

Health monitoring

Guide for ethyl benzene





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Introduction

This guide is intended to be read by a registered medical practitioner with experience in health monitoring who is engaged by person conducting a business or undertaking (PCBU) to carry out or supervise health monitoring. It provides practical guidance to registered medical practitioners about requirements under the work health and safety (WHS) laws for health monitoring.

This guide applies to all workplaces covered by the WHS Regulations where health monitoring is required.

How to use this guide

This guide includes references to the legal requirements under the WHS Act and WHS Regulations. These are included for convenience only and should not be relied on in place of the full text of the WHS Act or WHS Regulations.

The words 'must', 'requires' or 'mandatory' indicate a legal requirement exists that must be complied with. The word 'should' is used in this guide to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

This guide provides information for those registered medical practitioners engaged by a PCBU to carry out or supervise health monitoring for workers. This guidance should be read in conjunction with the following:

- Health monitoring guide for registered medical practitioners
- Health monitoring guides for hazardous chemicals
- Health monitoring guide for workers
- Health monitoring guide for persons conducting business or undertakings (PCBUs).

Health monitoring under the WHS Regulations

In certain circumstances, the model WHS Regulations place duties on a PCBU to provide health monitoring to workers. These requirements arise if the worker is carrying out work with hazardous chemicals including lead and asbestos. In addition, the work being carried out must be the kind of work specified in the WHS Regulations. A PCBU has the duty to determine if health monitoring is required.

The WHS Regulations prescribe that health monitoring is carried out by or supervised by a registered medical practitioner with experience in health monitoring.

Ethyl benzene

Ethyl benzene (CAS 100-41-4) is a colourless flammable liquid with a petrol-like odour. It is a monocyclic aromatic hydrocarbon.

Synonyms: ethylbenzol, phenylethane.

Work activities that may represent a high risk exposure

Ethyl benzene is mainly used in the manufacture of styrene and other chemicals.

Examples of other work activities involving ethyl benzene that require special attention include:

- oil and gas extraction
- coal tar and petroleum processing facilities
- manufacturing of styrene
- manufacture and use of chemicals containing ethyl benzene including paints, varnishes, solvents, carpet glue, ink and pesticides containing ethyl benzene, and
- · motor vehicle refinishing.

Sources of non-occupational exposure

Ethyl benzene occurs naturally in petroleum and coal tar. It is emitted from motor vehicle exhaust, waste sites, tobacco smoke and agricultural and consumer products including paints, varnishes, glues, polishes, cleaners, insulation, vinyl flooring, herbicides and insecticides. It may also occur naturally as it has been found in orange peel, parsley leaves, dried legumes and other food stuffs.

1. Health monitoring for ethyl benzene under the Work Health and Safety (WHS) Regulations

Collection of demographic, medical and occupational history

Records of personal exposure

Physical examination

Baseline blood sample for haematological profile

Urinary mandelic acid level

Health monitoring before starting work in an ethyl benzene process

Health monitoring for ethyl benzene may be required before the worker starts work so that changes to the worker's health can be detected.

Initial discussions about a health monitoring program should include:

- possible health effects from exposure to ethyl benzene
- how to recognise and report symptoms, and
- what is involved in the health monitoring program, for example the frequency of testing and the tests that may be needed.

An initial physical examination should be carried out if work and medical history indicates this is necessary, for example through the presence of symptoms as listed below.

Ethyl benzene is a respiratory irritant and it is important to investigate respiratory symptoms. However, spirometry may not be required at this stage.

A blood sample for a haematological profile should be used to record the worker's baseline health status.

During exposure to an ethyl benzene process

2. Monitoring exposure to ethyl benzene

Where workers are exposed, suspected of being exposed or are concerned about exposure to ethyl benzene, the person conducting the business or undertaking (PCBU) has a duty to arrange a health monitoring appointment with a registered medical practitioner. For example, an appointment should be arranged following spills or loss of containment of ethyl benzene resulting in excessive exposure to workers or when workers develop symptoms of ethyl benzene exposure.

