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AIRBORNE DUST MONITORING AT VARIOUS LONDON UNDERGROUND STATIONS - ES12102

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Executive Summary

Dust monitoring was undertaken across 24 London Underground (LU) train station platforms and ticket halls. The monitoring was undertaken between October and November 2020.

The results for the respirable dust fractions were compared against the previous dust monitoring exercise conducted in July 2019 at 12 LU train stations. The majority of the concentrations had decreased at the following eight stations: Euston Square, Hampstead, Paddington, King's Cross, Piccadilly Circus, Oxford Circus, Tottenham Court Road and Vauxhall.

A slight increase in dust levels were monitored at the following four LU train stations: Aldgate East, Baker Street, Elephant & Castle and Waterloo. The most significant increase in dust levels was observed at Elephant & Castle station Platform 2, southbound Northern line.

The metal content within the inhalable dust fraction showed very low concentrations, Iron oxide was found present at greater concentrations compared to other metals analysed. This would be expected in the underground tunnel environment, as a result of the wheel-rail interface.

The airborne dust concentration in the inhalable, PM_{10}, respirable and $PM_{2.5}$ decreased as the size fraction decreased as expected. Some exceptions were noted, potentially due to sampling variations or local interference.

1. Introduction

1.1. At the request of Mr Nick Wilson, Occupational Hygienist – Transport for London, a dust monitoring programme was to be undertaken during October and November 2020 at twenty-four selected platforms and ticket halls across London Underground (LU) stations.

1.2. The scheduled dust monitoring sessions was to be undertaken in accordance with the scope specification document ES12102, version v3, 09.01.2020. 'London Underground Network: Occupational Exposures to dust monitoring and survey.' As follows:

- *To undertake monitoring in line with MDHS14/4 and HSG173, with exposure results being compared to those detailed within HSE document EH40, issue 4, Jan 2020, where applicable.*
- *To establish the work shift exposures to respirable dust for train operators for each underground line*
- *To establish the work shift exposures to respirable crystalline silica for train operators for each underground line*
- *To establish the workshift exposures to respirable dust for station staff across a sample of 24 stations*
- *To measure respirable dust levels at the platforms and gatelines of the sample group of stations*
- *To replicate each static station measurement and personal samples on train operators in PM 2.5 and PM 10 aerodynamic diameter fraction sizes*
- *To analyse 24 samples in inhalable fraction from the sample group of stations for their metallic content.*
- *To measure in real time (can use photo optical measurement device) the dust levels along each line in Respirable, PM 10 and PM 2.5 fractions.*
- *To produce a final report detailing the findings, broadly following the British occupational Hygiene Societies guidance on report writing.*

Undertake a programme of workplace sampling at London Underground Stations and in trains in accordance with the Health and Safety Executives (HSE) guidance on gravimetric sampling (MHDS 14/4).

1.2.1 Undertake Work shift exposure monitoring for the train operators (drivers) on the following lines

- *Victoria*
- *Piccadilly*
- *Central*
- *Northern*
- *Jubilee*
- *Bakerloo*
- *Circle*
- *District*

The sampling for each line will involve at least 3 entire line runs (end to end) and will monitoring the following:

- *Respirable Dust*
- *PM 2.5*
- *PM 10*
- *Respirable Crystalline Silica (to be analysed by the Institute of Occupational Medicine)*

1.2.2 Undertake real time monitoring of dust levels in train operators cabins. This work can be undertaken using photo optical equipment. The calibration test particulate density must be stated in the report and whether or not the results were corrected to take account of the high density of rail dusts.

1.2.3 Undertake static and personal monitoring at 12 London Underground stations

The Stations will include the following group. The number of anticipated sample points including one personal sample per station are detailed in brackets below:

Aldgate East (4)

Baker Street (8)

Elephant & Castle (7)

Euston Square (5)

Hampstead (4)

Kings Cross (11)

Oxford Circus (8)

Paddington (6)

Piccadilly Circus (6)

Tottenham Court Road (6)

Vauxhall (4)

Waterloo (8)

1.2.4 Undertake static and personal monitoring at an additional twelve stations from across the network. These will be selected by London Underground Management and Trade Unions for monitoring. It is anticipated all or most of these stations will be within the curtilage of the North and South Circular road system

The quote should assume:

- *74 Static sampling points to measure respirable, PM 2.5, PM 10 dust fractions*
- *12 Personal samples measuring respirable dust*
- *12 sample points on the deep tube (where applicable) to measure Inhalable dust and to analyse those for metal content (see section 3.1.5)*

- *At least one personal sample in respirable fraction shall be taken at each station. The similarly exposed group of staff from which to sample are the Customer Service Assistants at each station*

1.2.5 Additionally a single inhalable sample will be taken at each station from a Platform on the deep tube lines. This sample will then be submitted for content analysis for comparison against the exposure limits published in the HSE document EH40/2005.

The sample will be analysed for the following substances:

- *Iron (in oxide form)*
- *Manganese*
- *Copper*
- *Zinc*
- *Chromium (all species)*
- *Chromium VI*
- *Nickel*
- *Arsenic*
- *Aluminium*

1.3. The scheduled monitoring exercise that took place this year, was altered slightly from the initial scope of works due to the Coronavirus pandemic. Personal monitoring on London Underground station staff and train driver operators was not possible due to social distancing requirements.

1.4. The train operator's exposure assessments will be undertaken at a later date.

1.5. Static monitoring has been the primary tool of this year's assessment, with the focus being placed on stations selected by the client. This year's monitoring included an additional 12 stations on top of the standard 12 that have undergone exposure assessments for a number of previous years.

1.6. In line with the above scope document, dust monitoring was carried out at the following twenty-four selected stations, platforms and gate lines (see Table 1). Dust monitoring comprised of air sampling for respirable dust and inhalable dust as well as $PM_{2.5}$ and PM_{10} aerodynamic diameter fraction sizes.

STATIONS	SAMPLING LOCATIONS	SAMPLE TYPE
Aldgate East	District, Hammersmith & City and Circle lines platforms Gate line/ Ticket Hall.	Static
Baker Street	Jubilee, Bakerloo, Hammersmith & City and Circle lines platforms, Ticket Hall and Gate lines.	Static

STATIONS	SAMPLING LOCATIONS	SAMPLE TYPE
Elephant & Castle	Bakerloo line platforms, Ticket Hall and Gate lines.	Static
Euston Square	Circle and Hammersmith & City line platforms, Ticket Hall & Gate lines.	Static
Hampstead	Northern line platforms & Ticket Hall, Gate lines.	Static
King's Cross	Piccadilly, Victoria, Northern, Hammersmith & City, Circle and Metropolitan lines platforms & Ticket Hall.	Static
Oxford Circus	Bakerloo, Central and Victoria lines platforms & Ticket Hall.	Static
Paddington	District & Circle, Bakerloo lines platforms and Ticket Hall.	Static
Piccadilly Circus	Piccadilly and Bakerloo lines platforms & Ticket Hall.	Static
Tottenham Court Road	Central and Northern lines platforms & Northern Ticket Hall.	Static
Vauxhall	Victoria Line platforms & Ticket Hall	Static
Waterloo	Bakerloo, Northern and Jubilee lines platforms, Ticket Hall.	Static
Westminster	Jubilee, District & Circle lines platforms, Ticket Hall.	Static

STATIONS	SAMPLING LOCATIONS	SAMPLE TYPE
Mile End	Central and Hammersmith and City & District lines platforms, Ticket Hall.	Static
Holborn	Piccadilly and Central lines platforms, Ticket Hall.	Static
Kennington	Northern line platforms and Ticket Hall.	Static
Highbury & Islington	Victoria line platforms and Ticket Hall.	Static
Tooting Bec	Northern line platforms and Ticket Hall.	Static
London Bridge	Jubilee and Northern lines platforms, Ticket Hall.	Static
Bank	Central and Northern lines platforms, Ticket Hall.	Static
Moorgate	Northern, Metropolitan, Hammersmith and City, Circle lines platforms, Ticket Hall.	Static
Embankment	Bakerloo and Northern lines platforms, Ticket Hall.	Static
Canada Water	Jubilee line platforms and Ticket Hall.	Static
Colliers Wood	Northern line platforms and Ticket Hall.	Static

Table 1. Locations to be monitored.

2. Technical Background

2.1. Airborne Dust in Occupational Health

2.1.1. The health effects from the inhalation of airborne dust are dependent upon the size, shape and composition of the particulates. In occupational health, airborne dust is classified as three fractions - inhalable, thoracic or respirable. Summary as follows:

- The inhalable fraction of dust is defined as particulates that can be inhaled and deposited throughout the respiratory tract, i.e. from the nasal to the alveolar region in the lungs, diameter size measuring up to 100µm.
- Thoracic dust is the fraction of inhaled airborne material penetrating beyond the larynx.
- Respirable dust is the fraction of dust that are small enough to penetrate the deep lung, typically less than 4-5µm diameter size, and largely deposit in the alveolar region where gas exchange takes place.

2.1.2. The COSHH definition of a substance hazardous to health includes dust of any kind when present in air equal or greater than 10mg/m^3 8-hr time-weighted average (TWA) for inhalable dust and 4mg/m^3 8-hour TWA for respirable dust. A short-term 15-minute TWA exposure limits do not currently exist for airborne dust, but usually the short-term exposure limits are taken to be 3 times the long-term exposure limits.

2.1.3. Substances in Health and Safety Executive Document EH40/2005, 4th Edition 2020 Workplace Exposure Limits use the inhalable and respirable dust fractions.

2.1.4. Many metals have WELs in EH40/2005, 4th Edition 2020 as they can pose additional health risks. Therefore, the metal content in the inhalable dust samples are determined by laboratory analysis . Inhalable dust samples were taken at each deep tube line platform, as per Scope document ES12102 version v3, 09.01.2020. 'London Underground Network: Occupational Exposures to dust monitoring and survey'.

2.1.5. The Workplace Exposure Limits for Iron Oxide (fumes, as Fe), Zinc, Chromium, Copper, Nickel and Manganese, Arsenic, Aluminium are detailed within table below (Table 2):

SUBSTANCE	LONG - TERM EXPOSURE LIMIT OF (8-HOUR TIME WEIGHTED AVERAGE) / MG.M^{-3}
Iron oxide (fumes, as Fe)	5
Copper dusts and mists (as Cu)	1
Chromium	0.5
Chromium II compounds (as Cr)	0.5

SUBSTANCE	LONG - TERM EXPOSURE LIMIT OF (8-HOUR TIME WEIGHTED AVERAGE) / MG.M^{-3}
Chromium III compounds (as Cr)	0.5
Chromium VI, compounds (as Cr)	0.01 0.025 (process generated)
Nickel and its organic compounds Water-soluble Water insoluble	 0.1 0.5
Manganese and its inorganic compounds – respirable	0.05
Zinc distearate – respirable dust	4
Arsenic and arsenic compounds except arsine (as As)	0.1
Aluminium metal Inhalable dust Respirable dust	 10 4

Table 2. Workplace Exposure Limits from HSE EH40/05, 4th Edition, January 2020.

2.2. Particulate Matter

2.2.1. Particulate Matter (PM) is a mixture of micrometre sized solid and liquid particulates of various sizes and chemical composition. It is recognised as pollutant with an impact on human health.

2.2.2. There are two fractions of particular health interest due to their sizes. These dust fractions are defined by their diameters, with aerosol particulates having a diameter of less than 10µm, known as PM_{10} and aerosol particulates with a diameter of less than 2.5µm, known as $PM_{2.5}$. Due to their size differences, PM_{10} is known as the coarse fraction and $PM_{2.5}$ is known as the fine fraction. While particulate matter is known to cause adverse effects to human health, they are not assessed using Workplace Exposure Limits.

2.2.3. Sources of PM vary based on location, with the source of PM in urban environments mainly from road traffic. Within the railway environment the particulate matter mainly originates from the train wheel and rail interface, braking activity, but may also be from cementitious sources. Studies to determine concentrations and compositions of the $PM_{2.5}$ and PM_{10} within the underground environment have noted that iron oxide is the most predominant at 47% of the overall composition (J.D. Smith et al., 2020).

3. Method

3.1. Airborne dust concentrations were monitored in accordance to 4-RAIL Services limited, UKAS accredited laboratory number 1931, in-house test procedure 4R-E206 Method for sampling and gravimetric analysis of respirable, thoracic and inhalable aerosols. On site monitoring and procedures are based on guidance given in Health & Safety Executive Document MDHS 14/4.

