HAZARDOUS DRUG PROCEDURES

A list of hazardous drugs, which includes cytotoxic/antineoplastic agents, for which these procedures must be followed may be found in Appendix A. A table that summarizes the protective equipment and engineering controls is found in Appendix B.

I. Liquid Drug Preparation Precautions

A. Personal Protective Equipment

1. Gloves

a. Surgical latex gloves should be used for the preparation of hazardous drugs unless the manufacturer specifically stipulates that some other glove provides better protection.

b. Thicker, longer latex gloves that cover the gown cuff are recommended.

c. Individuals with latex allergy should consider the use of vinyl or nitrile gloves or glove liners.

d. Gloves with minimal or no powder are preferred since the powder may absorb contamination.

e. Double gloving is recommended if it does not interfere with an individual's technique.

f. Because all gloves are to some extent permeable and their permeability increases with time, they should be changed regularly (hourly is preferable) or immediately if they are torn or punctured.

g. Hands should always be washed before gloves are put on and after they are removed.

2. Gowns

a. A protective disposable gown made of lint-free low permeability fabric with a closed front, long sleeves, and elastic or knit-closed cuffs should be worn, with the cuffs tucked under the gloves.

b. If double gloves are worn, the outer glove should be over the gown cuff and the inner glove should be under the gown cuff.

c. When the gown is removed, the inner glove should be removed last.

d. Gowns and gloves in use should not be worn outside the preparation area.

3. Respirators

a. A biological safety cabinet (BSC) is essential for preparation of hazardous drugs, but where one is not currently available, a NIOSH approved respirator with a high efficiency filter (preferably a powered air-purifying respirator), used by personnel who have been trained to use respirators and have met the medical monitoring and fit test requirements identified in the OU

Respiratory Protection Program, will provide the best protection until the BSC is installed. Permanent respirator use as a substitute for the use of a BSCs is considered imprudent practice by OSHA.

b. Surgical masks do **not** protect against the breathing of aerosols.

4. Eye and Face Protection

a. Whenever splashes, sprays, or aerosols of hazardous drugs may be generated, which can result in eye, nose, or mouth contamination, or if a BSC is not in use, face and eye protection should be provided such as a plastic face shield and splash goggles. Eye glasses with temporary side shields are not appropriate.

b. Eyewash facilities should be made available.

B. Protective Equipment Disposal and Decontamination

1. All gowns, gloves, and disposable materials used in preparation should be disposed of as hazardous drug waste as described in Section X., "Hazardous Drug Waste Disposal".

2. Goggles, face shields, and respirators may be cleaned with mild detergent and water for reuse.

C. Preparation Work Area

1. It is recommended that all hazardous drugs be prepared in a restricted, preferably centralized area. If this is not practical, the number of areas used for preparation should be minimized.

2. Warning signs designating the area as a hazardous drug preparation area and restricting the access of unauthorized personnel should be prominently displayed. Spill procedures should also be posted.

3. Eating, drinking, smoking, chewing gum, applying cosmetics, and storing food in the preparation area should be prohibited.

4. A class II or III Biological Safety Cabinet (BSC) should be used.

a. If possible, a dedicated BSC, where only hazardous drugs are prepared is recommended.

b. Decontamination should occur in accordance with the manufacturer's recommended frequency, whenever spills occur, and when the cabinet requires moving, service or certification.

(1) Decontamination consists of surface cleaning with water and detergent followed by thorough rinsing.

(2) Quaternary ammonium cleaners should be avoided due to the possibility of vapor build-up in recirculated air.

(3) Ethyl alcohol may be used with the cleaner if the contamination is soluble only in alcohol and where the BSC is vented to the outside and air is not recirculated.

(4) Ordinary decontamination procedures, which include fumigation with a germicidal agent, are inappropriate in a

BSC used for HDs because such procedures do not remove or deactivate the drug.

(5) Removable work trays, if present, should be lifted in the BSC so the back and the sump below can be cleaned.

(6) During cleaning, the worker should wear a respirator, gown, double latex gloves, and splash goggles or other suitable eye protection.

