Occupational Health and Safety Practitioner

Learning Guide

UNIT BSBOHS505C
MANAGE HAZARDS IN THE WORK ENVIRONMENT

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SafetyLine INSTITUTE®
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Skills checklist
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OVERVIEW

Welcome to the Unit of Competence **BSBOHS505C – Manage hazards in the work environment.** “OHS” and “health and safety” are used in this guide even though relevant legislation and guidance material in some jurisdictions uses “OSH” and “safety and health”.

This unit specifies the outcomes required to identify hazards, and assess and control risks in the work environment. It focuses on the knowledge, processes and techniques necessary to control specific hazards. Hazards may include noise, light, radiation, hazardous substances, dangerous goods, dusts and fibres, gravity (falls from heights), thermal environment, biomechanical hazards, manual handling, biological or psychosocial hazards or hazards arising from work organisation.

Where the use of monitoring equipment is appropriate, useful underpinning skills are provided in unit **BSBOHS406 Use equipment to conduct workplace monitoring.** This unit is linked to but differs from **BSBOHS504 Apply principles of OHS risk management**, which takes a generic approach to risk management and provides underpinning knowledge and skills.

Learners may find it useful to study the two units BSBOHS504 and this unit, BSBOHS505 simultaneously. Alternatively, you may already have achieved competence in BSBOHS504, or at least have read the learning guide, which is available on the SafetyLine website.

The unit of competence consists of five elements and 24 performance criteria, which are reflected in the format of this learning guide. Each section covers a competency element and each sub-section covers a required performance criterion. You can access a copy of the actual competency unit from the National Training Information Service at:

It is important that you read the **Course Guide** before commencing this learning guide, as it contains important information about learning and assessment. It is particularly important to read it if you feel you may already be able to provide evidence that you meet the performance criteria for this unit. You can access the Course Guide at:  

**Assessment**

Assessment is the process of checking your competence to perform to the standard detailed in each element’s performance criteria.

At the end of each element of the learning guide are activities designed to enable you to collect evidence for assessment. They are also listed in the assessment section at the back of the guide.

As there is a broad range of hazards, it is a requirement that you demonstrate competency across your selected hazard types. While there should be some access to a workplace, part of the assessment may be through simulated project activity, case studies or role-play.

While the case studies in the learning guide give examples of how to apply the hazard management process, where possible you should have an OHS practitioner as a mentor or coach to assist you to develop the practical skills to apply your knowledge.

When you have completed this learning guide you should contact a participating training provider (see [www.worksafe.wa.gov.au/institute](http://www.worksafe.wa.gov.au/institute)) who will, for a fee, be able to have your competency in this unit assessed by a qualified assessor and subject expert. This unit may be assessed alone or as part of an integrated assessment activity involving other related units such as BSBOHS504 *Apply principles of OHS risk management* or BSBOHS506 *Monitor and facilitate the management of hazards associated with plant*.

When collecting material for your assessment portfolio, please ensure that you protect the confidentiality of colleagues, workers and other persons, and block out any sensitive information. If you have any doubts about confidentiality issues, contact the organisation concerned.
Required readings and resources

The on-line Readings and Resources section at the SafetyLine Institute website provides additional essential material to help you understand and complete the activities in this learning guide.

The readings are particularly important for this unit as they provide hazard-specific information, which is not practical to provide in the learning guide.

Further information


Websites

Some useful websites for information on OHS risk management include:

- www.nicnas.gov.au – National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
- www.actu.asn.au – has an OHS information and resources page published by the Australian Council of Trade Unions (ACTU)
• www.hse.gov.uk – OHS regulator for the United Kingdom
• www.osha.gov – US Department of Labour, OHS Administration
• www.cdc.gov – US Centre for Disease Control and Prevention
• www.osh.dol.govt.nz – New Zealand health and safety information
• www.atsb.gov.au – air safety
• www.amsa.gov.au – maritime safety
• www.seacare.gov.au – Australian seafarer’s health and safety
• www.arpansa.gov.au – nuclear and radiation safety
• www.nopsa.gov.au – national oil and gas safety
• www.comcare.gov.au – responsible for workplace safety, rehabilitation and compensation in the Commonwealth jurisdiction
• www.workcover.act.gov.au – ACT occupational health and safety
• www.workcover.nsw.gov.au – NSW occupational health and safety, except mines
• www.minerals.nsw.gov.au – NSW mining health and safety
• www.nt.gov.au/wha – NT occupational health and safety
• www.minerals.nt.gov.au – NT mining health and safety
• www.whs.qld.gov.au – Queensland health and safety except mines
• www.nrme.qld.gov.au – Queensland mining safety
• www.eric.sa.gov.au – SA occupational health and safety
• www.wsa.tas.gov.au – Tasmanian occupational health and safety
• www.workcover.vic.gov.au – Victorian occupational health and safety
• www.worksafe.wa.gov.au – WA occupational health and safety
• www.docep.wa.gov.au/resourcessafety – WA mining and petroleum health and safety
• www.workcover.wa.gov.au – WA workers compensation body
• www.marcsa.com – WA mining OHS induction training body
• www.standards.com.au – the Australian standards organisation
References


Your feedback

We are committed to continuous improvement. If you take the time to complete the on-line Feedback Form at the SafetyLine Institute website, you will help us to maintain and improve our high standards.

You can provide feedback at any time while you are completing this learning guide.

Glossary of terms

The criteria for this unit of competency include understanding certain OHS terms. Developing a glossary of terms is a useful way to ensure you have the basic terminology correct. It is strongly recommended that you develop your own glossary and add to it throughout this unit and the rest of your study.

Some terms relevant to this unit are defined below. Make sure that you are familiar with the Glossary of terms before going any further. When they are first used, glossary terms are indicated in the learning guide with an asterisk (*).

**Active sampling**  
Collecting samples of an airborne contaminant by drawing into a collecting medium by a pump.

**Aerosol**  
Liquid or solid particles dispersed in a gas (e.g., smoke or paint spray).
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthropometry</strong></td>
<td>The science dealing with the comparative measurement of the size and proportions of the human body and the range of movement of limbs as a basis for improving safety and functionality in design and in ergonomic evaluations.</td>
</tr>
<tr>
<td><strong>Captor (as in LEV)</strong></td>
<td>Device for collecting airborne contaminants where the contaminant is released somewhere outside the hood and the air flowing into the hood is drawn into the hood by the velocity of the inflowing air.</td>
</tr>
<tr>
<td><strong>Consultation</strong></td>
<td>A process of seeking information or informed opinions from one or more people prior to decision-making. Should particularly include those who may affect the outcomes or be affected by the decisions made, but may also include specialist sources. Consultation does not necessarily mean reaching agreement.</td>
</tr>
<tr>
<td><strong>Dilution ventilation</strong></td>
<td>Sometimes called general ventilation. Uncontaminated air is added to contaminated air to reduce the concentration of the contaminant.</td>
</tr>
<tr>
<td><strong>Direct reading device</strong></td>
<td>Equipment that provides a direct readout of a contaminant without further off-site laboratory analysis.</td>
</tr>
<tr>
<td><strong>Electromagnetic radiation (EMR)</strong></td>
<td>Electromagnetically propagated radiation that covers a wide spectrum of wavelengths (or frequencies) from very energetic short wavelength gamma rays through X-rays, visible light to microwaves and radio waves.</td>
</tr>
<tr>
<td><strong>Exposure standard</strong></td>
<td>A quantitative guideline, or level set for concentrations of workplace contaminants to which, according to current knowledge, most workers may be exposed without impairment to health or undue discomfort.</td>
</tr>
</tbody>
</table>
**Fume**
Mix of particulates in air where the particulates are extremely small and are generally produced by processes such as combustion or condensation.

**Hazard**
A source of potential harm in terms of human injury, ill-health, damage to property, the environment or a combination of these.

A source of potentially damaging energy.

**Hazard identification**
The process of identifying sources of harm.

**Hierarchy of control**
The priority order in which hazard and risk controls should be considered with the eventual outcome often being a combination of measures. The prime emphasis is on:
- Elimination;

and where this is not practicable, minimisation of risk by:
- substitution;
- engineering controls, including isolating the hazard from personnel;

then, when these options have been implemented as far as is practicable
- administrative controls (eg procedures, training); and
- personal protective equipment (PPE).

**Incident**
An event that has caused or has the potential for injury, ill-health or damage. (Note that ‘incident’ is the preferred term rather than ‘accident’).

Refer also to ‘occurrence’.

**Ionising radiation**
EMR containing enough energy to dislodge electrons and so break chemical bonds and cause chemical changes. Can cause damage to living tissue.
<table>
<thead>
<tr>
<th><strong>Key personnel</strong></th>
<th>People involved in OHS decision-making or those who are affected by OHS decisions.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Latency</strong></td>
<td>Period that elapses between exposure and appearance of the first signs and symptoms of a disease.</td>
</tr>
<tr>
<td><strong>Local exhaust ventilation (LEV)</strong></td>
<td>Collects contaminants close to the source and is preferred to dilution or general ventilation.</td>
</tr>
<tr>
<td><strong>Mist</strong></td>
<td>Fine liquid droplets suspended in air. Usually generated by condensation from a gaseous to liquid state or by breaking up a liquid into a dispersed state by splashing foaming or atomising.</td>
</tr>
<tr>
<td><strong>Nomogram</strong></td>
<td>Alignment chart arranged so that the value of a variable can be found without calculation from the value of one or two other variables that are known.</td>
</tr>
<tr>
<td><strong>Occurrence</strong></td>
<td>Process(es) which give(s) rise to damage, injury or ill-health.</td>
</tr>
<tr>
<td><strong>Passive sampling</strong></td>
<td>Collecting samples of an airborne contaminant by exposing a medium to the contaminated air.</td>
</tr>
<tr>
<td><strong>Potentiate</strong></td>
<td>Occur where one risk factor or agent does not have an effect, but when added to another increases the risk associated the latter.</td>
</tr>
<tr>
<td><strong>Psychosocial hazards</strong></td>
<td>Sources of potential harm that are related to the way work is organised, the relationships or interactions which operate within the work environment or specific events that may lead to post-traumatic stress.</td>
</tr>
</tbody>
</table>
Random errors  Occur in monitoring and can arise at any time. They are difficult to predict and quantify. For example, excess loading of dust on a filter will increase the back pressure and cause the pump to slow; or dust may be lost from the surface of a filter due to poor handling; the volume of reagent placed in a bubbler may be slightly too great, etc.

Receptor (as in LEV)  LEV systems in which the contaminants are released within the hood or find their own way into the hood, eg laboratory fume cupboards and spray booths.

Risk  The potential for unwanted, negative consequences of an event. It is measured in terms of severity or consequence and the likelihood of the particular consequence occurring.

Risk assessment  A process to develop an understanding of a hazard and its associated risk involving analysing the hazard to:

- identify factors influencing the risk and the range of potential consequences;
- evaluate the effectiveness of existing controls;
- estimate the likelihood of the consequence, considering exposure and hazard level;
and combining these in some way to obtain a level of risk or to prioritise the risk for action.
Risk register

A document detailing:
- a list of hazards, their location and people exposed;
- a range of possible scenarios or circumstances under which these hazards may cause injury or damage;
- nature of injury or damage caused;
- the results of the risk assessment;
and may also include:
- possible control measures and dates for implementation.

Sometimes called a ‘Hazard Register’, but this is a narrow term implying the inclusion of only limited information relating to the sources of risk rather than the consequences of the risk and control measures.

Stakeholders

Those people or organisations who may be affected by, or perceive themselves to be affected by, an activity or decision. In workplace OHS, stakeholders include:
- managers;
- supervisors;
- health and safety and other employee representatives;
- OHS committees;
- employees and contractors; and
- the community.

Synergistic

Interaction of two or more risk factors or agents where the combined effect is greater than the sum of their separate effects.

Systematic errors

May occur in monitoring and, when they occur, they arise each time sampling is undertaken and are, to some extent, predictable and quantifiable. For example, an inaccurately calibrated pump will produce the same error in measured sample volume every time it is used until re-calibrated.
<table>
<thead>
<tr>
<th><strong>Time-weighted average (TWA)</strong></th>
<th>An amount or quantity expressed as a concentration, level or dose that represents the length of exposure to a potentially harmful agent averaged over a stated period of time, i.e., eight-hour day.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vapour</strong></td>
<td>Gaseous phase of a substance which is liquid at normal temperature and pressure.</td>
</tr>
</tbody>
</table>
INTRODUCTION

Required knowledge and understanding

As noted in the Overview, this unit of competency is associated with the OHS risk management unit BSBOHS504 Apply principles of OHS risk management. Knowledge of the legal and regulatory framework as it applies to specific hazards* is also essential required knowledge for this unit. Learners are advised to review the learning guide for BSBOHS408A Assist with compliance with OHS and other relevant laws before commencing this learning guide.

The activities at the end of each element will guide you to achieve the performance criteria. However, you will also need to acquire and demonstrate the necessary knowledge and understanding. Therefore, you should include relevant notes and supporting evidence in your assessment portfolio and ensure that you can explain:

- organisational personnel at all levels;
- OHS specialists and managers;
- report writing;
- location of information and data and advice from different sources to identify hazards;
- units of measurement to interpret measurement information and data;
- control* strategies; and
- relevant OHS legislation (acts, regulations, codes of practice, associated standards and guidance material).

As you work through the activities, also include in your assessment portfolio any reports and memos for which you have been asked. You should also have evidence of the relevant documents accessed or downloads collected. This may be through a resource file including electronic copies of the documents accessed. Also you should clearly reference your work with full citations for any quotes or references and a list of all materials that provided background material for completion of an activity.
Required skills and attributes

You will also need to show you have the necessary skills and attributes for this unit. To do this, you should include in your assessment portfolio as much evidence as possible to show you can:

- identify areas for hazard control;
- analyse relevant workplace information and data;
- contribute to the assessment of the resources needed to systematically manage OHS and, where appropriate, access resources;
- pay attention to detail when making observations and recording outcomes;
- use research skills to access relevant OHS information and data;
- use numeracy skills to carry out simple arithmetical calculations (e.g. % change), and to produce graphs of workplace information and data to identify trends and recognise limitations;
- use technological skills to use basic measuring equipment including reading scales and dials applicable to selected hazards;
- conduct effective formal and informal meetings and to communicate effectively with personnel at all levels of the organization, OHS specialists and, as required, emergency services personnel;
- prepare reports for a range of target groups including OHS committee, OHS representatives, managers and supervisors;
- use language and literacy skills appropriate to the workgroup and the task;
- use consultation* and negotiation skills to develop plans, and to implement and monitor designated actions;
- use project management skills to achieve change in OHS matters; and
- organisational skills to manage own tasks within a timeframe.
Hazard management and the OHS risk management process

Remember, it is a requirement that you demonstrate competency across your selected hazard types. These may be from noise, vibration, light, radiation, hazardous substances, dangerous goods, dusts and fibres, thermal environment, ergonomic hazards, manual handling, gravity (falls from heights), biological or psychosocial* hazards or hazards arising from work organisation.

The competency unit BSBOHS504 Apply principles of OHS risk management addressed the application of the generic approach to OHS risk* management as described below.

![OHS Risk Management Process Diagram]

This learning guide applies this generic risk management approach to manage specific hazards. The hazards are considered in the following groupings:

- Physical hazards (radiation, gravity, thermal, electrical, noise and vibration, moving plant and vehicles);
- Chemical hazards (hazardous substances and dangerous goods);
- Biological hazards (bacteria, viruses, animals and plant);
- Biomechanical (work posture and manual handling); and
Psychosocial (the way the work is organised, personal relationships or interactions within the work environment that have a potential for harm, or specific events which occur that may lead to post-traumatic stress). Psychosocial hazards may be direct contributors to incidents* (such as in fatigue) or may, over time, lead to physical conditions such as hypertension, coronary heart disease, or psychological illnesses such as depression.

While this learning guide considers hazards of both short and long latency, occupational diseases are addressed in detail in the learning guide for BSBOHS507 *Facilitate the application of principles of occupational health to control risk*. Plant hazards and their control is the subject of the learning guide for BSBOHS506 *Monitor and facilitate the management of hazards associated with plant*. 
Element 1: ACCESS INFORMATION AND DATA AND THE WORK ENVIRONMENT TO IDENTIFY HAZARDOUS TASKS AND CONDITIONS

Hazard identification* is all about good quality information. This information is gleaned from a number of sources and may be considered in two categories:

- sources external to the workplace that give the ‘bigger picture’;
- information within the workplace which includes historical data, procedures and registers, results of monitoring and workplace inspections.

In order to complete the first element of the competency unit successfully, you will have to show that you have satisfied the following performance criteria:

1.1 Access external sources of information and data to assist in identifying hazardous tasks or conditions for the selected hazard.

1.2 Review workplace sources of information and data to assist in identification of hazardous tasks or conditions for the selected hazard.

1.3 Use appropriate tools to identify hazardous tasks or conditions for the selected hazard.

1.4 Use appropriate tools to conduct workplace inspections in consultation with stakeholders.

1.5 Seek input from stakeholders, key personnel and OHS specialists if required.
Introduction

While a hazard is often defined as 'a source of potential harm' the learning guide to the competency unit BSBOHS504 Apply principles of OHS risk management examined the energy damage concept to arrive at the modified definition of a hazard as a source of potentially damaging energy.

The term 'hazard' is often misused by using it to refer to any feature of the physical, organisational and/or behavioural environment (such as a spill on the floor, lack of training or poor work practices), which contributes to an incident or the severity of the outcome. Such misuse of the term 'hazard' often leads to poor, or wrong, analyses of OHS problems and therefore a failure to identify effective controls.

Factors such as inadequate work practices, lack of training, or fatigue, are NOT hazards but are failures in controls, or conditions, that may result in injury or damage.

Hazards (or sources of potentially damaging energy) do not normally create injury or damage. Their potential to cause damage is usually controlled by the physical, organisational and/or behavioural features of the design, environment or process. It is not enough just to identify a hazard; you also need to be able to identify the circumstances and preconditions that may lead to the loss of control of a hazard.

The conditions that lead up to the loss of control of a hazard may develop over quite long periods of time and come directly from or through the interaction of one or more of five sources:

- the organisational and management environment;
- physical environment;
- equipment;
- procedures; and
- people and human error.

The concept of the ‘time sequence’ and the factors in loss of control of a hazard are examined in detail in the learning guide for BSBOHS504 Apply principles of OHS risk management.
1.1 ACCESS EXTERNAL SOURCES OF INFORMATION AND DATA TO ASSIST IN IDENTIFYING HAZARDOUS TASKS OR CONDITIONS FOR THE SELECTED HAZARD

You have identified a hazard that may require control or you have selected a hazard type to be investigated. The first step is to identify sources outside the workplace that may provide information about the hazard such as:

- legislation and codes of practice;
- standards and guidance material;
- organisations providing hazard-specific information;
- international sources of information;
- databases; and
- OHS specialist advisers.

OHS legislation and codes of practice

All states have hazard-specific legislation either as individual regulations or incorporated into combined regulations.

- Access the website for your state OHS regulator, or for your state legal service, to compile a list of the hazard-specific regulations in your state.

Codes of practice are an invaluable source of information for hazard identification as they give information on the hazard, the factors that contribute to the risk and what is acceptable/not acceptable.

- Access the website for your state OHS regulator for a list of the hazard-specific codes of practice for your state.

At this level of studying OHS, you should be familiar with the hazard-specific regulations and codes of practice for your state.
Standards and guidance material

Colloquial references to ‘Standards’ may refer to Australian standards published by Standards Australia or national standards developed by Safe Work Australia. Such standards generally set the minimum requirements, but they have no formal authority unless cited or ‘called up’ in regulations.

One of the first steps when investigating a specific hazard in the workplace is to check if there are any applicable national or Australian standards.

Safe Work Australia, state OHS regulators and industry bodies also provide a wealth of hazard-specific guidance material that the OHS practitioner should be aware of and access regularly.

WorkSafe Victoria publishes e-mail information bulletins targeting the manufacturing and construction industries. (To subscribe, go to the industry-specific areas of the WorkSafe Victoria website www.workcover.vic.gov.au and then to the e-mail bulletin.)

Australia has a number of industry bodies which provide hazard-specific information relevant to those industries. Such organisations include the Office of the Federal Safety Commission – Construction, Farmsafe, the Welding Technology Institute of Australia, the Australian Maritime Safety Authority, the National Offshore Petroleum Safety Authority and the Australian Council for Safety and Quality in Healthcare (which is concerned with patient safety rather than occupational safety).

Employer and union bodies also produce industry-specific and hazard-specific OHS information. The OHS page on the ACTU website (www.actu.asn.au) has a good selection of hazard-specific information.
Organisations providing hazard-specific information

In addition to Safe Work Australia and the state OHS regulators, there are government and non-government organisations that provide hazard-specific information. Some of these are listed below.

Physical hazards

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), as part of the Health and Ageing Portfolio, is a Federal Government agency charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of ionizing and non-ionizing radiation. The ARPANSA website has useful information such as ‘Radiation Basics’ and ‘Radiation Health Facts’. Information ranges from mobile phones, radiation in the home, lasers in the classroom, entertainment and construction, to radiation in health and nuclear physics.

The Energy Supply Association of Australia (ESAA) is the national body for energy supply companies. The ESAA Health and Safety Network deals with occupational health and safety affecting employees of the electricity industry. Most states also have a regulatory body for electrical safety (eg Energy Safe Victoria, www.esv.vic.gov.au) and electrical supply companies are often good sources of information on electrical hazards.

The National Acoustic Laboratories (NAL) undertakes scientific investigations into hearing, hearing loss and rehabilitation, and the prevention of hearing loss. The NAL is the research division of Australian Hearing, a Commonwealth Government Authority under the Department of Human Services. Much of its research is performed as a community service obligation funded by the Commonwealth Department of Health and Ageing. The results of this work are published in leading peer-reviewed journals and are available at no cost or at nominal cost to clinicians and other users of the research. Some additional research is performed in collaboration with commercial organisations from the hearing rehabilitation and hearing protection industries. The website contains many useful references on understanding occupational hearing loss and its prevention.
Chemical hazards

The website for the Australian Government Department of Environment and Heritage has a National Chemical Information Gateway with links to websites and databases organised in categories such as household chemicals, exposure and safety, chemicals by name, chemicals in agriculture, chemicals and human health, regulators and legislation, international portals and chemical databases.


The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is the Australian Government regulator for industrial chemicals and is located within the Australian Government Health and Ageing portfolio, in the Office of Chemical Safety. Established in 1990, NICNAS provides a national notification and assessment scheme to protect the health of the public, workers and the environment from the harmful effect of industrial chemicals.

In addition to over 1,400 scientific assessment reports, NICNAS produces a number of useful publications including a newsletter, general information sheets and information sheets on specific chemicals.


Biological hazards

The website for the Commonwealth Department of Health and Ageing has a range of information and extensive references on specific biological hazards and communicable diseases and guidelines for their management (www.health.gov.au).
Psychosocial hazards

The statutory body responsible for workplace safety, rehabilitation and compensation in the Commonwealth jurisdiction, Comcare, has a stress and psychological injury portal on its website (www.comcare.gov.au). This site gives information and links on topics such as:

- what are work-related stress, costs, contributing factors, warning signs, principles of prevention;
- practical information on identifying and assessing risk, implementing a prevention program, managing change, supporting staff;
- case studies;
- research; and
- related topics.

International sources of information

As we need to look outside the workplace for the ‘bigger picture’ on hazards, we should also look outside Australia for information on hazards generally and also industry-specific information.

Some key international sources of hazard-specific information are:

- US Centre for Disease Control and Prevention (www.cdc.gov);
- UK Health and Safety Executive (www.hse.gov.uk); and
Databases

Injury databases provide information on the causation and frequency of injuries, and so give an indication of hazards that may be present.

The Compendium of Workers' Compensation Statistics, Australia, a series of publications that presents nationally comparable workers' compensation statistics based on the national data set.

The Compendium Series provides an overall picture of Australia's OHS performance by industry and occupation as well as some trend data. The Series also provides information on the circumstances surrounding work-related injury and disease occurrences*, presenting high-level information predominantly at the national level. More detailed information to supplement the statistics in the Series is available from the Safe Work Australia Online Statistics Interactive Database of National Workers' Compensation (NOSI).

The Safe Work Australia NOSI database contains workers' compensation statistics, based on the National Data Set for Compensation-based Statistics. Users can interrogate the database to produce a variety of reports to their own design on the number, incidence and frequency of workers' compensation claims in Australia. The learning guide for BSBOHS504 Apply principles of OHS risk management gives a worked example of how the NOSI database can be used to identify hazards.

The Australian Bureau of Statistics (ABS) has collected information on work-related injuries, illnesses and disease via the Population Survey Monitor. Information includes the number of work days lost and how much work performance is reduced due to work-related injuries. Additional information was gathered from those people who were unable to find work because of work-related injuries (Safe Work Australia formerly ASCC/NOHSC, 2000).

Some information is available free through the ABS website (www.abs.gov.au); further information is contained in reports that can be purchased or through the ABS on-line subscription service.
A range of other databases are maintained by Australian authorities. The National Catalogue of State and Industry Based OHS Data (Safe Work Australia formerly ASCC/NOHSC, 2000) lists a wide range of databases and their salient features such as the purpose of data collection, data items, sources of information, frequency and methodology of data collection, and who to contact. Some 75 databases are listed in the catalogue with a small sample given below.

- Australian mesothelioma register;
- Coal industry accident data and health surveillance data (NSW);
- Safety performance for Australian paint manufacturers;
- Australian petroleum production and exploration association incident database;
- Australian mesothelioma register;
- Lead workers surveillance(NSW);
- National tractor death register; and
- National monitoring of occupational exposures to blood and body fluids among healthcare workers.

### 1.2 REVIEW WORKPLACE SOURCES OF INFORMATION AND DATA TO ASSIST IN IDENTIFICATION OF HAZARDOUS TASKS OR CONDITIONS FOR THE SELECTED HAZARD

This section requires you to identify the sources of information within the workplace that assist in identifying hazardous tasks or conditions for the selected hazard.

Sources of information for hazard identification available in most workplaces include:

- hazard, incident and injury reports;
- investigation reports, workplace inspections;
- maintenance records;
- risk registers;
- minutes of meetings;
• Job Safety Analyses (JSA) and risk assessments;
• work procedures including standard operating procedures (SOP);
• reports and audits;
• sick leave and personnel records;
• organisational data such as insurance records, enforcement notices and actions, workers' compensation data;
• collated information such as trend analyses of incident and injury reports, OHS performance data;
• Material Safety Data Sheets (MSDS) and chemical registers; and
• manufacturers’ manuals and specifications.

Some sources of information will be more useful for particular hazards. Maintenance records will be important for plant hazards; sick leave and personnel records may give indications of psychosocial hazards.

