Oncology nurses handle hazardous drugs when they administer medications to patients in inpatient and outpatient settings. Guidelines for the safe handling of hazardous drugs have been in place since the late 1980s; however, confusion still remains about the proper handling of the substances. Institutional policies vary and the use of personal protective equipment is inconsistent. In an effort to provide a safe working environment, nurses should be aware of the potential health risks of handling hazardous drugs and adhere to recommended guidelines to prevent occupational exposure.

Safe Handling of Hazardous Drugs: Are You Protected?

Susan Nixon, RN, BSN, OCN®, and Lisa Schulmeister, RN, MN, APRN-BC, OCN®, FAAN

Exposure to Hazardous Drugs

Nurses routinely administer medications that are categorized as hazardous, such as chemotherapy, biotherapy, antibiotics, immunotherapy, hormones, and other drugs. Administering hazardous drugs places nurses at risk for occupational exposure and creates a potential health risk to all staff members caring for patients. The occupational risk from handling hazardous drugs has been documented in the literature since the 1980s, and guidelines from the Occupational Safety and Health Administration (OSHA) were published in 1986 in an effort to protect healthcare workers from possible exposure (OSHA, 1999).

Although the recommended guidelines for handling hazardous drugs have not changed significantly since the late 1980s, more information about the potential for occupational exposure has become available (Blecher, Glynn-Tucker, McDiarmid, & Newton, 2003). A number of studies have been conducted to better elucidate the risk. In a study by Hedmer, Georgiadi, Bremberg, Jonsson, and Ekberg (2005), chemotherapy agents prepared in a biologic safety cabinet (BSC) were detectable in wipe samples from the counter, floor, and refrigerator where the agents were handled or stored. The findings suggest that, although proper equipment was used to prepare chemotherapy, chemotherapy residue on surfaces outside the BSC was still found. In a study in South India where no guidelines were in place, nurses prepared and administered hazardous drugs without any personal protective equipment (PPE) and damage to the DNA of their lymphocytes was documented (Rekhadevi et al., 2007). The studies suggest that the risk of exposure to hazardous drugs extends beyond the BSC and the potential for adverse health issues exists.

The purpose of this article is to review the guidelines recommended for practice when healthcare professionals are handling hazardous drugs and caring for patients after they have received those drugs, the education and training recommendations for staff who handle hazardous drugs, and the recommended guidelines to monitor healthcare workers through surveillance programs.

At a Glance

- Chemotherapy residue is found on work surfaces where chemotherapy agents are handled and stored.
- Personal protective equipment use decreases the risk of exposure to hazardous drugs such as chemotherapy.
- All healthcare workers with the potential to be exposed to hazardous drugs should be monitored in a surveillance program.

Medications are routinely handled by healthcare providers as a part of their daily patient care routine. Numerous medications are considered hazardous because of their mechanisms of action and can create an occupational risk to healthcare workers through exposure. Drugs are defined as hazardous if studies of animals or humans indicate that an exposure to the drugs creates a health risk (National Institute for Occupational Safety and Health [NIOSH], 2004; OSHA, 1999) (see Figure 1). The electronic version of NIOSH Alert lists the drugs that meet the criteria to be labeled as hazardous (NIOSH). This list is revised routinely, and updates can be found on the Centers for Disease Control and Prevention (CDC) Web site.

Susan Nixon, RN, BSN, OCN®, is a charge nurse at St. Joseph Medical Center in Tacoma, WA; and Lisa Schulmeister, RN, MN, APRN-BC, OCN®, FAAN, is a self-employed oncology nursing consultant in River Ridge, LA. The authors were participants in the 2008 Clinical Journal of Oncology Nursing Writing Mentorship Program. (Submitted October 2008. Accepted for publication November 7, 2008.)

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Drugs that are known to have

- Carcinogenicity: capable of causing cancer
- Genotoxicity: capable of damaging DNA or leading to mutations
- Teratogenicity: capable of causing damage to a fetus or embryo
- Reproductive toxicity: infertility or miscarriages
- Organ toxicity at low doses in animal studies or in treated patients

**Figure 1. Hazardous Drug Definition**

*Note.* Based on information from Occupational Safety and Health Administration, 1999.

www.cdc.gov/niosh (CDC, 2006). Knowledge about the potential toxicities of drugs should be available to all healthcare workers in all work settings. Exposure to even a very small concentration may be hazardous for workers who handle or work near them (NIOSH).

