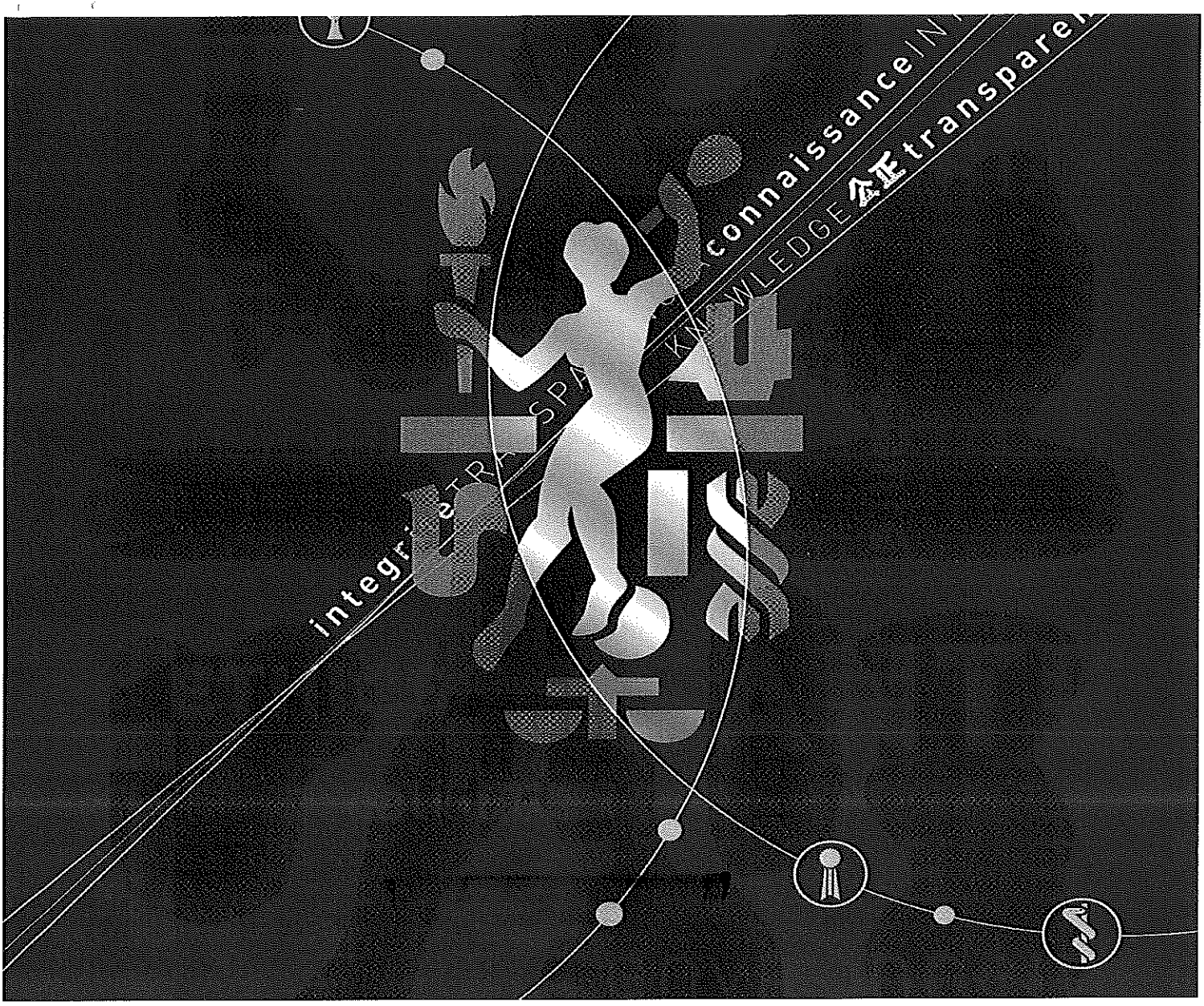

Le Crossing Limited

Workplace Exposure Survey

7th August 2008

Project Number BTAX1779/v1/CC/R1

BUREAU VERITAS

Move Forward with Confidence

WORKPLACE MONITORING SURVEY

LE CROSSING LTD

7th AUGUST 2008

Le Crossing Ltd

South Orbital Way
Dartford
Kent
DA1 5PR

Tel: 01322 221603
E-mail : [redacted]

Bureau Veritas UK Ltd

Unit 308
Fort Dunlop
Fort Parkway
Birmingham
B24 9FD

Tel: 0121 377 2000
Fax: 0121 377 2001

Project Number BTAX1779/v1/CC/R1

Executive Summary

- This report relates to the workplace exposure survey carried out by [redacted] and [redacted] of Bureau Veritas UK Ltd on the 7th August 2008. The survey was undertaken to ascertain personal exposures and background concentrations to diesel fume, carbon monoxide, carbon dioxide, nitrogen oxides, toluene, xylene, ethly benzene and benzene during the normal working day at site.

