

**A Guide to
Non-Respiratory
Personal Protective
Equipment (PPE)
for use with
Chemical Agents
in the Workplace**





Our vision:

A country where worker safety, health and welfare and the safe management of chemicals are central to successful enterprise



A Guide to Non-Respiratory Personal Protective Equipment (PPE) for use with Chemical Agents in the Workplace

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1.0 Introduction

Personal Protective Equipment (PPE) not properly worn or selected appropriately may be totally ineffective and may give the user a false sense of protection. This guidance does not include advice on respiratory protective equipment (RPE). A detailed guidance document on RPE is available at www.hsa.ie.

The aim of these guidelines is to provide basic information and general guidance on the selection, use and maintenance of personal protective equipment (PPE) in the workplace for use with chemical agents.

These guidelines are not intended to be a legal interpretation of Chapter 3 of Part 2 of the Safety, Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No.299 of 2007).

Further specialist advice on PPE should be sought in consultation with a qualified Occupational Hygienist or appropriate Health and Safety professional.

1.1 What is PPE?

Personal Protective Equipment (PPE) means any device or appliance designed to be worn or held by an individual for protection against one or more health and safety hazards. It could include safety glasses, gloves, face shields, protective clothing or footwear.

The use of PPE should be considered in the framework of the hierarchy of control measures set out in Figure 1. The supply of PPE may still be required even with the use of engineering controls, for example, during maintenance.

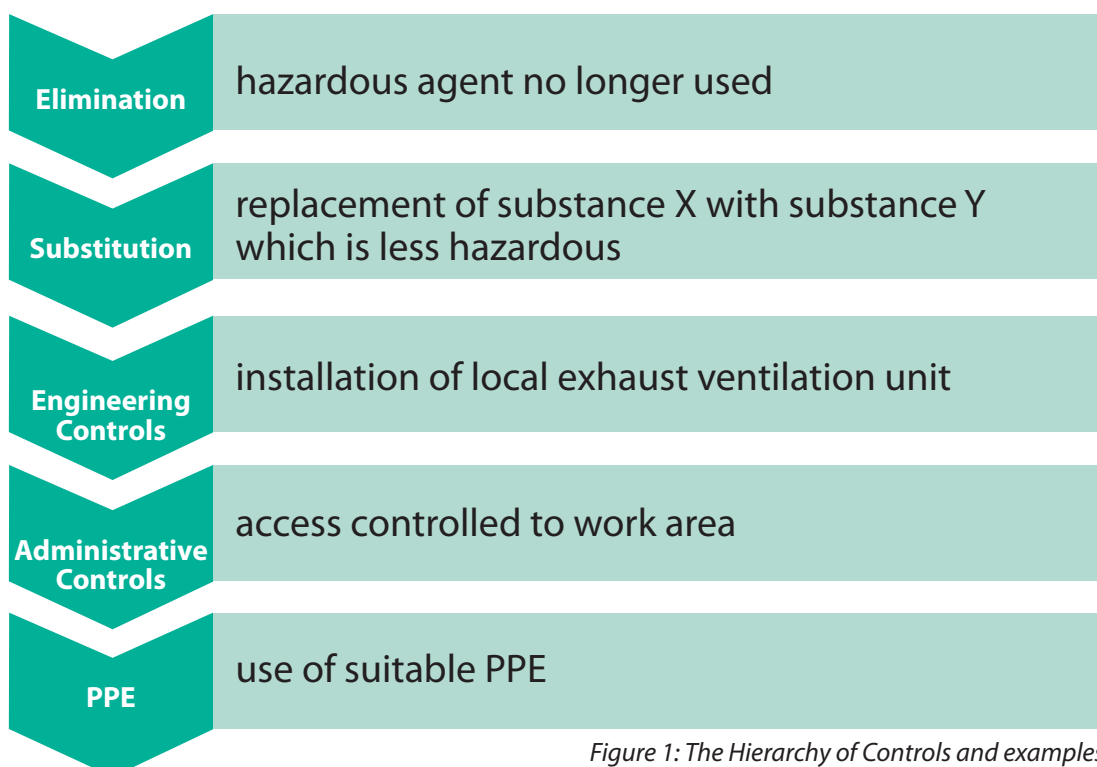


Figure 1: The Hierarchy of Controls and examples.

