

TerranearPMC Safety Share

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Welding is a common task performed at worksites around the US and world. It is a [process](#) that joins materials, usually [metals](#), by using high [heat](#) to melt parts together, allowing them to cool and fuse. Welding is different from other metal-joining techniques such as brazing and soldering as these operations use low temperatures which do not [melt](#) the base metal.

The word, weld, is derived from the Old Swedish word *valla*, meaning "to boil". Sweden was a large exporter of iron during the Middle Ages, and many other European languages used different words but with the same meaning to refer to welding iron, such as the Illyrian (Greek) *variti* (to boil) or Turkish *kaynamak* (to boil). In Swedish, however, the word only referred to joining metals when combined with the word for iron (*jarn*), as in *valla jarn* (literally: to boil iron).

A considerable amount of welding that is performed today is arc welding and involves joining metal to metal by using electricity to create enough heat to melt metal. A source of electricity is used (typically a generator) that is connected to an electrode, commonly referred to as a stick – and via contact with the base metal (the material that is desired to be welded) creates an electric arc (aka electrical discharge) which creates extreme heat. This, in turn, melts the metals at the point of contact.

Welding arcs give off radiation over a broad range of wavelengths - from 200 nm (nanometers) to 1,400 nm. These ranges include ultraviolet (UV) radiation (200 to 400 nm), visible light (400 to 700 nm), and infrared (IR) radiation (700 to 1,400 nm). UV-radiation is divided into three ranges - UV-A (315 to 400 nm), UV-B (280 to 315 nm) and UV-C (100 to 280 nm). UV-C – the range of UV produced by welding – is absorbed in the cornea of the eye. Meanwhile visible light and IR radiation - also produced by welding - can reach the retina.

The cornea is the transparent front part of the eye that covers the iris, pupil, and anterior chamber. The cornea, with the anterior chamber and lens, refracts light, accounting for approximately two-thirds of the eye's total optical power. The retina is a thin layer of tissue that lines the back of the eye on the inside. It is located near the optic nerve. The purpose of the retina is to receive light that the lens has focused, convert the light into neural signals, and send these signals on to the brain for visual recognition via the optic nerve. Therefore, damage to either the cornea or retina can create serious vision consequences.

Looking at an electric arc can cause a flash burn, which is a painful inflammation of the cornea. A flash burn occurs when you are exposed to UV light. While flash burns can be caused by all types of UV light, welding torches create UV-C which is the most common source of cornea damage: hence the name 'welder's flash' or 'arc eye.'

Flash burns are like sunburn in the eye and can affect both your eyes. Your cornea can repair itself in one to two days, and usually heals without leaving a scar. However, if the flash burn is not treated, an infection may start. This can be serious and may lead to some loss of vision. Symptoms include:

- pain - ranging from a mild feeling of pressure in the eyes to intense pain in severe instances
- tearing and reddening of the eye and membranes around the eye (bloodshot)
- sensation of "sand in the eye"
- abnormal sensitivity to light



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- inability to look at light sources (photophobia)

UV damage is more common at close ranges for extensive periods of time, but even a 5 - 10 second exposure can cause welder's flash. If you can see the purple-white light, even reflected from a wall or ceiling, you are at risk for developing welder's flash.

Unlike skin cells that contain melanin to absorb incoming UV light, corneal cells are transparent and have no melanin. As a result, the UV photons break up the unprotected DNA of the corneal cells, preventing them from metabolizing correctly. However, most corneal cells have a sufficient reserve stocks of necessary proteins to keep living for 6 - 12 hours after exposure. That's the reason why welder's flash typically awakens the exposed person about 3:00 in the morning, with an intense sandy feeling in both eyes, making the tissue swell and become cloudy, and painful.

Welders are required to use specific eye protection per OSHA regulations 29 CFR 1910.133 and 1926.102 ("Eye and Face Protection"). These regulations present certain shading for the specific type of welding or hot work being performed. For instance, metal-arc welding using electrodes with a 1/8" diameter is assigned an eye shading of 10, while the same activity that uses a 1/4" electrode is assigned a shading of 12. These numbers are dimensionless and are based on a relative scale of darkness provided by the lens. Thus, a shading of 12 is darker than a shading of 10.

But while these shadings are designed for the person performing welding operations, it is the unsuspecting and unprotected onlooker that can be exposed to welder's flash. As such, welding curtains – equipment designed to block visible exposure to welding operations - are a preventative measure. However, outdoor use of welding curtains may not be feasible due to high winds and uneven surfaces. Therefore, it is a best practice -regardless of indoor or outdoor welding activities – to ensure persons not involved with hot work, are limited from entering the welding area.

Should someone feel the effects of a flash burn, here are a few measures that can be applied:

- Dilating drops can be used to relax the eye muscles, which in turn eases pain and allows your eyes to rest and heal. Your pupils (the black part of the eye) will look bigger than normal. This effect lasts several hours to a few days.
- Your eyes may be covered with a padded dressing to rest them and allow them to heal. Do not drive with an eye patch on.
- Antibiotic drops or ointment may be advised to stop infection. You may also be given a mild steroid-based anti-inflammatory drop.

Should you notice your vision is blurred (other than from applying eye drops or ointment) or experiencing a worsening glare, you should see a medical professional (doctor or other licensed health care professional) as soon as possible.

If I have seen further than others, it is by standing upon the shoulders of giants.

Isaac Newton