Inhaled ethyl benzene is rapidly absorbed and pulmonary retention has been estimated to be 60 per cent. Uptake can be increased with exercise. Approximately 70 per cent of the absorbed dose is metabolised to mandelic acid and 20 per cent to phenylglyoxylic acid.

The following tests may be used to measure the worker's ethyl benzene exposure levels:

end of shift urinary mandelic acid level.

Where urinalysis is performed, the following value should be used as a guide for assessing exposure to ethyl benzene:

Biological exposure standard for ethyl benzene¹

Urinary mandelic acid:

520 mmol/mol creatinine (4.6 mmol/L)

As the maximal excretion rate of metabolites is at the end of the workshift, the urine sample should be collected at the end of shift, at the end of the working week.

Co-exposures with other solvents should be noted as these may influence the level of metabolite formed from ethyl benzene due to competitive inhibition. It is likely that alcohol will interfere with the metabolism of ethyl benzene. Alcohol consumption should be noted and a possible effect on urinary mandelic acid levels considered.

Mandelic acid and phenylglyoxylic acid are also metabolites of styrene. Therefore, the urinary test is not specific for ethyl benzene. It may be necessary to consider air monitoring results to confirm exposure to ethyl benzene or perform a subsequent assessment for urinary ethyl benzene. Urinary excretion of ethyl benzene likely represents a negligible fraction of the absorbed dose and thus a urinary test for ethyl benzene is recommended to confirm exposure rather than provide an indication of the extent of exposure.

Inhaled ethyl benzene may result in an altered haematological profile (increased lymphocyte counts and decreased platelets and haemoglobin (Hb) concentrations). If urine testing reveals mandelic acid levels greater than 520 mmol/mol creatinine (4.6 mmol/L), the registered medical practitioner should consider taking a blood sample to compare the haematological profile with the worker's baseline haematological profile.

¹ See <u>Chemical analysis branch handbook, 9th Edition, Workplace and biological monitoring exposure analysis, WorkCover NSW (PDF 3.39MB) for more details</u>

Other health monitoring methods

Biological guidance values of 150 mg/g creatinine for the sum of mandelic and phenylglyoxylic acids in urine (approximately 110 mmol/mol creatinine; end of shift urine sample)² and 250 mg/g creatinine for the sum of mandelic and phenylglyoxylic acids in urine (approximately 185 mmol/mol creatinine; end of shift urine sample)³ are available. It has been suggested that measuring the combination of urinary mandelic and phenylglyoxylic acids is less affected by sample timing and possible accumulation over the week.

Workplace exposure standard

The workplace exposure standard for ethyl benzene is:

- eight hour time weighted average (TWA) of 100 ppm (434 mg/m³), and
- short term (15 minute time weighted average) exposure limit (STEL) of 125 ppm (543 mg/m³).

A physical examination and urinary testing may be indicated if the results of air monitoring indicate frequent or potentially high exposure (half of the TWA or above).

Removal from work

Where a medical examination indicates the worker is displaying symptoms of exposure to ethyl benzene or where results of biological monitoring indicate exposure that may cause adverse health effects, the registered medical practitioner should consider recommending the worker be removed from ethyl benzene-related work.

When removal from ethyl benzene-related work is indicated, the registered medical practitioner must provide the PCBU with the following recommendations:

- the worker should be removed from work with ethyl benzene, and
- the PCBU should review control measures and carry out recommended remedial action.

The worker must be informed of the results of health monitoring.

Return to work

Should a worker be removed from ethyl benzene-related work, they must not return until the registered medical practitioner has:

- assessed them as medically fit, and
- made a recommendation to the PCBU that the worker can return to remediated ethyl benzene-related work.

This assessment should take into consideration the clinical condition of the worker, the worker's urinary mandelic acid levels and remediation of the circumstances that led to the symptoms if possible.