Exposure to hazardous drugs can occur through direct or indirect contact. The greatest risk for exposure occurs during preparation, as the drug has not been diluted and is in its highest concentration (Blecher et al., 2003). Drugs used in the treatment of cancer are considered hazardous, causing toxicity when exposed to skin, mucous membranes, and the cornea (Polovich, White, & Kelleher, 2009). Skin irritation, eye irritation, nausea, vomiting, infertility, low birth weight babies, and spontaneous abortions, as well as DNA damage, have been reported in nurses preparing and administering chemotherapy (Rekhadevi et al., 2007). The risk for exposure is considered lower during handling of patient excreta, as the drug or toxic metabolites usually are diluted (although no safe level of exposure to hazardous drugs truly exists, even diluted) (Blecher et al.; OSHA, 1999).

Among the list of hazardous drugs are biologic agents used in the treatment of cancer and other medical conditions. Limited data are available regarding the effects of handling biologic agents, although most do not affect DNA or cause genetic changes (Polovich et al., 2009). Biologic agents are included on the list for their reproductive and/or organ toxicity risk (CDC, 2006).

*Safe-Handling Guidelines*

OSHA first published guidelines for safe handling of cytotoxic drugs in 1986 after several published articles revealed exposure to healthcare workers (OSHA, 1999). Despite recommendations for practice, research studies continued to demonstrate occupational risk to healthcare workers, prompting OSHA to revise and clarify earlier guidelines. The new guidelines provide evidence from research in an effort to guide the practice of anyone who handles the substances.

To increase awareness among healthcare workers and their employers, NIOSH (2004) published *NIOSH Alert*, which cites evidence through research to support the need for additional safe practice guidelines. Although guidelines were in place, evidence showed that measurable levels of hazardous drug residue on numerous workplace surfaces continued to be common and widespread. In an effort to reduce exposure, NIOSH suggested the recommendations be followed.

The Oncology Nursing Society (ONS) also has published guidelines based on the American Society of Hospital Pharmacists (ASHP) recommendations, OSHA guidelines, and the NIOSH recommendations (Polovich et al., 2009). The *Chemotherapy and Biotherapy Guidelines and Recommendations for Practice* outlines practice standards that protect nurses from hazardous drug exposure. In addition, the ONS publication *Safe Handling of Hazardous Drugs* provides additional guidelines for safe practice and presents research supporting the guidelines (Polovich, 2003).

**Sources of Exposure**

Healthcare workers are exposed to hazardous drugs in the workplace through different sources. Clinical and nonclinical staff may be exposed to hazardous drugs when dust is created from powder, aerosols are generated when air is expelled from syringes, or surfaces are contaminated by inappropriate disposal techniques (NIOSH, 2004). All workers who come in contact with hazardous drugs have the potential of occupational exposure (Connor, 2006). Reported routes of exposure include dermal, inhalation, ingestion, and injection.

Direct contact with the drug, or contact with objects or surfaces contaminated with the drug, are potential sources of exposure (Polovich et al., 2009). Dermal absorption can occur from touching cabinets, flooring, countertops, and other surfaces that have been unknowingly contaminated with a hazardous drug (Blecher et al., 2003). In a study to evaluate dermal exposure to cyclophosphamide (CP) in a Dutch hospital setting, several sources of exposure were revealed (Fransman, Vermeulen, & Kromhout, 2005). Gloves worn by pharmacy technicians preparing CP were contaminated. Nurses’ hands were repeatedly contaminated after handling bed linen and bathing patients and gloves worn while handling urine were contaminated. Other potential sources of exposure were identified when CP was detected on the outside of all urinals, on bedpans, on bed linens, on cleaned toilet seats, and in bath water. Cleaning cloths and mop heads used by cleaning staff also were contaminated. The results of the study demonstrated actual dermal exposure to CP in nurses and multiple areas of potential exposure to healthcare workers caring for patients who had received CP.