The Safety, Health and Welfare at Work Act 2005 (S.I. No.10 of 2005) requires the assessment and provision of PPE in the workplace. Employers shall determine the conditions of use of PPE and in particular, assess the **adequacy** of the PPE selected. An employer shall ensure that the use of an item of PPE provided is normally confined to one employee.

Employers have further duties concerning the provision and use of PPE in the workplace in accordance with chapter 3 of Part 2 of the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No.299 of 2007). PPE has to be provided free of charge by the employer where risks to the safety and health of the employees cannot be avoided or sufficiently limited by technical means or other collective or organisational protection measures at work.

Employees have a duty to use PPE properly whenever it is required to be used, report any defects in or damage to the PPE immediately, participate in any training or instruction provided on PPE and inform their employer of any medical conditions they have that might be affected by the use of the PPE provided to them.

Schedule 2, Part A, of the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) provides a non-exhaustive list of activities and sectors of activity which may require provision of PPE.

In relation to signage indicating the mandatory use of PPE, Schedule 9 of the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) sets out the requirements for safety signs which must be used when hazards cannot be avoided or adequately reduced.

Other Regulations which may apply to PPE depending on the situation include:

- The Safety, Health and Welfare at Work (Confined Spaces) Regulations, 2001 (S.I. No.218 of 2001).
- The Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 (S.I. No.619 of 2001).
- The Safety, Health and Welfare at Work (Carcinogens) Regulations, 2001 (S.I. No.78 of 2001).
- The Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations, 2006 (S.I. No.236 of 2006).
- The Safety, Health and Welfare at Work (Exposure to Asbestos) (Amendment) Regulations, 2010 (S.I. No.589 of 2010).

Please refer to Section 4 for information on the European Communities (Personal Protective Equipment) Directive (89/686/EEC).

3.0 Workplace Risk Assessment

The proper selection of PPE is based on risk assessment. A written assessment of the hazards in the workplace must be carried out to identify the correct type of PPE to be provided for the level of risk. Suppliers can often advise on the different types of PPE available and how suitable they are for different tasks. Safety data sheets or manufacturers' catalogues may contain useful information. The supply of PPE should be accompanied by information to the user on usage, maintenance, shelf life and any special conditions necessary for its safe use. It may be necessary in complex cases to obtain advice from specialist sources and from PPE manufacturers.

Particular attention must be paid when multiple types of PPE are required at the same time, for example, eye and respiratory protection.

PPE intended for use in explosive atmospheres must be so designed and manufactured that it cannot be the source of an electric, electrostatic or impact-induced arc or spark likely to cause an explosive mixture to ignite.

PPE must be worn when necessary and not left off for short jobs.

Note: For further information on conducting chemical risk assessments, the Health and Safety Authority has produced guidance for SMEs – 'Your Steps to Chemical Safety' – available for download at www.hsa.ie

3.1 Selection of PPE

- Once it is established that PPE is needed, the proper type must be selected based on the degree of protection required and the practicality of the PPE for the task. PPE must match the chemical hazard. Sometimes the worker will have to be protected against several hazardous chemicals at once.
- The chemical safety data sheets must be consulted for advice on relevant PPE.
- Advice should be sought from PPE/chemical suppliers or manufacturers. A great deal of information is on their websites including PPE selection tools for different scenarios.
- Trade associations and safety organisations may have further advice on PPE.
- Workers should be consulted because if the PPE is uncomfortable it will not be worn.
- An Occupational Health Adviser should be consulted if the worker has a medical condition which may affect their ability to wear PPE.
- The PPE must be CE marked. Where this is not possible due to the nature of the PPE, for example, ear plugs, the CE marking should be on the packaging.
- Checks need to be carried out to ensure that the PPE fits the workers correctly to ensure an adequate level of protection.

The placing of PPE on the European Market is subject to the requirements of European Directive 89/686/EEC as amended.

The classification of PPE is divided into 3 categories:

- Category I – Includes PPE of simple design and made for minimal risk, for example, gardening or janitorial gloves. The manufacturers are allowed to test and certify the gloves themselves.
- Category II- includes PPE of intermediate design for intermediate risk, for example, high visibility clothing or general handling gloves requiring good cut, puncture and abrasion performance where there is a risk of serious injury. This PPE is subjected to independent testing and certification by a notified body. The name and address of that body must appear with the instructions for use that are supplied with the PPE.
- Category III- includes PPE of complex design for irreversible or mortal risk to the worker. The PPE will be CE marked and tested and certified by a notified body. Also the quality control system of the manufacturer must be independently checked. The body carrying out this function will be identified by a number which must appear alongside the CE mark.



