Protective Clothing Standard: Selection and Use

In many University workplaces, exposure to or contact with harmful agents such as chemicals, infectious agents, sharp objects, or extreme temperatures can create a potential for injury to the body and skin. Wherever practicable, these hazards should be eliminated or reduced through the use of engineering and/or administrative controls. We can protect against those hazards which continue to exist by using appropriate protective clothing for the job.

SCOPE:

Any worker who may be exposed to body or skin injury from an operation or process conducted within a University of Toronto workplace.

Note:

- *In this standard, "worker" includes faculty, staff, students and visitors.*
- *Protective clothing in the form of gloves and footwear are covered under separate standards (see University of Toronto Protective Glove Standard and University of Toronto Protective Footwear Standard).*

RESPONSIBILITIES:

Principal investigators, supervisors and all others in authority shall:

- Identify the hazards in the workplace requiring the use of body and skin protection;
- Determine (using this standard or in conjunction with the Office of Environmental Health and Safety) the type of protective clothing required for the specific hazard;
- Provide employees with appropriate protective clothing;
- Ensure that workers are informed in the proper use, care and maintenance of clothing; and
- Ensure that employees, students and visitors wear appropriate protective clothing at all times where hazards to the body and skin exist.

Workers shall:

- wear appropriate protective clothing at all times in areas where hazards to the body and skin exist; and
- maintain protective clothing in good condition.

PERSONAL PROTECTIVE CLOTHING:

Appropriate protective clothing must be worn in all situations where the body and skin are potentially exposed to hazards such as chemicals, infectious agents, radioactive materials, harmful dusts, sharp objects, burns and harmful temperature extremes. Protective clothing includes apparel such as aprons, leggings, sleeve protectors, shirts, pants, jackets, laboratory coats, coveralls, and full-body suits. Protective clothing material and design must protect against the specific hazards encountered in the workplace, cover and protect the areas of the body potentially exposed to the identified hazards, and provide a comfortable and secure fit.

The selection of appropriate protective clothing must be conducted following an appropriate assessment of workplace hazards. The Office of Environmental Health and Safety may be consulted for assistance in hazard assessment and clothing selection. Given the wide range of hazards in the workplace, a number of specific situations are discussed below.

Protective Clothing in Chemical or Biological Laboratories

Appropriate protective clothing must be worn in laboratories where chemical, biological or other hazardous materials are used and stored. In most laboratories, these hazards are generally mild to moderate in nature. In such circumstances, laboratory coats must be worn when working in the laboratory. Laboratory coats are intended to protect against minor splashes or spills, and to minimize contamination of street clothing with materials used in the laboratory. Laboratory coats must be made of material (e.g. cotton or cotton/polyester blend) suitable for the work environment, the materials handled and the tasks performed. They must fit properly, be fastened when worn, and provide appropriate flexibility to carry out tasks. As with all protective clothing, laboratory coats must be regularly cleaned and maintained, and replaced when worn or exhibiting significant deterioration. Given the potential for contamination by chemicals or other hazardous agents, laboratory coats must be removed when leaving the laboratory work environment. Laboratory coats must not be worn in eating areas (e.g. cafeterias, lunch rooms, coffee areas), in administrative office areas, or in public areas (e.g. washrooms, libraries, seminar rooms, public meeting places).

Because of the limited protection offered by laboratory coats, appropriate clothing (e.g. aprons, leggings, sleeve protectors, coveralls) which provide a higher degree of protection may be warranted in some laboratories. For example, plastic or rubber aprons should be used for greater splash protection when handling larger quantities of corrosive materials. When handling toxic chemicals, the chemical resistant properties of the selected clothing material must be appropriate to the chemicals being handled. Chemical performance in terms of degradation and permeation are further discussed below. Depending on the hazards in the laboratory, clothing which protect against other hazards such as cold, heat, moisture, radiation or electrical shock, may also need to be considered.

Hazardous Dusts

Where the potential exists for exposure to highly toxic dusts or fibres (e.g. lead, asbestos) in situations where the potential of body and skin contamination is high, appropriate protective clothing must be worn. This generally would include full-body coveralls which are highly resistant to retention or penetration by such particles (e.g. disposable Tyvek® coveralls). Such clothing must fit properly and allow appropriate flexibility to conduct tasks. After use, disposable protective clothing must be discarded as hazardous waste.

Temperature Hazards

Heat: Where the potential exists for exposure to heat, appropriate heat-resistant clothing must be worn. Depending on the source of heat, this may include apparel made of leather, aluminized fabric, or other heat-resistant material. For example, aprons or jackets made of leather or a flameproof material will protect against radiated heat or sparks.

Cold: Where the potential exists for exposure to cold, such as work conducted in refrigerated environments or outdoors, or work with cryogenic materials, appropriate thermally insulated clothing (e.g. coats, vests, aprons) must be worn.

Chemical Resistant Clothing

Where the chemical hazard results in a high level of skin protection required, an appropriate chemical resistant apparel which provides an effective barrier between the chemicals used and the area of the body to be protected must be worn. It is important to note that no single material will protect against all chemicals, and that no material is totally impermeable. Materials only temporarily resist chemical breakthrough; even the most chemically resistant material will break down after repeated chemical exposures.

Selecting the clothing material which best protects against a particular chemical must be based on chemical resistance performance upon contact with the chemical. Appropriate chemical resistant

clothing must demonstrate no penetration, no significant degradation, a breakthrough time greater than the duration of the task, and a low permeation rate upon contact with the chemicals used:

1) **Penetration** occurs when a chemical leaks thought seams, zippers, pinholes and other imperfections in the clothing.

2) **Degradation** is the physical deterioration of a material due to contact with a chemical. This may cause the material to soften, swell, shrink, stretch, dissolve, or to become hard and brittle. Materials having a good to excellent rating against degradation should be selected.

3) **Permeation** is the process by which a specific chemical diffuses through a material at the molecular level, from the outside to the inside surface of the material. Chemical permeation frequently occurs with no obvious signs of physical degradation of the material. The rate of permeation is affected by factors such as the type of chemical, chemical concentration, material thickness, humidity, temperature and pressure. Permeation testing provides two important pieces of data for material selection --- **breakthrough time** and **permeation rate.**

   Breakthrough time is the elapsed time from the initial contact of the chemical on the material exterior to the time of detection of the chemical on the inside surface and is a measure of the time needed for a chemical to soak through the clothing material. The expected duration for handling the chemical must fall well within the breakthrough time of the clothing material under the conditions of use.

   Permeation rate refers to the rate at which a chemical will move through the clothing material once the chemical has broken through. The higher the permeation rate, the faster the chemical will move through the material. The chemical protective clothing must have a low permeation rate under the conditions of use.

Always consult the pertinent material safety data sheets as well as the protective clothing product manufacturer's chemical resistance data to assist in selecting appropriate chemical resistant clothing.

The physical properties of a particular clothing material and its likelihood for puncture, tearing, abrasion or snagging under conditions of use must always be considered when selecting appropriate clothing. Penetration of chemicals through a tear or hole will lead to much higher exposures than by molecular permeation alone.

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