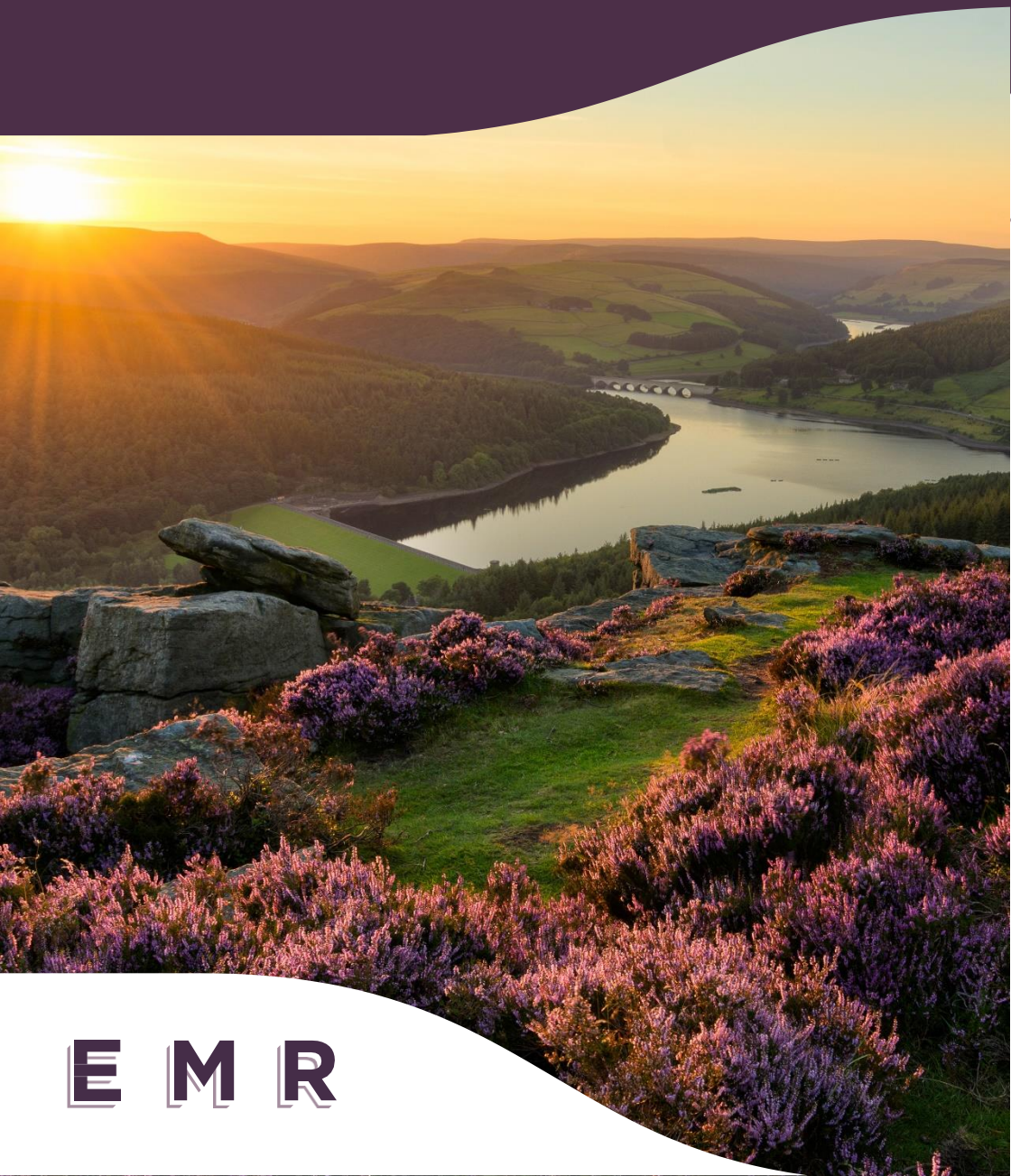# East Midlands Railway
Clean Air Report 2022

EMR

1. Executive Summary

Poor air quality, nationally and in the communities we serve, continues to be an increasingly important issue and challenging problem to solve. East Midlands Railway (EMR) continues to play vital role in reducing emissions from our trains, by understanding the risks associated and actively working with stakeholders, including regulators and policy makers, to improve local air quality.