(7) All materials from the decontamination process should be handled as hazardous drug waste as described in Section X., "Hazardous Drug Waste Disposal".

c. The blower on the vertical airflow hood should be on at all times, 24 hours/day, 7 days/week. If the BSC is turned off, it should be decontaminated and covered in plastic until airflow is resumed.

d. The BSC should be equipped with a continuous monitoring device to allow confirmation of adequate air flow and cabinet performance.

e. Venting to the outside is preferable where feasible. If the hood has an outside exhaust system, it should be vented away from air intake units.

f. BSCs must be certified by a qualified technician at least annually, after maintenance, or any time the cabinet is moved. High efficiency particulate air (HEPA) filters should be changed when they restrict airflow or if they are contaminated by a spill.

(1) Technicians servicing these cabinets or changing HEPA filters should be notified of the hazardous drugs present/used and potential risks and should wear a respirator, gown, double latex gloves, and splash goggles or other suitable eye protection.

(2) Removed HEPA filters should be disposed of as hazardous drug waste as described in Section X., "Hazardous Drug Waste Disposal".

D. Preparation Work Equipment

1. Work with hazardous drugs should be carried out in a BSC on a disposable, plastic-backed paper liner, which should be changed after preparation is completed for the day or after a shift, whichever comes first, or immediately after a spill.

2. Syringes and IV sets with Luer-lock fittings should be used, and syringes should always be large enough so that they are not full when the entire drug dose is present.

3. A covered disposable container should be used to contain excess solution.

4. A covered sharps container should be in the BSC. All syringes and needles used in the course of preparation should be placed in the sharps container without being crushed, clipped or capped.

5. Hazardous drug waste bags or containers should be available for all contaminated materials such as gloves, gowns, and paper liners.

E. Work Practices in Preparation

1. Aseptic technique is standard practice for drug preparation.
2. All personal protective equipment should be donned before work is started in the BSC.
3. All items necessary for drug preparation should be placed within the BSC before work is begun and all extraneous items should be kept out of the work area in order to avoid contamination.
4. Since BSC benches differ from horizontal flow units in several ways, manipulations should not be performed close to the work surface of a BSC and unsterilized items, including liners and hands must be kept downstream from the working area. Entry and exit of the cabinet should be perpendicular to the front, and rapid lateral hand movement should be avoided.
5. All syringes and IV bags containing hazardous drugs should be labeled with a distinctive warning labels such as "special handling/disposal precautions required", and should be labeled with the chemical name and hazard warning, such as "cytotoxic", or "hazardous drug".
6. Drug administration sets should be attached and primed within the BSC, prior to addition of the drug to eliminate the need to prime the set in a less well-controlled environment, and to ensure that any fluid that escapes during priming contains no drug.
7. Extremes of positive and negative pressure in medication vials should be avoided.
    a. The use of large-bore needles, #18 or #20, avoids high-pressure syringing of the solutions. However, some experienced personnel believe that large-bore needles are more likely to drip. Multi-use dispensing pins are recommended to avoid these problems.
    b. Venting devices such as filter needles or dispensing pins permit outside air to replace the withdrawn liquid.
    c. Although venting devices are recommended, another technique is to add diluent slowly to the vial by alternately injecting small amounts, allowing displaced air to escape into the syringe. When all diluent has been added, a small amount of additional air may be withdrawn to create a negative pressure in the vial, but this should **not** be expelled into room air because it may contain drug residue. It should either be injected into a vacuum vial or remain in the syringe to be discarded.

F. Handling Ampules

1. Ampules with dry material should be gently tapped down before opening to move any material in the top of the ampule to the bottom quantity.

2. A sterile gauze pad should be wrapped around the ampule neck before breaking the top to protect against cuts and catch airborne powder or aerosol.

3. If diluent is to be added, it should be injected slowly down the inside wall of the ampule. The ampule should be tilted gently to ensure that all the powder is wet before agitating it to dissolve the contents.

4. After the solution is withdrawn from the ampule with a syringe, the needle should be cleared of solution by holding it vertically with the point upwards, the syringe should be tapped to remove air bubbles and the air bubbles expelled into a closed container.

II. Non-liquid Hazardous Drugs

A. Tablets which may produce dust or potential exposure to the handler should be counted in a BSC. Automated counting machines should not be used unless an enclosed process isolates the hazard from the employee.

