

## Guidance on Workplace Hazards Impacting Reproduction and Development

### I. Introduction

University employees working with any hazardous agent must know how to safely work in order to protect their health, and use good procedures at all times to minimize their potential exposures to hazardous agents. The University of Washington strives to ensure a safe and healthy workplace for all workers by implementing environmental and occupational health and safety standards.

This guidance has been developed to inform employees about potential reproductive and developmental hazards to ensure safe work conditions and practices in their work environment. The Environmental Health and Safety (EH&S) Department is available to assist in evaluating risks, and to advise on steps that can help reduce potential for risks. Although primarily meant for UW employees and their supervisors, this guidance should also be helpful for students and instructors. And this guidance may alert an individual about risks in the home environment, including hobbies.

### II. Background for this document

Hazardous agents could be chemical, biological, radiological, or physical. Although some mention is made of biological, radiological, and physical agents that are reproductive or developmental hazards, this guidance primarily addresses chemical agents. The [Radiation Safety Manual](#) and Radiation Safety ([radsaf@uw.edu](mailto:radsaf@uw.edu), 206-543-0463), should be referred to for questions concerning radiation exposures.

The Washington Department of Labor and Industries performed a detailed evaluation of possible reproductive hazards in 1999 and their final report ([“Workplace Hazards to Reproduction and Development,” Technical Report Number 21-3-1999](#)) concludes:

It is important to remember that exposure to toxic agents is only one of many factors that can harm reproduction and result in poor pregnancy outcomes. Although much is still unknown about the extent to which workplace hazards contribute to these health problems, hazardous workplace exposures are generally preventable. Therefore, the goal for employers and workers should be to reduce exposures as much as possible. This is the surest way to prevent toxic exposures from harming workers or the fetus.

### III. Reproductive and Developmental Health

Some agents can affect the potential to conceive a child or affect the embryo or fetus early in the pregnancy or even before. If a pregnancy is possible, you and your partner should be aware of any chemicals in the work area that may cause reproductive or developmental hazards prior to pregnancy. Possible hazards can affect male or female reproductive abilities, embryo or fetal development, development after birth, and the mother or child while breast feeding. Both partners before and during reproductive periods need to be conscious of these hazards.

Appendix A contains a glossary covering many terms used when describing reproductive and developmental hazards. Agents that adversely affect sexual function or the ability of men or women to conceive and reproduce are referred to as reproductive hazards. Agents that disturb the proper growth or health of the offspring, acting at any point between conception and puberty are identified as developmental toxicants. Agents that affect sperm production can be referred to as male reproductive toxicants.

Appendix B lists examples of agents that have appeared in the literature as being known or probable reproductive hazards. The literature for most chemicals has little if any information about the dose, duration of exposure and time of exposure (e.g., prior to conception, during the embryo stage, etc.) that increases risk to pregnancy and offspring in humans. Frequently, risks are extrapolated for humans from studies using other species.

Appendix B does *not* include *all* chemicals that can cause reproductive or developmental risks, because reproductive effects have not been adequately studied for many chemicals and chemical mixtures. Material Safety Data Sheets (MSDSs), Safety Data Sheets (SDSs) and other literature sources can provide additional information about the chemicals in use in a particular workplace. Drugs/medicines can be reviewed for their reproductive effects in the Micromedex:

<http://www.micromedexsolutions.com/micromedex2/librarian> .

Appendix C is a useful questionnaire for compiling information about possible reproductive and developmental effectors that may impact you individually, and Appendix D contains references and additional resources concerning reproductive and developmental health.

### IV. Steps to Reduce Exposure Risks in the Workplace

#### Step 1: Inform Yourself

The first step you can take is to learn about possible hazards in your workplace that could have an effect on reproduction. You can use the questionnaire in Appendix C to compile relevant information. This should be shared with your health care provider (HCP), prior to work with potentially hazardous materials. As you complete this questionnaire, you will notice sources of information that may be helpful:

- a) Review the MyChem inventory of chemicals for your workplace;
- b) Obtain information about the ingredients in chemical mixtures from each chemical's MSDS/SDS: note particularly the sections on ingredients and health hazards (section 2 or 3), methods to control exposure (often section 8) and any toxicological information concerning potential carcinogenic or other possible risks (often section 11);
- c) Talk with your supervisor in order to see how risks are assessed and mitigated for hazardous agents;
- d) Talk with an EH&S Occupational Health Nurse (OHN) at 206-221-7770, to discuss your work situation and resources to minimize exposures;
- e) Make use of the Additional Resources listed in Appendix D.

Step 2: Talk to your health care provider (HCP) and your supervisor

- a) Using the information gathered via the Appendix C questionnaire and from the inventory of chemicals from MyChem, the MSDSs, and the SDSs, discuss your findings with your HCP. Be sure that you understand your HCP's assessment of potential risk and suggestions (if any) about possible modifications to reduce or eliminate risk.
- b) Review the concerns and recommendations of your HCP with your immediate supervisor or departmental administrator. Together you can begin to work on strategies and approaches that will permit any modifications necessary to minimize any reproductive risks.
- c) Concerns about reproductive health generally do not require an employee to perform different job duties or take time off to avoid potential reproductive hazards. However, if your health care provider advises you to temporarily change job duties, or take a leave of absence, the University will consider such requests. In order to determine what action is most appropriate, the University may request that you provide a release from your HCP to inform the University about medical circumstances that have resulted in the health care provider's recommendation.
- d) If you decide to request leave because of concerns about reproductive health, follow your department's normal leave request procedures. If you need to request a temporary or permanent change in job duties you should contact the human resources consultant that serves your department, see this website: <http://hr.uw.edu/>

### Step 3: Minimize exposures

Note: Minimizing exposure to hazardous substances to ensure safe work conditions should be an on-going effort, supporting the culture of safety.

