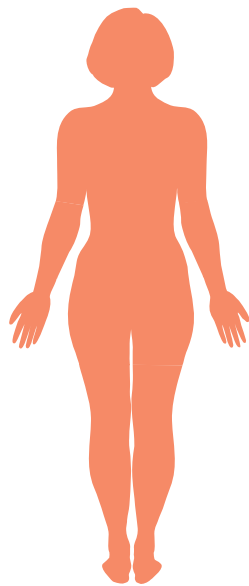




National Institute for Occupational Safety and Health

The Effects of Workplace Hazards on Female Reproductive Health



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INTRODUCTION

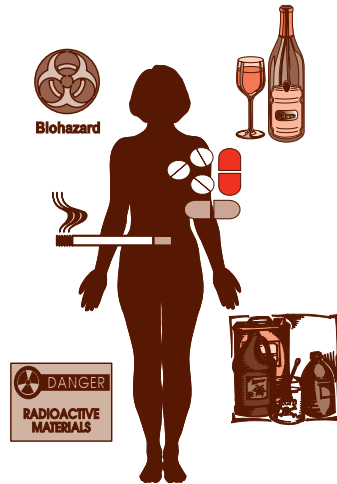
Many factors can affect a woman's reproductive health and her ability to produce healthy children. We know that the health of an unborn child can suffer if a woman fails to eat right, smokes, or drinks alcohol during pregnancy. However, we know very little about the cause of most reproductive health problems such as infertility, miscarriage, and birth defects. We do know that some workplace hazards can affect a woman's reproductive health, her ability to become pregnant, or the health of her unborn children.

This document answers the following questions:

- ◆ What are reproductive hazards for female workers?
- ◆ How does the female reproductive system work?
- ◆ What reproductive problems might be caused by workplace exposures?
- ◆ How are workers and their babies exposed?
- ◆ How are families exposed?
- ◆ How can exposures be prevented?
- ◆ What additional information is available from NIOSH?

What are Reproductive Hazards for Female Workers?

Substances or agents that affect the reproductive health of women or men or the ability of couples to have healthy children are called *reproductive hazards*. Radiation, some chemicals, certain drugs (legal and illegal), cigarettes, some viruses, and alcohol are examples of reproductive hazards. This pamphlet focuses on reproductive hazards in the workplace that affect women and their ability to have healthy children. For information about a pamphlet describing male reproductive hazards, see page 18.



The harmful effects of a few agents found in the workplace have been known for many years. For example, more than 100 years ago, lead was discovered to cause miscarriages, stillbirths, and infertility in

female pottery workers. Rubella (German measles) was recognized as a major cause of birth defects in the 1940s. However, the causes of most reproductive health problems are still not known. Many of these problems—infertility, miscarriage, low birth weight—are fairly common occurrences and affect working and nonworking women.

A reproductive hazard could cause one or more health effects, depending on when the woman is exposed. For example, exposure to harmful substances during the first 3 months of pregnancy might cause a birth defect or a miscarriage. During the last 6 months of pregnancy, exposure to reproductive hazards could slow the growth of the fetus, affect the development of its brain, or cause premature labor. Reproductive hazards may not affect every worker or every pregnancy.

Table 1 lists chemical and physical reproductive hazards for women in the workplace. The list is not complete and is constantly being revised. Therefore, do not assume that a substance is safe if it is missing from the list.

Table 2 lists viruses and other disease-causing (infectious) agents that are found in some workplaces and that have harmful reproductive effects in pregnant women.

Table 1. Chemical and physical agents that are reproductive hazards for women in the workplace

Agent	Observed effects	Potentially exposed workers
Cancer treatment drugs (e.g., methotrexate)	Infertility, miscarriage, birth defects, low birth weight	Health care workers, pharmacists
Certain ethylene glycol ethers such as 2-ethoxyethanol (2EE) and 2-methoxyethanol (2ME)	Miscarriages	Electronic and semi-conductor workers
Carbon disulfide (CS ₂)	Menstrual cycle changes	Viscose rayon workers
Lead	Infertility, miscarriage, low birth weight, developmental disorders	Battery makers, solderers, welders, radiator repairers, bridge repainters, firing range workers, home remodelers
Ionizing radiation (e.g., X-rays and gamma rays)	Infertility, miscarriage, birth defects, low birth weight, developmental disorders, childhood cancers	Health care workers, dental personnel, atomic workers
Strenuous physical labor (e.g., prolonged standing, heavy lifting)	Miscarriage late in pregnancy, premature delivery	Many types of workers

