

Occupational Health & Safety System	
OHS Standards	Number: WP-08
Environmental Exposures: UV Radiation & Heat Stress	

Ultraviolet (UV) radiation

Ultraviolet (UV) radiation is a form of electromagnetic radiation, like radio waves, x-rays and light. It is divided according to its effects on living tissue into three wavelength bands: UV-A, UV-B and UV-C

Sources of UV radiation in the workplace include various kinds of welding arcs, UV lasers and UV lamps. The sun is the main source of UV radiation out of doors. Outdoor workers may easily be overexposed to UV radiation from the sun during spring and summer.

Effects of Overexposure

Acute effects of overexposure include sunburn (erythema) and arc-eye, otherwise known as welder's flash or snow-blindness (photokeratoconjunctivitis).

Sunburn is a reddening of the skin, with blistering and peeling in severe cases. Of the three UV bands, UV-B is most effective in causing sunburn. To protect itself against UV radiation, the skin "tans". Prolonged exposure to UV radiation causes a thickening of the skin's outer layer. Since people with lighter skin, hair and eyes have less pigment, they are more sensitive to UV exposure. Typically sunburn is not noticeable until a few hours after exposure and, given time, sunburned skin repairs itself.

Arc-eye is a painful irritation of the cornea and the conjunctiva (the membrane connecting the eyeball with the inner eyelid). There is a feeling of "sand in the eye" and sensitivity to light. UV-B is most effective in causing this "sunburn of the eye". Symptoms appear from six to 24 hours after exposure and usually disappear within the following 48 hours. No permanent damage to the eye results unless a severe exposure has occurred.

Note: Hypersensitivity to UV radiation may result from the use of certain prescription drugs, such as tetracycline (a common antibiotic), or from exposure to some industrial chemicals, such as coal-tar distillates. Workers who may be exposed to UV radiation should ask their physicians about the possibility of sensitization when given any new prescriptions.

Chronic effects of overexposure include skin cancer and senile cataracts.

A person's risk of contracting skin cancer has been shown to increase with excessive exposure to UV radiation over many years. The most common types of skin cancer, basal cell carcinoma and squamous cell carcinoma, are not usually life-threatening if treated early. Malignant melanoma is a more rare but much more dangerous form of skin cancer.

A senile cataract is a clouding of the lens of the eye in older people, often impairing vision and eventually requiring surgery. Long-term UV exposure has been shown to be an important factor in the development of this disease.

Exposure Guidelines

Threshold limit values recommended by the American Conference of Government Industrial Hygienists (ACGIH) are adopted by the Ontario Ministry of Labour and are applicable in Ontario workplaces. The guidelines limit the "effective UV radiant exposure" to three millijoules per square centimetre, accumulated over an eight-hour period.

Additionally, the total irradiance of "near UV radiation" (320 to 400 nm) on the unprotected eye is limited to 1.0 milliwatt per square centimetre for periods greater than 16.7 minutes and to 1.0 joule per square centimetre for shorter periods. These guidelines do not apply to UV lasers or to workers exposed to hypersensitizing substances.

REQUIREMENT:

Engineering Controls

UV radiation should be contained or confined to a restricted area when practicable. UV radiation can be easily contained with opaque materials, such as cardboard or wood. Transparent materials, such as glass, PVC (polyvinylchloride), plexiglass and perspex, block UV radiation in varying degrees.

A high-power UV source should have interlocked access, so that it is shut off when the protective enclosure is open.

Administrative Controls

Whenever UV radiation cannot be contained or confined, worker exposure should be minimized by limiting exposure times and increasing the distance between workers and the sources. Areas where exposure to UV radiation is possible should have appropriate warning signs.

The exposure of outdoor workers to solar UV radiation should be minimized by:

- making use of natural or artificial shade
- scheduling alternative tasks when the sun is most intense

Personal Controls

Workers exposed to UV radiation in excess of the above guidelines should use the following personal protective equipment:

- UV-blocking safety eyewear (goggles, spectacles, face shields, welding shields, etc.) with side-shields
- Long-sleeved, closely-woven clothing that covers as much of the body as practicable
- Sun-screen with a sun-protection factor (SPF) of 15 or higher and effective against UV-A and UV-B on all exposed skin.

Outdoor workers should:

- Wear a wide-brimmed hat
- Wear long-sleeved, closely-woven clothing that covers as much of the body as practicable
- Use sun-screen with a sun-protection factor (SPF) of 15 or higher, effective against UV-A and UV-B on all exposed skin
- protect their lips with sunscreen or lipstick with an SPF of 15 or higher
- use UV-blocking sunglasses

Note: The use of UV-safety measures should not lead to other safety risks--the risk of head injuries from using hats with inadequate impact protection, for example, or the risk of heat stress from wearing heavy clothing in hot environments.