Inhalation of hazardous drugs can occur through aerosolization or vaporization of substances. Aerosolization can occur during any manipulation of the drug: opening an ampule, withdrawing a needle from a vial, transferring drugs from syringe to another container, expelling air from a syringe, and dust from tablets or powder from open or damaged capsules (Blecher et al., 2003; OSHA, 1999). The inappropriate venting of BSCs can result in the release of drug vapors into the work environment (Blecher et al.). Uncovered hazardous drug disposal containers also can pose a risk from the release of potential drug vapors (Blecher et al.).

Unintentional ingestion of hazardous drugs can occur from hand-to-mouth contact (NIOSH, 2004). Smoking, drinking, applying cosmetics, and eating where these drugs are prepared, stored, or used increases the chance of exposure (OSHA, 1999). Ingestion can occur when food or beverages are prepared, stored, or consumed in work areas (Connor, 2006); therefore, food and beverages should not be consumed in work areas where hazardous drugs are prepared, administered, or handled. Healthcare workers should wash their hands after working with hazardous drugs and again before eating or drinking (Blecher et al., 2003).
Unintentional injection from a needle stick or sharps exposure also is possible (NIOSH, 2004). The use of safe needle devices, needleless systems, dispensing pins, and closed system devices reduces the likelihood of exposure to hazardous drugs (Blecher et al., 2003; Wick, Slawson, Jorgenson, & Tyler, 2003). Caution should be taken when breaking ampules or handling needles after administering hazardous drugs by injection.

**Guidelines to Minimize Exposure Risk**

Guidelines for safe practice while handling hazardous drugs were established to protect healthcare workers who may be exposed to harmful substances. The evidence supports the toxic potential of the drugs when improperly handled. Research has demonstrated that the use of PPE and other safe handling measures reduces the incidence of adverse health effects (Blecher et al., 2003). Correct work practices are essential to worker protection; therefore, adhering to the guidelines is critical (OSHA, 1999).

In a study conducted in the United Kingdom in two oncology wards, the use of PPE and formal education demonstrated a significant decrease in levels of contamination of the urine samples of nurses and wipe samples of counters in the administration area. The results suggest that the implementation of guidelines when handling hazardous drugs reduced the risk of exposure to healthcare workers (Ziegler, Mason, & Baxter, 2002).

In a study done in Sweden, the hospital pharmacy, oncology ward, and outpatient center were tested with wipe samples. The floors in utility rooms and around patient toilets showed higher contamination than other surfaces tested. This was attributed to urine spillage or possible aerosol formation during flushing. Appropriate PPE were worn by all personnel, except the cleaning staff, who wore thin vinyl gloves. The biologic monitoring of urine samples from various staff showed no uptake of hazardous drugs (Hedmer, Tinnerberg, Axmon, & Jonsson, 2008).

In a study of glove permeation by Klein, Lambov, Samev, and Carstens (2005), different types of gloves were tested with numerous chemotherapy agents over a three-hour time. The majority of agents showed little or no permeation, although carmustine did permeate single-layer latex after 45 minutes of exposure. The data demonstrated that the thickness of gloves and the duration of exposure to the agent can be major determinants of permeability. Therefore, the prevention of exposure is critical (OSHA, 1999).

ONS members who handle hazardous drugs in outpatient and office settings (N = 263) were studied by Martin and Larson (2005) to determine adherence to the guidelines and the use of PPE. During preparation of chemotherapy, 99% reported usually (more than 50% of the time) wearing gloves and 53% of nurses usually wore gowns. During administration, 94% usually wore gloves; however, gowns were rarely (less than 25% of the time) worn. Goggles and masks were rarely used in the preparation and administration of chemotherapy agents. The study demonstrated an increase in the use of PPE compared to previous studies, although significant gaps in compliance to the recommended guidelines still exist (Martin & Larson).