Table 2. Disease-causing agents that are reproductive hazards for women in the workplace

Agent	Observed effects	Potentially exposed workers	Preventive measures
Cytomegalovirus (CMV)	Birth defects, low birth weight, developmental disorders	Health care workers, workers in contact with infants and children	Good hygienic practices such as handwashing
Hepatitis B virus	Low birth weight	Health care workers	Vaccination
Human immunodeficiency virus (HIV)	Low birth weight, childhood cancer	Health care workers	Practice universal precautions
Human parvovirus B19	Miscarriage	Health care workers, workers in contact with infants and children	Good hygienic practices such as handwashing
Rubella (German measles)	Birth defects, low birth weight	Health care workers, workers in contact with infants and children	Vaccination before pregnancy if no prior immunity
Toxoplasmosis	Miscarriage, birth defects, developmental disorders	Animal care workers, veterinarians	Good hygiene practices such as handwashing
Varicella-zoster virus (chicken pox)	Birth defects, low birth weight	Health care workers, workers in contact with infants and children	Vaccination before pregnancy if no prior immunity

Workers with immunity through vaccinations or earlier exposures are not generally at risk from diseases such as hepatitis B, human parvovirus B19, German measles, or chicken pox. But pregnant workers without prior immunity should avoid contact with infected children or adults.

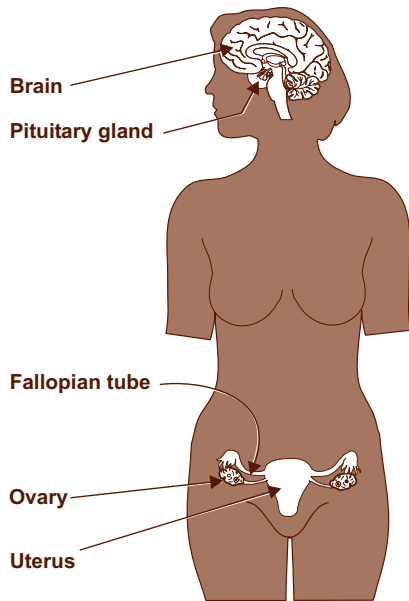
Workers should also use good hygienic practices such as frequent handwashing to prevent the spread of infectious diseases among workers in elementary schools, nursery schools, and daycare centers. In addition, they should use universal precautions such as glove wearing and safe disposal of needles to protect against disease-causing agents found in blood.

How Does the Female Reproductive System Work?

To understand how reproductive hazards can affect a woman's reproductive health and her ability to have healthy children, it is helpful to understand how the female reproductive system works.

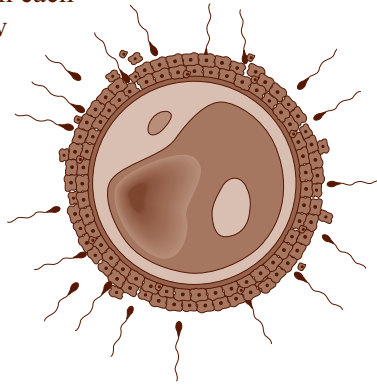
The main reproductive tissues in women are the **ovaries**, **uterus**, and **fallopian tubes**. The functions of these tissues are largely controlled by hormones

produced by the **brain** and the **pituitary gland**. Hormones are chemicals that are formed in the body and circulate in the blood. These hormones regulate the menstrual cycle, pregnancy, and the production of breast milk. Estrogen and progesterone the sex hormones are produced by the ovaries. These hormones are responsible for sexual development and for preparing the uterine wall to hold and nourish a fertilized egg every month. These sex hormones also contribute to the basic health of the heart, bones, liver, and many other tissues. Finally, during pregnancy the placenta produces a hormone (human chorionic gonadotropin, or hCG) that signals the body to support the pregnancy.



A woman is born with all of the **eggs** that she will ever have. Therefore, if her eggs are damaged or

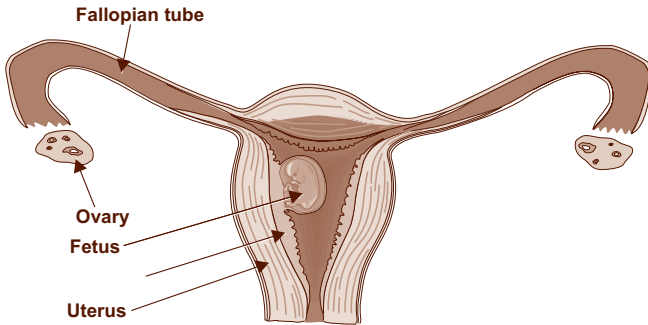
destroyed, she will not be able to replace them. At puberty, a woman begins to have menstrual cycles, which enable her to release an egg each month from one of her ovaries. Each cycle begins with a few days of menstrual flow. When each new cycle begins, a new egg starts to grow. After 2 to 3 weeks, a mature egg (ovum) is released from the ovary into the fallopian tubes, where it might be fertilized by one of the many sperm that may surround it.



