safe work australia

Health monitoring

Guide for nickel

safe work australia

Contents

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.

Nickel

Nickel (CAS 7440-02-0) is a hard, silver-white metal that is a naturally occurring element in the earth's crust and small amounts are found in food, water, air and soil.

Nickel compounds can be classified based on their solubility:

- soluble compounds
    - nickel chloride, nickel nitrate, nickel sulfate, nickel acetate, and
- poorly soluble compounds
    - elemental nickel, nickel oxides, nickel hydroxide, nickel carbonate, nickel sulfide, nickel subsulfide.

Work activities that may represent a high risk exposure

Under the Work Health and Safety (WHS) Regulations, nickel and its compounds are listed as restricted hazardous chemicals and must not be used at concentrations greater than 0.1 per cent as nickel without authorisation from a relevant WHS regulator.

Nickel is combined with other metals such as iron, copper, chromium and zinc to form alloys and increase hardness, strength and resistance to corrosion.

The major uses of nickel are:

- electroplating
- industrial plating
- as an insulating agent
- as a catalyst
- in mineral oil lubricant
- in welding and soldering, and
- in the manufacturing of stainless steel and alloys.

Examples of work activities involving nickel that require special attention when assessing exposure include:

- nickel refining
- manufacturing, welding and hot cutting of stainless steels and nickel alloys
- nickel plating and electroplating
- packing of nickel powders and alloys, and
- maintenance of plant and equipment used in nickel processes.

Sources of non-occupational exposure

The main source of non-work-related exposure to nickel is through food, drinking water and cigarettes.

1. Health monitoring for nickel under the WHS Regulations

Collection of demographic, medical and occupational history

Physical examination with emphasis on dermatological and respiratory systems

Urinary nickel level

Health monitoring under the WHS Regulations is applicable to nickel and its inorganic compounds. The toxic effects of nickel compounds is primarily attributed to the nickel ion. Hence, nickel and its compounds are considered to have a similar hazard and toxicity profile.

In this guide, 'nickel' is used to refer to nickel and its compounds.

Health monitoring before starting work in a nickel process

Health monitoring for nickel 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 nickel
- how to recognise and report symptoms, including the need to check for skin changes, rashes and skin damage, and respiratory symptoms of both upper and lower respiratory tracts, 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 place emphasis on the respiratory system, including baseline spirometry, and skin to determine baseline measurements.

Nickel compounds may be skin or respiratory sensitisers and previous work history with the chemical and symptoms of sensitisation should be investigated.

During exposure to a nickel process

2. Monitoring exposure to nickel

Where workers are exposed, suspected of being exposed or are concerned about exposure to nickel, 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 nickel processes resulting in excessive exposure to workers or when workers develop symptoms of nickel exposure.

Pulmonary absorption is generally high (greater than 50 per cent) and the absorption rate is dependent on the solubility of the compound. Absorption by the oral route is generally low, but is dependent on the nickel compound. Nickel is not metabolised and is eliminated from the body via the urine.

Following inhalational exposure to soluble nickel compounds, there is an increase in urinary nickel during the working day followed by an initial wash-out period with a half-life of 17–39 hours. Some accumulation occurs during the week with a significant fall over the weekend. Urinary nickel levels do not return to baseline over the weekend in workers who are more highly exposed. For workers exposed to soluble nickel compounds, urinary nickel concentrations generally correlate with exposure.

For workers exposed to insoluble or slightly soluble nickel salts, there is a less pronounced but more prolonged increase in urinary nickel levels. The urinary concentration of nickel in these workers is reflective of the combination of long term and recent exposure.

The following test should be used to assess the worker's level of exposure to nickel:

- end of shift urinary nickel level.

The urine should be collected at the end of shift, preferably at the end of the working week, given the elimination kinetics of nickel. Care should be taken during sample collection to avoid contamination from air and exposed skin and clothing.

Test results should be interpreted in consideration of the exposure route, source and duration, the nickel compound being used or exposed to, in particular whether it is a soluble or poorly soluble compound, and other relevant information about the worker's clinical and physiological record including renal function.

The urinary concentration of nickel in non-occupationally exposed subjects have reported to be less than 3 µg/L[1]. Exposures above this are likely to reflect occupational exposure. An individual with an exposure level greater than the background level should be monitored for signs and symptoms of nickel exposure. Additional medical examinations may be warranted.