Each type of information has its limitations. Minor injuries occur much more frequently than serious injuries or fatalities. It is unlikely that many workplaces would have sufficient injury data to identify hazards and preconditions associated with fatalities. The value of addressing minor-severity incidents as a means of preventing more serious injuries or fatalities is questionable. However, occurrences resulting in relatively minor consequences still need to be evaluated to assess the potential for high severity injury. Historical data from the workplace also has limited predictability value, as changes to the workplace may result in changes in exposure.

1.3 USE APPROPRIATE TOOLS TO IDENTIFY HAZARDOUS TASKS OR CONDITIONS FOR THE SELECTED HAZARD

Depending on the nature of the hazard, there are ‘tools’ that assist in identifying the presence of the hazard. Some of these are discussed below. These ‘tools’ are ‘indicators’ only and it is important that the OHS practitioner is aware of their limitations and that specialist advice is sought as appropriate.
The prosecution of a consultant acting as an occupational hygienist reported in Piney (2002) is a salutary lesson on the ramifications of inappropriate use and interpretation of monitoring tools and techniques in hazard identification. In this case a consultant performed an inadequate exposure survey, misleading a woodworking company into believing that workers’ exposure to hazardous dust was under control when it was not.

The report includes a useful framework of ‘common errors’ and makes the following summary comments.

- **To analyse exposure fully requires an understanding of work processes, operations and tasks.** It is essential to identify all significant sources and how these cause exposure. Analysing exposure is not just or even wholly about measurements, although when these are taken they must be done properly.

- **Confidence is difficult, but not impossible, to define.** The guidance associated with the management of Health and Safety at Work Regulations 1999 (UK) makes it clear that the level of knowledge and experience involved must be tied to the complexity of the problems to be tackled.

- **Incompetent advice can be expensive.** The employer may be liable in common law. The person giving the flawed advice may be prosecuted and fined, and suffer a loss of reputation and a large rise in professional indemnity fees.

(M. Piney, 2002)
Physical hazards

Dusts and particulates

Airborne particles that can penetrate to the depths of the lungs are often too small to be seen with the naked eye. A simple inexpensive technique of shining a bright light through the air to show contaminants is known as the Tyndall Lamp technique. It will show dusts and other aerosols* such as mists* and fumes* but it will not show up vapours and gases. This bright light technique may not work in brightly light areas (M. Piney, Alesbury, R. J., Fletcher, A. M., Folwell, J., Gill, F. S., Lee, G. L., Sherwood, R. J., and Tickner, J, 1987).

The use of smoke tubes will give some idea of the direction that vapours and gases may move and so provide a visual tracer from which general airflow patterns may be judged (M. Piney, Alesbury, R. J., Fletcher, A. M., Folwell, J., Gill, F. S., Lee, G. L., Sherwood, R. J., and Tickner, J, 1987).

How to position the lamp using the Tyndall Lamp technique

Don’t forget secondary sources of contamination by focusing only on the primary part of the process.

Noise

For the purposes of hazard identification, if it is difficult to communicate with a person at normal conversation level, the noise level is probably in excess of 85dB(A) and continued exposure to the noise level may cause damage to hearing.
Thermal comfort

It is common to assess thermal comfort by asking people how warm they feel. A structured approach may involve asking respondents to indicate their thermal sensation on a rating scale. Examples are the Bedford and ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers) scales shown in the table below.

<table>
<thead>
<tr>
<th>Bedford and ASHRAE thermal comfort scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedford</td>
</tr>
<tr>
<td>Much too warm 7</td>
</tr>
<tr>
<td>Too warm 6</td>
</tr>
<tr>
<td>Comfortably warm 5</td>
</tr>
<tr>
<td>Comfortable 4</td>
</tr>
<tr>
<td>Comfortably cool 3</td>
</tr>
<tr>
<td>Too cool 2</td>
</tr>
<tr>
<td>Much too cool 1</td>
</tr>
</tbody>
</table>

Assigning numbers to the perception of comfort permits statistical analysis of responses from groups of people. The subjective comfort scales may be coupled to survey instruments which collect a range of related workplace environment data such as a dry bulb temperature, wet bulb temperature, relative humidity and black globe temperature.

Radiation

Electromagnetic radiation (EMR)* is produced by the motion of electrically charged particles that behave like waves. They travel through empty space as well as through air and other substances. The particles with the highest energy correspond to the shortest wavelengths. The range of wavelengths is referred to as the electromagnetic spectrum.

<table>
<thead>
<tr>
<th>EMR Spectrum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long wave length</td>
</tr>
<tr>
<td>Radio waves</td>
</tr>
<tr>
<td>Non-ionising</td>
</tr>
</tbody>
</table>
**Ionising radiation**

High energy radiation (ionizing radiation)* is able to cause chemical changes by breaking chemical bonds. This effect can cause damage to living tissue. The presence of ionising radiation can be detected using **Geiger counters** and **dosimeter badges**. As there is a high potential for health effects, specialist advice should be sought where there is exposure to ionising radiation.

**Non-ionising radiation**

Non-ionising radiation includes ultraviolet light and visible light.

**Ultraviolet radiation** is classified by wavelength into three regions:

- UVA which is thought to contribute to premature aging and wrinkling of the skin and has recently been implicated as a cause of skin cancer.
- UVB, which is more dangerous than UVA, has been implicated as the major cause of skin cancers, sun burning and cataracts.
- UVC, which is extremely dangerous but does not reach the earth’s surface due to absorption in the atmosphere by ozone.

While there are UV meters, a useful way to identify UV hazards is the Global Solar UV Index. The UV Index is a simple and informative way of describing the daily danger of solar UV radiation intensity. The Bureau of Meteorology's UV forecast gives the index value for midday (1pm during daylight saving) when the sun's radiation is most intense. The Index is published daily by the Bureau and is available on its website [www.bom.gov.au](http://www.bom.gov.au).

**Visible light** is the band of electromagnetic radiation that can be seen by the human eye. Inadequate or inappropriate lighting can cause eye strain, headache, neck and shoulder pain. Common faults in lighting are:

- glare from unshielded or excessively bright lights or sunlight;
- reflected light, especially on computer screens;
- patchy, uneven lighting;
- insufficient lighting, especially for fine or high precision tasks; and
- flickering or flashing lights.
AS1680.1 *Interior lighting, Part 1, General principles and practices* gives further information on lighting requirements. Light is measured using a *luxmeter* and lighting surveys should be conducted according to the procedures set out in AS1680.1 (Standards Australia, 1990).

Lasers are non-ionising radiation that have potential for eye and skin injury. Lasers are found in many fields including medical, industrial (welding, cutting), construction, surveying, communications, entertainment, the military and scientific research. Lasers are also found in many consumer items such as laser pointers, barcode scanners, CD and DVD players and laser printers.

Lasers are classified according to the hazard associated with their emissions, as defined in the Australian/New Zealand Standard AS/NZS 2211.1:2004 *Safety of Laser Products Part 1: Equipment classification, requirements and user’s guide*:

### Chemical hazards – gases and vapours

**Detector tubes** contain chemical reagents in which colour changes may be produced when a contaminated air sample is drawn through it. The concentration of the contaminant present in the air can be determined from the length of the stain, or by comparing the colour change against a set of standards.

As the name implies, the tubes will detect the presence of contaminants, but their accuracy and specificity depends both upon the tubes and the circumstances under which they are used.

The advantages and limitations of detector tubes are listed below.

<table>
<thead>
<tr>
<th>Detector tubes</th>
<th>Advantages</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quick</td>
<td>Only a grab sample</td>
</tr>
<tr>
<td></td>
<td>Simple</td>
<td>Possibility of cross sensitivity</td>
</tr>
<tr>
<td></td>
<td>Instantaneous result</td>
<td>Random errors of up to ± 20%</td>
</tr>
<tr>
<td></td>
<td>Relatively cheap</td>
<td>Limited shelf life</td>
</tr>
<tr>
<td></td>
<td>Large range of tubes</td>
<td>Tubes are not reusable</td>
</tr>
</tbody>
</table>
Despite the limitations, detection tubes are widely used devices. Provided that simple checking procedures are adopted and the limitations are understood, they are very useful tools.

Colorimetric sampling is also undertaken using **badges** that will react to specific chemicals. The intensity of the colour change in the badge is compared with a supplied chart.

**Direct reading gas detection equipment** can also be used to take ‘grab samples’ to indicate the presence of an airborne chemical that may be toxic or flammable. Such detectors are usually electrical, electrochemical or electromagnetic and are often fitted with an alarm. They may be used to detect hazardous atmospheres in confined spaces or in general workplaces where the process, or records such as MSDS, suggest that there may be an issue.

Direct reading devices are often equipped to detect several different airborne contaminants and increasingly they have the capacity to log data such that the concentrations recorded over time can later be reviewed and manipulated on a personal computer.

A multi-gas detector for use in confined spaces will typically be equipped with sensors that measure hydrogen sulphide (the ‘rotten eggs’ gas that is a potent asphyxiant produced by decaying organic matter and is common in drains, sumps, etc) and carbon monoxide (another potent asphyxiant produced by combustion and, for example, a problem where internal combustion engine powered pumps are used); as well as flammable gases and oxygen.

**Contaminant separators** are an alternative where direct reading devices and detector tubes may be inappropriate. Such circumstances may be where personal exposure needs to be assessed and neither device can collect air from within the breathing zone of the worker (ie within 300mm of the nose and mouth and typically assessed by positioning sampling device inlets on the lapel) or can offer time-weighted average sampling. Contaminant separators are used to collect contaminants from the air onto a medium that will hold it until the sample can be transported to a laboratory for analysis. The medium may be activated charcoal or a synthetic material that has properties that
bind (adsorb) a range of organic gases and vapours until the material is heated or chemically released (desorbed) into an instrument for analysis. The analysis enables the time-weighted average concentration of the contaminant in the breathing zone of the worker to be calculated. The contaminant may be drawn on to the collecting medium in the worker's breathing zone by a pump (known as active sampling*) or by simply exposing the medium to the contaminated air (known as passive sampling*). Passive sampling can be used only where the passive adsorption rate for the contaminant in question is known. This information is provided by the manufacturer of the passive sampling device.

Unlike direct reading devices, contaminant separators of this type cannot provide the exposure history (ie the variations in airborne concentrations at different times during the sampling period); they can only provide the time-weighted average exposure for the sampling period.

The results of airborne contaminant sampling are compared with occupational Exposure Standards* that are usually listed as time-weighted average values. The Exposure Standards used in Australia are listed on the Safe Work Australia website (www.ascc.gov.au).

**Biological hazards**

Biological hazards include fungi, protozoa, bacteria and viruses, some of which are beneficial, while others cause disease (ie are pathogenic). These organisms may be present in ventilation systems, the work process or in other aspects of the work environment. Biological hazards may also include insects, spiders, snakes and larger animals. In some occupations, plants may be biological hazards (ie an allergic response to some plants).

With the exception of animals, most of these hazards are not detected until they produce signs or symptoms of disease in people, animals or plants. Samples to detect the presence of such organisms may be taken from air, liquids or surfaces with techniques including settling plates (agar plates), surface sampling using swabs, centrifugal samplers, electrostatic samplers and membrane filtering.

These techniques require specialist input, not only to supply and use the equipment and interpret the results, but to ensure the
safety of those undertaking the testing. Sampling may concentrate the pathogens and could place those handling the equipment at high risk unless appropriate control measures are taken.

Simple detection tests are available for bacterial contamination of surfaces. These include a 'swab kit' where swabs are mailed out by a supplier; swabs of a surface are then taken and sent for culture to a laboratory, which provides a report.

One example of a biological hazard that has received recent attention in Australia is ‘Legionnaires’ Disease’ which refers to any severe form of pneumonia caused by the *Legionella* species of bacteria. *Legionella* bacteria may be found in natural water sources, circulating water of cooling towers and other warm moist sources such as hot water systems, spas, potting mix, soil and mulch. The bacteria are transmitted via inhalation of aerosol mists breathed into the lungs. (Commission for Occupational Safety and Health WA)

The WA Code of Practice for Legionnaires’ Disease notes that identifying potential sources of infection is about awareness of the sources of *Legionella* and the design and maintenance requirements for air and water handling systems. The Code states that as sampling for *Legionella* and the interpretation of results are specialised processes, routine water sampling for *Legionella* is not advocated, but sampling may sometimes be appropriate to check the efficacy of the water treatment regime (Commission for Occupational Safety and Health WA). Information on testing is available in *AS/NZS 3666 Air handling and water systems for buildings – Microbial control*, which provides information on identification and management of such systems to prevent *Legionella* infections.

**Biomechanical hazards**

Biomechanical hazards are found wherever muscles are used for doing work including lifting, pushing, pulling, holding, restraining or where work involves repetitive use of muscles. Biomechanical hazards are concerned with more than manual handling and include hazards associated with static work postures such as working at visual display screens and working postures that involve bending or stooping. The most common injury is muscle strain which is referred to as ‘musculoskeletal disorder’ (MSD) in recent legislation and codes of practice.
Often the first indicators of biomechanical hazards are production bottlenecks or quality issues, workers avoiding certain tasks or physical tasks requiring several people, worker complaints and/or injury/discomfort.

As with all hazards, workplace information such as hazard and incident reports, injury reports and workers compensation claims provide information for identifying biomechanical hazards. However, the impact of biomechanical hazards is often cumulative and may be expressed as fatigue or discomfort rather than acute injury. Also, the cause of the injury, pain or discomfort may not always be apparent.

Questionnaires are often used as screening tools to identify biomechanical hazards requiring investigation. Two examples are given below. The first identifies body pain and discomfort over the working day which can then be correlated with the tasks carried out. This questionnaire is most useful for identifying any patterns of pain over the day or week, especially as they apply to individuals.

The second questionnaire uses the collated responses of a group to identify the tasks that cause the most problems for the most people. However, it too is useful in identifying biomechanical problems as they apply to individuals.

### Task Analysis and Body Stress Questionnaire

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Back</th>
<th>Front</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For each hour write down a brief description of what you have been doing.*

*At the end of each hour shade any parts of your body where you feel tiredness, discomfort, irritation or pain.*

*If you feel tiredness, discomfort, irritation or pain, mark on the scale below the extent of your discomfort.*

- Slightly Uncomfortable
- Uncomfortable
- Very Uncomfortable
- Extremely Uncomfortable

*The blocks may be repeated to allow for hourly recording throughout the shift.*
MANUAL HANDLING RISKY TASK QUESTIONNAIRE

This survey is being used to collect information on manual handling tasks which may need to be assessed for risk of injury. Individual results will not be kept nor will they be used for any other purpose.

Please focus on the effect on you, not what you think is the effect on others. You may list any task in more than one category.

Please focus on the task and give full information (do not just say 'lifting'). The more specific your comments, the more valuable they are in making the workplace healthy and safe for all employees.

Unit _______________________________________________
Job Title ____________________________________________

1. List, in order of priority to you, the tasks that you find are MOST PHYSICALLY DEMANDING.
   A ___________________________________________________
   B ___________________________________________________
   C ___________________________________________________

2. List, in order of priority to you, the tasks that you find are THE MOST STRAIN ON THE BACK OR ARMS.
   A ___________________________________________________
   B ___________________________________________________
   C ___________________________________________________

3. List, in order of priority to you, the tasks that you MOST DISLIKE.
   A ___________________________________________________
   B ___________________________________________________
   C ___________________________________________________

A prioritised list of ‘risky tasks’ for further investigation is obtained by giving the A, B, C, responses a 3, 2, 1, weighting then collating the responses.

The Australian OHS regulators take varying approaches to identifying biomechanical hazards. WorkSafe Victoria requires that tasks involving ‘hazardous’ manual handling are identified. Such tasks are those requiring one or more of:

• repetitive or sustained force;
- repetitive or sustained awkward posture;
- repetitive or sustained movement;
- high forces or loads; and
- unpredictable or unstable loads.

These risk factors are exacerbated when the body is required to work outside its neutral or natural posture and/or there is a requirement for both precision and strength. Most other states consider a broader range of risk factors such as those given in the WA Code of Practice for Manual Handling which lists the following:

- size, shape and weight of objects (if carried or held) and forces required (if pushed, pulled or restrained);
- sudden unexpected or jarring movements;
- awkward movements, such as twisting, bending, over-reaching, especially if combined with load handling;
- static postures, like holding the body or part of the body in a fixed position for a long time; and
- personal factors, such as age, physical dimensions and any disabilities the person may have.

(Commission for Occupational Safety and Health WA, 2000)

Researchers in the area have focused recently on discussing the role of psychosocial factors in musculoskeletal disorders. Macdonald (Macdonald, 2005) presents a composite range of factors contributing to musculoskeletal disorders.

The physical and mental demands of a task combine to create a **hazardous activity**. These physical and mental demands arise as a result of the physical and psychosocial factors in the workplace. When these primary risk factors for musculoskeletal disorders are present; then the presence of other factors associated with work organisation, job design, personal conditions or factors will either potentiate* or have a synergistic* effect on the musculoskeletal disorder. This is represented by Macdonald as shown below. This model helps explain why individual workers have varying responses to similar work conditions (Macdonald, 2005).
WIDER COMMUNITY INFLUENCES
OSH Codes, Regulations, Standards & Enforcement Practices; Injury Compensation Laws & Practices; Job marked, pay levels and other economic factors; Social norms; Health services

HAZARDOUS CONDITIONS – Physical & Psychosocial Workplace Environment Factors

HAZARDOUS CONDITIONS – Work Organisation & Job Design

HAZARDOUS PERSONAL CONDITIONS

HAZARDOUS PERSONAL STATES – STRESS, CHRONIC FATIGUE

MSD RISK

(Macdonald, 2005)
An example of this approach could be applied as follows.

Task: Removing chickens from a processing line for dressing and packing.

<table>
<thead>
<tr>
<th>Work environment</th>
<th>Tasks demands</th>
<th>Work conditions</th>
<th>Individual worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical:</td>
<td>Physical:</td>
<td>Work Organisation:</td>
<td>Hazardous personal conditions</td>
</tr>
<tr>
<td>• Layout of the production line</td>
<td>• Speed of production line/pick rate</td>
<td>• Long hours</td>
<td>ie: normal/chronic sub-optimal conditions that increase vulnerability.</td>
</tr>
<tr>
<td>• Production targets</td>
<td>• Standing for long periods</td>
<td>• Shift work</td>
<td>• Pre-existing injury</td>
</tr>
<tr>
<td>• Hand above shoulder height</td>
<td>• Little recognition for job</td>
<td>• Highly supervised</td>
<td>• Fatigue or stress due to non-work conditions (lack of sleep, child care demands)</td>
</tr>
<tr>
<td>• Twisting movement to remove chickens from line</td>
<td>• Little job latitude</td>
<td></td>
<td>• Age</td>
</tr>
<tr>
<td>• Protective clothing</td>
<td></td>
<td></td>
<td>• Low levels of general fitness</td>
</tr>
<tr>
<td>Mental:</td>
<td>Physical:</td>
<td>Job design</td>
<td>ie: short-term stress or fatigue.</td>
</tr>
<tr>
<td>• Monotonous task</td>
<td>• Speed of production line/pick rate</td>
<td>• Cold environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Standing for long periods</td>
<td>• Harsh lighting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hand above shoulder height</td>
<td>• Slippery underfoot</td>
<td></td>
</tr>
</tbody>
</table>

### Psychosocial hazards

While some of the usual sources of workplace information for hazard identification (ie hazard and incident reporting, minutes of meetings) are useful for psychosocial hazards, identification and monitoring of these hazards often requires alternative methods such as surveys, questionnaires and interviews.

One such questionnaire on work-related stress has been developed by the European Agency for Safety and Health at Work (see below). In Australia there is increasing attention being given to fatigue as a psychosocial hazard, and the codes of practice and guidance information have recommendations for identifying fatigue and related issues.
### IS THERE A PROBLEM WITH WORK-RELATED STRESS IN MY WORKPLACE?

**Atmosphere**
- Do you feel that you have to work long hours to keep your job or get promoted?
- Is suffering from stress seen as a weakness or is it taken seriously?
- Are your work and suggestions valued?
- Is there a constant feeling of pressure to do more, faster?

**Demands**
- Have you got too much work to do in too little time?
- Do you find your work too difficult?
- Is your work satisfying?
- Does your work make you bored?
- Is your workplace too noisy, is the temperature comfortable, and what about ventilation and lighting?
- Are you worried about hazards in your workplace, such as the use of chemicals?
- Do you feel at risk of violence from customers, clients or members of public?

**Control**
- Can you influence the way your job is done?
- Are you involved in making decisions?

**Relationships**
- Is your relationship with your boss OK?
- How about your relationship with colleagues, or your staff if you are a manager?
- Are you bullied by anyone in your workplace, by for example experiencing insults, offensive behaviour or that your bosses abuse their power?
- Are you harassed because of your colour, sex, ethnic origin, disability, etc?

**Change**
- Are you given information about changes in your workplace?
- Are you involved in making changes to your job?
- Are you given support during changes?
- Does it feel like there is too much change, or maybe not enough?

**Role**
- Are you clear about what your job is and your responsibilities?
*Remember: work-related stress is a symptom of an organisational problem, not an individual weakness!*
- Do you have to do tasks which you think are not part of your job?
- Do you ever have conflicting roles?

**Support**
- Do you have the support of your boss and colleagues?
- Are you praised when you do a good job?
- Do you receive constructive comments or do you feel you get only criticism?

**Training**
- Do you have the right skills to do your job?
- Are you encouraged to develop your skills?
1.4 USE APPROPRIATE TOOLS TO CONDUCT WORKPLACE INSPECTIONS IN CONSULTATION WITH STAKEHOLDERS

Workplace inspections will generally be supported by a checklist.

Source a checklist as a starting point

Hazard-specific workplace inspection checklists may be available in the workplace or may be accessed from the OHS regulator, industry bodies, similar workplaces or OHS advisers. Even if there is an existing checklist(s) in the workplace it is important to regularly ‘benchmark’ to check if there are better or more useful checklists available.

Codes of practice are a useful resource. By their definition, they give guidance on how to comply with regulatory requirements. Most hazard-specific codes of practice include one or more tools to assist in hazard identification. These tools may be generic or may be adapted to suit specific industries. While codes of practice should be followed unless there is an equal or better way, the checklists still need to be reviewed to ensure that they are appropriate for a particular situation.

Review the checklist

Any hazard-specific checklist should be reviewed prior to use to ensure that it:

- is relevant to the industry or type of work;
- suits the workplace;
- addresses all the required areas or items; and
- is usable by the people in your workplace.

The people who should be involved in the review include:

- those who will use the checklist;
- those who do the work;
- specialist advisers related to the work; and
- OHS advisers.
As we are learning more about workplace hazards and their action all the time, all checklists should be reviewed on an on-going basis to ensure that they allow for emerging issues and reflect current industry knowledge and practice.

Remember, the conditions that lead up to the loss of control of a hazard may develop over quite long periods of time and come directly from, or through the interaction of one or more of five sources:

- the organisational and management environment;
- the physical environment;
- equipment;
- procedures; and
- people and human error.

Checklists usually focus on the physical environment. In reviewing the checklist consider to what extent it includes items addressing the other four areas listed above.

Get organised

Checklists are useful but it is how they are used that is important.

Sections 1.1 and 1.2 of this learning guide addressed the information to be collected about the hazards being investigated. Before conducting any inspection, revisit this to check for any areas, tasks or processes that require special attention.

Identifying hazards and the pre-conditions that may result in loss of control of the hazard should be a collaborative effort. Where possible, workplace inspections are best conducted by a team. This may be two people for each inspection, and it may mean rotating the people who do the inspection so that ‘fresh eyes’ are applied from time to time. It may also mean bringing in someone from outside the workplace to accompany a person who is familiar with the workplace and the work. A team approach allows for a more comprehensive and collaborative review of the work and the environment.
The team may include (not necessarily at the same time):

- the supervisor whose area is being inspected – they can help to add insight into the procedures and systems in place;
- workers in the area – they know the work;
- the OHS representative – they can help to coordinate the inspection and follow up and bring skilled experience to the team;
- OHS and technical experts; and
- ‘fresh eyes’ from another work area.

Remember, the OHS representative has a legal right to be in the inspection team and to conduct workplace OHS inspections of his or her own.

**Conduct the inspection**

Inspections should be repeated at regular intervals. They should also be conducted at unscheduled times to pick up on the items that may not be apparent when scheduled inspections occur.

There is a danger that the checklist may ‘blinker’ the people doing an inspection or the format may limit the extent of the comments or notes. Also, there is the ‘tick and flick’ approach that results in a pile of paper but little effective hazard identification.

Does the following situation sound familiar?

> Joe went to a safety training day. They said that inspections were important. So the boss said to Joe “I sent you to the course, you’re now the safety guy. Off you go”. There is now a pile of checklists that Joe completes monthly with things ticked and crossed; some of the items do not relate to their work and the same things are crossed each month, so not a lot has changed.

While checklists are a vital tool in hazard identification, some hazards may not be identified if the process is totally checklist-driven.
All workplaces should consider seeking expert input to the hazard identification process, especially at key times such as:

- at design or pre-purchase;
- before new forms of work and organisation of work are implemented; and
- before changes are made to the workplace, equipment, work processes or work arrangements.

As you become more experienced in hazard identification, you will find that you look beyond the standard tool or checklist and take a more analytical approach to hazard identification. Your understanding of hazards as sources of ‘potentially damaging energy’, together with some knowledge of manual handling, issues associated with work posture and psychosocial hazards is vital to this analytical approach.

**Guidelines for conducting inspections for hazard identification**

The following suggestions may assist you when conducting an inspection:

- The sole purpose of the inspection is to identify hazards and preconditions so that preventive action can be taken. (The purpose is NOT to catch people out!)
- Open discussion among team members can enable others to see things from a different perspective and may also lead to improvement in the inspection checklist.
- Don’t ‘white wash’ by omitting items that present difficulties to any of those concerned.
- Vary the routine of inspection, look beyond the obvious.
- Remember that workplace inspections are a constructive process – avoid negativity and criticism. The inspection must be used as a means of working towards the solutions to problems and not as a way to pass judgment on individuals.
- If you identify anything that is an immediate threat to safety, then quickly bring it to somebody’s attention for action – do not just note it down.
- Ensure that the outcomes of the workplace inspection are reported promptly and that there is an action plan with delegated responsibilities and timeframes.
- Keep in mind that you should be an example of good OHS when you are conducting an inspection. Remember to follow the rules and procedures.
1.5 SEEK INPUT FROM STAKEHOLDERS, KEY PERSONNEL AND OHS SPECIALISTS IF REQUIRED

Collecting workplace information (section 1.2), using 'tools' to identify hazardous conditions and tasks (section 1.3) and conducting inspections (section 1.4) not only requires the input of stakeholders and key personnel but needs their active involvement. Some of the issues of not adequately involving these groups are highlighted by Piney (2002) (refer to section 1.3).

Various stakeholders and key personnel are identified below.

