

Workplace air
monitoring

Workplace
noise

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noise

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**AN ASSESSMENT OF EMISSIONS TO ATMOSPHERE
FROM DISCHARGE STACKS DURING A POLYURETHANE CURING
PROCESS**

**AT
TPPL COVENTRY
FOR
TRELLEBORG APPLIED TECHNOLOGIES
HALFPENNY LANE
KNARESBOROUGH
NORTH YORKSHIRE
HG5 0PP**

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Author: Geoff Waggett LFOH
Occupational Hygienist

info@ssuk.eu

01782 341827



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EXECUTIVE SUMMARY

Emissions of total isocyanate and volatile organic compounds (VOC) to atmosphere were monitored on 5 May 2016 during a polyurethane curing process. The monitoring was required to comply with the requirements stated in Local Authority Permit PPC 194. The results and information obtained during the visit indicated that:

- Levels of Isocyanates as methylene diphenyl diisocyanate (MDI) were under the LOD (Limit of Detection) and also under all pollution prevention control limits.
- Levels of VOC were below the PPC 194 limits given as 100mg/nm³.
- The average concentration of total carbon from Oven 13 exhaust stack was 0.72 mg.m⁻³ equating to 0.001 kg/hr.
- The average concentration of total carbon from Oven 18 exhaust stack was 6.4 mg.m⁻³ equating to 0.004 kg/hr.

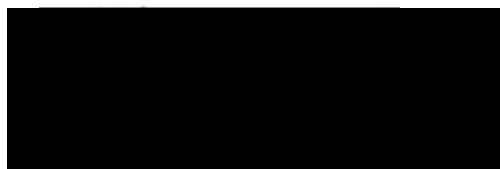
Isocyanates

Stack ID	Conc. mg.Nm ⁻³	Conc. mg.Nm ⁻³	Average Conc.	Mass Emission
	Run 1	Run 2	mg.Nm ⁻³	kg/hr
Oven 13	<0.09	<0.09	<0.09	<0.00002
Oven 18	<0.09	<0.09	<0.09	<0.00002

VOC

Stack ID	Conc. mg.Nm ⁻³	Conc. mg.Nm ⁻³	Average Conc.	Mass Emission
	Run 1	Run 2	mg.Nm ⁻³	kg/hr
Oven 13	0.33	1.1	0.72	0.001
Oven 18	7.9	4.9	6.4	0.004

SURVEYED BY:



Geoff Waggett LFOH
Occupational Hygienist

VERIFIED BY:



Simon Skentelbery
General Manager

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1. INTRODUCTION

The survey described in this report was carried out on 5 May 2016 by Geoff Waggett at the request of Mike Gouws of TPPL Coventry, in accordance with our work specifications outlined in quotation reference ISS00327, in order to determine emissions to atmosphere to comply with the company's Local Authority authorisation.

The stacks monitored emit from two curing ovens to atmosphere.

2. DESCRIPTION OF PROCESS

The TPPL facility in Coventry specialises in moulding components using a polyurethane compound based on MDI and a polyol. The processes tested concerned ovens used to force-cure polyurethane items, venting to atmosphere via short stacks through the factory roof.

3. MONITORING

Isocyanate Monitoring

A sampling pump was connected to an impinger tube containing a solution of 1-(2 methoxyphenyl) piperazine in dry toluene, the method based on MDHS 25. Sampling is performed by extracting air from the stack or vent, and bubbling through the impinger solution at 1 litre per minute for 60 minutes. The process was repeated over a 2 hour period.

The sampling solution was sealed in glass jars and sent for analysis using High Performance Liquid Chromatography.

Volatile Organic Compound (VOC) Monitoring

The sampling system comprises of a sampling head containing a SKC Sorbent sample tube (226-01), connected to a portable precision pump, capable of running continuously for 8 hours at the recommended flow rate. The pump flow rate is stable to within 5% and the total volume of air sampled by the pump over the recommended sampling period is within 10% of the calculated volume. Sampling was carried out at 0.1 litre per minute for 60 minutes, repeated over a 2 hour period.

The location and duration of sampling and flow rate are recorded. Following monitoring the 226-01 sorbent tube is capped and placed in a sealed inert container until analysis can be carried out. Analysis is by Gas Chromatography/Mass Spectrometry using specified procedures for the instrumentation.

