HS659 Personal Protective Equipment Guideline

Policy Hierarchy link	WHS Act 2011 WHS Regulation 2011 Code of Practice: Managing Risks of Hazardous Chemicals in the Workplace WHS Policy
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Superseded Documents	Personal Protective Clothing and Equipment Guideline Version 2.1
File Number	2007/1508
Associated Documents	See section 5.2

Version	Authorised by	Approval Date	Effective Date
2.2	Director, Human Resources	23/3/2013	23/03/2013

1. Introduction and Scope

The purpose of this Guideline is to provide information in the selection, use and maintenance of personal protective equipment, including protective clothing, wherever it has been identified as a risk control measure. Risk management forms must have been completed for hazardous tasks in laboratories and risks controlled using the Hierarchy of Risk Controls methodology. Higher order risk control measures (elimination, substitution and engineering controls) should always be considered before relying exclusively on Personal Protective Equipment (PPE).

This Guideline applies to all staff and students who undertake any activity on behalf of UNSW where PPE has been chosen as a risk control measure. It applies in mechanical, chemical and biological laboratories as well as in workshops and when on field trips. This Guideline does not apply to designated computer laboratories.

2. Definitions

PPE: Personal protective equipment

Hierarchy of Risk Controls: The method of addressing and implementing risk control measures in order of importance, which is:

1. Elimination: Remove the hazard
2. Substitution: Replace with a less hazardous substance or activity
3. Engineering: Example install guards on machinery, provide fume extraction
4. Administration: Signs, Procedures, Following safe work practices, Training
5. Personal protective equipment: Respirators, ear plugs, etc.

3. Guideline

UNSW requires all staff, students and visitors working in laboratories and preparing for field trips to document a risk management plan for their activities. Where risks cannot be completely eliminated or controlled by higher order risk control measures, then PPE must be used.

The minimum PPE requirements of the Australian Standard AS/NZS 2243 must be taken into account i.e.

- laboratory clothing;
- protective eyewear;
- gloves;
- closed shoes;
- hearing protection;
- additional or specialised PPE, e.g. respirators.

All possible routes of entry of the hazard into the body must be taken into account when considering the PPE to be used.

3.1 Signage

Where PPE is expected to be worn inside a facility, there needs to be appropriate PPE signage on the outside of the doors leading into the facility. HS701 PPE Signs is a tool that Laboratory Managers can use to help achieve this.

3.2 PPE selection

PPE shall be selected, used and maintained in accordance with the relevant Australian Standard. Some Australian Standards appropriate to PPE include:

- AS/NZS 1336 Recommended practices for occupation eye protection
- AS/NZS 2161 Occupation protective gloves
- AS/NZS 2210 Occupation protective footwear
- AS/NZS 1270 Acoustics – hearing protectors
- AS/NZS 1715 Selection, use and maintenance of respiratory protective devices
- AS/NZS 4503 part 1-3 Protective clothing - Protection against liquid chemicals - Test method: Resistance of materials to permeation by liquids

Proof of compliance with the relevant Australian Standard is a prerequisite for purchase of any personal protective equipment.

Personal protective equipment must be:

- properly selected for the individual and the task ;
- readily available if supplied by UNSW;
- clean and functional;
- correctly used;
- appropriately stored and maintained

3.2.1 Laboratory clothing

All laboratory users shall use protective clothing appropriate to the tasks being undertaken. These may include long-sleeved laboratory coats, wrap-around gowns, disposable gowns and boiler suits. Cotton or cotton/polyester is the preferred material.

Specialised clothing may be required for certain hazardous processes. Such additional clothing will be identified in the Safety Data Sheet (SDS) for any hazardous chemicals being used. For instance, when handling hydrofluoric acid, always wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene or viton.

The most appropriate type of protective clothing required for a laboratory will depend on the activities being undertaken. Work that predominantly involves biological risks, such as working with microorganisms, bio-fluids (blood, urine faeces, sputum), viruses etc, requires the use of a rear-fastening, wrap around laboratory gown. A gown has longer sleeves enabling the cuff of the gloves to be pulled *over* the cuff of the gown, thereby protecting the wrist from exposure to biological material. The gown also provides better protection for the upper body if a lot of work is carried out in a seated position.

Where work predominantly involves the use of chemicals, particularly corrosives (acids and bases) and flammable materials, then the laboratory coat, which is generally made of a stronger cotton material, offers better protection and complies with the requirement of being able to be removed easily in the event of a chemical splash/spill.

In addition, factors such as the ability of the garment to get caught up in equipment should be considered. For example, the open end of the sleeves on a laboratory coat can get caught in things or knock items over whilst the baggy sleeves of a gown can get caught when reaching across equipment or other items.