- a) Change the process to eliminate use of the hazardous material;
- b) Change the experimental procedures to the smallest quantities needed or most dilute formulations needed;
- c) Buy pre-mixed or pre-diluted formulations;
- d) Perform procedures with adequate ventilation that pulls the hazardous material away from you by:
  - 1. using a properly operating fume hood,
  - 2. working in a biological safety cabinet that does not re-circulate air back into the room, or
  - 3. using another ventilation control system such as a swinging arm exhaust system;

Note: Always check to make sure the ventilation system is actually operating before starting the procedure;

- e) Follow laboratory rules, such as No food or drink in the laboratory;
- f) Follow all steps in your standard operating procedures (SOPs);
- g) Reduce the chance for spills by:
  - 1. eliminating clutter,
  - 2. working on flat surfaces,
  - 3. mounting equipment firmly,
  - 4. carrying containers in tubs,
  - 5. making sure all containers are closed as soon as feasible, and
  - 6. properly disposing of waste chemicals routinely so as to avoid accumulating large quantities;
- h) Avoid skin contact with hazardous materials;
- i) Wash hands after removing gloves and before touching anything you may put in your mouth;
- j) Wear appropriate personal protective equipment (PPE) such as lab coats, liquid repellent aprons, chemical goggles, impervious gloves;

Note: Thin latex or nitrile gloves are not impervious for most chemicals;

- k) If precautions still seem to present an unacceptable risk, discuss with your supervisor whether those job tasks in which the potential reproductive risk is still of concern, despite appropriate protective measures, could be temporarily suspended and other tasks assigned instead.

## V. EH&S Assistance

For additional information and assistance, please contact the UW Employee Health Center, in Hall Health Primary Care Center room G-07A or at 206-685-1026.

The clinical staff at the Employee Health Center can also coordinate with other EH&S health and safety specialists in industrial hygiene and chemical safety, biosafety, and radiation safety to assist in reviewing the workplace to determine what, if any modifications may be appropriate.

Other services that EH&S specialists can provide include:

- a) Performing workplace assessments of activities involving chemical, radioactive, physical and biological reproductive hazards;
- b) Providing information about these hazards;
- c) Recommending ways to minimize exposures to workplace hazards;
- d) Providing general training to employees.

Exposure to ionizing radiation necessitates steps starting on page 6-6 of the [Radiation Safety Manual](#). Contact Radiation Safety at 206-543-0463 or [radsaf@uw.edu](mailto:radsaf@uw.edu) if there are any questions.

Occasionally, people want to use a respirator to reduce exposures. Respirators may add stress to the body during pregnancy; and respirators might not be needed if other steps as previously described are rigorously followed. However if respirators are prescribed by your health care provider, all steps in the UW Respirator Protection Program must be complied with, including requirements to be medically qualified to wear a respirator and completion of training and fit testing. The medical evaluation and fit testing should be periodically re-evaluated to assure the respirator is fitting properly. For additional information concerning respirators and other PPE, please contact EH&S at 206-543-7388.

## Appendix A

### Glossary – Useful Terms for Researching Reproductive Hazards

(Most of the following definitions are from L & I Technical Report Number: 21-3-1999)

<b>agent</b>	For purposes of these guidelines, a chemical substance, biological substance or organism, radioactive substance or ionizing radiation exposure, or physical exposure (such as intense noise) that can affect a human.
<b>birth defect</b>	A structural, functional, or biochemical abnormality present at birth that is not due to injuries suffered during birth. The cause may be either genetic or due to a problem that occurred during development in the uterus. A birth defect is not always detected at the time of birth.
<b>CAS number</b>	An assigned number that identifies the material. CAS stands for Chemical Abstracts Service, a Columbus, Ohio, organization that indexes information published in Chemical Abstracts by the American Chemical Society and provides index guides by which information about particular substances may be located in the Abstracts when needed. CAS numbers identify specific chemicals and are assigned sequentially. (Chemical Abstracts Service, Division of American Chemical Society, Box 3012, Columbus, OH 43210 [614] 421-3600, <a href="http://www.cas.org">http://www.cas.org</a> .)
<b>carcinogen</b>	A chemical or physical agent capable of causing cancer. Such an agent is “carcinogenic”. The ability to cause cancer is “carcinogenicity”.
<b>childhood cancer</b>	A cancer occurring in a child or young adult.
<b>clastogen</b>	A chemical or physical agent that can cause breaks in chromosomes (genetic material in the cell).
<b>congenital malformation</b>	A physical abnormality present at birth (birth defect).
<b>developmental disorders</b>	Abnormal mental development and behavior, as manifested in effects which may be temporary or permanent.
<b>developmental hazard</b>	An agent that could result in an adverse effect in an individual as it grows from conception to puberty, depending on the dose and on the individual’s susceptibility.
<b>developmental toxicant</b>	An agent which disturbs the proper growth or health of the offspring, acting at any point between conception and puberty. The resulting effects include spontaneous abortion, growth retardation, birth defects, and functional alterations.

<b>dose</b>	The amount of a chemical that enters or is absorbed by the body. Dose is usually expressed in milligrams of chemical per kilogram of body weight (mg/kg).
<b>DOSH</b>	Division of Occupational Safety and Health, is part of the Department of Labor and Industries (L&I) that: develops safety and health rules; enforces safety and health rules by inspecting worksites for unsafe working conditions; provides free on-site consultations to help employers create safe and healthy workplaces; provides free training, safety and health programs, and other resources to help prevent, find, and fix hazards.
<b>embryo</b>	The developing organism from conception until about 8-9 weeks.
<b>embryotoxicity</b>	Increased risk of embryo death as measured in studies involving animals; also see spontaneous abortion.
<b>endocrine</b>	Organs and structures whose function is to secrete into the blood or lymph a substance (hormone) that has a specific effect on another organ or part.
<b>engineering controls</b>	Methods of controlling worker exposure by modifying the source or reducing the amount of contaminants released into the workplace. Engineering controls include process design and modification, equipment design, enclosure and isolation, and ventilation.
<b>epidemiology</b>	The study of the patterns of health and disease in a population of people.
<b>exposure</b>	An encounter between a chemical, biological, or physical agent and a worker. Usually expresses in terms of amount in air, water, dusts.
<b>fertilization</b>	The union of egg and sperm to form an embryo.
<b>fetotoxicity</b>	Increased risk of fetal death as measured in studies involving test animals; also see stillbirth.
<b>fetus</b>	The developing human from about 8-9 weeks until birth.
<b>gene</b>	The part of the genetic material of a cell that encodes a particular protein.
<b>genetic defects</b>	Abnormal cell and organ development and growth, due to changed

germ cells (sperm or egg cells) prior to conception or altered genetic material in developing cells prior to birth. Physical, chemical or biological agents causing such effects are frequently identified as “mutagens.”

