

# M501: MEASUREMENT OF HAZARDOUS SUBSTANCES INCLUDING RISK ASSESSMENT

## DUST PRACTICAL – STUDENT EXERCISES

**AIM:** To demonstrate the correct procedures for use when sampling dusts

### EXERCISES:

#### Part (A)

Break up into your allocated group and complete the four (4) exercises below. A maximum of 25 minutes is allocated for each exercise before rotating to the next exercise.

1. ***Respirable Dust*** – Select all the equipment necessary to prepare a sample train for respirable dust. Insert a filter into the sample head and calibrate to the correct flowrate using an electronic flowmeter. Fix the sampling head within the breathing zone of a member of your team and attach the pump appropriately. A respirator can be worn if required.

A member of the team should cover their clothes with disposable coveralls, wear glasses and a respirator (if required) and generate a dust cloud by sanding a wooden board while the dust cloud is sampled.

After five minutes (maximum) sanding, recalibrate the pump and open the filter cassette. Refer to your lecture notes and the appropriate standard method if it is available.

2. ***Inhalable Dust*** – Select all the equipment necessary to prepare a sample train for inhalable dust. Insert a filter into the sample head and calibrate to the correct flowrate using a soap film flowmeter. Fix the sampling head within the breathing zone of a member of your team and attach the pump appropriately. A respirator can be worn if required.

A member of the team should cover their clothes with disposable coveralls, wear glasses and a respirator (if required) and generate a dust cloud by sanding a wooden board while the dust cloud is sampled.

After five minutes (maximum) sanding, recalibrate the pump and open the filter cassette. Refer to your lecture notes and the appropriate standard method if it is available.

3. ***Evaluation of a Dust Cloud*** – Using MDHS 82 as a guide, generate a dust cloud using the sander and wooden board so as to observe the Tyndall effect. If a direct reading instrument is available, record the peak results over the sanding exercise. Discuss with your supervisor how this approach can be useful in developing an appropriate monitoring strategy.
4. ***Selection and Weighing of Filters*** – Inspect the range of filters provided and select the one(s) suitable for respirable and inhalable dust. Prepare several filters for equilibration (use your notes as a guide) and weigh them on the microbalance. If a microbalance is not available discuss with your supervisor which filters should be used for what contaminants and why.

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

## **Part (B)**

You are an occupational hygienist who has been asked to evaluate employee exposures to wood dust at a joinery making cupboards from softwood particle board.

You make an inspection of the joinery and note the following:

- A number of processes are performed, eg belt sanding, orbital sanding, wood turning, planing, routing and sawing (Photographs 1 & 2).
- Several machines are connected to an extraction ventilation system which appears to be overloaded and discharges within the work area (Photograph 3).

- Considerable dust appears to build-up around the equipment and fallout on surfaces within the workshop (Photographs 4 & 5).
- The company has previously employed a consultant to monitor the workplace and as a result of the workplace monitoring programme performed at this joinery you have acquired the following information:
  - a) Monitoring results for both respirable and inhalable dust
  - b) Peak exposure levels from a direct reading instrument
  - c) Toxicological properties of the particle board used in the exercise
  - d) Documentation on the appropriate exposure standards from the MSDS for the particle board

