Radiation

INTRODUCTION

Welding and cutting processes produce quantities of radiation requiring protective measures.

DEFINITION

In the welding environment, radiation is electromagnetic energy that can injure eyes and burn skin. A welder can see visible light radiation but cannot see ultraviolet or infrared radiation. Radiation is often silent and undetected, yet injuries can occur. Have all personnel in the welding environment learn about the effects of radiation.

EFFECTS OF RADIATION

The effects of radiation depend on wavelength, intensity, and length of time one is exposed to the radiant energy. Although a variety of effects is possible, the following two injuries are most common:

- Skin burns.
- Eye damage.

TYPES OF RADIATION

There are two types of radiation that can be associated with welding operations:

- Ionizing (such as X-rays or radioactive materials).
- Nonionizing (such as ultraviolet, visible light, laser or infrared).

IONIZING RADIATION

- Produced by the electron beam welding process. Controlled within acceptable limits by using suitable shielding around the electron beam welding area.
- Dust produced during grinding (pointing) of thoriated tungsten electrodes for Gas Tungsten Arc Welding (GTAW) process is radioactive. Controlled by using local exhaust and, if necessary, an NIOSH approved respirator.

NONIONIZING RADIATION

- Intensity and wavelength of energy produced depend on the process, welding parameters, electrode and base metal composition, fluxes, and any coatings or plating on the base material Ultraviolet radiation increases approximately as the square of the welding current.
- Visible brightness (luminance) of the arc increases at a much lower rate. Processes using argon shielding produce larger amounts of ultraviolet

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radiation than those using most other shielding gases.

HOW TO PROTECT AGAINST IONIZING RADIATION

- Required protection varies with time of exposure, distance from source, and shielding used.

- Use thorium-free electrodes whenever possible. When grinding (pointing) thoriated tungsten electrodes, use dust collecting grinders. Always use local exhaust and, if necessary, respiratory protection to prevent inhalation of dust.

HOW TO PROTECT AGAINST NONIONIZING RADIATION

- Use welding helmet with correct shade of filter plate according to AWS F2.2.

- Do not use blue transparent welding curtains as they do not protect against the blue light spectrum (see Fact Sheet #X Welding Curtains and AWS F2.3M:2019 standard).

  Note: Transparent welding curtains are not intended as welding filter plates, but rather are intended to protect passersby from incidental exposure.

- Protect exposed skin with adequate gloves and clothing according to ANSI Z49.1.

- Be aware of reflections from welding arcs and protect all persons from intense reflections.

  Note: Paints using titanium dioxide or zinc oxide as major pigmentation media have a low reflectance for ultraviolet radiation.

- Locate welding operations so that other workers are not exposed to either direct or reflected radiation. Use screens, curtains, or adequate distances from other workstations, aisles, or walkways to avoid exposure.

- Wear safety glasses with UV protective side shields in addition to a proper welding helmet with filter plate. The side shields provide needed protection from reflected radiation.

- Have all persons wear safety glasses with UV protective side shields anytime near welding or cutting areas.

- Choose safety glasses conforming to ANSI Z87.1.

INFORMATION SOURCES

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes* (ANSI Z49.1), American National Standards Institute, <www.aws.org>.

ANSI Z87.1, *Practice for Occupational and Educational Eye and Face Protection,* American National Standards Institute, <www.ansi.org)>.

ANSI Z136.1, *Safe Use of Lasers,* American National Standards Institute <www.ansi.org>.

AWS C7.1, *Recommended Practices for Electron Beam Welding,* American Welding Society, <www.aws.org>.

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AWS F2.3, *Specification for Use and Performance of Transparent Welding Curtains and Screens*, American Welding Society, <www.aws.org>.

AWS Safety and Health Committee, "Choosing the Right Welding Screen or Curtain", 2023 Welding Journal 102(6), 56-58 <www.aws.org>.

AWS Safety and Health Committee, "The Hidden Hazard of Transparent Blue Welding Screens", 2016 Welding Journal 95(12), 82-84 <www.aws.org>.

AWS, *Ultraviolet Reflectance of Paint*, American Welding Society, <www.aws.org>. Hinrichs, J. F., *Project Committee on Radiation - Summary Report, 1978,* Welding Journal 57(62): <www.aws.org>.

Manufacturers' Product Information Literature

MSHA Title 30, Parts 1-199, *Mineral Resources*, Mine Safety and Health Administration, Code of Federal Regulations*,* <www.msha.gov>.

Moss, C. E. *Optical Radiation Transmission Levels Through Transparent Welding Curtains,* 1979 Welding Journal 58(69s-75s) <www.aws.org>.

Moss, C. E., et al. *Optical Radiation Levels Produced by Air-Carbon Arc Cutting Processes,*198*0,* Welding Journal 59(43-46):<www.aws.org>.

Moss, C. E. and Murray, W. E. *Optical Radiation Levels Produced in Gas Welding, Torch Brazing and Oxygen Cutting,* 1979*,* Welding Journal 89(37-46), <www.aws.org>.

NTIS Nonionizing Radiation Protection Special Study No. 42-0053-77, *Evaluation of the Potential Hazards from Actinic Ultraviolet Radiation Generated by Electric Welding and Cutting Arcs,* National Technical Information Service <www.ntis.gov>.

NTIS Nonionizing Radiation Protection Special Study No. 42-0312-77, *Evaluation of the Potential Retinal Hazards from Optical Radiation Generated by Electric Welding and Cutting Arcs,* National Technical Information Service <www.ntis.gov>.

Naidoff, M. A. and Sliney, D. H. *Retinal Injury from a Welding Arc,* 1974 American Journal of Ophthalmology, 77(5), 663-668.

Sliney, D. H. and Freasier, B. C. *Evaluation of Optical Radiation Hazards,* 1973 Applied Optics, 12(1), 1-24.

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