B. Compounding should occur in a BSC or a NIOSH-approved respirator should be worn. A gown and gloves should also be worn.

III. Packaging and Transport

A. The outside of bags or bottles containing the prepared drug should be wiped with moist gauze.

B. Entry ports should be wiped with moist alcohol pads and capped.

C. Transport should occur in sealed plastic bags and transported in containers designed to avoid breakage.

D. Personnel involved in transport of hazardous drugs should be trained in spill procedures.

E. Hazardous drugs that are shipped are also subject to Department of Transportation (DOT) regulations. For information, contact the EHSO.

IV. Drug Administration

A. Personal Protective Equipment

1. Personnel administering hazardous drugs should wear gowns, latex or other appropriate gloves, and chemical splash goggles or equivalent safety glasses.

2. NIOSH-approved respirators should be worn when administering aerosolized drugs.

B. Work Practices

1. Hands should be washed before donning and after removing gloves.

2. Gowns or gloves that become contaminated should be changed immediately.

3. Infusion sets and pumps, which should have Luer-lock fittings should be observed for leakage during use. A plastic backed absorbent pad should be placed under the tubing during administration to catch any leakage. Sterile gauze should be placed around any push sites; IV tubing connecting sites should be taped.

4. Priming IV sets or expelling air should be carried out in a BSC. If priming must occur at the administration site, the line should be primed with non-drug containing solution or a back-flow system should be used.

5. Syringes, IV bottles and bags, and pumps should be wiped clean of any drug contamination with sterile gauze. Needles and syringes should not be crushed or clipped, but should be placed in a puncture resistant sharps container then into a hazardous drug disposal bag with all other contaminated materials. The bag should be disposed as hazardous drug waste as described in Section X., "Hazardous Drug Waste Disposal".

6. Administration sets should be disposed of intact, in accordance with the procedures in Section X., "Hazardous Drug Waste Disposal".

7. Protective goggles should be cleaned with detergent and properly rinsed.

8. All protective equipment should be disposed of upon leaving the patient care area.

C. Drug Administration to Animals

If animals are administered hazardous drugs, the researcher must:

1. Determine whether the animal tissue or excreta will be contaminated with or have residual amounts of hazardous drugs remain. If so, the tissue and/or excreta must be collected, stored, and disposed as hazardous drug waste. See Section X., “Hazardous Drug Waste Disposal” for hazardous drug waste disposal procedures; and

2. Develop Standard Operating Procedures (SOPs) for the administration of the drug, the safe handling of such animals, and appropriate waste disposal procedures as appropriate for Animal Resources technicians to follow, and submit such procedures with IACUC protocol applications.

V. Spills

A. General Procedures

1. Spills and breakages of hazardous drugs (HDs) should be cleaned up immediately by a properly protected person trained in the appropriate procedures.

2. The area should be identified with a warning sign to limit access to the area.

B. Personnel Contamination

1. Contamination of protective equipment or clothing, or direct skin or eye contact should be treated by:

a. immediately removing the gloves or gown,

b. immediate cleansing of the affected skin with soap and water,

c. for eye exposure, flooding of the affected eye at an eyewash fountain or with water or isotonic eyewash designated for the purpose for at least fifteen minutes, and

d. obtaining medical attention immediately.

2. Documentation of the exposure should occur through the following steps.

a. The employee should notify his/her supervisor.

b. The employee must complete an *Employee's Report of Injury* form and the employee's supervisor must complete and sign a *Supervisor's Report of Employee's Injury* form, found at http://hr.ou.edu/benefits/Workerscompensation.asp

C. Clean-up of Small Spills

1. Spills of less than 5 ml or 5 gm outside a biological safety cabinet should be cleaned up immediately by personnel wearing gowns, double latex gloves, and splash goggles.

2. An approved respirator should be used for either powder or liquid spills where airborne powder or aerosol is or has been generated.

3. Liquids should be wiped with absorbent gauze pads; solids should be wiped with wet absorbent gauze. The spill areas then should be cleaned (three times) using a detergent solution followed by clean water.

4. Any broken glass fragments should be picked up using a small scoop (never the hands) and placed in a sharps container. The container should then go into a HD disposal bag, long with used absorbent pads and any other contaminated waste.

