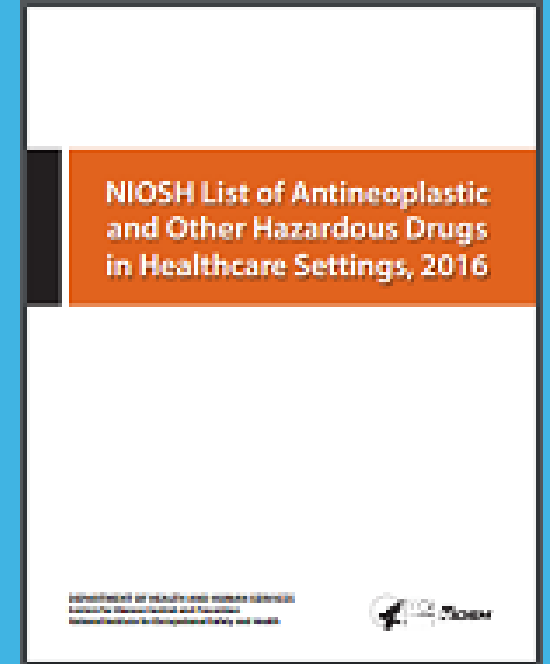


# Hazardous Drug Exposures In Healthcare

The National Institute for Occupational Safety and Health (NIOSH) List



Medication Safety Department SPSC

# Outlines

Hazardous Drugs Definition

NIOSH Classification

Conclusion

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# Hazardous Drugs

(NIOSH definition)

Drugs considered hazardous include those that exhibit one or more of the following **six** characteristics in humans or animals:

1-Carcinogenicity

2-Teratogenicity

3-Reproductive toxicity

4-Organ toxicity at low doses

5-Genotoxicity

6-Structure and toxicity profiles of new drugs that mimic existing drugs determined hazardous by the above criteria

# What are the potential risks to healthcare workers?



Skin rashes



Adverse reproductive outcomes (including infertility, spontaneous abortions, and congenital malformations),



leukemia and other cancers.



Note: The health risk depends on how much exposure a worker has to these drugs and how toxic they are

# There are 3 Key Steps to Consider When Handling Hazardous Drugs

**1**

Determine if the drug is on the Hazardous Drugs List (Using NIOSH List)

**2**

Determine the dosage form of the drug that you are going to handle and refer to handling precautions

**3**

Follow NIOSH requirement (Personal Protective Equipment (PPE) are essential for handling hazardous drugs. (Table 5)

# Step 1 -Is the medication that I'm handling Hazardous?

The National Institute for Occupational Safety and Health (NIOSH) classified the Hazardous medication into three groups of drugs:

- **Group 1**
- Antineoplastic drugs.
- Note that many of these drugs may also pose a reproductive risk for susceptible populations (Table 1).

Table 1 (Continued). Group 1: Antineoplastic drugs, including those with the manufacturer's safe-handling guidance (MSHG)

Drug	AHFS classification	MSHG	Supplemental information	Links
altretamine	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
amsacrine	NA antineoplastic agents	yes	IARC Group 2B <sup>1</sup>	<a href="#">DrugBank</a>
anastrozole	10:00 antineoplastic agents		FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
arsenic trioxide	10:00 antineoplastic agents	yes	IARC Group 1 carcinogen; NTP** <sup>1</sup> ; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
<b>axitinib</b>	<b>10:00 antineoplastic agents</b>		Teratogenic, embryotoxic and fetotoxic in mice at exposures lower than human exposures; FDA Pregnancy category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
azacitidine	10:00 antineoplastic agents	yes	IARC Group 2A carcinogen; NTP** <sup>1</sup> ; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
Bacillus Calmette Guerin (BCG)	80:12 vaccines	yes	See special handling requirements <sup>1</sup> ; FDA Pregnancy Category C	<a href="#">DailyMed</a>
<b>belinostat</b>	<b>10:00 antineoplastic agents</b>	<b>yes</b>	May cause teratogenicity and/or embryo-fetal lethality because it is a genotoxic drug and targets actively dividing cells; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
bendamustine	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
bexarotene	10:00 antineoplastic agents		FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
bicalutamide	10:00 antineoplastic agents		FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
bleomycin	10:00 antineoplastic agents	yes	IARC Group 2B; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
bortezomib	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>

(Continued)

Table 1 (Continued) Group 1: Antineoplastic drugs, including those with the manufacturer's safe-handling guidance (MSHG)