- Control of substances hazardous to health appears to be adequate for the survey conducted at Le Crossing Ltd on the 7th August 2008. The results obtained from this monitoring survey indicate that the personal exposures and background concentrations were below the relevant workplace exposure limits and guidance values.

- The personal exposures to carbon dioxide were all significantly below the 5000ppm 8hr TWA workplace exposure limit. The static sample was also below the numerical value of 5000ppm.

- Personal exposures to carbon monoxide were all below the 30ppm 8hr TWA workplace exposure limit. The static sample was also below the numerical value of the 30ppm WEL.

- All personal exposures to diesel fume were below the German limit of 0.15 mg/m^3 for elemental carbon. The static sample was also below this numerical value. The limit of 0.15 mg/m^3 was used because the organic carbon levels were greater than 50% of the total carbon results.

- Benzene concentrations were below the 1ppm workplace exposure limit.

- Ethylbenzene, toluene and xylene concentrations were also below their respective workplace exposure limits.

- Nitrogen Monoxide and Nitrogen Dioxide levels were below the previous CHAN 28 and 29 limits detailed in Section 4. (It should be noted that both CHANs have been withdrawn at the time of writing) and the previous limits used only for purposes of control.

1.0 Introduction

1.1 At the request of [redacted] of Le Crossing Company Ltd, a workplace monitoring survey has been carried out at the site in Dartford. [redacted]

1.2 The survey was conducted to quantify airborne concentrations of diesel fume, carbon monoxide, carbon dioxide, nitrogen oxides, toluene, xylene, ethly benzene and benzene during the normal working day at the site.

1.3 Typical exposures have been compared to the relevant workplace exposure limits (WELs) detailed in EH40/latest update (Workplace Exposure Limits).

1.4 Workplace exposure limits are in place in order to protect the health of workers exposed to hazardous substances. WELs are occupational exposure limits set under COSHH. WELs are concentrations of hazardous substances in the air, averaged over a specified period of time referred to as a time weighted average (TWA). Long term exposure limits (LTEL) are based on 8 hours and short term exposure limits (STEL) are based on 15 minutes.

1.5 Mr [redacted] and [redacted] of Bureau Veritas UK Ltd carried out the investigation on Thursday the 7th August 2008.

1.6 It is understood that the operators work the following shift patterns:

- 6.00 am till 2.00 pm
- 2.00 pm till 10.00 pm
- 10.00 pm till 6.00 am

With four, half hour breaks.

1.7 The survey was intended to assist Le Crossing Company Ltd in fulfilling its obligations under Regulation 7 (Prevention or control of exposure to substances hazardous to health) and Regulation 10 (Monitoring exposure at the workplace) of the COSHH Regulations 2002 (as amended).

2.0 Description of work

2.1 The Dartford - Thurrock River Crossing is one of Europe's most heavily used toll crossings and complex traffic management systems. Spanning the Thames between Dartford and Thurrock, the crossing forms a vital link in the M25, Britain's most important orbital road.

2.2 The facility comprises of two two-lane tunnels carrying traffic to the north and a four-lane cable-stayed bridge carrying traffic to the south.

2.3 Le Crossing Company Limited currently operates the crossing on behalf of the Highways Agency under the terms of Dartford-Thurrock Crossing Act 1988.

3.0 Investigation

3.1 The survey was carried out in accordance with the guidelines given in HSE document HSG173, "*Monitoring Strategies for Toxic Substances*".

3.2 Representative personal exposures were taken during the normal working day at the site, so as to compare to the diesel fume guidelines in the HSE document HSG187, *"Control of Diesel Engine Exhaust Emissions in the Workplace."*

4.0 Workplace Exposure Limits

4.1 The Health and Safety Executive (HSE) in their guidance note EH40/2005 entitled "*Workplace Exposure Limits*" give the following workplace exposure limits for the materials addressed as part of this investigation:

Substance	Workplace Exposure Limit (LTEL) mg/m^3	Workplace Exposure Limit (STEL) mg/m^3	Comments
Carbon monoxide	30 ppm	200 ppm	Bmgv, R12, 23, 48/23, 61
Carbon dioxide	5000 ppm	15000 ppm	No comments listed
Nitrogen dioxide	Withdrawn	Withdrawn	Old CHAN 28 limit of 1ppm used for purposes of control
Nitrogen monoxide	Withdrawn	Withdrawn	Old CHAN 29 limit of 1ppm used for purposes of control
Benzene	3.25 mg/m^3 (1ppm)	-	Carc, Sk, R45,46,11,36/38 48/23/24/25 , 65
Ethyl Benzene	441 mg/m^3 (100ppm)	552 mg/m^3 (125ppm)	SK R11,20
Toluene	191 mg/m^3 (50ppm)	384mg/m^3 (100ppm)	Sk R11,38,48/20,63,65,67
Xylene	220 mg/m^3 (50ppm)	441 mg/m^3 (100ppm)	Sk, BMGV R10, 20/21, 38

Carc Capable of causing cancer

Sk Can be absorbed through skin. The assigned substances are those for which there are concerns that dermal absorption will lead to system toxicity.