<b>genotoxicity</b>	Ability of an agent to damage DNA, potentially leading to mutations.
<b>hormone</b>	A chemical substance, produced in the body or by an organ or cells of an organ which is secreted into the bloodstream and has a specific regulatory effect on the activity of a certain organ or organs.
<b>impotence and decreased libido</b>	Alterations in the nervous system or in the secretion of sex hormones which results in lower libido (sex drive) or altered sexual response in either men or women.
<b>infertility</b>	The inability of a couple desiring a child to become pregnant.
<b>ingestion</b>	Taking in a substance through the mouth and swallowing it, including substances first inhaled, adsorbed, and then ingested.
<b>inhalation</b>	Breathing in a substance.
<b>irritant</b>	A substance which can cause an inflammatory response or a reaction of the mucous
<b>low birth weight</b>	Delayed growth of the embryo or fetus. This condition may also be due to a premature birth, or due to small size for gestational age, or due to environmental factors.
<b>material safety data sheet (MSDS)</b>	A legally-mandated form which lists the hazardous ingredients, physical and chemical properties and health and safety hazards of a product or substance. See also Safety Data Sheet (SDS).
<b>menstruation</b>	Shedding the lining of the uterus.
<b>menstrual disorders</b>	Changes in the balance of sex hormones in women that may potentially cause menstrual irregularities, although limited information is presently available as to the agents producing such changes; increased bleeding during menstruation.
<b>miscarriage</b>	Loss of the embryo or fetus before full term; also referred to as a spontaneous abortion.



<b>mutagen</b>	A mutagen is an agent that causes changes to the DNA (genetic material) and may be of physical, chemical or biological origin. The mutagen may act directly on the DNA, causing direct damage, and most often results in DNA replication error (a mutation). Some mutagens can be carcinogenic; many are not. The change may be permanent and/or heritable (passed along).
<b>mutation</b>	A permanent and heritable change in the cell's DNA, resulting in potential changes in the organism's structure, appearance, or functionality. Such changes may be relatively benign, such as the original cause for eyes to be different colors, or may be life-threatening.
<b>OSHA</b>	Either the Occupational Safety and Health Act or the Occupational Safety and Health Administration; the exact reference depends on the context. In the context of this information page, OSHA refers to the US agency responsible for worker safety and health oversight; their reproductive information page is at <a href="http://www.osha.gov/SLTC/reproductivehazards/index.html">http://www.osha.gov/SLTC/reproductivehazards/index.html</a> OSHA has jurisdiction in Washington state over only: workplaces with federal employees; nonfederal employees working on federal reservations and military bases; employees working on floating worksites (such as floating dry docks, fishing boats, construction barges); employees working for tribal employers on tribal lands.
<b>ovulation</b>	Release of an egg from the ovary.
<b>premature birth</b>	A birth prior to 37 weeks of gestation.
<b>permissible exposure limit (PEL)</b>	A maximum allowable exposure level under OSHA and WISHA regulations. Weighted over an 8-hour work shift.
<b>personal protective equipment</b>	Equipment and clothing designed to control exposure to hazards, e.g., hard hats, safety shoes, protective eye wear, protective clothing and gloves, hearing protectors and various types of respirators, such as dust and gas masks.
<b>RCW/RCWs</b>	Stands for the "Revised Code of Washington" and: is the collection of all state laws (the RCW) or a single statute (WISHA is an RCW); is maintained by the Office of the Code Reviser (not by DOSH); gives "teeth" to regulations by giving them the force of law.
<b>reproductive health hazards</b>	Agents which can adversely affect sexual function or the ability of men and/or women to produce healthy children.
<b>reproductive toxicant</b>	An agent which interferes with the sexual or reproductive function or performance of an adult.

<b>respirator</b>	A device worn to prevent inhalation of hazardous substances.
<b>route of exposure</b>	The way in which a chemical enters the body. The common routes of exposure in the workplace are inhalation, ingestion and absorption through the skin.
<b>safety data sheet (SDS)</b>	A legally-mandated form which lists the hazardous ingredients, physical and chemical properties and health and safety hazards of a product or substance, in compliance with the revised Hazard Communication standard implementing the Globally Harmonized System for Classification and Labeling of Chemicals (GHS); replaces the Material Safety Data Sheet (MSDS).
<b>spermatogenesis</b>	The ten-week cycle of sperm production. Sperm are produced in a man's testicles.
<b>spontaneous abortion</b>	Death of the embryo or fetus before full term (usually defined as before 20 weeks). Also known as miscarriage.
<b>still birth</b>	Death of the embryo or fetus before full term (usually defined as after 20 weeks).
<b>teratogen</b>	A chemical, biological or physical agent which can lead to malformations (physical defects) in the fetus. Such an agent is "teratogenic." The ability to cause birth defects is "teratogenicity."
<b>toxicant</b>	An agent that interrupts the normal function of a cell, tissue, organ or organism.
<b>transplacental carcinogen</b>	A carcinogen which crosses the placenta and causes cancer in the child or young adult.
<b>Washington Administrative Code (WAC)</b>	The rules and regulations adopted to carry out the laws of the state of Washington.
<b>WISHA</b>	Washington Industrial Safety and Health Act of 1973: is a statute (state law) in <a href="#">the RCW</a> , specifically <a href="#">RCW 49.17</a> (there are also <a href="#">other RCWs that relate to occupational safety and health</a> ); empowers L&I to create and enforce safety and health regulations; allows Washington rules/regulations to be more stringent than OSHA's, if needed; applies to you if: you hire someone to work for you as an employee, including workers from a temporary agency; you are hired to work for someone as their employee; have elected industrial insurance coverage for yourself; you own your own business or you are a corporate officer; you have a contract with someone else that primarily involves personal labor, even though you are not required to pay

industrial insurance or unemployment insurance premiums; you volunteer your personal labor, or you have volunteers working for you who receive any benefit or compensation; is further described in the pamphlet ["A Guide to Workplace Safety and Health in Washington State: What Every Employer and Worker Should Know."](#)