5. Contaminated reusable items, such as glassware and scoops, should be washed twice with detergent by a trained employee wearing double latex gloves and a gown.

6. Protective goggles and respirators should be cleaned with mild detergent and water after use.

D. Clean-up of Large Spills

1. For spills of amounts larger than 5 ml or 5 gm, the area should be isolated and aerosol generation avoided.

2. Liquid spread should be limited by gently covering with absorbent sheets or spill-control pads or pillows.

3. If a powder is involved, damp cloths or towels should be used.

4. Protective apparel, including respirators, should be used as with small spills when there is any suspicion of airborne powder or that an aerosol has been or will be generated.

5. Chemical inactivators should be avoided in this setting.

6. All contaminated surfaces should be thoroughly cleaned three times with detergent and water. All contaminated absorbent sheets and other materials should be place in an HD disposal bag.

7. Protective goggles and respirators should be cleaned with mild detergent and water after use.

E. Spills in Biological Safety Cabinets

1. Extensive spills within a biological safety cabinet (BSC) necessitate decontamination of all interior BSC surfaces after completion of the spill cleanup.

2. If the HEPA filter of a BSC is contaminated, the unit should be labeled and sealed in plastic until the filter can be changed and disposed of properly by trained personnel wearing appropriate protective equipment.

F. Spill Kits

1. Spill kits, clearly labeled, should be kept in or near preparation and administrative areas.

2. The MSDS for the drug should include sections on emergency procedures, including appropriate personal protective equip-ment.

3. It is suggested that kits include chemical splash goggles, two pairs of gloves, utility gloves, a low-permeability gown, two sheets (12"x12") of absorbent material, 250-ml and 1-liter spill control pillows, a sharps container, a small scoop to collect glass fragments, and two large HD waste disposal bags. Absorbent sheets should be incinerable.

G. Spill Material Waste Disposal

Disposal of all HD contaminated materials and cleanup materials should follow the procedures outlined in Section X., "Hazardous Drug Waste Disposal".

VI. Storage Areas

A. Access to areas where hazardous drugs are stored should be limited to authorized personnel with signs restricting entry.

B. A list of all drugs covered by hazardous drug policies and information on spill and emergency response procedures should be posted or easily available to employees.

C. Facilities used for storing hazardous drugs should not be used for other drugs and should be designed to prevent containers from falling to the floor.

D. Warning labels should be applied to all hazardous drug containers, as well as the shelves and bins where these containers are permanently stored.

VII. Receiving Damaged Hazardous Drug Packages

A. Damaged cartons should be opened in an isolated area by an employee wearing double gloves, a gown, goggles, and a NIOSH-approved respirator.

B. Broken containers and contaminated packaging should be placed in a sharps container if possible, and then into hazardous drug disposal bags.

C. The appropriate protective equipment and waste disposal materials should be kept in the area where shipments are received and employees should be trained in their use and the risks of exposure to hazardous drugs.

VIII. Training and Information Dissemination

A. All personnel involved in any aspect of the handling of hazardous drugs (shipment-receiving personnel, physicians, nurses, pharmacists, housekeepers, or employees involved in the transport or storage of drugs) must receive information and training to apprise them of the hazards of the hazardous drugs present in the work area. The information and training should include:

1. information on any operation/procedure in their work area where drugs that present a hazard are present,

2. methods and observations that may be used to detect the presence or release of a hazardous drug in the work area (such as monitoring conducted, continuous monitoring devices, visual appearance or odor),

3. the physical and health hazards of the hazardous drugs, including carcinogenic and reproductive hazard potential,

4. the measures employees can take to protect themselves from these hazards (including appropriate work practices, emergency procedures, and personal protective equipment), and

5. hazard communication training as required by the *OUHSC Hazard Communication Policy and Program*.

B. This information should be provided at the time of an employee's initial assignment to a work area where hazardous drugs are present and prior to assignments involving new hazards. Annual refresher information and training is required.

C. Knowledge and competence of personnel should be evaluated after the first orientation or training session and at least annually thereafter.

1. Evaluation may involve direct observation of an individual's performance on the job.

2. Non-hazardous solutions may be used for evaluation of preparation techniques. Quinine, which will fluoresce under ultraviolet light, provides a easy mechanism for evaluation of technique.