Bmgv Biological monitoring guidance values

Please see Appendix 2 & for Risk Phrases and Guidance of regulation 7 of the COSHH regulations 2002 (as amended).

4.2 The American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) and the World Health Organisation (WHO) recommend a guidance limit value of 1000 ppm for carbon dioxide. At concentrations above this, susceptible individuals can show health effects such as lethargy occurring. Carbon dioxide is exhaled in people's breath, which will account for higher levels detected, say in a small office or meeting room.

4.3 Benzene

Benzene occurs naturally at trace levels in crude oil and natural gas. It is produced in large quantities from petroleum refining. Benzene exposure may also occur when handling petrol. The health effects associated with benzene are concerned with blood forming tissues, which can result in anaemia, leukaemia and other blood disorders. However, concentrations below 25 – 30ppm are not likely to cause any adverse health effects.

4.4 Toluene

Toluene is produced by catalyic reforming of petroleum feedstokes and also occurs naturally in crude oils. Toluene is used in a range of industrial chemicals and as a solvent in adhesives. It is a common component of many mixed petroleum hydrocarbon solvents. Toluene exposure shows narcotic effects at concentrations of 200ppm.

4.5 Xylene

Xylene is used as a component of petrol and hydrocarbon solvent mixtures and is used in chemical manufacture and as a solvent. Eye, nose and throat irritation has been reported at levels down to 100ppm. Exposure to levels of 300ppm affected the sense of balance, caused visual disturbance and slowed reaction times.

4.6 Ethylbenzene

Ethylbenzene can be found in crude oils, refined petroleum products and combustion products. It is also used in the production of styrene and can be found in paints, lacquers and in the rubber and chemical manufacturing industries. Ethylbenzene effects the central nervous system and is an irritant of mucus membranes and the eyes.

5.0 Chemical Hazard Alert Notices

5.1 At the time of writing, the WEL for nitrogen oxide and nitrogen dioxide did not exist. Additionally, the Chemical Hazard Alert Notice (CHAN) for the gases have been withdrawn. The use of limits set out in the CHAN have been used as a reference guide only. The limits referenced for both gases for long term exposure (8hr TWA) should not exceed 1ppm. It is the advice of the HSE to apply the COSHH regulations to these substances. Further information can be found in Appendix 3 of this document

6.0 Diesel Fume Guidance

6.1 The assessment of the level of exposure to diesel engine exhaust emissions is explained in the Health & Safety Guidance HSG 187 entitled "*Control of Diesel Engine Exhaust Emissions in the Workplace*". Levels of exposure are explained in the following table:

Low	Medium	High
No visible haze in the workplace	Occasional white, blue or black smoke	Permanent white, blue or black smoke
No visible soot deposits	Visible soot deposits in certain areas	Heavy soot deposits especially near emission points
No complaints of irritancy	Some complaints of irritancy	All exposed workers complain of irritancy
CO_2 levels much lower than 1000 ppm 8hr TWA	CO_2 levels about 1000 ppm 8hr TWA	CO_2 levels greater than 1000 ppm 8hr TWA
Controls likely to be adequate	Check adequacy of controls	Controls not adequate; decide on control strategy

6.2 There is no occupational exposure limit set for diesel fume (diesel engine exhaust emissions – DEEE's) at present in the UK. However, there is a limit of 0.1 mg/m^3 for elemental carbon, set in Germany in 1997 and used for non-coal and non-mine activities. If the organic carbon in the sample is greater than >50% of the total carbon, then the limit will be 0.15 mg/m^3.

6.3 The HSE have carried out a technical development survey on diesel fume. Forklift truck drivers were found to have the highest personal exposure levels, where the mean result gave a level of 0.075 mg/m^3 for elemental carbon (EC). The median exposure value for all of the groups tested was 0.025 mg/m^3 for EC.

6.4 For purposes of control, a figure of 0.2 mg/m^3 for elemental carbon should be considered as high exposure.

7.0 Methodology

7.1 Diesel Fume

Respirable exposures to diesel fume were measured by drawing a known volume of air through a 25mm pre-treated quartz filter supported in an enclosed sampling head. The pumps were calibrated before and after sampling, where a flow rate of approximately 3.5 l/min was maintained throughout the monitoring period. On return to the laboratory, the filters were analysed for elemental, organic and total carbon by Thermal-optical analysis; flame ionization detector (FID).

(Method Reference: NIOSH 5040 Diesel Particulate Matter (as elemental carbon) issue 3, March 2003).