The report provides the third full year of air quality data from EMR's Air Quality (AQ) Monitoring Network. Across seven key stations and all our Train Maintenance Depots, we have installed air quality monitoring equipment to provide high-quality, timely, continuous air quality data. Allowing EMR to gain a greater understanding and actively work to reduce the impact of emissions from diesel train engines to our passengers, staff and the environment.

Monitoring over 2022 has enabled EMR to further determine baseline performance and refine the monitoring methodology post the Covid-19 pandemic – as train services and wider background sources of air pollution returned to a pre-pandemic, steady state.

The positive clean air impacts of EMR introducing its first all-electric train service, continue to be evident – with EMR Connect providing low emission train services between London St.Pancras and Corby. Results in 2022 from station and depot sites impacted by EMR Connect trains, demonstrate a continued positive improvement on 2021 data – generally resulting in less peaks of poor air quality which could be attributed to diesel engines. Notably, for the first year London St. Pancras nitrogen dioxide levels fell below National Air Quality Objectives limits – a direct impact of less diesel trains terminating at the location and therefore providing a cleaner, safer environment for passenger and staff.

Wider results indicate a positive and improving position on 2021, with National Air Quality Objectives being met at all monitoring locations for the first time. It should be noted data capture over the year was low due to monitoring equipment being down for maintenance and calibration. See Section 6.

EMR's Fleet Strategy continues to progress well – with the pending introduction of new bi-modal (Class 810) trains being transformational to EMR's clean air and low emissions railway aspiration – Section 5 outlines our key actions to improve AQ which we will be working to deliver and reporting on progress annually.

If you would like more information regarding EMR's air quality work or have any feedback or comments – please contact: sustainableEMR@eastmidlandsrailway.co.uk.

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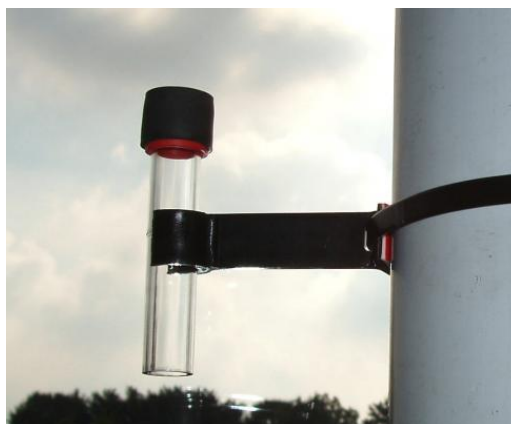
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2.   Monitoring approach and methodology

EMR's approach and methodology to AQ monitoring was agreed with the Department for Transport on 16th October 2019. This was developed following consultation with Rail Safety Standards Board (RSSB) and Local Authority air quality specialists.

The monitoring approach is based on the following principles, which seek to provide:

- High-quality, timely, continuous air quality data, demonstrating EMR's commitment to the environment and occupational health compliance; as well as quantifying the local air quality impact of EMR's new fleet introduction strategy

- An indicative evaluation and greater understanding of the risks associated with diesel engine exhaust emissions (DEEE)

- Data which can be easily shared with interested Local Authorities and external stakeholders – it being highly valuable to Local Authority air quality management planning and therefore informs collaborative action plans to improve local AQ

- EMR the opportunity to become an active part of the solution to poor air quality and making this core to a wider Sustainability Strategy

Currently, EMR monitor emissions from diesel train engines at 10 locations – the figure below provides an illustrative example of EMR's AQ monitoring equipment.

Figure 1: AQMesh air quality monitor and nitrogen dioxide diffusion tubes:

The AQMesh is a continuous emissions monitor, measuring concentrations of nitrogen dioxide (NO_2) and particulate matter (PM) every 15 minutes. AQMesh monitoring locations are provided in Section 3 below – locations were selected with consideration to relevant guidance (notability the Local Air Quality Management Technical Guidance series), including that of RSSB and Local Authority air quality specialist and following consultation with staff and Trade Unions.