## Appendix B

### Reproductive/Developmental Hazards List

Even though an agent may be listed, there may be no significant risk from small doses. In some cases, an agent is listed due to positive studies involving non-human species, even though human metabolism may differ. This list is based on the citations listed in the “Sources/References” section at the end of the list, primarily from the reference by Drozdowsky and Whittaker. This list is not complete, due to insufficient information.

Other organizations may have other listings due to differing criteria. Appendix D gives additional information from the State of California (Prop 65) and the U.S. Navy for chemicals that may cause reproductive as well as mutagenic harm.

[Revised as of 1/6/09.]

Name of Chemical, Physical, or Biological Agent	CAS #	Literature Reported Effects, Without Regard to Dose	Comments
Acetaldehyde	75-07-0	See “Ethyl alcohol” below	Not considered a serious risk in typical occupational settings; effects thought to be due to metabolizing to ethyl alcohol.
Acetone	67-64-1	Birth defects, Menstrual disorders	May be due to other solvents mixed with acetone.
Acrolein	107-02-8	Birth defects, Embryotoxicity	
Acrylamide	79-06-1	Fetotoxicity, Infertility	No human studies available.
Acrylonitrile	107-13-1	Birth defects	Reductions in serum testosterone in humans.
Aldrin	309-00-2	Birth defects, Fetotoxicity, Infertility	
Aluminum	Varies by compound, Aluminum is 7429-90-5	Birth defects	Exposures via water ingestion.
Ammonia	7664-41-7		Related to Toxemia in third trimester.
Aniline	62-53-3		May induce fetal methemoglobinemia.
Antimony	7440-36-0	Spontaneous abortion, Stillbirth	
Antimony Potassium Tartrate	28300-74-5	Premature birth, Spontaneous abortion	
Arsenic and Arsenic Compounds	Varies by compound, Arsenic is 7440-38-2	Birth defects, Spontaneous abortion	
Atrazine	1912-24-9	Birth defects	Increased ratio of male to female embryos.

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Benomyl	17804-35-2	Teratogen	
Benzene	71-43-2	Menstrual disorders	
Benzo(a)pyrene	50-32-8	Birth defects, Fetotoxicity, Infertility, Stillbirth	
Beryllium	Varies by compound, Beryllium is 7440-41-7	Mutagen	
Boric Acid	10043-35-3	Infertility	Effects testes and sperm.
Boron Oxide	1303-86-2		Thought to be similar to boric acid.
Bromine	7726-95-6	Exposure after birth, Infertility	
1-Bromopropane	106-94-5	Birth defects	No human studies available.
2-Bromopropane	75-26-3	Infertility	Exposure levels were on the high end of routine workplace levels.
Busulfan	55-98-1	Birth defects, Spontaneous abortion	Known reproductive hazard for males and females.
Butyl Benzyl Phthalate (BBP)	85-68-7	Birth defects	Exposure levels were higher than are estimated to occur in workplaces.
Cadmium and Cadmium Compounds	Varies by compound, Cadmium is 7440-43-9	Infertility	
Carbamide (Urea)	57-13-6	Spontaneous abortion	
Carbaryl	63-25-2	Infertility	
Carbon Dioxide	124-38-9	Birth defects	
Carbon Disulfide	75-15-0	Birth defects, Impotence and decreased libido, Infertility, Menstrual disorders, Premature birth, Stillbirth	
Carbon Monoxide	630-08-0	Developmental disorders, Low birth weight	
Carbon Tetrachloride	56-23-5	Embryotoxicity, Fetotoxicity	Exposure levels were higher than routine workplace levels.
Chlorambucil	305-03-3	Birth defects, Infertility	
Chlordecone (Kepone)	143-50-0	Infertility	
Chloroform	67-66-3	Embryotoxicity, Fetotoxicity, Teratogen	Teratogenic effects in mice and rats but not rabbits.
Chloroprene	126-99-8	Infertility	
Chlorpyrifos (Dursban)	2921-88-2		Exposure levels would have exceeded permissible exposure limits.