4. RESULTS

The detailed results are attached as Appendix 2. The results for the monitoring period are summarised below and over:

Isocyanate

Stack ID	Conc. mg.Nm ⁻³	Conc. mg.Nm ⁻³	Average Conc.	Mass Emission
	Run 1	Run 2	mg.Nm ⁻³	kg/hr
Oven 13	Oven 13	<0.09	<0.09	<0.00002
Oven 18	Oven 18	<0.09	<0.09	<0.00002

Volatile organic compounds

Stack ID	Conc. mg.Nm⁻³ Run 1	Conc. mg.Nm⁻³ Run 2	Average Conc. mg.Nm⁻³	Mass Emission kg/hr
Oven 13	0.33	1.1	0.72	0.001
Oven 18	7.9	4.9	6.4	0.004

Oven stack 13, diameter 0.3m, flowrate 6.7m/s

Oven stack 18, diameter 0.25m, flowrate 3.6m/s

**APPENDIX 1
IMAGE OF STACKS**



Image 1. Oven 13 test point



Image 2. Oven 18 test point

APPENDIX 2 EMISSIONS CALCULATIONS

VOC Emission Calculations

Location: **Oven 13 run 1**
Date of Sample: 05-May-16

Absolute temperature in duct (Td)	359	K
Total pressure in duct = barometric + static (Pd)	1009	kPa
Flow rate for VOC sampling (f)	100	ml/min
Total period of sampling (t) = T1-T0	60	mins
Total quantity of air samples = f x t (Q voc)	0.006	m ³
Weight of VOC collected expressed as carbon	0.015	mg
Concentration VOC = $\frac{Wc}{Q \text{ voc}}$	2.5	mg/m ³
Correction to STP = $\frac{Wc \times Td \times 101.3}{Q \text{ voc} \times 273 \times Pd}$	0.33	mg/m ³

Code:- VOC = Volatile Organic Compound
Sample GW2009

VOC Emission Calculations

Location: **Oven 13 run 2**
Date of Sample: 05-May-16

Absolute temperature in duct (Td)	<input type="text" value="359"/>	K
Total pressure in duct = barometric + static (Pd)	<input type="text" value="100.9"/>	kPa
Flow rate for VOC sampling (f)	<input type="text" value="100"/>	ml/min
Total period of sampling (t) = T1-T0	<input type="text" value="60"/>	mins
Total quantity of air samples = f x t (Q voc)	<input type="text" value="0.006"/>	m ³
Weight of VOC collected expressed as carbon (Wc)	<input type="text" value="0.005"/>	mg
Concentration VOC = $\frac{Wc}{Q \text{ voc}}$	<input type="text" value="0.83"/>	mg/m ³
Correction to STP = $\frac{Wc \times Td \times 101.3}{Q \text{ voc} \times 273 \times Pd}$	<input type="text" value="1.1"/>	mg/m ³

Code:- VOC = Volatile Organic Compound, sample
GW2010

VOC Emission Calculations

Location: **Oven 18 run 1**
Date of Sample: 05-May-16

Absolute temperature in duct (Td)	<input type="text" value="366"/>	K
Total pressure in duct = barometric + static (Pd)	<input type="text" value="100.8"/>	kPa
Flow rate for VOC sampling (f)	<input type="text" value="100"/>	ml/min
Total period of sampling (t) = T1-T0	<input type="text" value="60"/>	mins
Total quantity of air samples = f x t (Q voc)	<input type="text" value="0.006"/>	m ³
Weight of VOC collected expressed as carbon (Wc)	<input type="text" value="0.035"/>	mg
Concentration VOC = $\frac{Wc}{Q \text{ voc}}$	<input type="text" value="5.8"/>	mg/m ³
Correction to STP = $\frac{Wc \times Td \times 101.3}{Q \text{ voc} \times 273 \times Pd}$	<input type="text" value="7.85"/>	mg/m ³

Code:- VOC = Volatile Organic Compound, sample
GW2011

VOC Emission Calculations

Location: **Oven 18 run 2**
 Date of Sample: 05-May-16

Absolute temperature in duct (Td)	366	K
Total pressure in duct = barometric + static (Pd)	100.8	kPa
Flow rate for VOC sampling (f)	100	ml/min
Total period of sampling (t) = T1-T0	60	mins
Total quantity of air samples = f x t (Q voc)	0.006	m ³
Weight of VOC collected expressed as carbon (Wc)	0.022	mg
Concentration VOC = $\frac{Wc}{Q \text{ voc}}$	3.7	mg/m ³
Correction to STP = $\frac{Wc \times Td \times 101.3}{Q \text{ voc} \times 273 \times Pd}$	4.9	mg/m ³

Code:- VOC = Volatile Organic Compound, sample
 GW2012

Isocyanate emissions were all under the analytical Limits of Detection.