3.2. Sampling was carried out using pumps with different sampling heads to collect the different fractions of dust needed, as follows:

3.2.1. PM2.5 – sampled using SKC Personal Environmental Monitor (PEM) PM2.5 impactor heads with glass fibre filters

3.2.2. PM10 – sampled using SKC Personal Environmental Monitor (PEM) PM2.5 impactor heads with glass fibre filters

3.2.3. Respirable dust – sampled using cyclone heads with polyvinyl chloride (PVC) filters

3.2.4. Inhalable dust – sampled using IOM Inhalable heads with PVC filters.

3.3. Examples of the $PM_{2.5}$, PM_{10}, IOM inhalable and respirable cyclone dust heads and air samplers used in this exercise are shown in Appendix 1.

3.4. Sampling for respirable dust, $PM_{2.5}$ and PM_{10} was undertaken at arrival ends on each platform and within each ticket hall/ gate line, where LU station staff were carrying out customer service duties. Inhalable dust sampling was to be carried out on the deepest tube lines at each station.

3.5. The sampling points and location codes are given in the table of results.

3.6. The inhalable samples were analysed for metal content by UKAS accredited laboratory, Institute of Occupational Medicine (IOM), accreditation no. 0374.

4. Analysis

4.1. The samples taken on site were returned to the laboratory where gravimetric analysis was undertaken in accordance with MDHS 14/4 & 4-RAIL Services in-house test procedure 4R-E206.

4.2. Following gravimetric analysis of the inhalable dust samples, the filters were submitted together with the site blanks to the Institute of Occupational Medicine (IOM) for quantitative analysis of metals.

5. Results & Discussion

The airborne respirable dust, inhalable dust, $PM_{2.5}$ and PM_{10} results for the station monitoring programme are shown in Tables 3 to 26.

The quantitative metal concentrations of the inhalable samples are given in Tables 27 to 30.

The respirable dust results are summarised for each of the stations monitored, listed below. Where data was available from previous monitoring programme carried out in July 2019 (Report ref. *4RS-APO-190189-R658226, issue date February 2020)*, a comparison between concentrations was carried out in order to assess trends in dust levels.

5.1. Respirable Dust Results

5.1.1. Aldgate East Station

The monitoring carried out on the 27th October 2020 (Table 3) showed that the respirable dust concentrations were between 0.43 and 0.64 mg/m^3, with the highest sample collected from the ticket hall.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight increase in dust levels at two out of three of the locations monitored. The most significant increase from previous monitoring programme was from 0.22 mg/m^3 to 0.64mg/m^3, recorded for the sample collected from the ticket hall.

5.1.2. Baker Street Station

The monitoring carried out on the 28th October 2020 (Table 4) showed that the respirable dust concentrations were between 0.03 and 1.18 mg/m^3, with the highest sample collected from Platform 9.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight increase in dust levels at the majority of the locations monitored. The most significant increase from previous monitoring programme was from 0.27 mg/m^3 to 0.53mg/m^3, recorded for the sample collected from Platform 5.

5.1.3. Elephant & Castle Station

The monitoring carried out on the 29th October 2020 (Table 5) showed that the respirable dust concentrations were between < 0.02 and 1.21 mg/m^3, with the highest sample collected from Platform 2.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight increase in dust levels at all of the locations monitored. The most significant increase from previous monitoring programme was from 0.43 mg/m^3 to 1.21mg/m^3, recorded for the sample collected from Platform 2.

5.1.4. Euston Square Station

The monitoring carried out on the 30th October 2020 (Table 6) showed that the respirable dust concentrations were between 0.02 and 0.42 mg/m^3, with the highest sample collected from outside the station supervisor office.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a decrease in dust levels at all of the locations monitored. The most significant decrease from previous monitoring programme was from 0.56 mg/m^3 to 0.07mg/m^3, recorded for the sample collected from Platform 2.

5.1.5. Hampstead Station

The monitoring carried out on the 2nd November 2020 (Table 7) showed that the respirable dust concentrations were between 0.13 and 0.59 mg/m^3, with the highest sample collected from Platform 2.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a decrease in dust levels at all of the locations monitored. The most significant decrease from previous monitoring programme was from 1.09 mg/m^3 to 0.46mg/m^3, recorded for the sample collected from Platform 1.

5.1.6. King's Cross Station

The monitoring carried out on the 30th November 2020 (Table 8) showed that the respirable dust concentrations were between 0.08 and 1.14 mg/m^3, with the highest sample collected from Platform 3. It should be noted that the air sampler positioned at Platform 4 was found non-functional and no data could be reported.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at the majority of the locations monitored. The most significant decrease from previous monitoring programme was from 0.73 mg/m^3 to 0.23mg/m^3, recorded for the sample collected from Platform 2.

5.1.7. Oxford Circus Station

The monitoring carried out on the 4th November 2020 (Table 9) showed that the respirable dust concentrations were between < 0.02 and 1.14 mg/m^3, with the highest sample collected from Platform 1.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at the majority of the locations monitored. The most significant decrease from previous monitoring exercise was of 1.64 mg/m^3 to 0.98mg/m^3, recorded for the sample collected from Platform 3.

5.1.8. Paddington Station

The monitoring carried out on the 5th November 2020 (Table 10) showed that the respirable dust concentrations were between 0.05 and 1.14 mg/m^3, with the highest sample collected from Platform 4.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at half of the locations monitored. The most significant decrease from previous monitoring programme was from 0.48 mg/m^3 to 0.05mg/m^3, recorded for the sample collected from the District & Circle Line ticket hall.

5.1.9. Piccadilly Circus Station

The monitoring carried out on the 6th November 2020 (Table 11) showed that the respirable dust concentrations were between 0.07 and 1.69 mg/m^3, with the highest sample collected from Platform 3.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at the majority of the locations monitored. The most significant decrease from previous monitoring programme was from 1.56 mg/m^3 to 0.11mg/m^3, recorded for the sample collected from Platform 2. This result might be indicative due to the very low dust concentration obtained in comparison to the dust concentration on the sample from the other platforms.

5.1.10. Tottenham Court Road Station

The monitoring carried out on the 9th November 2020 (Table 12) showed that the respirable dust concentrations were between < 0.02 and 1.12 mg/m^3, with the highest sample collected from the Platform 4.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at the majority of the locations monitored. The most significant decrease from previous monitoring programme was from 1.96 mg/m^3 to 1.06mg/m^3, recorded for the sample collected from Platform 2.

5.1.11. Vauxhall Station

The monitoring carried out on the 10th November 2020 (Table 13) showed that the respirable dust concentrations were between 0.36 and 1.12 mg/m^3, with the highest sample collected from Platform 1.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight decrease in dust levels at the majority of the locations monitored. The most significant decrease from previous monitoring programme was from 0.54mg/m^3 to 0.36mg/m^3, recorded for the sample collected from the ticket hall.

5.1.12. Waterloo Station

The monitoring carried out on the 11th November 2020 (Table 14) showed that the respirable dust concentrations were between 0.23 and 1.10 mg/m^3, with the highest sample collected from Platform 3.

When compared to the previous results obtained in July 2019, the general trend for respirable dust concentrations showed a slight increase in dust levels at the majority of the locations monitored. The most significant increase from previous monitoring programme was from 0.52 mg/m^3 to 0.92mg/m^3, recorded for the sample collected from Platform 5.

5.1.13. Westminster Station

The monitoring carried out on the 12th November 2020 (Table 15) showed that the respirable dust concentrations were between 0.35 and 0.91 mg/m^3, with the highest sample collected from Platform 3.

5.1.14. Mile End Station

The monitoring carried out on the 13th November 2020 (Table 16) showed that the respirable dust concentrations were between 0.19 and 0.75 mg/m^3, with the highest sample collected from Platform 4.

5.1.15. Holborn Station

The monitoring carried out on the 16th November 2020 (Table 17) showed that the respirable dust concentrations were between 0.03 and 2.27 mg/m^3, with the highest sample collected from Platform 1.

5.1.16. Kennington Station

The monitoring carried out on the 17th November 2020 (Table 18) showed that the respirable dust concentrations were between 0.19 and 1.00 mg/m^3, with the highest sample collected from Platform 2.

5.1.17. Highbury & Islington

The monitoring carried out on the 18th November 2020 (Table 19) showed that the respirable dust concentrations were between 0.06 and 0.66 mg/m^3, with the highest sample collected from Platform 3.

5.1.18. Tooting Bec Station

The monitoring carried out on the 19th November 2020 (Table 20) showed that the respirable dust concentrations were between 0.03 and 0.70 mg/m^3, with the highest sample collected from Platform 1.

5.1.19. London Bridge

The monitoring carried out on the 20th November 2020 (Table 21) showed that the respirable dust concentrations were between 0.52 and 1.23 mg/m^3, with the highest sample collected from the Platform 2.

5.1.20. Bank Station

The monitoring carried out on the 23rd November 2020 (Table 22) showed that the respirable dust concentrations were between 0.27 and 0.83 mg/m^3, with the highest sample collected from Platform 5.

5.1.21. Moorgate Station

The monitoring carried out on the 24th November 2020 (Table 23) showed that the respirable dust concentrations were between 0.21 and 1.36 mg/m^3, with the highest sample collected from Platform 8.

5.1.22. Embankment Station

The monitoring carried out on the 25th November 2020 (Table 24) showed that the respirable dust concentrations were between 0.45 and 0.94 mg/m^3, with the highest sample collected from outside the station supervisor office.

5.1.23. Canada Water Station

The monitoring carried out on the 26th November 2020 (Table 25) showed that the respirable dust concentrations were between 0.33 and 1.15 mg/m^3, with the highest sample collected from Platform 2.

5.1.24. Colliers Wood Station

The monitoring carried out on the 27th November 2020 (Table 26) showed that the respirable dust concentrations were between 0.28 and 0.88 mg/m^3, with the highest sample collected from Platform 1.

5.2. Particulate Matter – $PM_{2.5}$ and PM_{10}

The findings were assessed by comparing the various dust fractions concentrations at each of the stations monitored. A general particulate size distribution would be classified as follows: the inhalable fraction of dust to include all particulates with size diameters of up to 100 µm, the respirable fraction to include all particulates with an average aerodynamic diameter of up to 4-5 µm, PM_{10} to include all particulates with diameters of up to 10 µm and the $PM_{2.5}$ to include all particulates with a diameter of up to 2.5 µm.

Therefore, a typical particle size distribution trend for the dust concentrations obtained from this current monitoring exercise would show at each location monitored the highest concentration for the inhalable fraction, followed by PM_{10} concentrations, then respirable fraction and finally $PM_{2.5}$ concentration. The findings of this trend and any deviations are detailed below for each station and summarised in the conclusion section 6.

5.2.1. Aldgate East Station

The results for particulate matter were between 0.15 and 0.17 mg/m^3 for $PM_{2.5}$ and between 0.49 and 0.53 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 1.

At the majority of the locations monitored, the particulate size collection trend applied. There was a slight deviation, where the PM_{10} concentration was less than the respirable fraction for the samples collected from the station's ticket hall.

5.2.2. Baker Street Station

The results for particulate matter were between <0.02 and 1.31 mg/m^3 for $PM_{2.5}$ and between 0.05 and 1.88 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 8.

At two locations out of six monitored, the particulate size collection trend the trend applied. The respirable dust fraction concentrations were found less than the particulate matter $PM_{2.5}$ for the samples collected from the following locations:

- Platform 7, Jubilee line eastbound
- Platform 9, Bakerloo line northbound
- Platform 8, Bakerloo line southbound

There was also a slight deviation where the PM_{10} concentration was less than the respirable fraction for the samples collected from Platform 6.

5.2.3. Elephant & Castle Station

The results for particulate matter were between 0.03 and 1.10 mg/m^3 for $PM_{2.5}$ and between 0.04 and 0.93 mg/m^3 for PM_{10}, highest levels were recorded on the samples collected from Platform 1.

For all of the locations monitored, the particulate size collection trend did not apply.

There were slight deviations from the trend where respirable dust fraction was greater than the particulate matter fraction PM_{10} for samples collected at the following locations:

- Bakerloo line Ticket hall
- Northern Line Ticket hall
- Platform 2, Northern line southbound
- Platform 3, Bakerloo line northbound

- Platform 4 Bakerloo line northbound

There was a significant deviation noted for the samples collected from Platform 1, where the concentration for the particulate matter PM_{10} is less than the concentrations for the respirable fraction and particulate matter $PM_{2.5.}$

5.2.4. Euston Square

The results for particulate matter were between 0.09 and 0.71 mg/m^3 for $PM_{2.5}$ and between 0.14 and 0.58 mg/m^3 for PM_{10}, with highest levels being recorded on the samples collected from Platform 1.

