

# M501 – INTERNATIONAL MODULE: MEASUREMENT OF HAZARDOUS SUBSTANCES INCLUDING RISK ASSESSMENT

## GAS & VAPOUR SAMPLING PRACTICAL – STUDENT EXERCISES

**AIM:** To demonstrate the correct procedures for use when sampling gases and vapours

### EXERCISES:

#### Part (A)

Break up into your allocated group and complete the four (4) gas and vapour sampling exercises below.

Refer to your lecture notes and the appropriate standard method if it is available for each exercise.

A maximum of 25 minutes is allocated for each exercise before rotating to the next exercise.

1. **Sorbent Tube** – Select all the equipment necessary to prepare a sorbent tube sample train for sampling organic vapours. Insert a sorbent tube into the tube holder and calibrate the sampling train to the correct flow rate using an electronic flowmeter.

Attach the sampling train with the sampling head within the breathing zone of this team member.

Commence the sampling exercise.

After the conclusion of the sampling period, (for the purpose of the exercise several minutes only), prior to switching off the pump record the time and immediately remeasure and record the flow rate, remove and store the collection device.

2. **Direct Reading Instrumentation** – Using the instrument provided, measure the concentration of gas or vapour in the area indicated by the lecturer.

Using the information supplied with the instrument (Manufacturer's Manual), establish the limitations of the instrument and the calibration requirements.

3. **Colorimetric Tubes** – Select the range of colorimetric tubes, sampling pumps and any other necessary equipment to measure organic vapours.

Select the appropriate tube(s)

Leak test the pump

Prepare and use the tube for use

4. **Diffusion or Passive Badges** – Inspect the range of diffusion badges provided and select the one(s) suitable for sampling of organic vapours.

Prepare the diffusion badge for use and attach it in the breathing zone of a team member.

Commence the sampling exercise.

After the conclusion of the sampling period, (for the purpose of the exercise several minutes only), record the time and remove and store the collection device.

***A total of 100 minutes is allocation for Part A***

**Part (B)**

You are an Occupational Hygienist who has been asked to evaluate employee exposures to organic solvents (ie styrene) at a fibreglass boat factory. In this factory a number of processes are performed and include lay up of moulds (photograph 1), use of a fibreglass chopper gun (photograph 2) and gelcoating (photograph 3) or painting with styrene based resins/paints.



(Source: R Terpstra – Reproduced with permission)

**Photograph 1 – Hand Lay Up**



(Source: R Terpstra – Reproduced with permission)

**Photograph 2 – Chopper Gun**



(Source: R Terpstra – Reproduced with permission)

**Photograph 4 – Gel Coating**

The company has previously employed a consultant to monitor the workplace and as a result of the workplace monitoring programme at this boat building shed, you have acquired the following information:

- a) Monitoring results for styrene
- b) Peak exposure levels from a direct reading instrument and colorimetric tubes
- c) Toxicological properties of styrene used in the exercise
- d) Appropriate exposure standards

Using the above information, complete the following tasks:

- Calculate all results of workplace employee exposures and determine the relevance and limitations of the data. Has the consultant collected the appropriate information?
- Assess the risks of potential adverse health effects arising from the exposures.
- Prepare an appropriate report on the monitoring exercise. Include in your report how you conducted the monitoring, the basis for your assessment of risk, recommendations on controlling exposures (if required) and any future monitoring (if required).

***A total of 45 minutes is allocated for Part B***

**SUPPLEMENTARY INFORMATION****a) Exposure Data****- Charcoal Tube**

<b>Name</b>	<b>Task</b>	<b>Sample Time (24hr Clock)</b>	<b>Initial Flowrate (mL/min)</b>	<b>Final Flowrate (mL/min)</b>	<b>µg Styrene</b>
B Bartlett	Hand lay up	0730 – 1530	147	143	3480
J Smith	Chopper gun	0735 – 1525	97	101	12,100
J Smith	Chopper gun	0830 – 0900	125	129	1,580
R Clift	Chopper gun asst	0740 – 1500	139	135	905
I Kerr	Sanding	0730 – 1520	100	120	530
A Blakey	Gelcoating	0800 - 1500	90	90	7,560

Where Molecular weight of styrene = 104.16

Assume 100% desorption efficiency

**- Organic Vapour Monitor Diffusion Badge**

<b>Name</b>	<b>Task</b>	<b>Sample Time (24hr Clock)</b>	<b>µg Styrene</b>
M Watt	Hand lay up	0745 – 1515	695
J Wilson	Chopper gun	0800 – 1500	3530
M Howie	Gelcoating	0750 – 1520	2330
Area	Chopper area	0730 – 1530	200
Area	Finishing area	0740 – 1540	110

Where Calculation Constants      A = 34.6 mg/m<sup>3</sup>      B = 8.12 ppm  
 Recovery Coefficient (r)      0.97  
 Temperature      25°C



b) **Peak Readings from Direct Reading Instrument/Colorimetric Tube**

During the work day the following peak readings were recorded in the breathing zone of the person operating the chopper gun and during spraying of gelcoat using a MIRAN IR Analyser and/or direct reading Colorimetric Tubes. All results were recorded when using the chopper gun or spraying was taking place.

Chopper gun	400 ppm
	290 ppm
	350 ppm
	800 ppm
Gelcoat spraying	360 ppm
	500 ppm
	790 ppm
	450 ppm

c) **Material Safety Data Sheet**

*Product Name:* XYZ Resin Solution  
*Uses:* Composites fabrication

***Physical Description & Properties***

*Appearance:* Clear to hazy liquid with a characteristic styrene odour

<b><i>Chemical Name</i></b>	<b><i>CAS No.</i></b>	<b><i>Proportion</i></b>
<i>Polyester resin</i>	Proprietary	30-60%
<i>Styrene monomer</i>	100-42-5	30-60%
<i>Other ingredients determined not to be hazardous</i>		0-10%
<i>Quinone and/or phenolic inhibitors</i>	Proprietary	0-0.99%
<i>Metal Napthenates and/ or octoates</i>	Proprietary	0-0.99%
<i>Amine and/or aniline derivatives</i>	Proprietary	0-0.99%

## ***Health Effects***

### *Acute (short term) effects*

- Swallowed: Ingestion of this product may irritate the gastric tract causing nausea and vomiting.
- Eye: Irritating to eyes. On eye contact this product will cause tearing, stinging, blurred vision, redness and possible conjunctivitis.
- Skin: Will cause irritation in contact with skin. Prolonged contact with skin may cause blistering, and repeated contact may have a defatting effect causing dryness and cracking.
- Inhaled: Harmful by inhalation. Vapour can cause severe irritation to the respiratory tract. Styrene at 400 ppm is irritating to all parts of the respiratory tract. Styrene possesses narcotic-like properties: excessive exposure may result in dizziness, incoordination, fatigue, nausea, loss of appetite and loss of consciousness.

### *Chronic (long term) Health Effects*

Continued exposures to levels near 400 ppm can cause respiratory tract irritation: prolonged inhalation of vapours can cause respiratory tract obstruction. Long term exposure to styrene vapours may cause peripheral neuropathy and CNS depression

### *Other Health Hazard Information*

Styrene is classified as 'possibly carcinogenic to humans (Group 2B)' by the International Agency for Research on Cancer (IARC).

### *Exposure Standards - Styrene*

TWA 20 ppm  
STEL 40 ppm

**Note:** *These MSDS have been specially prepared for use in this case study and are not to be used for any other purpose*