If the egg is not fertilized, it will die and leave the body about 2 weeks later in the woman's menstrual flow. Then the process begins again with a new menstrual cycle.

If the egg is fertilized, the complex process of reproduction continues. The fertilized egg travels for about a week down the fallopian tube to reach the uterus, where it attaches to the wall. A specialized tissue called the **placenta** forms between the uterus and the newly developing **fetus**. The placenta transfers oxygen and nutrients from the mother to the fetus. During the first 3 months of pregnancy (first trimester),

the major fetal organs are formed. During the remainder of the pregnancy, these organs mature and the fetus grows rapidly.



What Reproductive Hazards Might Be Caused by Workplace Exposures?

Only a few substances (some viruses, chemicals, and drugs) are known to cause reproductive health problems. Scientists are just beginning to discover how workplace exposures might cause reproductive problems. The following problems may be caused by workplace exposures:

- ◆ Menstrual cycle effects
- ◆ Infertility and subfertility
- ◆ Miscarriage and stillbirths

- ◆ Birth defects
- ◆ Low birth weight and premature birth
- ◆ Developmental disorders
- ◆ Childhood cancer

Each problem is discussed in more detail in the following sections.

Menstrual Cycle Effects

High levels of physical or emotional stress or exposure to chemicals such as carbon disulfide may disrupt the balance between the brain, pituitary, and ovaries. This disruption can result in an imbalance of estrogen and progesterone, and lead to changes in menstrual cycle length and regularity and ovulation. Because these sex hormones have effects throughout a woman's body, severe or long-lasting hormone imbalances may affect a woman's overall health.

Infertility and Subfertility

About 10% to 15% of all couples are unable to conceive a child after 1 year of trying to become pregnant. Many factors can affect fertility, and these factors can affect one or both partners. Damage to the woman's eggs or the man's sperm, or a change in the hormones needed to regulate the normal menstrual cycle are just a few things that can cause problems with fertility.

Miscarriage and Stillbirths

About 1 in every 6 pregnancies ends in a miscarriage the unplanned termination of a pregnancy. Miscarriages can occur very early in pregnancy, even before the woman knows she is pregnant. Miscarriages and stillbirths occur for many reasons, such as the following:

- ◆ The egg or sperm may be damaged so that the egg cannot be fertilized or cannot survive after fertilization.
- ◆ A problem may exist in the hormone system needed to maintain the pregnancy.
- ◆ The fetus may not have developed normally.
- ◆ Physical problems may exist with the uterus or cervix.

What causes most of these problems is still unknown.

Birth Defects

A birth defect is a physical abnormality present at birth, though it may not be detected until later. About 2% to 3% of babies are born with a major birth defect. In most cases, the cause of the birth defect is unknown. The first 3 months of the pregnancy is a very sensitive time of development because the internal organs and limbs are formed during this period.

Many women are not aware that they are pregnant during much of this critical period.

Low Birth Weight and Premature Birth

About 7% of babies born in the United States are born underweight or prematurely. Poor maternal nutrition, smoking, and alcohol use during pregnancy are believed to be responsible for most of these cases. Although better medical care has helped many underweight or premature babies to develop and grow normally, they are more likely than other babies to become ill or even die during their first year of life.

Developmental Disorders

Sometimes the brain of the fetus does not develop normally, which leads to developmental delays or learning disabilities later in life. About 10% of children in the United States have some form of developmental disability. Such problems are often not noticeable at birth. They can be difficult to measure, may be temporary or permanent, and range from mild to severe. Developmental problems may appear as hyperactivity, short attention span, reduced learning ability, or (in severe cases) mental retardation.

Childhood Cancer

Ionizing radiation has caused cancer in some children whose mothers were exposed during pregnancy. The

current practice of minimizing the use of X-rays on pregnant women, the use of newer equipment that reduces the risk of exposure, and the use of protective shields have all helped to decrease the likelihood of harmful radiation exposure to fetuses.

