity



SLIDES will be distributed afterwards

Webinar Overview

- What is air pollution and where does it come from?
- How polluting is the construction industry?
- Which policies regulate air pollution?
- What can we do to reduce emissions and personal exposure?

Go to Menti.com on your phone or laptop

Participate in the poll now....

Enter the code 5551 1302



Mentimeter – Question 1

- How important do you think air quality is as an environmental health concern?
 - Extremely Important
 - Very Important
 - Moderately Important
 - Slightly Important
 - Not at all Important

Mentimeter – Question 2

- How much do you think the construction sector contributes to air pollution compared to other emission sources?
 - A significant amount
 - Somewhat
 - A small amount
 - Not at all
 - Don't know

What is air pollution?



Air pollution is the release of particles and noxious gases into the atmosphere



Emissions can be natural or manmade and are considered to have an effect on human health.

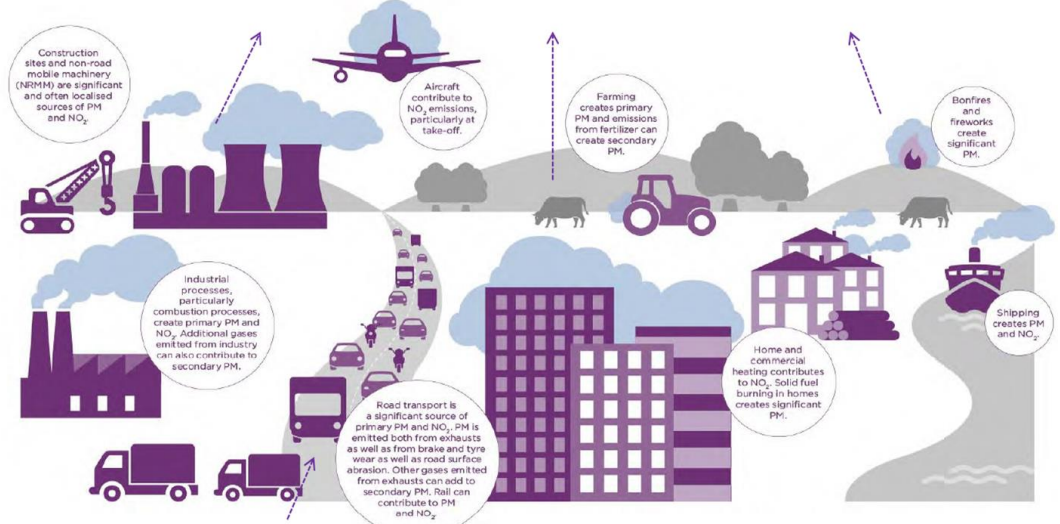


Natural emissions of particles come from the sea, the soil and from plants.



Pollution from human activity is largely the result of the combustion of fossil fuels such as coal, oil, petrol or diesel.

Emissions are the total amount of each pollutant that ends up in the atmosphere.



Concentrations are the amounts of pollutants found within a specific area – often where people are.

Pollutants of concern – Nitrogen Dioxide (NO₂)



Nitrogen dioxide (NO₂) is one of a group of gases called nitrogen oxides



Road transport is estimated to be responsible for about 50% of total UK emissions of nitrogen oxides