Figure 2: CE mark

CE marking is a key indicator of a product's compliance with EU legislation and enables the free movement of products within the European market. By affixing the CE marking on a product, a manufacturer is declaring, on his sole responsibility, conformity with all of the legal requirements to achieve CE marking. However CE marking is not a guarantee of quality.

Comprehensive harmonised EN standards have been developed to enable manufacturers to comply with the PPE Directive.

Conformity with a harmonised standard provides the manufacturer with a presumption of conformity with the Directive.

5.0 Types of PPE to Protect Against Hazardous Chemicals at Work

The following sections look in more detail at PPE for different parts of the body other than the respiratory system.

5.1 Protective Gloves

Protective gloves should be used when there is a risk of adverse exposure of chemicals to the skin.

There is no one-type-fits-all glove that can be worn that will protect the worker from all chemical hazards which is why proper selection is so important.

It is recommended that powdered latex (natural rubber/latex) gloves are not used, where reasonably practicable, as it is known that latex can cause asthma and dermatitis. A more serious allergic reaction such as anaphylaxis is possible in the case of highly sensitive people. Powder is added to the gloves to make them easier to put on and take off. Proteins in the natural rubber latex can leak into the powder and the worker can be exposed by inhalation of the powder or direct contact with the skin. This happens when the gloves are put on or off. The risk can be reduced by using non-powdered low-protein single-use gloves.

Some glove materials are quickly penetrated by chemicals so care must be taken when selecting glove types. For example, a glove that is suitable for use with one solvent may not be effective with others.

Further information is available in manufacturers' charts, which indicate properties and performance details of the differing gloves to help make an informed decision on glove selection.



*Dermatitis on worker's hands,
Source <http://www.hse.gov.uk>*

The definitions below are useful to understand the information given by glove manufacturers and inform the user of the suitability of the glove for use with specific chemicals.

- **Permeation** – the process where the chemical travels through the glove at a molecular level. The permeation rate indicates how long the glove can be worn. A glove with a low permeation rate is best.
- **Penetration** – the bulk flow of chemical through pinholes, seams or other faults in the glove.
- **Degradation** – the damaging change in one or more physical properties of the protective glove as a result of exposure to a chemical.
- **Breakthrough Time** – the time between the first contact with the glove and the detection of the chemical inside the glove. This is stated on chemical compatibility charts in minutes. To be approved as a chemical resistant glove a breakthrough time greater than 30 minutes must be achieved. If mixtures of chemicals are used the “shortest breakthrough time” chemical should be used as the basis to select the appropriate glove to protect the workers.

It should be noted that permeation and degradation tests are carried out under laboratory conditions and that real life working applications will vary. Gloves should be removed and disposed of according to manufacturer’s instructions.



Heavyweight chemical latex glove

5.2 Overview of Glove Materials

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- **Natural rubber/latex gloves** – Offer good flexibility and good resistance to many acids and alcohols. Gloves are comfortable and give chemical and liquid protection. Products containing natural rubber may cause allergic reaction. They should not be used when lubricants and other oils are used (see earlier advice on powdered latex gloves).
- **Nitrile gloves** – Offer the best protection against bases, oils and many solvents and animal fats. They offer resistance to snags and punctures. Nitrile cannot be used with ketones and some organic solvents.



Latex Gloves



Butyl/viton glove with CE marking



Nitrile Gloves

- **Neoprene gloves** – Resist a broad range of oils, acids, caustics and solvents but are less resistant to snags, punctures, abrasions and cuts than nitrile or natural rubber.
- **PVC gloves** – Offer good resistance to many bases, caustics, acids and alcohols. They also provide good abrasion resistance. They are useful for workers with latex allergies.

Table 1 recommends the most suitable glove materials to protect wearers from chemical exposure.

One of the factors influencing material selection is the extent of exposure. For chemical groups such as strong acids, only one choice of glove material is identified as most suitable, whereas a range of materials may be suitable for other chemical groups such as weak acids. Where there is a choice of

glove material, the extent of exposure to the chemical agent will be a significant factor in choosing between, for example, a neoprene glove or a less costly natural rubber glove.