At termination of work in an ethyl benzene process

3. Final medical examination

A final medical examination should be carried out. A blood sample should be taken and results compared with the worker's baseline haematological profile. Workers with haematological abnormalities, health conditions or continuing symptoms due to ethyl benzene exposure should be advised to seek continuing medical examinations as

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² The American Conference of Governmental Industrial Hygienists (ACGIH)

³ DFG (German Research Foundation)

organised by the registered medical practitioner supervising the health monitoring program. This should be organised with consideration of the worker possibly building a tolerance to exposure.

A health monitoring report from the registered medical practitioner should be provided to the PCBU as soon as practicable after the completion of the monitoring program, and at regular intervals for longer term or ongoing health monitoring processes. The report must include:

- the name and date of birth of the worker
- the name and registration number of the registered medical practitioner
- the name and address of the PCBU who commissioned the health monitoring
- the date of the health monitoring
- any test results that indicate whether or not the worker has been exposed to a hazardous chemical
- any advice that test results indicate that the worker may have contracted an injury, illness or disease as a result of carrying out the work that triggered the requirement for health monitoring
- any recommendation that the PCBU take remedial measures, including whether the worker can continue to carry out the type of work that triggered the requirement for health monitoring, and
- whether medical counselling is required for the worker in relation to the work that triggered the requirement for health monitoring.

Potential health effects following exposure to ethyl benzene

4. Route of occupational exposure

The primary route of ethyl benzene exposure is via inhalation.

5. Target organ/effect

The target organs and potential effects of ethyl benzene exposure include:

Table 1 Target organs and potential effects of ethyl benzene exposure

Target organ	Effect	
Central nervous system	DizzinessHeadacheComa	
Skin	RashesDermatitis	
Respiratory system	Irritation	
Eyes	Irritation	

6. Acute effects

Acute effects include:

- irritation of the eyes, nose, throat and skin
- chest tightness
- dizziness, and

headache.

7. Chronic effects

Some animal studies have shown chronic effects on the:

- inner ear exposure to relatively low concentrations of ethyl benzene for a period of several days to weeks resulted in potentially irreversible damage to the inner ear and hearing of test species
- liver, and
- kidneys.

8. Carcinogenicity

Ethyl benzene has not been classified as carcinogenic according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

9. GHS classification

The following GHS health hazard classification for ethyl benzene has been taken from Safe Work Australia's Hazardous Chemicals Information System.

Hazard category

Acute toxicity – category 4 (harmful if inhaled)

Eye irritation - category 2A

Skin irritation – category 2

Source documents

Agency for Toxic Substances and Disease Registry; <u>Toxic Substances Portal – Ethyl Benzene.</u>

American Conference of Governmental Industrial Hygienists (ACGIH) (2017) *Biological Exposure Indices*; Ethylbenzene.

Australian Government; Department of the Environment and Energy; National Pollutant Inventory; Ethylbenzene.

Centers for Disease Control and Prevention; The National Institute for Occupational Safety and Health (NIOSH); Ethyl benzene.

<u>Chemical analysis branch handbook, 9th Edition, Workplace and biological monitoring exposure analysis,</u> WorkCover NSW (PDF 3.39MB).

DFG (2017) List of MAK and BAT Values.

Knecht, U., Reske, A. and Woitowitz, H.J. (2000) Biological monitoring of standardized exposure to ethylbenzene: evaluation of a biological tolerance value. *Arch. Toxicol.* 73: 632-640.

Lauwerys, R.R. and Hoet, P. (2001) *Industrial Chemical Exposure Guidelines for Biological Monitoring*, 3rd Ed, Lewis Publishers, Boca Raton.

PubChem Open Chemistry Database, <u>Compound Summary for CID 7500 Ethylbenzene</u>. Safe Work Australia (2013); <u>Workplace Exposure Standards for Airborne Contaminants</u> (PDF 873KB).

Safe Work Australia; Hazardous Chemicals Information System.

United States Department of Labor; Occupational Safety and Health Administration (OSHA); Chemical Sampling Information; Ethyl Benzene.