It is important to take into account whether the work will be conducted in a seated or a standing position. When working with chemicals in a seated position an additional layer of protection may be required such as that offered by a chemically resistant apron worn over the laboratory coat.

The need to protect the gap between where a glove ends and a laboratory sleeve begins should also be considered. This may not automatically result in a gown being a better choice than a laboratory coat. It may also be acceptable to use protective sleeves over the arms of the lab coat.

In summary, the choice of protective clothing to be worn in a particular laboratory is based on risk and thus should be determined in consultation with the literature and with other laboratory users through a documented risk management plan. Whichever option is taken it is important to communicate the need to wear the clothing as intended i.e. gowns properly fastened at both ties and laboratory coats fully buttoned up.

The following table provides a summary of protective clothing types

Protective Clothing Type	Advantages	Disadvantages
Laboratory Coat	• Offers more protection in the event of a fire • Offers better protection against corrosives • Comes in a range of sizes • Is able to be removed quickly	• Gaping sleeves may expose the wrist • The open sleeve may get caught up in equipment or knock things over

	in the event of an emergency	• Exposes the top of the upper legs and lap when working in a seated position • Exposes the neck • Designed to be used whilst standing • Offers spatter protection only and a further layer of protection such as chemical apron is required for direct spills.
Laboratory Gown	• Offers better protection against biological risks (covers full front of body) • Tight cuffs fully protect the wrist • Offers better protection for the lap and upper legs • The snug fitting sleeve ends prevents the sleeve getting caught up in equipment /knocking things over	• Offers poor protection against corrosives • Offers poor fire resistance • Has limited size choices
Chemical Splash Apron	• Can be worn easily over a labcoat to provide an extra layer of protection against strong corrosives and other dangerous chemicals.	• They cannot be used on their own as they do not provide protection to arms and upper torso.
Dust coats	• Keeps street clothing clean in dusty areas	

Laboratory clothing must be removed before leaving the laboratory to reduce the risk of contamination to non-laboratory users. Where dust coats are used to simply keep street clothing clean and no risk of contamination exists (i.e. no chemical, biological or radiation hazards exist), then the dust coat does not need to be removed. However to avoid confusion the dust coat should be distinguishable from lab coats or gowns (e.g. use a coloured dust coat).

The University provides a laundry service for laboratory clothing for staff. Where students are laundering their own laboratory clothing, they should use a suitable detergent (e.g. for biological contamination Napisan may be appropriate) and launder separately to other clothes.

3.2.2 Protective eyewear

All laboratory users shall use protective eyewear where there is a risk of damage to the eyes. Sources of damage may include splashing of liquids hazardous to the eyes, impact, foreign particle entry and laser radiation.

The Occupational Optometry Clinic in the School of Optometry and Vision Science provides a selection and fitting service for safety glasses and goggles.

The following statements are from AS2243.3

- Appropriate eye protection shall be used to protect eyes from contaminated or hazardous materials or from ultraviolet light.

- Protective eyewear shall be worn unless a documented risk assessment can justify a lesser requirement.

Safety glasses

Safety glasses have lenses that are impact resistant and frames that are much stronger than standard prescription glasses. Safety glasses must have side shields and must be worn whenever there is a possibility of objects striking the eye, such as particles, glass or metal shards.

Safety glasses may not always provide adequate protection from chemical splashes as they do not seal to the face. Safety glasses may be adequate where the potential splash is minimal e.g. opening eppendorf tubes, or where the chemicals in use are of low toxicity.

Ordinary prescription glasses do not provide adequate protection from injury to the eyes and could even be hazardous to the wearer. For further information on prescription glasses, see the section below on prescription spectacles.

Splash Goggles

Goggles come in a variety of styles for maximum comfort and splash protection. Chemical splash goggles should be worn when there is a high potential for splash from a hazardous material. For example, goggles should be worn when working with glassware under reduced or elevated pressure and when glass apparatus is used in combustion or other high temperature operations. Like safety glasses, goggles are impact resistant. Chemical splash goggles shall have indirect ventilation so hazardous substances cannot drain into the eye area. Some can be worn over prescription glasses.

Face shields

Face shields are required when working with large volumes of hazardous materials, either for protection from splash to the face or flying particles. Face shields may need to be used in conjunction with safety glasses or goggles. *AS2243.1 Safety in laboratories (Planning and Operational aspects)* provides the following examples where a face shield should be used:

(a) where glass apparatus is evacuated, recharged with gas or pressurized;
(b) when pouring corrosive liquids;
(c) when using cryogenic fluids;
(d) when combustion processes are being carried out;
(e) where there is a risk of explosion or implosion;
(f) when using chemicals that can cause direct damage to the skin; and
(g) when using chemicals and biological agents that can be rapidly absorbed into the body via any path e.g. through the skin, eyes or nose.