IX. Medical Surveillance

A. All employees with potential exposure to hazardous drugs through preparation, administration, housekeeping, waste disposal, transport or storage should receive an initial medical evaluation by an occupational physician consisting of a history, physical exam, and laboratory studies.

B. These exams should be repeated at an interval determined by the occupational physician.

X. Hazardous Drug Waste Disposal

A. Hazardous Drug Waste Collection and Storage

1. Personnel handling or disposing of hazardous drug waste should wear gowns and protective gloves when handling waste containers.

2. All waste material should be placed in sealable plastic biohazard bags of 4 mil thick polyethylene or 2 mil polypropylene, labeled with a “hazardous drug” and “incinerate only” label.

a. Needles, syringes, and breakable items should be placed in a biohazard labeled plastic vial or puncture proof box before they are placed into the bag.

b. Needles should not be clipped or capped nor syringes crushed.

3. The waste bag should be kept inside a covered waste container indicating "hazardous drug”.

4. If the outer container is also disposable, it should be labeled “incinerate only”.
5. At least one such receptacle should be located in every area where the drugs are prepared or administered.
6. The waste should not be moved from one area to another.
7. The bag should be sealed when filled and the covered waste container taped, or the bag should be placed in an appropriate box or other container supplied by a disposal vendor, then sealed shut.
8. Precaution should be taken to prevent contamination of the exterior of the outer container.
9. A container with a contaminated exterior should be placed in a second container in a manner which eliminates contamination of the second container.

B. Hazardous Drug Disposal

1. All hazardous drug waste disposal must be pre-arranged through an outside vendor for incineration.
2. Special labels indicating “hazardous drug” and “incinerate only” must identify the containers.
3. If the waste contains animal tissues, carcasses, excreta and other materials contaminated with hazardous drugs including cytotoxic/antineoplastic material, it may be disposed through Comparative Medicine who will ship the material through a qualified vendor for incineration, but the waste must be identified as such when collected and sent to Comparative Medicine.
4. Unused or spent liquid hazardous drugs must be disposed through coordination by the EHSO as hazardous waste, but must not be mixed with other hazardous wastes.
5. Unused or spent solid hazardous drugs listed by the EPA as hazardous waste [Arsenic trioxide, Chlorambucil, Chlornaphazin, Cyclophosphamide, Daunomycin, Diethylstilbesterol, Epinephrin, Melphalan, Mitomycin C, Nicotine, Nitroglycerine, Phentermine, Physotigmine, Physostigmine Salicylate, Streptozocin (Streptozoticin), and Uracil Mustard] must be disposed as hazardous waste through the EHSO.
6. Unused or spent solid hazardous drugs not listed by the EPA as hazardous waste and material that has come in contact with any form of hazardous drugs, including empty vials, used containers, syringes, discarded gloves, gowns, goggles and any other disposable material may be disposed through a biomedical waste vendor marked for incineration.

APPENDIX A

HAZARDOUS DRUGS

AGENT	TRADE NAME
Abacavir	
Abiraterone	
Ado-trastuzumabemtansine	
Aldesleukin (rIL-2)	Proleukin
Alemtuzumab	Campath
Alitretinoin	Panretin
Altretamine	Hexalen
Aminoglutethimide	
Amsacrine	
Anastrozole	Arimidex
Apomorphine	
Arsenic Trioxide*	Trisenox
Asparaginase/L-Asparaginase	Elspar
Azacytidine	Azacytidine
Azathioprime	Azathioprine
Bexarotene	Targretin
Bicalutamide	Casodex
Bleomycin/Bleomycin Sulfate	Blenoxane
Brentuximabvedotin	
Busulfan	Myleran
Cabazitaxel	
Capecitabine	Xeloda
Carboplatin	Paraplatin
Carmustine (BCNU)	BiCNU
CCNU	Belustine
Chlorambucil*	Leukeran
Chloramphenicol	
Chlornaphazin	
Chlorotrianisene	
Chlorozotocin	
Cisplatin/Cis-Platin	Platinol
Cladribine (2-chlorode-oxyadenosine, 2CdA)	Leustatin
Crizotinib	
Cyclophosphamide*	Cytoxan, Neosar
Cyclosporin	
Cytarabine (ara-C)/Cytosine Arabinoside	Cytosar-U
Dacarbazine	DTIC, DIC, DTIC-Dome
Dactinomycin (Actinomycin-D)	Cosmegen
Daunomycin*	
Daunorubicin/Daunorubicin Hydrochloride	Cerubidine
Daunorubicin (Liposomal)	DaunoXome
Deferiprone	
Denileukin Diftitox	Ontak
Dexrazoxane	
Diethylstilbesterol	
Docetaxel	Taxotere