Health monitoring report

Ethyl benzene

(information provided by the PCBU)

☐ New to ethyl benzene work

This form contains confidential information and must not be disclosed to another person except in accordance with the Work Health and Safety Regulations or with consent of the worker

Health monitoring report - Ethyl benzene

This health monitoring report is a confidential health record and must not be disclosed to another person except in accordance with the Work Health and Safety Regulations or with the consent of the worker.

There are two sections. Complete both sections and all questions as applicable.

Section 1 A copy of this section should be forwarded to the person conducting the business or undertaking (PCBU) who has engaged your services.

Section 2 may contain confidential health information. Information that is required to be given to the PCBU should be summarised in Section 1.

Section 1 – A copy of this section to be provided to the PCBU

Person conducting a business or undertaking Company/organisation name: Click here to enter text. Site address: Click here to enter text. Suburb: Click here to enter text. Postcode: Click here to enter text. Site Tel: Click here to enter text. Site Fax: Click here to enter text. Contact Name: Click here to enter text. Other businesses or undertakings engaging the worker □ N/A (include a separate section for each PCBU) Company/organisation name: Click here to enter text. Site address: Click here to enter text. Suburb: Click here to enter text. Postcode: Click here to enter text. Site Tel: Click here to enter text. Site Fax: Click here to enter text. Contact Name: Click here to enter text. Worker details (tick all relevant boxes) Surname: Click here to enter text. Given names: Click here to enter text. Date of birth: Click here to enter a date. **Sex:** □ Male □ Female Address: Click here to enter text. Suburb: Click here to enter text. Postcode: Click here to enter text. Current job: Click here to enter text. **Tel (H):** Click here to enter text. Mob: Click here to enter text. Date started employment: Click here to enter a date. **Employment in ethyl benzene risk work** (tick all relevant boxes)

This form contains confidential information and must not be disclosed to another person except in accordance with the Work Health and Safety Regulations or with consent of the worker ☐ New worker but not new to ethyl benzene work ☐ Current worker continuing in ethyl benzene work Worked with ethyl benzene since: Click here to enter a date. Risk assessment completed: ☐ Yes ☐ No Work environment assessment (tick all relevant boxes) (information provided by the PCBU) Date of assessment: Click here to enter a date. Ethyl benzene industry/use ☐ Oil and gas extraction ☐ Coal tar and petroleum processing facilities ☐ Manufacturing of styrene ☐ Motor vehicle refinishing ☐ Manufacture and use of chemicals containing ethyl benzene including: paints varnishes solvents carpet glue ink pesticides ☐ Other (specify): Click here to enter text. Other chemicals the worker may be exposed to: Click here to enter text. **Controls** ☐ Yes Eye protection □ No Wear gloves ☐ Yes □ No Respirator use ☐ Yes □ No Click here to enter text. Respirator type Local exhaust ventilation ☐ Yes \square No

Health monitoring results

Overalls/work clothing

Other please specify

Laundering by employer

Biological monitoring results

Wash basins and showers (with hot and cold water)

Include/attach test results that indicate whether or not the worker has been exposed

☐ Yes

☐ Yes

☐ Yes

□ No

□ No

□ No

Date	Tests performed	Recommended action or comment
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.

Comments about health monitoring results (for example any early indications or diagnosis of injury, illness or disease): Click here to enter text.

Recommendations (by registered medical practitioner) (tick all relevant boxes)

Further/additional health monitoring for worker	r							
$\hfill\Box$ This is the final health monitoring report								
 □ Repeat health assessment in Click here to enter text. month(s) / Click here to enter text. week(s) □ Counselling required □ Medical examination by registered medical practitioner. On Click here to enter a date. 								
							\square Referred to Medical Specialist (respiratory/dem	natology/other). On Click here to enter a date.
							Recommendations to PCBU	
$\hfill\Box$ The worker is suitable for work with ethyl benze	ene							
\square Review workplace controls								
$\hfill\Box$ The worker should be removed from work with	ethyl benzene. On Click here to enter a date.							
$\hfill\Box$ The worker is fit to resume work. On Click here	to enter a date.							
$\hfill\Box$ Biological monitoring results indicate unaccepta	ably high exposure levels							
Specialist's name: Click here to enter text.								
Additional comments or recommendations: Cli	ck here to enter text.							
Registered medical practitioner (responsible	e for supervising health monitoring)							
Name: Click here to enter text.								
Signature:								
Date: Click here to enter a date.								
Tel: Click here to enter text.	Fax: Click here to enter text.							
Registration Number: Click here to enter text.								
Medical Practice: Click here to enter text.								
Address: Click here to enter text.								
Suburb: Click here to enter text.	Postcode: Click here to enter text.							