The level of protection chosen shall take into account any eye and face hazards from other work being carried out in the vicinity. For some tasks, a face shield with a brow guard, chin guard or both, should be used. AS2243.3 suggests face shields should be worn when opening an autoclave.

Prescription spectacles

Prescription spectacles (as distinct from prescription eye protectors) are generally inadequate against flying objects or particles and could even be hazardous. For persons requiring eye protection in addition to sight correction, the use of prescription spectacles worn with additional protection, e.g. overglasses, wide vision goggles or clip-ons will be necessary. It is important to note the following disadvantages of wearing these with prescription glasses:

- The majority of prescription eye protectors can provide no more than low impact protection because of their lightweight design. Where medium impact resistance is required, medium impact resistant eye protectors complying with AS/NZS 1337 suitable for use over prescription lenses shall be used over the prescription lenses.

- The use of safety goggles worn over prescription lenses will not necessarily provide protection against impact from flying objects. Fracture of the prescription lenses can occur when the safety goggles deflect under impact, even if the goggles are not penetrated.

Information on the requirements for prescription eye protectors is given in Section 7 of AS/NZS 1336.

Contact lenses

Contact lenses are not eye protective devices and wearing them does not reduce the requirement for eye and face protection. When the work environment entails exposure to intense heat, molten metals, a highly particulate atmosphere, corrosive substances or any of the following substances (acrylonitrile, methylene chloride, 1,2 dibromo-3-chloropropane, ethylene oxide and methylene dianiline), contact lens use should be avoided.

The following safety measures must be implemented should contact lenses be worn by individuals working with chemicals:

- Conduct a risk management plan prior to working with any chemicals or biological material to determine what type of eye protection is required, and whether the wearing of contact lenses should be avoided.
- Notify workers and visitors about any defined areas where contact lenses are restricted.
- Identify all contact lens wearers working in chemical environments to supervisors to ensure that the proper risk management form is completed and the appropriate eye protection and first aid equipment is available.
- In the event of a chemical exposure, begin eye irrigation immediately and remove contact lenses as soon as practical. Do not delay irrigation while waiting for contact lens removal.
- Instruct workers who wear contact lenses to remove the lenses at the first sign of eye redness or irritation.

Laser eye protection:

To ensure the correct laser eye protection is selected users must understand:

- what type of laser is to be used;
- what power and wavelength is the laser;
- whether impact resistance is required.

The local Laser Safety Officer should be consulted when selecting laser eye protection.

3.2.3 Gloves

Many laboratory activities could lead to contamination of the hands and therefore potentially serious injury. A risk management plan should identify the type of glove required for the chemical and activity contemplated and the thickness of the material. Disposable gloves will only protect against splashes. If you know that you will be getting your hands wet, you may need thicker gloves.

It is important to choose gloves carefully as many hazardous substances pass readily through some glove types. The SDS for the chemical will indicate the appropriate glove material. There are also glove selection services and permeation guides on the internet.

You must use the SDS from the /manufacturer supplier of the chemical and you must use the website for the manufacturer of the gloves that you are purchasing.

Gloves must be removed before leaving the laboratory to reduce the risk of contamination to non-laboratory users.

3.2.4 Protective footwear

All laboratory users must wear footwear appropriate to the hazards of the laboratory. Australian Standard AS/NZS 2210 should be used to select the correct footwear. As a minimum, enclosed footwear equivalent to Type A (low shoe), Figure 3 in AS/NZS 2210.5 must be worn. Shoes made of absorbent material or woven fabric e.g. most types of joggers, runners and tennis shoes), should not be worn in laboratories where exposure to corrosive, or chemicals that are easily absorbable through the skin, could occur.

3.2.5 Hearing protection

All laboratory users must wear appropriate hearing protection when noise may damage or impair hearing, or as directed by legislation.

UNSW is required to eliminate or minimise any noise which may damage or impair hearing. WHS Regulation (clause 56-57) defines a workplace as unsafe if any person is exposed to noise levels that exceed an 8 hour noise equivalent of 85dB(A) or that peak at more than 140dB(C).

In determining the choice of hearing protection reference should be made to Table A1 in AS/NZS 1269.3 Occupational noise management - Part 3: Hearing protector program

TABLE A1	
CLASS OF HEARING PROTECTOR REQUIRED	
$L_{Aeq,8h}$, dB(A)	**Class**
Less than 90	1
90 to less than 95	2
95 to less than 100	3
100 to less than 105	4
105 to less than 110	5
Greater than 110 or equal to 110	seek specialist advice

The HS Unit can provide a basic noise survey service upon request.

