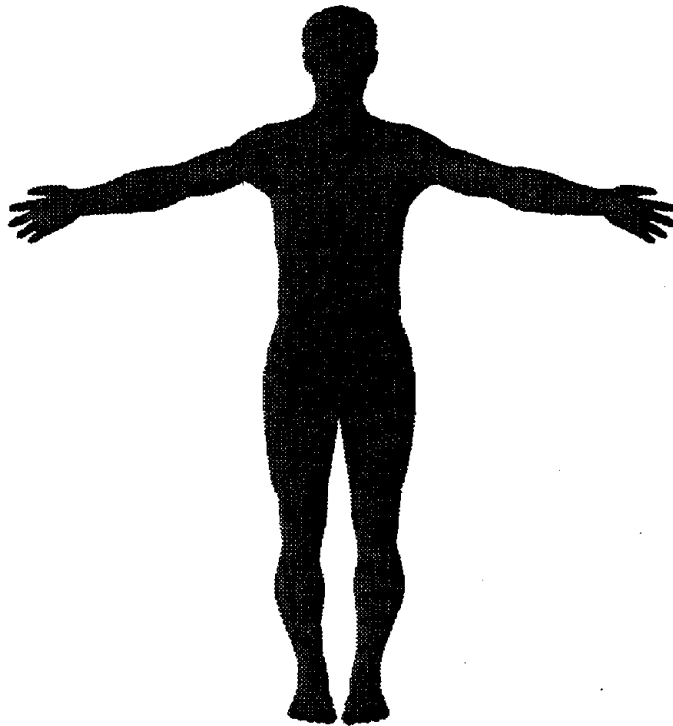


NIOSH

National Institute for Occupational Safety and Health

The Effects of Workplace Hazards on Male Reproductive Health



Introduction

Many factors can contribute to producing healthy children. It is well known that the health of an unborn child can suffer if a woman fails to eat right, smokes, or drinks alcohol during pregnancy. It is not well known, however, that a man's exposure to substances in the workplace can affect his ability to have healthy children.

This document provides general information about reproductive hazards, an explanation of how substances in the workplace can cause reproductive problems in men, and suggestions for preventing exposure to reproductive hazards. For more information about the topics covered in this document, call toll free:

1-800-35-NIOSH

(1-800-356-4674)

or visit the NIOSH Home Page on
the World Wide Web at:

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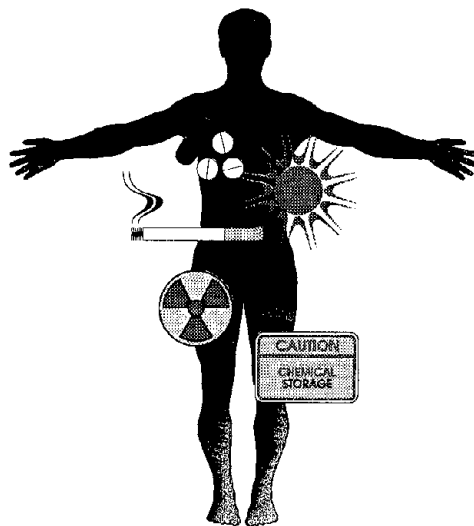


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16. Abstract (Limit: 200 words) This pamphlet discussed male reproductive hazards which occur in the workplace. Reproductive hazards were defined as substances which have an effect on the ability to produce healthy children. These included radiation, various chemicals, drugs, cigarettes, and heat. At the workplace several substances have been identified as hazardous to the reproductive system including lead (7439921). Workers can be exposed through inhalation, skin contact, or ingestion. Those substances which affect a man at work may also indirectly cause harm to their families as they may be brought home on the worker's clothing. In addition to lead, the following substances have also been shown to affect reproductive functions of male workers: dibromochloropropane (96128), carbaryl (63252), toluenediamine (25376458), and dinitrotoluene (25321146), ethylene-dibromide (106934), styrene (100425), acetone (67641), ethylene-glycol-monoethyl-ether (110805), welding, perchloroethylene (127184), mercury (7439976) vapor, heat, military radar, kepone (143500), bromine (7726956), radiation, carbon-disulfide (75150), and 2,4-dichlorophenoxy-acetic-acid (94757). Specific effects on sperm were discussed, including the number, shape and transfer of sperm. Changes in sexual performance may also occur and the effect of a damaged sperm on an egg was noted. Suggestions were offered for assisting the male worker in preventing exposures which may prove to be harmful.			
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What Are Reproductive Hazards?