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Copper and Copper Compounds	Varies by compound, Copper is 7440-50-8	Birth defects, Spontaneous abortion	May be due to other metals mixed with copper.
Cyclophosphamide (Cytoxan; Neosar)	50-18-0 (anhydrous), 6055-19-2 (hydrated)	Birth defects	Effects identified through therapeutic applications as a drug and may not appear at occupational dose levels.
Cytomegalovirus	N/A	Birth defects, Developmental disorders, Stillbirth	
Diazinon	333-41-5	Birth defects, Impotence and decreased libido	
Dibromochloropropane (DBCP)	96-12-8	Infertility	
Di-n-Butyl Phthalate	84-74-2	Birth defects, Infertility	Exposure levels may have been higher than levels found in workplaces.
1,2-Dichlorobenzene (ortho-Dichlorobenzene)	95-50-1	Birth defects, Infertility	
Dichlorodiphenyl-trichloroethane (DDT)	50-29-3	Exposures after birth	
1,1-Dichloroethane	75-34-3	Low birth weight	Test doses were so high that maternal effects were also observed.
1,2-Dichloroethane	107-06-2	Embryotoxicity, Possible Mutagen	
2,4-Dichlorophenoxy-acetic Acid (2,4-D)	94-75-7	Birth defects, Spontaneous abortion	
Dichlorvos	62-73-7	Birth defects	
Dicofol	115-32-2	Birth defects	
Dieldrin	60-57-1	Birth defects	Post natal death
Di(2-ethylhexyl) phthalate (DEHP)	117-81-7	Birth defects, Fetotoxicity	
Diethylstilbestrol (DES)	56-53-1	Transplacental carcinogen	
Dimethoate	60-51-5	Birth defects, Fetotoxicity, Premature birth	Testicular toxicant.
Dimethylformamide (DMF)	68-12-2	Birth defects, Spontaneous abortion, Stillbirth	
Dimethyl Phthalate	131-11-3	Fetotoxicity, Teratogen	
Dimethyl Sulfoxide (DMSO)	67-68-5	Birth defects, Fetotoxicity, Infertility	Experimental animals showed developmental effects.
Dinitrotoluene	25321-14-6	Spontaneous abortion	May induce fetal methemoglobinemia.
Dinoseb	88-85-7	Embryotoxicity, Fetotoxicity, Teratogen	
1,4-Dioxane	123-91-1	Fetotoxicity	Effects observed at the highest dose only.

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Endosulfan	115-29-7		Experimental animals showed reproductive organ effects.
Epichlorohydrin	106-89-8		Male experimental animals showed reproductive organ effects.
Ethyl Alcohol	64-17-5	Birth defects, Fetotoxicity, Infertility	Fetal alcohol syndrome. Effects known from ingestion studies but expected to be similar for high dose inhalation exposures.
Ethylene Dibromide (EDB)	106-93-4	Fetotoxicity, Infertility	
Ethylene Dichloride	107-06-2		See 1,2-Dichloroethane
Ethylene Glycol Monoethyl Ether (EGEE)	110-80-5	Birth defects	
Ethylene Glycol Monomethyl Ether (EGME)	109-86-4	Birth defects, Infertility	Testicular toxicant.
Ethylene Oxide	75-21-8	Fetotoxicity, Spontaneous abortion	
Ethylene Thiourea	96-45-7	Teratogen	No human studies.
Fluoroacetic Acid	144-49-0		Thought to be similar to sodium fluoroacetate.
Fluorocarbons	Varies by compound	Birth defects, Fetotoxicity	Examples include Dichlorofluoromethane at high exposure levels, and Trifluoromethane. Many fluorocarbons do not seem to present a hazard.
Fluoxetine	59333-67-4	Low birth weight, Exposures after birth	
Formaldehyde	50-00-0	Menstrual disorders, Spontaneous abortion	
Formamides	Varies by compound	Birth defects, Embryotoxicity, Fetotoxicity	Examples include Dibutylformamide, Dimethyl formamide, Formamide and Methylformamide,
Gasoline	8006-61-9	Birth defects, Menstrual disorders	Effects not well documented.
Halothane	151-67-7	Developmental disorders	No human studies.
Heat, Excessive	N/A	Infertility	
Heavy, Physical Exertion	N/A	Low birth weight, Premature birth, Spontaneous abortion	Repetitive heavy lifting, stooping or climbing.
Hepatitis B Virus	N/A	Low birth weight	Increased risk of liver disease in the child.
High Frequency Electromagnetic Radiation	N/A	Infertility	Exposure levels were higher than routine workplace levels.
Human Immunodeficiency Virus (HIV)	N/A	Birth defects, Premature birth	
Ionizing Radiation	N/A	Developmental disorders, Mutagen, Spontaneous abortion	

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Lead and Lead Compounds	Varies by compound, Lead is 7439-92-1	Developmental disorders, Exposures after birth, Infertility, Low birth weight, Spontaneous abortion	
Lindane	58-89-9	Exposures after birth, Menstrual disorders, Stillbirth	
Lithium	7439-93-2	Birth defects	Positive human studies from therapeutic doses, which may not be equivalent to occupational exposures.
Malathion	121-75-5	Infertility	Test doses were so high that maternal effects were observed.
Manganese	7439-96-5	Impotence and decreased libido	Manganese excess and manganese deficiency are both hazardous.
Mercury (Metallic Mercury and Inorganic Salts)	Varies by compound, Mercury is 7439-97-6	Exposures after birth, Impotence and decreased libido	
Mercury (Methyl Mercury and Organic Mercury Compounds)	Varies by compound	Birth defects, Developmental disorders, Exposures after birth, Stillbirth	
Methane	74-82-8	Birth defects	No human studies.
Methanol (Methyl Alcohol)	67-56-1	Birth defects	
Methotrexate	59-05-2	Birth defects, Exposures after birth, Infertility	
Methoxychlor	72-43-5	Infertility, Fetotoxicity	
Methylene Chloride	75-09-2	Birth defects, Exposures after birth, Low birth weight, Spontaneous abortion	
Methyl Ethyl Ketone (MEK)	78-93-3	Birth defects	Exposure levels were higher than routine workplace levels.
Methyl Methacrylate	80-62-6	Birth defects	
Methyl n-Butyl Ketone	591-78-6	Birth defects	
Methyl Parathion	298-00-0	Birth defects	
N-Methylformamide	123-39-7	Teratogen	No human studies.
N-Methyl-2-Pyrrolidone	872-50-4	Fetotoxicity, Teratogen	No human studies.
Nickel	7440-02-0	Embryotoxicity, Teratogen	No human studies.
Nitrogen Dioxide	10102-44-0	Fetotoxicity, Infertility, Menstrual disorders,	
Nitrous Oxide	10024-97-2	Birth defects, Spontaneous abortion	
Noise, Intense	N/A	Infertility, Low birth weight	Effects may be due to standing or excessive stress.