How Are Workers and Their Babies Exposed?

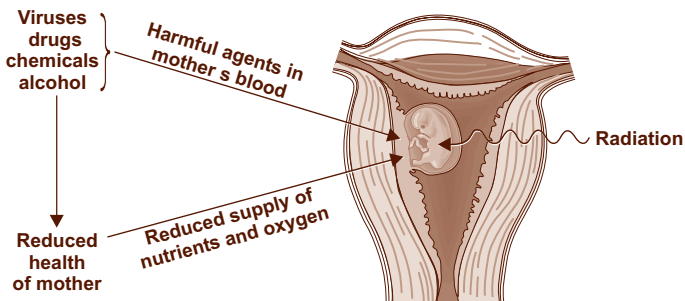
Harmful substances can enter a woman's body through

- ◆ *breathing in* (inhalation),
- ◆ *contact with the skin*,
- ◆ *or swallowing* (ingestion).

Pregnant workers and those planning to become pregnant should be especially concerned about exposure to reproductive hazards. Some chemicals (such as alcohol) can circulate in the mother's blood, pass through the placenta, and reach the developing fetus. Other hazardous agents can affect the overall health of the woman and reduce the delivery of nutrients to the fetus. Radiation can pass directly through the mother's body to harm her eggs or the fetus. Some drugs and chemicals can also pass through a mother's

body into the nursing baby through the breast milk. However, breast feeding has many positive effects. Thus a woman who may be exposed to reproductive hazards on the job should consult with her doctor or other health care provider before deciding whether or not to breast feed.

Reproductive hazards do not affect every woman or every pregnancy. Whether a woman or her baby is harmed depends on *how much* of the hazard they are exposed to, *when* they are exposed, *how long* they are exposed, and *how* they are exposed.



How Are Families Exposed?

Workplace substances that affect female workers and their pregnancies can also harm their families. Without knowing it, workers can bring home harmful substances that can affect the health of other family members both adults and children. For example, lead brought home from the workplace on a worker's skin, hair, clothes, shoes, tool box, or car can cause lead poisoning in family members, especially young children.



How Can Exposures Be Prevented?

Employers are responsible for training and protecting their workers. Employees are responsible for learning

about the hazards in their workplace, using personal protective equipment, and following proper work practices. Since little is known about reproductive hazards in the workplace, workers should also take the following steps to ensure their own safety:

- ◆ Store chemicals in sealed containers when they are not in use.
- ◆ Wash hands after contact with hazardous substances and before eating, drinking, or smoking.
- ◆ Avoid skin contact with chemicals.
- ◆ If chemicals contact the skin, follow the directions for washing in the material safety data sheet (MSDS). Employers are required to have copies of MSDSs for all hazardous materials used in their workplaces and to provide them to workers upon request.
- ◆ Review all MSDSs to become familiar with any reproductive hazards used in your workplace. If you are concerned about reproductive hazards in the workplace, consult your doctor or health care provider.

- ◆ Participate in all safety and health education, training, and monitoring programs offered by your employer.
- ◆ Learn about proper work practices and engineering controls (such as improved ventilation).
- ◆ Use personal protective equipment (gloves, respirators, and personal protective clothing) to reduce exposures to workplace hazards.
- ◆ Follow your employer's safety and health work practices and procedures to prevent exposures to reproductive hazards.
- ◆ Prevent home contamination with the following steps:

Change out of contaminated clothing and wash with soap and water before going home.

Store street clothes in a separate area of the workplace to prevent contamination.

Wash work clothing separately from other laundry (at work if possible).

Avoid bringing contaminated clothing or other objects home. If work clothes must be brought home, transport them in a sealed plastic bag.

What Additional Information is Available from NIOSH?

NIOSH has published the following documents that contain information about reproductive hazards in the workplace:

National Occupational Research Agenda DHHS (NIOSH) Publication No. 96 115

Reproductive issues are an important part of the *National Occupational Research Agenda* that is being coordinated by NIOSH. The *Agenda* is expected to help focus attention on reproductive issues and to increase the amount of research conducted in this critical area. This document discusses fertility and pregnancy abnormalities as one of 21 priority research areas.

The Effects of Workplace Hazards on Male Reproductive Health DHHS (NIOSH) Publication No. 96 132

This document provides general information about reproductive hazards for men in the workplace. The text explains how substances in the workplace can cause reproductive problems and suggests methods for preventing exposures.

Notes

Notes



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