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***



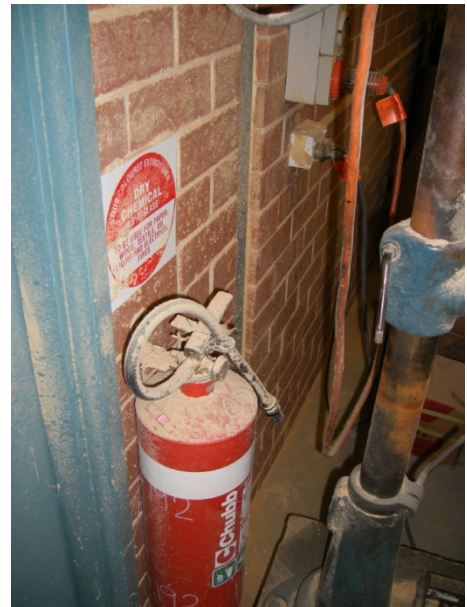
**Photograph 1 – Router**



**Photograph 2 - Saw**



**Photograph 3 – Extraction System**



**Photograph 4 – Dust Build-up**



**Photograph 5 – Dust Build-up**



## SUPPLEMENTARY INFORMATION

### a) Exposure Data

#### - *Respirable Dust*

Name	Task	Pre Filter Weight (g)	Post Filter Weight (g)	Sample Time (24hr Clock)	Initial Flowrate (L/min)	Final Flowrate (L/min)
J Smith	Belt Sanding	0.00752	0.01148	0730 – 1530	2.2	2.15
A Jones	Orbital Sanding	0.00684	0.01296	0735 – 1525	2.25	2.2
D Brown	Lathe Operator	0.00701	0.00842	0740 – 1528	2.2	1.9
T Van	Router Operator	0.00656	0.00782	0738 – 1515	2.2	2.2
T Tran	Saw Operator	0.00741	0.00806	0745 – 1500	2.15	2.2
M Dokic	Planer Operator	0.00708	0.00824	0748 – 1510	2.15	2.2

#### - *Inhalable Dust*

Name	Task	Pre Filter Weight (g)	Post Filter Weight (g)	Sample Time (24hr Clock)	Initial Flowrate (L/min)	Final Flowrate (L/min)
A Black	Belt Sanding	0.00702	0.01654	0700 – 1500	2.0	2.0
S Mann	Orbital Sanding	0.00685	0.06206	0705 – 1520	2.0	2.05
R Small	Lathe Operator	0.00692	0.02792	0710 – 1505	2.0	1.95
M Water	Router Operator	0.00724	0.00972	0715 – 1520	2.0	1.9
S Wiskey	Saw Operator	0.00730	0.00861	0732 – 1508	1.95	1.95
O Book	Planer Operator	0.00696	0.00913	0800 – 1430	2.0	1.7
F White	Belt Sanding	0.00705	0.01905	0750 – 1200	2.0	2.0
F White	Orbital Sanding	0.00712	0.03886	1205 – 1535	2.0	1.9



b) **Peak Readings from Direct Reading Instrument**

During the work day the following peak readings were recorded in the breathing zone of the person operating the orbital sander using a TSI Dust Trak direct reading instrument. All results were recorded when sanding was taking place.

240 mg/m<sup>3</sup>

75 mg/m<sup>3</sup>

260 mg/m<sup>3</sup>

1 mg/m<sup>3</sup>

120 mg/m<sup>3</sup>

420 mg/m<sup>3</sup>

7 mg/m<sup>3</sup>

**Note:** The TSI Dust Trak instrument was calibrated to read inhalable dust

c) **Material Safety Data Sheet**

**PRODUCT NAME:** Particle Board

**USES:** Construction of cabinets, furniture and as a general purpose building board

**PHYSICAL DESCRIPTION & PROPERTIES**

Appearance:	Pressed boards of 9 – 33 mm thickness
Odour:	Newly cut surfaces may have a resin and pine odour

**COMPOSITION**

Chemical Name	CAS Number	Proportion
Wood Particles (softwood)	None	>85%
Urea Formaldehyde Resin	9011-05-6	<13%
Melamine Urea Formaldehyde Resin	25036-13-9	<13%
Paraffin Wax	8002-74-2	<2%
<b>Dust from this product contains:</b>		
Softwood Dust		>85%
Cured Binder		<15%



## **HEALTH EFFECTS**

### **Acute (short term) Health Effects**

- Swallowed: Unlikely under normal conditions. Swallowing the dust may cause abdominal discomfort.
- Eye: Wood dust and the resin may be irritating to the eyes resulting in redness and watering.
- Skin: Skin contact with wood dust and the resin, may result in skin itching and redness and dermatitis in some people.
- Inhaled: Inhalation of wood dust and the resin may be irritating to the nose, throat and lungs.

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

Repeated exposures over many years to uncontrolled dusts increase the risk of nasal cavity cancer. Inhalation of wood dust may also increase the risk of lung fibrosis (scarring). There are also increased risks of respiratory and skin sensitisation from wood dust and resin in asthma and dermatitis respectively.