Heat Stress

The body is always generating heat and passing it to the environment. The harder the body is working, the more heat it has to lose. When the environment is hot or humid or has a source of radiant heat (for example, a furnace or the sun), the body must work harder to get rid of its heat. If the air is moving (for example, from fans) and it is cooler than the body, it is easier for the body to pass heat to the environment.

The longer you do hard work in the heat the better your body becomes at keeping cool. This is known as acclimatization. Generally, you can become acclimatized by gradually introducing your body to physical work in a hot environment by adjusting the exposure times or the physical demands and increasing these over a period of a week or two. Hot spells in Ontario seldom last long enough to allow for proper acclimatization.

Humidex is a calculation that combines temperature and humidity into one number and is used to describe how hot humid weather feels to the average person. A humidex over 40° is considered extremely high and represents conditions under which activity should be curtailed.

Humidex vs. Degree of Comfort

Less than 29° ----- No discomfort
30 – 39° ----- Some discomfort
40 – 45° ----- Great discomfort
Above 45° ----- Dangerous
Above 54° ----- Heat Stroke imminent

REQUIREMENT:

Engineering Controls

Control the heat at source through the use of insulating and reflective barriers (insulate furnace walls).
Exhaust hot air and steam produced by specific operations.
Reduce the temperature and humidity through air cooling.
Provide air-conditioned rest areas.
Increase air movement if temperature is less than 35°C (fans).
Reduce physical demands of work task through mechanical assistance (hoists, lift-tables, etc.).

Administrative Controls

Establish a work / rest regime and adjust the frequency of work and rest periods accordingly. During rest periods workers are provided an opportunity to take on water, spend time in a cooler environment and reduce physical demands.
When working in the heat, workers should put salt on their food (if on a low-salt diet, this should be discussed with a doctor).
Schedule hot jobs to cooler times of the day.
Provide cool drinking water near workers and remind them to drink a cup every 20 minutes or so.
Assign additional workers or slow down work pace.
Train workers to recognize the signs and symptoms of heat stress and start a 'buddy system' since people are not likely to notice their own symptoms. (*see attached table*)
Pregnant workers and workers with a medical condition should discuss working in the heat with their doctor.

Personal Controls

Light summer clothing should be worn to allow free air movement and sweat evaporation.
Outside, wear light-coloured clothing.
In a high radiant heat situation, reflective clothing may help.
Vapour barrier clothing, such as acid suits, greatly increases the amount of heat stress on the body, and extra caution is necessary.

CONDITION	Cause	Symptoms	Treatment	Prevention
Heat Rash	Hot humid environment; plugged sweat glands.	Red bumpy rash with severe itching.	Change into dry clothes and avoid hot environments. Rinse skin with cool water.	Wash regularly to keep skin clean and dry.
Heat Cramps	Heavy sweating drains a person's body of salt, which cannot be replaced just by drinking water.	Painful cramps in arms, legs or stomach which occur suddenly at work or later at home	Move to a cool area; loosen clothing and drink cool salted water (1 tsp. salt per gallon of water) or commercial fluid replacement beverage. If the cramps are severe or don't go away, seek medical aid.	When working in the heat, workers should put salt on their food (if on a low-salt diet, this should be discussed with a doctor). This will give the body all the salt it needs; don't take salt tablets.
Fainting	Not enough blood flowing to the head, causing loss of consciousness.	Sudden fainting after at least two hours of work; cool moist skin; weak pulse.	Fainting may be due to a heart attack or other illness. GET MEDICAL AID Assess need for CPR. Move to a cool area; loosen clothing; make person lie down; and if the person is conscious, offer sips of cool water.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms which often precede heat stroke.
Heat Exhaustion	Inadequate salt and water intake causes a person's body's cooling system to start to break down.	Heavy sweating; cool moist skin; body temperature over 38oC; weak pulse; normal or low blood pressure; person is tired, weak, clumsy, upset or confused; is very thirsty; or is panting or breathing rapidly, vision may be blurred.	GET MEDICAL AID. This condition can lead to heat stroke, which can kill. Move the person to a cool shaded areas; loosen or remove excess clothing; provide cool water to drink (salted if possible); fan and spray with cool water.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms which often precede heat stroke.
Heat Stroke	If a person's body has used up all its water and salt, it will stop sweating. This can cause body temperature to rise.	High body temperature (over 41oC) and any one of the following: the person is weak, confused, upset or acting strangely; has hot, dry, red skin; a fast pulse; a headache or dizziness. In later stages, a person may pass out and have convulsions.	GET MEDICAL AID This condition can kill a person quickly. Remove excess clothing; fan and spray the person with cool water; offer sips of cool water if the person is conscious.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms which often precede heat stroke.

Reference: - Condensed from the Ontario Ministry of Labour Guidelines
- Environment Canada