At the majority of the locations monitored, the particulate size collection trend applied. There was a slight deviation, where the PM_{10} concentration was less than the respirable fraction for the samples collected from Platform 2.

5.2.5. Hampstead Station

The results for particulate matter were between 0.05 and 0.7 mg/m^3 for $PM_{2.5}$ and between 0.13 and 2.05 mg/m^3 for PM_{10}, with highest levels being recorded on the samples collected from Platforms 1 and 2.

The results for the particulate size collection trend applied for the particulate matter PM_{10} concentrations being highest throughout the set of samples. However, slight deviations were noted for the respirable dust fraction concentrations that were found lower than the particulate matter $PM_{2.5}$ for the samples collected from Platform 1 and 2.

5.2.6. King's Cross Station

The monitoring carried out on the 3rd November 2020 (Table 7) showed that the concentrations for particulate matter were between 0.05 and 1.06 mg/m^3 for $PM_{2\,5}$ and between 0.05 and 1.16 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 1 and 4, respectively.

At four locations out of ten monitored, the expected particulate size collection the trend applied. Platform 4 could not be assessed due to no result available for the respirable dust fraction sample.

There was a significant deviation observed for the sample collected from Platform 1, where particulate matter $PM_{2.5}$ concentration was considerably greater than the concentrations for respirable dust fraction and particulate matter PM_{10}.

There were slight deviations from the trend where respirable dust fraction was greater than the particulate matter fraction PM_{10} for samples collected at the following locations:

- Main Ticket hall
- Platform 5, Piccadilly line westbound
- Platform 7, Northern line northbound
- Platform 3, Victoria line northbound

5.2.7. Oxford Circus

The results for particulate matter were between 0.04 and 1.06 mg/m^3 for $PM_{2.5}$ and between 0.10 and 1.85 mg/m^3 for PM_{10}, with the highest levels being recorded at Platform 1.

At the majority of the locations monitored, the particulate size collection trend applied. There was a slight deviation, where the PM_{10} concentration was less than the respirable fraction for the samples collected from the station's ticket hall.

5.2.8. Paddington Station

The results for particulate matter were between <0.02 and 0.52 mg/m^3 for $PM_{2.5}$ and between 0.07 and 1.54 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 3 and 4.

At the majority of the locations monitored, the particulate size collection trend applied. There were two slight deviations, where the PM_{10} concentration was less than the respirable fraction for the samples collected from the Bakerloo line ticket hall and Platform 2.

5.2.9. Piccadilly Circus Station

The results for particulate matter were between 0.05 and 0.67 mg/m^3 for $PM_{2.5}$ and between 0.05 and 1.64 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 1 and 3.

At two of the locations monitored, the particulate size collection trend applied.

There were two slight deviations, where the particulate matter PM_{10} concentration was less than the respirable fraction concentration for the samples collected from the ticket hall and Platform 3.

There was one slight deviation, where the respirable fraction was less than the particulate matter $PM_{2.5}$ concentration for the samples collected from Platform 2

5.2.10. Tottenham Court Road Station

The results for particulate matter were between 0.03 and 0.77 mg/m^3 for $PM_{2.5}$ and between 0.07 and 1.52 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 1 and 2.

At the majority of the locations monitored, the particulate size collection trend applied.

There was one slight deviation, where the PM_{10} concentration was less than the respirable fraction for the samples collected from Platform 4.

5.2.11. Vauxhall Station

The results for particulate matter were between 0.42 and 0.65 mg/m^3 for $PM_{2.5}$ and between 0.60 and 1.44 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 1.

At all of the locations monitored, the particulate size collection trend applied.

5.2.12. Waterloo Station

The results for particulate matter were between 0.08 and 3.25 mg/m^3 for $PM_{2.5}$ and between 0.62 and 2.56 mg/m^3 for PM_{10}, with the highest levels were recorded on the samples collected from Platforms 3 and 4, respectively.

At the majority of the locations monitored, the particulate size collection trend applied.

There was a significant deviation noted for the samples collected from the Platform 3, where the dust concentration for particulate matter PM_{10} is less than the dust concentrations for respirable fraction and particulate matter $PM_{2.5}$.

5.2.13. Westminster Station

The results for particulate matter were between 0.19 and 1.49 mg/m^3 for $PM_{2.5}$ and between 0.67 and 4.12 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 2.

At the majority of the locations monitored, the particulate size collection trend applied.

However, there was a significant deviation noted for the samples collected from the Platform 2, where the dust concentration for respirable dust fraction was considerably lower the concentration for the particulate matter PM_{10} and $PM_{2.5}$.

5.2.14. Mile End Station

The results for particulate matter were between 0.32 and 0.50 mg/m^3 for $PM_{2.5}$ and between 0.32 and 1.19 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 3.

At the majority of the locations monitored, the particulate size collection trend applied.

There were two slight deviations, where the respirable fraction was less than the particulate matter $PM_{2.5}$ concentration for the samples collected from the ticket hall and Platform 2.

5.2.15. Holborn Station

The results for particulate matter were between 0.25 and 0.93 mg/m^3 for $PM_{2.5}$ and between 0.09 and 2.53 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 1.

At the majority of the locations monitored, the particulate size collection trend applied.

There were two slight deviations, where the PM_{10} concentration was less than the concentrations for the respirable fraction and particulate matter $PM_{2.5}$ for the samples collected from Platform 2 and ticket hall.

5.2.16. Kennington Station

The results for particulate matter were between 0.18 and 1.36 mg/m^3 for $PM_{2.5}$ and between 0.45 and 1.66 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 2.

At the majority of the locations monitored, the particulate size collection trend applied.

There was a slight deviation noted, where the respirable fraction concentration was less than the particulate matter $PM_{2.5}$ concentration for the samples collected from Platform 2.

5.2.17. Highbury & Islington Station

The results for particulate matter were between <0.02 and 2.16 mg/m^3 for $PM_{2.5}$ and between 0.45 and 1.01 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 5.

At one of the locations monitored, the particulate size collection trend applied.

There was a significant deviation observed for the sample collected from Platform 5, where particulate matter $PM_{2.5}$ concentration was considerably greater than the concentrations for respirable dust fraction and particulate matter PM_{10}.

5.2.18. Tooting Bec Station

The results for particulate matter were between <0.02 and 0.82 mg/m^3 for $PM_{2.5}$ and between 0.51 and 1.49 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 1 and 2.

At the majority of the locations monitored, the particulate size collection trend applied.

There was a slight deviation noted, where the respirable fraction concentration was less than the particulate matter $PM_{2.5}$ concentration for the samples collected from Platform 2.

5.2.19. London Bridge Station

The results for particulate matter were between 0.16 and 0.67 mg/m^3 for $PM_{2.5}$ and between 0.81 and 1.59 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 2.

At the majority of the locations monitored, the particulate size collection trend applied.

There was a slight deviation noted, where the particulate matter PM_{10} concentration was less than the respirable dust fraction concentration for the samples collected from the station's ticket hall.

5.2.20. Bank Station

The results for particulate matter were between 0.19 and 0.63 mg/m^3 for $PM_{2.5}$ and between 0.99 and 1.19 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from the Northern line ticket hall/ gate line and from Platform 5.

At the majority of the locations monitored, the particulate size collection trend applied.

There was a significant deviation observed for the sample collected from Northern line ticket hall, where particulate matter $PM_{2.5}$ concentration was considerably greater than the concentrations for respirable dust fraction and particulate matter PM_{10}.

5.2.21. Moorgate Station

The results for particulate matter were between 0.10 and 0.44 mg/m^3 for $PM_{2.5}$ and between 0.30 and 1.08 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from the ticket hall/ gate line and from Platform 8.

At two of the locations monitored, the particulate size collection trend applied.

There were deviations noted, where the respirable fraction concentration was less than the particulate matter $PM_{2.5}$ concentrations for the samples collected from Platform 1 and 8.

5.2.22. Embankment Station

The results for particulate matter were between 0.39 and 0.57 mg/m^3 for $PM_{2.5}$ and between 0.23 and 1.47 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 4.

At the majority of the locations monitored, the particulate size collection trend applied.

There were two deviations noted, where the particulate matter PM_{10} concentrations were less than the respirable fraction concentrations for the samples collected from the Platform 3 and 4.

5.2.23. Canada Water Station

The results for particulate matter were between 0.11 and 0.42 mg/m^3 for $PM_{2.5}$ and between 0.23 and 1.31 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platforms 1 and 2.

At all of the locations monitored, the particulate size collection trend applied.

5.2.24. Colliers Wood Station

The results for particulate matter were between < 0.02 and 0.44 mg/m^3 for $PM_{2.5}$ and between 0.32 and 0.62 mg/m^3 for PM_{10}, with the highest levels being recorded on the samples collected from Platform 2.

At one of the locations monitored, the particulate size collection trend applied.

There were two slight deviations noted, where the respirable fraction concentrations were less than the particulate matter $PM_{2.5}$ concentrations for the samples collected from Platforms 1 and 2.

5.3. Inhalable dust fraction and metal content

The results for the inhalable dust fraction showed concentrations varying from 0.45 mg/m^3 for the sample collected from N/B platform of Bakerloo line at Elephant and Castle station, to 1.78 mg/m^3 for the samples collected from N/B platform of Northern line at Hampstead station and E/B platform of Piccadilly line at Piccadilly Circus station.

At twelve of the locations monitored, the concentrations for the inhalable dust and particulate matter PM_{10} followed the particle size collection trend where inhalable dust would be greater than PM_{10}.

There was a significant deviation observed for the dust concentrations between the inhalable dust and the particulate matter PM_{10} (of 1.24 mg/m^3), for the samples collected from E/B platform of Jubilee line at Westminster station.

The results for all the stations assessed, showed that the metal content concentrations were all generally low, below the applicable Workplace Exposure Limits (WELs)

- **Chromium –** all results below 0.01 mg/m^3
- **Manganese** – all results were found between 0.001 and 0.009 mg/m^3. The highest concentration was recorded for the sample collected from W/B platform of Piccadilly line at Holborn station.
- **Nickel** – all results were found below or same as the limit of detection (0.001 mg/m^3) for the samples collected.
- **Zinc –** all results were found below or same as the limit of detection (0.001 mg/m^3) for the samples collected.
- **Iron Oxide -** all results were found between 0.167 and 1.146 mg/m^3. The highest concentration was recorded for the sample collected from N/B platform of Victoria line at Vauxhall station.
- **Copper** - results were found below or same as the limit of detection (0.001 mg/m^3) for the majority of the samples collected. The sample collected from W/B platform of Central line at Oxford Circus station was found with a Copper concentration of 0.004 mg/m^3.
- **Arsenic** - were found below the limit of detection (0.001 mg/m^3) for all of the samples collected.
- **Aluminium** were found between 0.003 and 0.021 mg/m^3. The highest concentration was recorded for the sample collected from W/B platform of Piccadilly line at Holborn station.

Chromium VI was not undertaken in this analysis. This will be included in the planned assessment of the train operators, to be undertaken at a later date.

6. Conclusions

6.1. All of the static samples taken had respirable and inhalable dust concentrations that would be below applicable Workplace Exposure Limits.

6.2. When compared to previous round of sampling in July 2019 (Report ref. *4RS-APO-190189-R658226, issue date February 2020)*:

6.2.1. The results showed a general decrease in the respirable dust levels at some or all the monitoring locations at the following stations: Euston Square, Hampstead, Paddington, King's Cross, Piccadilly Circus, Oxford Circus, Tottenham Court Road and Vauxhall.

6.2.2. The results that showed a slight increase in dust levels at the following locations: Aldgate East, Baker Street, Elephant and Castle and Waterloo.

6.3. Iron oxide was found present at greater concentrations compared to other metals analysed. This would be expected in the underground tunnel environment, as a result of the wear at the wheel rail interface. The highest iron oxide concentration was recorded for the sample collected from Platform 1 at Vauxhall station.

6.4. The remaining metals analysed had very low concentrations, below or equal to the limit of detection of the analysing method for Manganese, Aluminium, Chromium, Nickel, Zinc, Copper and Arsenic.

6.5. The results obtained from particulate matter $PM_{2.5}$ samples showed concentrations between 0.17mg/m^3 for the sample collected from Aldgate East station Platform 1 and 3.25mg/m^3 for the sample collected from Waterloo station Platform 3.

6.6. The results obtained from particulate matter PM_{10} samples showed concentrations varying between 0.53mg/m^3 for the sample collected from Aldgate East station Platform 1 and 4.12mg/m^3 for the sample collected from Westminster station Platform 2.