7.2 Carbon dioxide and carbon monoxide

Carbon monoxide and carbon dioxide samples were collected by using direct reading diffusive Drager tubes. The tubes were clipped to the operator's lapel so as to establish the operators exposure. At the end of the sampling period, the length of the colour change was noted and the concentration calculated.

7.3 Toluene, Xylene, Ethyl Benzene and Benzene (Diffusive)

Samples were collected diffusively onto thermal diffusion tubes containing Tenax TA packing. The tubes were clipped to the operator's lapel for the duration of the monitoring period. On completion of sampling, the tubes were uniquely labelled and returned to the laboratory for analysis by thermal desorption and gas chromatography.

(MDHS 80 *'Volatile organic compounds in air'*).

7.4 Nitrogen Oxides

Nitrogen oxide and nitrogen dioxide exposures were measured by drawing a measured volume of air through coated molecular sieve filled tubes in series. The pumps were calibrated before and after sampling, where a flow rate of 30ml/min was maintained for the sampling period. On return to the laboratory, the tubes were analysed by ion chromatography (IC)

(Method Reference OSHA ID190)

7.5 Calibration and analytical quality control

Sampling pumps were calibrated before and after sampling using a calibrated meter traceable to national standards. A UKAS accredited laboratory that performs satisfactorily in an external control scheme such as WASP (Workplace Analysis Scheme for Proficiency) was used for the analysis of the samples.

8.0 Observations

8.1 Respiratory Protective Equipment (RPE) was not used by the tollbooth operators.

8.2 A distinct smell of fume was noticed when larger vehicles were passing the tollbooths.

8.3 Weather conditions on the day of the survey were warm and overcast. There were also some heavy rain showers during the day.

8.4 A constant flow of traffic was noted throughout the day.

8.5 The mechanical ventilation systems were in use during the monitoring period shift.

8.6 The windows and door of the Operation Managers office were all shut when the samples was deployed and collected.

8.7 Due to some exposed sharp glass on the tubes used to monitor Nitrogen oxides, it was deemed unsafe for mobile workers to carry the monitoring equipment in case of injury. Therefore, personal exposures for [redacted] and [redacted] were not sampled. Also, the sample for [redacted] of the breakdown crew was not used as a personal sample, and was instead placed inside by an open door of Old Essex Point.

8.8 [redacted] undertook the sampling of the South plaza during the morning shift. [redacted] monitored the North plaza during the afternoon/evening shift.

9.0 Results

9.1 The results for this monitoring survey are tabulated in Appendix 1 to this report.

10.0 Discussion

10.1 Diesel Fume Personal Monitoring

10.1.1 The seven diesel fume personal exposures were below the 0.15 mg/m^3 German limit. The results were compared to the 0.15 mg/m^3 limit because the organic carbon levels were greater than 50% of the total carbon concentrations.

10.1.2 The highest diesel fume exposure to elemental carbon was 0.022 mg/m^3 for [redacted] 8 hour time weighted average was approximately 7 times below the 0.15 mg/m^3 german limit. It should be noted that this operative was working in toll booth 17 South Plaza during the survey.

10.2 Carbon dioxide (CO_2) Self-indicating diffusion tubes

10.2.1 Personal exposures to carbon dioxide were all below the workplace exposure limit (WEL) of 5000 ppm 8 hour time weighted average (TWA). The highest concentration was recieved by [redacted] with a concentration of 1246.8ppm. However, this is above the 1000ppm guidance limit value as set by ASHRAE and WHO.

10.2.2 Five out of the seven personal exposure to carbon dioxide were also below the ASHRAE and WHO recommended guidance limit of 1000ppm.

10.2.3 The static sample taken in the operation managers office had a concentration of 1037ppm, approximately 5 times below the numerical value of the workplace exposure limit for CO_2. This is slightly over the 1000ppm guidance limit value set by WHO and ASHRAE.

10.3 Carbon Monoxide (CO) Self-indicating diffusion tubes

10.3.1 Personal exposures to carbon monoxide were all below the workplace exposure limit (WEL) of 30 ppm 8 hour time weighted average (TWA). [redacted] received the highest exposure of <14.0ppm. A less than figure has been calculated based on the analytical limit of detection and the sample volume collected.

10.3.2 The static sample taken in the operation managers office had a concentration of <7.4 below the numerical value of the workplace exposure limit for CO.

10.4 Benzene

10.4.1 The seven personal exposures to benzene all gave results lower that the analytical limit of detection hence less than (<) figures have been reported. The highest personal exposure was received by [redacted] with a concentration of <0.04ppm. The results are more than 25 times below the 1ppm WEL, 8 hour TWA.

10.4.2 The static sample taken in the operation managers office had a concentration of <0.02ppm, below the 1ppm guidance value.

