

### 3.21. Reproductive Toxins, Mutagens, Teratogens, and Embryotoxins – Procedures for Safe Handling and Storage

The Occupational Safety and Health Administration (OSHA) establishes the safety standards for use of hazardous chemicals in the workplace including reproductive chemical toxins. The OSHA Laboratory Safety Standard recommends that the Chemical Hygiene Plan include standard operating procedures for handling and storage of reproductive toxins including mutagens, teratogens, and embryotoxins.

Traditional definitions of “reproductive toxins” typically involve any agent that can damage the sperm, egg, fertilization and related processes. Agents that may cause adverse reproductive effects include chemical, biological, and radiological agents. Reproductive and developmental toxicity may affect the ability to reproduce and the development of the fetus and child.

The most recent definition of reproductive toxins according to the *Globally Harmonized System of Chemical Classification and Labelling* includes chemicals that cause adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring including adverse effects on or via lactation. Some reproductive toxic effects cannot be clearly assigned to either impairment of sexual function and fertility or to developmental toxicity however chemicals with these effects are classified as reproductive toxicants also.

The male reproductive system can be affected resulting in reduced sperm count, changes in the shape and performance of the sperm, contaminants being carried by the sperm, decreases in sexual performance, or damage to the sperm chromosomes. Females may experience infertility, subfertility, changes in menstrual cycle, miscarriage or premature births, and changes in the pregnancy, fertilized egg and developing fetus. Birth defects, developmental disorders or childhood cancer may also result. Reproductive hazards may not affect every worker or every pregnancy.

The Center for Disease Control’s (CDC) National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS) identifies seven major categories with sixty-five specific effects including paternal and maternal effects, fertility effects, effects on the embryo or fetus, developmental effects, tumorigenic effects and effects upon the newborn.

#### 3.21.1. Definitions

**Reproductive Toxicity** - Adverse effects on the health of the reproductive organs, endocrine system, or gametes (egg or sperm) from exposure to an exogenous agent. This exposure may result in effects such as menstrual dysfunction, impaired fertility, feminization/masculinization, or inability to maintain a pregnancy.

**Developmental Toxicity** - Adverse effects on the developing organism that may occur anytime from conception to sexual maturity. These effects may include spontaneous abortion, structural or functional defects, low birth weight, or effects that may appear later in life.

**Mutagens** - Agents that cause change in the genetic material (DNA) of an organism and therefore increase the frequency of mutations above the natural background level. These mutations are passed along as the cell divides sometimes leading to defective cells or cancer. Because the mutations may cause cancer, mutagens are typically also carcinogens.

Not all mutations are caused by mutagens. Spontaneous mutations occur due to errors in DNA replication, repair, and recombination. Chemical mutagens include substances such as ethidium bromide used as a stain for DNA analysis. Because the molecule fits easily in between the strands of DNA it is a potent mutagen.

**Embryotoxins** - Embryotoxins are, by definition, toxic to embryos. Embryotoxins are agents that may kill, deform, retard the growth, or adversely affect the development of

specific functions in the unborn child and cause postnatal functional problems. Embryotoxins include mercury compounds, lead compounds and other heavy metals, and organic compounds such as formamide.

**Teratogens** - Agents that can disturb or cause a malformation in the development of an embryo or fetus. Teratogens may cause a birth defect in the child or cause termination of the pregnancy.

**Reproductive Toxin** - Any hazardous substance that damages reproductive organs and can cause sterility or birth defects. The OSHA definition of reproductive toxins are chemicals that cause “adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring.”

**Particularly Hazardous Substances** - Reproductive toxins are included in a category of chemicals identified by OSHA as “Particularly Hazardous Substances” and must be handled in accordance with [SOP 3.8, Particularly Hazardous Substances](#).

Personnel may only handle “particularly hazardous substances” in a containment (i.e., fume hood or glove box) or a closed system (instrument plumbing, syringe, gavage, cannula, etc.). There must be an area designated for use by posting signs or barriers and there must be procedures for decontamination of the tools and area after use and provisions for waste removal.