<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Oral Contraceptives	Varies by compound	Birth defects, Infertility	
Ozone	10028-15-6		
Paints	Varies by compound	Birth defects, Spontaneous abortion	Effects may be due to some specific ingredients such as lead or methylene chloride.
Parathion	56-38-2	Embryotoxicity, Fetotoxicity	No human studies.
Parvovirus B19, Human	N/A	Spontaneous abortion	
Perchloroethylene	127-18-4	Birth defects, Exposures after birth, Menstrual disorders	
Phenol (Carbolic Acid)	108-95-2	Impotence and decreased libido, Spontaneous abortion	
Platinum and its Compounds	Varies by compound, Platinum is 7440-06-4		
Poisonous Plants: Broom Snakeweed, Larkspurs, Locoweeds, Lupines, Ponderosa Pines, Poison Hemlock, Wild Tobacco	N/A	Birth defects, Fetotoxicity, Spontaneous abortion	Causative agents identified as labdane acid resins (acetyl isocupressic acid, isocupressic acid, and succinyl isocupressic acid), piperidine alkaloids, quinolizidine alkaloids, and swainsonine
Polybrominated Biphenyls (PBBs)	Varies by compound	Exposures after birth, Teratogen	
Polychlorinated Biphenyls (PCBs)	Varies by compound	Birth defects, Developmental disorders, Exposures after birth, Low birth weight, Menstrual disorders, Premature birth, Stillbirth	
Polyvinyl Chloride (PVC Resin)	9002-86-2	Spontaneous abortion, Stillbirth	
Potassium Silver Cyanide	506-61-6	Birth defects	Although adult testicular effects are presumed due to its cyanide content, effects appear at lower exposure levels than other cyanide compounds.
Radioactive Isotopes	Varies by compound	Childhood cancer, Developmental disorders, Genetic defects	
Ribavirin (Virazole)	36791-04-5	Embryotoxicity, Teratogen	
Rubella (German Measles)	N/A	Birth defects, Developmental disorders, Stillbirth	Especially serious during first 16 weeks of pregnancy.

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Selenium	7782-49-2	Birth defects, Menstrual disorders, Spontaneous abortion	Trace element necessary for metabolism.
Sodium Fluoroacetate	62-74-8		Damaged testes and sperm.
Solvents	Varies by compound	Birth defects, Impotence and decreased libido, Menstrual disorders, spontaneous abortion	Effects may be due to some specific ingredients.
Styrene (Vinyl Benzene)	100-42-5	Birth defects, Menstrual disorders, Spontaneous abortion	
Sulfur Dioxide	7446-09-5	Low birth weight, Spontaneous abortion	
Tellurium	13494-80-9	Birth defects	No human studies.
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	Birth defects, Spontaneous abortion	
Tetrachloroethylene	127-18-4	Fetotoxicity, Developmental disorders	
Thalidomide	50-35-1	Birth defects	Positive human studies from therapeutic doses, which may not be equivalent to occupational exposures.
Thallium and its Compounds	Varies by compound, Thallium is 7440-28-0	Developmental disorders	Testicular damage observed in rats.
Toluene	108-88-3	Menstrual disorders	Positive human studies due to inhalation abuse, expected to be higher than routine occupational exposures.
Toluene-2,4-Diisocyanate	584-84-9		
o-Toluidine	95-53-4	Menstrual disorders, Transplacental carcinogen	
Toxaphene (Camphechlor)	8001-35-2	Birth defects	No human studies.
Toxoplasmosis	N/A	Birth defects, Developmental disorders, Spontaneous abortion, Stillbirth	
1,1,1-Trichloroethane	71-55-6	Birth defects, Fetotoxicity, Low birth weight	No human studies. Other references list it as Possible
Trichloroethylene	79-01-6	Birth defects, Spontaneous abortion	
Trinitrotoluene (TNT)	118-96-7	Male Infertility	Exposure levels were higher than routine workplace levels.
Triorthocresyl Phosphate (TOCP)	78-30-8		No human studies. Testicular toxicant.

<b>Name of Chemical, Physical, or Biological Agent</b>	<b>CAS #</b>	<b>Literature Reported Effects, Without Regard to Dose</b>	<b>Comments</b>
Triple Super Phosphate, Granular (TSP)	7758-23-8	Menstrual disorders	Calcium and phosphate are required for normal fetal growth.
Varicella-zoster Virus	N/A	Birth defects, Low birth weight	
Vinclozolin	50471-44-8	Male infertility	No human studies.
Vinyl Chloride Monomer	75-01-4	Birth defects, Fetotoxicity, Impotence and decreased libido	
Vinylidene Chloride (1,1-Dichloroethylene)	75-35-4	Birth defects, Fetotoxicity, Infertility	
Warfarin	81-81-2	Birth defects, Developmental disorders, Spontaneous abortion	
Xylene	1330-20-7	Birth defects, Menstrual disorders	

**References:**

CDC Chemical Safety Manual, Appendix J, Reproductive Toxins and Highly Acute Toxic Materials, Centers for Disease Control and Prevention, Office of Health and Safety, June 26, 2001

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National Toxicology Program – Center for the Evaluation of Risks to Human Reproduction, "NTP-CEHRH Monograph on the Potential Human Reproductive and Developmental Effects of Acrylamide," February 2005, NIH Publication No. 05-4472.

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National Toxicology Program – Center for the Evaluation of Risks to Human Reproduction, "NTP-CEHRH Monograph on the Potential Human Reproductive and Developmental Effects of 2-Bromopropane," December 2003, NIH Publication No. 04-4480.

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National Toxicology Program – Center for the Evaluation of Risks to Human Reproduction, “NTP-CEHRH Monograph on the Potential Human Reproductive and Developmental Effects of Di-n-Butyl Phthalate (DBP),” undated.

National Toxicology Program – Center for the Evaluation of Risks to Human Reproduction, “NTP-CEHRH Monograph on the Potential Human Reproductive and Developmental Effects of Fluoxetine,” November 2004, NIH Publication No. 05-4471.