10.5 Ethylbenzene, Toluene and Xylene

10.5.1 A breakdown of all of the results can be found in Appendix 1 of this report.

10.5.2 Where detected, the results are considered to be trivial when compared with their respective WELs 8 hour TWA.

10.6 Nitrogen Monoxide

10.6.1 All six background concentrations to Nitrogen monoxide were below the 1ppm limit (used for purposes of control). Less than figures have been calculated based on the analytical limit of detection and the sample volume collected

10.7 Nitrogen Dioxide

10.7.1 Nitrogen dioxide concentrations, when detected, were below the 1ppm limit used for purposes of control. The highest personal exposure was received by [redacted], with a concentration of 0.27ppm. Less than figures were calculated based on the analytical limit of detection and the sample volume collected.

11.0 Conclusion and Recommendations

11.1 Control of substances hazardous to health appears to be adequate for the survey conducted at Le Crossing Ltd on the 7th August 2008. The results obtained from this monitoring survey indicate that the personal exposures and background concentrations were below the relevant workplace exposure limits and suggested guidance values.

11.2 The personal exposures to carbon dioxide were all significantly below the 5000ppm 8hr TWA workplace exposure limit. The static sample was also below the numerical value of the 5000ppm WEL (8 hour TWA). Although two samples were found to be over the 1000ppm guidance limit value set by ASHRAE and WHO, there is no immediate cause for concern. This value has been set, as susceptible individuals may begin to experience health effects such as lethargy when carbon dioxide concentrations are around this value. There are no long term health effects with concentrations at these levels.

11.3 The static sample for Carbon Dioxide in the Operation Managers office was found to be over the 1000ppm guidance limit value as set by ASHRAE and WHO. It was noted at the time that there were no open windows or doors during the time of the survey. This may suggest that there is inadequate fresh air reaching the office, that there was a build-up of carbon dioxide within the office during the survey, or that carbon dioxide is coming in from outside through some unknown source.

11.4 All personal exposures to carbon monoxide were all below the 30ppm 8hr TWA workplace exposure limit. The static sample was also below the numerical value of the 30ppm WEL (8 hour TWA).

11.5 Personal exposures to diesel fume were below the German limit of 0.15 mg/m^3 for elemental carbon. The static sample was also below this numerical value. The limit of 0.15 mg/m^3 was used because the organic carbon levels were greater than 50% of the total carbon results.

11.6 Benzene concentrations were below the 1 ppm workplace exposure limit (8 hour TWA).

11.7 Ethylbenzene, toluene and xylene concentrations were also below their respective workplace exposure limits.

11.8 Nitrogen Monoxide and Nitrogen Dioxide levels were below the previous CHAN 28 and 29 limits detailed in Section 4. (It should be noted that both CHANs have been withdrawn at the time of writing) and the previous limits used only for purposes of control.

12.0 Authentication

Client	Le Crossing Company Ltd
Title	Workplace Monitoring Survey
Project Number	BTAX1779/v1/CC/R1
Version 1	Status – Final issue
Prepared by: [redacted]	
Date	1st October 2008
Checked and approved by: [redacted]	
Date	2nd October 2008

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APPENDIX 1

TABLES OF RESULTS

APPENDIX 1

TABLES OF RESULTS

To comply with the COSHH Regulations 2002 (as amended) Regulation 7, adequate control of exposure will require employers to:

- Apply the eight principles of good practice for the control of substances hazardous to health.
- Ensure that the WEL is not exceeded.
- Ensure that exposure to substances that can cause occupational asthma; cancer; or damage to genes that can be passed from one generation to another; is reduced to as low a level as is reasonably practicable.

(Reference section 4 of EH40/2005 Workplace Exposure Limits).

The principles of good practice (EH40/2005 Workplace Exposure Limits);

- Design and operate processes and activities to minimise emission, release and spread of substances hazardous to health.
- Take into account all relevant routes of exposure - inhalation, skin absorption and ingestion - when developing control measures.
- Control exposure by measures that are proportionate to the health risk.
- Choose the most effective and reliable control options which minimise the escape and spread of substances hazardous to health.
- Where adequate control of exposure cannot be achieved by other means, provide, in combination with other control measures, suitable personal protective equipment.
- Check and review regularly all elements of control measures for their continuing effectiveness.
- Inform and train all employees on the hazards and risks from the substances with which they work and the use of control measures developed to minimise the risks.
- Ensure that the introduction of control measures does not increase the overall risk to health and safety.

(Reference section 5 of EH40/2005 Workplace Exposure Limits).

