



Head Office: Unit 3, Metro Centre,  
Britannia Way, London, NW10 7PA  
Phone: 020 8955 9680 Fax: 020 8955 9689

Laboratory: Unit 11, Ironbridge Close,  
Great Central Way, London, NW10 0UF  
Phone: 020 8955 1700 Fax: 020 8830 1003  
Email: enquiries@4-rail.com  
Web: www.4-rail.com

Report No. 4RS-JB-150604-R500751Rev01

**RESPIRABLE AIRBORNE DUST MONITORING ON  
THE VICTORIA LINE – SEPTEMBER 2015**

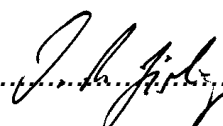
Prepared for: **Mr. Chris Beach**  
**Occupational Hygiene Advisor**  
**Transport for London**  
**Windsor House**  
**42-50 Victoria Street**  
**London**  
**SW1H 0TL**

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Prepared by: **Mr. J. Bailey**  
**Senior Consultant**

Signature: .....

Certified by: **Dr I R Girling**  
**Senior Consultant**

Signature: .....

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REQUESTS FOR ADDITIONAL INFORMATION ON THE SUBJECT OF THIS REPORT OR OTHER QUERIES SHOULD BE ADDRESSED TO THE AUTHOR.

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## 1. INTRODUCTION

- 1.1. At the request of the client, Mr Chris Beach, Occupational Hygiene Advisor to London Underground, respirable personal dust monitoring was to be undertaken on the Victoria Line Train Operators whilst driving.
- 1.2. Personal monitoring for respirable dust was undertaken on the Victoria line train operators on the 21<sup>st</sup>, 22<sup>nd</sup> & 23<sup>rd</sup> September 2015. In addition to the train operator undergoing monitoring, the 4-RAIL Services analyst undertook personal monitoring on herself and a static sample was also taken where possible within the cab itself.
- 1.3. The site monitoring was carried out by Ms Sandra Kardinskaite on the above dates.
- 1.4. Prior to this monitoring be commissioned, 4-RAIL Services Ltd had undertaken an extensive monitoring regime on a variety of location and situations within London Underground. The results of which are reported within 4RS-RL-140792-R440676. This report documented varying results for the Victoria Line Train Operator's - Thursday 4th December 2014 was 1.81 mg/m<sup>3</sup> and on Monday 8th December 2014 was 0.46 mg/m<sup>3</sup>, as there was no obvious explanation for the differences in exposure, this additional monitoring was requested.

## 2. HAZARD INFORMATION AND EXPOSURE LIMITS

- 2.1. Workplace exposure limits for airborne particulates are given in the HSE Document EH40/2005 Workplace Exposure Limits 2005, issue 2. The workplace exposure limits for respirable and total dust are detailed below.

Substance	Long - term exposure limit of (8-hour time weighted average)	
	ppm	mg/m <sup>3</sup>
Total Inhalable General Dust	-	10
Respirable General Dust	-	4

To comply with COSHH the exposure should be reduced as far as practically possible below the relevant limits.

## 3. SAMPLING AND ANALYTICAL METHODOLOGY

- 3.1. Monitoring was undertaken for respirable dust using personal samples. For personal samples the cyclone sampling head was located within the breathing zone. For static samples they were simply positioned within the central part of the cab between the driver and the 4-RAIL analyst. Flow rates of 2.2 L/min are used for the cyclone heads to ensure the respirable fraction of air is collected on to the filter.
- 3.2. For the three requested shifts of monitoring to be undertaken, these were to be carried out on different train operators and during different shift times, including morning, afternoon and

evening shifts. These shifts were suggested and agreed by the TOSM Brixton.

- 3.3. When the train operator took a rest break. The sampling pump was stopped and sealed during this time; and then refitted after the rest period, and the monitoring was continued using the same filter.
  
- 3.4. Sampling and analysis was undertaken for respirable dust in accordance with MDHS 14/4: General methods for sampling and gravimetric analysis of respirable, thoracic and inhalable aerosols as approved by the HSE, and in house test procedure 4R-E206 Issue 7.

#### **4. RESULTS**

- 4.1. The results of the personal and static dust monitoring are detailed in Table 1 below.
  
