

A hazard is an agent that has potential to cause harm to a person. A ‘reproductive’ hazard is therefore an agent that can adversely affect the reproductive health of women and men and/or that can negatively impact the growth and development of a fetus. Examples of reproductive problems linked to hazardous agents include: reduced fertility, by harming sperm or ova; a miscarriage, if an embryo is damaged (toxic agents can be transferred by sperm); or disruption of the complex hormonal pathways (eg. reduced testosterone levels). Hazardous agents are present in both non-occupational and occupational settings. Examples include cigarette smoke, x-rays and car exhaust.

The Man’s Role in Reproduction

Because the emphasis of a healthy pregnancy traditionally focuses on the woman’s role, the potential for problems resulting from the man’s exposure to a reproductive hazard is often overlooked or unknown. On the basis of current understanding, reproductive health problems in men are thought to occur via five main mechanisms:

1. Changes in the genetic make-up of the sperm
2. Hormonal changes (example, reduced testosterone levels)
3. Decreases in sperm numbers
4. Changes in the shape of the sperm or its ability to move
5. Difficulty achieving an erection (i.e. erectile dysfunction)

Exposure to reproductive hazards in the workplace such as vibration, heat, certain chemicals and metals (i.e. particulate matter, arsenic, lead), and even scheduling and/or occupational stress, can impact male reproductive function through one or more of these mechanisms, thereby preventing or inhibiting conception and therefore successful pregnancy and/or by disrupting normal sexual practices. It is therefore important for men to have access to information about potential workplace hazards and actions they can implement to maintain and/or improve their reproductive health.

How are Sperm Made?

Sperm are the reproductive cells, located in semen; the fluid that transports sperm. Sperm production, known as ‘spermatogenesis,’ occurs in the testicles during an approximate 70-day cycle. The testicles also produce the hormone testosterone, which is a key factor for sperm production, reproductive tissue development, libido, and sexual performance.



Common Physical Hazards

Physical hazards in the mining industry are primarily related to work tasks involving noise, vibration, and heat.

Noise:

Constant use of loud machines and tools in the mine may cause hormonal disturbances such as decreased testosterone levels, which can lead to infertility. Following safety guidelines can prevent this; workers should use protective hearing aids and avoid greater than 8 hours exposure per day to noises exceeding 85dBA in order to ensure minimal protection against hazardous workplace noise.

Heat:

Working in hot and/or humid environments has been shown to affect spermatogenesis. Testicular function is temperature-dependent, such that normal sperm development requires temperatures 2-4°C below core body temperature. Decreased sperm count, reduced sperm movement, genetic damage, and/or sperm cell death are all linked to increased testicular heat. Exert caution when working in hot environments and if in a seated position for long periods of time, change positions often to protect scrotum from overheating. Wear loose underwear to prevent heat trapping in the scrotal area. Heat-induced changes to sperm can be reversible; workers with known changes to sperm, who have had heat exposure, should avoid high heat exposure for three to six months and then re-assess their sperm.

Vibration:

Vehicle operation, equipment, and other mining tools that generate vibration may impair spermatogenesis or cause erectile dysfunction. There are very few studies examining this reproductive hazard. However, a study examining continuous seat vibration has been linked to erectile dysfunction in motorcyclists and a study examining occupational exposure to vibration, which included some mine workers, had lower sperm counts than non-exposed workers. Note: vibration, particularly when in a seated position can increase scrotal temperature – see above.

Common Chemical Hazards

Chemicals in the mining industry are primarily related to work tasks involving mechanical extraction of ores, smelting/refining, welding, vehicle operation and mine fires. Always request a review of personal work tasks to itemize potential reproductive hazards and discuss any potential risks and strategies to minimize exposure.

Mechanical extraction of ores and milling:

Mechanical extraction of ores is the blasting of rock and its transportation to the milling and refining facilities. Milling involves the subsequent crushing and grinding of the rock. The blasting process involves explosives, which produce chemicals that have been known to negatively affect spermatogenesis and cause disruptions of testicular function. During mechanical extraction and milling, rock dust is created, which on its own does not pose significant risk. However, rock dust containing either arsenic or cadmium can be toxic to reproductive organs and disrupt normal spermatogenesis. Smelting and refining:

Smelting is a form of metal extraction from ore. This process emits large quantities of hazardous fumes including sulfur dioxide, nitric oxides, hydrogen fluoride, polyaromatic hydrocarbons and metals (arsenic, aluminum, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, thallium and zinc). These chemicals can accumulate in the testes and are associated with reproductive risks for male workers including: hormonal disturbances, sperm DNA damage, disruption to testicular function and spermatogenesis, a decrease in sperm count, motility and infertility.

Welding:

The welding process involves the melting and joining of metals. This process emits large quantities of fumes containing chemicals such as aluminum, beryllium, chromium, manganese, nitric oxides, and others. These chemicals are linked to decreased sperm counts, damage to testicular structures, sperm morphology, and decreased libido and fertility. However studies examining welding effects specifically over the past 20 years have been conflicting. Some have shown changes in semen quality and others have not. It is speculated that inconsistencies are due to reductions over time in exposure levels. There is also difficulty to see an obvious mechanism, with the exception of heat, which may only be a factor in special situations.

Vehicle operation:

Gas and diesel-operated equipment and vehicles in the mines release fumes, which require additional ventilation to protect operators. These fumes contain carbon monoxide, nitric oxides, polyaromatic hydrocarbons (PAHs), and particulate matter all of which may cause damage to sperm DNA and result in decreased fertility. Cigarette smoke is another source of these same chemicals, so it is particularly important to consider smoking cessation and/or avoid exposure to second-hand smoke.

Mine fire:

Chemicals released during a fire are numerous, unpredictable, and often hazardous. Fire smoke has been linked to disruptions in spermatogenesis and fertility. Beware of smoke inhalation and if a fire occurs, extinguish with caution and leave the area as soon as possible. If you are trying to have a baby, consider waiting 3-6 months for sperm to turnover.