**Guidelines for Personal Protective Equipment Use**

The use of PPE while handling hazardous drugs reduces the risk of occupational exposure. PPE guidelines are used in an effort to protect healthcare workers from occupational exposure (see Figure 2). Gloves, gowns, masks, and face protection are worn when any suspicion of possible exposure exists. A safe level of exposure to hazardous drugs has not been determined; therefore, guidelines should be followed per institutional standards (Blecher et al., 2003). The use of PPE also educates patients and caregivers to the importance of safe handling practices and the protection of healthcare workers.

Gloves are worn that can adequately protect the hands from exposure. Double gloves are recommended when preparing and administering hazardous drugs (NIOSH, 2004; OSHA, 1999). The practice of double gloving decreases the chance of contaminating hands when gloves are removed (Polovich, 2008). Powder-free gloves are recommended because powder may absorb contaminants, leading to increased risk of exposure (Blecher et al., 2003). Wearing cloth gowns or lab coats is not recommended because of the possibility of permeation. Only gowns with polyethylene or vinyl coatings provide protection and prevent the penetrations, leading to increased risk of exposure (Blecher et al., 2003). Wearing cloth gowns or lab coats is not recommended because of the possibility of permeation. Only gowns with polyethylene or vinyl coatings provide protection and prevent the penetration of harmful substances. The evidence supports the toxic potential of the drugs when improperly handled. Research has demonstrated that the use of PPE and other safe handling measures reduces the incidence of adverse health effects (Blecher et al., 2003). Correct work practices are essential to worker protection; therefore, adhering to the guidelines is critical (OSHA, 1999).

**Figure 2. Personal Protective Equipment Use Guidelines**

**Gloves**

- Wear gloves that are thicker, longer, and powder free and have been tested for hazardous drugs.
- Use double gloves for all activities involving hazardous drugs. The inner glove is worn under the gown cuff and the outer glove is worn over the gown cuff.
- Change gloves every 30 minutes or if contaminated with a spill, torn, or punctured.
- Dispose of gloves after each use.
- Observe gloves for any physical defects before use.
- Wash hands before gloves are put on and after they are removed.

**Gowns**

- Gowns should be a lint-free, low-permeability fabric with a closed front, long sleeves, elastic cuffs, and a back closure.
- Wear disposable gowns made of polyethylene-coated material.
- Dispose of gowns after each use. They should not be reused.
- Discard gown if visibly contaminated, before leaving drug preparation area, and after handling hazardous drugs.

**Eye and Face Protection**

- Whenever splashes, sprays, or aerosols of hazardous drugs may be generated, chemical-barrier face and eye protection must be worn.
- Goggles only protect the eyes from splashing or spraying.

**Respiratory Protection**

- Biologic safety cabinets (BSCs) are essential for preparing hazardous drugs.
- If a BSC is not available, a National Institute for Occupational Safety and Health (NIOSH)-approved respirator must be worn until the BSC is installed. The respirator is never a replacement for a BSC.
- NIOSH-approved respirator masks are used when cleaning spills or when aerosolization of substances is suspected.

**Removal and Disposal**

- Personal protective equipment is removed at the site of administration by removing the outer glove, then gown, then inner glove.
- All gowns, gloves, and disposable materials are placed directly into a chemotherapy waste container and the lid is immediately closed.
tion of hazardous drugs (Blecher et al.). These gowns can be uncomfortable and warm to wear, but they are the only type of gown that prevents possible leakage and exposure. The practice of hanging gowns between uses may lead to surface contamination and is not recommended (Blecher et al.). Face shields are recommended in place of goggles, as goggles do not protect the face from potential sprays and aerosolization (Blecher et al.). All disposable items are placed in a chemotherapy waste container at the site of preparation or administration. Waste containers should be readily accessible to staff.

**Drug Preparation Guidelines**

All hazardous drugs are prepared in accordance with the guidelines to reduce and eliminate the risk of occupational exposure. The work area where hazardous drugs are prepared should be restricted and labeled appropriately to warn unauthorized personnel from entering (OSHA, 1999). Class II type B or Class III BSCs are recommended by OSHA for hazardous drug preparation in any setting (OSHA). Facilities should include the installation of a BSC in their plans if the preparation of hazardous drugs is conducted. If a BSC is not available, the drug should be prepared at a different site in a BSC and transported to the area of administration (NIOSH, 2004; OSHA). The use of a closed-system device is not an acceptable substitute for a BSC and should only be used within the BSC (NIOSH).