3.2.6 Respirators and dust masks

Respirators should only be used to minimise the risk from inhalation risks (such as dusts, mists, fumes and vapours) if other hazard control methods are not practicable.

Situations at UNSW when they can be considered include:

- when engineering solutions such as mechanical ventilation, fume cupboards, local exhaust ventilation etc. are not technically feasible;
- while engineering controls are being installed or repaired;
- if emergencies or other temporary situations arise (e.g. cleaning up spills etc.).

What are the different classes of respirators?

The two main types are:

Air-purifying respirators and;
Supplied-air respirators.

<u>Air Purifying Respirators</u>

Some Air-Purifying Respirators work by filtering out particulates (e.g., dusts, metal fumes, mists, etc.) from contaminated air. Others can purify air by adsorbing gases or vapours onto an adsorbing material (like charcoal) in a cartridge or canister. They are either negative pressure units (most common types used at UNSW) or positive-pressure units such as powered air-purifying respirators (PAPRs). A powered air purifying respirator requires a battery to operate. The battery functions to supply power to the impellor that draws ambient air through the filter. A powered air purifying respirator has a headpiece which can be in the form of a respirator hood, mask, a loose fitting face-piece or a full face-piece.

Negative pressure Air Purifying Respirators are tight-fitting and are available as either:

- half-face mask (covering the face from the nose to below the chin), or
- full face-piece (covering the face from above the eyes to below the chin).

Examples include:

- disposable dust masks (half face only);
- particulate respirators which have a filter for trapping particulate matter;
- chemical cartridge respirators that can have a combination of chemical cartridges and a dust pre-filter. Different options are available such as acid gas cartridges (for example if exposure to hydrochloric acid was an issue) or organic vapour cartridges (e.g. if the issue was related to ethanol or xylene).

There are three classes of particulate filters suitable for filtering finely divided solid or liquid particles, or both, from inhaled air. These are classified in accordance with the tests in AZ/NZS 1716 and are classified as P1, P2 and P3.

P1 classification is for protection against mechanically-generated particulates. Suitable applications include woodworking, workshop and construction type activities.

P2 classification is for protection against mechanically and thermally-generated particulates, mists and fumes.

Cartridges are colour coded in accordance with the type of contaminant they offer protection against. e.g.

- Dust -- purple cartridge
- Solvents – black cartridge
- Formaldehyde – black cartridge
- Ammonia – green cartridge
- Acid Gas – yellow cartridge

Class P3 filters are intended for use against all particulates including highly toxic materials. However for non-powered respirators, a class P3 classification can only be assigned where a class P3 filter is used with a **full** face piece. *[If a P3 filter is used with a half face respirator then a maximum rating of P2 is obtained]*

Air Purifying respirators must not be used if the hazard is an Oxygen deficient environment.

Supplied Air Respirators

Supplied-air respirators supply clean air from either an air filled gas cylinder i.e. Self Contained Breathing Apparatus (SCBA) or from an external air line which supplies clean compressed air from outside the work area.

Supplied-air respirators may have either tight-fitting or loose-fitting respiratory inlets. Respirators with tight-fitting respiratory inlets have half or full face-pieces. Types with loose-fitting respiratory inlets can be hoods or helmets that cover the head and neck. These respirators are used where there is a potential for an Oxygen deficient environment or if there is a concentration of toxic gas which is immediately dangerous to health.

Points to consider before choosing a respirator

- The risk management plan must have identified the hazardous chemical that present the inhalation risk. The hierarchy of risk controls should have been implemented to reduce the risk as much as possible before applying the control of PPE.
- An attempt should be made to quantify the potential exposure from the hazardous chemical - this can be done provisionally using simple and inexpensive gas detection systems such as a pump and colorimetric tubes (contact your HS coordinator).
- Determine whether a half face or full face respirator is required.
- Once the appropriate respirator and cartridges are selected a fit test must be conducted. The wearer may be required to obtain medical clearance if the duration of use is frequent or of significant duration (e.g. may not be required if the use is for a one off clean up of a chemical spill which may only require wearing it for a few minutes duration).
- Factors which influence the effectiveness of the seal of the respirator onto the face must be eliminated e.g. no beards, long sideburns or stubble.
- Potential wearers must be trained in the respirator's selection, use, cleaning, storage and maintenance.