Drug	AHFS classification	MSHG	Supplemental information	Links
bosutinib	10:00 antineoplastic agents		FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
brentuximab vedotin	10:00 antineoplastic agents	yes	Conjugated monoclonal antibody; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
busulfan	10:00 antineoplastic agents	yes	IARC Group 1 carcinogen; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
cabazitaxel	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
<b>cabozantinib</b>	<b>10:00 antineoplastic agents</b>		Embryolethal in rats at exposures below the recommended human dose; FDA Pregnancy category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
capecitabine	10:00 antineoplastic agents	yes	Metabolized to 5-fluorouracil; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
carboplatin	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
<b>carfilzomib</b>	<b>10:00 antineoplastic agents</b>		Special warnings on contraception while taking and 2 weeks post-treatment; FDA Pregnancy category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
carmustine	10:00 antineoplastic agents	yes	IARC Group 2A carcinogen; NTP** <sup>1</sup> ; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
chlorambucil	10:00 antineoplastic agents	yes	IARC Group 1 carcinogen; NTP** <sup>1</sup> ; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
cisplatin	10:00 antineoplastic agents	yes	IARC Group 2A carcinogen; NTP** <sup>1</sup> ; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
cladribine	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
clofarabine	10:00 antineoplastic agents	yes	FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>

# Step 1 -Is the medication that I'm handling Hazardous?

## Group 2:

Non-antineoplastic drugs that meet one or more of the NIOSH criteria for a hazardous drug. Note that some of these drugs may also pose a reproductive risk for susceptible populations (Table 2).

**Table 2 (Continued). Group 2: Non-antineoplastic drugs that meet one or more of the NIOSH criteria for a hazardous drug, including those with the manufacturer's safe-handling guidance (MSHG)**

Drug	AHFS classification	MSHG	Supplemental information	Links
carbamazepine	78:12:92 anticonvulsants, miscellaneous		Black Box warning for aplastic anemia; congenital malformations in offspring of mothers who took drug; rapid transplacental passage; FDA Pregnancy Category D*	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
chloramphenicol	8:12:08 chloramphenicols		IARC Group 2A carcinogen; NTP***; FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
cidofovir	8:18:32 nucleosides and nucleotides	yes	FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
cyclosporine	92:44 immunosuppressive agents		IARC Group 1 carcinogen; NTP**; FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
deferiprone	64:00 heavy metal antagonists		Genotoxic in vitro and in vivo; FDA Pregnancy Category D	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
dexrazoxane	92:56 protective agents	yes	FDA Pregnancy Category C; secondary malignancies observed in patients treated long term with Razoxane (a racemic mixture containing dexrazoxane); genotoxic in vitro and in vivo; in laboratory studies, testicular atrophy observed at or below the human dose	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
diethylstilbestrol	NA		IARC Group 1 carcinogen; NTP**; FDA Pregnancy Category X	<a href="#">DrugBank</a>
divalproex	78:12:92 anticonvulsants, miscellaneous		Black Box warning for teratogenicity; FDA Pregnancy Category D; tumors seen in laboratory studies at doses below MRHD	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>



# Step 1 -Is the medication that I'm handling Hazardous?

## Group 3:

Drugs that primarily pose a reproductive risk to men and women who are actively trying to conceive and women who are pregnant or breast feeding, because some of these drugs may be present in breast milk (Table 3).

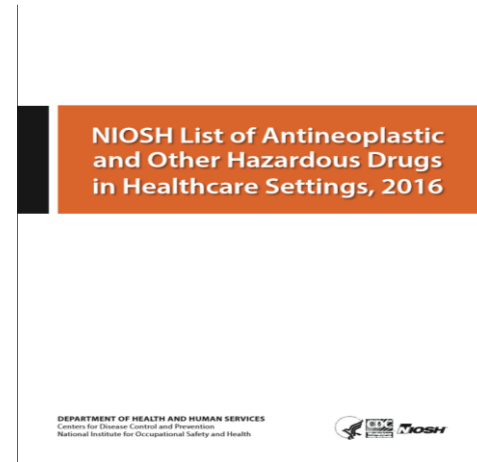
**Table 3 (Continued). Group 3: Non-antineoplastic drugs that primarily have adverse reproductive effects**