SELF-INDICATING DIFFUSION TUBES

Carbon Monoxide (CO) = 30ppm WEL (8hr TWA)
Carbon Dioxide (CO_2) = 5000ppm WEL (8hr TWA)

(For Diesel fume Control, a concentration of 1000ppm CO_2)
(WHO guidelines for indoor air quality suggest 1000ppm CO_2)

Description	Time of Test	Tube Reading	CO_2 Concentration ppm	CO_2 8 hour TWA ppm
[redacted] – Breakdown Crew	06:30 – 12:55	8,000	1246.8	1246.8
[redacted] Mobile Staff, South side	07:10 – 13:20	5,000	810.8	810.8
[redacted] – Booth 7, North side	06:55 – 13:30	4,000	607.6	607.6
[redacted] – Booth 9, North side	07:00 – 13:15	3,000	480.0	480.0
OM Office	06:40 – 13:25	7,000	1037.0	-
[redacted] – Booth 17, South side	14:05 – 17:45	2000	545.5	545.5
[redacted] – Booth 20, South side	14:10 – 17:45	2000	558.1	558.1
[redacted] Mobile Staff, South side	13:55 – 17:55	4000	1000.0	1000.0

Description	Time of Test	Tube Reading	CO Concentration ppm	CO 8 hour TWA ppm
[redacted] Breakdown Crew	06:30 – 12:55	<50	<7.8	<7.8
[redacted] Mobile Staff, South side	07:10 – 13:20	<50	<8.1	<8.1
[redacted] – Booth 7, North side	06:55 – 13:30	<50	<7.6	<7.6
[redacted] – Booth 9, North side	07:00 – 13:15	<50	<8.0	<8.0
Operations Managers Office	06:40 – 13:25	<50	<7.4	-
[redacted] – Booth 17, South side	14:05 – 17:45	<50	<13.6	<13.6
[redacted] – Booth 20, South side	14:10 – 17:45	<50	<14.0	<14.0
[redacted] – Mobile Staff, South side	13:55 – 17:55	<50	<12.5	<12.5

8 hour TWA's do not apply to static concentrations.

Less than figures have been calculated based on the analytical limit of detection and the sample volume.

Respirable Diesel Fume Results (German limit = 0.1 mg/m³ or 0.15mg/m³ where the organic carbon is greater than 50% of total carbon)
For purpose of control, 0.2 mg/m³ should be considered as high exposure

Name & Date	Location	Operation	Time On & Time Off	Exposure Time (minutes)	Sample Volume (litres)	Elemental Carbon µg	Concentration mg/m³	Calculated 8hr TWA mg/m³
[redacted]	Tool Booth 7 North Plaza	Tool Booth Worker	06:55 – 13:30	395	856.9	5.5	0.006	0.006*
[redacted]	Tool Booth 9 North Plaza	Tool Booth Worker	07:00 – 13:15	375	1332.2	9.6	0.007	0.007*
[redacted]	North Plaza	Mobile Worker	07:10 – 13:20	370	1307.6	10.0	0.008	0.008*
[redacted]	Essex Recovery	Break Down Crew	06:30 – 12:55	325	1369.8	26.0	0.019	0.019*
[redacted]	Tool Booth 17 South Plaza	Tool Booth Worker	14:05 – 17:45	220	777.3	17.0	0.022	0.022*
[redacted]	Tool Booth 20 South Plaza	Tool Booth Worker	14:10 – 17:45	205	735.2	15.0	0.020	0.020*
[redacted]	South Plaza	Mobile Worker	13:55 – 17:55	240	860.9	13.0	0.015	0.015*
[redacted]	Operation Managers Office	-	06:40 – 13:25	375	3525.5	<2.0	<0.0005	-

The term '8-hour reference period' relates to the procedure whereby the occupational exposures in any 24-hour period are treated as equivalent to a single uniform exposure for 8 hours (the 8-hour time-weighted average (TWA) exposure). The 8-hour TWA may be represented mathematically by:

$$\frac{(C1*T1)+(C2*T2)+(Cn*Tn\ldots)}{8}$$

Where C1 is the occupational exposure and T1 is the associated exposure time in hours in any 24-hour period.
* indicates limit of 0.15mg/m³ due to organic carbon greater than 50% of the total carbon.

Benzene Workplace Exposure Limit = 1ppm (3 mg/m³) 8 hour TWA

Tube ID	Name	Operation	Time On	Time Off	Time	Time mins	Mass (ng)	Corr mass (ng)	Up Take rate	Conc ppm Overall	8 Hour TWA ppm
Mi006950	[redacted]	Breakdown Crew	06:30	12:55	6:25	325	<10	<10	1.3	<0.02	<0.02
Mi107357	[redacted]	Mobile staff North side	07:10	13:20	6:10	370	<10	<10	1.3	<0.02	<0.02
Mi084423	[redacted]	Tool booth 7	06:55	13:30	6:35	365	<10	<10	1.3	<0.02	<0.02
Mi107375	[redacted]	Toll booth 9	07:00	13:15	6:15	375	<10	<10	1.3	<0.02	<0.02
Mi080896	[redacted]	Toll booth 17	14:05	17:45	3:40	220	<10	<10	1.3	<0.03	<0.03
Mi080831	[redacted]	Toll booth 20	14:10	17:35	3:25	205	<10	<10	1.3	<0.04	<0.04
T51	[redacted]	Mobile staff South side	13:55	17:55	4:00	240	<10	<10	1.3	<0.03	<0.03
Mi099163	[redacted]	Operations Managers Office	06:40	13:25	6:45	405	<10	<10	1.3	<0.02	<0.02