Doxorubicin	Adriamycin
Doxorubicin Hydrochloride Liposomal Injection	Doxil
Epinephrin (excluding Epinephrin salts)*	
Epirubicin/Epirubicin Hydrochloride	Ellence
Eribulin	
Erlotinib	
Estradiol	
Estramustine	Emcyt
Ethinyl Estradiol	
Etoposide (VP-16-213)	VePesid
Exemestane	Aromasin
Fingolimod	
Floxuridine	
Fluconazole	
Fludarabine/Fludarabine Phosphate	Fludara
Fluorouracil/5-Fluorouracil	Adrucil
Flutamide	Eulexin
Fosphenytoin	
Fulvestrant	
Ganciclovir	
Gemcitabine	Gemzar
Gemtuzumab Ozogamicin	Mylotarg
Goserelin/Goserelin Acetate	Zoladex
Hydroxyurea	Droxia, Mylocel
Ibritumomab Tiuetan	Zevalin
Icatibant	
Idarubicin	Idamycin
Ifosfamide	Ifex
Imatinib Mesylate	Gleevec
Interferon-A/Interferon Alfa (2a, 2b)	Roferon-A, Intron-A
Interleukin-2 (IL-2)	
Irinotecan (CPT-11)	Camposar
Isotretrinoin	
Letrozole	Femara
Leuprolide/Leuprolide Acetate	Lupron, Lupron Depot
Levamisole	Ergamisol
Liraglutide Recombinant	
Lomustine (CCNU)	CeeNu
Mechlorethamine (Nitrogen Mustard)	Mustargen
Mechlorethamine Hydrochloride	
Medroxyprogesterone/Medroxyprogesterone Acetate	Provera
Megestrol/Megestrol Acetate	Megace
Melphalan*	Alkeran
Mercaptopurine (6-MP)	Purinethol
Methotrexate (MTX)	Mexate, Folex
Methyl-CCNU	Semustine
Misoprostol	
Mithramycin	Mithracin
Mitomycin	
Mitomycin C*	Mutamycin
Mitotane	

Mitoxantrone	Novantrone
Myleran	
Nafarelin	
Nevirapine	
Nicotine*	
Nilutamide	NIlandron
Nitrogen Mustard	Mustargen
Nitroglycerin*	
Oprelvekin	Neumega
Oxaliplatin Paclitaxel	Taxol
Pegaspargase	
Pentostatin (2-deoxycoformycin, DCF)	Nipent
Phentermine*	
Phenytoin	
Physostigmine*	
Physostigmine salicylate*	
Pipobroman	
Plicamycin	
Procarbazine/Procarbazine Hydrochloride	Matulane
Propylthiouracil	
Ribavirin	
Rituximab	Rituxan
Spironolactone	
Streptozocin (Streptozoticin)*	Zanosar
Tamoxifen/Tamoxifen Citrate	Nolvadex
Temozolomide	Temodar
Teniposide	Vumon
Teosulfan	
Testolactone	
Thioguanine	
Thiotepa	Thioplex
Topiramate	
Topotecan	Hycamtin
Toremifene/Toremifene Citrate	Fareston
Trastuzumab	Herceptin
Tretinoin (ATRA)	Vesanoid
Triethylene Thiophosphoramide	Thiotepa
Triptorelin Pamoate	Trelstar Depot
Ulipristal	
Uracil Mustard*	Uramustine
Valrubicin	
Vandetanib	
Vemurafenib	
Vidarabine	
Vinblastine/Vinblastine Sulfate	Velban
Vincristine/Vincristine Sulfate	Oncovin
Vindesine	
Vinorelbine/Vinorelbine Tartrate	Navelbine
VM-26	
Voriconazole	
Warfarin*	
Zidovudine	Retrovir