Wierenga T Personal communication (email), USDA-ARS Poisonous Plant Research Laboratory, Logan, Utah, December 8, 2000.

Winker R and Rüdiger H W, “Reproductive toxicology in occupational settings: an update,” *Int Arch Occup Environ Health* (2006) 79:1-10.

## Appendix C

### Questionnaire to Help in Evaluating Workplace Exposures

The questionnaire below is for **men and women** who use chemicals at work or may be exposed to other hazardous conditions and for use by their healthcare providers to help estimate exposure risk relative to the workplace.

This questionnaire was adapted from the one in “Workplace Hazards to Reproduction and Development, Appendix D” Sharon L. Drozdowsky and Stephen G. Whittaker, Technical Report Number 21-3-1999, August 1999, Washington Department of Labor and Industries (L&I), Safety and Health Assessment & Research for Prevention (SHARP) Program.

Although meant primarily for use of chemicals at the work place, there are also spaces for noting exposures to biological, radiological and physical hazards, and spaces for considering exposures at home and from other jobs and hobbies.

What is your reproductive health concern?

Are you pregnant, planning to become pregnant or have you had problems conceiving, carrying to term or have children with congenital medical problems?

#### Instructions for Workers and Providers:

Collect the information you need to complete the questions on this and the following pages:

Name:

Date:

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1. What is your current job title and in where in the University do you work?

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2. Describe the tasks or activities you perform at work.

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3. What does your work center produce or manufacture, or, what kind of services does it provide?

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4. How many hours per week do you work? \_\_\_\_\_ hours

5. Do you work rotating shifts? Yes \_\_\_\_\_ No \_\_\_\_\_

6. Do you have another job? Yes \_\_\_\_\_ No \_\_\_\_\_

If so, provide the same information as questions 1-5:

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7. Write the names of any chemicals you work with at the end of this question in the column at the left. If you use more than one, list them in order of how frequently you use them. Put the one you use most frequently in the top space.

In the column on the right, describe how you use each chemical. Write when and for how long you use them. For example, "twice a day for ten minutes each time." Also, write how much of each chemical or product you use each time you work with it, for example, "1-2 gallons."

Brand names aren't very helpful. Sometimes a product label has ingredient information, but often the information on labels is incomplete and unreliable. The best way to find out what chemicals are in the product(s) being used is to get a copy of the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for that product from the employer. An MSDS/SDS lists the hazardous ingredients in the product. MSDSs/SDSs are available from the MyChem system or EH&S (206-616-3441) if you have any difficulty getting them from the MyChem system. Employers must ensure workers have access to a copy of the MSDS/SDS (WAC 296-901-14014(7)) for each hazardous chemicals in use and also provide this information to a treating doctor on request.

	Chemical Name	How, when I use them, and how much I use
Most Freq. Use	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Least Freq. Use	_____	_____
	_____	_____
	_____	_____

8. In your work area, how many other people also use these chemicals? \_\_\_\_\_

9. Besides the chemical that you work with, what other chemicals do people in your area use?

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10. List any of these chemicals that you or other workers in your area use that are heated. Also, if you know, write the temperature to which they are heated.

Chemicals that are heated	Temperature
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

11. Can you smell or taste any chemical fumes or vapors where you work?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, list them by chemical name.

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12. Do you feel sick when you work with any of the chemicals? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, list which chemicals in the column on the left. In the column on the right, describe how you feel when you work with each chemical (such as, headache, nausea, bad taste in my mouth, burning eyes, burning nose, throat irritation, congestion, difficulty concentrating, shortness of breath, chest pain, chest tightness, numbness in my hands, tingling in my feet, irregular menses).

Chemicals	Symptoms
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

13. If working with any chemicals makes you feel ill, do you feel better at other times?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, please explain when it is you feel better.

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14. If you are pregnant, did you have these symptoms before becoming pregnant?

Yes \_\_\_\_\_ No \_\_\_\_\_ N/A \_\_\_\_\_

15. List any of the chemicals that you work with that get on your skin.

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16. Do you do any of the following in the work area?

EAT	Yes _____ No _____
DRINK	Yes _____ No _____
SMOKE	Yes _____ No _____
APPLY MAKEUP	Yes _____ No _____

17. Are hand washing facilities available? Yes \_\_\_\_\_ No \_\_\_\_\_

18. Do you wash your hands before eating or smoking? Yes \_\_\_\_\_ No \_\_\_\_\_

19. Are showering facilities available? Yes \_\_\_\_\_ No \_\_\_\_\_

**The following questions are about protective measures used in your workplace.**

20. Mark the type of VENTILATION used in your work area

\_\_\_\_\_ hood with power exhaust pulling fumes away away from you  
\_\_\_\_\_ local exhaust pulling fumes away from you  
\_\_\_\_\_ general ventilation (wall fans, roof fans, ceiling vents)  
\_\_\_\_\_ natural ventilation (open windows and doors)  
\_\_\_\_\_ none unless someone opens the door when entering or leaving the area

21. Do you think the ventilation is effective in reducing your exposure? Yes \_\_\_\_\_ No \_\_\_\_\_

22. Is the ventilation always turned on when you are using chemicals? Yes \_\_\_\_\_ No \_\_\_\_\_

23. Does the ventilation usually work well? Yes \_\_\_\_\_ No \_\_\_\_\_

24. Has there been a breakdown of the ventilation or a period when it was not on? Yes \_\_\_\_\_  
No \_\_\_\_\_

25. Describe the types of PROTECTIVE CLOTHING you wear on the job.

Type of Gloves

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Type of Apron/Coat

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Type of Eyewear

---

Type of Footwear

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Hearing Protection such as earplugs or earmuffs? Yes \_\_\_\_\_ No \_\_\_\_\_

26. Do chemicals leak through your gloves or clothing? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, please explain.

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27. Mark the kind of RESPIRATORY PROTECTION (respirator) you use on the job.

