

# WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

## Personal Protective Equipment for Health Care Workers Who Work with Hazardous Drugs

### Summary

Health care workers who handle hazardous drugs are at risk of skin rashes, cancer, and reproductive disorders. NIOSH recommends that employers provide appropriate personal protective equipment (PPE) to protect workers who handle hazardous drugs in the workplace.

### Description of Exposure

Health care workers face serious health risks when exposed to hazardous drugs. This is a group of drugs that cause specific health effects such as cancer or birth defects, or are highly toxic at low doses. A list of hazardous drugs has been developed by NIOSH [2004]. For patients, potential benefits of treatment outweigh the risks from adverse side effects. However, health care workers should minimize their exposure and health risks.

In the United States, an estimated 8 million health care workers [BLS 2007] are potentially exposed to hazardous drugs or drug waste at their work-sites. These workers include pharmacy and nursing personnel, physicians, operating room personnel, veterinary personnel, shipping and receiving personnel, laundry workers, waste handlers, and maintenance workers. They may be exposed to hazardous drugs when they handle drug vials; compound, administer, or dispose of hazardous drugs; clean spills; or touch contaminated surfaces. These activities may create aerosols, thereby increasing the risk of exposure [NIOSH 2004]. Inhalation, ingestion, (from hand to mouth), injection with a sharp, and transconjunctival or skin absorption are possible routes of exposure.

### Controls

NIOSH recommends minimizing exposure to hazardous drugs [NIOSH 2004] through primary prevention measures such as engineering controls, administrative controls, and personal protective equipment (PPE). Engineering controls include Class II or III biological safety cabinets (BSC),

compounding aseptic containment isolators, closed system transfer devices, and needleless systems. Administrative controls include implementing work practices, management policies, and training programs to reduce worker risk. A medical monitoring program serves as a form of secondary prevention by identifying indicators of exposure or early disease [NIOSH 2007]. PPE should be used when engineering controls and/or administrative controls are not feasible in reducing exposures to hazardous drugs or when other control measures are not available or practical [OSHA 1999]. PPE should always be used in the context of an overall health and safety program that provides adequate training, retraining, and periodic testing of the workers' knowledge of the proper use of PPE.

### PPE

PPE such as NIOSH-certified respirators and protective clothing must be used to reduce exposure to hazardous drugs when other measures are not possible. The following general guidelines apply to PPE use and care:

- Select specific respirators and protective clothing based on an assessment

of your potential exposure to hazardous drugs.

- Understand the proper use and limitations of any selected PPE to ensure that it functions properly.
- Use care in donning and removing all items to prevent damage to PPE and to reduce the spread of contamination.
- Ensure that all PPE fits correctly and is constructed of materials that are appropriate for hazardous drug exposure [NIOSH 2004].
- Donning and removal of PPE should follow local hospital procedures and the manufacturer's instructions.

## Gloves

Surfaces in areas where hazardous drugs are present may be contaminated with these drugs [NIOSH 2004]. Not all gloves offer adequate protection from dermal exposure to hazardous drugs. Some gloves may permit rapid permeation of hazardous drugs. For example, polyvinyl chloride exam gloves offer little protection against drug exposures [Wallemacq et al. 2006]. Although thicker gloves may offer better protection, glove thickness does not always indicate the level of protection and may make work activities more difficult. Instead, it is important to rely on test information provided by the glove manufacturer that demonstrates permeation resistance to specific hazardous drugs. Currently, guidelines are only available for testing "chemotherapy gloves" [ASTM 2005] and information may not be available for other types of hazardous drugs.

Follow these work practices when using gloves:

- Inspect gloves for defects before use and change gloves on a regular basis. Changing recommendations vary from 30–60 minutes [NIOSH 2004; ASHP 2006]. Whenever gloves are damaged or contact with a drug is known or suspected, carefully remove and dispose of them properly.
- Use powder-free gloves since the powder can contaminate the work area and can adsorb and retain hazardous drugs.
- Wear two pairs of gloves when compounding, administering, and disposing of hazardous drugs.
- Sterile chemotherapy gloves are required for compounding of sterile preparations under USP Chapter <797>.
- Wear the inner glove under the gown cuff and the outer glove over the cuff. Place gloves with long cuffs over the cuff of the gown to protect the wrist and forearm [ASHP 2006; Polovich et al. 2005].
- When compounding sterile preparations, sanitize gloves with sterile 70% alcohol spray or gel and allow them to dry; ensure that the selected gloves are not degraded by alcohol.