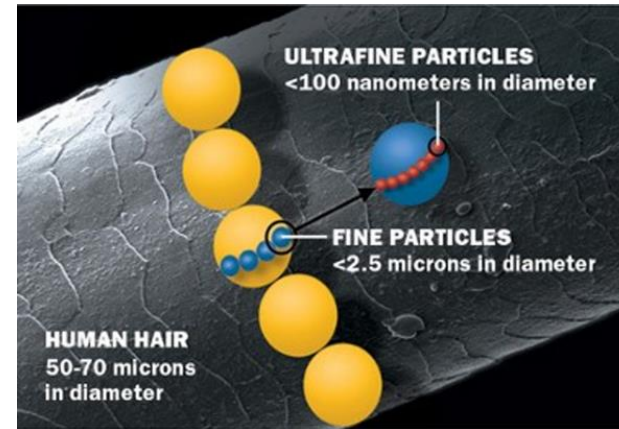
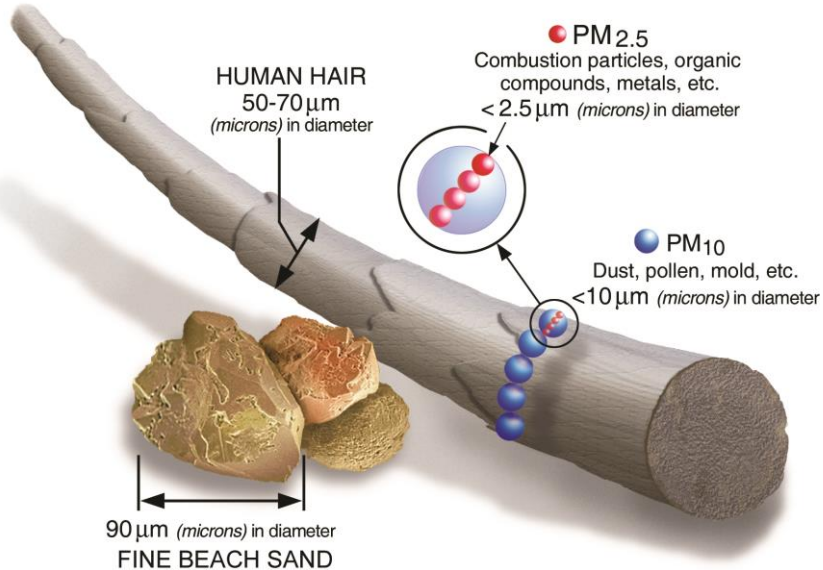


Nitrogen dioxide levels are highest near busy roads and urban areas



Nitrogen dioxide also reacts with hydrocarbons in the presence of sunlight to create 'ground level' ozone, and contributes to the formation of particles

Pollutants of concern – Particulate Matter (PM)



Small particulate pollution has health impacts even at very low concentrations – there is no threshold that has been identified below which no damage to health is observed (WHO 2004)

Health Impacts

Chief Medical Officer's
Annual Report 2022
Air pollution



4.5.3 The construction industry

Ben Pearce - Portfolio Manager, Health effects of air pollution programme, Impact on Urban Health
Kate Langford - Programme Director, Health effects of air pollution programme, Impact on Urban Health

Air pollution emissions from construction

Construction sites contribute significantly to air pollution, particularly in urban areas, where poor air quality can harm health and disproportionately affect some of the most vulnerable people in communities, as discussed in Section 1.2.

Of the many different types of pollution emitted from construction sites, the pollutants that are the biggest concern for health are particulate matter (PM), and nitrogen oxides (NO_x). NO_x is emitted by engines that power non-road mobile machinery (NRMM), while PM is emitted from demolition and earthworks. PM often leaves sites on the wheels of vehicles and is then re-suspended back into the air we breathe.

People who work on construction sites, and those living near sites, are most at risk from being exposed to the highest concentrations of emissions from on-site works. As construction sites vary in size and the length of time they are in place, the scale of polluting emissions varies between sites. However, in densely packed urban areas where construction sites are a common occurrence, they can contribute significantly to overall levels of air pollution.

The construction industry has adopted several approaches and regulations to help minimise the construction sector's polluting emissions - for example, hybrid or electric NRMM, emissions standards for NRMM, and low-emission zones for construction plant and planning.

Improving air quality in and around construction sites

Impact on Urban Health, which is part of Guy's & St Thomas' Foundation, are running a 10-year programme that tests equitable interventions to address air pollution in inner city areas. The programme aims to improve health, particularly for those who are disproportionately affected by poor air quality. One of the programme's key areas of focus is working with the construction industry to reduce the sector's pollution emissions.