Maintaining the Respirator
Reusable respirators must be cleaned after use. The cartridges should be removed and the respirator washed in warm soapy water, rinsed and left to dry. Solvents must never be used to clean respirators. Once dry the respirator and cartridges should be returned to a seal proof bag or container and stored in a personal locker or cupboard dedicated to the storage of personal protective equipment. The manufacturer's instructions will provide further details on maintenance which can be incorporated into the Safe work procedure for the use of the respirators.

Any defects such as scratches, loose parts, tears, holes etc affects the proper functioning of the respirators and such respirators should not be used.

Use of the Cartridges should be tracked/logged to ensure they remain effective. There is no absolute way of determining whether or not they are still effective; however as an example if they are being used to protect against a material that presents an odour, as soon as the odour starts to become noticeable whilst wearing the respirators confirms that the cartridges are no longer effective. Often it is easier to use a blanket rule such as: replace 6 months after first use. In any case they must never be used past their expiry date.

4. Correct use of PPE

4.1.1 Fitting

The correct fit is a prerequisite for the correct operation of PPE and must be checked before the PPE is used. This is especially important for respiratory devices where a good facial seal is required.

4.1.2 Instruction and training

Staff, students and visitors must be taught the correct way to use the PPE. Instruction should include the need for the equipment, its basic design principles, its application and limitations.

4.1.3 Maintenance

All PPE must be maintained, tested and stored according to the manufacturer's requirements. The PPE must be kept in a clean, hygienic and effective condition. When not in use, PPE should be stored sealed, in a convenient, accessible and appropriate manner.

Laboratory coats and gowns must be hung on coat hooks provided and not draped over the back of laboratory chairs.

4.1.4 Issuing PPE

All staff, research students and visitors are to be issued with PPE when required. The only exception applies to research students where the provision of steel-capped safety boots is their responsibility.

Undergraduate students are required to provide their own PPE, such as laboratory coats and protective eyewear.

4.2 Responsibilities

4.2.1 Supervisors and Managers

All staff who are designated as supervisors, area managers or laboratory managers are responsible to ensure staff, students and visitors:

1. are supplied with the appropriate PPE for their work activities;
2. ensure that the PPE required, in the area of their responsibility, is worn

4.2.2 Users of PPE

All staff, students and visitors must use and look after the PPE provided to them for their personal protection

4.3 Review and evaluation

4.3.1 Risk management

Risk management plans must be periodically reviewed to ensure that all hazards and risks in the laboratory have been identified and eliminated, or controlled by the use of the Hierarchy of Risk Controls.

4.3.2 PPE

The adequacy of personal protective equipment must be regularly assessed to ensure that personal injuries are not occurring.

5. Acknowledgements

5.1 References

Ansell glove guide: http://www.ansell.com.au/specware/search.asp
Australian Standards:

AS/NZS 1336 Recommended practices for occupation eye protection
AS/NZS 2161 Occupation protective gloves
AS/NZS 2210 Occupation protective footwear
AS/NZS 1270 Acoustics – hearing protectors
AS/NZS 1715 Selection, use and maintenance of respiratory protective devices
AS/NZS 2243 Safety in laboratories (series)
HB 9: Occupational Personal Protection
AS/NZS 1269.3 Occupational noise management - Part 3: Hearing protector program
Policy on Eye Protection in Laboratories, The University of Queensland, April 2009

5.2 Associated Documents

UNSW Risk Management Program
UNSW Outdoor Workers Guideline
UNSW Fieldwork Guideline
HS701 PPE Signs

Appendix A: History

The authorisation and amendment history for this document must be listed in the following table. Refer to information about Version Control on the Policy website.

Version	Authorised by	Approval Date	Effective Date	Sections modified
1.0	Director, Human Resources	4/6/2007	4/6/2007	New Document
1.1	Director, Human Resources	20/5/2008	4/6/2007	4.1.3.2 Protective eyewear section expanded to include the specific need for goggles where a chemical splash hazard exists
1.2	Director, Human Resources	17/7/2008	4/6/2007	4.1.3.2 Laser eyewear requirements added
1.3	Director, Human Resources	23/6/2010	4/6/2007	Section 4.1.3.1 Provide more information to assist with the choice of lab gown or lab coat for a laboratory application.
2.0	Director, Human Resources	9/04/2010	9/04/2010	Review entire document. Reformat to UNSW Guideline template (ML)
2.1	Director, Human Resources	10/12/2010	10/12/2010	Added reference to PPE Signs in 3.1 and 4.2 Changed PPCE to PPE
2.2	Director, Human Resources	23/03/2013	23/03/2013	Updated legislation reference with WHS Act and Regulation Updated Branding Logo in accordance with UNSW Branding Guidelines. Modified the document identifier from OHS to HS in accordance with WHS legislation review