- When removing double gloves, turn gloves inside-out so that contaminated surfaces do not touch uncontaminated surfaces.
- Wash hands thoroughly with soap and water both before donning and after removing gloves.

## Gowns

Proper gowns protect the worker from spills and splashes of hazardous drugs and waste materials. Gowns should not have seams or closures that could allow drugs to pass through. They should have long sleeves with tight fitting cuffs. Disposable gowns made of polyethylene-coated polypropylene or other laminate materials offer better protection than those of non-coated materials [NIOSH 2004; ASHP 2006]. Cloth laboratory coats, surgical scrubs, or other absorbent materials permit the penetration of hazardous drugs, and can hold spilled drugs against the skin and increase exposure.

Follow these work practices when wearing gowns:

- Dispose of gowns after each use. Reusing gowns increases the likelihood of exposure to hazardous drugs.
- Wear gowns whenever there is a possibility of splash or spill as in compounding or administration of hazardous drugs.
- Do not wear gowns outside the compounding or administration area to avoid spreading drug contamination to other areas and possibly exposing nonprotected workers.
- If no permeation information is available for the gowns you use, change them every 2 to 3 hours or immediately after a spill or splash [ASHP 2006].

## Respiratory Protection

For most activities requiring respiratory protection, a NIOSH-certified N-95 or more protective respirator is sufficient to protect against airborne particles [NIOSH 2005]; however, these respirators offer no protection against gases and vapors and little protection against direct liquid splashes. A surgical N-95 respirator provides the respiratory protection of an N-95 respirator and the splash protection provided by a surgical mask. Surgical masks alone do not provide respiratory protection from drug exposure and should not be used to compound or administer drugs [NIOSH 2004].

Follow these recommendations when using respiratory protection:

- Use an appropriate full-facepiece chemical cartridge-type respirator [42 CFR\* 84; NIOSH 2005] for events such as large spills when an intravenous (IV) bag breaks or a line

\*Code of Federal Regulations. See CFR in references.

disconnects and leaks, or where there is known or suspected airborne exposure to vapors or gases.

Following medical evaluation, fit-test and train workers to use respiratory protection. Follow all requirements in the Occupational Safety and Health Administration respiratory protection standard [29 CFR 1910.134] ([www.osha.gov/SLTC/etools/respiratory/index.html](http://www.osha.gov/SLTC/etools/respiratory/index.html)).

## Eye and Face Protection

Proper eye and face protection is needed whenever hazardous drugs may splash in the eyes since many hazardous drugs are irritating to eyes and mucous membranes and may be absorbed by the eyes.

Follow these work practices when using eye and face protection:

- Use eye and face protection when compounding a drug outside the BSC or isolator (e.g., in the operating room), working at or above eye level, cleaning a BSC or containment isolator, or cleaning a spill.
- Use face shields in combination with goggles to provide a full range of protection against splashes to the face and eyes. Face shields alone do not provide full eye and face protection.
- Do not use eye glasses or safety glasses with side shields, as they do not offer adequate protection to the eyes from splashes.
- A full-facepiece respirator also provides eye and face protection.

## Sleeve, Hair, and Shoe Covers

Other types of PPE may be used to reduce exposure or to protect workers from contamination.

- Use sleeve covers constructed of coated materials to provide additional protection for the areas of the arms that come in contact with the BSC.
- Use hair and shoe covers constructed of coated materials to reduce the possibility of particulate or microbial contamination in clean rooms and other sensitive areas.
- Do not wear shoe covers outside drug compounding areas to avoid spreading drug contamination to other areas and possibly exposing nonprotected workers.

## PPE Disposal

- Consider all PPE worn when handling hazardous drugs as being contaminated with, at a minimum, trace quantities of hazardous drugs.

- Contain and dispose of such PPE either as trace or bulk contaminated waste [NIOSH 2004].

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