In partnership with Anup, Impact on Urban Health are developing up to 4 low-emission construction sites in the London boroughs of Lambeth and Southwark. These sites will demonstrate best practice for mitigating air pollution. One of the sites is a social housing estate comprising over 600 homes, with the programme spanning over 6 years. While results will not be available until the developments are completed, their aim is to limit NO_x and PM to levels significantly lower than the standards set by the Greater London Authority's NRMM Low Emission Zone (LEZ). Based on research undertaken by the project, as well as consultations with stakeholders, approaches that are expected to reduce air pollution from construction sites include:

Dementia and cognitive decline
Impacts on the central nervous system (PM)

Irritation of eyes, nose
and throat

Breathing problems
(O₃, PM, NO₂)

Irritation, inflammation
and infections

Ischaemic heart disease,
stroke, heart failure (PM, O₃)

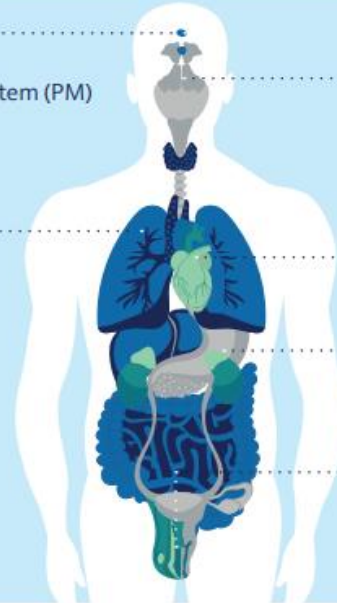
Asthma and reduced lung
function (NO₂, O₃)

Metabolic effects (PM, O₃)

Chronic obstructive
pulmonary disease (PM)

Impacts on the reproductive
system (PM)

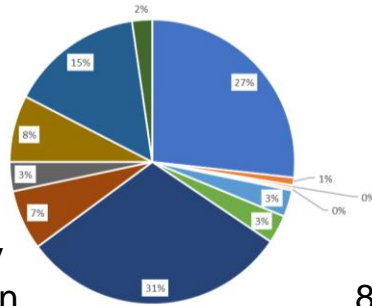
Lung cancer (PM)



Source: Adapted from EEA (2020)²⁰

How polluting is the construction industry?

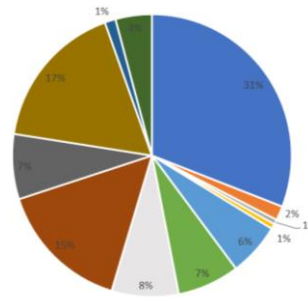
PM10 Emissions by Source Type - LAEI 2019



31% PM10 activity
15% Resuspension



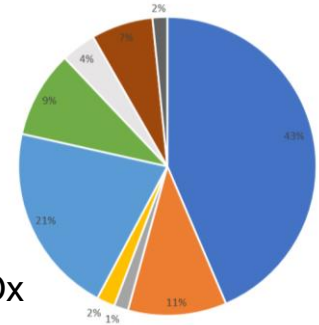
PM2.5 Emissions by Source Type - LAEI 2019



8% PM2.5



NOx Emissions by Source Type - LAEI 2019



4% NOx



Construction air pollution sources

- Fugitive dust
 - Mechanically generated dusts
 - Typically, worse during demolition and earthwork phases
- Non-road mobile machinery
 - Engine emissions dominated by diesel exhaust
- Trackout dust
 - Particles that are transported onto the public highway & resuspended
- Construction transport (supply chain)
 - Road transport used for material delivery and waste collection

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



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.

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 soot particles than petrol exhaust fumes, and the mixture includes several carcinogenic substances, meaning they are classified as a carcinogen



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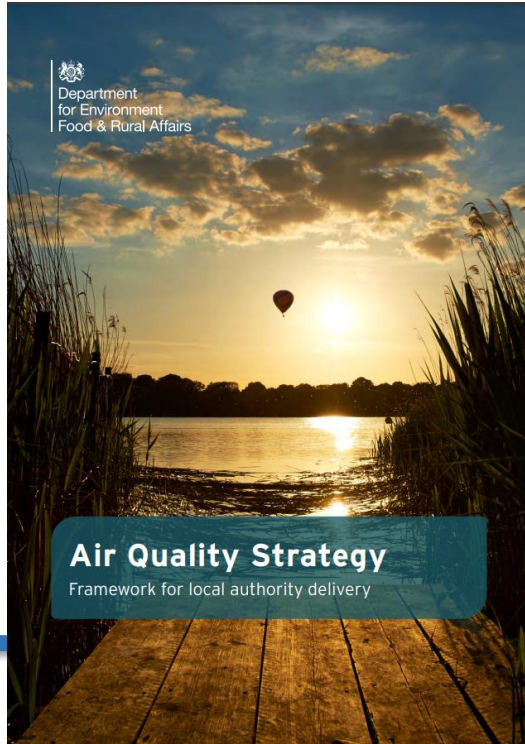
... people regularly exposed to exhaust fumes are 40% more likely to develop lung cancer...