Section 2 – This section to be retained by the registered medical practitioner

Person conducting a business or undertaking				
Company/organisation name: Click Site address: Click here to enter text. Suburb: Click here to enter text. Site Tel: Click here to enter text. Contact Name: Click here to enter to	xt.	Posto	code: Click here to enter text. Fax: Click here to enter text.	
Other businesses or undertaki	ngs enga	aging the	worker	□ N/A
Company/organisation name: Click here to enter text. Site address: Click here to enter text. Suburb: Click here to enter text. Postcode: Click here to enter text. Site Tel: Click here to enter text. Site Fax: Click here to enter text. Contact Name: Click here to enter text.				
Worker details (tick all relevant	boxes)			
Surname: Click here to enter text. Date of birth: Click here to enter a date. Sex: Male Pregnant/breast feeding Address: Click here to enter text. Suburb: Click here to enter text. Postcode: Click here to enter text. Current job: Click here to enter text. Tel (H): Click here to enter text. Mob: Click here to enter text. Date started employment: Click here to enter a date.				
Past employment and exposure details (tick all relevant boxes)				
Have you ever worked in any of the following jobs? If you answered 'yes' to any of the questions, please advise if you experienced any symptoms such as cough or wheeze or asthma when working. Comments (all 'yes' answers)				
Oil and gas extraction	□ No	□ Yes	Click here to enter text.	
Coal tar and petroleum processing facilities	□ No	□ Yes	Click here to enter text.	
Manufacturing of styrene Manufacture and use of chemicals containing ethyl benzene	□ No	□ Yes	Click here to enter text. Click here to enter text.	

			Comments (all 'yes' answers)
Motor vehicle refinishing	□ No	☐ Yes	Click here to enter text.
Other (please specify)	□ No	☐ Yes	Click here to enter text.
Have you been exposed to:			
Benzene	□ No	☐ Yes	Click here to enter text.
Degreasers	□ No	☐ Yes	Click here to enter text.
Dyes	□ No	□ Yes	Click here to enter text.
Formaldehyde	□ No	□ Yes	Click here to enter text.
Paint remover	□ No	☐ Yes	Click here to enter text.
Solvents	□ No	☐ Yes	Click here to enter text.
Cleaning fluids	□ No	□ Yes	Click here to enter text.
Isocyanates	□ No	☐ Yes	Click here to enter text.
General health questionnaire (t	ick all re	levant box	es)
			Comments (all 'yes' answers)
Did you suffer any incapacity lasting two weeks or longer in the last two years	□ No	☐ Yes	Click here to enter text.
Have you ever had any operations or accidents or been hospitalised for any reason	□ No	☐ Yes	Click here to enter text.
Are you currently being treated by a doctor or other health professional for any illness or injury	□ No	□ Yes	Click here to enter text.
Are you currently receiving any medical treatment or taking any medications. Please detail.	□ No	□ Yes	Click here to enter text.
Do you currently smoke	□ No	☐ Yes	Click here to enter text.
Do you practice personal hygiene at work, for example nail biting, frequency of hand washing, eating or smoking, clean shaven, shower and change into clean clothes at end of shift	□ No	□ Yes	
Specific health questions (tick a	all releva	nt boxes)	
Do you have or have you ever had	l:		
Blurred vision or other vision problems	□ No	□ Yes	Click here to enter text.
Itchy eyes, runny or congested nose	□ No	☐ Yes	Click here to enter text.