If workers' gloves are significantly contaminated for extended periods, the neoprene glove may be required. If, however, there is only occasional splashing of chemical onto the glove, then the less costly natural rubber glove may be adequate.

Other factors to consider are the manual dexterity required for the job and required length of the glove (that is, do you need gauntlets?). If workers cannot do their job because the glove material is too thick or stiff, then they may decide not to wear them.

Once the inner surface of a glove becomes contaminated, it will not matter how much care, attention and expertise has gone into the selection process – exposure will occur. Also if contaminated gloves are temporarily taken off, hands may become contaminated from handling the gloves and this contamination can be transferred to the glove interior once they are put back on. To prevent this, re-usable gloves should be thoroughly cleaned if necessary before taking them off.

Where protective gloves are necessary, clear procedures backed up by training need to be established to cover their use, cleaning, removal, replacement and storage.

Chemical Group	Glove Material					
	Natural Rubber	Nitrile Rubber	Neoprene TM	PVC	Butyl	Viton TM
Water miscible substances Weak acids/alkalis	✓	✓	✓	✓	–	–
Oils	–	✓	–	–	–	–
Chlorinated hydrocarbons	–	–	–	–	–	✓
Aromatic solvents	–	–	–	–	–	✓
Aliphatic solvents	–	✓	–	–	–	✓
Strong acids	–	–	–	–	✓	–
Strong alkalis	–	–	✓	–	–	–
PCBs	–	–	–	–	–	✓