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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"

MAYOR OF LONDON

MAYOR OF LONDON LONDONASSEMBLY

Home Search Menu

Home > Programmes and Strategies > Environment and Climate Change >
Pollution and air quality > The Mayor's Ultra Low Emission Zone (ULEZ) for London >
Non-Road Mobile Machinery (NRMM)



Non-Road Mobile Machinery (NRMM)

On this page

- > [Log in or create an account](#)
- > [London's 'Low Emission Zone' for Non-Road Mobile Machinery](#)
- > [Development zones map](#)
- > [Future changes to the standards](#)
- > [NRMM Register](#)
- > [Guidance for site operators](#)
- > [Compliance by Retrofit](#)

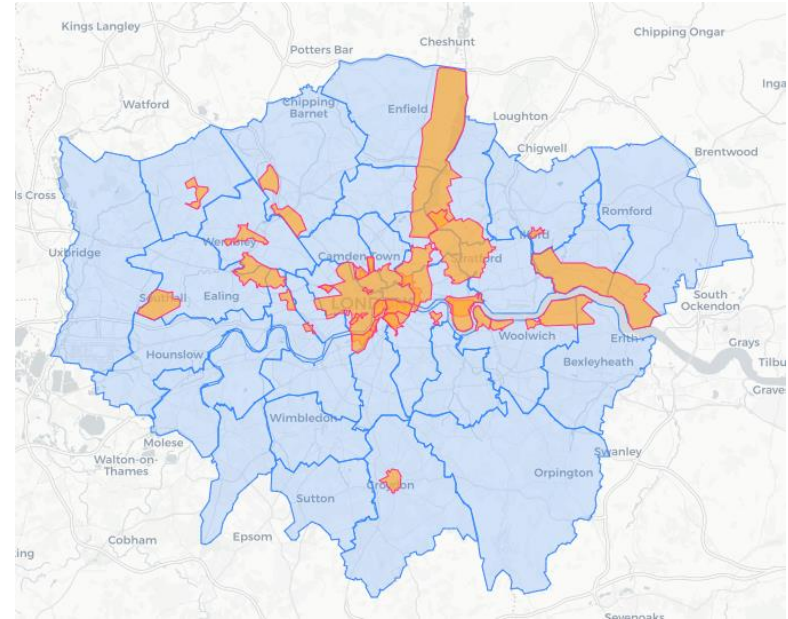
London
Environment
Strategy

MAY 2016

London's Low Emission Zone for NRMM

The current standards are stage IV for construction machinery operating in the **Central Activities Zone and Opportunity Areas (including Canary Wharf)** and stage IIIB in the rest of London.

- From 1 January 2025 the standards will be stage IV throughout London
- From 1 of January 2030 the standards will be stage V throughout London
- From 1 of January 2040 only zero emission machinery will be allowed.