### **3.21.2. General Procedures**

The presence of any reproductive toxins in the lab does not mean that personnel have been exposed, nor are they likely to experience adverse effects. However, personnel must use proper precautions while handling these substances and those of childbearing age or known pregnancies may need to exercise extra precautions.

It is very important to recognize the potential risks and intervene early because short-term exposures during a critical period can result in long-term health effects. All personnel, both men and women, handling reproductive toxins must follow these general procedures:

- Minimize all chemical exposures.
- Review the chemicals in use to identify these chemicals.
- Read the Safety Data Sheet (SDS) and follow the recommended precautions.
- Review the use of these materials with the principal investigator, lab manager, or lab supervisor.
- Review the continuing use of these chemicals annually or when a procedural change is made.
- Label the containers with the chemical name and the hazard (e.g., reproductive toxin).
- Store in an adequately ventilated area in an unbreakable secondary container.
- Notify supervisors of all incidents of exposure or spills.
- Seek medical attention when appropriate. Refer to [Section 5.0, Medical Consultations and Examinations](#).
- Have a designated area (signs or barriers) for their use.
- Handle these substances only in a closed system (glass apparatus, instrument plumbing, syringe, gavage, cannula, etc.) or in a containment (fume hood or glove box) whose satisfactory performance has been confirmed.
- Use appropriate protective apparel (especially gloves) to prevent skin contact.
- Follow procedures for decontamination of the tools and area after use.
- Follow procedures for waste removal.

### **3.21.3. Pregnant Individuals**

Women expecting a child should follow the general guidelines above and implement the following administrative, engineering, and personal protective equipment hazard controls to help minimize or eliminate chemical exposure.

Individuals may contact IUEHS for their respective campus in confidence to receive safety information about reproductive or developmental hazards posed by potential exposures any time without declaring actual, suspected, or planned pregnancy.

#### **3.21.3.1. Administrative Controls**

- Consult your personal physician and inform them of the activities and chemicals used in the laboratory. Follow the instructions provided by the physician explicitly.
- Avoid handling reproductive toxins, mutagens, teratogens, embryotoxins, or carcinogens.
- Avoid all chemical exposure if possible. Many chemicals have not been tested to determine their reproductive or toxicological properties. Therefore, if the Safety Data Sheet (SDS) does not have sufficient information they too should be avoided.
- Minimize the amount of time spent in the lab.
- Use job rotation or transfers to reduce exposures.
- Use substitute personnel to perform specific chemical procedures.
- Substitute a less hazardous agent to eliminate exposure.
- Modify work practices or laboratory procedures to reduce exposure.
- Review the laboratory chemical inventory to identify these chemicals. Contact IUEHS for your respective campus for assistance.
- Read the Safety Data Sheet (SDS) and follow the recommendations provided.
- Review the use of these materials with the research supervisor.
- Label the containers with the chemical name and the hazard (e.g., reproductive toxin).
- Avoid touching work surfaces and equipment, handling waste, and practice good personal hygiene, washing hands after touching surfaces.
- All laboratory personnel practice good chemical hygiene and follow the standard operating procedures found in the Laboratory Safety and Chemical Hygiene Plan.
- All laboratory personnel practice good housekeeping and keep work surfaces clean.
- Be aware that the use of PPE, fume hoods, etc., will minimize the risk of exposure but does not completely eliminate the risk.
- Leave the area immediately in the event of an accident or spill.

#### **3.21.3.2. Engineering Controls**

- Ensure that all laboratory personnel perform all chemical manipulations in fume hood.
- Ensure that the fume hood is operating properly. Check the latest evaluation sticker. Monitor the velocity meter (if present) and/or tape a tell-tale indicator (tinsel, yarn, or light weight string or thread) to the sash that visually indicates air flow.
- Ensure that all personnel use fume hoods properly with the sash in the proper operating position, not fully open, and closed when not in use.

### **3.21.3.3. Personal Protective Equipment**

- Ensure that all laboratory personnel use personal protective equipment (PPE), gloves, lab coat, and eye protection.
- Gloves must be removed and placed in a closed waste bag prior to exiting the lab.
- Lab coats should remain in the laboratory at the end of the day and not taken home.