6.7. The results of the inhalable dust concentrations followed the particle size distribution trend, with inhalable dust greater than PM_{10}. There was one significant deviation observed, with the PM_{10} greater than the inhalable dust concentration for the samples taken from Platform 3 at Westminster station.

6.8. The data showed a general trend of the larger fraction sizes having greater dust concentrations. However, multiple deviations from the expected trend were recorded. These deviations could be due to a number of factors, as follows:

- Sampling variations and general outliers within a statistical data set;
- Possible impact of different filter types required to be used within the impactor heads, compared to the cyclone and IOM sampling heads;
- Possible local engineering activities the night before the sampling shift resulting in elevated concentrations.

6.9. Resampling should be considered where abnormal results were present.

7. References

HSE Document, EH40/2005 Workplace Exposure Limits (Fourth Edition, January 2020);

Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended);

Health and Safety at Work Act 1974;

MDHS 14/4 – General methods for sampling and gravimetric analysis of respirable, thoracic and inhalable aerosols;

J.D. Smith, B.M. Barratt, G.W. Fuller, F.J. Kelly, M. Loxham, E. Nicolosi, M. Prietsman, A.H. Tremper, D.C. Green (2020) $PM_{2.5}$ on the London Underground.

Previous Trains and Stations monitoring, 4-RAIL Report Reference 4RS-APO-190189-R658226, February 2020.

Table 3. Aldgate East Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of A R (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/01	RD	Gate Line/ Ticket Hall	27.10.20	09:24	13:52	2.2	589.6	0.64
202073/06	PM2.5			09:24	13:52	2.0	536	0.15
202073/07	PM10			09:24	13:52	2.0	536	0.52
202073/02	RD	Hammersmith & City, District Line - Platform 2 (Eastbound)	27.10.20	09:38	13:54	2.2	563.2	0.43
202073/08	PM2.5			09:38	13:54	2.0	512	0.16
202073/09	PM10			09:38	13:54	2.0	512	0.49
202073/05	ID			09:40	13:54	2.0	508	0.59
202073/03	RD	Hammersmith & City, District Line - Platform 1 (Westbound)	27.10.20	09:42	13:45	2.2	534.6	0.46
202073/10	PM2.5			09:42	13:45	2.0	486	0.17
202073/11	PM10			09:42	13:45	2.0	486	0.53
202073/04	RD	Outside Station Supervisor Office	27.10.20	09:18	14:01	2.2	622.6	0.40

Table 4. Baker Street Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{n} (mg/m^3)
202073/12	RD	Metropolitan Gate Line/ Ticket Hall (by staff pod)	28.10.20	09:06	13:44	2.2	611.6	0.03
202073/21	PM2.5			09:06	13:44	2.0	556	< 0.02
202073/22	PM10			09:06	13:44	2.0	556	0.05
202073/473	RD	Hammersmith, Circle, Metropolitan line - Platform 5 (Eastbound)	02.12.20	09:22	13:25	2.2	534.6	0.53
202073/23	PM2.5		28.10.20	09:21	13:59	2.0	542	0.15
202073/24	PM10			09:21	13:59	2.0	542	0.62
202073/14	RD	Hammersmith, Circle, Metropolitan line - Platform 6 (Westbound)	28.10.20	09:34	13:59	2.2	583	0.71
202073/25	PM2.5			09:34	13:59	2.0	530	0.33
202073/475	PM10		02.12.20	09:26	13:27	2.0	482	0.64
202073/20	RD	Top of Bakerloo & Jubilee - Northbound escalators	28.10.20	09:46	14:06	2.2	572	0.38
202073/15	RD	Bakerloo line - Platform 9 (Northbound)	28.10.20	09:08	13:57	2.2	635.8	1.18
202073/27	PM2.5			09:08	13:57	2.0	578	0.46
202073/28	PM10			09:08	13:57	2.0	578	1.50
202073/16	RD	Jubilee line - Platform 10 (Westbound)	28.10.20	09:20	14:03	2.2	622.6	0.64

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/29	PM2.5	Jubilee line - Platform 10 (Westbound)	28.10.20	09:20	14:03	2.0	566	0.49
202073/30	PM10			09:20	14:03	2.0	566	1.05
202073/17	RD	Bakerloo line - Platform 8 (Southbound)	28.10.20	09:31	13:53	2.2	576.4	1.15
202073/31	PM2.5			09:31	13:53	2.0	524	1.31
202073/32	PM10			09:31	13:53	2.0	524	1.88
202073/18	RD	Jubilee line - Platform 7 (Eastbound)	28.10.20	09:44	13:50	2.2	541.2	0.99
202073/33	PM2.5			09:44	13:50	2.0	492	0.82
202073/34	PM10			09:44	13:50	2.0	492	1.44
202073/19	ID			09:44	13:50	2.0	492	1.41

Table 5. Elephant & Castle Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/35	RD	Bakerloo Ticket Hall Gate line	29.10.20	09:19	13:33	2.2	558.8	0.31
202073/43	PM2.5			09:19	13:33	2.0	508	0.03
202073/44	PM10			09:19	13:33	2.0	508	0.04
202073/36	RD	Northern Ticket Hall Gate line	29.10.20	09:12	13:36	2.2	580.8	0.26
202073/45	PM2.5			09:12	13:36	2.0	528	0.09
202073/46	PM10			09:12	13:36	2.0	528	0.06
202073/37	RD	Northern Line - Platform 2 (Southbound)	29.10.20	09:27	13:44	2.2	565.4	1.21
202073/47	PM2.5			09:27	13:44	2.0	514	0.39
202073/48	PM10			09:27	13:44	2.0	514	0.92
202073/38	RD	Northern Line - Platform 1 (Northbound)	29.10.20	09:40	13:50	2.2	550	0.99
202073/49	PM2.5			09:40	13:50	2.0	500	1.10
202073/50	PM10			09:40	13:50	2.0	500	0.93
202073/39	RD	Bakerloo line - Platform 4 (Northbound)	29.10.20	09:54	13:57	2.2	534.6	0.39

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/51	PM2.5	Bakerloo line - Platform 4 (Northbound)	29.10.20	09:54	13:57	2.0	486	0.06
202073/52	PM10			09:54	13:57	2.0	486	0.24
202073/40	RD	Bakerloo line - Platform 3 (Northbound)	29.10.20	09:38	13:51	2.2	556.6	0.24
202073/41	ID			09:38	13:51	2.0	506	0.48
202073/53	PM2.5			09:38	13:51	2.0	506	0.11
202073/54	PM10			09:38	13:51	2.0	506	0.23
202073/42	RD	Outside of station supervisor office	29.10.20	09:06	13:39	2.2	600.6	< 0.02

Table 6. Euston Square Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of A R (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/57	RD	Hammersmith, Circle, Metropolitan line - Platform 1 (Westbound)	30.10.20	09:21	13:40	2.2	569.8	0.08
202073/65	PM2.5			09:21	13:40	2.0	518	0.14
202073/66	PM10			09:21	13:40	2.0	518	0.58
202073/58	RD	Hammersmith, Circle, Metropolitan line - Platform 2 (Eastbound)	30.10.20	09:11	13:35	2.2	580.8	0.07
202073/67	PM2.5			09:11	13:35	2.0	528	0.71
202073/68	PM10			09:11	13:35	2.0	528	0.56
202073/59	ID			09:11	13:35	2.0	528	0.59
202073/55	RD	Gate Line (A) - North side	30.10.20	09:25	13:45	2.2	572	0.11
202073/61	PM2.5			09:25	13:45	2.0	520	0.04
202073/62	PM10			09:25	13:45	2.0	520	0.14
202073/56	RD	Gate Line (B) - South side	30.10.20	09:35	13:50	2.2	561	0.02
202073/63	PM2.5			09:35	13:50	2.0	510	0.09
202073/64	PM10			09:35	13:50	2.0	510	0.32
202073/60	RD	Outside of station supervisor office	30.10.20	09:43	13:52	2.2	547.8	0.42

Table 7. Hampstead Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/M N)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^{3})
202073/69	RD	Gate line Ticket Hall (High Street entrance)	02.11.20	09:15	13:32	2.2	565.4	0.13
202073/74	PM2.5			09:15	13:32	2.0	514	0.05
202073/75	PM10			09:15	13:32	2.0	514	0.13
202073/70	RD	Northern Line - Platform 2 (Southbound)	02.11.20	08:55	13:36	2.2	618.2	0.59
202073/76	PM2.5			08:55	13:36	2.0	562	0.70
202073/77	PM10			08:55	13:36	2.0	562	1.17
202073/71	RD	Northern Line - Platform 1 (Northbound)	02.12.20	08:55	13:40	2.2	627	0.46
202073/78	PM2.5			08:55	13:40	2.0	570	0.65
202073/79	PM10			08:55	13:40	2.0	570	2.05
202073/474	ID			09:10	13:30	2.0	520	1.78
202073/73	RD	Outside of station supervisor office	02.11.20	09:11	13:29	2.2	567.6	0.14

Table 8. King's Cross Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/456	RD	Main Ticket Hall	30.11.20	08:48	12:59	2.2	552.2	0.24
202073/92	PM2.5		03.11.20	09:00	13:11	2.0	502	0.05
202073/93	PM10			09:00	13:11	2.0	502	0.05
202073/459	RD	Piccadilly Line - Platform 6 (Eastbound)	30.11.20	09:08	13:08	2.2	528	0.73
202073/94	PM2.5		03.11.20	09:00	13:41	2.0	562	0.40
202073/95	PM10			09:00	13:41	2.0	562	0.99
202073/460	RD	Piccadilly Line - Platform 5 (Westbound)	30.11.20	09:04	13:04	2.2	528	1.11
202073/96	PM2.5		03.11.20	09:54	13:54	2.0	480	0.29
202073/97	PM10			09:54	13:54	2.0	480	0.74
202073/458	RD	Hammersmith, Circle, Metropolitan line - Platform 1 (Westbound)	30.11.20	09:00	13:10	2.2	550	0.30
202073/468	PM2.5			09:00	13:10	2.0	500	1.06
202073/99	PM10		03.11.20	09:15	13:25	2.0	500	0.40

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/457	RD	Hammersmith, Circle, Metropolitan line - Platform 2 (Eastbound)	30.11.20	09:05	13:15	2.2	550	0.23
202073/100	PM2.5		03.11.20	09:26	13:31	2.0	490	0.15
202073/101	PM10			09:26	13:31	2.0	490	0.38
202073/461	RD	Victoria Line - Platform 3 (Northbound)	30.11.20	08:56	13:01	2.2	539	1.14
202073/102	PM2.5		03.11.20	09:37	13:48	2.0	502	0.46
202073/103	PM10			09:37	13:48	2.0	502	1.13
202073/462*	RD*	Victoria Line - Platform 4 (Southbound)	30.11.20	08:59	-	-	-	-
202073/104	PM2.5		03.11.20	09:19	13:42	2.0	526	0.52
202073/105	PM10			09:19	13:42	2.0	526	1.16
202073/466	RD	Gate Line Ticket Hall (Circle Line)	30.11.20	09:07	13:17	2.2	550	0.11
202073/106	PM2.5		03.11.20	09:10	13:21	2.0	502	0.11
202073/107	PM10			09:10	13:21	2.0	502	0.12
202073/463	RD	Northern Line - Platform 8 (Southbound)	30.11.20	08:50	12:56	2.2	541.2	0.62

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/108	PM2.5	Northern Line - Platform 8 (Southbound)	03.11.20	09:17	13:44	2.0	534	0.26
202073/109	PM10			09:17	13:44	2.0	534	0.70
202073/464	RD	Northern Line - Platform 7 (Northbound)	30.11.20	08:46	12:55	2.2	547.8	0.57
202073/110	PM2.5		03.11.20	09:40	13:50	2.0	500	0.15
202073/111	PM10			09:40	13:50	2.0	500	0.47
202073/467	ID		30.11.20	08:46	12:55	2.0	498	0.99
202073/465	RD	Outside of station supervisor office	30.11.20	08:44	12:50	2.2	541.2	0.08