Clean Air Zones (CAZs)

Environment Act 2021

- Long term environmental plans
- Targets include air quality & PM_{2.5}
- There are currently 7 cities charging under clean air zones in England: Bath, Birmingham, Bradford, Bristol, Portsmouth, Sheffield, and Tyneside
- *Creating a 'level playing field'*



Centre for
Low Emission Construction



National Highways Strategic Road Network

- The most heavily used part of the national road network
- 4,500 miles of motorways and major A roads
- It carries a third of all traffic and two-thirds of all freight
- The road network is essential to the growth, wellbeing and balance of the nation's economy

A net zero Britain will still travel by road in 2050



National Highways Air Quality and NRMM

Work to reduce emissions from construction and machinery on the network is currently being driven by the ***Net Zero Highways Plan***

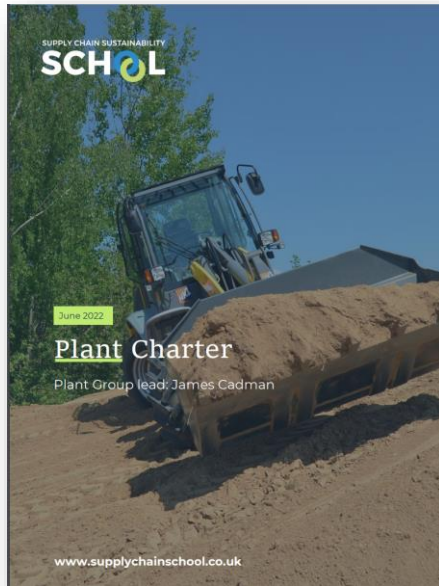
“All construction plant and compounds zero emission by 2030”

Potential changes coming up:

- In 2022 National Highways was given new duties to cooperate with Local Air Quality Action Plans
- These plans focus on all sources of emissions, including those from NRMM
- The Lower Thames Crossing is proposing to meet London standards for NRMM as part of their code of construction practice



SCSS Plant Commitment Charter



- **Minimum standards in procurement:** buy or hire CPE that meets, or exceeds, the minimum standards for AQ and GHG emissions, as laid out in the latest technical paper³.
- **Engagement:** engage suppliers and contractors to actively participate in meeting the minimum standards
- **Awareness raising and education:** providing our supply chain with the skills, knowledge and confidence they need to achieve our aims.
- **Measurement and reporting:** measure progress in reducing our emissions and report them to stakeholders.
- **Innovation:** investigate, trial and implement new technologies that will help us on the route to zero emissions onsite.

SCSS Plant Commitment Charter

Signatories to the Updated Charter



SKANSKA



STRABAG

Working in
partnership with

HS2



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Mentimeter – Question 3

Who is responsible for reducing air pollution from industry?

- Employer
- Government
- Lead organisation
- Contractor groups
- Individual

Diesel-free construction



- **HS2** achieved the first diesel-free site in May 2022, they now have ten similar sites
- Committed all sites diesel-free by 2029
- The **Construction Leadership Council's** CO2nstruct Zero campaign, has set a target to cut diesel used in construction by 78% by 2035

A Diesel-free future

- Improving efficiency: Using best practice
 - Transition to cleaner fuels
 - Transition to electric
 - Wider industry support
-

Behavioural change

- Understanding engine telematics
- Anti-idling & operator eco-training
- Using AI and machine learning



Image is an example for indicative purposes only



 **SUPPLY CHAIN SUSTAINABILITY**
SCHOL

AIR QUALITY

HS2 Anti Idling Video

VIDEO

★★★★★

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

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

Alternative fuels

- Biofuels include hydrotreated vegetable oil (HVO) and gas-to-liquid (GTL)
- HS2 trials carried out to test the potential air quality benefits
- The results showed limited reductions when compared to diesel
- There is potential for carbon reduction through **sustainable sourcing**
- Alternative fuels are not as effective as using cleaner stage machinery or retrofitting existing plant



Retrofit technology

- Successful pilot of world's first retrofit on large construction equipment will have massive impact across the HS2 project, saving millions of pounds
- Certified by the Energy Saving Trust
- The trial on older vehicles showed emissions reduced below Stage V NRMM standards
- Allows for industry-wide roll-out that will bring benefits for the environment, communities and the workforce



Flywheel energy storage systems

- Technology adopted from Formula 1 used to capture energy from an engine that is normally wasted and stored in a high-speed flywheel
- Smaller generators are used more efficiently



PUNCH | Flybrid



Energy management systems

- Actively manages energy demand
- Intelligently switches off non-essential assets when energy demand peaks
- Down-sizing generators reduces hire, fuel and maintenance costs whilst reducing emissions