Preparation guidelines (see Figure 3) are developed in an effort to protect healthcare workers from exposure. In a hospital setting where drugs are prepared in the pharmacy, the guidelines protect the technicians from exposure during the preparation process. Nurses who then administer the drugs rely on the techniques of pharmacy staff to minimize the risk of exposure by adhering to the guidelines.

The transportation of hazardous drugs to the area of administration is completed by ensuring the safety of the drug and personnel involved. Hazardous drugs are transported in a labeled, closed transport receptacle that can contain spillage and avoid breakage if dropped (OSHA, 1999). Personnel involved in transporting hazardous drugs should be aware of the contents, trained in hazardous spill clean-up, and carry a spill kit with them (Polovich et al., 2009). On arrival to the administration area, all hazardous drugs should be immediately secured in a locked and labeled cabinet or drawer (Rich, 2004).

**Drug Administration Guidelines**

Nurses administer hazardous drugs using guidelines designed to guard against exposure and minimize the risk of workplace contamination. Guidelines recommend the use of safety equipment, protective apparel, and safe practice to reduce risk. Administration guidelines are written per institutional policies but should align with the occupational guidelines recommended by OSHA (see Figure 4).

PPE is worn during any handling of a hazardous drug, which includes opening the outer bag, assembling the delivery system, delivering the drug to the patient, and disposing of all equipment used to administer the drug (NIOSH, 2004). The use of a clear, sealable bag allows for the thorough inspection of the contents, looking for safety measures such as roller clamps secured in place and taped connections or leakage of contents (Blecher et al., 2003). It also facilitates the verification process of the correct drug, dose, additives, and patient identification.

Hazardous drugs should be delivered to the place of administration in their final form (Blecher et al., 2003). Oral agents to be administered through a feeding tube must be in a liquid form; crushing tablets or opening capsules at the bedside or in the medication room is inappropriate practice for nursing staff (Blecher et al.). If splashing is possible, the use of facial protection with PPE is recommended.

Areas of administration and patient rooms should be labeled during and after the administration of hazardous drugs to alert staff or visitors of the potential risk for exposure. A study by Fransman et al. (2005) concluded that, because of potential dermal exposure, patient areas should be labeled to indicate possible surface contamination with hazardous drugs and warn individuals before entering the area. Oncology units with patients at various stages of treatment and mixed units of oncology/medical patients would benefit from the additional communication tool to alert healthcare workers of a potential exposure risk. Every effort should be made to protect medical personnel and visitors from the risk of exposure.

**Postadministration Guidelines**

Precautions are necessary when caring for patients who have received drugs that are listed as hazardous. Variable amounts of hazardous drugs or metabolites are excreted in the urine, feces, and sweat of patients (Blecher et al., 2003). The use of universal precautions should always be observed while handling body fluids, but additional precautions are recommended when caring for this patient population.

The use of PPE when handling body fluids and linens is recommended for the first 48 hours after the completion of the drug administration and face shielding is recommended if splashing is possible (OSHA, 1999). Every attempt should be made to contain the body fluids of an incontinent patient with the use of

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**Figure 3. Drug Preparation Guidelines to Reduce Risk of Exposure**

*Note: Based on information from National Institute for Occupational Safety and Health, 2004; Occupational Safety and Health Administration, 1999.*

- Personal protective equipment is worn in all preparation activities (i.e., opening packages or vials, handling finished products, and disposing of waste).
- All vials and ampules are handled under a biologic safety cabinet (BSC) when withdrawing hazardous drugs.
- Avoid overfilling syringes and securely cap their-lock end.
- Mix, prepare, crush, break, compound powders, count tablets, or pour liquid drugs inside a BSC.
- Expelling air from syringes must take place inside a BSC.
- IV tubing should be primed with nondrug-containing fluid.
- All syringes and IV bags containing hazardous drugs must be labeled as hazardous to warn employees.
- After preparation, the outside of syringes, bags, or bottles should be wiped with moist gauze and entry ports wiped with alcohol to remove any drug residue.
- Items should be placed in a clear, sealable bag before BSC removal.
diapers and other absorbent material. After each diaper change, the skin should be cleaned with soap and water and a barrier cream should be used on the area at risk for exposure to urine or stool (Blecher et al., 2003).