Stakeholders – those people or organisations who may be affected by, or perceive themselves to be affected by an activity or decision. Stakeholders in workplace OHS include:

- managers;
- supervisors;
- health and safety representatives and other employee representatives;
- OHS committees;
- employees and contractors; and
- the community.

Key personnel are people who are involved in OHS decision-making or who are affected by decisions.

OHS technical advisers are persons providing specific technical knowledge or expertise in areas related to OHS and may include:

- risk managers;
- health professionals, injury management advisers;
- legal practitioners with experience in OHS;
- engineers (such as design; acoustic; mechanical; civil);
- security and emergency response personnel;
- workplace trainers and assessors; and
- maintenance and tradespersons.
OHS specialist advisers

It is not only practically important but it is an ethical responsibility for all OHS practitioners to recognise their own professional limitations and when to call for specialist advice. OHS is a multidisciplinary function, so it is impossible for a practitioner to be equally competent across all areas of OHS. Section 5.2 gives detailed descriptions of the respective roles of each type of OHS professional.

In summary, OHS specialist advisers may include:

- safety professionals (generalist role);
- ergonomists (biomechanical hazards);
- occupational hygienists (chemical, physical and biological hazards);
- toxicologists (chemical hazards);
- occupational health professionals (hazards causing occupational diseases);
- audiologists (impact of noise on hearing); and
- safety engineers (physical hazards).

Competency check for Element 1

Key issues for each performance criterion in Element 1 are as follows:

1.1 Access external sources of information and data to assist in identifying hazardous tasks or conditions for the selected hazard:

- Identify and access state, national and international sources of information on the selected hazard.
1.2 Review workplace sources of information and data to assist in identification of hazardous tasks or conditions for the selected hazard:

- Identify sources of workplace information relevant to the selected hazards.
- Recognize the limitations of workplace information due to limited numbers of reports, the timeframe and/or changing circumstances.

1.3 Use appropriate tools to identify hazardous tasks or conditions for the selected hazard:

- A range of hazard-specific indicative ‘tools’ are known and used to identify hazards in the workplace.
- Tools are treated as indicators only, with limitations recognised.
- Specialist advice is sought as appropriate.

1.4 Use appropriate tools to conduct workplace inspections in consultation with stakeholders:

- A suitable checklist is accessed, reviewed and, where required modified to suit the workplace, the nature of the work and to be usable by those in the workplace.
- Preparation for the inspection includes reviewing available information and organising appropriate people as an inspection team or to provide input to the inspection.
- In conducting the inspection, the checklist is used as a guide but the observations and recording of information are not bound by the checklist.
- Own safety is addressed while conducting the inspection.
- Any immediate hazards are reported promptly.

1.5 Seek input from stakeholders, key personnel and OHS specialists if required:

- The need to seek input from and involve stakeholders and key personnel is identified and addressed.
- Own limitations are identified and appropriate OHS specialists consulted as required.
Case Study 1

Accessing and reviewing information to identify hazards

While the details of applying the principles of hazard management to a real situation will vary depending on the hazard, a case study based on noise hazards¹ will be followed through the learning guide to demonstrate how the competency is applied in a real situation.

NOISE CASE STUDY

A medium-sized manufacturing company employing 100 people produces boilers, gas cylinders and other pressed metal products. The production plant is very noisy, communication is difficult and employees have to shout to be heard. Some workers have found that they do not hear their car radios as well after work as they do before work, even though the volume has not changed. The noise levels have never been measured and so management was not aware of the risk to the employees' hearing.

The issue became apparent when the company received a claim for noise-induced hearing loss from an employee who had left the company recently.

HAZARD IDENTIFICATION

Access external sources of information to identify hazards

A check of the OHS regulations (Occupational Health and Safety Regulations, Western Australia, 1996) revealed that the exposure standard for noise is $L_{Aeq,8hr} \ 85dB(A)$ and $L_{Cpeak} \ 140dB(C)$.

¹ This case study is based on an example drawn from the Safe Work Australia formerly ASCC/NOHSC 1990 publication *Occupational health and safety for engineers; A resource for engineering education.*
Further information on identification of noise hazards was also accessed through the websites of the state OHS regulators. The most recent publication being the *Guide for assessing and fixing noise problems at work* (WorkSafe Victoria, 2005b).

This publication not only explains the process of noise-induced hearing loss but notes that exposure to noise may have other health effects including damage to the cardio-vascular, endocrine, metabolic, gastro-intestinal and neurological systems. Noise can also impair concentration and affect performance in reading, writing and listening tasks and so impact on both safety and work performance. (WorkSafe Victoria, 2005b).

The guidelines for identifying noise hazards suggest that there may be a problem in the workplace where employees:

- have to raise their voice to communicate at a distance of one metre;
- have a temporary reduction in hearing or a ringing in the ears after leaving work for the day; and
- use hearing protectors during the work day.

**Access and review workplace sources of information to identify hazards**

Having reviewed this information obtained from sources external to the workplace, the company then requested the occupational health and safety representative to review any relevant workplace information including:

- hazard, incident and injury reports;
- investigation reports, workplace inspections;
- maintenance records;
- risk registers;
- minutes of meetings;
- Job Safety Analyses (JSA) and risk assessments;
- work procedures including standard operating procedures (SOP);
- reports and audits;
- enforcement notices and actions, workers’ compensation data; and
- manufacturers’ manuals and specifications.
The health and safety representative found several hazard reports that linked noise with headaches, but there had been little follow up. The manufacturers’ manuals for some of the plant did refer to noise, but as the plant and equipment was all more than 15 years old, noise had not been highlighted in the plant specifications.

**Use appropriate tools to identify hazardous tasks or conditions and conduct workplace inspection to identify hazards**

Following receipt of the claim for compensation for noise-induced hearing loss and the review of external information, the company now recognised that they had a noise problem in the workplace and decided to quantify the noise levels using a simple, survey-type sound level meter.

The health and safety representative consulted with the workers in various areas to identify the noisiest areas and tasks. He then took a number of readings over several days in various parts of the workplace. The outcome was that several areas had levels as high as 113dB(A) meaning that many workers were likely to be receiving daily noise exposures exceeding the permissible exposure level set down in the state regulations.
Activity 1

Keep a copy of this Activity for your Assessment Portfolio.

You have been asked to advise on issues related to a particular hazardous task or condition in the workplace.

Access information to identify hazardous tasks or conditions

1. Describe the hazardous task or condition and the general type of hazard(s).

2. Research the current knowledge about the hazard(s) by accessing a range of sources of information external to the workplace. Describe and explain:

   (i) how the hazard behaves and how it causes harm;
   (ii) conditions that contribute to the level of harm;
   (iii) legislative requirements relating to the hazard(s);
   (iv) the extent of the problem in industry generally and, where possible, your industry in particular; and
   (v) standard industry practice relating to the hazard(s).

   Be sure that you reference your sources of information.

3. Collect information from the workplace on the selected hazard(s):

   (i) identify the sources of workplace information relevant to the hazard(s) you are examining;
   (ii) collect and collate information to assist in identifying the relevant hazards and hazardous tasks/conditions in the workplace; and
   (iii) identify any gaps or limitations in the information collected.
4 (i) Source a hazard-specific tool, method or technique for identifying the hazardous/tasks conditions in the workplace. This may be a checklist, questionnaire or monitoring equipment. Include the tool as an attachment in your report.

(ii) Describe how you reviewed the checklist or ‘tool’, and the consultation process, to ensure that it was applicable to the workplace and the hazards.

(ii) Use the selected tool to identify hazardous tasks/conditions. Describe the outcomes, including any areas for immediate attention, and any limitations in the process.

5 Did you need to consult an OHS specialist? If yes, then how were they selected? If no, why did you consider that specialist advice was not required?
Element 2: ANALYSE THE WORK ENVIRONMENT TO ASSESS THE RISK

The terms ‘hazard’ and ‘risk’ are often confused. A hazard is either present or not present, while risk is variable depending on the environment and circumstances. A hazard does not pose a risk unless people are exposed to it and a risk arises when people are exposed to a hazard.

**Risk** is a measure of the potential for unwanted, negative consequences of an event. It is measured in terms of consequence and likelihood of the particular consequence occurring.

The first element in this unit of competency required you to access a range of information within and outside the workplace for your nominated hazard type or hazardous task. You also used simple tools and inspected the workplace to identify hazardous tasks or conditions. This section requires you to analyse the work environment to assess the risk.

The learning guide for BSBOHS504 *Apply principles of OHS risk management* examines aspects of the work environment and the broad processes for analysis. This unit (505) goes further and focuses on using monitoring equipment and strategies to analyse the work environment as a basis for risk assessment.

In order to complete the second element of this competency unit successfully, you will have to show that you have satisfied the following performance criteria:

2.1 Identify and appropriately use equipment and strategies required for basic workplace measurement and monitoring of the selected hazard.

2.2 Interpret results of workplace measurements in accordance with recognised standards.

2.3 Seek input from stakeholders to clarify and confirm issues related to the selected hazard.
2.4 Report results of workplace measurements and interpretations to stakeholders in a format easily understandable by the target group.

2.5 Assess risks associated with identified hazards in the work environment in consultation with stakeholders and take into account effectiveness of existing controls.

2.6 Identify and prioritise hazardous tasks or conditions requiring control action in consultation with stakeholders, taking account of recognised standards.

2.7 Establish and update risk register* as appropriate.

The learning guide for the unit BSBOHS504 *Apply principles of OHS risk management* defined the work environment as including:

- the task environment (organisation and management environment, physical environment and equipment); and
- the task demands, organisation of work and the work relationships.

The concept map on the following page summarises the sources of hazards and factors that may contribute to loss of control of a hazard and each of these categories and factors are examined in detail in the learning guide for the unit BSBOHS504 *Apply principles of OHS risk management*. While this element focuses on the physical environment, the impact of the features of the other aspects of the work environment should be considered.

This section assumes that the learner has the knowledge and skills concerning the monitoring equipment (as addressed in the competency unit BSBOHS406 *Use equipment to monitor the work environment*) and adds the processes that address basic analysis and reporting. However, it is vital that the OHS practitioner developing their skills, recognises their own limitations and the need for specialist knowledge in this area.

Also, as noted by Cowley, while environmental measurement and monitoring may be valuable in confirming the presence of a hazard, once a hazard is identified, the focus should be on control rather than intensive monitoring (Cowley, 1990).
2.1 IDENTIFY AND APPROPRIATELY USE EQUIPMENT AND STRATEGIES REQUIRED FOR BASIC WORKPLACE MEASUREMENT AND MONITORING OF THE SELECTED HAZARD

Occupational hygiene monitoring techniques are frequently used to measure the levels of physical, chemical and biological agents in the workplace as part of risk assessment. While Cowley (1990) raises concern regarding the emphasis on monitoring as possibly detracting from the desired focus of achieving effective control, measurement or sampling of agents in the workplace is important for certain hazardous agents.

In this section, you will examine the principles for selecting and using some of the more common equipment and strategies for monitoring the work environment for physical, chemical, biological and biomechanical hazards.

A useful reference for monitoring and monitoring equipment is Monitoring for Health Hazards at Work (Ashton & Gill, 2000).

Section 1 of this learning guide discussed the use of questionnaires for monitoring psychosocial hazards.

Physical hazards

Physical hazards that may be monitored include:

- thermal hazards (hot/cold environments);
- noise and vibration;
- fluids under pressure;
- electricity [Electromagnetic Force (EMF)]; and
- radiation.

Noise is discussed below as an example of a physical hazard. Further information on noise as a hazard, how it behaves and how it causes damage, is available in the readings for this unit at the SafetyLine Institute website (www.worksafe.wa.gov.au/institute).
Noise

While noise is present in all environments, excessive or prolonged exposure to noise can lead to hearing loss and other health effects. The impact is usually only apparent after cumulative and prolonged exposure.

Noise can be measured in a number of ways and using a range of equipment of varying sophistication. A sound level meter consists of a microphone, amplifiers and filters to make the device respond to different noise frequencies in similar ways to the human ear (frequency weighting) and a display. The device may be precision grade – used by professionals for noise survey work, or industrial grade – used for investigatory work. When used for assessing personal exposure, the microphone of either type of meter is positioned where the worker’s ear would be and thus the noise level to which workers might be exposed if they remained at that work position may be estimated. These devices are also very useful for diagnostic work, when attempting to identify particular machines or process components that are a significant noise source. In this case, the microphone is positioned according to the requirements of the particular situation.

More accurate assessments of noise exposure are made using noise dose meters. These are small data logging devices connected to a microphone that is positioned on the worker’s collar as close to the ear as possible. The data logger is carried in the pocket. At the completion of the survey work, the data logger may be connected to a personal computer and a noise exposure history downloaded along with summary data that offers the time-weighted average noise exposure level (LAeq), maximum and minimum noise level, peak noise level, etc. Noise dose meters are particularly useful when the noise level is fluctuating and variable over the sample period and when the worker is mobile.
Chemical hazards

Chemical hazards may include hazardous substances, dangerous goods, hazardous atmospheres and combustible and explosive materials.

Chemicals may be present in the work environment as solids, liquids, gases or vapours. They may affect the health of workers due to their toxicity or irritant effects, by the displacement of oxygen in the breathable air, or they may cause injury and damage by their explosive or flammable properties.

Chemicals may enter the body through the respiratory system, but they may also enter the body by absorption through the skin or, less frequently in the work environment, through the digestive system. Detection of chemicals in the breathable atmosphere may be difficult, especially where there is no odour.

Sampling strategy

Before embarking on a monitoring program, a thorough knowledge of the work process is necessary to assess the likely airborne contaminants, exposure pathways, etc. The most obvious hazard is not necessarily the only or greatest hazard.

A number of factors must be considered in deciding the sampling strategy. These include:

- the site of the sample;
- timing for collecting samples;
- persons exposed;
- number of samples; and
- duration of sampling time.
Site of the sample

This is not normally difficult to decide. If the purpose is to evaluate a worker’s exposure then personal monitoring usually is required, i.e. the sampling head is fixed in the worker’s breathing zone. Using this technique, the daily time-weighted average exposure can be measured. Estimation of the actual exposure can only be achieved by sampling in the breathing zone. Area monitors, even when placed close to the worker's position will not give a good estimation and results can be several orders of magnitude less than personal monitoring. Area monitoring does, however, permit continuous monitoring and is also useful to provide information on background concentrations.

Timing

Again, this is not normally difficult and is often governed by factors outside the practitioner’s control. Generally monitoring is undertaken throughout a shift or at least over the period where exposure is likely. Sampling for shorter periods may result in the omission of significant exposure peaks from the sample.

Person exposed

How the person works must be considered. For example, one worker may orientate themselves in front of a ventilation hood, while another on the same process may orientate themselves to the side. Normal working patterns and characteristics must be considered.

Number of samples

Generally the rule is ‘the-more-the-better’ to improve the statistical reliability of the survey. It is unwise to draw conclusions based on one sample.

Duration of sampling time

The volume of air sampled and the length of the sampling time are related to the sensitivity of the analytical procedures or instruments employed.
Sampling method

The sampling method chosen depends upon the chemical and its physical properties, the analytical technique that can be employed and the cost of the equipment and analysis. The choice of sampling device depends on several factors, including portability and ease of use, efficiency of the device, reliability and user acceptance where personal monitors are involved. Measurement techniques can be laboratory or instrument (direct monitoring) based (see figure below).

**Measurement techniques**

<table>
<thead>
<tr>
<th>Direct monitoring</th>
<th>Laboratory based</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site measurement</td>
<td>On-site measurement</td>
</tr>
<tr>
<td>Immediate results</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Snap or grab sampling</td>
<td>Time-weighted average</td>
</tr>
<tr>
<td>Continuous</td>
<td>Passive</td>
</tr>
</tbody>
</table>

**Snap or grab sampling**

A ‘snap’ or ‘grab sample’ is of short duration compared with the working shift and therefore can be used to assess exposure over a short period of time. This technique ignores the characteristics of exposure occurring outside the sample period.

**Continuous sampling**

A ‘continuous sample’ is one collected over the duration of the exposure period, thus providing the practitioner with a continuous assessment of exposure either via a digital or analog display and/or printer or chart recorder. This technique is particularly useful when assessing peak exposures during the course of a shift.
Time-weighted average sampling

Time-weighted average (TWA)* sampling involves the averaging of ‘peaks’ and ‘troughs’ of exposure and the exposure concentration expressed in relation to time.

\[
\text{TWA} = \frac{\text{Concentration} \times \text{Exposure Time Shift Duration}}{\text{Shift Duration}}
\]

eg TWA = \frac{60\text{ppm} \times 5\text{ hours}}{8\text{ hours}} = 37.5\text{ppm} (8\text{hr TWA})

Where:

60ppm= concentration measured over 5 hours exposure period (zero exposure for remainder of shift).
5 hrs= exposure time (not working in same area for remainder of shift ie zero exposure).
8 hrs= shift duration.
37.5ppm= 8 hour TWA (given zero exposure for 3 hrs).

Averaging over a shift does not permit identification of individual peaks.

Monitoring equipment

Simple sampling devices to detect the presence of a chemical hazard were identified in section 1.3 of this learning guide. Some additional types of equipment available for atmospheric monitoring are outlined below in general terms and are by no means a comprehensive or detailed description. Whenever air sampling is undertaken a hygienist and/or the analyst to be used should be consulted to ensure that the most appropriate and suitable technique is employed.

Generally, the types of equipment available fall within one of the following categories:

- direct reading devices;
- contaminant separators
  - particle filtration
  - absorption
  - physical adsorption onto solids; and
- air volume collection.
Direct reading devices

Two types can be distinguished:

- where the contaminant is removed from the air and perhaps destroyed in the process, e.g., heat of combustion; and
- where the contaminant is not removed but where the presence of the substance produces some kind of physical response.

An example of the latter is where a mercury vapour monitor passes sample air through a cell and a beam of ultra violet (UV) light. Mercury atoms absorb UV light and so reduce the amount falling to a photocell. The magnitude of the response is proportional to the concentration of mercury vapour in the atmosphere and is displayed in analog or digital form. Similarly, many gases and vapours absorb infrared light. This principle is adopted in the MIRAN (Miniature Infra Red Analyser) instrument which can be used to detect and determine the concentration of a range of chemicals. The instrument is direct reading and can provide a hard copy trace via a printer.

Direct reading instruments for the quantification of airborne dust are also available. These instruments rely upon the scattering of light by airborne dust particles by the beta-ray absorption of the deposit of dust on a mylar film or the oscillation frequency variation of a quartz crystal when laden with dust (‘piezo-electric’ microbalance). Most instruments express concentrations in mg/m$^3$ (milligrams per cubic metre of air). Particle counts are rarely used.
Contaminant separators

*Mechanical Trapping*

Dust sampling other than by direct reading devices involves the drawing of a known volume of air through a filter of known weight. Once sampling is complete, the pre-weighed filter is re-weighed and the weight of dust collected is determined. Total dust samples are generally collected using a volume flow rate of two litres a minute. That means over an eight-hour sampling period collecting 960 litres of air or 0.96m³. A simple calculation determines the weight of dust:

\[
\text{Volume of weight of dust collected (mg)} = \frac{\text{dust concentration (mg/m}^3\text{)}}{\text{Volume of air sampled (m}^3\text{)}}\]

Medium flow sampling pumps are used to draw the sample through the 25mm diameter filter, which is held in one of a range of sampling heads. The sample head chosen depends on the nature of the sampling. For example, a single orifice filter holder is used for collecting lead dust, a seven-hole ‘modified’ UKAEA filter-holder for collecting total dust.

A cyclone filter-holder is then used for separating the respirable (or alveolar) fraction of dust from the inspirable dust.

Metal fumes can also be collected using the filter separation method. Metal dusts and fumes are usually analysed by laboratory techniques other than gravimetric.
Absorption Devices – Non-reactive

In non-reactive sampling, the gas or vapour is dissolved in a liquid medium contained in a trapping vessel as the air is bubbled through it. It is important that the air breaks into bubbles of small size to ensure intimate contact with the absorbent; for example, Methanol and formaldehyde may be collected in water, both being readily water-soluble.

Absorption devices – reactive

A gas or vapour can be collected with a high efficiency when it is passed at a slow rate through a medium with which it will react to form a non-volatile product; for example, acid gases in alkalis, hydrogen sulphide with cadmium sulphate solution.

Both reactive and non-reactive techniques generally require the drawing of air through a bubbler using a low flow personal sampling pump. Laboratory analysis of the absorbed airborne contaminant is necessary.

Bubblers have the disadvantages of being difficult to fix in a worker’s breathing zone, and are sometimes dangerous given the liquids used. They are also fragile. The maximum sample air volume is often very small and sample time is therefore limited.
Adsorption Devices

Many organic vapours can be collected on a solid adsorbent such as activated charcoal, silica gel and a number of polymers. Using a low-flow pump, air is drawn through the tube packed with adsorbent. The adsorbent has a very large surface area onto which the vapour is adsorbed. In the laboratory, the adsorbent bed is removed and the vapour desorbed into a solvent. The sample is then analysed and quantified by gas chromatography. The sample tube usually contains a second section of adsorbent known as the ‘back-up’. This section is analysed separately. If sample material is present, it indicates that the sample layer was saturated and some material may have been lost.

If the adsorbents are packed into metal tubes, it is possible to employ thermal desorption prior to analysis. This has a number of advantages including the elimination of the solvents used, which are sometimes toxic. It also permits reuse of the tubes.

This technique is very well suited to personal sampling.

Over recent years the adsorptive tube devices have been developed and used in preference to the bubbler/impinger type of trap, which are cumbersome and fragile. However, there is now a wide range of passive samplers which work on a diffusion principle and require no air pump. A diffusion barrier, either a fixed air gap or a microporous membrane, is placed between an adsorbent bed and the air containing vapour. The rate of diffusion of a vapour onto the bed will be directly proportional to the average concentration of vapour outside the diffusion barrier. The diffusion rate will vary from substance to substance, and is predetermined.

Analytical techniques employed are the same as for active adsorbent sampling (ie using a pump).

The passive technique has the advantage of dispensing with the often cumbersome (and sometimes unreliable) pump.

The capacity of adsorbents to adsorb vapours is significantly affected by humidity and begin to fail at about 50 per cent Relative Humidity.
Air volume collection

With this method a known volume of air is collected and returned to a laboratory for analysis, although sometimes it can be analysed on site. A good example of this is the exhaled-breath method for carbon monoxide absorbed in the blood. Gas-tight syringes, evacuated containers and plastic bags are widely used for such sampling. Since the volume of air taken is small this is generally a short-term sampling method. However, evacuated containers fitted with a needle valve have been devised, which sample over longer periods.

The advantages and disadvantages of the two main types of equipment are summarised below.

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Examples of common use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct reading devices</td>
<td>• instantaneous results; and</td>
<td>• bulky and often not appropriate for personal (breathing zone) sampling;</td>
<td>Confined spaces</td>
</tr>
<tr>
<td></td>
<td>• data logging and time history available.</td>
<td>• costly; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• available for limited number of contaminants.</td>
<td></td>
</tr>
<tr>
<td>Contaminant separators</td>
<td>• a technique is available for all contaminants;</td>
<td>• no time history;</td>
<td>Personal dust, gas or vapour exposure, eg powder bagging, spray painting and glueing.</td>
</tr>
<tr>
<td></td>
<td>• relatively cheap; and</td>
<td>• laboratory analysis required; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ideal for personal sampling.</td>
<td>• results consumed at analysis stage (ie data not stored).</td>
<td></td>
</tr>
</tbody>
</table>

Sampling errors

Errors can be of two types, systematic or random.

**Systematic errors** will arise each time sampling is undertaken and are, to some extent, predictable and quantifiable. For example, an inaccurately calibrated pump will produce the same error in a measured sample volume every time it is used until recalibrated.

**Random errors** are difficult to predict and quantify. They can arise at any time. For example, excess loading of dust on a filter will increase the back pressure and cause the pump to slow; or dust may be lost from the surface of a filter due to poor handling; or the volume of reagent placed in a bubbler may be slightly too great.
Systematic errors are easier to control and careful planning and sampling techniques can reduce these. Although more difficult, random errors must also be minimised.

Assuming that the correct method has been selected, errors can occur for the simple reason that samples are taken at the wrong time or in the wrong position and a 'true' estimation of exposure is not obtained. The practitioner should always be thoroughly familiar with the process and should spend time talking to operators and supervisors both before and during the survey to get a 'feel' for the nature of the work and how representative it is.  (The time spent collecting samples is the ideal time to start investigating possible control measures. Always talk with the workers as they often know the process best and already have ideas about ways of improving it).

**Biological hazards**

Testing for biological hazards requires specialist expertise to conduct the tests and to interpret the results and, for safety reasons, specialist facilities.

An option for a simple test for biological hazards was noted in section 1.3 where a 'swab kit' can be used to check possibly contaminated surfaces. Swabs are mailed out by a supplier; swabs are taken of a surface and then sent to a laboratory for culture. A report is then provided by the laboratory.

**Biomechanical hazards**

There are a number of 'tools' for biomechanical analysis. Irrespective of the analysis technique used, preliminary information should be obtained and documented by:

- recording a description of the task;
- sketching the work area noting direction and flow of work and people;
- measuring the physical dimensions of the work environment, objects handled and reach distance using a tape measure; and
- photographing the work area and postures, and noting the movements of people and other factors such as required grip.
Both video and still photography are useful tools in analysing the work environment and biomechanical hazards. When taking photographs or video it is important to obtain clear views from both lateral (flexing, reaching) and rear/front positions (twisting, leaning). This is not artistic or creative photography but a technique for identifying and measuring body angles and movement. Clothing colour and style should allow for the worker being photographed to be easily distinguished against the background. Placing contrasting dots on the worker to indicate key joints such as knee, hip and shoulder will assist analysis.

An indication of forces involved can be obtained by:

- weighing an object using a spring balance or force gauge; and
- measuring push or pull forces using a spring balance or force gauge.

Putting all this information together to assess the risk associated with biomechanical hazards requires some knowledge of how acute and chronic musculoskeletal disorders occur, the role of dynamic work and static posture, and other factors such as the influence of psychosocial hazards. Most codes of practice give some basic information. Learners requiring more in-depth information should refer to an ergonomic text such as Kodak’s *Ergonomic Design for People at Work* (The Eastman Kodak Company, 2003).

Analysis of biomechanical hazards may be qualitative, semi quantitative or quantitative.

**Qualitative analysis**

Qualitative analysis is usually based on checklists such as those included in a number of the Australian codes of practice for manual handling. Checklists may be generic or designed for specific tasks or situations such as for computer-based work stations as given in *Officewise* (WorkSafe Victoria, 1997).
Semi quantitative analysis

Semi quantitative analysis methods combine a checklist with number ratings. One example of this is the *Muscle Fatigue Assessment (MFA)* proposed by Rodgers (The Eastman Kodak Company, 2003). This assessment is based on the hypothesis that a rapidly fatiguing muscle is more susceptible to injury, therefore the risk of injury can be minimised by avoiding muscle fatigue. The MFA assesses the amount of fatigue accumulating in muscles within a five-minute period and is most applicable to tasks performed for an hour or more and where awkward postures or frequent exertions are present (The Eastman Kodak Company, 2003).