**Note: Air sampler found non-functional. The result could not be reported due to insufficient air volume.*

Table 9. Oxford Circus Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/112	RD	Ticket Hall	04.11.20	08:45	13:05	2.2	563.62	0.13
202073/121	PM2.5			08:45	13:05	2.0	505.06	0.04
202073/122	PM10			08:45	13:05	2.0	503.29	0.10
202073/113	RD	Bakerloo Line - Platform 4 (Northbound)	04.11.20	09:05	13:28	2.2	569.42	0.79
202073/123	PM2.5			09:05	13:28	2.0	514.33	0.48
202073/124	PM10			09:05	13:28	2.0	514.29	1.26
202073/114	RD	Bakerloo Line - Platform 3 (Southbound)	04.11.20	09:15	13:22	2.2	534.13	0.98
202073/476	PM2.5		01.12.20	09:22	13:31	2.0	498	0.51
202073/126	PM10		04.11.20	09:15	13:22	2.0	478.50	1.55
202073/115	RD	Victoria Line - Platform 6 (Northbound)	04.11.20	08:54	13:32	2.2	600.43	0.72
202073/127	PM2.5			08:54	13:32	2.0	548.11	0.43
202073/128	PM10			08:54	13:32	2.0	541.14	1.29

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/116	RD	Victoria Line - Platform 5 (Southbound)	04.11.20	09:12	13:24	2.2	545.52	0.78
202073/129	PM2.5			09:12	13:24	2.0	494.80	0.44
202073/130	PM10			09:12	13:24	2.0	492.83	1.48
202073/117	RD	Central Line - Platform 2 (Eastbound)	04.11.20	08:52	13:12	2.2	561.56	1.10
202073/131	PM2.5			08:52	13:12	2.0	509.93	0.70
202073/132	PM10			08:52	13:12	2.0	504.86	1.37
202073/118	RD	Central Line - Platform 1 (Westbound)	04.11.20	09:02	13:15	2.2	546.44	1.14
202073/133	PM2.5			09:02	13:15	2.0	499.12	1.06
202073/134	PM10			09:02	13:15	2.0	493.55	1.85
202073/119	ID			09:02	13:15	2.0	490.09	1.43
202073/120	RD	Outside of station supervisor office	04.11.20	08:39	13:04	2.2	572.36	< 0.02

Table 10. Paddington Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/135	RD	District & Circle Line - Gate Line Ticket Hall	05.11.20	09:10	13:11	2.2	521.11	0.05
202073/142	PM2.5			09:10	13:11	2.0	473.73	0.03
202073/143	PM10			09:10	13:11	2.0	473.73	0.07
202073/136	RD	District & Circle Line - Platform 2 (Eastbound)	05.11.20	09:19	13:20	2.2	521.11	0.19
202073/144	PM2.5			09:19	13:20	2.0	473.73	< 0.02
202073/145	PM10			09:19	13:20	2.0	473.73	0.07
202073/138	RD	Bakerloo Line - Platform 4 (Southbound)	05.11.20	09:31	13:34	2.2	525.43	1.14
202073/148	PM2.5			09:31	13:34	2.0	477.67	0.39
202073/149	PM10			09:31	13:34	2.0	477.67	1.54
202073/139	RD	Bakerloo Line - Platform 3 (Northbound)	05.11.20	09:43	13:44	2.2	521.11	1.11
202073/150	PM2.5			09:43	13:44	2.0	473.73	0.52
202073/151	PM10			09:43	13:44	2.0	473.73	1.25
202073/140	ID			09:43	13:44	2.0	473.73	1.05

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/137	RD	Bakerloo line - Gate Line	05.11.20	09:18	13:23	2.2	529.76	0.28
202073/146	PM2.5			09:18	13:23	2.0	481.60	0.13
202073/147	PM10			09:18	13:23	2.0	481.60	0.23
202073/141	RD*	Outside of station supervisor office	05.11.20	09:08	-	-	-	-

**Note: Air sampler found non-functional. The result could not be reported due to insufficient air volume.*

Table 11. Piccadilly Circus Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/152	RD	Piccadilly Circus Gate Line Ticket Hall	06.11.20	08:40	12:48	2.2	545.6	0.07
202073/159	PM2.5			08:40	12:48	2.0	496	0.05
202073/160	PM10			08:40	12:48	2.0	496	0.05
202073/153	RD	Bakerloo Line - Platform 1 (Northbound)	06.11.20	09:07	13:08	2.2	530.2	1.05
202073/161	PM2.5			09:07	13:08	2.0	482	0.67
202073/162	PM10			09:07	13:08	2.0	482	1.61
202073/154	RD	Bakerloo Line - Platform 2 (Southbound)	06.11.20	08:56	13:00	2.2	536.8	0.11
202073/163	PM2.5			08:56	13:00	2.0	488	0.33
202073/164	PM10			08:56	13:00	2.0	488	1.21
202073/155	RD	Piccadilly Line - Platform 4 (Westbound)	06.11.20	08:50	12:53	2.2	534.6	1.00
202073/165	PM2.5			08:50	12:53	2.0	486	0.38
202073/166	PM10			08:50	12:53	2.0	486	1.48

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^{3})
202073/156	RD	Piccadilly Line - Platform 3 (Eastbound)	06.11.20	09:02	13:06	2.2	536.8	1.69
202073/167	PM2.5			09:02	13:06	2.0	488	0.49
202073/168	PM10			09:02	13:06	2.0	488	1.64
202073/470	ID		01.12.20	09:22	13:25	2.0	486	1.78
202073/158	RD	Outside of station supervisor office	06.11.20	08:39	12:45	2.2	541.2	0.08

Table 12. Tottenham Court Road Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/M N)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/169	RD	Gate Line/ Ticket Hall	09.11.20	07:54	11:59	2.2	539	0.07
202073/176	PM2.5			07:54	11:59	2.0	487.2	0.03
202073/177	PM10			07:54	11:59	2.0	487.2	0.07
202073/471	RD	Central Line - Platform 2 (Eastbound)	01.12.20	09:41	13:42	2.2	530.2	1.06
202073/178	PM2.5		09.11.20	08:07	12:17	2.0	497.15	0.74
202073/179	PM10			08:07	12:17	2.0	497.1	1.52
202073/171	RD	Central Line - Platform 1 (Westbound)	09.11.20	08:16	12:22	2.2	541.2	0.86
202073/180	PM2.5			08:16	12:22	2.0	492	0.77
202073/181	PM10			08:16	12:22	2.0	492	1.14
202073/172	RD	Northern Line - Platform 4 (Southbound)	09.11.20	07:57	12:04	2.2	538.1	1.12
202073/182	PM2.5			07:57	12:04	2.0	494	0.36
202073/183	PM10			07:57	12:04	2.0	494	0.85
202073/173	RD	Northern Line - Platform 3 (Northbound)	09.11.20	08:04	12:09	2.2	539	0.70

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/M N)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/184	PM2.5	Northern Line - Platform 3 (Northbound)	09.11.20	08:04	12:09	2.0	490	0.50
202073/185	PM10			08:04	12:09	2.0	490	1.20
202073/174	ID			08:04	12:09	2.0	487.3	1.11
202073/175	RD	Outside of station supervisor office	09.11.20	07:52	11:57	2.2	539	< 0.02

Table 13. Vauxhall Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/186	RD	Gate Line/ Ticket Hall	10.11.20	08:51	13:00	2.2	547.8	0.36
202073/191	PM2.5			08:51	13:00	2.0	498	0.17
202073/192	PM10			08:51	13:00	2.0	498	0.42
202073/190	RD	Outside of station supervisor office	10.11.20	08:44	13:02	2.2	567.6	0.45
202073/187	RD	Victoria Line - Platform 2 (Southbound)	10.11.20	09:06	13:06	2.2	528	1.06
202073/193	PM2.5			09:06	13:06	2.0	480	0.60
202073/194	PM10			09:06	13:06	2.0	480	1.23
202073/188	RD	Victoria Line - Platform 1 (Northbound)	10.11.20	08:58	13:10	2.2	554.4	1.12
202073/195	PM2.5			08:58	13:10	2.0	504	0.65
202073/196	PM10			08:58	13:10	2.0	504	1.44
202073/189	ID			08:58	13:10	2.0	504	1.60

Table 14. Waterloo Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/197	RD	Gate Line/ Ticket Hall (Low level)	11.11.20	09:03	13:29	2.2	585.2	0.23
202073/206	PM2.5			09:03	13:29	2.0	532	0.08
202073/207	PM10			09:03	13:29	2.0	532	0.62
202073/198	RD	Bakerloo Line - Platform 3 (Northbound)	11.11.20	09:31	13:37	2.2	541.2	1.10
202073/208	PM2.5			09:31	13:37	2.0	492	3.25
202073/209	PM10			09:31	13:37	2.0	492	1.08
202073/199	RD	Bakerloo Line - Platform 4 (Southbound)	11.11.20	09:37	13:40	2.2	534.6	0.61
202073/210	PM2.5			09:37	13:40	2.0	486	0.28
202073/211	PM10			09:37	13:40	2.0	486	0.94
202073/200	RD	Northern Line - Platform 1 (Northbound)	11.11.20	09:11	13:37	2.2	585.2	0.99
202073/212	PM2.5			09:11	13:37	2.0	532	0.43
202073/213	PM10			09:11	13:37	2.0	532	1.37

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/201	RD	Northern Line - Platform 2 (Southbound)	11.11.20	09:00	13:30	2.2	594	0.75
202073/214	PM2.5			09:00	13:30	2.0	540	0.50
202073/215	PM10			09:00	13:30	2.0	547.25	2.56
202073/202	RD	Jubilee Line - Platform 5 (Westbound)	11.11.20	09:28	13:54	2.2	585.2	0.92
202073/216	PM2.5			09:28	13:54	2.0	532	0.44
202073/217	PM10			09:28	13:54	2.0	532	1.04
202073/203	RD	Jubilee Line - Platform 6 (Eastbound)	11.11.20	09:19	13:47	2.2	589.6	0.81
202073/218	PM2.5			09:19	13:47	2.0	536	0.46
202073/219	PM10			09:19	13:47	2.0	536	1.04
202073/204	ID			09:19	13:47	2.0	536	1.13
202073/205	RD	Outside of station supervisor office	11.11.20	08:52	13:27	2.2	605	0.42

Table 15. Westminster Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/220	RD	Gate Line/ Ticket Hall	12.11.20	08:50	13:00	2.2	550	0.35
202073/227	PM2.5			08:50	13:00	2.0	500	0.19
202073/228	PM10			08:50	13:00	2.0	500	1.89
202073/221	RD	District & Circle Line - Platform 2 (Eastbound)	12.11.20	09:00	13:06	2.2	541.2	0.47
202073/229	PM2.5			09:00	13:06	2.0	492	1.49
202073/230	PM10			09:00	13:06	2.0	492	4.12
202073/222	RD	District & Circle Line - Platform 1 (Westbound)	12.11.20	09:09	13:11	2.2	532.4	0.51
202073/231	PM2.5			09:09	13:11	2.0	484	0.30
202073/232	PM10			09:09	13:11	2.0	484	0.72
202073/223	RD	Jubilee Line - Platform 4 (Westbound)	12.11.20	09:06	13:16	2.2	550	0.50
202073/233	PM2.5			09:06	13:16	2.0	500	0.32
202073/234	PM10			09:06	13:16	2.0	500	0.67

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start T me	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^{3})
202073/224	RD	Jubilee Line - Platform 3 (Eastbound)	12.11.20	09:12	13:13	2.2	530.2	0.91
202073/235	PM2.5			09:12	13:13	2.0	482	0.44
202073/236	PM10			09:12	13:13	2.0	482	2.18
202073/225	ID			09:12	13:13	2.0	482	0.94
202073/226	RD	Outside of station supervisor office	12.11.20	08:50	13:01	2.2	552.2	0.35

Table 16. Mile End Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/237	RD	Gate Line/ Ticket Hall	13.11.20	08:37	13:04	2.2	587.4	0.32
202073/244	PM2.5			08:37	13:04	2.0	534	0.13
202073/245	PM10			08:37	13:04	2.0	534	0.32
202073/238	RD	Central Line - Platform 1 (Westbound)	13.11.20	08:58	13:11	2.2	556.6	0.57
202073/246	PM2.5			08:58	13:11	2.0	506	0.36
202073/247	PM10			08:58	13:11	2.0	503.35	0.86
202073/239	RD	District and Hammersmith and City - Platform 2 (Westbound)	13.11.20	09:06	13:13	2.2	548.3	0.47
202073/248	PM2.5			09:06	13:13	2.0	494	0.49
202073/249	PM10			09:06	13:13	2.0	494	1.10
202073/240	RD	District and Hammersmith and City - Platform 3 (Eastbound)	13.11.20	08:54	13:12	2.2	567.6	0.54
202073/250	PM2.5			08:54	13:12	2.0	516	0.35
202073/251	PM10			08:54	13:12	2.0	516	1.19