Locations sought to balance providing a representational assessment of local AQ with consideration of emissions from EMR trains, with practical, technical, and regulatory constraints for siting.

NO$_2$ diffusion tubes were used primarily in establishing the AQ Monitoring Network – allowing EMR to better determine locations which can provide a representational assessment of local AQ. Diffusion tubes provide an average measurement of NO$_2$ concentrations – typically across four weeks. As described in Section 5, EMR's AQ work with the RSSB outlines plans to establish routine NO2 diffusion tube use across seven stations.

EMR continues to work closely with the RSSB, to optimise its AQ Monitoring Network and in supporting their research to improve AQ monitoring and develop actions to improve local AQ – See Section 5.

Details of the UK Rail Industries strategic approach to AQ management can be found here - https://www.rssb.co.uk/en/research-and-technology/sustainability/Air-quality
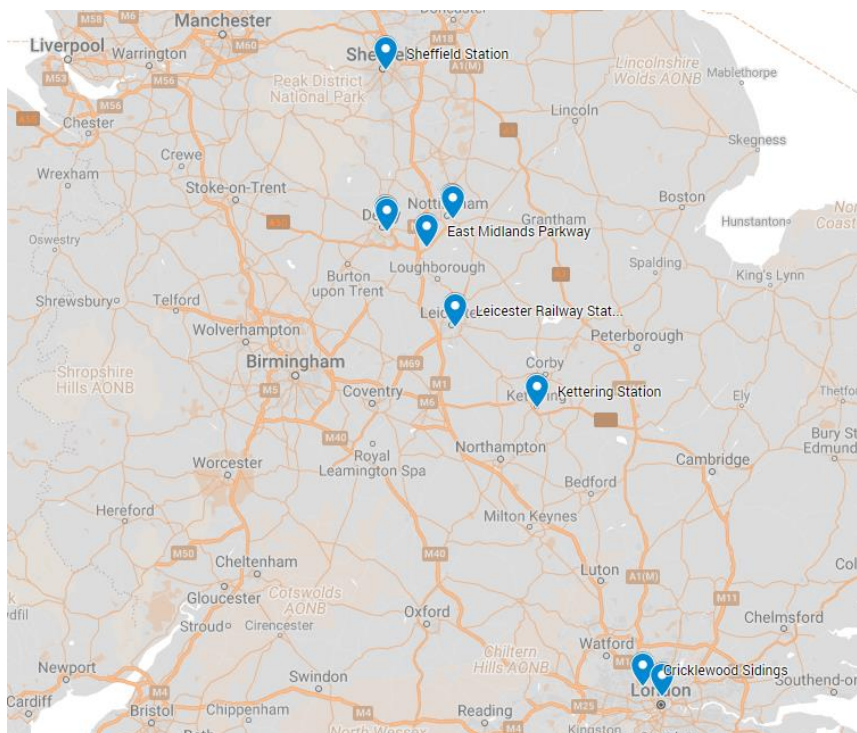
3. Monitoring results

During December 2019 and January 2020 EMR installed and commissioned a network of 10 air quality monitors – the AQMesh, at the following sites and monitoring locations:

Site	Address	Monitoring l\focation
Derby Station	Derby Railway Station, Midland Road, Derby, Derbyshire, DE1 2SA	Platform 5
Kettering Station	Kettering Station, Station Road, Kettering, Northamptonshire, NN15 7HJ	Platform 2/3
East Midlands Parkway Station	East Midlands Parkway, Ratcliffe On Soar, Nottingham, Nottinghamshire, NG11 0EB	Platform 1
Cricklewood Depot	Cricklewood Depot Brent Terrace London NW2 1LN	Fuelling Roads
Nottingham Station	Nottingham Station, Carrington Street, Nottingham, Nottinghamshire, NG2 3AQ	Platform 6
Eastcroft Depot	Eastcroft Sidings, Off London Road, Sneinton, Nottingham, Nottinghamshire, NG2 3AH	Fuelling Apron
Sheffield Station	Sheffield Station, Sheaf Street, Sheffield, South Yorkshire, S1 2BP	Platform 6/8
London St. Pancras Station	St Pancras International, Euston Rd, Kings Cross, London N1C 4QP	Platform 3/4
Leicester Station	Leicester Station, London Road, Leicester, Leicestershire, LE2 0QB	Platform 3/4
Etches Park Depot	Etches Park Depot, Deadmans Lane, Derby, Derbyshire, DE24 8BS	Fuelling & Inspection Roads