Health monitoring report - Ethyl benzene This form contains confidential information and must not be disclosed to another person except in accordance with the Work Health and Safety Regulations or with consent of the worker Loss of hearing or ringing in the Click here to enter text. \square No ☐ Yes Liver disease (including alcohol \square No ☐ Yes Click here to enter text. related or other hepatitis) Kidney or bladder disease Click here to enter text. \square No ☐ Yes Click here to enter text. Anaemia or other blood disorders \square No ☐ Yes $\ \square \ {\rm Yes}$ Chronic fatigue or tiredness \square No Click here to enter text. General health assessment (if applicable) Height: Click here to enter text. cm Weight: Click here to enter text. kg BP: Click here to enter text. / Click here to enter text. mmHg **Urinalysis Blood:** □ Normal □ Abnormal Protein: Click here to enter text. Referred for further testing Sugar: Click here to enter text. ☐ No ☐ Yes **Medical comments** Cardiovascular system (for all yes/abnormal) □ Normal ☐ Abnormal Click here to enter text. Blood pressure Heart rate □ Normal ☐ Abnormal Click here to enter text. Heart sounds □ Normal ☐ Abnormal Click here to enter text. Murmurs present ☐ Yes Click here to enter text. □ No Evidence of □ No ☐ Yes Click here to enter text. cardiac failure/oedema

Respiratory system			
Breathing normal and regular in character	☐ Yes	□ No	Click here to enter text.
Auscultation normal	☐ Yes	□ No	Click here to enter text.
Signs of past/present respiratory disease	□ No	□ Yes	Click here to enter text.
Skin			
Eczema, dermatitis or allergy	□ No	☐ Yes	Click here to enter text.
Skin cancer or other abnormality	□ No	□ Yes	Click here to enter text.
Evidence of nail biting	□ No	□ Yes	Click here to enter text.
Other	□ No	☐ Yes	Click here to enter text.

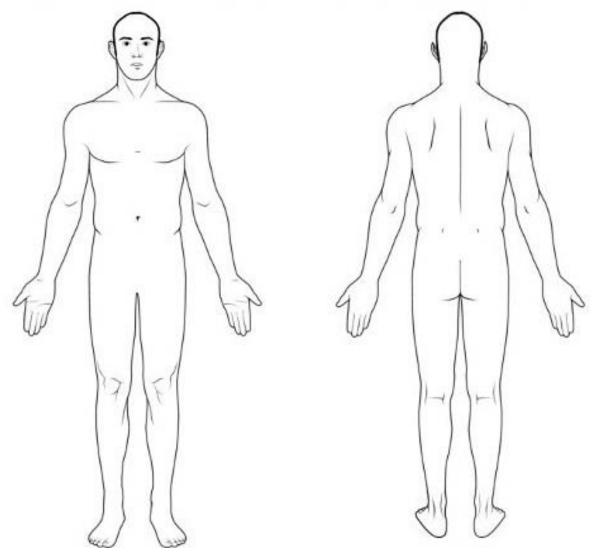


Figure 1 Template of the human body to indicate the location of abnormalities

Eye			Medical comments (for all abnormal)
Evidence of eye irritation	□ No	☐ Yes	Click here to enter text.

Biological monitoring results

Include/attach at least the previous two test results (if available)

Date	Tests performed	Recommended action or comment
Click here to enter a date.	Click here to enter text.	Click here to enter text.
Click here to enter a date.	Click here to enter text.	Click here to enter text.
Click here to enter a date.	Click here to enter text.	Click here to enter text.
Click here to enter a date	Click here to enter text	Click here to enter text

Other medical history, family medical history, current medication, comments, tests or recommendations (use separate sheet if necessary)

Click here to enter text.

Registered medical practitioner (responsible for supervising health monitoring)

Name: Click here to enter text.

Signature:

Date: Click here to enter a date.

Tel: Click here to enter text. Fax: Click here to enter text.

Registration Number: Click here to enter text.

Medical Practice: Click here to enter text.

Address: Click here to enter text.

Suburb: Click here to enter text. Postcode: Click here to enter text.