



## Thoriated Tungsten Electrodes

### INTRODUCTION

Thoriated tungsten electrodes contain thorium, a radioactive material that can pose health and environmental risks at elevated exposure levels. Thorium is a low-level radioactive material that primarily emits alpha particles as well as some beta and gamma radiation. These electrodes are normally sharpened by grinding as part of the standard procedure while preparing to perform gas tungsten arc welding (GTAW). Dust particles from this grinding process can cause internal radiation exposure if the dust is accidentally ingested or inhaled, so caution is necessary. Concern regarding radiation exposure to the external body from these electrodes is minimal.

Thoriated tungsten electrodes are widely used because they make good welds and are long lasting and quite easy to use. A thoriated tungsten electrode operates at a temperature well below its melting temperature compared to a pure tungsten electrode. This results in a much lower rate of consumption of the electrode during welding, which eliminates much of the “arc wander” associated with balled pure tungsten. Other reasons for their use include easier arc initiation, reduced weld metal contamination, higher current-carrying capacity, the ability to sharpen the electrode, and long life.

### IS THERE A CONCERN TO THE USER?

The risk of internal exposure during welding is negligible in most circumstances since the thoriated electrode is consumed at a very slow rate.

During the grinding of the thoriated tungsten electrodes, radioactive dust is created, posing the potential hazard of internal radiation exposure by inhalation or ingestion unless care is taken to control the dust.

### HOW TO REDUCE EXPOSURE

- Choose thorium-free tungsten electrodes such as those containing cerium, lanthanum, yttrium, or zirconium whenever possible.
- Read, understand, and follow all information in the Material Safety Data Sheet (MSDS) for the selected tungsten electrode.
- Use a high-efficiency dust collection system to capture particles created during the grinding of electrodes or disturbed during housekeeping.
- Evaluate the ventilation system before acceptance and periodically thereafter to minimize personnel and environmental contamination.

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- Develop and implement standard operating procedures for the use of thoriated tungsten electrodes, including proper procedures for storage, grinding, use, housekeeping and disposal.
- Provide training in the operation of the welding and grinding equipment, personal hygiene, and safety.

## WHAT TO DO WITH THE COLLECTED DUST PARTICLES

- Regularly remove the dust generated by grinding.
- Properly dispose of the dust and spent electrodes in accordance with federal, state, and local regulations.

## SUMMARY

Several of the information sources listed indicate that the risk of occupational exposure to radiation during storage, handling, and welding with thoriated tungsten electrodes is negligible where simple precautions are taken. Special care should be taken to control and collect dust from grinding these electrodes in order to prevent a potential ingestion and inhalation exposure to radioactive dust particles resulting from this operation.

## INFORMATION SOURCES

International Institute of Welding (IIW). Statement from Commission VIII, Health and Safety 2000. *Welding with Non-Consumable Thoriated Tungsten Electrodes*. Document IIW-VIII-1901-00. np: np.

Jankovic, J. T., W. S. Underwood, and G. M. Goodwin. 1999. Exposures from Thorium Contained in Thoriated Tungsten Electrodes. *American Industrial Hygiene Journal* 60: 384 – 389.

Nuclear Regulatory Commission (NRC). *Code of Federal Regulations, Title 10 Energy, Part 40.13 (c) (1) (iii)* (Available from the U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954; tel: 800-321-6742; Web site: [www.nrc.gov](http://www.nrc.gov)).

Oak Ridge National Laboratory (ORNL): Estimated Radiation Doses from Thorium and Daughters Contained in Thoriated Welding Electrodes, by L. M. McDowell-Boyer (ORNL/NUREG/TM-344). Oak Ridge, TN: ORNL, 1979.

Sinclair, M. L., and K. S. Thind: "Assessment of Thorium Exposure Due to Grinding of Thoriated Tungsten Electrodes." Paper presented at the American Industrial Hygiene Conference, Boston, MA., May 1992,

Breslin, A. J., and W. B. Harris: Use of thoriated tungsten electrodes in inert gas shielded arc welding. *Ind. Hyg. Q.* 13:191-195 (1952).

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