To use the MFA:

1. divide the job into tasks and determine the percentage of the shift that each task is done;
2. analyse those tasks that are done for more than 10 per cent of the shift and those tasks that are considered ‘difficult’;
3. for each task, assign an Effort rating for each body region;
4. using the key at the bottom of the table assign a rating for Continuous Effort Duration and Effort Frequency; and
5. refer to the interpretation table to identify the combination of ratings and so the priority for action. (Note that the ratings are not treated arithmetically.)
Rogers Muscle Fatigue Assessment (MFA) Method
(extract only)

<table>
<thead>
<tr>
<th>Region</th>
<th>Effort Level</th>
<th>Scores</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effort</td>
<td>Dur</td>
<td>Freq</td>
</tr>
<tr>
<td>Neck</td>
<td>Light = 1</td>
<td>Moderate = 2</td>
<td>Heavy = 3</td>
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<tr>
<td></td>
<td>Head turned partly to side, back or slightly forward.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Head turned to side, head fully back, or head forward about 20°.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Same as Moderate but with force or weight, or head stretched forward.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulders</td>
<td>Arms slightly away from sides, or arms extended with some support.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arms away from body with no support, or working overhead.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exerting forces or holding weight with arms away from body or overhead.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other body regions: back; arms/elbows; wrists/hands/fingers; legs/knees; and Ankles/feet/toes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>……</td>
<td>……</td>
<td>……</td>
</tr>
</tbody>
</table>

Refer to (The Eastman Kodak Company, 2003) for the full text

<table>
<thead>
<tr>
<th>Continuous Effort Duration</th>
<th>Effort Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6s</td>
<td>&lt;1/min</td>
</tr>
<tr>
<td>6-20s</td>
<td>1-5/min</td>
</tr>
<tr>
<td>20-30s</td>
<td>0.5-15/min</td>
</tr>
<tr>
<td>&gt;30secs</td>
<td>&gt;15/min</td>
</tr>
</tbody>
</table>

MFA Interpretation Table

<table>
<thead>
<tr>
<th>Low (L)</th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Very High (VH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>111, 112, 113, 211, 121, 212, 311, 122, 131, 221</td>
<td>123, 132, 213, 222, 231, 232, 312</td>
<td>223, 313, 321, 322</td>
<td>323, 331, 332, 4xx, 4x4, xx4</td>
</tr>
</tbody>
</table>

(The Eastman Kodak Company, 2003)
A commonly used semi-quantitative tool for assessing manual handling tasks is the *Liberty Mutual Tables* (often called the *Snook Tables*) compiled by Snook and Ciriello (The Eastman Kodak Company, 2003).

These tables indicate the weight in kg that is acceptable to 75 per cent of the female population for the following task parameters:

- horizontal distance from front of body to load;
- distance of lift/carry/push/pull; and
- frequency of action;


**Quantitative analysis**

**NIOSH Revised Lifting Equation**

Developed by the US National Institute of Occupational Safety and Health the NIOSH Equation is a method for assessing the manual handling risks associated with lifting and lowering tasks in the workplace. It is not applicable to manual handling activities such as pushing, pulling, carrying or holding. It also does not apply to one-handed tasks or tasks such as shovelling or handling of people. For lifting tasks it can help to answer two common questions:

- 'What is considered a safe weight to lift in a particular situation or circumstance?'
- 'What can be done to make this lifting safe?'

To apply the NIOSH Equation it is necessary to collect information about the task such as:

- the weight of the object being lifted;
- how often the lifting is done;
- how long the lifting is done for;
- the height of the hands at the start and end of the lift;
- how far the hands are away from the body at the start and end of the lift;
- how good a grip the employee can get on the object; and
- the degree of twisting of the body.
Once this information is collected and the calculations are made, the calculation produces a recommended weight limit for the particular lifting task being assessed. This is the weight nearly all healthy workers doing this task could handle without increasing their risk of incurring lower back pain. Dividing the actual weight by the recommended weight limit gives the Lifting Index. If the Lifting Index is less than or equal to 1 then the lifting is considered safe.

The application and calculation of the NIOSH lifting equation is addressed in detail in Kodak’s ergonomic design for people at work (The Eastman Kodak Company, 2003). However, the Manual handling Assessment Charts (MAC) developed by the UK Health and Safety Executive (Health and Safety Executive) combine the principles of the NIOSH equation, together with other biomechanical information, into a user–friendly set of diagnostic photographs and charts for lifting, carrying and team handling tasks. (Available at www.hse.gov.uk/msd/mac/index.htm)

Software programs for ergonomic analysis

Specialist OHS advisers may use tools such as the 3D Static Strength Prediction Program, developed by the University of Michigan which is utilized to simulate the posture and peak exertion of a worker in three dimensional space, to obtain predictions about the capabilities of a population for performing a task based on the posture, exertion requirements, and the anthropometry* of the work force. (Refer to www.engin.umich.edu/dept/ioe/3DSSPP)
2.2 INTERPRET RESULTS OF WORKPLACE MEASUREMENTS IN ACCORDANCE WITH RECOGNISED STANDARDS

Results of workplace measurements are interpreted with reference to standards. In regard to noise, this is typically $85\text{dB}(A)_{L_{	ext{eq},8\text{hr}}}$, i.e. the measured noise level averaged over an eight-hour shift should not exceed 85 decibels. The results of airborne contaminant sampling are compared with Occupational Exposure Standards that are usually listed as time-weighted average values. The Exposure Standards used in Australia are listed on the Safe Work Australia website (www.ascc.gov.au). The standards are not, however, values that define the boundary between what is safe and what is unsafe. The standards have been established on the basis of acceptable risk for the community at large at the time the standard was set. Therefore, there are compromises and there is an acceptance that, even at exposure levels equivalent to the standards, some individuals may experience some ill-health. Also, standards change over time as more knowledge about risk emerges. As a result, through consultative processes, most workplaces establish action levels that are below the standard and, when risk assessments discover that exposure is approaching or above those levels, action is taken to control the risk.

Risk control is the end point of risk assessment. Therefore, exposure assessment is a means to an end, not an end in itself.

2.3 SEEK INPUT FROM STAKEHOLDERS TO CLARIFY AND CONFIRM ISSUES RELATED TO THE SELECTED HAZARD

While you have searched various sources of information and inspected the workplace, do not forget the people. This is essential not only to ensure that all available information for hazard identification and risk assessment* is obtained, but also because information from those who do the work is vital to ensure the validity of any monitoring.
Consultation as part of risk assessment

Those who do the work (eg operators, maintenance personnel, cleaners) have a wealth of practical experience that can contribute to identifying hazards and assessing risk. Those who have technical knowledge about the work (eg designers, engineers, chemists and technician roles) can add another perspective as can, of course, expert OHS advisers. Anybody who may have a stake in the work or safety outcomes will have something to contribute and the right to be involved.

Effective hazard identification and risk assessment requires analysis of documentation, the work environment and the people. Risk assessment based only on technical information will be incomplete as will any risk assessment that takes account only of the people doing the work without a sound knowledge and research base.

The following checklist is a useful tool for ensuring that stakeholders, key personnel and OHS specialists are consulted as required. Some people will have information that is more relevant to certain hazards. Remember, there may be a number of ways that you can obtain the information, through informal discussion or more formal processes such as meetings, focus groups, surveys or interviews.
PEOPLE SOURCES OF INFORMATION FOR HAZARD IDENTIFICATION

Stakeholders – those people or organisations who may be affected by or perceive themselves to be affected by an activity or decision.

Stakeholders in workplace OHS include:
- managers;
- supervisors;
- health and safety and other employee representatives;
- OHS committees;
- employees and contractors; and
- the community.

Key personnel are:
- people who are involved in OHS decision-making or who are affected by decisions.

OHS technical advisers are people providing specific technical knowledge or expertise in areas related to OHS and may include:
- risk managers;
- health professionals;
- injury management advisers;
- legal practitioners with experience in OHS;
- engineers (such as design; acoustic; mechanical; civil);
- security and emergency response personnel;
- workplace trainers and assessors; and
- maintenance and tradespersons.

OHS specialists are people who specialise in one of the many disciplines that make up OHS including:
- safety professionals;
- ergonomists;
- occupational hygienists;
- audiologists;
- safety engineers;
- toxicologists; and
- occupational health professionals.
Consultation as part of workplace monitoring

Piney (2002) noted that:

_To analyse a workplace exposure fully requires an understanding of work processes, work operations and tasks. It is essential to identify significant sources of containment emission…and to understand how these can cause exposures to particular work groups._

(M. Piney, 2002)

Such an understanding can be obtained only by consulting with the work group and those who organise the work. One of the principle errors in the prosecution of the OHS consultant reported by Piney was that:

_not all the potentially exposed work groups were identified and surveyed, and not enough personal samples were taken. It is also conceivable that the working conditions on the day of the survey were atypical._

(M. Piney, 2002)

It is likely that these errors would not have occurred had there been effective consultation with the work group when planning the sampling strategy.

2.4 REPORT RESULTS OF WORKPLACE MEASUREMENTS AND INTERPRETATIONS TO STAKEHOLDERS IN A FORMAT EASILY UNDERSTANDABLE BY THE TARGET GROUP

Having made the measurements and recorded the results, the outcomes and the interpretations need to be reported in a format that is easily understood by the people who are exposed to the hazard and those who need to act on the outcomes including:

- managers;
- engineers, designers; and
- purchasing personnel.
In regard to occupational health, we should also consider longer-term users of information such as:

- occupational hygienists who are undertaking repeat measures for comparative purposes;
- researchers attempting to establish databases of exposure data for the purposes of predicting exposures that may be associated with typical processes; and
- epidemiologists attempting to link health records with past exposures.

Thus, reports should contain sufficient information about the workplace, processes, machinery etc, for people in the future to understand what it was like.

In addition, reports should detail the current state of knowledge about the hazard being assessed and thus the assumptions that underpin the risk assessment. The current standard should be detailed. The limitations in expertise of the report writer and the need to obtain further advice should also be noted in the report when appropriate.

The stages in report writing are:

1. determine the reason for the report;
2. identify the recipient;
3. decide on approach – clarify objective, identify response you need, consider the matter from the receivers’ point of view;
4. research and collect facts;
5. organise information;
6. write first draft;
7. revise draft – including having somebody else read the report (check for sentence length, wordy expression, spelling, use of technical or jargon terms, sexist language, allocating blame or anything that may arouse hostility in the recipient); and
8. write final draft.
GUIDELINES FOR EFFECTIVE WRITTEN COMMUNICATION

Know your reader
Who will read the report? What do they know about the problem? What do they need to know? How can the information best be provided so that they can make an informed decision?

Keep to simple language
Using fancy, big or technical words will only blur your message. However, oversimplification can also lead to inaccuracies in technical information.

Keep the report short while still giving the information
The value of the report is not measured by its size. The more wordy the report, the more likely that the message will not be received, or will be clouded.

Do not use long rambling sentences
If a sentence has more than 20 words, see if you can express it in a different way.

Present only the facts
Do not use emotive language. State the source of your facts.

Make sure your recommendations and the required actions of the reader are clearly stated
Do not leave the reader guessing as to what you want them to do.

2.5 ASSESS RISKS ASSOCIATED WITH IDENTIFIED HAZARDS IN THE WORK ENVIRONMENT IN CONSULTATION WITH STAKEHOLDERS AND TAKE INTO ACCOUNT EFFECTIVENESS OF EXISTING CONTROLS

The concept of ‘risk’ was explored in detail in the learning guide for BSBOHS504 Apply principles of OHS risk management. Some points are noted below as a refresher.

Risk is variable depending on the circumstances and conditions. It is measured in terms of the consequences of the possible outcome and the probability (level of certainty or likelihood) that the particular consequences will occur.
The objective of risk assessment is to develop an understanding of the hazard and its associated risk. In this learning guide, risk assessment is defined as analysing a hazard to:

- identify factors influencing the risk and the range of potential consequences;
- evaluate the effectiveness of existing controls;
- estimate the likelihood of the consequence, considering exposure and hazard level;

and combining these in some way to obtain a level of risk or to prioritise the risk for action.

The second component of risk assessment is risk evaluation, which involves applying the outcomes of risk analysis to inform decision-making about risk. This decision-making process is addressed in section 2.6.

In some organisations, risk assessments are treated as an end in themselves but they should be just part of the three-step process of:

- hazard identification;
- risk assessment; and
- risk control.

**Identify factors contributing to risk**

Factors influencing the risk may be associated with:

- organisational and management environment;
- physical environment;
- equipment;
- procedures; and
- people and human error.

These factors, which were introduced at the beginning of Element 2 and outlined in a concept map, need to be revisited to identify factors contributing to risk.
An additional factor, exposure, must be considered as a factor influencing risk. Exposure is affected by the:

- frequency that the task is carried out or the times a person is exposed to the hazard;
- duration of the exposure; and
- number of people exposed/involved in the task.

**Identify and evaluate current controls**

History developed from investigating occurrences and workplace OHS issues shows that there are six predictable ways in which risk controls fail:

- inadequate initial design;
- inadequate installation;
- incorrect usage;
- inadequate maintenance;
- changing parameters of the problem such as changes in personnel, materials or work methods; and
- authorised or unauthorised modifications to equipment or processes.

When evaluating the effectiveness of controls, it is important to consider these predictable ways in which controls may fail, together with the factors that may influence the risk:

- the organisational and management environment;
- the physical environment;
- equipment;
- procedures; and
- people and human error.

**Risk controls fail when there is an interaction of one or more of the workplace factors to create one or more predictable causes of failure in risk control.**

Ways in which control measures for specific hazards such as noise, airborne contaminants and biomechanical hazards are applied is discussed in section 3.3.
Developing risk controls is addressed in Element 3 Control risk of this learning guide where you will apply three criteria for evaluating the effectiveness of risk controls as part of risk assessment. The three criteria are:

- the hierarchy of control;
- legislation and other standards; and
- effectiveness of monitoring of the controls.

**Hierarchy of control**

The hierarchy of control gives the priority order in which hazard and risk controls should be considered with the eventual outcome often being a combination of measures. The prime emphasis is on:

- elimination of the hazard;

and where this is not practicable, minimisation of risk by:

- substitution;
- engineering controls, including isolating the hazard from personnel;

then, when these options have been implemented as far as is practicable:

- administrative controls (eg procedures, training); and
- personal protective equipment (PPE).

This hierarchy can be presented as a triangle where the area of the triangle represents the effectiveness or reliability of the control and the area outside the triangle indicates the opportunity for the control to fail.
The ‘traffic light’ colouring is a reminder of the priority of the control option. For a task assessed as HIGH RISK:

- the use of PPE as a sole risk control, or even PPE and administrative controls is a **STOP** (not acceptable);
- engineering controls, including isolation may be acceptable, but should be used with **CAUTION**; and
- elimination or substitution are the control options of choice and should be considered **GO**.

The hierarchy of control is a general principle. The labels for each level may be modified to best suit the particular type of hazard.

**Legislation and other ‘standards’**

In addition to using the hierarchy of control as a guide when evaluating effectiveness of controls, other factors to consider include whether:

- the law is satisfied;
- the controls meet or exceed industry standards; and
- the controls take account of currently available knowledge.
Hazard-specific legislation may require specific risk control actions. For example, the WA Occupational Health and Safety Regulations 1996 define a ‘toxic atmosphere’ and the PPE which must be worn where other controls have been applied or are inappropriate and a risk remains. Noise and lead regulations usually require specific actions.

As noted in section 1.1 of this learning guide, codes of practice provide examples of recommended levels of control, while Australian Standards establish minimum levels of exposure or practice.

Current industrial practices are also used as an example of minimum standards. This is particularly applicable when there has been a major shift in industrial practice. One example is the now standard practice of using airline supplied respiratory protective equipment for spraying 2-pack paint. This is not regulated as such but has become a minimum standard enforced by OHS inspectors.

The recent controversy regarding the exposure to beryllium of personnel in the armed services highlights the need to consider current knowledge in evaluating the adequacy of controls as part of risk analysis. Reports indicate that there was knowledge of the risk in 1980 (Osborne, 2005) but beryllium-based equipment was used until 1985 (Borger, 2005). Also, exposure standards for a range of chemicals are revised frequently, usually resulting in a lowering of the ‘acceptable’ level for the chemical – an example of the impact of considering current knowledge when determining adequacy of controls.

**Monitoring of controls**

The third factor in considering the adequacy of risk controls as part of risk assessment is the monitoring processes:

- Do the support systems and management processes ensure that controls are in place, effective and reliable?
- What processes warn when the controls may be breaking down?
- Will these warnings or alerts be heeded?
Section 1.2 of this learning guide listed sources of workplace data for identifying hazards, which included:

- hazard, incident and injury reports;
- investigation reports;
- workplace inspections;
- minutes of meetings;
- risk registers;
- Job Safety Analyses (JSA) and risk assessments;
- work procedures including standard operating procedures (SOP);
- maintenance records;
- organisational data such as insurance records, enforcement notices and actions, and workers’ compensation data;
- reports and audits;
- collated information such as trend analyses of incident and injury reports, and OHS performance data;
- Material Safety Data Sheets (MSDS) and registers;
- employees’ handbooks; and
- manufacturers’ manuals and specifications.

The information collected and analysed for hazard identification will also provide information on the effectiveness of controls.

The other important factor to remember when evaluating the effectiveness of controls is that the preconditions leading up to injury and damage may take a long time to develop. Thus the indicators for potential failure may not be evident in the workplace data. This is where workplace analysis of compliance with procedures and awareness of risk is important. These approaches are sometimes called behavioural safety, risk awareness or safety culture and are usually measured by surveys (of managers as well as those carrying out tasks identified as risky).

Hopkins (2000) in Lessons from Longford, highlighted this issue of ‘warning signs’ that indicate the potential for failure and the need for the organisation to be ‘mindful’ and attentive to such signs.
Estimate level of risk

Estimating risk of a particular task or scenario requires:

- identifying the most likely consequences of injury, ill-health or harm;
- determining the exposure to the task or hazard in terms of frequency, duration and numbers of people; and
- estimating the likelihood of the identified consequence occurring.

Estimating the consequence requires understanding how the hazard causes harm and how changing one or more of the risk factors influences the potential seriousness of the consequences and the likelihood of the consequences occurring. In many cases the interaction of the different risk factors is not a simple relationship and there may be a complex interaction between the risk factors.

*Additive effects* occur where there is a simple relationship and the combined effect is equal to the sum of each ($2 + 3 = 5$).

*Synergistic effects* occur when the combined effect of two agents is greater than the sum of the individual effect of each ($2 + 3 = 10$), eg combined exposure to carbon tetrachloride and ethanol; combined exposure to asbestos and smoking; the combined effect of some biomechanical risk factors, such as lifting a load while bending forward.

*Potentiative effects* occur where one agent does not have an effect but when added to another it makes the latter more toxic ($0 + 2 = 10$), eg isopropanol and carbon tetrachloride.

*Antagonistic effects* occur where the combined effects of two agents are less than the sum of each agent alone.

While comparison with exposure standards provides a benchmark, judgement is often required in estimating consequence and likelihood. People’s estimates of the level of risk are influenced by factors such as previous experience and knowledge, especially as it relates to the way the hazard causes injury or damage, which leads to problems in the validity and reliability of risk assessments.
Risk perception

People tend to judge an event as frequent or likely if the event is easy to imagine or recall (e.g., dramatic causes of death, personally encountered events such as death of friends). These events are usually overestimated compared with more common, less dramatic events. People also downgrade the risk if the threat will not be experienced until later in life.

Another problem is the assumption that no information on frequency means it is not likely to occur! This is further complicated by many people’s difficulty in dealing with large numerical values when estimates of risk are usually represented in large numbers such as 1 in 1,000,000 or $10^6$.

People’s estimates of risk may be based on particular information that stays in their mind and often persists in the face of new and more convincing information.

These factors influence people’s estimates of risk, including those made by experts. Accepting that risk perception is subjective is an important basis for ensuring that risk assessments are as objective and equitable as possible.

Another aspect of risk perception is the concept of ‘safe’ or ‘acceptable’ risk. ‘Safe’ is an often misused term as no activity or environment can be 100 per cent risk free. ‘Safe’ is generally taken to mean that the level of risk is as low as is reasonably practicable, does not breach any OHS legislation, is equitable and has the informed approval of those exposed to the risk.

People are more likely to accept risks that are perceived as voluntary, such as driving a car to work or playing sport. However, workers may ‘accept’ a degree of risk that they otherwise would refuse if they perceive that their job, or their level of pay, is threatened if they refuse. Therefore, the matter of choice (voluntary or imposed risk) may not be appropriate for work-related risks. One of the key factors in ‘acceptability’ of risk is seen to be the level of control that people feel that they have over the source of the risk.

There is no technical answer to what is an acceptable risk, as it is a complex interaction of technical, commercial and social factors. Recognition of the subjectivity of risk perception enables us to move on in the prioritisation of risks.
Communication about risk

Hopkins noted the role of communication (or lack of) as a factor in the failure to identify the development of the pre-conditions that led to the Longford explosion. He pointed out that:

‘one of the recurrent findings in disaster research is that information that something was wrong was available somewhere within the organisation but was not communicated to relevant decision makers.’

(Hopkins, 2000)

Workers are often aware of information which might indicate a problem. However, they may not pass it on because they are unable to articulate the problem or they feel that it will not be well received. It is vital that stakeholders and key personnel are offered the opportunity to have input in a receptive and safe environment.

It is also important to recognise that knowledge of the work task does not necessarily mean knowledge of the risk associated with the task. Therefore, a ‘team’ approach is important where those doing the work, those affected and those who are knowledgeable about the hazard and risk all have input and where there is opportunity to explore the viewpoints of others.

Process for risk assessment

How can we take account of these issues of validity and reliability to bring some structure to the process?

The following process was introduced in the learning guide for BSBOHS403 Identify hazards and assess OHS risk and in the learning guide for BSBOHS504 Apply principles of OHS risk management.
**RISK ASSESSMENT**

1. Estimate the potential for damage where there are no controls, e.g:
   - HIGH = death or permanent impairment
   - MEDIUM = temporary impairment
   - LOW = only minor inconvenience.

2. Estimate the effectiveness of the controls in place.

3. Estimate the consequences or seriousness if injury occurred.

4. Estimate the likelihood of being injured when proper controls are in place. This is a ‘what if’ process:
   - What could happen if …?
   - Is it possible that …?
   - Could someone …?
   - Has anybody ever …?
   - How often …?
   - Do not say, ‘it could not happen’!

5. Combine these estimates to obtain a level of risk.

**Tools for risk prioritisation**

The most common tools used to combine estimates of consequence and likelihood (and sometimes exposure) are nomograms* and matrices. One of the factors influencing the reliability of such tools in prioritising risk is the variation in how different people view the risk associated with a particular situation.

Care should be taken to ensure that the criteria the tool applies are modified to have meaning for the particular work situation, and that the people involved have a common understanding of the criteria.
For example:

<table>
<thead>
<tr>
<th>How would you interpret descriptors of likelihood such as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>almost certain</td>
</tr>
<tr>
<td>likely</td>
</tr>
<tr>
<td>moderate</td>
</tr>
<tr>
<td>unlikely</td>
</tr>
<tr>
<td>rare?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What about descriptors of consequence such as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>insignificant</td>
</tr>
<tr>
<td>minor</td>
</tr>
<tr>
<td>moderate</td>
</tr>
<tr>
<td>major</td>
</tr>
<tr>
<td>catastrophic?</td>
</tr>
</tbody>
</table>

Ask five people how they would interpret these terms. How much variation do you get in the responses?

How could you allow for cumulative exposure in the likelihood descriptors?

Section 6 of the handbook for AS 4360:2004, *Risk management* (Standards Australia, 2004b) and Appendix B of the *OHS Risk Management Handbook* (Standards Australia, 2004a) discuss the use of risk analysis (assessment) tools.

The magnitude of any discrepancy between the outcomes of monitoring and the exposure standard will give an indication as to the most appropriate likelihood and exposure descriptors.

**Recognise limitations of own expertise and seek advice**

It has been identified that risk assessment is a subjective process. The information collected, the consultation processes, the monitoring, together with knowledge of how the hazard causes damage and risk assessment, all impact on the validity of the outcome.
The outcomes of the risk assessment will inform decision-making about risk control. What might be the impact if the risk assessment is based on inappropriate assumptions or incorrect or incomplete information?

*In 1994 eleven men died in an underground mine explosion at Moura in Queensland when there was spontaneous combustion of coal in an area with a high concentration of methane.*

*Just months before the explosion a risk assessment identified the risk of spontaneous combustion and rated it as 'unlikely' and 'unable to cause harm to employees' as it did not consider the combined scenario of spontaneous combustion and a build up of methane. This was despite explosions occurring in similar circumstances in other mines.*

(Hopkins, 1999)

It is vital that the OHS practitioner recognise the limitations in his or her own expertise and the combined expertise of those informing the risk assessment process; and know how and where to seek specialist advice. The more serious the potential consequence, the more important it is to ensure that a high level of specialist advice informs the risk assessment process.

### 2.6 IDENTIFY AND PRIORITISE HAZARDOUS TASKS OR CONDITIONS REQUIRING CONTROL ACTION IN CONSULTATION WITH STAKEHOLDERS, TAKING ACCOUNT OF RECOGNISED STANDARDS

Is there a discrepancy between the current control and the required level of control for the hazard being investigated?

While no activity or environment can be 100 per cent risk free there is a legal obligation to minimise risk as far as is practicable. Thus the question becomes:

> 'What is a practicable level of control?'
Prioritising for action

A common approach (Standards Australia, 2004b) is to divide risks into three bands as below.

The concept of ALARP (As Low As Reasonably Practicable) encompasses the ideas of practicality (can something be done?) and also the costs and benefits of action or inaction (is it worth doing something in the circumstances?). These two aspects need to be balanced carefully in determining ‘practicability’.

Another concept associated with ‘practicable’ is that of ‘reasonable’. Employers, people in control of workplaces, and those who influence the ‘supply chain’ such as designers, manufacturers and importers, are expected to take steps that are practicable and reasonable to ensure the safety of employees and others.

These concepts of reasonable and practicable were explored in BSBOH408 Assist with compliance with OHS and other relevant laws.

In summary, the controls are acceptable where:

- the law is satisfied;
- the cost of putting safeguards in place is measured against the consequences of failing to do so, not whether the employer considers they can afford the safeguards;
- controls take account of currently available knowledge and meet or exceed industry standards; and
the people exposed to or affected by the risk feel comfortable about it.

A key point is that knowledge and technology change; therefore, what was an acceptable level of risk control yesterday may not currently be acceptable at a later date.

