PROTECTIVE GLOVES

In many University laboratories, exposure to chemicals, infectious agents, sharp objects, extreme temperatures and other hazards can create a potential for injury to the hand. Wherever practicable, these hazards should be eliminated or reduced through the use of

appropriate glove material for use with highly toxic substances, particularly for those chemicals which are readily absorbed through the skin and into the bloodstream. In such cases, gloves which have a very high resistance to chemical permeation must be used, such as laminated synthetic gloves.

Proper selection of an appropriate glove material must include:

- an assessment of the workplace hazards, including the specific chemical(s) to be used, the conditions and duration of use, and the specific tasks to be performed;
- consultation of each chemical's material safety data sheet for the recommended glove material to use;
- a review of the glove manufacturer's chemical resistance data on glove degradation and permeation for the specific chemicals to be used with it. A suitable glove must demonstrate no significant degradation, a high breakthrough time and a low permeation rate upon contact with the given chemical.
- **Refer to the Guide to Selection of a Chemical Resistant Glove**

Disposable gloves are usually made of lightweight plastic or rubber materials, and offer greater sensitivity and dexterity to the user. Users should be aware of the limitations of such gloves in protecting against chemical or physical hazards. Disposable gloves are generally intended to provide a barrier to infectious materials and guard against mild chemicals or other materials, and provide little or no protection against many chemicals. Although the need for high dexterity and low cost are often major factors in the selection of gloves, the potential for permeation of toxic materials though the glove must be of prime consideration. Disposable gloves should be replaced frequently, and should never be reused or washed with either water or alcohol, as washing increases the likelihood of permeability.

Hand washing and other personal hygiene practices are important measures for preventing or reducing contact with chemical contaminants. Current evidence tends to indicate that barrier creams and lotions offer little protection against chemical hazards, and often increase the likelihood of contact dermatitis. Such products often contain mineral oil lubricants which can weaken glove materials such as natural rubber latex. When finished the procedure involving the use of chemically resistant gloves, the gloves should be removed and either disposed of properly, or if being reused, decontaminated, dried and stored so as to avoid chemical contamination**,** sunlight and heat.

Inspection and care of chemical resistant gloves should be conducted routinely. Chemically resistant gloves will break down after repeated chemical exposures, and from heat and sunlight. As a result gloves should be inspected each time they are reused. Reusable gloves should be thoroughly rinsed and allowed to air dry. Gloves should be replaced on a regular and frequent basis. They should be replaced immediately upon signs of degradation, and particularly after contact with toxic chemicals. Once a chemical has been absorbed into the glove material, the chemical can continue to diffuse through the material even after the surface has been washed.

GUIDE TO SELECTION OF A CHEMICAL RESISTANT GLOVE

Chemical Degradation and Permeation Properties

In order to adequately prevent exposure to potentially harmful chemicals, an appropriate protective glove must provide an effective barrier between the chemicals being used and the skin of the hand. This table is intended as a guideline in the selection of the appropriate chemical resistant glove material by informing users of the limitations of glove materials, as well as the type of information that is available to indicate the degree of protection a glove material can provide. An inappropriate choice of glove material can result in worker exposure. In particular, extreme care must be taken in selecting the appropriate glove material for use with highly toxic substances, particularly for those chemicals which are readily absorbed through the skin and into the bloodstream.

The selection of an appropriate glove when working with chemicals must include an assessment of the hazards, related to the specific chemical(s) being used, the conditions of use and the tasks being conducted. The degree of protection from such hazards provided by a protective glove will depend on factors related to the glove material itself, including its chemical make-up, thickness, and method of construction.

Glove Limitations

- No single glove material will protect against all chemicals. Different materials interact differently with different types of chemicals. Natural rubber latex gloves may be suitable for dilute aqueous solutions; however, oils, greases, and many organic solvents will easily permeate latex material. Nitrile gloves may be used for oils and greases but are generally unsatisfactory for use against aromatic or halogenated solvents.
- No glove material is totally impermeable. Glove materials only temporarily resist chemical breakthrough and the chemical will permeate through the glove material over time. Once a chemical has been absorbed into the glove material, the chemical can continue to diffuse through the glove. Even the best chemically resistant glove will break down after repeated chemical exposures.
- Chemical resistance of a particular type of glove material(eg. nitrile) can vary significantly from product to product, and from manufacturer to manufacturer.

Chemical Resistance Properties of Gloves

The selection of a glove material which provides the best protection against a particular chemical should be based on the glove material's resistance to degradation and permeation upon contact with the chemical. When selecting gloves, degradation properties must first be considered. Once a glove material which demonstrates no significant deterioration when in contact with the intended chemical has been selected, its permeation properties in terms of breakthrough time and permeation rate must be considered. Glove manufacturers generally provide chemical resistance charts containing degradation and permeation data on their own products.

1. **Degradation** is the physical deterioration of a glove material due to contact with a chemical. Degradation may cause the glove to soften, swell, stretch, shrink, dissolve, or become hard and brittle. Glove manufacturers frequently conduct degradation tests on their glove products and rate them from poor to excellent. Glove materials having a good to excellent rating should initially be selected, and then evaluated with respect

to its permeability characteristics. A glove with a good or excellent degradation rating may perform poorly in terms of ch

as chemical exposure increases, such as with the resultant shortening of the breakthrough time with increase in chemical concentration, or with direct immersion into the chemical.

Temperature. In general, permeation rates increase and breakthrough times decrease with increasing temperatures. Permeation test data are obtained at room temperature (20^{o}C to 25^{o}C). If chemicals are being used at temperatures higher than this, glove performance may be significantly affected.

Glove thickness. A thicker glove offers better chemical resistance than a thinner one. In general, permeation rate decreases and breakthrough time increases with increasing thickness of glove material. A general rule of thumb is that double the thickness will quadruple the breakthrough time. Double gloving or choosing a stronger glove material may be necessary for adequate protection. Although thinner gloves offer greater dexterity, some chemical resistance may be sacrificed. Thick gloves can impair grip, dexterity and safety; a good balance needs to be struck.

Manufacturer. Because of variations in the manufacturing process, the permeability characteristics of the same glove material from different manufacturers can vary widely. It is essential to consult a specific manufacturer's test data for their particular glove product, including information on permeability, breakthrough time, and degradation.

Chemical mixtures vs. pure chemicals. Permeation testing is conducted using pure