Table 1 - Selecting protective gloves for work with chemicals,

www.hse.gov.uk/

✓ indicates acceptable material

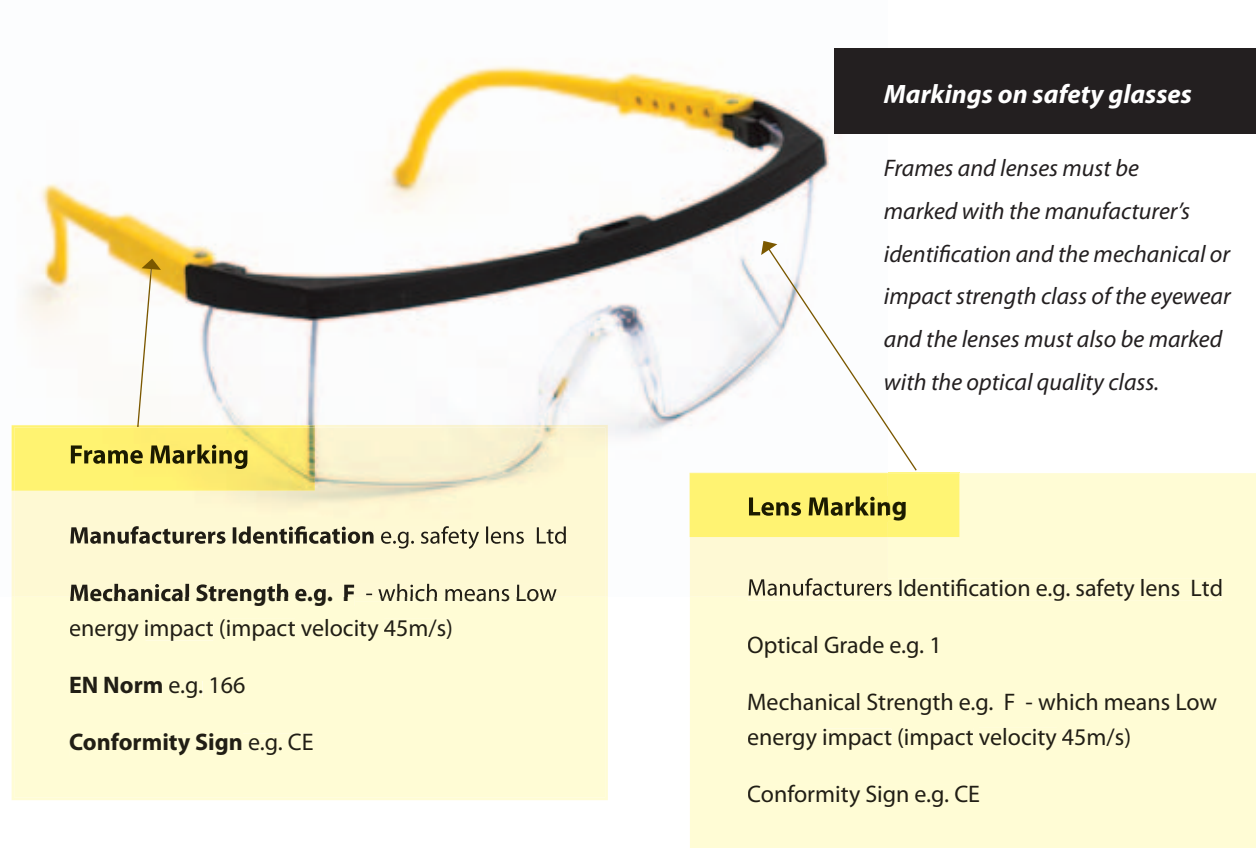
5.3 Eye and Face Protection

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PPE designed for the eyes and face is particularly important in that a single accident can lead to lifelong disability and disfigurement. Eye protection includes safety spectacles, goggles, face-shields and visors. Eye protection must fit properly and stay in place. The employer must assess the hazards and determine if it is necessary to use eye/face protection against hazards in the workplace including those faced by workers in an emergency situation.

The PPE chosen must provide the highest level of protection where the worker is exposed to multiple or simultaneous hazards at the same time. It should be comfortable and allow for sufficient peripheral vision. The personal vision needs of the worker should be considered, for example prescription safety glasses or goggles may be required. Safety eyewear is stronger than ordinary glasses as it is impact resistant. Safety glasses do not provide adequate physical protection from significant chemical splashes.

Antifog lens coatings are used on some safety goggles or glasses to stop the lens steaming up, and so reduce the danger of the worker removing them to clean the lens leaving their eyes exposed to chemicals.



For some applications protection against mechanical impact may also need to be considered in addition to chemical exposure.

Eye and face protection worn simultaneously must be adequate and compatible to ensure worker protection.

Due to the thick side pieces of chemical goggles the sound attenuation of hearing protection can be significantly reduced with the worker left exposed to high noise levels. Expert advice from suppliers and manufacturers of PPE should be sought where potential incompatibility issues are identified.

Safety glasses do not provide adequate protection from significant chemical splashes and are best used where potential chemical splash is minimal. Goggles with indirect ventilation should be worn when there is the potential for splash from hazardous chemicals.



Safety goggles

Face protection should comply with EN166. There are a number of options for the face screens according to the hazard it is protecting the worker from. For example, optical class 3 protects the worker against liquid droplets/splashes.

A face shield protects the face from large volumes of hazardous materials from chemical splashing or flying particles. Face shields should be used in conjunction with safety glasses or goggles depending on the type of risk to the eyes.



Face shield

5.4 Protection of Feet and Legs by PPE

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This PPE includes safety boots and shoes with protective toe caps and penetration-resistant mid-sole gaiters, spats and leggings. These are worn to protect the worker from chemicals damaging their feet or legs.

PPE must be worn when necessary and not left off for short jobs. Safety boots/wellingtons must be worn where there is a danger of chemical splashing on the legs. Safety footwear must be chemically resistant and may also need to have anti-static properties.

5.5 Chemical Suits and Protective Clothing

In the case of clothing designed to protect against chemicals, 6 product types have been identified with EN standards written for each one. For example, type 6 EN 13034:2005 is protective clothing against liquid chemicals. This offers protection against light splashes and sprays of lower hazard chemicals.

Potential exposures to large quantities of hazardous chemicals will often require the use of gas or liquid-tight suits. As the chemical hazard can vary from job to job, there is no chemical protective garment that will protect workers from all hazards. Chemical protective clothing is tested to standard methods for a range of hazardous conditions including chemicals.

A thorough workplace risk assessment must take place before selecting chemical protective clothing. The chemical hazards must be identified, in the form they appear, for example, gas, liquid, vapour or particulate. The minimum level of protection needed must be identified taking account of the toxicity of the chemical. The protective performance requirements of the fabric and seams of the clothing must be considered by checking the manufacturer's data on chemical penetration. The mechanical performance and comfort considerations must also be taken into consideration.

Comprehensive online tools help in making informed decisions when selecting chemical protective clothing. This gives the user information on the EN standard and the category of chemical protection provided by differing products.

The clothing has a limited lifespan. If the product is torn or punctured it is difficult to avoid potential chemical exposure. Suits must be disposed of when damaged as they will no longer give the relevant protection to the worker.



Disposable chemical suit

Employers are required to train each employee who must use Personal Protective Equipment at work.