AVAILABLE NOW

Clean Air Gas Engines

- CAGE generator currently using LPG
- Recognisable ICE technology
- System integrated into an Advanté Hybrid welfare cabins during covid
- Being tested as standalone H₂ generators
- DESNZ Red Diesel Replacement project



COMING SOON

Hydrogen dual-fuel

- Retrofitting existing on-road fleet to run on diesel and H₂
- Transferable technology for NRMM
- First dual fuel H₂ piling rigs being trialled on HS2
- Requires national H₂ infrastructure and green H₂ supply



AVAILABLE NOW

Hydrogen fuel cell

- Demonstrating safe use of H₂ on construction sites
- Developing safe fuel handling and storage protocols
- Zero harmful exhaust emissions



The importance of science-based evidence

“The results from these trials highlight how important it is that we continue to independently test and evaluate existing and emerging low emission fuels and technologies to produce scientific evidence to inform and encourage the uptake of low emission approaches across the wider construction industry.

This research will support accelerated decarbonisation programmes to meet stringent carbon targets by 2050, whilst still delivering local air quality benefits.”

Fully electric NRMM

- Battery technology already exists for small to medium NRMM
- Larger machines still likely to be hydrogen or hybrid
- Requires better site energy efficiency measures
- Charge cycles still being established
- Clean off-grid power generation required as the number of electric machines increase
- Early planning for full grid connection is essential



Hydrogen NRMM



- Hydrogen has potential to decarbonise sectors, such as construction
- Low-carbon hydrogen could meet 10% of global energy needs under the International Energy Agency's Net Zero by 2050 scenario
- Hydrogen demand is forecast to double by 2030
- Clear and consistent policy still required from Government

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Mentimeter – Word cloud

What do you feel is the greatest environmental challenge facing the construction industry today?

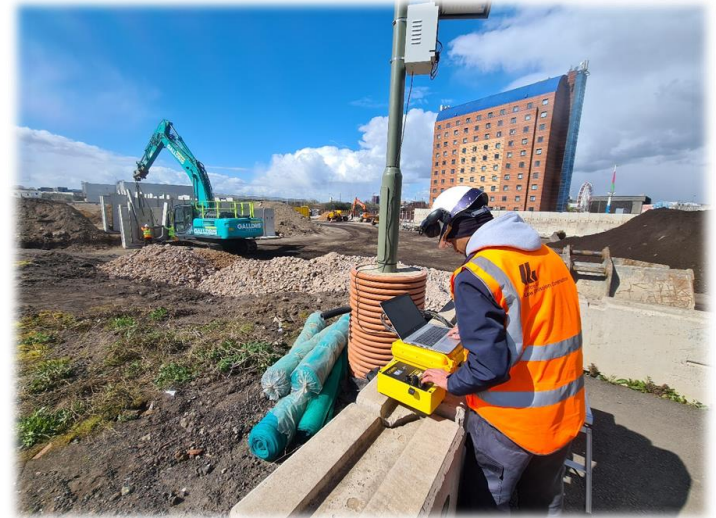


Any Questions?

CLEC.UK

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 guidance for industry, planners and air quality professionals



Environmental Research Group

NEXT EVENTS!

LOW CARBON INNOVATION – NATIONAL HIGHWAYS WEBINAR
ON 22ND NOVEMBER 1-2PM

DECARBONISING TRANSPORT TOGETHER (NATIONAL
HIGHWAYS/NETWORK RAIL AND HS2 JOINT WEBINAR)
1ST NOVEMBER ON NET ZERO AND SCIENCE BASED TARGETS

INFORMATION AND REGISTRATION

[HTTPS://LEARN.SUPPLYCHAINSCHOOL.CO.UK/LOCAL/TLACTION
PLANS/RESOURCES.PHP](https://learn.supplychainschool.co.uk/local/tlaction-plans/resources.php)

WE NEED YOUR FEEDBACK PLEASE



CLICK HERE FOR THE FEEDBACK FORM

[HTTPS://FORMS.OFFICE.COM/E/1VG3FCJVIZ](https://forms.office.com/E/1VG3FCJVIZ)

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