- \_\_\_\_\_ none
- \_\_\_\_\_ paper dust mask
- \_\_\_\_\_ paper mask with filter
- \_\_\_\_\_ N-95 \_\_\_\_\_ half-face mask with cartridges
- \_\_\_\_\_ full-face mask with cartridges
- \_\_\_\_\_ air-supplied respirator

If you wear a cartridge respirator (if not, skip to question 35):

28. What kind of cartridge? \_\_\_\_\_

29. When do you wear a respirator? \_\_\_\_\_

30. For what chemicals do you wear a respirator?

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31. Have you been fit-tested and trained to use your respirator? Yes \_\_\_\_\_ No \_\_\_\_\_

32. Have you received instructions about changing your cartridges and other maintenance?  
Yes \_\_\_\_\_ No \_\_\_\_\_

33. How often do you change your cartridges or respirator? \_\_\_\_\_ ----

34. How do you store your respirator?

35. Are there any unusual situations at work, such as equipment breakdowns or spills, that may expose you to any other chemicals or to larger amounts of those you use routinely?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, explain

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36. What types of instructions and warnings has your employer given you about the use of chemicals?

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37. Have the air levels of chemicals in your work area been measured? Yes \_\_\_\_\_ No \_\_\_\_\_

If monitoring has been done, you have a legal right to see the results relevant to your work area (WAC 296-841-20020). If you are a member of a union, the union can help you enforce this right.

If you know the results, write them here.

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38. Do you wear your own street clothes at work? Yes \_\_\_\_\_ No \_\_\_\_\_

39. Are there laundry facilities at work for contaminated clothing? Yes \_\_\_\_\_ No \_\_\_\_\_

40. Are you in a medical surveillance program at work? Yes \_\_\_\_\_ No \_\_\_\_\_

(A medical surveillance system involves an initial physical exam or lab tests, and periodic exams or tests due to the type of work you perform.) If yes, please identify what is being monitored.

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41. Do you do any other work outside your regular job, or have any hobbies, which involve exposure to chemicals? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, describe them:

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42. If you are involved in any of the following physical activities on the job, please describe them and write how many hours per day you perform each below.

	Description	Hours/day
Lifting	_____	_____
Climbing	_____	_____
Bending	_____	_____
Twisting	_____	_____
Sitting	_____	_____
Standing	_____	_____

43. If you are exposed to any of the following on your job, describe them by writing when, how often and how much you are exposed to each:

Anesthetic Gases

\_\_\_\_\_

Sterilizing Agents

\_\_\_\_\_

Chemotherapeutic Agents

\_\_\_\_\_

Pharmaceuticals

\_\_\_\_\_

Cleaning Agents

\_\_\_\_\_

Dust, Mist, Fumes, Smoke

\_\_\_\_\_

Noise

\_\_\_\_\_

Vibration

\_\_\_\_\_

Temperature Extremes

\_\_\_\_\_

Radiation, Including Lasers

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Infectious Agents

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Animals

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Genetic Material

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Metals (Lead, Mercury, or Other)

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Solvents, Glues or Adhesives

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Psychological Stress

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Other Concerns

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44. Do you handle animals at work, or have a pet cat at home? Yes \_\_\_\_\_ No \_\_\_\_\_

45. Please list other jobs/schooling prior to your current work, and from when to when you worked there. Please indicate if there were possible exposures to the sorts of agents we listed above:

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## Appendix D

### Additional Resources

The State of California Proposition 65 requires the state to generate a list of chemicals known to cause cancer and reproductive toxicity annually. A recent list can be viewed at [http://oehha.ca.gov/prop65/prop65\\_list/Newlist.html](http://oehha.ca.gov/prop65/prop65_list/Newlist.html).

Northwest Pediatric Environmental Health Specialty Units (PEHSU), <http://depts.washington.edu/pehsu/>, 1-877 KID CHEM (toll free). PEHSU Units have been developed in 10 US regions (1) to improve the health of children with respect to environmental exposures, and (2) to inform families, communities, and health care providers regarding environmental hazards, their effects, and practical ways to protect children's health.

Teratogen Information System (TERIS), <http://depts.washington.edu/~terisweb/teris/> is a subscription service computerized database designed to assist physicians or other healthcare professionals in assessing the risks of possible teratogenic exposures of pregnant women. An updated, automated version of Shepard's Catalog of Teratogenic Agents is distributed with TERIS. Users can access both systems simultaneously. Together, the two databases provide authoritative clinical teratogenic information on over 2800 agents.

National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services, "The Effects of Workplace Hazards on Female Reproductive Health," DHHS (NIOSH) Publication No. 99-104, February 1999, at <http://www.cdc.gov/niosh/docs/99-104/>, contains good, general information.

"The Effects of Workplace Hazards on Male Reproductive Health," NIOSH Publication No. 96-132, January 1997, at <http://www.cdc.gov/niosh/docs/96-132/>, also contains good general information. Or, you can order copies from NIOSH by dialing 1-800-35NIOASH (1-800-356-4674).

Occupational Safety & Health Administration, "Reproductive Hazards." This web site contains short summary information and many links to other sites for more detailed information, at <http://www.osha.gov/SLTC/reproductivehazards/index.html>.

The US Navy (<http://www.ehs.washington.edu/ohsreprohaz/USNavyReprodev2006.pdf>) has generated a list that provides citations as to their rationale for including a hazardous chemical.

"Workplace Hazards to Reproduction and Development," Sharon L. Drozdowsky and Stephen G. Whittaker, Technical Report Number 21-3-1999, August 1999, Washington Department of Labor and Industries (L&I), Safety and Health Assessment & Research for Prevention (SHARP) Program. This document gives good overall information, available for viewing at [http://www.lni.wa.gov/Safety/Research/files/repro\\_dev.pdf](http://www.lni.wa.gov/Safety/Research/files/repro_dev.pdf) or you can order a copy through <http://www.lni.wa.gov/Safety/Research/Pubs/default.asp>.