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/241	RD	Central Line - Platform 4 (Eastbound)	13.11.20	08:47	13:09	2.2	576.4	0.75
202073/252	PM2.5			08:47	13:09	2.0	524	0.50
202073/253	PM10			08:47	13:09	2.0	524	1.15
202073/242	ID			09:05	13:10	2.0	492.3	1.18
202073/243	RD	Outside of station supervisor office	13.11.20	08:39	13:06	2.2	587.4	0.19

Table 17. Holborn Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/254	RD	Gate Line/ Ticket Hall	16.11.20	08:32	12:40	2.2	545.6	0.06
202073/261	PM2.5			08:32	12:40	2.0	496	0.25
202073/262	PM10			08:32	12:40	2.0	496	0.09
202073/255	RD	Central Line - Platform 1 (Westbound)	16.11.20	08:39	12:49	2.2	550	2.27
202073/263	PM2.5			08:39	12:50	2.0	502	0.76
202073/264	PM10			08:39	12:50	2.0	502	2.53
202073/256	RD	Central Line - Platform 2 (Eastbound)	16.11.20	08:45	12:57	2.2	554.4	1.08
202073/265	PM2.5			08:45	12:57	2.0	504	0.67
202073/266	PM10			08:45	12:57	2.0	504	0.87
202073/257	RD	Piccadilly Line - Platform 4 (Eastbound)	16.11.20	09:04	13:09	2.2	539	1.06
202073/267	PM2.5			09:04	13:09	2.0	490	0.44

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/268	PM10	Piccadilly Line - Platform 4 (Eastbound)	16.11.20	09:04	13:09	2.0	490	1.49
202073/258	RD	Piccadilly Line - Platform 3 (Westbound)	16.11.20	08:50	13:00	2.2	550	1.19
202073/269	PM2.5			08:50	13:01	2.0	502	0.93
202073/270	PM10			08:52	13:01	2.0	498	1.80
202073/259	ID			08:51	13:00	2.0	498	1.91
202073/260	RD	Outside of station supervisor office	16.11.20	08:30	12:39	2.2	547.8	0.03

Table 18. Kennington Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/271	RD	Gate Line/ Ticket Hall	17.11.12	08:33	12:40	2.2	543.4	0.24
202073/278	PM2.5			08:33	12:40	2.0	494	0.18
202073/279	PM10			08:33	12:40	2.0	494	0.45
202073/272	RD	Northern Line - Platform 1 (Northbound to Charing Cross)	17.11.12	08:49	12:52	2.2	534.6	0.77
202073/280	PM2.5			08:49	12:52	2.0	486	0.42
202073/281	PM10			08:49	12:52	2.0	486	1.15
202073/273	RD	Northern Line - Platform 3 (Northbound to Bank)	17.11.12	08:41	12:45	2.2	536.8	0.83
202073/282	PM2.5			08:41	12:45	2.0	488	0.33
202073/283	PM10			08:41	12:45	2.0	488	1.94
202073/274	RD	Northern Line - Platform 2 (Southbound)	17.11.12	08:50	12:56	2.2	541.2	1.00
202073/284	PM2.5			08:50	12:56	2.0	492	1.36
202073/285	PM10			08:50	12:56	2.0	492	1.66

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/275	RD	Northern Line - Platform 4 (Southbound)	17.11.12	08:40	12:54	2.2	558.8	0.80
202073/286	PM2.5			08:40	12:54	2.0	508	1.12
202073/287	PM10			08:40	12:54	2.0	508	1.28
202073/276	ID			08:40	12:54	2.0	508	1.15
202073/277	RD	Outside of station supervisor office	17.11.12	08:31	12:38	2.2	543.4	0.19

Table 19. Highbury & Islington Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	F nish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/288	RD	Outside of station supervisor office	18.11.20	09:14	13:15	2.2	530.2	0.62
202073/289	RD	Gate Line/ Ticket Hall	18.11.20	09:15	13:18	2.2	534.6	0.06
202073/295	PM2.5			09:15	13:18	2.0	486	< 0.02
202073/296	PM10			09:15	13:18	2.0	486	0.45
202073/290	RD	Victoria line - Platform 3 (Northbound)	18.11.20	09:18	13:22	2.2	536.8	0.66
202073/469	PM2.5		30.11.20	09:19	13:21	2.0	484.0	0.88
202073/298	PM10		18.11.20	09:18	13:22	2.0	488	1.01
202073/291	RD	Victoria line - Platform 5 (Southbound)	18.11.20	09:26	13:30	2.2	536.8	0.40
202073/299	PM2.5			09:26	13:30	2.0	488	2.16
202073/300	PM10			09:26	13:30	2.0	488	1.01
202073/292	ID			09:26	13:30	2.0	488	0.91

Table 20. Tooting Bec Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/305	RD	Outside of station supervisor office	19.11.20	09:10	13:10	2.2	528	0.32
202073/306	RD	Gate Line/ Ticket Hall	19.11.20	09:11	13:12	2.2	530.2	0.34
202073/312	PM2.5			09:11	13:12	2.0	482	< 0.02
202073/313	PM10			09:11	13:12	2.0	482	0.51
202073/307	RD	Northern Line - Platform 1 (Northbound)	19.11.20	09:15	13:17	2.2	532.4	0.70
202073/314	PM2.5			09:15	13:17	2.0	484	0.30
202073/315	PM10			09:15	13:17	2.0	484	1.49
202073/308	RD	Northern Line - Platform 2 (Southbound)	19.11.20	09:16	13:20	2.2	536.8	0.53
202073/316	PM2.5			09:16	13:20	2.0	488	0.82
202073/317	PM10			09:16	13:20	2.0	488	0.92
202073/309	ID			09:16	13:20	2.0	488	0.82

Table 21. London Bridge Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/M N)	Volume of Air (Litres)	Calc. Dust Conc^{N} (mg/m^{3})
202073/322	RD	Gate Line/ Ticket Hall	20.11.12	09:16	13:20	2.2	532.30	0.96
202073/329	PM2.5			09:16	13:20	2.0	483.91	0.25
202073/330	PM10			09:16	13:20	2.0	483.91	0.81
202073/323	RD	Northern Line - Platform 1 (Northbound)	20.11.12	09:23	13:25	2.2	527.94	0.77
202073/331	PM2.5			09:23	13:25	2.0	479.95	0.16
202073/332	PM10			09:23	13:25	2.0	479.95	0.95
202073/324	RD	Northern Line - Platform 2 (Southbound)	20.11.12	09:25	13:30	2.2	534.48	1.23
202073/333	PM2.5			09:25	13:30	2.0	485.89	0.67
202073/334	PM10			09:25	13:30	2.0	485.89	1.59
202073/325	RD	Jubilee Line - Platform 4 (Eastbound)	20.11.12	09:31	13:41	2.2	543.21	0.73
202073/326	ID			09:31	13:41	2.0	493.83	1.07
202073/335	PM2.5			09:31	13:41	2.0	493.83	0.32

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/M N)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^{3})
202073/336	PM10	Jubilee Line - Platform 4 (Eastbound)	20.11.12	09:31	13:41	2.0	493.83	0.97
202073/327	RD	Jubilee Line - Platform 3 (Westbound)	20.11.20	09:44	13:44	2.2	523.58	0.86
202073/337	PM2.5			09:44	13:44	2.0	475.98	0.47
202073/338	PM10			09:44	13:44	2.0	475.98	1.22
202073/328	RD	Outside of station supervisor office	20.11.20	09:18	13:23	2.2	534.48	0.52

Table 22. Bank Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{n} (mg/m^3)
202073/424	RD	Central Line Ticket Hall	23.11.20	09:35	13:35	2.2	528	0.49
202073/436	PM2.5			09:35	13:35	2.0	480	0.19
202073/437	PM10			09:35	13:35	2.0	480	0.99
202073/425	RD	Central Line - Platform 5 (Westbound)	23.11.20	09:15	13:42	2.2	587.4	0.83
202073/438	PM2.5			09:15	13:42	2.0	534	0.56
202073/439	PM10			09:15	13:42	2.0	534	1.19
202073/426	RD	Central Line - Platform 6 (Eastbound)	23.11.20	09:20	13:45	2.2	583	0.77
202073/440	PM2.5			09:20	13:45	2.0	530	0.60
202073/441	PM10			09:20	13:45	2.0	530	1.15
202073/427	RD	Northern Line Ticket Hall	23.11.20	09:22	13:56	2.2	602.8	0.27
202073/442	PM2.5			09:22	13:56	2.0	548	0.63
202073/443	PM10			09:22	13:56	2.0	548	0.34

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{n} (mg/m^3)
202073/428	RD	Northern Line - Platform 3 (Southbound)	23.11.20	09:16	13:37	2.2	574.2	0.71
202073/444	PM2.5			09:16	13:37	2.0	522	0.38
202073/445	PM10			09:16	13:37	2.0	522	1.08
202073/429	RD	Northern Line - Platform 3 (Northbound)	23.11.20	09:12	13:44	2.2	598.4	0.72
202073/446	PM2.5			09:12	13:44	2.0	544	0.34
202073/447	PM10			09:12	13:44	2.0	544	1.13
202073/430	ID			09:12	13:44	2.0	544	1.13

Table 23. Moorgate Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/356	RD	Gate Line/ Ticket Hall	24.11.20	08:53	13:05	2.2	554.4	0.22
202073/363	PM2.5			08:53	13:05	2.0	504	0.44
202073/364	PM10			08:53	13:05	2.0	504	0.37
202073/357	RD	Metropolitan, Hammersmith and City, Circle Line - Platform 1 (Eastbound)	24.11.20	09:02	13:18	2.2	563.2	0.59
202073/365	PM2.5			09:02	13:18	2.0	512	0.17
202073/366	PM10			09:02	13:18	2.0	512	0.30
202073/358	RD	Metropolitan, Hammersmith and City, Circle Line - Platform 2 (Westbound)	24.11.20	09:12	13:19	2.2	543.4	0.25
202073/367	PM2.5			09:12	13:19	2.0	494	0.10
202073/368	PM10			09:12	13:19	2.0	494	0.33
202073/359	RD	Northern Line - Platform 7 (Northbound)	24.11.20	08:58	13:09	2.2	552.2	0.59
202073/369	PM2.5			08:58	13:09	2.0	502	0.42
202073/370	PM10			08:58	13:09	2.0	502	0.85

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/360	RD	Northern Line - Platform 8 (Southbound)	24.11.20	09:02	13:13	2.2	552.2	1.36
202073/371	PM2.5			09:04	13:13	2.0	498	0.31
202073/372	PM10			09:04	13:13	2.0	498	1.08
202073/361	ID			09:02	13:13	2.0	502	0.99
202073/362	RD	Outside of station supervisor office	24.11.20	08:45	13:03	2.2	567.6	0.21

Table 24. Embankment Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{n} (mg/m^3)
202073/373	RD	Gate Line/ Ticket Hall	25.11.20	08:58	13:20	2.2	576.4	0.45
202073/380	PM2.5			08:58	13:20	2.0	524	0.24
202073/381	PM10			08:58	13:20	2.0	524	0.68
202073/374	RD	Northern Line - Platform 3 (Northbound)	25.11.20	09:15	13:25	2.2	550	0.65
202073/472	PM2.5		01.12.20	09:30	13:30	2.0	480	0.35
202073/383	PM10		25.11.20	09:15	13:25	2.0	500	0.23
202073/375	RD	Northern Line - Platform 4 (Southbound)	25.11.20	09:28	13:22	2.2	536.8	0.93
202073/384	PM2.5			09:28	13:22	2.0	488	0.41
202073/385	PM10			09:28	13:22	2.0	488	0.88
202073/376	RD	Bakerloo Line - Platform 5 (Northbound)	25.11.20	09:21	13:26	2.2	539.0	0.79
202073/386	PM2.5			09:21	13:26	2.0	490.0	0.57
202073/352	PM10		26.11.20	10:08	14:08	2.0	480	1.26
202073/377	RD	Bakerloo Line - Platform 6 (Southbound)	25.11.20	09:13	13:30	2.2	565.4	0.74

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{n} (mg/m^3)
202073/388	PM2.5	Bakerloo Line - Platform 6 (Southbound)	25.11.20	09:13	13:30	2.0	494	0.39
202073/389	PM10			09:13	13:30	2.0	494	1.47
202073/378	ID			09:13	13:30	2.0	514	1.49
202073/379	RD	Outside of station supervisor office	25.11.20	08:59	13:18	2.2	569.8	0.94