Figure 2 below presents these locations geographically – this can be viewed interactively online here - https://www.google.com/maps/d/edit?mid=1bL_Pt3pBJycvrjXJ1oiEXafW4Ujf9AXY&ll=52.48480771240509%2C-1.5376287562500224&z=8

Figure 2: East Midlands Railway air quality monitoring locations:

Derby Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	54.1	1-hour mean*	n/a	514.0	200 – not to be exceeded more than 18 times per year	6
		Annual mean	31.7	n/a	40	n/a
PM10	43.9	24- hour mean	12.7	34.5	50 – not to be exceeded more than 35 times per year	0
		Annual mean	12.7	n/a	40	n/a
PM2.5	43.9	Annual mean	8.1	n/a	25	n/a

Kettering Station*

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	0	1-hour mean*	n/a	n/a	200 – not to be exceeded more than 18 times per year	n/a
		Annual mean	n/a	n/a	40	n/a
PM10	0	24- hour mean	n/a	n/a	50 – not to be exceeded more than 35 times per year	n/a
		Annual mean	n/a	n/a	40	n/a
PM2.5	0	Annual mean	n/a	n/a	25	n/a

East Midlands Parkway Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	19.8	1-hour mean*	n/a	126.9	200 – not to be exceeded more than 18 times per year	0
		Annual mean	18.0	n/a	40	n/a
PM10	20.6	24- hour mean	6.5	18.6	50 – not to be exceeded more than 35 times per year	0
		Annual mean	8.4	n/a	40	n/a
PM2.5	20.6	Annual mean	5.5	n/a	25	n/a

Cricklewood Depot

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	61.7	1-hour mean*	n/a	135.3	200 – not to be exceeded more than 18 times per year	0
		Annual mean	25.9	n/a	40	n/a
PM10	62.4	24- hour mean	12.9	55.9	50 – not to be exceeded more than 35 times per year	1
		Annual mean	12.8	n/a	40	n/a
PM2.5	62.4	Annual mean	9.4	n/a	25	n/a

Nottingham Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	57.1	1-hour mean*	n/a	402.0	200 – not to be exceeded more than 18 times per year	4
		Annual mean	40.3	n/a	40	n/a
PM10	58.0	24- hour mean	11.4	32.8	50 – not to be exceeded more than 35 times per year	0
		Annual mean	11.4	n/a	40	n/a
PM2.5	58.0	Annual mean	7.7	n/a	25	n/a

Eastcroft Depot

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	22.0	1-hour mean*	n/a	677.0	200 – not to be exceeded more than 18 times per year	2
		Annual mean	24.2	n/a	40	n/a
PM10	22.6	24- hour mean	13.3	39.6	50 – not to be exceeded more than 35 times per year	
		Annual mean	11.6	n/a	40	n/a
PM2.5	22.6	Annual mean	9.4	n/a	25	n/a

Sheffield Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	39.5	1-hour mean*	n/a	161.5	200 – not to be exceeded more than 18 times per year	0
		Annual mean	25.2	n/a	40	n/a
PM10	57.7	24- hour mean	10.0	32.2	50 – not to be exceeded more than 35 times per year	0
		Annual mean	10.1	n/a	40	n/a
PM2.5	58.0	Annual mean	7.7	n/a	25	n/a