Uptake rate of analyte in ng ppm^{-1} min^{-1} as defined in table 1 of MDHS 80 for Tenax TA

Ethyl benzene Workplace Exposure Limit = 100ppm (8 hour TWA), 125ppm (15 min TWA)
Toluene Workplace Exposure Limit = 50ppm (8 hour TWA), 150 (15 min TWA)
Xylene Workplace Exposure Limit = 50ppm (8 hour TWA), 100 (15 min TWA)

Tube ID	Name	Operation	Time On	Time Off	Time	Time mins	Analyte	Mass (ng)	Corr mass (ng)	Up Take rate	Conc ppm Over test	8 Hour TWA ppm
Mi006950	[redacted]	Breakdown Crew	06:30	12:55	6:25	325	Ethyl Benzene	<10	<10	2.0	<0.02	<0.02
							Toluene	<10	<10	1.67	<0.02	<0.02
							Xylene	<10	<10	1.82	<0.02	<0.02
Mi107357	[redacted]	Mobile staff North side	07:10	13:20	6:10	370	Ethyl Benzene	<10	<10	2.0	<0.01	<0.01
							Toluene	<10	<10	1.67	<0.02	<0.02
							Xylene	<10	<10	1.82	<0.01	<0.01
Mi084423	[redacted]	Tool booth 7	06:55	13:30	6:35	365	Ethyl Benzene	<10	<10	2.0	<0.01	<0.01
							Toluene	<10	<10	1.67	<0.02	<0.02
							Xylene	<10	<10	1.82	<0.02	<0.02
Mi107375	[redacted]	Toll booth 9	07:00	13:15	6:15	375	Ethyl Benzene	<10	<10	2.0	<0.01	<0.01
							Toluene	<10	<10	1.67	<0.02	<0.02
							Xylene	<10	<10	1.82	<0.01	<0.01
Mi080896	[redacted]	Toll booth 17	14:05	17:45	3:40	220	Ethyl Benzene	<10	<10	2.0	<0.02	<0.02
							Toluene	<10	<10	1.67	<0.03	<0.03
							Xylene	<10	<10	1.82	<0.02	<0.02

Tube ID	Name	Operation	Time On	Time Off	Time	Time mins	Analyte	Mass (ng)	Corr mass (ng)	Up Take rate	Conc ppm Over test	8 Hour TWA ppm
Mi080831	[redacted]	Toll booth 20	14:10	17:35	3:25	205	Ethyl Benzene	<10	<10	2.0	<0.02	<0.02
							Toluene	<10	<10	1.67	<0.03	<0.03
							Xylene	<10	<10	1.82	<0.03	<0.03
T51	[redacted]	Mobile staff South side	13:55	17:55	4:00	240	Ethyl Benzene	<10	<10	2.0	<0.02	<0.02
							Toluene	<10	<10	1.67	<0.03	<0.03
							Xylene	<10	<10	1.82	<0.02	<0.02
Mi099163	Static	Operations Managers Office	06:40	13:25	6:45	405	Ethyl Benzene	<10	<10	2.0	<0.01	<0.01
							Toluene	<10	<10	1.67	<0.01	<0.01
							Xylene	<10	<10	1.82	<0.01	<0.01

Uptake rate of analyte in ng ppm^{-1} min^{-1} as defined in table 1 of MDHS 80 for Tenax TA

Nitrogen Monoxide = 1ppm limit for purposes of control (CHAN Withdrawn)

Location	Time Tube On & Time Tube Off	Sample Time (mins)	Nitrogen Oxide	
			µg on tube	Concentration (ppm)
Tooth 7 North	06:55 – 13:30	395	2	0.11
Booth 9 North	07:00 – 13:15	375	<2	<0.12
Booth 17 South	14:05 – 17:45	220	3	0.27
Booth 20 South	14:10 – 17:45	205	2	0.23
Old Essex Point	06:30 – 12:55	388	3	0.17
Operation Managers Office	06:40 – 13:25	405	<2	<0.11

Nitrogen Dioxide = 1ppm limit for purposes of control (CHAN Withdrawn)

Location	Time Tube On & Time Tube Off	Sample Time (mins)	Nitrogen Oxide	
			µg on tube	Concentration (ppm)
Booth 7 North	06:55 – 13:30	395	<2	<0.072
Booth 9 North	07:00 – 13:15	375	<2	<0.079
Booth 17 South	14:05 – 17:45	220	<2	<0.117
Booth 20 South	14:10 – 17:45	205	<2	<0.151
Old Essex Point	06:30 – 12:55	388	<2	<0.072
Operation Managers Office	06:40 – 13:25	405	<2	<0.072