Drug	AHFS classification	Supplemental information	Links
colchicine	92:16 anti-gout agents	FDA Pregnancy Category C; published animal reproduction and development studies indicate it causes embryofetal toxicity, teratogenicity, and altered postnatal development at exposures within or above the clinical therapeutic range	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
dinoprostone	76:00 oxytocics	Hazardous only for women in late pregnancy; FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
dronedarone	24:04:04 antiarrhythmics	Teratogenic in laboratory studies at ½ MRHD; FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
dutasteride	92:08 5-alpha reductase inhibitors	Women warned not to handle; FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
eslicarbazepine	28:12:92 anticonvulsants, miscellaneous	Fetal malformations, fetal growth retardation, embryolethality, and reduced body weights observed in animal studies; excreted in human breast milk; FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
ergonovine/methylergonovine	76:00 oxytocics	Use is contraindicated during pregnancy because of its uterotonic effects; FDA Pregnancy Category C	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a> ; <a href="#">DrugBank</a>
finasteride	92:08 5-alpha reductase inhibitors	Women should not handle crushed or broken finasteride tablets when they are pregnant or may potentially be pregnant, due to potential risk to a male fetus; FDA Pregnancy Category X	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>
fluconazole	8:14.08 azoles	FDA Pregnancy Category C; case reports describe congenital anomalies in infants exposed in utero to maternal fluconazole (400-800 mg/ day) during most or all of the first trimester, similar to those seen in animal studies	<a href="#">DailyMed</a> ; <a href="#">DrugBank</a>

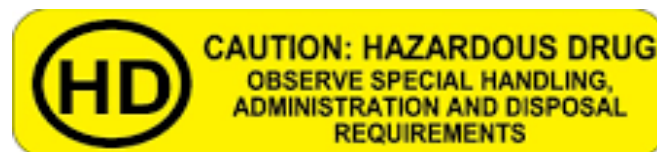


# Step 1 -Is the medication that I'm handling Hazardous?

Refer to NIOSH list /  
Hazardous medication list in your hospital



Find special labeling/precautions on the medication



## Step 2-Determine the dosage form of the drug that you are going to handle and refer to handling precautions

**Table 5 (Continued). Personal protective equipment and engineering controls for working with hazardous drugs in healthcare settings\***

Formulation	Activity	Double chemo-therapy gloves	Protective gown	Eye/face protection	Respiratory protection	Ventilated engineering control
Oral liquid drug or feeding tube	Compounding	yes	yes	yes, if not done in a control device	yes, if not done in a control device	yes <sup>†</sup>
	Administration	yes	yes	yes, if vomit or potential to spit up <sup>‡</sup>	no	N/A
Topical drug	Compounding	yes	yes	yes, if not done in a control device	yes, if not done in a control device	yes <sup>†</sup> , BSC or CACI (Note: carmustine and mustargen are volatile)
	Administration	yes	yes	yes, if liquid that could splash <sup>‡</sup>	yes, if inhalation potential	N/A

## Step 3-Follow NIOSH requirement (Personal Protective Equipment (PPE) are essential for handling hazardous drugs. (Table 5)

**Table 5. Personal protective equipment and engineering controls for working with hazardous drugs in healthcare settings\***

Formulation	Activity	Double chemo-therapy gloves	Protective gown	Eye/face protection	Respiratory protection	Ventilated engineering control
All types of hazardous drugs	Receiving, unpacking, and placing in storage	no (single glove can be used, unless spills occur)	yes, when spills and leaks occur	no	yes, when spills and leaks occur	no
Intact tablet or capsule	Administration from unit-dose package	no (single glove can be used)	no	no	no	N/A
Tablets or capsules	Cutting, crushing, or manipulating tablets or capsules; handling uncoated tablets	yes	yes	no	yes, if not done in a control device	yes <sup>†</sup>
	Administration	no (single glove can be used)	no	yes, if vomit or potential to spit up <sup>‡</sup>	no	N/A

# Conclusion

- Define the hazardous list based on NIOSH classification
- Spills kits, emergency eyewash stations and showers) should be readily available
- Personal Protective Equipment (PPE) are essential for handling hazardous drugs.
- Staff education
- Labeling and separation of Hazardous medication
- Special equipment while handling (Tablet counters and crushers)
- Follow NIOSH requirement (Personal Protective Equipment (PPE) are essential for handling hazardous drugs. (Table 5)



## Reference

<https://www.cdc.gov/niosh/docs/2016-161/pdfs/2016-161.pdf>