London St. Pancras Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	60.8	1-hour mean*	n/a	135.4	200 – not to be exceeded more than 18 times per year	0
		Annual mean	36.5	n/a	40	n/a
PM10	61.1	24- hour mean	5.4	32.0	50 – not to be exceeded more than 35 times per year	0
		Annual mean	5.4	n/a	40	n/a
PM2.5	60.4	Annual mean	5.3	n/a	25	n/a

Leicester Station

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	29.5	1-hour mean*	n/a	123.9	200 – not to be exceeded more than 18 times per year	0
		Annual mean	29.9	n/a	40	n/a
PM10	35.9	24- hour mean	13.6	31.4	50 – not to be exceeded more than 35 times per year	0
		Annual mean	13.6	n/a	40	n/a
PM2.5	35.9	Annual mean	9.2	n/a	25	n/a

Etches Park Depot

Pollutant	Valid data capture for monitoring period (%)	Concentration measured as	Mean measurement (µg/m³)	Maximum measurement (µg/m³)	Air Quality Objective in England (µg/m³)	Number of measurements greater than Air Quality Objective in England (µg/m³)
NO2	15.4	1-hour mean*	n/a	227.4	200 – not to be exceeded more than 18 times per year	1
		Annual mean	26.9	n/a	40	n/a
PM10	16.0	24- hour mean	10.6	48.8	50 – not to be exceeded more than 35 times per year	0
		Annual mean	10.2	n/a	40	n/a
PM2.5	16.0	Annual mean	8.6	n/a	25	n/a

Note, the 1-hour mean should apply to "*those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more*" – https://laqm.defra.gov.uk/technical-guidance/.

*Note, during 2022 technical constraints at Kettering Station prohibited the monitoring equipment gathering data. See Section 6 – Supporting technical information/air quality monitoring data quality assurance and control.

Indicates improving or static AQ monitoring results

Indicates deteriorating AQ monitoring results

4.   Comment, analysis, and interpretation

Over the third year of EMR's AQ monitoring network, further baseline data has been gathered across the 10 sites monitored. Notably 2022 results for the first time were not significantly impacted by the Covid-19 pandemic – as train services and wider background sources of air pollution stabilised and returned to pre-pandemic norms – with the exception of significant industrial action in the second half of the year and associated service disruption/reduced timetables.

Clear trends continue to be observed at the distinct types of sites monitored – poorer AQ at stations correlates to the timetable as more services and diesel engine exhaust emissions (DEEE) are evident at peak travel times. Depot site monitoring shows a clear night-time increase in emissions as Depot become operational during these hours.

Indicative of the impact from EMR's first all-electric trains (EMR Connect) being introduced and seen more widely across the monitoring network – all locations broadly experienced less peaks of poor AQ. Notably, for the first year London St. Pancras nitrogen dioxide levels fell below National Air Quality Objectives limits – a direct impact of less diesel trains terminating at the location and therefore providing a cleaner, safer environment for passenger and staff.

Overall results indicate a positive and improving position on 2021 with National Air Quality Objectives being met at all stations and depots. Across the majority to urban sites, annual mean concentrations for NO_2 were consistent or improved compared to 2021 levels.

As covered in Section 5, the RSSB is developing a project, in collaboration with industry partners, to establish a set of AQ targets specifically for the Rail Industry – EMR intends to analyse and interpret monitoring results to these target as they become established.

5.   Action to improve air quality

EMR is in the process of delivering a significant fleet replacement. Upgrading older diesel units for more modern/efficient units – which includes a bi-modal fleet for main line services, utilising electrified lines from and south of Corby and running on diesel where the network in not electrified. A gradual replacement of the train fleet commenced in 2020, including:

- Phase out the use of single car Class 153s trains (except in exceptional circumstances)

- Modern electric trains (Class 360) from Corby to London services introduced from May 2021

- A programme of regional fleet replaced by more modern diesel trains - Class 170 trains introduced from October 2020

- New bi-mode trains introduced in 2023

EMR's fleet introduction strategy will continue to mitigate the hazards and reduce DEEE. From May 2021; electric trains from Corby were introduced, producing zero DEEE – resulting in one less diesel train per hour to/from London St. Pancras. From 2023 services operating between Sheffield and Nottingham and London St Pancras will be phasing in bi-mode trains which will be powered electrically on the overhead line where they are available – including into London St. Pancras.