Workplace exposure standard

The workplace exposure standards for various nickel compounds include:

Table 1 Workplace exposure standards for various nickel compounds

Nickel compound	Eight hour time weighted average (TWA; mg/m^3)
Nickel carbonyl (as Ni)	0.12
Nickel dichloride	0.1
Nickel dinitrate	0.1
Nickel, metal	1
Nickel, powder	1
Nickel, soluble compounds (as Ni)	0.1
Nickel sulfide roasting (fume & dust) (as Ni)	1
Nickel salt, nitric acid	0.1

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 nickel 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 nickel-related work. Symptoms of concern may include:

- allergic contact dermatitis, and
- respiratory symptoms.

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

- the worker should be removed from work with nickel and nickel compounds, 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 nickel-related work, they must not return until the registered medical practitioner has:

[1] *EU Scientific Committee on Occupational Exposure Limits (2001) Recommendation from the Scientific Committee on Occupational Exposure Limits for nickel and inorganic nickel compounds. SCOEL/SUM/85.*

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

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

At termination of work in a nickel process

3. Final medical examination

A urine sample should be collected on the last day of the worker's final shift, and a final medical examination should be carried out and include a physical examination with emphasis on the dermatological and respiratory systems (including lung function testing and standard respiratory questionnaire), noting any skin changes and symptoms of sensitisation.

Workers with health conditions or continuing symptoms due to nickel exposure should be advised to seek continuing medical examinations as organised by the registered medical practitioner supervising the health monitoring program.

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 nickel

4. Route of occupational exposure

The primary route of exposure are via inhalation.

5. Target organ/effect

The target organs and potential effects of nickel exposure include:

Table 2 Target organs and potential effects of nickel exposure

Target organ	Effect
Skin	• Allergic contact dermatitis
Respiratory System	• Asthma • Cancer of nasopharynx and lung • Bronchitis

6. Acute effects

Acute effects are more likely to be experienced following inhalation or ingestion of large amounts of dust or powder such as in a spill situation.

Acute effects of exposure to nickel include:

- nausea
- vomiting
- weakness
- headache
- rash or itching of the fingers, hands and forearms
- asthma
- decreased lung function, and
- bronchitis.

7. Chronic effects

Chronic effects of exposure to nickel include:

- rhinitis
- sinusitis
- nasal septal perforations
- asthma
- inflammation, and
- cancers of the lungs, nose and sinuses.

8. Carcinogenicity

Most nickel compounds have been classified Category 1A carcinogens according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as they have been shown to cause cancer in humans. Exceptions to this are elemental nickel and tetracarbonylnickel which have been classified as Category 2 carcinogens according to the GHS as they are suspected of causing cancer in humans. For further information on specific nickel compounds, refer to Safe Work Australia’s Hazardous Chemical Information system or the relevant safety data sheet.

9. GHS classification

Different nickel compounds may have different health hazard classifications. The specific nickel compound that a worker is exposed to will need to be reviewed to ensure appropriate identification of the health hazards. For the GHS classification of a specific nickel compound, refer to Safe Work Australia's Hazardous Chemical Information System or the relevant safety data sheet for detailed information.

Source documents

Australian Institute of Occupational Hygienists (2016); Nickel and its Compounds - Potential for Occupational Health Issues Position paper (PDF 1.13MB).

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

Dept. of Health and Human Service; Nickel Compounds and metallic Nickel report on carcinogens 13th ed.; National toxicology program.

EU Scientific Committee on Occupational Exposure Limits (2001) Recommendation from the Scientific Committee on Occupational Exposure Limits for nickel and inorganic nickel compounds. SCOEL/SUM/85.

Health and Safety Laboratory (UK) (2013) Guidance on Laboratory Techniques in Occupational Medicine (13th edition).

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

National Industrial Chemicals Notification and Assessment Scheme; Human Health Tier II Assessment for Nickel.

Nickel and Nickel Compounds IARC Monograph p169 -218 Date 2012.

Sunderman Jr, F. W. (1993). Biological monitoring of nickel in humans. *Scand. J. Work Environ. Health* 19 (Suppl 1): 34-38.