Linen contaminated with body fluids should be handled with PPE and placed in a water-resistant container or bag (Blecher et al., 2003). Pre-laundering contaminated linens is recommended before washing with other linens, and laundry personnel should wear PPE when handling all contaminated linen (OSHA, 1999). Knowledge of institutional policies regarding the laundering of contaminated linen is recommended for healthcare workers.

Environmental contamination of the administration and patient care area is a concern. After use, equipment such as infusion pumps, carts, chemotherapy chairs, and other reusable items should be washed twice by personnel wearing PPE (OSHA, 1999). In a study of Swedish hospitals by Hedner et al. (2008), wipe samples from the control panels of infusion pumps on oncology wards showed detectable levels of hazardous drugs. Some cancer centers are using disposable wipes containing sodium thiosulfate, a neutralizing agent, to clean surfaces. All waste should be placed in a covered hazardous waste container located in the work area and disposed of by personnel wearing PPE (OSHA). The container lids are closed at all times and sealed per manufacturer guidelines when full (Polovich et al., 2009).

Housekeeping staff are at risk for exposure when cleaning the preparation or administration areas and should follow the same guidelines as all medical personnel exposed to hazardous drugs (NIOSH, 2004). A study by Fransman et al. (2005) showed actual and potential exposure of cleaning personnel while performing routine cleaning practices. The routine cleaning of rooms and bathrooms and the handling of linen of a patient who has received a hazardous drug within the past 48 hours warrant the use of PPE by housekeeping staff. Disposable cloths should be used to clean surfaces and floors that may be contaminated and should be disposed of as if contaminated (OSHA, 1999).

Hazardous drug spills are contained and cleaned immediately by trained personnel (OSHA, 1999). A spill of less than 5 cc is reported as a small spill and cleaned by personnel wearing proper PPE and using the following guidelines: Glass is handled with a safety device and placed in a sharps container, liquid is wiped with absorbent pads, solids are wiped with wet absorbent gauze, the area is cleaned three times with detergent followed by clean water, and all items are placed in the hazardous waste container (OSHA). In Martin and Larson (2005), a spill kit was used by oncology nurses only 20% of the time during a chemotherapy spill, although 98% of nurses reported a spill kit available. During a larger spill, the area should be isolated and guidelines followed by trained personnel to reduce additional exposure (see Figure 5). Spills within a BSC require the decontamination of all interior BSC surfaces (OSHA). Proper documentation of a spill should include the name of the drug, approximate volume, how the spill occurred, procedures followed, names of personnel and patients exposed, and personnel notified of the spill (Polovich et al., 2009).

If personnel are contaminated during a spill, PPE and all contaminated garments are immediately removed (OSHA, 1999). All skin surfaces exposed are cleaned with soap and water and exposed eyes are rinsed at the eye wash station for 15 minutes (OSHA). The exposed personnel should immediately seek medical attention and document exposure in their employee medical records (OSHA). In case of a patient exposure, implement the same decontamination procedure as personnel, notify the healthcare provider, and report the exposure (Polovich et al., 2009).

Reproductive Risks

Many of the hazardous drugs handled by healthcare workers have the potential to cause damage to a fetus or embryo or cause infertility and miscarriage (OSHA, 1999). In a retrospective study...
study of oncology nurses with exposure to hazardous drugs compared to nurses with no exposure, evidence showed a prolonged time to pregnancy, risk of premature delivery, and low birth weight (Fransman et al., 2007). In a study in South India by Rkkhadevi et al. (2007), nurses reported infertility, spontaneous abortions, and low birth weight after handling hazardous drugs without the use of PPE or a BSC.

