University of Nebraska Lincoln

Safe Operating Procedure

(Revised 9/08)

PERSONAL PROTECTIVE EQUIPMENT FOR CHEMICAL EXPOSURES

(For assistance, please contact EHS at (402) 472-4925, or visit our web site at http://ehs.unl.edu/)

Use of an appropriate ensemble of personal protective equipment (PPE) may be necessary to protect against potential chemical exposures. In all cases, PPE is a supplement to and not a substitute for feasible engineering and administrative controls. Components selected for an adequate ensemble of PPE vary with the nature of the contaminant, route(s) of exposure, and contaminant concentration. General classes of PPE, with specific examples, are discussed below. EHS is available to provide guidance on selection of specific PPE.

Ensemble Components

- ***Respirators*** - When engineering controls are not sufficient to reduce the concentration of air contaminants below an acceptable level, respirators may be required. Many types of respirators are available, ranging from filtering face pieces (dust masks) to full face covering respirators. The appropriate type of respirator depends on the concentration of contaminants, as well as the form of contaminants (e.g., dusts, mists, fumes, etc.). Respirator use must conform to the requirements of the UNL Respiratory Protection Program (RPP). The UNL RPP and associated documents are available on the EHS web page.

- ***Eye and Face Protection*** - Protective eyewear or eyewear/faceshield combination may be needed to protect against projectiles, airborne particles, thermal burns, chemical splashes, vapors, or mists, dusts, or radiant energy. See the EHS SOP, ***Personal Protective Equipment - Eyes and Face***.

- ***Hand Protection*** – Gloves provide protection for the hands from many types of hazards, including chemical absorption. Like other classes of PPE, many types of gloves are available, varying in materials of construction and thickness. All glove manufacturers provide glove permeability and degradation data that will assist in selecting the proper glove based on specific chemical and conditions of use. In general:
  - Butyl rubber gloves protect against a wide variety of chemicals such as peroxides, acids, bases, alcohols, aldehydes, ketones, esters, and nitro compounds. They resist oxidation, ozone corrosion and abrasion, and remain flexible at low temperatures. However, butyl rubber does not perform well with aliphatic and aromatic hydrocarbons and halogenated solvents.
  - Natural (latex) rubber gloves are usually fairly thin and provide a low barrier protection against incidental contact with water solutions of acids, alkalis, salts

and ketones. They are very elastic and are resistant to abrasion. Some people are prone to development of latex allergies.

- Neoprene gloves are usually of similar texture and appearance to latex gloves. Like latex, thin neoprene gloves offer comfort, dexterity, and resistance to tears and abrasions. Thin neoprene gloves, while generally more resistant than latex, provide a low barrier protection against incidental contact with hydraulic fluids, gasoline, alcohols, organic acids and alkalis.
- Nitrile gloves are usually of similar texture and appearance to latex or neoprene gloves. Like latex and neoprene, thin nitrile gloves offer comfort, dexterity, and resistance to tears and abrasions. They are made of a copolymer and provide protection from chlorinated solvents such as trichloroethylene and perchloroethylene, as well as oils, greases, acids, caustics, and alcohols, but are generally not recommended for use with strong oxidizing agents, aromatic solvents, ketones, and acetates.

- ***Body Protection*** – Protective body apparel may be required when there is potential for accidental contact through spills or splashes. To be effective in high risk splash hazard situations, body apparel should fully cover the torso, arms and legs. Material of construction varies with type of garment selected. Cotton, flame-retardant laboratory smocks or coats provide protection in low hazard situations. More sophisticated apparel, such as tyvek coveralls, may be necessary when working with large quantities or highly dangerous chemicals.

- ***Foot Protection*** – Protective footwear should be selected based on the degree of hazard. Street shoes are generally sufficient to provide protection in low-hazard operations. Bare feet, sandals, and open-toed shoes are ***not permitted*** when there is risk of chemical exposure. Shoe covers provide protection in medium-hazard operations (e.g., contact with chemicals is likely but risk of splash is low). Selection of the material of construction for shoe covers is very important. Like gloves, the material of construction and thickness determines the level of protection of the shoe cover. Formed boots provide the highest level of protection and are designed for operations with significant potential for contact with chemicals. Formed boots may also be necessary for medium-hazard activities that are not compatible with shoe covers because of the likelihood of damage to the shoe cover (e.g., outdoors, abrasive floor coverings, etc.) and for activities that require good footing (e.g., slippery surfaces).

Other Considerations

- All types of PPE have limitations and are only effective when in good condition. Ensure that selected PPE:
  - Is clean and ready for use.
  - Is appropriate for the task at hand.
  - Has sufficient resistance rating for the chemical(s) used.
  - Is routinely inspected for damage and is repaired or replaced as necessary.
  - Is stored in a clean area that is protected from excessive light, cold, and heat when not in use.

- Minimize potential exposures through administrative or engineering controls. For example, avoid the need for respiratory protection by working in a chemical fume hood; avoid the need for immersing hands in chemical baths by using retrieval tongs or removable baskets, etc.
- Use of disposable PPE is preferred if it is difficult to predict the remaining resistivity of PPE, such as gloves.

Care, Use, & Maintenance

- PPE must be used and maintained in a sanitary and reliable condition.
- Protective clothing should be inspected before each use to ensure the absence of tears, punctures, loose seams, deterioration/ de-lamination, stiffening, or other conditions that may impact performance.
- Store PPE in a clean, dry, and climate controlled environment, away from sunlight and potential contaminants (chemical vapors, dusts, etc.). Observe all additional recommendations provided by the manufacturer.
- The effectiveness of PPE is dependent on proper fit and donning procedures. In the case of respirators, users must be fit-tested by EHS on an annual basis. Users should use the proper size of outer garments, gloves, and foot wear.

Cleaning/Disposal

- Disposable PPE that is contaminated with chemicals may be regulated under hazardous waste regulations. Consult EHS to determine whether it is necessary to bag and tag PPE for collection by EHS, based on specific chemical contaminants.
- Reusable PPE may also be subject to regulation under hazardous waste regulations when cleaned. Consult EHS to determine if on-site laundering is prohibited and whether wash water from basins or baths must be containerized and tagged for collection by EHS.