Substances that affect the ability to have healthy children are called reproductive hazards.

Radiation, many chemicals, drugs (legal and illegal), cigarettes, and heat are examples of reproductive hazards.



What Reproductive Hazards Exist in the Workplace?

A number of workplace substances such as lead and radiation have been identified as reproductive hazards for men (see Table 1). However, there is no complete list of reproductive hazards in the workplace. Scientists are just beginning to understand how these hazards affect the male reproductive system. Although more than 1,000 workplace chemicals have been shown to have reproductive effects on animals, most have not been studied in humans. In addition, most of the 4 million other chemical mixtures in commercial use remain untested.

Although studies have found that workplace exposures affect the reproductive system in **some** men, these effects do not necessarily occur in every worker. Whether individuals are affected depends on how **much** of the hazard they are exposed to, how **long** they are exposed, **how** they are exposed, and other personal factors.

Reproductive issues are likely to receive more attention in the future because they are included in the *National Occupational Research Agenda* coordinated by NIOSH. As one of the 21 topics included in the *Agenda*, research on reproductive issues will undoubtedly increase nationwide. For copies of the *Agenda*, contact NIOSH at 1-800-356-4674.

How Are Workers Exposed?

Harmful substances can enter the body by inhalation, contact with the skin, or ingestion (if workers do not properly wash their hands before eating, drinking, or smoking).

Can A Worker Expose His Family To These Hazards?

Workplace substances that affect male workers may also indirectly cause harm to their families. Certain substances unintentionally brought home by a worker may affect a woman's reproductive system or the health of an unborn child. For example, lead brought home from the workplace on a worker's skin, hair, clothes, shoes, tool box, or car can cause severe lead poisoning among family members and can cause neurobehavioral and growth effects in a fetus.

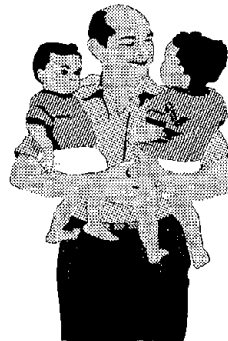


Table 1. Male Re

Type of exposure	Lowered number of sperm
Lead	✓
Dibromochloropropane	✓
Carbaryl (Sevin®)	
Toluenediamine and dinitrotoluene	✓
Ethylene dibromide	✓
Plastic production (styrene and acetone)	
Ethylene glycol monoethyl ether	✓
Welding	
Perchloroethylene	
Mercury vapor	
Heat	✓
Military radar	✓
Kepone [†]	
Bromine vapor [†]	✓
Radiation [†] (Chernobyl)	✓
Carbon disulfide	
2,4-Dichlorophenoxy acetic acid (2,4-D)	

*Studies to date show that some men experience the health effects listed here f
The amount of time a worker is exposed, the amount of hazard to which he is
affected.

[†]Workers were exposed to high levels as a result of a workplace accident.

Active Hazards

Observed effects		
Abnormal sperm shape	Altered sperm transfer	Altered hormones/sexual performance
✓	✓	✓
✓		
✓	✓	
✓		
✓	✓	
	✓	
		✓
	✓	
	✓	
✓	✓	
✓	✓	✓
		✓
✓	✓	

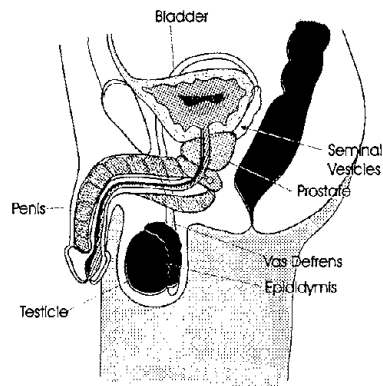
place exposures. However, these effects may not occur in every worker. and other personal factors may all determine whether an individual is

The Male Reproductive System

To understand how reproductive hazards affect a man's ability to have healthy children, it is important to understand how the male reproductive system works.