Table 25. Canada Water Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/339	RD	Gate Line/ Ticket Hall	26.11.20	09:19	13:36	2.2	565.4	0.33
202073/346	PM2.5			09:19	13:36	2.0	514	0.11
202073/347	PM10			09:19	13:36	2.0	514	0.49
202073/340	RD	Jubilee Line - Platform 1 (Westbound)	26.11.20	09:30	13:33	2.2	534.6	0.76
202073/348	PM2.5			09:30	13:33	2.0	486	0.42
202073/349	PM10			09:30	13:33	2.0	486	1.03
202073/341	RD	Jubilee Line - Platform 2 (Eastbound)	26.11.20	09:38	13:38	2.2	528	1.15
202073/350	PM2.5			09:38	13:38	2.0	480	0.36
202073/351	PM10			09:38	13:38	2.0	480	1.31
202073/342	ID			09:38	13:38	2.0	480	1.19
202073/343	RD	Outside of station supervisor office	26.11.20	09:11	13:37	2.2	585.2	0.33

Table 26. Colliers Wood Station

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID, Particulate Matter PM2.5 and PM10)	Sample Location	Date	Start Time	Finish Time	Flow Rate (L/min)	Volume of Air (litres)	Calc. Dust Conc^{N} (mg/m^3)
202073/390	RD	Gate Line/ Ticket Hall	27.11.20	08:54	13:07	2.2	556.6	0.28
202073/397	PM2.5			08:54	13:07	2.0	506	< 0.02
202073/398	PM10			08:54	13:07	2.0	506	0.35
202073/391	RD	Jubilee Line - Platform 1 (Westbound)	27.11.20	09:02	13:19	2.2	565.4	0.88
202073/399	PM2.5			09:02	13:19	2.0	514	0.23
202073/400	PM10			09:02	13:19	2.0	514	0.32
202073/392	RD	Jubilee Line - Platform 2 (Eastbound)	27.11.20	09:09	13:15	2.2	541.2	0.78
202073/401	PM2.5			09:09	13:15	2.0	492	0.44
202073/402	PM10			09:09	13:15	2.0	492	0.62
202073/393	ID			09:09	13:15	2.0	492	1.36
202073/394	RD	Outside of station supervisor office	27.11.20	08:52	13:11	2.2	569.8	0.61

Table 27. Inhalable dust fraction - Chromium and Manganese Quantitative Analysis

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Chromium (mg/filter)	Manganese (mg/filter)	Chromium conc. (mg/m^3)	Manganese conc. (mg/m^3)
202073/05	ID	Aldgate East Station. District, Hammersmith & City Line. Platform 2 (Eastbound)	27.10.20	508	0.0004	0.0011	0.001	0.002
202073/19	ID	Baker Street Station. Jubilee Line. Platform 7 (Southbound)	28.10.20	492	0.0013	0.0029	0.003	0.006
202073/41	ID	Elephant & Castle Station. Bakerloo Line. Platform 3 (Northbound)	29.10.20	506	0.0003	0.0005	0.001	0.001
202073/59	ID	Euston Square Station. Metropolitan, Hammersmith & City Line. Platform 2 (Eastbound)	30.10.20	528	0.0010	0.0012	0.002	0.002
202073/474	ID	Hampstead Station. Northern Line. Platform 1 (Northbound)	0212.20	520	0.0008	0.0020	0.002	0.004
202073/467	ID	King's Cross Northern Line. Platform 7 (Northbound)	30.11.20	498	0.0015	0.0040	0.003	0.008
202073/119	ID	Oxford Circus Station. Central Line. Platform 2 (Westbound)	04.11.20	490.09	0.0012	0.0030	0.002	0.006
202073/140	ID	Paddington Station Bakerloo Line. Platform 3 (Northbound)	05.11.20	473.73	0.0010	0.0027	0.002	0.006
202073/470	ID	Piccadilly Circus Station. Piccadilly Line. Platform 3 (Eastbound)	01.12.20	486	0.0012	0.0040	0.002	0.008
202073/174	ID	Tottenham Court Station. Northern Line Platform 3 (Northbound)	09.11.20	487.3	0.0009	0.0025	0.002	0.005
202073/189	ID	Vauxhall Station. Victoria Line. Platform 1 (Northbound)	10.11.20	504	0.0018	0.0036	0.004	0.007

F LTER NUMBER	SAMPLE TYPE (RESPIRABLE DUST, RD, INHALABLE DUST, ID)	SAMPLE LOCATION	DATE	VOLUME OF AIR (litres)	CHROMIUM (mg/filter)	MANGANESE (mg/filter)	CHROMIUM CONC. (mg/m^3)	MANGANESE CONC. (mg/m^3)
202073/204	ID	Waterloo Station. Jubilee Line. Platform 6 (Eastbound)	11.11.20	536	0.0013	0.0029	0.002	0.005
202073/225	ID	Westminster Station. Jubilee Line. Platform 3 (Eastbound)	12.11.20	482	0.0010	0.0020	0.002	0.004
202073/242	ID	Mile End Station. Central Line. Platform 4 (Eastbound)	13.11.20	492.3	0.0008	0.0022	0.002	0.004
202073/259	ID	Holborn Station. Piccadilly Line. Platform 3 (Westbound)	16.11.20	498	0.0015	0.0046	0.003	0.009
202073/276	ID	Kennington Station. Northern Line. Platform 4 (Southbound)	17.11.20	508	0.0009	0.0025	0.002	0.005
202073/292	ID	Highbury & Islington Station. Victoria Line. Platform 5 (Southbound)	18.11.20	488	0.0007	0.0018	0.001	0.004
202073/309	ID	Tooting Bec Station. Northern Line. Platform 2 (Southbound)	19.11.20	488	0.0008	0.0019	0.002	0.004
202073/326	ID	London Bridge Station. Jubilee Line. Platform 4 (Eastbound)	20.11.20	493.83	0.0011	0.0023	0.002	0.005
202073/430	ID	Bank Station. Northern Line. Platform 4 (Northbound)	23.11.20	544	0.0010	0.0027	0.002	0.005
202073/361	ID	Moorgate Station. Northern Line. Platform 8 (Southbound)	24.11.20	502	0.0009	0.0023	0.002	0.005
202073/378	ID	Embankment Station. Bakerloo Line. Platform 6 (Southbound)	25.11.20	514	0.0012	0.0033	0.002	0.006
202073/342	ID	Canada Water Station. Jubilee Line. Platform 2 (Eastbound)	26.11.20	480	0.0014	0.0028	0.003	0.006

FILTER NUMBER	SAMPLE TYPE (RESPIRABLE DUST, RD, INHALABLE DUST, ID)	SAMPLE LOCATION	DATE	VOLUME OF AIR (litres)	CHROMIUM (mg/filter)	MANGANESE (mg/filter)	CHROMIUM CONC. (mg/m^3)	MANGANESE CONC. (mg/m^3)
202073/393	ID	Colliers Wood Station. Jubilee Line. Platform 2 (Southbound)	27.11.20	492	0.0011	0.0022	0.002	0.004

Table 28. Inhalable dust fraction – Iron Oxide and Nickel Quantitative Analysis

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of Air (litres)	Fe_2O_3 (mg/filter)	Nickel (mg/filter)	Fe_2O_3 conc. (mg/m^3)	Nickel conc. (mg/m^3)
202073/05	ID	Aldgate East Station. District, Hammersmith & City Line. Platform 2 (Eastbound)	27.10.20	508	0.2011	< 0.0003	0.396	< 0.001
202073/19	ID	Baker Street Station. Jubilee Line. Platform 7 (Southbound)	28.10.20	492	0.4555	< 0.0003	0.926	< 0.001
202073/41	ID	Elephant & Castle Station. Bakerloo Line. Platform 3 (Northbound)	29.10.20	506	0.0846	< 0.0003	0.167	< 0.001
202073/59	ID	Euston Square Station. Metropolitan, Hammersmith & City Line. Platform 2 (Eastbound)	30.10.20	528	0.2199	< 0.0003	0.416	< 0.001
202073/474	ID	Hampstead Station. Northern Line. Platform 1 (Northbound)	0212.20	520	0.1576	< 0.0003	0.303	< 0.001
202073/467	ID	King's Cross Northern Line. Platform 7 (Northbound)	30.11.20	498	0.2922	0.0003	0.587	0.001
202073/119	ID	Oxford Circus Station. Central Line. Platform 2 (Westbound)	04.11.20	490.09	0.5284	< 0.0003	1.078	< 0.001
202073/140	ID	Paddington Station Bakerloo Line. Platform 3 (Northbound)	05.11.20	473.73	0.3908	< 0.0003	0.825	< 0.001
202073/470	ID	Piccadilly Circus Station. Piccadilly Line. Platform 3 (Eastbound)	01.12.20	486	0.3000	< 0.0003	0.617	< 0.001
202073/174	ID	Tottenham Court Station. Northern Line Platform 3 (Northbound)	09.11.20	487.3	0.4054	< 0.0003	0.832	< 0.001
202073/189	ID	Vauxhall Station. Victoria Line. Platform 1 (Northbound)	10.11.20	504	0.5776	< 0.0003	1.146	< 0.001

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of Air (litres)	Fe_2O_3 (mg/filter)	Nickel (mg/filter)	Fe_2O_3 conc. (mg/m^3)	Nickel conc. (mg/m^3)
202073/204	ID	Waterloo Station. Jubilee Line. Platform 6 (Eastbound)	11.11.20	536	0.4892	< 0.0003	0.913	< 0.001
202073/225	ID	Westminster Station. Jubilee Line. Platform 3 (Eastbound)	12.11.20	482	0.3232	< 0.0003	0.671	< 0.001
202073/242	ID	Mile End Station. Central Line. Platform 4 (Eastbound)	13.11.20	492.3	0.3935	< 0.0003	0.799	< 0.001
202073/259	ID	Holborn Station. Piccadilly Line. Platform 3 (Westbound)	16.11.20	498	0.3353	0.0004	0.673	0.001
202073/276	ID	Kennington Station. Northern Line. Platform 4 (Southbound)	17.11.20	508	0.1939	< 0.0003	0.382	< 0.001
202073/292	ID	Highbury & Islington Station. Victoria Line. Platform 5 (Southbound)	18.11.20	488	0.1339	< 0.0003	0.274	< 0.001
202073/309	ID	Tooting Bec Station. Northern Line. Platform 2 (Southbound)	19.11.20	488	0.1509	< 0.0003	0.310	< 0.001
202073/326	ID	London Bridge Station. Jubilee Line. Platform 4 (Eastbound)	20.11.20	493.83	0.1732	< 0.0003	0.351	< 0.001
202073/430	ID	Bank Station. Northern Line. Platform 4 (Northbound)	23.11.20	544	0.2043	< 0.0003	0.376	< 0.001
202073/361	ID	Moorgate Station. Northern Line. Platform 8 (Southbound)	24.11.20	502	0.1788	< 0.0003	0.356	< 0.001
202073/378	ID	Embankment Station. Bakerloo Line. Platform 6 (Southbound)	25.11.20	514	0.2382	0.0003	0.463	0.001
202073/342	ID	Canada Water Station. Jubilee Line. Platform 2 (Eastbound)	26.11.20	480	0.2231	< 0.0003	0.465	< 0.001

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Fe_2O_3 (mg/filter)	Nickel (mg/filter)	Fe_2O_3 conc. (mg/m^3)	Nickel conc. (mg/m^3)
202073/393	ID	Colliers Wood Station. Jubilee Line. Platform 2 (Southbound)	27.11.20	492	0.1728	< 0.0003	0.351	< 0.001

Table 29. Inhalable dust fraction – Copper and Zinc Quantitative Analysis

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Copper (mg/filter)	Zinc (mg/filter)	Copper conc. (mg/m^3)	Zinc conc. (mg/m^3)
202073/05	ID	Aldgate East Station. District, Hammersmith & City Line. Platform 2 (Eastbound)	27.10.20	508	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/19	ID	Baker Street Station. Jubilee Line. Platform 7 (Southbound)	28.10.20	492	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/41	ID	Elephant & Castle Station. Bakerloo Line. Platform 3 (Northbound)	29.10.20	506	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/59	ID	Euston Square Station. Metropolitan, Hammersmith & City Line. Platform 2 (Eastbound)	30.10.20	528	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/474	ID	Hampstead Station. Northern Line. Platform 1 (Northbound)	0212.20	520	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/467	ID	King's Cross Northern Line. Platform 7 (Northbound)	30.11.20	498	0.0003	0.0011	0.001	0.002
202073/119	ID	Oxford Circus Station. Central Line. Platform 2 (Westbound)	04.11.20	490.09	0.0021	0.0005	0.004	0.001
202073/140	ID	Paddington Station Bakerloo Line. Platform 3 (Northbound)	05.11.20	473.73	0.0006	0.0004	0.001	0.001
202073/470	ID	Piccadilly Circus Station. Piccadilly Line. Platform 3 (Eastbound)	01.12.20	486	< 0.0003	0.0006	< 0.001	0.001
202073/174	ID	Tottenham Court Station. Northern Line Platform 3 (Northbound)	09.11.20	487.3	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/189	ID	Vauxhall Station. Victoria Line. Platform 1 (Northbound)	10.11.20	504	< 0.0003	< 0.0003	< 0.001	< 0.001