- 4.2. Over the three shifts of monitoring, three personal samples were undertaken on the train operators, the 4-RAIL Analyst undertook personal sampling on herself for all three shifts and two static samples were undertaken within the train cabin.
  
- 4.3. There was intended to be three static samples, one per shift, but there was a pump malfunction on the first shift and as such only personal sampling was possible during this shift.

## Respirable Airborne Dust Monitoring on the Victoria Line – September 2015

**TABLE 1 AIRBORNE DUST CONCENTRATIONS**

FILTER NUMBER	SAMPLE TYPE (RESPIRABLE DUST, RD, INHALABLE DUST, ID)	SAMPLE LOCATION	DATE	START TIME	FINISH TIME	START TIME	FINISH TIME	FLOW RATE (l/min)	VOLUM E OF AIR (litres)	CALC. DUST CONC <sup>N</sup> (MG/M <sup>3</sup> )	ROUTE COVERED
150604/01	RD	Personal Sample Victoria Line Train Operator <b>Duty 809 - Kelvin M Rogers</b>	21/09/15	07.02	09.47	11.57	13.28	2.2	563.2	<b>0.32</b>	Brixton to Walthamstow (Train 213) - Walthamstow to Brixton (Train 205) - Brixton to Walthamstow (Train 250) - Walthamstow to Brixton (Train 234) - Brixton to - Walthamstow (Train 234) - Walthamstow to Brixton (Train 234) - Brixton to Green Park (Train 221)
150604/02	RD	Personal Sample 4-RAIL Analyst Sandra Kardinskaite	21/09/15	07.03	09.48	11.58	13.29	2.2	563.2	<b>0.36</b>	As Above
150604/04	RD	Personal Sample Victoria Line Train Operator <b>Duty 822 - Paul Boyne</b>	22/09/15	13.37	16.40	19.16	20.21	2.2	545.6	<b>0.15</b>	Brixton to Walthamstow (Train 224) - Walthamstow to Brixton (Train 224) - Brixton to Seven Sisters (Train 227) - Seven Sisters to NPD (Train 227) - NPD to Brixton (Train 227) - Brixton to Walthamstow (Train 233) - Walthamstow to Green Park (Train 236)
150604/05	RD	Personal Sample 4-RAIL Analyst Sandra Kardinskaite	22/09/15	13.37	16.40	19.17	20.21	2.2	543.4	<b>0.14</b>	As above
150604/06	RD	Static Sample within Train Cabin	22/09/15	13.38	16.41	19.17	20.22	2.2	545.6	<b>0.15</b>	As above
150604/07	RD	Personal Sample Victoria Line Train Operator <b>Duty 832 - Vasquez Castro</b>	23/09/15	16.24	19.01	21.18	22.35	2.2	514.8	<b>0.21</b>	Brixton to Walthamstow (Train 246) – Walthamstow to Brixton (Train 223) – Brixton to Walthamstow (Train 232) – Walthamstow to Brixton (Train 232) – Brixton to Seven Sisters (Train 232) – Seven Sisters to NPD (Train 232) – NPD – Green Park (Train 232)
150604/08	RD	Personal Sample 4-RAIL Analyst Sandra Kardinskaite	23/09/15	16.24	19.02	21.18	22.35	2.2	517	<b>0.19</b>	As above
150604/09	RD	Static Sample within Train Cabin	23/09/15	16.25	19.02	21.19	22.35	2.2	512.6	<b>0.21</b>	As above

### 5. DISCUSSION & CONCLUSION

From the above table the following observations can be:

- 5.1 All dust concentrations calculated above are **below** the HSE control limit for respirable dust of 4mg/m<sup>3</sup>.
- 5.2 The highest concentration of respirable dust for a train operator was recorded on Kelvin M Rogers (Duty 809) on the 21<sup>st</sup> September and this was at 0.32 mg/m<sup>3</sup> (The 4-RAIL Analyst recorded a result of 0.36 mg/m<sup>3</sup> this day) This is still well below the relevant control limit.
- 5.3 There appears to be good agreement and consistency for each shift of monitoring with all results for that day giving similar exposure, and the results across the three shifts varying very little, as would be expected.