Having decided what is the practicable or required level of control, the hazards requiring further action can be identified. In most cases there will also be the issue of limited resources, so there may be a need to prioritise risks for allocation of resources.

One process for prioritising tasks or hazards is given below.

<table>
<thead>
<tr>
<th>Prioritise risks for action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Is it a <strong>must do?</strong> ie it has a potential for high consequence such as a fatality, or it is required by law (refer to exposure standards and practicability as indicated by the risk assessment).</td>
</tr>
<tr>
<td>2 Is it <strong>cheap and easy?</strong></td>
</tr>
<tr>
<td>3 Is it a <strong>should do?</strong> ie it is recommended by a code of practice, standard or risk assessment</td>
</tr>
<tr>
<td>4 Is it a <strong>could do?</strong> ie it is based on standard cost-effective analysis or risk assessment.</td>
</tr>
</tbody>
</table>

Technically, no further prioritisation is required for the 'must do' risk. In reality there may be a ranking for action, but any employer who postpones a ‘must do’ leaves themselves open to legal action whether or not an injury occurs.

**Use and interpretation of outcomes from risk prioritisation tools**

Risk prioritisation tools are useful, but a number of writers have expressed concern regarding the reliability of a range of risk assessment tools:

*For each tool, there was considerable variation in the assessments made by different individuals. Furthermore, there was only a moderate degree of correlation between the assessments made by the same individual using different tools.*

(Harvey, 2002)
The issues are well summarised by Cross and Tretheway:

*Current practice in risk assessment is highly unreliable … a simple qualitative description of the magnitude of risk does not perform the function (of requiring managers to understand and take responsibility for the risks in their workplace). … Legislation requires employers to eliminate hazards or minimise all risks to health and safety. Ranking risks should be purely an administrative convenience to allow sensible consideration of where to start when a range of actions are required. (But) it has become the core of OHS risk management activity.*

(Cross & Tretheway, 2002)

An example of such problems occurred in a large multinational organisation that required all risks assessed at ‘10’ or greater to be reported to head office. Examination of the risk assessments found that 90 per cent of risks were assessed at ‘9’!

The *OHS Risk Management Handbook* HB 205-2004 (Standards Australia, 2004a) gives an analysis of the strengths and weaknesses of several prioritisation tools. It notes that 'the matrix does not work well as a decision tool, particularly concerning the need for action on high consequence-low probability risks’ (Standards Australia, 2004a).

The reliability and interpretation problems associated with risk assessment tools are further exacerbated in assessing risk of hazards with long latency or from cumulative exposure.

Risk analysis tools may be quantitative (ie number based) or qualitative (ie word based). Quantitative analysis tools have similar limitations to those of qualitative tools, but the existence of a number is sometimes used to imply a level of precision that cannot be justified.

Andrew Hopkins comments on the management emphasis sometimes placed on quantitative risk assessments:

*... it should never be allowed to over-ride sound professional judgements about necessary risk reduction measures. It can, however, have more modest uses, such as helping to determine priorities'.*

(Hopkins, 2004).
In summary:

- risk assessments are subjective and have limitations which should be taken into account when they are the basis for decisions;
- efforts need to be made to ensure that risk assessments are as informed and equitable as possible; and
- risk assessments are a tool to support management decision-making – they should not be the sole driver of such decisions.

The implications of risk perception, risk acceptance and assuming that knowledge of the task equalled knowledge of the risk were tragically highlighted when an employee of a national packaging company died as the result of being pulled into the rollers of an unguarded paper-making machine. In handing down the judgement in a prosecution, the judge commented that:

> 'while it was a classic industrial accident a risk assessment had described it as a 'remote possibility'.

The AGE newspaper, 29 October 2004 (Leung, 2004)

### 2.7 ESTABLISH AND UPDATE RISK REGISTER AS APPROPRIATE

A hazard or risk register is a document detailing:

- a list of hazards, their location and people exposed;
- a range of possible scenarios or circumstances under which these hazards may cause injury or damage;
- the nature of injury or damage that may be caused;
- the results of the risk assessment; and may also include
- possible control measures and dates for implementation.

‘Risk register’ has become the preferred term as a ‘hazard register’ implies the inclusion of only limited information relating to the sources of risk, rather than the consequences and control measures.
A risk register may be formatted to contain:

- unique record number for the hazard;
- date identified/assessed;
- location of hazard;
- who or what is exposed;
- ‘owner’ of the hazard (manager or responsible person for the area);
- description of hazard and risk factors;
- current controls;
- conditions under which there may be loss of control of the hazard and the consequences for each situation;
- outcomes of risk assessment (risk ranking or risk score; decision regarding need for action); and
- further controls required.

Section ten of the *Risk Management Guidelines* (Standards Australia, 2004b) gives some sample formats for a risk register.

**Competency check for Element 2**

Key issues for each performance criterion in this section are as follows:

2.1 Identify and appropriately use equipment and strategies required for basic workplace measurement and monitoring of the selected hazard:

- Specialist advisers, workers in the area and other relevant persons are consulted prior to determining monitoring technique and strategy.
- Sampling strategy is determined, taking account of the exposure of the workers, the nature of the work and the hazard.
- Appropriate equipment is selected, considering the hazard, the nature of the work and the sampling method.
- Sampling techniques minimise systematic and random errors.
2.2 Interpret results of workplace measurements in accordance with recognised standards:

- Occupational exposure standards are located and retrieved.
- A determination of risk is made against an appropriate standard.

2.3 Seek input from stakeholders to clarify and confirm issues related to the selected hazard:

- Information is sought from those who have information about the hazard, those who do the work and others who may have a stake in the work or safety outcomes.
- Those who do the work and those who organise the work are consulted to minimise error in the sampling process.

2.4 Report results of workplace measurements and interpretations to stakeholders in a format easily understandable by the target group:

- Target group for reported outcomes of the monitoring is identified.
- A professional, written report containing the necessary elements is produced.

2.5 Assess risks associated with identified hazards in the work environment in consultation with stakeholders and take into account effectiveness of existing controls:

- Risk factors for the task environment, including the organisational and management environment, physical environment, equipment, procedures and people are identified.
- Exposure parameters of frequency, duration and number of people are clearly defined and related to the outcomes of the monitoring.
- Risk factors associated with task demands, organisation of work and work relationships are identified.
• Current risk controls are identified and evaluated taking account of the hierarchy of control, legislation and standards, and processes for monitoring effectiveness of the controls.
• Suitable processes and tools are used to estimate level of risk.
• The need for specialist advice is recognised and actioned as appropriate.

2.6 Identify and prioritise hazardous tasks or conditions requiring control action in consultation with stakeholders, taking account of recognised standards:

• Hazardous tasks and conditions requiring control are identified considering the principles underpinning ALARP.
• An appropriate process is applied to prioritise hazards for action.
• Limitations of risk ranking tools are recognised.

2.7 Establish and update risk register as appropriate:

• OHS risk register includes information required to record and track hazards and risks in the organisation and the status of those risks.
Case Study 2

The case study begun in Section 1 of this learning guide is continued here.

A medium-sized manufacturing company employing 100 people produces boilers, gas cylinders and other pressed metal products. The production plant is very noisy, communication is difficult and employees have to shout to be heard. Following a claim for noise-induced hearing loss from an employee who had left the company recently, hazard identification was undertaken involving:

- accessing external sources of information;
- accessing and reviewing workplace sources of information; and
- a preliminary noise survey of the workplace.

The next step was to analyse the work environment to assess the risk.

**Use equipment and strategies for basic workplace monitoring**

After reviewing the requirements for noise assessments (WorkSafe Victoria, 2005b), the company decided to engage an occupational hygienist to carry out a noise assessment of the workplace.

The occupational hygienist advised the company that assessment of the daily noise exposure was not a simple task as none of the workers stayed in the same area for the whole day. The hygienist then advised that two types of measurement would be undertaken:

- an estimate of the daily noise dose using dosimeters worn by the workers; and
- measurement of noise levels at various locations in the plant and under a range of operating conditions.
The hygienist attached noise dosimeters to selected workers at the beginning of the shift and then read the outcome at the end of the shift. The noise dosimeter is a small sound level meter that measures the workers' noise exposure ($L_{Aeq,8h}$) over the whole day and provides a record in the form of a histogram of the average noise level and peak noise level per minute for the entire shift. Where patterns of movement and work are recorded, the readings on the histogram can be correlated with the task being undertaken.

The occupational hygienist also used a precision sound level meter held at the ear level of the operator to measure sound pressure levels. These measurements were taken over sufficient time to give a representative average sound levels for a particular job or process. Measurements were taken with various combinations of machinery operating and also close to key parts of the machinery to enable sources of noise to be identified for the purposes of noise control.

**Interpret results of workplace measurements**

The sound pressure levels together with the duration of the task were used by the occupational hygienist to calculate a partial noise dose. These were then added to give a daily noise exposure.

The results indicated that the daily noise exposure was 94 $L_{Aeq,8hr}$. Therefore, the workers would exceed their exposure of 85 $L_{Aeq,8hr}$ in one hour (WorkSafe Victoria, 2005b). As a 3dB increase in noise level is equivalent to doubling the rate of flow of noise energy, the workers in this workplace would have been exposed to eight times the acceptable daily dose of noise energy.

It was found that there were several noisy processes that contributed to this noise exposure.

<table>
<thead>
<tr>
<th>Equipment/process</th>
<th>Noise level at operator’s ear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch press</td>
<td>95dB(A) constant (fly wheel)</td>
</tr>
<tr>
<td></td>
<td>100dB(A) impact (stamping)</td>
</tr>
<tr>
<td></td>
<td>97dB(A) release of air</td>
</tr>
<tr>
<td>Valve tightening</td>
<td>107dB(A)</td>
</tr>
<tr>
<td>Metal number/letter stamping</td>
<td>113dB(A)</td>
</tr>
</tbody>
</table>
Seek input from stakeholders

As part of developing the sampling strategy and recording and interpreting the results, the occupational hygienist consulted with the workgroup to ensure that the measurements taken were a good representation of the workers' actual exposure. Information collected from the work group included:

- normal work processes and practices;
- normal operations of machines;
- patterns of movement;
- time usually spent at a particular location/work station;
- frequency of deviations from normal practice;
- level and pace of production; and
- any other factors that may affect exposure.

Report results of workplace measurements

The occupational hygienist provided a detailed report on the results of the noise assessment and the interpretation of the results and actions required. Copies of this detailed report were provided to the managers, the health and safety representative and other members of the OHS committee. Two copies were placed in the lunch room for anybody to read. The hygienist was also asked to provide a one-page summary written in simple language which could be posted for all employees to read.

The occupational hygienist was asked to attend a meeting of the OHS committee to explain the assessment process, the results and actions required, and to answer any questions.
Assess the risk associated with hazardous tasks or conditions

**Punch press**
A 60-tonne mechanical press was used in the production of steel lids for metal containers. An operator manually fed sheets of steel into the press then depressed a foot pedal to engage the flywheel drive mechanism to the cutting die assembly, which then stamped out the lids.

**Valve tightening**
Gas cylinders were fitted with an on/off valve screwed into a socket which had previously been welded into the cylinder body during manufacture. The valve required tightening to a specific torque setting during final assembly of the cylinder. An impact wrench was used for this tightening.
Stamping of serial numbers on the metal cylinders (example)
This process was performed using a hammer and a set of number/letter stamps hammered into the surface of a cylinder.

1 Identify risk factors

<table>
<thead>
<tr>
<th></th>
<th>Factors contributing to risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch press</td>
<td>Equipment:</td>
</tr>
<tr>
<td></td>
<td>• air release through flattened copper tubes;</td>
</tr>
<tr>
<td></td>
<td>• design of punch; and</td>
</tr>
<tr>
<td></td>
<td>• vibration of equipment parts.</td>
</tr>
<tr>
<td>Valve tightening</td>
<td>Equipment:</td>
</tr>
<tr>
<td></td>
<td>• impact wrench.</td>
</tr>
<tr>
<td>Metal number/letter stamping</td>
<td>Equipment:</td>
</tr>
<tr>
<td></td>
<td>• metal.</td>
</tr>
<tr>
<td></td>
<td>Procedure:</td>
</tr>
<tr>
<td></td>
<td>• hammering.</td>
</tr>
<tr>
<td></td>
<td>Environment:</td>
</tr>
<tr>
<td></td>
<td>• metal walls and the metal of the stacked cylinders.</td>
</tr>
</tbody>
</table>

2 Identify and evaluate current controls

The only control currently in place is hearing protection and this has not been accompanied by training or education on the hazards of noise exposure or the requirements for effective use of hearing protection. In this workplace, hearing protection is quite inadequate as a control, as the exposure level will be exceeded if hearing protection is removed for a short period. Also, research has shown that hearing protection often provides less protection in practice than under laboratory test conditions because of factors such as poor fitting, hardening of cushions, and leakage around spectacle frames.

Not only are the current controls unreliable, as indicated by the level on the hierarchy of control, there is also little monitoring of the correct use of the hearing protection.
The control strategy does not comply with the legislative requirements that the control priorities must be (in order):

- elimination of the noise source;
- substitution of quieter processes or engineering controls to reduce the noise level;
- administrative controls to reduce the noise exposure; and
- provision of hearing protection.

(WorkSafe Victoria, 2005b)

**Estimate level of risk**

The level of risk is determined by considering the seriousness of the consequence and the likelihood of the consequence occurring. All the people working near the machines are at risk of developing noise-induced hearing loss. The likelihood of this occurring is influenced by the magnitude of the noise and the person’s exposure to the noise. Therefore, the average time spent by workers in the area, together with peak levels, is important.

<table>
<thead>
<tr>
<th>Equipment/process</th>
<th>Noise level at operator’s ear</th>
<th>Possible exposure time*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch press</td>
<td>94dB(A) constant (fly wheel)</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>100dB(A) impact (stamping)</td>
<td>(15 min)</td>
</tr>
<tr>
<td></td>
<td>97dB(A) release of air</td>
<td>(30 min)</td>
</tr>
<tr>
<td>Valve tightening</td>
<td>106dB(A)</td>
<td>3.8 min</td>
</tr>
<tr>
<td>Metal number/letter stamping</td>
<td>112dB(A)</td>
<td>57 sec</td>
</tr>
</tbody>
</table>

* (WorkSafe Victoria, 2005b)

**Identify and prioritise hazardous tasks requiring control**

The noise associated with each of the tasks is greater than the exposure limit; therefore, in accordance with legislation, each task is a **must do** for control action. There may be some prioritisation as to which task is tackled first, but action must be taken to reduce the noise associated with each task/item of equipment.
### Establish and update risk register

<table>
<thead>
<tr>
<th>Record No</th>
<th>Date of entry</th>
<th>Location</th>
<th>Hazard owner/manager</th>
<th>Hazard</th>
<th>Possible injuries/damage</th>
<th>Potential scenario/conditions where injury/damage could occur</th>
<th>Risk score</th>
<th>Further action required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Punch press</td>
<td>Noise</td>
<td>Hearing loss &amp; other health hazards.</td>
<td>Operator working w/o hearing protection, or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valve tightening</td>
<td>Noise</td>
<td>Hearing loss &amp; other health hazards.</td>
<td>Operator working w/o hearing protection, or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number stamper</td>
<td>Noise</td>
<td>Hearing loss &amp; other health hazards.</td>
<td>Operator working w/o hearing protection, or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
<td></td>
</tr>
</tbody>
</table>
Activity 2

Keep a copy of this Activity for your Assessment Portfolio.

This activity continues the work that you began in Activity 1 where you collected information to enable you to identify hazardous tasks or conditions.

Analyse work environment to assess risk

For your selected hazard(s), conduct basic workplace monitoring as a basis for risk assessment and provide a report to the OHS committee.

Note that this activity is NOT intended to be an advanced occupational hygiene survey. It may be carried out in liaison with an occupational hygienist or under their instruction. If completed alone then ensure that you recognise your professional limitations.

1 Identify appropriate equipment to carry out basic workplace monitoring. Include in your report a discussion of the options available and why you selected the nominated equipment and technique.

2 Develop a sampling plan that addresses who, where, when and how. Explain the factors you considered in developing the plan, who you consulted in the workplace and any specialist advisers.

3 In your report address the outcomes of the monitoring including:
   (i) any anomalies or difficulties in the process;
   (ii) those consulted as part of the monitoring;
   (iii) reference to any relevant standards; and
   (iv) identified areas for further action.
4 Assess the risk of the hazards:
   (i) Identify the factors that contribute to the risk (consider organisational and management environment, physical environment, equipment, procedures and people and exposure).
   (ii) Identify the current controls in place.
   (iii) Evaluate the effectiveness of the current controls with reference to the hierarchy of control, legislation and any relevant standards, any processes for monitoring the effectiveness of the current controls.
   (iv) Estimate the level of risk by identifying the exposure, the potential consequence and the likelihood of the consequence. If appropriate, use a risk ranking tool. If such a tool is used, explain the use of the tool and the reasons for selecting the particular descriptor.
   (v) Prioritise, or rank, the risks for further action. Consider legislative requirements and the potential for high consequence in your recommendations.
   (vi) Comment on the level of subjectivity and reliability of your risk assessment process and outcomes.

5 Complete a risk register for the hazards identified and risks assessed.
Element 3: CONTROL RISK ASSOCIATED WITH A HAZARD

You have now identified hazardous tasks and conditions, conducted workplace monitoring as a basis for risk assessment, and assessed and prioritised the risks for further action. This element deals with developing and implementing risk controls.

In order to complete the third element of this competency unit successfully, you will have to show that you have satisfied the following performance criteria:

3.1 Seek information and data from external sources on control options for the specific hazard.

3.2 Seek information and data from stakeholders and key personnel on control options for the specific hazard.

3.3 Develop and advise a range of control options, in consultation with stakeholders and key personnel, by applying the hierarchy of control, noting that personal protective equipment (PPE) is regarded as the least satisfactory control measure.

3.4 Identify factors with a potential to impact on the effectiveness of controls.

3.5 Develop control strategy for the selected hazard in consultation with stakeholders.

3.6 Communicate outcomes of hazard identification, workplace monitoring and analysis, and the resultant control strategy to stakeholders and key personnel for action as appropriate.
INTRODUCTION

The objective of OHS risk management is to make the workplace as safe as practicable. The risk control strategy selected is the key to achieving this objective. In recent times, discussion on risk control strategies have focused on two approaches – ‘safe place vs safe person’ and ‘control at source’.

Safe place vs safe person

The learning guide for BSBOHS504 Apply principles of OHS risk management reviewed the principles of safe place vs safe person and control at source. A summary of these principles is provided here as a refresher.

The argument that has become known as safe place vs safe person is one that has engaged OHS personnel for many years. A ‘safe place’ approach focuses on risk controls incorporated in the design of equipment, work environment and processes, whereas the ‘safe person’ approach focuses on the behaviour of the person.

A person will always be close by when an incident or injury occurs, so it is easy to focus on the person (and their behaviour or personal factors) as the ‘cause’ of the occurrence.

What is the cause? Person or place?

The allocation of the relative importance of ‘place’ or ‘person’ for causation will depend on the approach taken when analysing the information.

The scenario described below is an actual incident. What do you think are the causes – human behaviour, design of the workplace, the work system, or training and supervision?
Following a fruit juicing process, the tanks require cleaning.

The cleaning involves using a caustic soda solution, made up by the employee. The solution is then pumped through the extraction plant to clean it. The normal process is to add the caustic soda granules to cold water in a large open holding tank (about 4000L).

On this day, the worker decided to preheat the water to increase the speed with which the caustic granules dissolved.

When the caustic soda granules were emptied by hand into the heated water, a violent reaction occurred that resulted in the mixture erupting from the tank onto the employee. As a result, the employee sustained major chemical burns.
Analysis of errors by military and civilian pilots found that most of the incidents could be attributed to ‘pilot error’. However, rather than embarking on training or awareness programs it was found that incidents based on human error could be reliably prevented, or mitigated by focusing on design [Fits in (Culvenor, 1997)].

It is human to lose concentration, to take a short cut or to occasionally take the wrong action, either intentionally or unintentionally. The work system should not rely on the perfect worker; and the perfect worker cannot be created by training or awareness programs.

**Control at source**

Another concept of risk control that you will hear about is ‘control at source’. This concept is illustrated by the energy damage model discussed in the introduction to Element 1.

This model describes an occurrence as arising when there is loss of control of potentially damaging energy. Injury or damage occurs when the energy transfers to the recipient and the energy level is greater than the injury or damage threshold of the recipient.

![Energy Damage Model](image)

(Viner, 1991)

The opportunities for intervention to control the risk are as below:

1. Eliminate or reduce the amount of energy
2. Improve the reliability of the barrier
3. Prevent transfer of energy or separate energy and people
4. Protect the person.
Where the risk controls are close to the source of the energy, there is greater scope for back-up or supplementary controls. Where the foreseeable outcome may be death or serious injury, then high reliability controls must be applied; such controls are those that act closest to the source of the energy.

While personal protection provides a shield between the hazard and the person and so may prevent the energy damaging the person, it is known to have low reliability. Personal protection is a last line of defence – there is no back-up.

Addressing the hazard at the source focuses on the ‘safe place’

The argument is not that people are part of the sequence leading to an injury, but that this approach does not assist in the development of effective risk control strategies. Rather, focusing on the person when developing options for risk control creates a barrier to effective controls as it diverts attention from the actions that can achieve the greatest effect.

This safe place/control at source approach is in line with current legislation in Australia. However, it is not always the focus in the workplace where a strong commitment to the ‘safe person’ is still evident in many organisations.

3.1 SEEK INFORMATION AND DATA FROM EXTERNAL SOURCES ON CONTROL OPTIONS FOR THE SPECIFIC HAZARD

Section 1.1 of this learning guide identified external sources of information for identifying hazardous tasks and conditions. These sources of information were:

- legislation and codes of practice;
- standards and guidance material;
- organisations providing hazard-specific information;
- international sources of information;
- databases; and
- OHS specialist advisers.

These sources should be revisited for information on risk control.
3.2 SEEK INFORMATION AND DATA FROM STAKEHOLDERS AND KEY PERSONNEL ON CONTROL OPTIONS FOR THE SPECIFIC HAZARD

Section 1.2 of this learning resource identified a number of workplace sources of information for hazard identification. Many of these should also be accessed for information on options for risk control. These include:

- risk registers;
- Job Safety Analyses (JSA) and risk assessments;
- work procedures, including standard operating procedures (SOP);
- reports and audits;
- enforcement notices;
- Material Safety Data Sheets (MSDS) and chemical registers; and
- manufacturers’ manuals and specifications.

In section 2.3, it was identified that those involved in the risk assessment process should include those who:

- do the work;
- are affected by the risk;
- are knowledgeable about the hazard; and
- are knowledgeable about the risk.

This also applies when developing risk controls; therefore, those involved in developing risk controls include:

- stakeholders (those people or organisations who may be affected by, or perceive themselves to be affected by an activity or decision);
- key personnel (managers from related areas, people involved in decision-making or who are affected by the decision);
- technical advisers; and
- OHS advisers.

The checklist, *People who may be involved in the development of risk controls*, introduced in section 2.3 is a useful tool for identifying the stakeholders, key personnel and other OHS specialists who should be involved in the development of controls.
Some people will have information that is more relevant to certain hazards. Remember, there may be a number of ways that you can obtain the information, such as by informal discussion or more formal processes eg meetings, focus groups or interviews.

3.3 DEVELOP AND ADVISE A RANGE OF CONTROL OPTIONS, IN CONSULTATION WITH STAKEHOLDERS AND KEY PERSONNEL, BY APPLYING THE HIERARCHY OF CONTROL, NOTING THAT PERSONAL PROTECTIVE EQUIPMENT (PPE) IS REGARDED AS THE LEAST SATISFACTORY CONTROL MEASURE

The underpinning principle for developing options for risk control is provided by the hierarchy of control, which was introduced in section 2.5. It combines the two concepts of ‘safe place’ and ‘control at source’ to give a tool for developing options for risk control.

The hierarchy of control gives the priority order in which hazard and risk controls should be considered, with the eventual outcome often being a combination of measures. The prime emphasis is on:

- elimination of the hazard;

and where this is not practicable, minimisation of risk by:

- substitution; and/or
- engineering controls including isolating the hazard from personnel;

then, when these options have been implemented as far as is practicable:

- administrative controls (eg procedures; training); and
- personal protective equipment (PPE).

This hierarchy can be presented as a triangle where the area of the triangle represents the effectiveness or reliability of the control and the area outside the triangle indicates the opportunity for the control to fail. Labels representing the safe place/safe person and control at source approaches show how the principles of control are all consistent.
The greater the risk or the more serious the potential consequences, the more the emphasis should be on options higher in the hierarchy of control.

![Hierarchy of Control Diagram]

The ‘traffic light’ colouring is a reminder of the priority of the control option. For a task assessed as HIGH RISK:

- the use of PPE as a sole risk control, or even PPE and administrative controls is a STOP (not acceptable);
- engineering controls, including isolation, may be acceptable but should be used with CAUTION; and
- elimination or substitution are the control options of choice and should be considered GO.

The hierarchy of control is not a fixed set of rules but a problem-solving tool to promote creative thinking when developing options for risk control. The hierarchy is represented in many forms in most hazard-specific legislation.

The most effective time to apply risk controls at the higher level of the hierarchy of control is at the design phase of a product, equipment or work process. ‘Safe design’ is a concept that is being promoted nationally.

The risk controls developed by applying the hierarchy of control will be a ‘package’. Even when a high level risk control is applied, there is still a need for organisational and management processes, procedures and supervision to support the control.
The key points to remember when selecting the ‘package’ of risk controls are:

- **Where do the individual risk controls sit on the hierarchy of control?** (How close to the source of the hazard will the control operate?).

- **What is the severity of the most likely outcome?** (The more serious the likely outcome, the more reliability is required in the control).

- **What are the factors that may impact on effectiveness of controls?**

The reality is that the trade-off between cost of implementing the risk control and the benefit achieved will also be a factor in deciding the priority of the interventions.

The timeframe for implementation is also an important factor in deciding the risk control package.

Where possible, the ‘safe place’ controls should be implemented as the first priority. But, if it will take six months to implement such changes, it is not acceptable to continue with an unsafe system of work while waiting to implement the preferred control. What actions could be taken in the short-term to mitigate the risk? Short-term may be a few days to few months but care should be taken that ‘short-term’ measures do not become long-term.

This is where we return to the hierarchy of control. Administrative controls and PPE can be implemented quickly to reduce the risk while the preferred controls further up the hierarchy are put in place. The administrative controls and PPE may then be unnecessary or may provide back-up. This relationship between time and the hierarchy of control is shown below.
While the hierarchy of control provides the underpinning principle for developing risk controls, there are hazard-specific principles that are also important in the development of effective controls for hazardous tasks and conditions. Some of these are examined below, following the section on PPE.