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Copper (mg/filter)	Zinc (mg/filter)	Copper conc. (mg/m^3)	Zinc conc. (mg/m^3)
202073/204	ID	Waterloo Station. Jubilee Line. Platform 6 (Eastbound)	11.11.20	536	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/225	ID	Westminster Station. Jubilee Line. Platform 3 (Eastbound)	12.11.20	482	< 0.0003	< 0.0003	< 0.001	< 0.001
202073/242	ID	Mile End Station. Central Line. Platform 4 (Eastbound)	13.11.20	492.3	0.0017	< 0.0003	0.003	< 0.001
202073/259	ID	Holborn Station. Piccadilly Line. Platform 3 (Westbound)	16.11.20	498	0.0004	0.0004	0.001	0.001
202073/276	ID	Kennington Station. Northern Line. Platform 4 (Southbound)	17.11.20	508	< 0.0003	0.0006	< 0.001	0.001
202073/292	ID	Highbury & Islington Station. Victoria Line. Platform 5 (Southbound)	18.11.20	488	< 0.0003	0.0004	< 0.001	0.001
202073/309	ID	Tooting Bec Station. Northern Line. Platform 2 (Southbound)	19.11.20	488	< 0.0003	0.0004	< 0.001	0.001
202073/326	ID	London Bridge Station. Jubilee Line. Platform 4 (Eastbound)	20.11.20	493.83	< 0.0003	0.0003	< 0.001	0.001
202073/430	ID	Bank Station. Northern Line. Platform 4 (Northbound)	23.11.20	544	0.0004	0.0006	0.001	0.001
202073/361	ID	Moorgate Station. Northern Line. Platform 8 (Southbound)	24.11.20	502	< 0.0003	0.0004	< 0.001	0.001
202073/378	ID	Embankment Station. Bakerloo Line. Platform 6 (Southbound)	25.11.20	514	0.0003	0.0007	0.001	0.001
202073/342	ID	Canada Water Station. Jubilee Line. Platform 2 (Eastbound)	26.11.20	480	< 0.0003	0.0004	< 0.001	0.001

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Copper (mg/filter)	Zinc (mg/filter)	Copper conc. (mg/m^3)	Zinc conc. (mg/m^3)
202073/393	ID	Colliers Wood Station. Jubilee Line. Platform 2 (Southbound)	27.11.20	492	< 0.0003	0.0003	< 0.001	0.001

Table 30. Inhalable dust fraction – Arsenic and Aluminium Quantitative Analysis

F LTER NUMBER	SAMPLE TYPE (RESPIRABLE DUST, RD, INHALABLE DUST, ID)	SAMPLE LOCATION	DATE	VOLUME OF AIR (litres)	ARSENIC (mg/filter)	ALUMINIUM (mg/filter)	ARSENIC CONC. (mg/m³)	ALUMINIUM CONC. (mg/m³)
202073/05	ID	Aldgate East Station. District, Hammersmith & City Line. Platform 2 (Eastbound)	27.10.20	508	< 0.0003	0.0066	< 0.001	0.013
202073/19	ID	Baker Street Station. Jubilee Line. Platform 7 (Southbound)	28.10.20	492	< 0.0003	0.0064	< 0.001	0.013
202073/41	ID	Elephant & Castle Station. Bakerloo Line. Platform 3 (Northbound)	29.10.20	506	< 0.0003	0.0014	< 0.001	0.003
202073/59	ID	Euston Square Station. Metropolitan, Hammersmith & City Line. Platform 2 (Eastbound)	30.10.20	528	< 0.0003	0.0033	< 0.001	0.006
202073/474	ID	Hampstead Station. Northern Line. Platform 1 (Northbound)	0212.20	520	< 0.0003	0.0032	< 0.001	0.006
202073/467	ID	King's Cross Northern Line. Platform 7 (Northbound)	30.11.20	498	< 0.0003	0.0100	< 0.001	0.020
202073/119	ID	Oxford Circus Station. Central Line. Platform 2 (Westbound)	04.11.20	490.09	< 0.0003	0.0086	< 0.001	0.018
202073/140	ID	Paddington Station Bakerloo Line. Platform 3 (Northbound)	05.11.20	473.73	< 0.0003	0.0066	< 0.001	0.014
202073/470	ID	Piccadilly Circus Station. Piccadilly Line. Platform 3 (Eastbound)	01.12.20	486	< 0.0003	0.0047	< 0.001	0.010
202073/174	ID	Tottenham Court Station. Northern Line Platform 3 (Northbound)	09.11.20	487.3	< 0.0003	0.0034	< 0.001	0.007
202073/189	ID	Vauxhall Station. Victoria Line. Platform 1 (Northbound)	10.11.20	504	< 0.0003	0.0053	< 0.001	0.011

F LTER NUMBER	SAMPLE TYPE (RESPIRABLE DUST, RD, INHALABLE DUST, ID)	SAMPLE LOCATION	DATE	VOLUME OF AIR (litres)	ARSENIC (mg/filter)	ALUMINIUM (mg/filter)	ARSENIC CONC. (mg/m^3)	ALUMINIUM CONC. (mg/m^3)
202073/204	ID	Waterloo Station. Jubilee Line. Platform 6 (Eastbound)	11.11.20	536	< 0.0003	0.0041	< 0.001	0.008
202073/225	ID	Westminster Station. Jubilee Line. Platform 3 (Eastbound)	12.11.20	482	< 0.0003	0.0026	< 0.001	0.005
202073/242	ID	Mile End Station. Central Line. Platform 4 (Eastbound)	13.11.20	492.3	< 0.0003	0.0045	< 0.001	0.009
202073/259	ID	Holborn Station. Piccadilly Line. Platform 3 (Westbound)	16.11.20	498	< 0.0003	0.0103	< 0.001	0.021
202073/276	ID	Kennington Station. Northern Line. Platform 4 (Southbound)	17.11.20	508	< 0.0003	0.0030	< 0.001	0.006
202073/292	ID	Highbury & Islington Station. Victoria Line. Platform 5 (Southbound)	18.11.20	488	< 0.0003	0.0021	< 0.001	0.004
202073/309	ID	Tooting Bec Station. Northern Line. Platform 2 (Southbound)	19.11.20	488	< 0.0003	0.0025	< 0.001	0.005
202073/326	ID	London Bridge Station. Jubilee Line. Platform 4 (Eastbound)	20.11.20	493.83	< 0.0003	0.0038	< 0.001	0.008
202073/430	ID	Bank Station. Northern Line. Platform 4 (Northbound)	23.11.20	544	< 0.0003	0.0032	< 0.001	0.006
202073/361	ID	Moorgate Station. Northern Line. Platform 8 (Southbound)	24.11.20	502	< 0.0003	0.0034	< 0.001	0.007
202073/378	ID	Embankment Station. Bakerloo Line. Platform 6 (Southbound)	25.11.20	514	< 0.0003	0.0080	< 0.001	0.016
202073/342	ID	Canada Water Station. Jubilee Line. Platform 2 (Eastbound)	26.11.20	480	< 0.0003	0.0043	< 0.001	0.009

Filter Number	Sample Type (Respirable Dust, RD, Inhalable Dust, ID)	Sample Location	Date	Volume of air (litres)	Arsenic (mg/filter)	Aluminium (mg/filter)	Arsenic conc. (mg/m^3)	Aluminium conc. (mg/m^3)
202073/393	ID	Colliers Wood Station. Jubilee Line. Platform 2 (Southbound)	27.11.20	492	< 0.0003	0.0021	< 0.001	0.004

Appendix 1. Photos of type of samplers and sampling heads used in the monitoring programme.

Figure 1. IOM Dust Head to monitor Inhalable Dust.

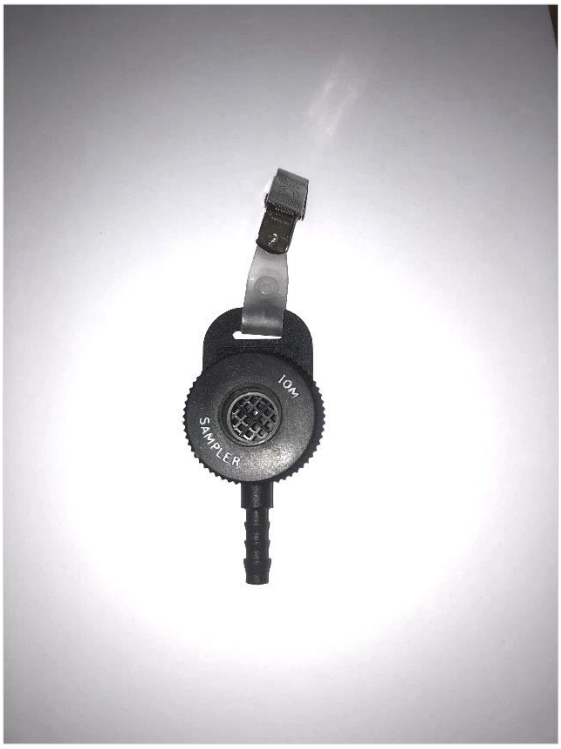

Figure 2. Impactor Heads to monitor $PM_{2.5}$ and PM_{10} aerodynamic diameter dust fraction size.

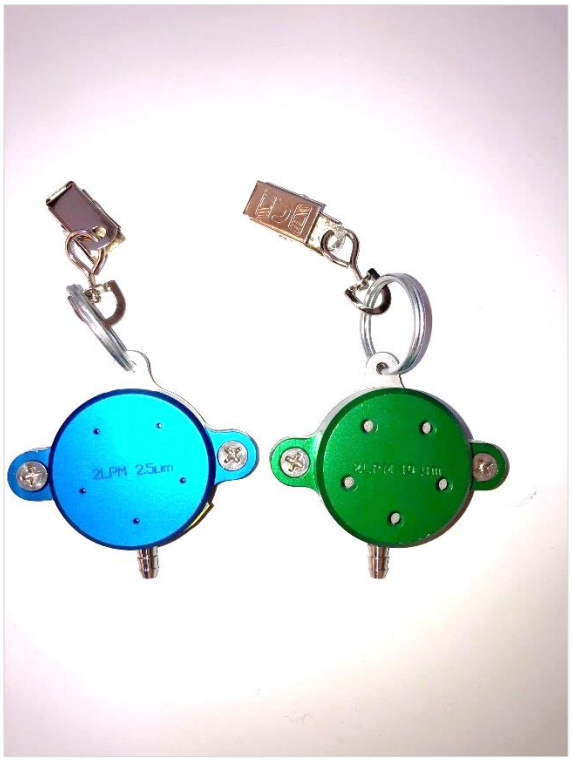

Figure 3. Cyclone Dust Head to monitor Respirable Dust.

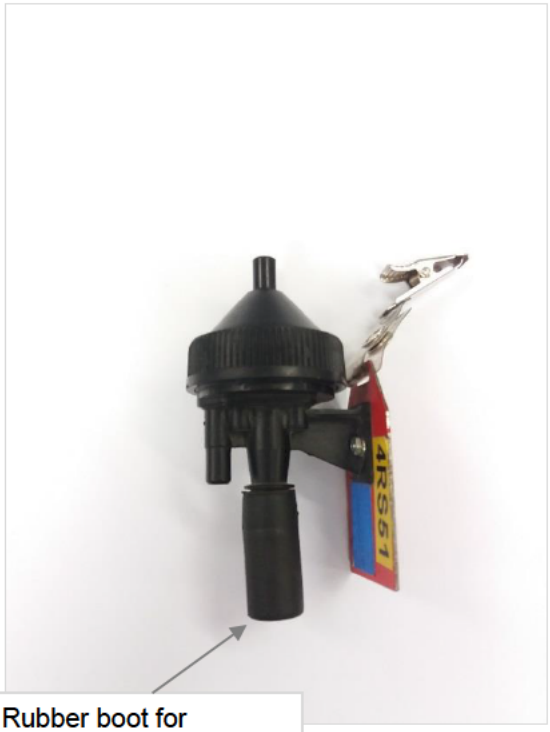

Figure 4. Examples of air samplers used for collecting airborne dust.