In developing the EMR AQ Monitoring Network working relationships have been developed with Local Authority AQ teams and policy makers at Camden Council, Nottingham City Council and Sheffield City Council.

This collaborative approach to local AQ management was an outlined objective of the project and EMR will continue to work with colleagues, customers and communities to ensure transparency of monitoring data and that appropriate action is taken to improve AQ.

Our AQ Monitoring Network also forms a central theme of EMR's Sustainability Strategy –outlining EMR's position and aspiration around supporting the industry in addressing the issue of poor AQ and becoming a low emission railway. Work in this area has included supporting the RSSB and Kings College London in undertaking a campaign of on-board AQ monitoring, participating in Depot AQ monitoring research at Neville Hill Depot and further research described in Section 5.1.

The table below outlines our key actions to improve AQ which we will be working to deliver and reporting on progress annually.

5.1   Key actions and to improve air quality

Action No.	Action	Date action introduced	Organisations involved	Progress to date
1.	Fleet replacement strategy	From Feb 2020	EMR, Network Rail, Rolling Stock Companies	Though impacted by Covid-19, and leasing constraints, timeframes associated are provided above. Results from station and depot sites impacted by EMR Connect trains, indicate a continued positive improvement on 2021 data.
2	Collaboration with stakeholders – sharing AQ monitoring and improvement action knowledge and best practise	From Jan 2020	EMR, RSSB, Local Authorities	Described above – a focus over 2023 is continued collaboration and support to the RSSB in relation to their station monitoring programme, see Action 5. EMR continue to work as part of the Camden Clear Air Partnership and actively working to develop a further Camden Clean Air Action Plan.
3	Station car park electric vehicle (EV) charging network and promotion of sustainable car use	From Aug 2021	EMR	Scoping, feasibly and design complete for first EV charging points – Loughborough Station charging points to be installed in early 2023.
4	Eminox exhaust aftertreatment trial on Class 170	From Feb 2021	EMR, Porterbrook, Innovate UK	Trial successfully completed, a report will be issued to the Secretary of State on its results and proposed next steps by 31 March 2023.
5	RSSB AQ monitoring programme	From April 2021	RSSB, EMR	Seven additional monitoring locations at EMR stations established and monitored over 2022 – EMR overseeing management and maintenance. Planning underway for a permanent reference monitor at Sheffield Station and participation in a study of on-board particulate emissions on EMR Class 222 trains
6	Policy and procedure improvements – consolidating relevant EMR policies and procedures (train idling, monitoring standards and change management) to reduce DEEE	From June 2021	EMR	Business AQ monitoring standard developed and scope of internal Depot monitoring increased over 2021. Progress EMR's Clean Air Working Group accountable for the delivery of an associated improvement plan.
7	A programme of Depot infrastructure improvements targeting and benefiting an improvement in local workplace AQ	From June 2021	EMR	Installation of extraction systems upgrades at Etches Park Depot – monitoring results post installation show significant reduction in nitrogen dioxide levels.

6. Supporting technical information/air quality monitoring data quality assurance and control

Our primary monitoring method – the AQMesh continuous emission monitor, was selected for EMR's AQ Monitoring Network as its attributes suit the safety critical and operational environments of the rail industry.

Monitoring devises are low maintenance and were calibrated by the supplier pre-installation. During 2022 all monitors underwent a full service and calibration from the manufacturer. Electro-chemical cell gas sensors were replaced and calibrated against reference equipment, Thermo Scientific 42i. Particulate analysers were serviced and calibrated against reference equipment, Fidas 200.

As a result of the service, maintenance and calibration of monitoring equipment, data capture over 2022 was lower than previous years. Work over 2023 will focus on optimising the monitoring networks performance and maximising data quality – specifically addressing the technical constraints at Kettering Station as a priority.

Data captured has been validated against other nearby monitoring data by Local Authority and Defra predicted background concentrations.

EMR