**Personal protective equipment**

Once the decision has been made to use personal protective equipment (PPE), the fact that it is regarded as the last line of defence should not detract from efforts to ensure its effectiveness as a risk control. Unfortunately, the focus is usually on the supply of the PPE, with little consideration given to the support systems such as cleaning, maintenance and training which are essential to PPE being an effective risk control measure.

**Selection**

Selection of PPE to suit the hazard, the level of risk, the environment and the level of protection required is not a simple matter. Providing PPE is not a matter of ‘pick a respirator’ or ‘here are some ear muffs’. It is beyond the scope of this learning guide to address in detail the selection of PPE, but it should be noted that specialist advice and user trials may be required, especially for respiratory and hearing protection.

**Use**

Once the required type of PPE is determined and, where required, workers have been individually fitted with the PPE, the use of PPE should be monitored. This may be by workplace observation.

The reasons why some people do not use the protection should be investigated and, where indicated, action taken. Action may include sourcing alternative types of PPE or providing a range of sizes. Marking areas where PPE has to be used can help to remind people entering these areas, but care should be taken to limit the boundary of an area. Small, defined areas which relate closely to peoples’ perception of where the hazards exist are likely to be more effective than making complete workshops into designated PPE areas.
A common reason given by people for not wearing personal protection is that it makes the job more difficult to perform, or that they feel less safe when using it. Such complaints should not be dismissed without thorough investigation. Personal protection is often worn on one or more of the major routes for information input to the body, and the PPE may significantly interfere with the reception of such information. For example, gloves reduce information from touch and make it harder to handle some items; and eye protection, respirators or helmets can interfere with peripheral vision. However, people often acclimatise to wearing personal protection and may learn to make use of information which is slightly transformed by the protection. They may also learn to use information from another sensory area such as making greater use of their eyes rather than relying on hearing the direction from which sounds originate.

PPE is unlikely to be successful unless all people involved receive adequate training. Users and those responsible for supervision need to know what the equipment is capable of protecting against, the consequences of non-use, how to fit the equipment, how to clean it, and when to have it replaced. The people responsible for maintaining and issuing the equipment also require adequate training. A problem which is commonly encountered is that although training is given when the scheme is initially introduced, no thought is given to refresher training or the training of all new starters or people transferred from other work areas.

The commitment of management at all levels is necessary for effective implementation of PPE as a risk control. Managers not only need to wear the personal protection themselves when they are in the hazardous areas, they also need to underpin the scheme with written systems and procedures. The procedures should cover:

- reviewing and updating PPE to cope with changes to the process;
- changes to materials or substances used in the work process;
- reductions in exposure limits due to changes in standards;
- change of personnel;
- availability of new types of PPE; and
- unavailability of current types PPE.
Cleaning, maintenance and storage

The calculated degree of protection will not be achieved in practice unless the PPE is cleaned and maintained. Cleaning can often be left to the users, provided that adequate provisions are made for them to have the necessary cleaning materials available and the necessary training in how to disassemble, clean and reassemble the equipment.

However, it is unwise to rely on users to check or maintain their own personal protection because the decreases in performance are usually insidious and therefore unlikely to be noticed by the user. The use of disposable items can reduce the need for maintenance, but it must be remembered that systems relying on disposable PPE may still have a maintenance requirement, (eg maintenance of dispensers for disposable earplugs).

PPE for eye protection is examined in detail below to illustrate the principles of selection, use and cleaning, maintenance and storage.

Eye Protection

Selection

The selection of eye protection relies on qualitative assessment of the hazards rather than the quantitative assessments required for other PPE, such as hearing protectors. A comprehensive survey of eye hazards is essential to identify the correct type of eye protector. Spectacle-type eye protection is designed to protect the wearer against impacts of relatively low energy projectiles (eg small particles of metal swarf ejected during the machining of metal on a lathe). Goggles or face shields are required for protection against high energy projectiles such as molten metal, chemical splash, dusts or gases. The type of hazard should also be considered when selecting goggles or face shields (eg chemical type or radiations, such as from gas or arc welding or lasers).

Proper fit is important in achieving a high rate of usage. Poorly fitting eye protection may cause discomfort due to localized high pressure points, eye strain or unnecessary restriction of the peripheral visual field. Selection of eye protection needs to take account of people with differing facial shapes and sizes. This may be done by providing a range of sizes in one style or by offering a choice from a range of different manufacturers. For example, each manufacturer produces goggles in only one size but some manufacturers' designs tend to be large while others tend to be much smaller.
Use

A high level of usage is required to achieve effective protection. An eye protector that is worn only for 50 per cent of the time the person is at risk, cannot reduce the risk by more than a factor of two regardless of how effective the protectors are in theory.

Once every effort has been put into providing people with the most comfortable eye protection, the level of usage should be monitored and the reasons for non-usage identified and action taken as required.

Cleaning, maintenance and storage

Equipment should be available for cleaning eye protection. Many companies provide ‘cleaning stations’ with lens cleaning solution and tissues. Procedures should exist for inspection and replacement of defective items.

How effective is PPE as a control measure in your workplace?

The following questions provide a basis for assessing the adequacy of PPE as a risk control measure in the workplace.

<table>
<thead>
<tr>
<th>Questions for your PPE program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why is personal protection being used to control the danger rather than making the place of work safe?</td>
</tr>
<tr>
<td>What efforts are being made to phase out the use of PPE when methods become available to make the workplace or process safe (eg, when the process is redesigned, or when new machines are purchased)?</td>
</tr>
<tr>
<td>Does the PPE theoretically provide adequate protection? Have calculations been made by competent people?</td>
</tr>
<tr>
<td>Does the PPE provide the same degree of protection in practice (eg does it fit all members of the user population and is it worn all the time by people at risk)?</td>
</tr>
<tr>
<td>Have provisions been made for cleaning and maintenance of the PPE?</td>
</tr>
<tr>
<td>Is the marking of personal protection areas adequate?</td>
</tr>
<tr>
<td>Have the users of PPE received appropriate training?</td>
</tr>
<tr>
<td>Is the use of PPE underpinned by written procedures?</td>
</tr>
<tr>
<td>Have provisions been made for updating the personal protection scheme?</td>
</tr>
</tbody>
</table>

This questioning structure for PPE programs is introduced in the text *Occupational Health Practice (Else.D.E, 1981).*
Physical hazards — Noise

Elimination and substitution — Buy Quiet

A ‘Buy Quiet’ policy establishes procedures to ensure that:

- invitations to tender for the supply of new plant and equipment specify the maximum noise exposure level for operators of the equipment under normal operating conditions;
- if plant or equipment is purchased without tender, then noise emission data for the equipment to be purchased must be provided by the potential supplier; and
- acceptance of delivery of the equipment to site is conditional on verification of the noise exposure assessment provided by the equipment supplier.

Both WorkSafe Victoria and WorkSafe WA publish guidelines for ‘Buy Quiet’ policies.

Engineering control

Before considering engineering controls for noise, it must be determined whether noise is produced as a result of mechanical vibration (impacts, friction, cutting forces) or by air turbulence (air being chopped up by a fan or disturbed by a blast of air from an air hose).

The options for engineering controls vary depending on the nature of the source of the noise.
Options for Engineering Control of Noise

<table>
<thead>
<tr>
<th>Mechanical Vibration</th>
<th>Air turbulence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control vibration at source by:</td>
<td>Control vibration at source by:</td>
</tr>
<tr>
<td>• reducing impacts (eg reducing the distances that products fall on their way into a bin);</td>
<td>• reducing the amount of disturbance of the air, eg:</td>
</tr>
<tr>
<td>• reducing friction (eg increasing lubrication); and</td>
<td>- by fitting a purpose-built low-noise nozzle on ejectors used to eject faulty product on a line; or</td>
</tr>
<tr>
<td>• reducing cutting forces (eg changing the shape of the cutting tool).</td>
<td>- by fitting silencers on pneumatic exhausts so that the exhaust air mixes with still air in a workshop over a larger area than the area of the exhaust jet; consequently reducing the airspeed and amount of turbulence created.</td>
</tr>
</tbody>
</table>

Control vibration by Isolation:

Reduce the amount of vibration that passes from the source into surrounding machine or structure by inserting purpose-selected anti-vibration mounts.

Control vibration by Damping:

Reduce the noise from vibration by applying a surface treatment to reduce the ability of surfaces to radiate noise. (The surface treatment turns the vibration energy into heat energy before it has a chance to escape from the surface as noise.)

Insulation and Absorption

The transmission of noise from either vibration or air turbulence can be minimised by enclosing the source within a structure made from dense material (noise insulator) which stops noise from passing through. This is also coated on the interior with lightweight sound absorbing materials (eg acoustic tiles) to stop the noise from building up inside the enclosure from the multiple reflections of the noise.

WorkSafe WA’s website (www.worksafe.wa.gov.au) has several examples of case studies in noise control.

PPE and hearing protection

There are two main types of hearing protection:

Earplugs, which are inserted in the ear canals. These are usually disposable items made from materials such as glass down, plastic-coated glass down or polyurethane foam. Re-useable earplugs are made from semi-rigid plastic or rubber and these can be obtained in either a range of sizes or in one size designed to fit all shapes of ear canals. Re-useable earplugs have the disadvantage that they require frequent washing.
**Earmuffs**, which fit over the external ears. These consist of two rigid cups held together by a headband. Annular cushions, made from envelopes of plastic filled with polyurethane foam or a liquid, are used to seal between the cups and the sides of the head around the ears.

**Selection**

The reduction in sound level provided by a hearing protector, usually referred to as its ‘attenuation’, depends on the frequency of the noise in which it is worn. Hearing protectors should be chosen to reduce the noise level at the wearer’s ears to below the recommended limit for unprotected exposure to noise, eg 85 decibels (dB(A)). Hearing protectors keep out different amounts of noise when they are worn in different noisy environments. Therefore, someone has to ensure that the hearing protector is adequate for this noise exposure. The most accurate method of selection of effective hearing protection requires analysing the frequency of the noise and level of the noise and calculating the required attenuation. This requires some expert knowledge. The simplest is the Class system that is offered by the Australian Standard AS1269.3 (Standards Australia, 2005):

<table>
<thead>
<tr>
<th>Class</th>
<th>LAeq8h, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 90</td>
</tr>
<tr>
<td>2</td>
<td>90 to less than 95</td>
</tr>
<tr>
<td>3</td>
<td>95 to less than 100</td>
</tr>
<tr>
<td>4</td>
<td>100 to less than 105</td>
</tr>
<tr>
<td>5</td>
<td>105 to less than 110</td>
</tr>
</tbody>
</table>

There are quick methods that use single numbers to predict the amount of dB(A) noise reduction that a hearing protector will deliver, but they are less accurate and tend to result in people being asked to wear ‘heavier’ and more sound-excluding devices than may be needed. This may increase the risk that wanted sounds are not heard as well, or may result in the protectors being removed for short periods, which can drastically reduce their effectiveness.

Unfortunately, hearing protectors are often purchased without the necessary calculations being made, with the result that the user may be inadequately protected. For example, an earmuff might reduce the noise level from a high frequency noise by as much as 30dB(A) but the same earmuff worn in a low frequency noise environment, such as a compressor room, might provide only a 10dB(A) reduction in sound level.
This is why the WA Code of Practice for Managing Noise at Workplaces pays attention to selection of the right equipment in Section 7.7 (see www.worksafe.wa.gov.au).

The fit of hearing protection also has an impact on its effectiveness. There are two stages at which hearing protectors can be fitted incorrectly: initially when the protectors are selected and fitted to the individual; and then on each occasion that the individual fits the hearing protector prior to entry into the noisy area.

Earmuff users should be given an opportunity to select from a range of earmuffs, all of which should be capable of reducing the level of noise to below recommended limits. The earmuff which is most suitable for the majority of users does not necessarily provide an adequate and comfortable fit for all. Some earmuffs are larger than others and some have more adjustment in the headbands.

The wearing of spectacles may reduce the protection provided by earmuffs by as much as five decibels. Where a person wears spectacles and is required to wear hearing protection, the spectacles should have thin side arms.

How comfortable a hearing protector is and whether it can be worn for the full duration of exposure by people who may also have to wear other forms of protective equipment are vital factors that should be considered during the initial selection. User trials are usually the only way of discovering how acceptable, comfortable or compatible a particular type of hearing protector will be for a specific application. Unfortunately, it is quite common to find that people exposed to noise levels only slightly in excess of recommended noise limits have been issued with high attenuation earmuffs; but the high attenuation is often obtained at the expense of comfort and as a result there is a low level of use of earmuffs.

Use
As noted above, poor fit of hearing protection, especially ear plugs, significantly affects the level of protection. Users must be given adequate instruction to enable them to fit the earplugs correctly as a matter of routine.

The removal of hearing protectors for very short periods during exposure to noise substantially reduces the protection. For example, if it were necessary to protect a person exposed continuously for eight hours per day to a sound level of 115dB(A), no hearing protector could provide adequate protection unless worn for at least 99.9 per cent of the exposure duration (removing the hearing protectors for one minute would result in the person receiving twice the recommended daily maximum noise dose of 85dB(A) for eight hours per
day). If a high attenuation hearing protector is removed for part of the noise exposure then the same degree of protection, or greater, could be achieved with one which provides less instantaneous reduction in sound level, provided that it would be worn for a sufficiently high percentage of the exposure time.

High usage of hearing protectors is unlikely to be achieved unless workers receive appropriate training. All people exposed to high noise levels, or responsible for such areas, must receive training at the start of their employment because hearing damage occurs rapidly during the initial period of noise exposure. All hearing protectors are uncomfortable to some degree, and the training, therefore, has to arouse sufficient concern for the wearer to want to cope with the slight discomfort rather than suffer the consequences of hearing damage.

One of the questions likely to be raised during training sessions is the possible effect of hearing protectors on the safety of the wearer. Potential wearers, or people who have worn hearing protectors for short periods of time, may express concern about speech communication or the perception of warning sounds. Hearing protectors can in some circumstances present a further hazard to the user, especially if the user has already suffered significant hearing impairment. Many studies have shown that hearing protectors reduce the user’s ability to detect the direction from which sounds originate. Earmuffs have a much greater effect than earplugs, though even earmuff users seem to cope by making greater use of visual cues.

Cleaning, maintenance and storage

Earmuffs require maintenance. Earmuff cushions are likely to need replacement frequently because most cushions become less compliant as a result of contact with natural hair oils, perspiration and hair dressings. Many manufacturers now make replacement parts available, including cushions and the inner foam inserts for earmuff cups. The complete earmuff or parts of the earmuff are likely to have to be replaced as a result of wear in the adjustment mechanisms, damage resulting from the earmuff being dropped, distortion resulting from exposure to intense heat, or as a result of normal wear and tear.
Chemical hazards — Airborne contaminants

Elimination and substitution — control at source

Some key questions here are:

- Why is the job being done? Is it really necessary?
- Could alternative processes be used to achieve the same outcome?
- How are airborne contaminants being produced?
- Could processes be used that will produce less contaminants? (eg lower process temperature pellets or wet slurry rather than powders; powders rather than sprays; larger droplets rather than fine aerosols; water-based rather than oil-based processes.)

Engineering controls

If the airborne contaminant cannot be controlled at source, then ventilation may be an option. The type of ventilation will depend on the process that is releasing the contaminants. Local exhaust ventilation (LEV)* collects contaminants close to the source and is preferred to dilution or general ventilation, which allows the contaminants to escape into the work environment before it is diluted with large volumes of general airflow.

Enclosure

Enclosures are usually the most efficient types of LEV. They are less affected by side draughts and generally require less airflow. A total enclosure is a good starting point for the design of LEV. If enclosure is not possible, then a receptor or captor* hood has to be used.

Receptors

Receptors are LEV systems in which the contaminants find their own way into the hood. Laboratory fume cupboards and spray booths are receptors. The contaminants in these cases are released within the hood. The greater the degree of enclosure, the better the control. Some receptors are canopy hoods above hot processes. At the design stage, there must be certainty that the contaminants will find their own way into the hood and that it will not be affected by cross-draughts. It is also necessary to consider whether the worker can access the process without their head entering the path of the contaminants and to ensure that the hood will empty faster than it fills.
Captor Hoods

If it is not possible to enclose the process either totally or partially and it is not possible to design a receptor hood into which contaminants will find their own way, then a captor hood may be considered. In this case, the contaminant is released somewhere outside the hood and the air flowing into the hood has to capture the contaminants and draw them in. Therefore, it is very important to use an appropriate capture velocity, i.e. ensure that the speed of the air moving into the hood is great enough to draw all the contaminant being released into the hood. Design of a system that does not create a great enough capture velocity is a common failing of captor systems.

The relationship between capture velocity and distance from the hood is important. Capture velocity reduces very rapidly as the distance from the hood increases; and to ensure that the system achieves the degree of capture desired it is often necessary for workers to remain very close to the hood. A rule of thumb is that, at a distance in front of the hood equivalent to the diameter of the hood, the capture velocity will be $\frac{1}{10}$th (0.1) of the velocity at the face of the hood.

Guidelines regarding appropriate capture velocities for different processes are printed in ventilation design books.

Low-volume, high-velocity LEV is particularly suited to the control of airborne contaminants from portable tools, such as angle grinders or welders. They comprise small extraction hoods mounted on the tool close to the source of the contaminants. Because the hood is small, very high capture velocities can be achieved while using low volumes of air.

Mounting of the hood on the equipment means that the captor hood will always be close to the source of the contaminant and it does not rely on the operator to repeatedly reposition captor hoods in the vicinity of the work.

Dilution

Dilution ventilation* or general ventilation relies on drawing large volumes of air into the workplace to mix with the contaminated air and reduce the concentration to an acceptable level. Although this can be effective in controlling poor thermal environments and low concentrations of very low toxicity vapours, it is not usually suitable for control of exposure to toxic airborne contaminants.
PPE and airborne contaminants

For short-term control of exposure, personal protective equipment may be used. Respiratory protective equipment (RPE) is chosen to suit the contaminant in question, the environment in which the RPE will be used and the person who will wear the equipment. For example, a simple disposable particulate filter may be suitable to reduce exposure to a nuisance dust, but a silicone half mask with filters and exhalation valves or a powered air purifying device may be necessary if the material is toxic. The choice of RPE will be influenced by factors including whether the environment is hot or oxygen deficient, are flammable materials present or are other forms of PPE necessary. If the person has facial hair, a respiratory complaint (eg asthma) or is claustrophobic, this will further influence the choice of device.

There are a multitude of different types and brands of RPE devices available and many of these may be fitted with a multitude of different filters to suit different contaminants. However, they broadly fall into two categories; air-purifying and air-supplied.

Non-powered air-purifying devices filter the air as the wearer breathes in. Some air-purifying devices are simple ori-nasal masks made from a paper-like filtering medium, some are rubber ori-nasal masks and some are rubber full-face piece masks. All operate under negative pressure which means that the wearer creates a negative pressure inside the face piece as they inhale and this causes the air to be drawn through the filter. It also means that any leaks around the seal on the face will allow contaminated air inside. Fit-testing of RPE is therefore very important.

Powered air purifying devices use a fan to draw air through a filter and blow the clean air into the mask. Such devices are generally operating under positive pressure, ie any leakage will be outwards.

Air-supplied devices provide clean air to the worker from a remote source either via a hose (air-line supplied) or a cylinder carried with the wearer (self-contained breathing apparatus).

Therefore, selection is a very complex process and requires a detailed knowledge of the contaminant(s), the environment and the wearer. Having selected a device and filters that may be appropriate, fitting must be arranged along with fit testing. Training of the user is necessary and care and maintenance must be considered. In addition, organisational factors such as PPE program management, supervision, purchasing of consumables and replacement equipment must be considered. All these demands add fuel to the argument for the use of exposure control measures from a position higher on the hierarchy of controls.
Biological hazards

As with airborne contaminants, the control of biological hazards must be specific to the hazard and requires an understanding of the characteristics and action of hazard. However, the principle of a hierarchy of control also applies to biological hazards and this is demonstrated by considering control strategies for Legionnaires’ Disease.

Control of Legionnaires’ Disease

The objective for control is to minimise micro-organism growth in artificial environments and reduce the likelihood of inhaling any potentially contaminated aerosols (Commission for Occupational Safety and Health WA). The hierarchy of control in achieving this directive may be described as below.

Elimination:

- Non water-based cooling system.

Design:

- Positioning of systems with consideration to the nature of enclosure, location of building air inlets, direction of prevailing winds and local wind patterns, height, avoidance of exposure to sunlight for wetted areas, design of adjacent structures, proximity of other discharges such as kitchen exhausts and future planned development.
- Facilitate cleaning, control of bacterial growth and minimise drift carryover with attention to convenient and safe accessible opening for maintenance, components which minimise corrosion and can easily be removed, minimal internal components with can collect sediment, sumps that can readily be drained, efficient drift eliminators, and surfaces that can readily be cleaned. (Commission for Occupational Safety and Health WA)

Administrative controls:

- A maintenance and cleaning regime in compliance with established standards that includes routine cleaning as well as at commissioning, following periods of non-use, and changes to the system. (This requires established procedures and training to address the safety of the maintenance workers.)
- Maintenance of appropriate records.
- Use of biocides to control bacterial growth where there are deficiencies in the design of the system – biocides are not required for regular cleaning (Commission for Occupational Safety and Health WA). (This requires established procedures, PPE and training to ensure the safety of the operators.)
- Water testing and monitoring as per established standards.
• The case study of Legionella at the Melbourne Aquarium, as described in *EcoLibrium* (Australian Institute of Refrigeration Air Conditioning and Heating, 2005), demonstrates the costs of not addressing the biological hazard and also how the hierarchy of control can be applied when considering control options.

*In April 2000, Melbourne had a prominent new tourist attraction on the north bank of the Yarra River – the Melbourne Aquarium. People were visiting in droves ... In the following days many of them became terribly ill with fever, chills, muscle aches, and a dry, rasping cough. They were suffering from the early symptoms of legionnaires’ disease. For four people who visited the aquarium that month, the experience proved tragically fatal. Another 95 were hospitalised. It was quickly confirmed that the air conditioning system of the Melbourne Aquarium was the source of the Legionella outbreak.*

*The case was brought not only against the aquarium, but also the construction company, mechanical engineers, air conditioning company, and the water treatment company, in relation to the maintenance, cleaning, testing and repair of the cooling towers and cooling tower pumps serving the aquarium. The Melbourne Aquarium initially claimed that cleaning and maintenance of the cooling towers were conducted in compliance with guidelines and Australian standards, however, an investigation by the Victorian Department of Human Services discovered a lack of regular servicing of the towers and a faulty dosing pump created conditions ripe for an outbreak of Legionella bacteria. The Court awarded the victims a total of $450,000 compensation, to be shared between them. The aquarium, for its part, is now free to pursue legal action against its contractors. One contractor is in liquidation, and another is under administration.*

*The Melbourne Aquarium (subsequently) made an expensive shift to an air cooled system in an effort to divorce itself completely from associations with Legionella (and Victoria introduced stringent new regulations for the control of Legionella).*

*Bernard Zwolak (of the Victorian Department of Human Services) applauds these developments, seeing that the new regulations have encouraged the industry to seek new alternatives to old problems. But he warns of new problems for building owners who choose to switch from cooling towers to air cooled systems. ‘There is a power consumption issue here. If every building in the CBD switched to electric or air cooled systems we would have massive power consumption problems,’ he says. Air cooled systems require constant circulation via fans, and consume far more energy than cooling towers. For his part, Mr Zwolak believes cooling towers remain a sensible and viable option, provided an appropriate risk management strategy is in place.*

*For building owners eager to avoid the spectre of a Legionella scare, there is a choice to be made between two imperfect options.*

(Carey, 2005)
Biomechanical hazards

As with risk assessments, the OHS regulations have varying but similar approaches to control of biomechanical risk. Relevant regulations and codes of practice are generally titled ‘manual handling’ but attempt to address the broader issues of static postures.

For example, the WA Code of Practice for manual handling (Commission for Occupational Safety and Health WA, 2000) lists three questions as directing control options:

1. Is the manual handling necessary?
2. Can the work be changed to eliminate, reduce or control the risk?
3. What are the manual handling training needs?

Under the second question, the options listed are:

- modifying the workplace layout and equipment;
- modifying the load;
- controlling the work environment;
- redesigning work patterns; and
- warming up and stretching prior to manual handling.

(Commission for Occupational Safety and Health WA, 2000)

The Victorian approach (WorkSafe Victoria, 2000) differs slightly in that the control options are listed as eliminate or reduce the risk by:

- altering the workplace or environmental conditions;
- altering the systems of work;
- changing the objects used;
- using mechanical aids; and
- providing information, training and instruction (if the above are not practicable).

(WorkSafe Victoria, 2000)

The various manual handling codes of practice have many practical examples of risk controls.

Macdonald identifies that these approaches do not address the complexity of the causal factors contributing to biomechanical hazards, and offers a revised hierarchy of control that is a two-way matrix addressing the categories of causal factor and high, medium and low priority control options. A modified version of this matrix is given below.
A revised hierarchy of control for biomechanical hazards

<table>
<thead>
<tr>
<th>Source of hazard</th>
<th>Risk Control Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Priority</strong></td>
<td><strong>Eliminate/reduce hazards</strong></td>
</tr>
<tr>
<td><strong>Task demands:</strong></td>
<td>• Design to eliminate physical stressors – poor posture, high repetitions, combinations of stressors.</td>
</tr>
<tr>
<td>• physical; and  • mental.</td>
<td>• Design to eliminate psychosocial stressors – mental demands, short cycle times.</td>
</tr>
<tr>
<td><strong>Work conditions:</strong></td>
<td>• Design work processes to control physical and psychosocial hazards – workload, work rate, control and autonomy, and variety of work.</td>
</tr>
<tr>
<td>• work organisation; and  • job design.</td>
<td></td>
</tr>
<tr>
<td><strong>Work environment:</strong></td>
<td>• Optimise physical environment.  • Consultation processes.  • Leadership and workplace culture that values safety and people.</td>
</tr>
<tr>
<td>• physical; and  • psychosocial.</td>
<td></td>
</tr>
<tr>
<td><strong>Individual worker:</strong></td>
<td>• Managers:  • knowledge and understanding to eliminate reduce risks; and  • are highly motivated to achieve risk reduction, including providing resources.</td>
</tr>
<tr>
<td>• personal conditions (chronic); and  • personal states (short-term).</td>
<td></td>
</tr>
</tbody>
</table>

Modified from (Macdonald, 2005)
PPE and control of biomechanical hazards

Back belts have become popular in some workplaces as a supposed aid in manual handling injury prevention. While back belts may have some short-term value immediately following an injury, the use of back belts is not recommended for manual handling risk control as there is:

- little scientific evidence of increased lifting power;
- little scientific evidence of lower rates of injury in workers wearing back belts; and
- some evidence of potential harm from increased abdominal pressure and increased blood pressure.

The reasons why back belts are not recommended is detailed in a guidance note published by the WorkSafe Victoria (WorkSafe Victoria, 2005a)

Principles of design

There are two basic principles for design to minimise biomechanical hazards.