The **testicles** have two important functions: (1) they produce the hormone testosterone, which produces the deep male voice, beard, and sex drive; and (2) they produce sperm.

After the sperm are made (in about 72 days), they are stored in the **epididymis**, the outer structure of the testicles. The sperm remain in the epididymis for about 15 to 25 days. While there, they mature and develop the ability to swim. If the sperm are not ejaculated, they eventually die and are absorbed by the body.



When a man ejaculates, the mature sperm cells move through the **vas deferens** (the tube cut in a vasectomy) and past the **seminal vesicles** and **prostate gland**. The seminal vesicles and the prostate provide most of the liquid in semen.

The semen is deposited in the vagina and the sperm must then swim through the cervix into the uterus and up into the fallopian tubes. If an egg is present, it is fertilized in the fallopian tubes. The fertilized egg then moves down to the uterus, where it attaches to the wall and continues to grow. If no egg is present, the sperm may live within the uterus for up to 2 days.

How Do Reproductive Hazards Affect the Male Reproductive System?

Number of Sperm

Some reproductive hazards can stop or slow the actual production of sperm. This means that there will be fewer sperm present to fertilize an egg; if no sperm are produced, the man is sterile. If the hazard prevents sperm from being made, sterility is permanent.

Sperm Shape

Reproductive hazards may cause the shape of sperm cells to be different. These sperm often have trouble swimming or lack the ability to fertilize the egg.

Sperm Transfer

Hazardous chemicals may collect in the epididymis, seminal vesicles, or prostate. These chemicals may kill the sperm, change the way in which they swim, or attach to the sperm and be carried to the egg or the unborn child.

Sexual Performance

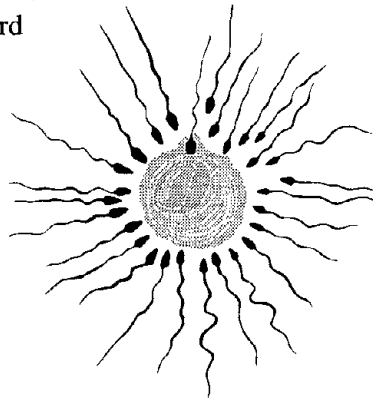
Changes in amounts of hormones can affect sexual performance. Some chemicals, like alcohol, may also affect the ability to achieve erections, whereas others may affect the sex drive. Several drugs (both legal and illegal) have effects on sexual performance, but little is known about the effects of workplace hazards.

Sperm Chromosomes

Reproductive hazards can affect the chromosomes found in sperm. The sperm and egg each contribute 23 chromosomes at fertilization. The DNA stored in these chromosomes determines what we will look like and how our bodies will function. Radiation or chemicals may cause changes or breaks in the DNA. If the sperm's DNA is damaged, it may not be able to fertilize an egg; or if it does fertilize an egg, it may affect the development of the fetus. Some cancer treatment drugs are known to cause such damage. However, little is known about the effects of workplace hazards on sperm chromosomes.

Pregnancy

If a damaged sperm does fertilize an egg, the egg might not develop properly, causing a miscarriage or a possible health problem in the baby. If a reproductive hazard is carried in the semen, the fetus might be exposed within the uterus, possibly leading to problems with the pregnancy or with the health of the baby after it is born.



How Can Workers Be Protected From Reproductive Hazards?

Employers have a responsibility to protect their workers. However, because so little is known about reproductive hazards, 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 before eating, drinking, or smoking.
- ◆ Avoid skin contact with chemicals.
- ◆ If chemicals contact the skin, follow directions for washing provided in the material safety data sheet (MSDS). Employers are required to provide an MSDS for all hazardous materials used in the workplace.
- ◆ Become familiar with the potential reproductive hazards used in your workplace.

- ◆ To prevent home contamination:
 - 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), and
 - avoid bringing contaminated clothing or other objects home.
- ◆ Participate in all safety and health education, training, and monitoring programs offered by your employer.
- ◆ Learn about proper work practices, engineering controls, and personal protective equipment (i.e., gloves, respirators, and personal protective clothing) that can be used to reduce exposures to hazardous substances.
- ◆ Follow the safety and health work practices and procedures implemented by your employer to prevent exposures to reproductive hazards in the workplace.