- The level of training provided will vary with the level of risk involved and the complexity and performance of the equipment.
- Where PPE is provided employees must be informed of the risks against which they are being protected and the level of protection afforded.
- PPE users must be trained as regards the wearing, proper use and any limitations including the expected lifespan of the PPE.
- Employees must be made aware that it will protect the worker wearing it, not those around. If the PPE is damaged it will not give the expected protection and could lead to worker exposure to chemicals.
- Different PPE may be required for emergency situations such as chemical spills. Staff including supervisors should be trained in the use of PPE in emergency situations.



7.0 Maintenance

The effectiveness of the Personal Protective Equipment cannot be assured without proper maintenance. The most important part of maintenance is the need for continuing inspection of the PPE.

- PPE must be stored properly, kept clean and in a good state of repair. The manufacturer's instructions for use must be followed.
- PPE must be thoroughly examined regularly, by properly instructed staff, in accordance with supplier's and manufacturer's instructions, to ensure it is in good working order before use.
- Defective PPE must never be worn.
- PPE maintenance programmes will vary with the type of equipment used.
- Maintenance should include, when appropriate, cleaning, examination, repair, testing and record keeping.
- As a general rule simple maintenance can be carried out by the user, provided they have been adequately instructed and trained. An example would be lens cleaning of goggles.
- The examination, maintenance and repair of PPE used in high-risk situations should be carried out by properly trained staff.
- Where there is a risk to persons handling contaminated PPE, it should be dispatched for cleaning or if disposable it should be packed in a suitable container for disposal to prevent the escape of the hazardous substance.
- Sufficient and suitable spare parts for all PPE should be available on the premises. Only the correct spare parts should be used in the maintenance and repair of PPE to maintain the degree of protection.

The listed points below cover the key areas to consider when looking at the area of Personal Protective Equipment.

- A written risk assessment for the workplace must be carried out and must be kept up to date; any pre-existing health conditions must be taken into consideration.
- Employees must be given details of the risk assessment.
- Chemical safety data sheets should provide relevant information on PPE selection.
- Further advice from suppliers/manufacturers of PPE is available.
- Other measures to control hazards rather than solely depending on PPE need to be considered.
- The use of PPE in emergency situations must be determined also.
- Training must be given on the PPE provided, how to use it safely, maintenance and not using defective PPE. When wearing several types of PPE simultaneously they must be compatible.
- PPE must be fit for use, fit the worker properly, and be CE marked.
- Proper maintenance is important including the access to replacement PPE.



9.0 Further Information

Guidance from the European Commission

- Basic information on CE marking and frequently asked questions on the subject can be found at www.ec.europa.eu.

Guidance from Ireland

- Health and Safety Authority "*Your Steps to Chemical Safety*" and "*A Guide to Respiratory Protective Equipment*" can be downloaded at www.hsa.ie.
- National Standards on PPE can be sourced from NSAI (the National Standards Authority of Ireland) at www.nsai.ie.

Guidance from the United Kingdom

Guidance is available from the Health and Safety Executive in the United Kingdom (at www.hse.gov.uk) including:

- "*Guidance on PPE and Selecting Personal Protective Equipment (PPE)*".
- "*Skin health - It's in your hands*".
- "*Selecting protective gloves for work with chemicals*".
- "*Chemicals causing harm via skin or eye contact: control guidance sheet S101*".
- "*Managing risks from skin exposure at work*".

- CE – Conformance Europeene
- EN – European Norm (Standard)
- HSA – Health and Safety Authority
- HSE – Health and Safety Executive (UK)
- PPE – Personal Protective Equipment



Appendix 1

PPE Checklist

- Has a written risk assessment been carried out?
- Is the risk assessment reviewed periodically?
- Has the user been consulted about the selection of PPE?
- Does the PPE protect the user from the identified risks?
- Does the PPE fit the worker?
- If more than one type of PPE is worn at the same time are they compatible?
- Have the workers been trained in the use, limitations, cleaning and maintenance of the equipment?
- Is the PPE in good condition before use?
- Is the PPE cleaned after use and maintained in good working order?
- Is disposable PPE disposed of after one use?
- Are overalls laundered at work or in a specialised laundry?
- Is there a risk of contaminated PPE being brought home?
- Is protective clothing stored in a clean storage area?
- Is the PPE used meeting all the correct standards? It must be CE marked.



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