Wood dust has been evaluated by the International Agency for Research on Cancer (IARC) as group 1, carcinogen to humans.

Formaldehyde has been evaluated by the IARC as group 1, carcinogenic to humans and by the European Union (EU) as a Category 3 carcinogen (possibly carcinogenic).

## **TOXICOLOGICAL & EPIDEMIOLOGICAL DATA**

Any health hazards associated with these products have been evaluated on the basis of the individual ingredients, and these hazards should be assumed to be additive. The hazards described in this document have been evaluated based on a threshold of 1.0% for all hazardous ingredients and 0.1% for all carcinogens.

### Acute Effects

The dust, which may be generated during manual or mechanical cutting, drilling, sanding or other abrading processes, and the smoke generated by heating or laser cutting, may cause temporary irritation of the eyes and upper respiratory system.

The symptoms are expected to subside after exposure has stopped and are not expected to cause any long-term effects.

Allergic skin and lung reactions have been reported with exposure to various wood panels' dusts due to the chemicals presented in wood and cured resin. These rashes resemble other allergic skin reactions caused by plants, and usually heal rapidly.

### Chronic Effects

The risk of nasal cancer has been associated with wood dust exposure. In the 1960s, studies linking wood dust exposure in the furniture industry with nasal cancer were first reported in England. The link was confirmed in several other European countries and furniture industries. The studies showing a link to nasal cancer have been primarily conducted in industries using hardwood. The International Agency for Research on Cancer (IARC) evaluated dusts from both hardwood and softwood in 1995 and concluded that: "There is sufficient evidence in humans for the carcinogenicity of wood dust. There is inadequate evidence in experimental animals for the carcinogenicity of wood dust. Wood dust is carcinogenic to humans (Group 1)."

The IARC also evaluated formaldehyde in 1995<sup>1</sup> and concluded that: "There is *limited evidence* in humans for the carcinogenicity of formaldehyde; there is *sufficient evidence* in experimental animals for the carcinogenicity of formaldehyde; and that overall formaldehyde is *probably carcinogenic to humans* (Group 2A)".

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<sup>1</sup> IARC *Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 62: Wood dust and formaldehyde. IARC, Lyon, France. 1995.

The IARC again evaluated formaldehyde in June 2004<sup>2</sup> and concluded that “*there are adequate data available from humans for an increased risk of nasopharyngeal cancer*” and that formaldehyde should now be classified as Group 1, carcinogenic to humans.

Whilst this wood panel product contains less than 0.01% free formaldehyde, people using the product may be exposed to low concentrations of formaldehyde if the boards are heated (as in laminating), are cut by laser cutting machines, and/or if dust particles come in contact with the moist mucous membranes lining the upper respiratory tract. Extensive literature searches and research carried out by independent occupational and environmental health specialists has not indicated any risks over and above those associated with wood dust without binder. This research includes the 1999 formaldehyde risk assessment carried out by US scientists in collaboration with the US EPA and Health Canada. The risk assessment concludes that if a non-smoking worker were exposed to 0.004 ppm of formaldehyde continuously for 80 years and also to 0.1 ppm for 40 years at work then the predicted additional risk of respiratory tract cancer would be 4.1 per 1,000,000,000. The controls needed for minimising the potential for formaldehyde exposure from this product will be the same as those for control of dust exposures. These risk assessments and conclusions are in no way altered by the reclassification of formaldehyde to Group 1 by the IARC.

d) **Exposure Standards**

Softwood (as inhalable dust) = 1 mg/m<sup>3</sup>

Formaldehyde = 0.3 ppm

e) **Explosion Hazard**

Wood dust may ignite at temperatures greater than 204°C and at high concentrations in air (>60 mg/m<sup>3</sup>) may spontaneously explode.

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<sup>2</sup> IARC Press Release No.153, 15 June 2004, IARC, Lyon, France.

**Note:** *This practical has been prepared from a mixture of factual and fictitious material and any resemblance to any situation or organisation is coincidental.*

*The MSDS used in this exercise has been specifically prepared for this situation and should not be used for any other purpose.*