Safe Work Australia (2013); *Workplace Exposure Standards for Airborne Contaminants* (PDF 873KB).

Safe Work Australia; *Hazardous Chemicals Information System*.

Health monitoring report

Nickel

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 – Nickel

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 nickel risk work (tick all relevant boxes)
(information provided by the PCBU)

☐ New to nickel 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

☐ New worker but not new to nickel work

☐ Current worker continuing in nickel work

Worked with nickel 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.

Nickel industry/use

☐ Nickel refining

☐ Maintenance in nickel processes.

☐ Manufacturing, welding and hot cutting of stainless steels and nickel alloys

☐ Nickel plating and electroplating

☐ Packing of nickel powders and alloys

☐ Other (specify):

Other chemicals the worker may be exposed to: Click here to enter text.

Controls		
Eye protection	☐ Yes	☐ No
Emergency eye wash	☐ Yes	☐ No
Wear gloves	☐ Yes	☐ No
Respirator use	☐ Yes	☐ No
Respirator type	Click here to enter text.	
Local exhaust ventilation	☐ Yes	☐ No
Overalls/work clothing	☐ Yes	☐ No
Laundering by employer	☐ Yes	☐ No
Wash basins and showers (with hot and cold water)	☐ Yes	☐ No
Other please specify		

Health monitoring results

Biological monitoring results

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

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.

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

Comments about health monitoring results (for example any early indications or diagnosis of injury, illness or disease):

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

Further/additional health monitoring for worker

☐ 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.

☐ Referred to Medical Specialist (respiratory/dermatology/other). On Click here to enter a date.

Recommendations to PCBU

☐ The worker is suitable for work with nickel

☐ Review workplace controls

☐ The worker should be removed from work with nickel. On Click here to enter a date.

☐ The worker is fit to resume work. On Click here to enter a date.

☐ Biological monitoring results indicate unacceptably high exposure levels

Specialist's name: Click here to enter text.

Additional comments or recommendations: 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.

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

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

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

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 ☐ Pregnant/breastfeeding

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)
Nickel plating and electroplating	☐ No	☐ Yes	Click here to enter text.
Manufacturing of stainless steel and alloys	☐ No	☐ Yes	Click here to enter text.
Nickel refining	☐ No	☐ Yes	Click here to enter text.
Maintenance of plant and equipment used in nickel processes	☐ No	☐ Yes	Click here to enter text.

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

			Comments (all 'yes' answers)
Manufacturing, welding and hot cutting of stainless steels and nickel alloys	☐ No	☐ Yes	Click here to enter text.
Packing of nickel powders and alloys	☐ No	☐ Yes	Click here to enter text.
Other (please specify)	☐ No	☐ Yes	Click here to enter text.

General health questionnaire (tick all relevant boxes)

			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 all relevant boxes)

Do you have or have you ever had:			**Comments** (all 'yes' answers)
Shortness of breath on exertion	☐ No	☐ Yes	Click here to enter text.
Wheezing, bronchitis or asthma now or in the past	☐ No	☐ Yes	Click here to enter text.
Any other lung or respiratory conditions (emphysema, pneumonia or sinusitis)	☐ No	☐ Yes	Click here to enter text.
Allergies, hay fever, or allergic bronchitis	☐ No	☐ Yes	Click here to enter text.
Does anyone in your immediate family (blood relatives only) have asthma, hay fever or eczema	☐ No	☐ Yes	Click here to enter text.

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

Do you have or have you ever had:			**Comments** (all 'yes' answers)
Breathing problems, nasal blockage, nose bleeds or lump in nose	☐ No	☐ Yes	Click here to enter text.
Skin disorders or dermatitis	☐ No	☐ Yes	Click here to enter text.
Any form of cancer	☐ No	☐ Yes	Click here to enter text.
Any other significant health conditions	☐ No	☐ Yes	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.

Sugar: Click here to enter text.

Referred for further testing

☐ No ☐ Yes

Cardiovascular system			**Medical comments** (for all yes/abnormal)
Blood pressure	☐ Normal	☐ Abnormal	Click here to enter text.
Heart rate	☐ Normal	☐ Abnormal	Click here to enter text.
Heart sounds	☐ Normal	☐ Abnormal	Click here to enter text.
Murmurs present	☐ No	☐ Yes	Click here to enter text.
Evidence of cardiac failure/oedema	☐ No	☐ Yes	Click here to enter text.
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.