Healthcare workers who are pregnant, actively trying to conceive, or breast feeding should be allowed to refrain from preparing, administering, or caring for patients who have received hazardous drugs (OSHA, 1999; Polovich et al., 2009). Knowledge of potential risks should be provided during orientation and training by employers, and the exposure concerns of staff should be respected.

Medical Surveillance

In addition to implementing and practicing guidelines to prevent exposure, medical surveillance should be part of the safety program. The need to monitor all employees exposed to hazardous drugs is evident. In a German study conducted to evaluate the potential exposure of pharmacy and oncology staff (N = 100), results of urine samples detected hazardous drugs in 40% of the staff tested despite some of the employees having no direct contact with the drugs (Pethran et al., 2003).

Healthcare workers should be monitored in a surveillance program to identify the earliest biologic effects of exposure (NIOSH, 2004; OSHA, 1999). The identification of exposure can reduce or eliminate additional injury to medical personnel. A program to monitor exposure should be implemented initially at hire, after a known exposure, periodically during employment, and at the time of job transfer (OSHA). Many cancer centers conduct surveillance monitoring annually. The program should include physical examinations, laboratory studies, and history of exposure (see Figure 6). In Martin and Larson (2003), 46% of respondents reported that their employers provided health evaluations for monitoring, although only 6% included reproductive and cancer evaluations. If no surveillance program is offered, seeking an examination from a healthcare provider and informing him or her of the occupational risk to exposure is suggested (NIOSH).

Education and Training

Healthcare personnel should be informed of the risks involved when preparing, administering, and caring for patients receiving hazardous drugs. All personnel involved in any aspect of handling hazardous drugs must receive information and training to advise them of the presence of hazardous drugs in the work area (OSHA, 1999). Information and training should be provided at initial assignment and annually (OSHA). In Martin and Larson’s (2003) study, 87% of oncology nurses reported attending an educational program focused on handling hazardous drugs, whereas 8% reported on-the-job training as their only education.

Initial training should include the health hazards from the exposure to hazardous drugs, policies and procedures to protect personnel from exposure, and safe handling practices to minimize the risk of occupational exposure (OSHA, 1999). Annual reviews are recommended for healthcare workers to inform them of practice changes and review practice guidelines (NIOSH, 2004). To demonstrate knowledge of practice guidelines, competencies can be evaluated through testing or direct observation. Ideas for ongoing education and evaluation are listed in Figure 7. Evaluating the clinical practice and knowledge of healthcare workers who handle hazardous drugs is an important aspect in protecting the working environment from unintentional contamination. Quality-improvement programs that monitor compliance with practice standards also should be implemented (Polovich et al., 2009).

Practice Standards

Standards for practice are an essential part of an occupational safety program. OSHA has implemented guidelines to provide a safe environment for workers who handle hazardous drugs. A hazardous drug safety and health plan is required by OSHA and is to be available and accessible to all employees. The plan should include elements such as operating procedures, engineering controls, use of PPE, training, medical examinations for personnel exposed to hazardous drugs, a committee to review and maintain the plan and procedures for waste management, and decontamination procedures (OSHA, 1999). These standards are based on evidence that demonstrated the actual and potential risk to healthcare workers.

Compliance with practice standards is necessary to protect all personnel from exposure to hazardous drugs. Employers must implement policies and procedures related to safe handling practices and require that all workers adhere to those guidelines.
(Polovich et al., 2009). In Martin and Larson (2003), 85% of worksites reported that policies and procedures related to chemotherapy handling were available to staff. Despite this result, noncompliance of practice standards is an issue that puts all healthcare workers at risk for exposure. Performance standards for healthcare workers should be monitored and documented (Polovich et al.) in an effort to promote a safe work environment with minimal risk of exposure to hazardous drugs.

**Conclusion**

Safe practice in nursing always has been a priority. The use of hazardous drugs is expanding in all fields of health care, increasing the risk of occupational exposure. Measures to promote safety must be taken by healthcare workers to protect themselves and coworkers from the potential exposure to hazardous drugs.

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**Author Contact:** Susan Nixon, RN, BSN, OCN®, can be reached at susan.nixon@hshealth.org, with copy to editor at CJONEditor@ons.org

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