*These agents are listed by the Environmental Protection Agency as hazardous wastes and must be disposed of as such

Sources: American Hospital Formulary Service Drug Information 1995
American Hospital Formulary Service Drug Information 2002
Occupational Safety and Health Administration (OSHA) Instruction PUB 8-1.1 Appendix A, *Work Practice Guidelines for Personnel Dealing with Cytotoxic (Antineoplastic) Drugs*, January 29, 1986
OSHA Instruction CPL 2-2.20B CH-4, Chapter 21, *Controlling Occupational Exposure to Hazardous Drugs*, April 14, 1995
OSHA Technical Manual Section VI, Chapter 2 Appendix VI:2-1, *Some Common Drugs that are Considered Hazardous*
Environmental Protection Agency Regulation 40 CFR 261.33
Oklahoma Department of Environmental Quality *Instructions for Disposal of Antineoplastic (Chemotherapy) Agents at Permitted Biomedical Waste Incinerators*
Adams, Val R., "Guide to Cancer Chemotherapeutic Regimens," *Pharmacy Practice News*, October 2002 Supplement, pp. 29-46.
Adams, Val R., "Guide for the Administration and Use of Cancer Chemotherapeutic Agents 2003," *Oncology Special Edition*, Vol 6, 2003, pp. 123-138.
Department of Health and Human Services, CDC, NIOSH. *NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings,* 2014.

Appendix B

Personal Protective Equipment and Engineering Controls for Working with Hazardous Drugs

Formulation	Activity	Double Gloves	Protective gown	Eye Protection	Respiratory protection	Ventilated engineering controls
Intact tablet or capsule	Administration from unit-dose package	No (single glove should be used	No	No	No	N/A
Tablets or capsules	Cutting, crushing or otherwise manipulating tablets or capsules	Yes	Yes	No	Yes, if not done in a control device	Yes*
	Administration	Yes	Yes	No	Yes, if powder generated	N/A
Oral liquid drug	Compounding	Yes	Yes	Yes, if not done in a control device	Yes, if not done in a control device	Yes*
	Administration	Yes	Yes	No**	No**	N/A
Topical drug	Compounding	Yes	Yes	Yes	Yes, if not done in a control device	Yes*
	Administration	Yes	Yes	Yes, if liquid that could splash**	Yes, if inhalation potential	N/A
Ampoule	Opening	Yes	Yes	Yes, if not done in a control device	Yes, if not done in a control device	Yes, BSC or CACI
Subcutaneous intramuscular injection	Preparation (withdrawing from vial or ampoule)	Yes	Yes	Yes, if not done in a control device	Yes, if not done in a control device	Yes, BSC or CACI
	Administration from prepared syringe	Yes	Yes	Yes, if liquid that could splash**	Yes, if inhalation potential**	N/A
Intravenous solution	Compounding	Yes	Yes	Yes, if not done in a control device	Yes, if not done in a control device	Yes, BSC or CACI; recommend use of CSTD
	Administration of prepared solutions***	Yes	Yes	Yes, if liquid that could splash**	Yes, if inhalation potential**	N/A; recommend use of CSTD
Solution for irrigation	Compounding	Yes	Yes	Yes, if not done in a control device	Yes, if not done in a device	Yes, BSC or CACI; recommend use of CSTD
	Administration (bladder, HIPEC, limb perfusion, etc.)	Yes	Yes	Yes	Yes	N/A
Powder/Solution for Inhalation	Inhalation	Yes	Yes	Yes	Yes	Yes, when applicable

The table provides general guidance for some of the possible scenarios that may be encountered in healthcare settings, but cannot coverall possible situations.

BSC=Class II biological safety cabinet; CACI= compounding aseptic containment isolator; CSTD= closed system drug transfer device; HIPEC= hyperthermic intraperitoneal chemotherapy.

*For non-sterile preparations, an engineering control such as a fume hood or Class I BSC is sufficient. It is recommended that these activities be carried out in a control device, but it is recognized that under some circumstances, it is not possible. If the activity is performed in an engineering control that is used for sterile intravenous preparations, a thorough cleaning is required following the activity.

**Required if patient may resist (infant, unruly patient, veterinary patient) or if administered by feeding tube.

***Intravenous tubing already attached and primed.