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

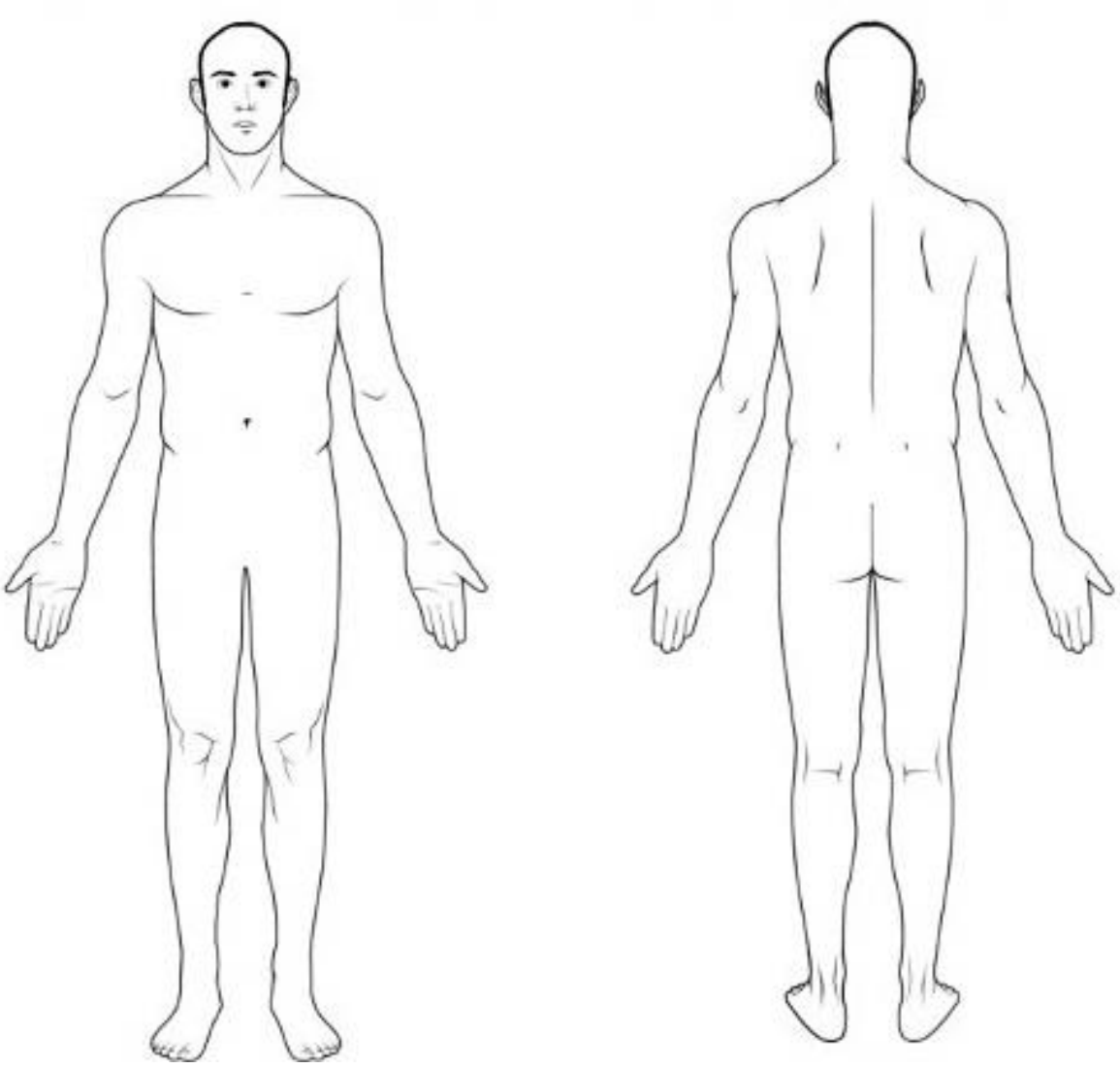

Figure 1 Template of the human body to indicate the location of abnormalities

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.

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

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.