*Design for the potential workforce, not the existing work force*

Designing for the existing workforce means that every time there is a change in staffing then there are likely to be problems.

*Design for the large majority*

Not only is this required by equal opportunity legislation, but it minimises the risk of overexertion injury and illness, minimises fatigue, provides for staff flexibility, enables a greater range of workers to do the job, including older workers, and supports a team-based approach to work.

Anthropometric tables enable these principles to be applied for effective risk control. Anthropometry is the science dealing with the comparative measurement of the size and proportions of the human body and the range of movement of limbs as a basis for improving safety and functionality in design and in ergonomic evaluations. The tables produced from such data provide useful information in assessing the design of equipment and its suitability for different groups of people.

Most good ergonomic text books will have information on the use of anthropometric tables. When using the tables be sure to check the reference population as the standard measurements will vary.
Ergonomic studies have resulted in guidelines for an extensive range of tasks and situations such as:

- standing work;
- seated work;
- computer work stations;
- process lines;
- design of controls and displays;
- tool design; and
- visual inspection tasks.

A good ergonomic text book such as Kodak's *Ergonomic Design for People at Work* (The Eastman Kodak Company, 2003) can be invaluable for those involved in designing, selecting, modifying and approving such equipment or work stations.

### 3.4 IDENTIFY FACTORS WITH A POTENTIAL TO IMPACT ON THE EFFECTIVENESS OF CONTROLS

What works in one organisation or work environment may not work in another! There are many organisational factors which may influence the effectiveness of risk controls, such as:

- workplace culture related to OHS;
- commitment by managers and supervisors to OHS;
- level of compliance with procedures and training;
- profile of the workforce such as cultural diversity, language, literacy and numeracy skills; and
- workplace organisational structure and geographic location, especially for remote workers or multi-site organisations.

The failure of risk controls is usually predictable.

*Risk controls fail when there is an interaction of one or more of the workplace factors to create one or more predictable causes of failure.*
In section 2.5, the six predictable ways in which risk controls might fail were identified as:

- inadequate initial design;
- inadequate installation;
- incorrect usage;
- inadequate maintenance;
- changing parameters of the problem such as changes in personnel, materials, work methods; and
- authorised or unauthorised modifications to equipment or processes.

These ways in which the controls might fail are the result of deficiencies in one or more of five workplace factors:

- the organisational and management environment;
- physical environment;
- equipment;
- procedures; and
- people and human error.

Identifying such limiting factors and predictable ways in which controls might fail does not mean that a risk control option is rejected, but rather it enables actions to be put in place to address the potential problems.

Limitations and failures in controls for noise, airborne contaminants and biomechanical hazards were discussed in section 3.3.

The learning guide for BSBOHS504 *Apply principles of OHS risk management*, gave examples of strategies for identifying organisational factors that may impact on the effectiveness of risk controls. One of these strategies is based on Edward de Bono’s *6 Thinking Hats* which forces people to go outside their habitual thinking style to look at a decision from a number of perspectives (De Bono, 1987). The application of creative thinking to generating and evaluating OHS risk control solutions was examined by Culvenor, and his thesis is interesting reading for those seeking further information (www.culvenor.com/publications.htm) (Culvenor, 1997).

In a group situation, different people may take different positions; or alternatively each position or ‘angle’ could be considered in turn by the group. This approach can be used on your own or in a group to structure the thinking so that a broader approach is applied. It is also a tool to promote involvement by a range of people.
A summary of this approach is outlined below.

<table>
<thead>
<tr>
<th>Thinking role</th>
<th>General description</th>
<th>Risk control application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rational, factual</strong></td>
<td>What information do we have? Where are the gaps? Can we fill in the knowledge gaps or do we allow for them?</td>
<td>What are the legislative requirements? Are there any relevant codes of practice or standards? What are other organisations doing about the problem? What are the trends in our organisation? What other information do we have such as inspections or audits?</td>
</tr>
<tr>
<td><strong>Emotional</strong></td>
<td>What is the ‘gut reaction’? Will it work? Will it be well-received?</td>
<td>How will the risk control be received at management level? What will the workers think? Does it seem like more work? Will it require ‘selling’?</td>
</tr>
<tr>
<td><strong>Pessimistic</strong></td>
<td>What are the negatives? Why won’t it work? What are the weaknesses?</td>
<td>What if …?</td>
</tr>
<tr>
<td><strong>Optimistic</strong></td>
<td>What are the benefits?</td>
<td>What will/could be the OHS benefits? What could be other benefits for productivity, product quality, financial, staff morale?</td>
</tr>
<tr>
<td><strong>Creative</strong></td>
<td>Where do we go if we think outside the square?</td>
<td>What about…? Another way would be…?</td>
</tr>
</tbody>
</table>

The outcome from such an approach allows emotion and scepticism as well as rational thinking to be part of the risk control decision-making and helps overcome either persistent pessimism or unrealistic optimism. As a consequence, decisions should result in sounder, more effective risk control and include good contingency management.
3.5 DEVELOP CONTROL STRATEGY FOR THE SELECTED HAZARD IN CONSULTATION WITH STAKEHOLDERS

The involvement of stakeholders, key personnel and operational staff has been highlighted in this learning guide at each stage of the hazard management process. Refer to sections 1.5 (hazard identification), section 2.3 (risk assessment) and section 3.2 (risk control). In section 3.2 it was identified that those involved in the risk control process should include:

- stakeholders (those people or organisations who may be affected by, or perceive themselves to be affected by an activity or decision);
- key personnel (managers from related areas, people involved in decision-making or who are affected by the decision);
- technical advisers; and
- OHS advisers.

Those who do the work, those who have technical knowledge about the work and anybody who may have a stake in the work or safety outcomes, all have something to contribute and the right to be involved. Many expensive mistakes could have been avoided by including those who do the work in the development of risk controls. It is not only a practical requirement to ensure that the broadest range of options are considered and that the eventual outcome will actually work, but there is also a legal obligation to involve those who may be affected by the risk control decisions.

3.6 COMMUNICATE OUTCOMES OF HAZARD IDENTIFICATION, WORKPLACE MONITORING AND ANALYSIS, AND THE RESULTANT CONTROL STRATEGY TO STAKEHOLDERS AND KEY PERSONNEL FOR ACTION AS APPROPRIATE

As a follow-on from consultation for development of risk control, those who are affected by the risk control or have responsibility for implementing the control strategy need to be informed of the outcome of the hazard identification, risk assessment and risk control process. This involves:
• checking that the documentation requirements for hazard identification and risk assessment are completed (such documentation may include risk register, details of the risk assessment, and outcomes of monitoring of the work environment);
• documenting the OHS risk management plan including actions, responsibilities and timeframes;
• identifying the people who should be provided with information on the outcomes; and
• determining the most appropriate format for that information.

Remember that employees and their representatives have a legal right to information on health and safety in the workplace and to be consulted during decision-making about matters that may impact on their health and safety. There is also an obligation to provide employees with any information they require in order to do their job safely.

Stakeholders may also include people outside the organisation, so external communication processes may need to be considered.

Therefore, there is a need to communicate to stakeholders and key personnel the outcomes of the hazard identification, risk assessment and risk control processes using a readily understandable and accessible format.

The way this is done will depend on the nature of the organisation, the employees, and the communication processes and technology used by the organisation. The test is – do those who need the information, or who may be affected by the information, have ready access and can they understand it?

**Competency check for Element 3**

Key issues for each performance criterion in this section are as follows:

3.1 Seek information and data from external sources on control options for the specific hazard:

• External sources of hazard-specific information for risk control are identified and accessed.

3.2 Seek information and data from stakeholders and key personnel on control options for the specific hazard:

• Workplace sources of hazard-specific information and data for risk control are identified and accessed.
• Information for risk control is sought from appropriate workplace personnel.

3.3 Develop and advise a range of control options, in consultation with stakeholders and key personnel, by applying the hierarchy of control, noting that personal protective equipment (PPE) is regarded as the least satisfactory control measure:

• The hierarchy of control is used as a tool to apply the underpinning principle of safe place/control at source in the development of control options.
• Where PPE is a necessary control option, the requirements for optimising the effectiveness of PPE are identified and incorporated into the control strategy.
• Risk control principles specific to particular hazard types are known and applied.

3.4 Identify factors with a potential to impact on the effectiveness of controls:

• Limitations and potential failures of specific hazard control strategies are known and identified.
• Strategies are used to predict ways in which the controls might fail and the risk control plan modified to address the potential failures.
• In identifying potential failures in control, consideration is given to the organisational and management environment, the physical environment, equipment, procedures and the competency of the people and the potential for human error.

3.5 Develop control strategy for the selected hazard in consultation with stakeholders:

• The reasons for consulting stakeholders and others in the development of risk controls are identified.
• Individuals and groups who should be consulted in developing the controls are identified and consulted.

3.6 Communicate outcomes of hazard identification, workplace monitoring and analysis, and the resultant control strategy to stakeholders and key personnel for action as appropriate:

• Target group for reporting outcomes of hazard management is identified.
• Information is collated and reported in an appropriate format.
Case Study 3

A medium-sized manufacturing company employing 100 people produces boilers, gas cylinders and other pressed metal products. The production plant is very noisy, communication is difficult and employees have to shout to be heard. Following the company receiving a claim for noise-induced hearing loss, hazard identification was undertaken involving:

- accessing external sources of information;
- accessing and reviewing workplace sources of information; and
- undertaking a preliminary noise survey of the workplace.

Then the work environment was analysed to assess the risk and the risk register updated with three tasks marked for further action.

<table>
<thead>
<tr>
<th>Location</th>
<th>Hazard</th>
<th>Possible injuries/damage</th>
<th>Potential scenario/conditions where injury/damage could occur</th>
<th>Risk score</th>
<th>Further action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch press</td>
<td>Noise</td>
<td>Hearing loss and other health hazards.</td>
<td>Operator working w/o hearing protection or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
</tr>
<tr>
<td>Valve tightening</td>
<td>Noise</td>
<td>Hearing loss and other health hazards.</td>
<td>Operator working w/o hearing protection or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
</tr>
<tr>
<td>Number stamper</td>
<td>Noise</td>
<td>Hearing loss and other health hazards.</td>
<td>Operator working w/o hearing protection or hearing protection not optimal.</td>
<td>Required by legislation.</td>
<td>Must do</td>
</tr>
</tbody>
</table>

Risk controls were developed by the following processes.

**Seek information on control options from external sources**

The OHS regulations require that the priorities for noise control reflect the hierarchy of control:

- eliminate the noise source;
- substitute with a less noisy process or implement engineering modifications to reduce the noise;
- introduce administrative processes to reduce noise exposure; and
- provide hearing protection together with audiometric testing.
During the research on how to control noise, the health and safety representative located a very useful publication titled *Noise Control* (US Department of Labour, 1991) on a website [http://www.noiseline.org/hearing/noisecon/noisecon.htm](http://www.noiseline.org/hearing/noisecon/noisecon.htm). The noise control principles and examples of noise control measures in this publication alerted the company managers to the need for specialist engineering advice in the development of control measures. Other information on strategies for controlling noise was obtained from the *SafetyLine Institute* on-line Readings ([www.worksafe.wa.gov.au/institute](http://www.worksafe.wa.gov.au/institute)).

**Seek information on control options from stakeholders and key personnel**

The company engaged a consultant engineer with experience in noise control. They also convened a small working party comprising the production manager, the maintenance engineer, the health and safety representative and two operators with experience with each of the machines; to work with the engineer and also to act as liaison with the rest of the work group.

The objective of the working party was to ensure that the engineer had the required information so that the outcomes not only reduced the noise but were practical and would not impact negatively on production.

**Develop a range of control options and identify factors impacting on the effectiveness of controls**

As the noise levels were considered excessive and it would take some time to design and engineer the changes to reduce the noise levels, it was decided to review the hearing protection worn by each worker and to provide a short training session on the health effects of noise and the requirements for wearing and fitting hearing protection. An OHS adviser was contacted to prepare a ‘tool box’ presentation to be delivered by the health and safety representatives in each workgroup.

The risk control actions developed by the engineer, in liaison with the working party, are described below.
### Noise sources

| Punch press | Stamping operation:  
| | • steel pinion drive;  
| | • punching operation; and  
| | • vibration transmitted though floor and walls. | • Steel drive pinion replaced with one made from synthetic material.  
| | • Die re-engineered to slice rather than cut.  
| | • Vibration isolating mountings fitted under press. | Durability of pinion equal to steel pinion.  
| Air release from flattened copper tubes that forces steel cut-outs into a collecting bin. | • Nozzle changed to special air release nozzle. |  
| Valve tightening tool | Impact wrench used to tighten valves into socket previously welded onto cylinder. | • Different type of tool (high torque; low speed).  
| | • Counter-weighted system to support tool.  
| | • Cost 4-5 times the purchase price of the impact wrench. | • Valve had to be tightened to a specific torque.  
| | • Process had to be integrated into the production line.  
| | • Avoid introducing manual handling hazards. | • Avoid reducing efficiency.  
| Number stamping | Metal stamp hammered against metal cylinder. | • Hydraulic process rather than hammering process.  
| | • Trials to identify force required.  
| | • Supplier provided modified version of a commercially available tool. | • Avoid introducing manual handling hazards. |

In addition to these engineering controls, the company also implemented administrative controls addressing maintenance and purchasing.

The company recognised that, because worn and unbalanced parts of machines cause both noise and vibration, proper maintenance plays a very important part in controlling noise at workplaces. The maintenance schedule was reviewed to ensure that it covered:

- lubricating/oiling all moving parts;
- balancing and aligning parts, especially rotating ones;
- replacing worn parts; and
- checking the machine’s feed rates.
The company also implemented a ‘Buy Quiet’ policy. This policy recognises that it is generally cheaper in the long-term to consider ways to reduce noise when buying equipment than to try to modify the equipment later, or to require workers to use hearing protection.

The company found information on ‘Buy Quiet’ policies on the websites for the state OHS regulators and Safe Work Australia.

**Communicate outcomes of hazard management activity**

The actions required to implement these risk controls were identified and recorded in an action plan which listed the responsible person, resources and budget requirements, and the date for completion. This risk control action plan together with a summary report of the hazard identification, risk assessment and risk control process was tabled at the management meeting, the OHS committee meeting and posted for all workers to read.
Activity 3

Keep a copy of this Activity for your Assessment Portfolio.

This activity continues the work begun in Activity 1 and continued in Activity 2.

Control risk

1 Develop a range of options for controlling the risk associated with the hazard(s) being examined.

   (i) Consider research information, legislation, codes of practice and standards, current industry practice and other relevant sources of information external to the workplace.
   (ii) Seek input from workplace stakeholders, key personnel, technical advisers and OHS specialists.

2 In consultation with the stakeholders and others, evaluate the effectiveness of the various options to arrive at a recommended ‘package’ of controls. Demonstrate that you have considered the hierarchy of control and ways in which the various control strategies might fail.

3 Prepare a report for the responsible manager detailing the recommendations including:

   (i) how the controls were developed;
   (ii) the recommended control ‘package’ and the reasons why they were selected;
   (iii) the required support and maintenance processes to ensure effectiveness;
   (iv) where PPE is part of the control package, include the requirements for optimising effectiveness; and
   (v) the implementation action plan.
Element 4: MONITOR AND REVIEW
EFFECTIVENESS OF CONTROL

You have now developed and implemented a control for a specific hazard. How effective is the control?

- Is the control in place?
- Are there any bottlenecks hindering implementation? Difficulties? Resistance?
- Did the risk controls actually achieve a reduction in risk?
- Has the change created any new hazards or unanticipated effects?
- What is the level of compliance with any new procedures?
- Is this reduction in risk likely to be on-going?
- Have there been any organisational or process changes that may impact on the effectiveness of the risk controls?
- Is it possible to make further improvements to increase the reliability and effectiveness of the risk controls?
- Are there any lessons to be learnt that can be applied to other hazards or hazard control processes?

Hazard management is often represented as a three-step process:
- identify hazards;
- assess risks; and
- control risks.

As the ultimate objective is risk control, it is important that risk control is considered in three stages:

- development of risk control;
- evaluation of controls implemented; and
- on-going monitoring of the controls.

This section examines the stages of evaluating and monitoring the effectiveness of the controls.

In order to complete the fourth element of the competency unit successfully, you will have to show that you have satisfied the following performance criteria:

4.1 Regularly review effectiveness of control strategy.
4.2 Determine frequency, method and scope of review in consultation with workplace stakeholders and in accordance with workplace procedures.

4.3 Seek input from stakeholders to review.

4.4 Identify areas for improvement in the control of the selected hazard and make recommendations for improvement.

4.1 REGULARLY REVIEW EFFECTIVENESS OF CONTROL STRATEGY

The effectiveness of control strategies should be evaluated following initial implementation and monitored on an on-going basis.

The evaluation and monitoring involves:

- evaluating the extent of change;
- evaluating the effectiveness of the controls; and
- checking if any new hazards have been introduced as a result of the change.

Evaluate extent of change

The first question is – **has the risk control action plan been implemented?** You cannot expect change if the implementation actions have not been completed.

While it is not the role of the OHS practitioner to manage change, the practitioner should monitor the implementation of change in association with the responsible manager. Risk control action plans should be updated on an on-going basis and any actions that are delayed or ‘blocked’ should be reviewed, the reasons for the delay identified, and appropriate action taken.

The second question is – **did the planned risk controls result in change?**
Where your risk assessment included monitoring of the work environment, further sampling post-implementation of the control will provide good information on the extent of change.

OHS performance measures routinely used in the workplace will provide information on change; however, the availability and value of the information will depend on the nature of the measure. Both positive (lead) and negative (lag) indicators are important here.

Where a workplace has performance measures that focus on the ‘drivers’ of OHS change and recognise achievement, it is easier to measure change; also key personnel are motivated to achieve the change or desired actions. This reinforces a basic principle of organizational, behaviour -

*What interests my managers absolutely fascinates me!*

Favourite saying of Professor Dennis Else (formerly Chairman of National Occupational Health and Safety Commission)

Part of the changes for risk control may be new procedures. Compliance with the new procedures will be a key factor in the change.

The *Safety Behaviour Survey of the Western Australian Mining Industry* (Mines Occupational Safety and Health Advisory Board, 2002) identified some interesting differences in the perceptions of managers and workers regarding compliance with procedures. When asked to comment on certain statements there was wide disagreement in the perceptions of managers, supervisors and the workforce. Such differences in perception should be taken into account when evaluating compliance with procedures.

<table>
<thead>
<tr>
<th></th>
<th>Managers disagree %</th>
<th>Supervisors disagree %</th>
<th>Workforce disagree %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees take short cuts to meet production demands.</td>
<td>71.6</td>
<td>64.5</td>
<td>51.0</td>
</tr>
<tr>
<td>The work practices in my workplace are not the same as the written (safe) work procedures.</td>
<td>82.8</td>
<td>75.2</td>
<td>58.4</td>
</tr>
</tbody>
</table>

*In your opinion, which group would have the most realistic view of the level of compliance? Why?*
Change is often difficult. There may be resistance or habits that are hard to break. Changes in procedures may require training. Has everybody been trained in the new procedure?

One strategy used to monitor compliance with procedures is ‘workplace sampling’. Workplace sampling involves:

- selecting a procedure;
- selecting a time period;
- observing the work practices for the selected period; and
- recording compliance/non-compliance during the selected period.

The observations can be expressed as the percentage of non-compliant practices compared with the number of times the procedure was undertaken.

There are some important rules to follow if you undertake workplace sampling:

- The results should not identify any persons who are non-compliant, or be used for discipline purposes.
- Workers should understand the reasons for the survey and that they will not be identified.
- Workers should know that the surveys will be undertaken, but not the time period.

Should an unacceptable level of non-compliance be observed, there should be clarification as to whether:

- the workers were aware of the procedure;
- the workers were capable of performing the procedure;
- there were factors that prevented/discouraged the workers complying with the procedure;
- there are strategies that can be introduced to make it easier for the workers to comply with the procedure; and
- the employees had a reason for not complying with the procedure, and the nature of that reason.

The follow-up actions will depend on the reasons for non-compliance and may include:

- changes to the procedure;
- changes to the workplace or equipment;
- training;
- changes to supervisory practices; and
- counselling.

## Evaluate effectiveness of risk controls

In section 1.2, you identified and accessed sources of information to assist in identifying hazards. You now need to revisit the workplace sources of information to obtain updated data to evaluate the effectiveness of controls in reducing risk and to identify whether any new hazards have been introduced as a result of the change.

Remember the predictable reasons why risk controls might fail and the sources of these failures. Ensure you collect information that will enable you to evaluate the potential for such failures.

### Reminder on how risk controls might fail

Risk controls may fail due to:
- inadequate initial design;
- inadequate installation;
- incorrect usage;
- inadequate maintenance;
- changing parameters of the problem such as changes in personnel, materials, work methods; and
- authorised or unauthorised modifications to equipment or processes.

Risk control failure is the result of deficiencies in one or more workplace factors of:
- the organisational and management environment;
- physical environment;
- equipment;
- procedures; and
- people and human error.
One strategy for evaluating the effectiveness of risk control is to conduct a second risk assessment post-control and compare the outcome with the pre-control assessment. It is important that the assumptions underpinning the assessments are consistent, with the only variations being those affected by the new controls.

**Monitor on-going effectiveness of controls**

The successful risk control evaluation and updating of the risk register will indicate the need for monitoring the effectiveness of the control. Few risks remain static. Factors affecting the consequence or likelihood may change, as will perceptions of the suitability of the control.

Controls implemented at the higher levels of the hierarchy of controls require less frequent monitoring due to their inherent reliability. For example, where a low toxicity chemical is used to replace a hazardous substance there is minimal need to monitor, compared with the necessity of monitoring the maintenance of procedural controls.

Control measures low in the hierarchy of control (administration and PPE) are not reliable and as such are prone to failure. Quite often these types of controls may fail and go unnoticed until it is too late. For example, a trolley is purchased to be used to move materials, but it is not stored in its usual place. The next operator picks up the material by hand, carries it some distance and is therefore exposed to the risk of an injury occurring. That is, the control measure ‘fails-dangerous’.

Monitoring of ‘safe person’ controls requires active and frequent monitoring with regular inspections and observations to ensure the risk control is in place and effective.

Risk registers may be used to generate monitoring checklists that can then be allocated to the appropriate personnel for completion on a regular basis. Workplace inspection checklists should include monitoring questions or points to ensure that systematic observations occur.
Monitoring control measures includes monitoring any residual risk over time. For example, a noise hazard not reduced below levels where hearing may be damaged will require the employees hearing to be monitored on a regular basis in line with local statutes.

4.2 DETERMINE FREQUENCY, METHOD AND SCOPE OF REVIEW IN CONSULTATION WITH WORKPLACE STAKEHOLDERS AND IN ACCORDANCE WITH WORKPLACE PROCEDURES

If you ask workplace personnel 'How often should the effectiveness of controls be reviewed?' the answer is often 'continually'. However, this approach often results in only superficial review and relies on information such as incident and hazard reports.

Frequency and scope

Where workplace monitoring is carried out, continuous or frequent sampling may be inappropriate and consume resources that can be better used in other ways. Also, where there is such monitoring, there is often a tendency to focus on the monitoring activity rather than controlling the risk. Factors to consider when determining the frequency include:

- the timeframe for ‘things to go wrong’;
- the reliability of the controls (ie the level on the hierarchy of control);
- the severity of the consequence should there be a failure in the control;
- the sensitivity and reliability of the review strategies; and
- the most effective use of resources.

Having determined the required frequency for review it is important that review is undertaken in accordance with the schedule.
In *Lessons from Longford*, Hopkins (2000) notes the impact of a deferred HAZOP (Hazard and Operability study) in the occurrence sequence of the explosion in 1998 that killed two people and injured eight others, cutting off Melbourne’s gas supply for two weeks:

> A HAZOP for gas plant 1 was planned for 1996 and the cost of the study was included in Esso’s budget for that year. The figure budgeted was $70,000, a modest sum by industry standards. But the planned study never took place. Although no formal decisions were taken it seems that each year the matter was simply deferred. ….The deferral in 1995 was explained as a matter of resources. It was said that the resources required for the HAZOP could be put to better use attending to issues thrown up in another risk assessment exercise undertaken on 1994.

(Hopkins, 2000)

Scope and frequency of review are interlinked. It is likely that reviews of a smaller scope will occur more often than major reviews. There may be review of chemical hazards or manual handling hazards for one task, one part of the workplace or the workplace overall.

The frequency and scope of reviews of the effectiveness of hazard management for specific hazards should be determined on the input of specialist advisers, those responsible for managing OHS and those who may be affected by a failure in the hazard controls.

**Method**

While the stakeholders such as managers, supervisors, OHS representatives and operators should have some input to the methods of review, this input should be ‘informed’.

Specialist advice is required to ensure that the method for review is appropriate for the hazard and the level of risk. A full HAZOP may be required for a petrochemical process, while a different approach will meet the need within a small food manufacturing company. The adviser or practitioner should be able to explain and justify the reasons for recommending a particular method of review so that input by managers, supervisors, OHS representatives and operators is informed and the most appropriate decision is made taking account of hazard and risk issues, and operational and resource requirements.
4.3 SEEK INPUT FROM STAKEHOLDERS TO REVIEW

The involvement of stakeholders, key personnel and operational staff has been highlighted in this learning guide at each stage of the hazard management process.

This is not only based on the legal right of employees and their representatives to information on health and safety in the workplace and to be consulted during decision-making about matters that may impact on their health and safety, but also as a point of practicality. Employees and operators know the job and have vital information about the work, including when things are likely to go wrong. Managers need to be involved as they have the responsibility for ‘managing’ safety including related resource and operational matters.

4.4 IDENTIFY AREAS FOR IMPROVEMENT IN THE CONTROL OF THE SELECTED HAZARD AND MAKE RECOMMENDATIONS FOR IMPROVEMENT

Monitoring the risk controls should also include identifying areas for further improvement. The processes outlined above will result in areas for improvement being identified. The next step is to document and plan for action to implement the improvements.

Planning for improvement needs to be systematic. A documented action plan is needed to implement improvements identified. The risk control action plan should include:

- actions required for the risk controls to be effective;
- responsibility for actions (by name AND position);
- target date for completion;
- expected outcome; and
- budgets.

Remember to compare the levels of the risk control hierarchy with the timeframe when determining target dates.
Making recommendations is not completed by writing a report or developing an action plan. You may also be required to make a presentation to management, the OHS committee or a working party to explain the recommendations, options for action and answer queries.

Competency check for Element 4

Key issues for each performance criterion in this section are as follows:

4.1 Regularly review effectiveness of control strategy:

- Extent of change is evaluated.
- Effectiveness of risk controls is evaluated.
- On-going effectiveness of controls is monitored.