Less than figures have been calculated based on the analytical limit of detection and the sample volume collected

APPENDIX 2

RISK PHRASES

Risk Phrases from the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 used in EH40

R2	Risk of explosion by shock, friction, fire or other sources of ignition
R4	Forms very sensitive explosive metallic compounds
R5	Heating may cause an explosion
R6	Explosive with or without contact with air
R7	May cause fire
R8	Contact with combustible material may cause fire
R10	Flammable
R11	Highly flammable
R12	Extremely flammable
R14	Reacts violently with water
R16	Explosive when mixed with oxidising substances
R17	Spontaneously flammable in air
R19	May form explosive peroxides
R20	Harmful by inhalation
R20/21	Harmful by inhalation and in contact with skin
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed
R20/22	Harmful by inhalation and if swallowed
R21	Harmful in contact with skin
R21/22	Harmful in contact with skin and if swallowed
R22	Harmful if swallowed
R23	Toxic by inhalation
R23/24	Toxic by inhalation and in contact with skin
R23/25	Toxic by inhalation and if swallowed
R23/24/25	Toxic by inhalation, in contact with skin and if swallowed.
R24	Toxic by contact with skin
R24/25	Toxic in contact with skin and if swallowed
R25	Toxic if swallowed
R26	Very toxic by inhalation
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed
R26/28	Very toxic by inhalation and if swallowed
R27	Very toxic in contact with skin
R27/28	Very toxic in contact with skin and if swallowed
R28	Very toxic if swallowed
R29	Contact with water liberates toxic gas
R31	Contact with acids liberates toxic gas
R32	Contact with acids liberates very toxic gas
R33	Danger of cumulative effects
R34	Causes burns
R35	Causes severe burns
R36	Irritating to eyes
R36/37	Irritating to eyes and respiratory system
R36/37/38	Irritating to eyes, respiratory system and skin
R36/38	Irritating to eyes and skin
R37	Irritating to respiratory system
R37/38	Irritating to respiratory system and skin
R38	Irritating to skin
R39	Danger of very serious irreversible effects
R39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skins and if swallowed
R40	Limited evidence of a carcinogenic effect
R42	Risk of serious damage to eyes
R42	May cause sensitisation by inhalation
R42/43	May cause sensitisation by inhalation and skin contact
R43	May cause sensitisation by skin contact

R44	Risk of explosion if heated under confinement
R45	May cause cancer
R46	May cause heritable genetic damage
R48	Danger of serious damage to health by prolonged exposure
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation
R48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R48/20/22	Harmful: danger of serious damage by prolonged exposure through inhalation and if swallowed
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation
R48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed
R49	May cause cancer by inhalation
R50	Very toxic to aquatic organisms
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R51	Toxic to aquatic organisms
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R53	May cause long-term adverse effects in the aquatic environment
R59	Dangerous for the ozone layer
R60	May impair fertility
R61	May cause harm to the unborn child
R62	Possible risk of impaired fertility
R63	Possible risk of harm to the unborn child
R65	Harmful: may cause lung damage if swallowed
R66	Repeated exposure may cause skin dryness or cracking
R67	Vapours may cause drowsiness and dizziness
R68	Possible risk of irreversible effects

APPENDIX 3

COSHH REGULATIONS 2002 (AS AMENDED)
REGULATION 7

To comply with the COSHH Regulations 2002 (as amended) Regulation 7, adequate control of exposure will require employers to:

- Apply the eight principles of good practice for the control of substances hazardous to health.
- Ensure that the WEL is not exceeded.
- Ensure that exposure to substances that can cause occupational asthma; cancer; or damage to genes that can be passed from one generation to another; is reduced to as low a level as is reasonably practicable.

(Reference section 4 of EH40/2005 Workplace Exposure Limits).

The principles of good practice (EH40/2005 Workplace Exposure Limits);

- Design and operate processes and activities to minimise emission, release and spread of substances hazardous to health.
- Take into account all relevant routes of exposure - inhalation, skin absorption and ingestion - when developing control measures.
- Control exposure by measures that are proportionate to the health risk.
- Choose the most effective and reliable control options which minimise the escape and spread of substances hazardous to health.
- Where adequate control of exposure cannot be achieved by other means, provide, in combination with other control measures, suitable personal protective equipment.
- Check and review regularly all elements of control measures for their continuing effectiveness.
- Inform and train all employees on the hazards and risks from the substances with which they work and the use of control measures developed to minimise the risks.
- Ensure that the introduction of control measures does not increase the overall risk to health and safety.

(Reference section 5 of EH40/2005 Workplace Exposure Limits).