4.2 Determine frequency, method and scope of review in consultation with workplace stakeholders and in accordance with workplace procedures:

- Frequency and scope of review is determined taking account of the timeframe for things to go wrong, reliability of controls, severity of potential consequence, sensitivity of monitoring processes and specialist advice.
- Method of review is appropriate to the hazard, level of risk, and operational and resource requirements.

4.3 Seek input from stakeholders to review:

- Reasons for involving stakeholders are identified.
- Stakeholders’ input is sought actively.

4.4 Identify areas for improvement in the control of the selected hazard and make recommendations for improvement:

- Areas for improvement are identified.
- Recommendations are made to address areas for improvement.
- Recommendations are in an easily understood format.
Case Study - 4

A medium-sized manufacturing company employing 100 people produces boilers, gas cylinders and other pressed metal products. The production plant was very noisy, communication was difficult and employees had to shout to be heard. Following the company receiving a claim for noise-induced hearing loss from an employee who had resigned recently, the company identified the noisy tasks, assessed the risk and implemented strategies to reduce the noise levels.

Risk controls do not always work in the way that is intended or there may be barriers to effective implementation that are not recognised. Therefore, it is vital that the effectiveness of the risk controls are monitored and reviewed.

**Review effectiveness of control strategy**

The risk control action plan was listed as an agenda item for monthly management meetings and for the OHS committee meetings. Responsible persons were required to provide status reports on the implementation actions at each meeting. Thus the company ensured that the planned changes actually occurred.

The next step was to confirm that risk controls resulted in a reduction in noise exposure at the workplace. The occupational hygienist who conducted the pre-control noise measurements was requested to come back to take comparable measurements to evaluate the extent of change. The results are summarised below.
<table>
<thead>
<tr>
<th>Equipment/process</th>
<th>Pre Control</th>
<th>Post Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noise level at operator’s ear</td>
<td>Possible exposure time*</td>
</tr>
<tr>
<td>Punch press</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>94dB(A) constant (fly wheel)</td>
<td>1 hour</td>
</tr>
<tr>
<td></td>
<td>100dB(A) impact (stamping)</td>
<td>(15 min)</td>
</tr>
<tr>
<td></td>
<td>97dB(A) release of air</td>
<td>(30 min)</td>
</tr>
<tr>
<td>Valve tightening</td>
<td>106dB(A)</td>
<td>3.8 min</td>
</tr>
<tr>
<td>Metal number stamping</td>
<td>112dB(A)</td>
<td>57 sec</td>
</tr>
</tbody>
</table>

* (WorkSafe Victoria, 2005b)

There has been significant reduction in noise levels with the valve tightening and metal stamping tasks being below the exposure limits set in the regulations.

However, if workers are likely to be operating the metal stamping machine for longer than two hours, then further control measures are required.

**Involve stakeholders and operational staff**

The company used a survey to involve the various stakeholders and key personnel in the review of the effectiveness of the controls.

Operators were asked to respond to a simple questionnaire about their perception of noise before and after work. The questions referred to activities such as listening to the car radio, participating in conversation at home and socially, and whether they had noticed any change since the risk controls were implemented.

The production manager, maintenance engineer and production scheduler were asked for their input as to whether there had been any changes. Their comments are summarised below.
**Punch press**
Less maintenance requirements as the vibration in the machine and fly wheel is reduced.

**Valve tightening**
No loss of productivity.
One-off cost of tool greater than torque wrench, but it has a longer life.

**Number stamping**
Significant productivity and quality improvement (number stamping not dependent on constant vigilance by the operator).
System adopted in other areas of the factory.

**Identify areas for improvement and make recommendations**

Further improvements were identified for the punch press and the number stamping tasks.

While the noise for the number stamping had been reduced below the exposure limits, the operator suggested that the work posture could be improved if the cylinders could be laid flat. This was possible with the hydraulic process, but would not have been possible with the hammering process.

Operators needed to work the punch press for longer than two hours and, as the objective was to eliminate the need for hearing protection, it was decided to invite the acoustic engineer to review the punch press to identify if the noise could be reduced further.

The engineer recommended surrounding the punch press with an acoustic insulating enclosure to isolate the noise source from the workers. However, he pointed out that in practice many such enclosures fail because access panels are left open or the enclosure is breached in other ways, such as holes being cut in the walls to access the machine.

The company decided to re-convene the original working party to liaise with the engineer to examine the feasibility of isolating the noise from the operators. In the interim, operators were required to wear hearing protection while working on the punch press.
Activity 4

Keep a copy of this Activity for your Assessment Portfolio.

This activity continues the work carried out in Activities 1, 2 and 3.

Monitor effectiveness of controls

You have prepared a report for the OHS committee on the hazard identification and risk assessment, which was then followed up with a report to the responsible manager on the recommended risk controls. The manager has requested you to prepare a presentation to be made at the senior management meeting on the requirements for further and on-going monitoring and review of the hazard, the risk and the effectiveness of the controls.

In developing the recommendations for monitoring show that you have addressed the following:

1 Strategy for evaluation identifies whether change has occurred and whether this actually results in a reduction in risk.

2 Frequency, method and scope of review is developed in consultation with appropriate persons and considers:

   (i) timeframe for things to go wrong;
   (ii) severity of potential consequence;
   (iii) reliability of controls;
   (iv) sensitivity of monitoring processes; and
   (v) operational and resource requirements.

4 Outcomes of review are documented in a manner that:

   (i) identifies areas for improvement; and
   (ii) supports implementation (ie clearly states actions, responsibilities and timeframes).
Element 5: APPLY PROFESSIONAL PRACTICE

Many OHS practitioners holding a Diploma of OHS consider themselves to be operating at a professional level. Operating as a professional implies that there is a code of ethics that underpins the approach to OHS.

OHS practitioners who are members of a professional body, such as the Safety Institute of Australia, the Human Factors and Ergonomics Society of Australia or the Australian Institute of Occupational Hygienists, are bound by a formal Code of Conduct.

The complexity of the ethical issues facing the OHS practitioner and the legal ramifications are the topic of the editorial and a number of articles in a special edition of the Safety in Australia journal published by the Safety Institute of Australia (Sheriff, 2005) (Pryor, 2005) (Cowley, 2005) (Ruschena, 2005).

In order to complete the fifth element of the competency unit successfully, you will have to show that you have satisfied the following performance criteria:

5.1 Manage collection of information and data, reporting of outcomes and maintenance of records in an ethical manner.

5.2 Identify situations where OHS specialists may be required.

5.1 MANAGE COLLECTION OF INFORMATION AND DATA, REPORTING OF OUTCOMES AND MAINTENANCE OF RECORDS IN AN ETHICAL MANNER

The codes of conduct for OHS professional bodies address the issue of ethics and collection and use of OHS information. These ethical issues include:

- privacy;
- confidentiality;
- access to own personal records; and
- commercial-in-confidence requirements.
Confidentiality and privacy

These two terms are often confused.

Privacy relates to control over other peoples’ access to information about oneself and the preservation of boundaries against giving such protected information to others or receiving unwanted information.

Confidentiality relates to agreement with a person or organisation about what is done (and may not be done) with their data.

Anonymity is another term that is sometimes confused with confidentiality. Anonymity means lack of identifiers or information that would indicate which individuals or organisations are provided with data.

For example, personnel records are protected under privacy legislation, while health records such as results of audiometry or medical assessments are both confidential and private. It may be that some incident reporting is anonymous, ie the name of the person making the report is not acknowledged.

Privacy legislation impacts on both the collection and storage of OHS information and on providing access to the information. The legislation and issues related to privacy and OHS information are discussed in the learning guide for BSBOHS502 Participate in the management of OHS information and data systems published on the SafetyLine Institute website.

Privacy legislation does not give employers the right to refuse to disclose information on health and safety to health and safety representatives, OHS committees or inspectors.

The Victorian WorkCover Authority has prepared information for employers on access to OHS information. This can be accessed on the authority’s website (www.worksafe.vic.gov.au) and then going to the ‘employer information’ section.

(Victorian WorkCover Authority, 2003a)
(Victorian WorkCover Authority, 2003b)
Commercial-in-confidence

The commercial interests of a company are often given as reasons for not providing information. The requirement not to pass on information that may be commercially sensitive is often protected in law. For example, the NSW Occupational Health and Safety Act 2000 has the following provision (Section 137) with penalties for breaches:

… a person who is, or was at any time, an authorised official exercising functions under this Act must not disclose any information relating to any manufacturing or commercial secrets or working processes that was obtained by an authorised official in connection with the administration and execution of this Act.

5.2 IDENTIFY SITUATIONS WHERE OHS SPECIALISTS MAY BE REQUIRED

It is not only practically important, but it is an ethical responsibility for all OHS practitioners to recognise their own professional limitations and when to call in specialist advice. OHS is a multidisciplinary function, so it is impossible for a practitioner to be equally competent across all areas of OHS.

OHS specialists may include:

- safety professionals;
- ergonomists;
- occupational hygienists;
- occupational health professionals;
- audiologists;
- safety engineers; and
- toxicologists.
Safety professionals provide advice on development and implementation of systematic approaches to managing OHS, OHS risk management and the management of specific hazards. The Safety Institute of Australia (SIA) is the professional body for safety professionals with members agreeing to abide by a code of practice and continuing professional development as part of their professional approach. Many professionals who are members of the other specialist bodies are also members of the SIA (www.sia.org.au).

Ergonomists use scientific and technical knowledge about human capabilities, functions and requirements to look at the design of jobs, systems, machinery and equipment and the environment where work is done. They aim to match the work to the needs of people, for safety, productivity and work satisfaction. The website for the Human Factors and Ergonomics Society of Australia (HFESA) (previously the Ergonomics Society of Australia) can be found at www.ergonomics.org.au

Occupational hygienists apply a scientific and technical approach to identification, assessment and control of chemical, physical and biological agents that may affect the health of people at work. The website for the Australian Institute of Occupational Hygienists (AIOH) is www.aioh.org.au

Occupational health professionals include occupational physicians, occupational health nurses, occupational therapists, occupational physiotherapists and health physicists.

Specialist OHS advice may be obtained from persons internal to the organisation or externally such as consultants.

When seeking specialist advice, it is important to evaluate the expertise and relevance of the consultant’s experience to the particular industry, the problem and the work context. It is also important to clarify how the specialist will interact with the workgroup to obtain the required information. A specialist working in isolation, without the input of the people doing the work, may well come up with erroneous evaluations and inappropriate recommendations.
In reviewing the prosecution of an occupational hygienist in the UK, Piney identified a range of errors common in hygiene analyses which combine to result in inadequate control. These errors include:

- failure to identify all exposed work groups;
- inappropriate sampling techniques;
- incorrect use of exposure standards; and
- poor understanding of the action of the hazard.

(M. Piney, 2002)

While this case applied to hygiene surveys, these types of errors may occur in any OHS hazard survey and subsequently result in inappropriate or inadequate control measures.

The OHS legislation for most Australian states and territories includes the requirement to ‘employ or engage persons suitably qualified in occupational health and safety’. In order to prevent similar situations to that in the UK prosecution, an organisation should have guidelines for obtaining OHS specialist advice.

In selecting an OHS specialist to provide advice on hazard identification it is prudent to consider the following points summarised from the publication *Getting Started with Workplace Health and Safety – An Introduction to Hazard Management, Workplace Inspections and Selecting a Health and Safety Consultant* (Victorian WorkCover Authority, 1997):

- **Education and qualifications** – What is their level of qualification, where was the qualification obtained?
- **Previous work experience and experience in the particular industry** – What is the length and variety of their experience? Do they have referees?
- **Professional affiliations** – Are they a member of a relevant professional body, do they work to a code of ethics? Do they undertake continuing professional development?
- **Special capabilities** – Does the consultant specialise in particular areas?
- **Business practice** – What are their fees? Do they have professional indemnity and public liability insurance? Are there any issues of confidentiality or conflict of interest?

(Victorian WorkCover Authority, 1997)
Other sources of information on engaging OHS specialist advice is available in publications such as:

- *Need help on health and safety?* [www.hse.gov.uk](http://www.hse.gov.uk)

When deciding whether to consult an OHS specialist, you should consider:

- the complexity of the hazard;
- the level of risk (seriousness of potential consequences); and
- the knowledge within the workplace (remember: knowledge of the task does not equate to knowledge of the risk).

**Competency check for Element 5**

Key issues for each performance criterion in this section are as follows:

5.1. Manage collection of information and data, reporting of outcomes and maintenance of records in an ethical manner:

- Personal practice complies with the requirements for confidentiality, privacy and commercial in confidence.

5.2 Identify situations where OHS specialists may be required:

- Own limitations are recognised.
- Specialty areas and skills in OHS are identified.
- Reasons, or circumstances where OHS specialist input is required, are identified.
Activity 5

Keep a copy of this Activity for your Assessment Portfolio.

Apply professional practice

Develop a personal code of professional practice.

1. Go to the websites for the Safety Institute of Australia, the Human Factors and Ergonomics Society of Australia and the Australian Institute of Occupational Hygienists and access the code of conduct, or code of ethics, for each organisation.

2. Review the various codes together with those from any other relevant professional societies.

3. Develop your own personal code of professional conduct.
   Ensure that you address issues of:

   (i) confidentiality, privacy, and commercial in confidence information, while considering potential safety implications; and

   (ii) recognising your own limitations and specialty areas and skills.
REFERENCES USED IN THIS LEARNING GUIDE


Online unit test questions

As a final Activity, check your understanding of managing hazards in the work environment by answering the on-line test questions for the unit, which you can access at the SafetyLine Institute:

www.worksafe.wa.gov.au/institute

The test questions have been taken from the Readings and Resources for this unit as well as from this learning guide.

Keep a copy of your student record in your Assessment Portfolio as evidence you have correctly answered the on-line test questions. Please note that you may be further questioned about the test questions during your Assessment Interview.
Integrated project

Keep a copy of this Project for your Assessment Portfolio.

By completing the Activities, you have undertaken the actions necessary to demonstrate OHS hazard management as it applies to a specific hazard.

While each Activity has to be individually identifiable for assessment purposes, you should also present them in a way that provides an integrated report for your workplace and demonstrates that you can apply the principles of OHS hazard management to a specific hazard type.

It is a requirement that you demonstrate competency in managing hazards for your selected hazard types, for example, noise, vibration, light, hazardous substances, dusts and fibres, thermal environment, ergonomic hazards, manual handling, and gravity (falls from heights). Therefore, your integrated report will need to cover your selected hazards.

This will also give you the opportunity to check that you have provided evidence that you have:

- the required knowledge and understanding; and
- the required skills and abilities, which are outlined in the Introduction to this unit.

You should ensure that you integrate evidence of the required knowledge and skills into your report.

Summative presentation

In addition to the written report, you are required to make an oral report to a workgroup (or a simulated workgroup) on the hazard management processes that you have applied and the outcomes. You may select the format and approach that you consider is most appropriate to the workgroup, but you should take account of the Project Review Checklist that will be used to assess you.
ASSESSMENT

Assessment portfolio from learning guide

For BSBOHS505C – Manage hazards in the work environment.

Note to participant

Any documentation provided as evidence must be prepared by you to a satisfactory standard and be in accordance with workplace procedures.

When collecting material for your assessment portfolio, please ensure that the confidentiality of colleagues, workers and other persons is protected, and block out any sensitive information. If you have any doubts regarding confidentiality issues, contact the organisation concerned.

Participant’s name: _______________________________
Date: _______________________________

✓ the box when you complete an activity from the Learning Guide. Add the material from the activity to your assessment portfolio.

☐ Activity 1 Access information to identify hazardous tasks or conditions
☐ Activity 2 Analyse work environment to assess risk
☐ Activity 3 Control risk
☐ Activity 4 Monitor effectiveness of controls
☐ Activity 5 Apply professional practice
☐ On-line test questions
☐ Integrated project and presentation
Note:
Attach a copy of this document to your assessment portfolio, so that your assessor can see you have completed all the activities.

Assessor's signature: ________________________________

Date: ________________________________
Project review check-list
For BSOHS505C – Manage hazards in the work environment.

Participant's name: _______________________________
Date: ______________________________

✓ the box if the learner has completed the following:

☐ Presented a written report detailing the application of OHS hazard management process for selected hazard types.

☐ Given a summary oral presentation to a workgroup (or a simulated workgroup), that summarised the OHS hazard management process you have applied and explained how the following knowledge underpins this process:
  - Organisational personnel at all levels.
  - OHS specialists and managers.
  - Report writing.
  - Location of information and data and advice from different sources to identify hazards.
  - Units of measurement to interpret measurement information and data.
  - Control strategies.
  - Relevant OHS legislation (acts, regulations, codes of practice, associated standards and guidance material).

Assessor’s Signature: _______________________________
Date: ______________________________
Third party (manager/mentor) report

For BSBOHS505C – Manage hazards in the work environment.

Note to participant

Where possible you should have an OHS practitioner as a mentor to assist in developing your practical skills in applying your knowledge. Your manager is also an important source of feedback on your competence, although from a different perspective.

The assessor will arrange to meet with you and your mentor, coach or manager to discuss completion of the third party report. The third party report will support integrated assessment of this unit.

The mentor, coach or manager is required to provide the Assessor with any relevant information. This report will be forwarded by the Assessor to the candidate for inclusion in their assessment portfolio.

The following is provided as the basis for a checklist for you and your mentor, coach or manager. Where you have both mentor and manager, separate forms should be completed.

The checklist has been designed to reflect the performance criteria and to collect information about your demonstration of competence in the workplace. The assessor may use additional questions to address any need for supplementary evidence to support your competence.

Checklist

<table>
<thead>
<tr>
<th>Did the Candidate satisfactorily:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Access sources of information and data to identify hazards</td>
<td>1.1 Access external sources of information and data to assist in identifying hazards?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2 Review workplace sources of information and data to access and assist in identification of hazards?</td>
<td></td>
</tr>
<tr>
<td>Did the Candidate satisfactorily:</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>----------------------------------</td>
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</tr>
<tr>
<td>1.3 Use appropriate tools to identify hazardous tasks or conditions for the selected hazard?</td>
<td></td>
<td></td>
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<tr>
<td>1.4 Use appropriate tools to conduct workplace inspections in consultation with stakeholders?</td>
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<td></td>
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<tr>
<td>1.5 Seek input from stakeholders, key personnel and OHS specialists if required?</td>
<td></td>
<td></td>
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</tbody>
</table>

Comments:

<table>
<thead>
<tr>
<th>2. Analyse the work environment to assess risks</th>
<th>2.1 Identify and use equipment and strategies for basic workplace measurement and monitoring?</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Interpret results of workplace measurements in accordance with recognised standards?</td>
<td></td>
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<tr>
<td>2.3 Seek input from stakeholders to clarify and confirm issues related to the selected hazard?</td>
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<tr>
<td>2.4 Report results of workplace measurements and interpretations to stakeholders in an easily understandable format?</td>
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<tr>
<td>2.5 Assess risks associated with hazard in consultation with stakeholders and taking account of effectiveness of existing controls?</td>
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<tr>
<td>2.6 Identify and prioritise hazardous tasks requiring controls in consultation with stakeholders and taking account of recognised standards?</td>
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<td></td>
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<tr>
<td>2.7 Establish and update risk register as appropriate?</td>
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</tbody>
</table>

Comments:
<table>
<thead>
<tr>
<th>Did the Candidate satisfactorily:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Control risks associated with hazards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Seek information and data on control options from external sources?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Seek information on control options from stakeholders and key personnel?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Develop and advise on a range of risk control options in consultation with stakeholders and key personnel by applying the hierarchy of control?</td>
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</tr>
<tr>
<td>3.4 Identify factors potentially impacting on the effectiveness of controls?</td>
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</tr>
<tr>
<td>3.5 Develop control strategies in consultation with stakeholders?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.6 Communicate outcomes of risk management activity for action?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Monitor and review effectiveness of control strategy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Regularly review effectiveness of control strategies?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Determine frequency, method and scope of review in consultation with stakeholders and workplace procedures?</td>
<td></td>
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<tr>
<td>4.3 Seek input to the review from stakeholders?</td>
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<tr>
<td>4.4 Identify areas for improvement in risk control and make recommendations for improvement?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
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</tbody>
</table>
### 5. Apply professional practice

<table>
<thead>
<tr>
<th></th>
<th>5.1 Manage information and data collection, reporting of outcomes and maintenance of records in an ethical manner?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.2 Identify situations where OHS specialists may be required?</td>
</tr>
</tbody>
</table>

**Comments:** Further comments by assessor (if required)

---

**Keep a record of the following:**

- **Name of person completing checklist:**
- **Background/experience in topic (if any):**
- **Date:**

**Relationship to person being assessed (tick):**

- □ Mentor/coach for ______ Months
- □ Manager for ______ Months
- Other ______ Months (explain)

**Team Manager/Mentor’s Signature:**

**Assessor’s Signature:**

**Date:**
Skills checklist

For BSBOHS505C – Manage hazards in the work environment.

<table>
<thead>
<tr>
<th>Candidate’s name</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Assessor’s name</td>
<td></td>
</tr>
<tr>
<td>Work activity</td>
<td>OHS hazard management</td>
</tr>
<tr>
<td>Unit of competency</td>
<td>BSBOHS505C – Manage hazards in the work environment</td>
</tr>
<tr>
<td>Location</td>
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</tbody>
</table>

**Instructions:**
The candidate undertakes hazard management (may be simulated).

**During hazard management did the candidate demonstrate or provide evidence of the following abilities:**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify areas for hazard control?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyse relevant workplace information and data?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribute to the assessment of the resources needed to systematically manage OHS and, where appropriate, access resources?</td>
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<td></td>
</tr>
<tr>
<td>Pay attention to detail when making observations and recording outcomes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use research skills to access relevant OHS information and data?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use numeracy skills to carry out simple arithmetical calculations (e.g. % change), and to produce graphs of workplace information and data to identify trends and recognise limitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use technological skills to use basic measuring equipment including reading scales and dials applicable to selected hazards</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
During hazard management did the candidate demonstrate or provide evidence of the following abilities:

<table>
<thead>
<tr>
<th>Ability</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct effective formal and informal meetings and to communicate effectively with personnel at all levels of the organization, OHS specialists and, as required, emergency services personnel?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare reports for a range of target groups including OHS committee, OHS representatives, managers and supervisors?</td>
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</tr>
<tr>
<td>Use language and literacy skills appropriate to the workgroup and the task?</td>
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<td></td>
</tr>
<tr>
<td>Use consultation and negotiation skills to develop plans, and to implement and monitor designated actions?</td>
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<td></td>
</tr>
<tr>
<td>Use project management skills to achieve change in OHS matters?</td>
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<tr>
<td>Organisational skills to manage own tasks within a timeframe?</td>
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<td></td>
</tr>
</tbody>
</table>

The candidate's overall performance met the standard:  

<table>
<thead>
<tr>
<th>Standard Met</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Comments / observations:

Assessor's signature

Candidate's signature

Date of assessment
Interview questions

For BSBOHS505C – Manage hazards in the work environment.

Note to participant

The questions listed below cover the performance criteria for this unit and support your required knowledge and skills. The assessor can add to or modify these questions to suit the particular context.

<table>
<thead>
<tr>
<th>Candidate's name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessor's name</td>
<td></td>
</tr>
<tr>
<td>Work activity</td>
<td>Hazard management</td>
</tr>
<tr>
<td>Unit of competency</td>
<td>BSBOHS505C – Manage hazards in the work environment</td>
</tr>
</tbody>
</table>

Location

Instructions:

The candidate is required to provide verbal answers (using examples where possible) to the following questions that will be asked by the assessor. It is suggested that the interview should be a ‘conversation’. The interviewer should be prepared to insert his or her own questions to explore weaknesses or other issues that arise during the ‘conversation’.

Did the candidate satisfactorily answer the following questions:  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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</tbody>
</table>
|     |    | In your workplace, have you been involved in identifying hazardous tasks or conditions? What were the hazard types you investigated?  
- Did you find any information outside the workplace that assisted in identifying the hazardous tasks/conditions? What were the sources of this information?  
- What sources of data from inside the workplace were used in identifying the hazardous tasks/conditions?  
- Who did you talk to as part of the hazard identification?  
- What, if any, were the limitations or gaps in the information available? |
<table>
<thead>
<tr>
<th>Did the candidate satisfactorily answer the following questions:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Have you conducted any basic workplace monitoring? What types of hazards were you monitoring?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• What equipment or techniques did you use?</td>
<td></td>
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<tr>
<td>• What do you see as the role and limitations of using the common monitoring equipment and techniques for hazard identification and risk assessment?</td>
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</tr>
<tr>
<td>• What advice or support did you have in using this equipment and interpreting the results?</td>
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<tr>
<td>• What issues did you encounter in the monitoring?</td>
<td></td>
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<tr>
<td>• What would you do differently next time?</td>
<td></td>
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</tr>
<tr>
<td>3 What is your understanding of ‘Exposure Standards’ and their application?</td>
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<td></td>
</tr>
<tr>
<td>4 How did you identify risks that require further action?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Have you been involved in developing risk controls for specific hazards?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Who did you talk to about potential control methods for the hazard?</td>
<td></td>
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<tr>
<td>• What legislation did you look at when developing control options?</td>
<td></td>
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<tr>
<td>• How did you find out about what other organisations are doing and what is considered ‘current industry practice’?</td>
<td></td>
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</tr>
<tr>
<td>• How did you prioritise the suggested control options or decide on the final control 'package'?</td>
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<tr>
<td>• Where on the hierarchy of controls did these controls sit?</td>
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<tr>
<td>• Were you satisfied with the change process in implementing the controls? Would you do anything differently next time or make different recommendations?</td>
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<tr>
<td>6 Have you been involved in recommending strategies for monitoring the effectiveness of controls?</td>
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<tr>
<td>• What factors do you think may be important when monitoring the effectiveness of controls?</td>
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<tr>
<td>• What did you consider when developing the monitoring strategy?</td>
<td></td>
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<tr>
<td>• Who did you talk with while developing the strategy?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did the candidate satisfactorily answer the following questions:</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
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<td>----</td>
</tr>
<tr>
<td>7 Have you ever encountered any ‘ethical’ issues during hazard management activities? (ie in relation to privacy, confidentiality, commercial-in-confidence information or working outside your area of expertise).</td>
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<tr>
<td>• How did you manage the situation?</td>
<td></td>
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<tr>
<td>• Would you do anything differently if faced with such a situation again?</td>
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<tr>
<td>8 What did you learn during the hazard management process?</td>
<td></td>
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<tr>
<td>• Did you encounter any problems? How did you overcome these problems?</td>
<td></td>
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<tr>
<td>• Were OHS specialists involved in the hazard management process? How was it decided either to involve, or not involve OHS specialists?</td>
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<tr>
<td>• What were the key points that you learned?</td>
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<tr>
<td>• What would you do differently next time?</td>
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</tr>
</tbody>
</table>

The candidate’s required knowledge was satisfactory:

Notes / Comments:

Assessor’s signature

Candidate’s signature

Date of assessment