

2.6

Exposures due to TIG welding using thoriated tungsten electrodes

K.H. Lehmann, A. reichelt, P. Guglhör

TÜV Energie- und Systemtechnik

Germany

EXPOSURES DUE TO TIG WELDING USING THORIATED TUNGSTEN ELECTRODES

Karl-Heinz Lehmann, Andreas Reichelt, Peter Guglhör¹

INTRODUCTION

In 1990 we got the order from the Bavarian Government to carry out a research project with the title "Man-Modified Materials Containing Natural Radionuclides". First of all, there had to be found exposure pathways which are relevant in Bavaria, concerning the radiation exposure of population and working persons. By means of a literature study and own calculations, we found relevant subjects and proposed to investigate them more intensively [1]. One of these topics was the handling with thoriated tungsten welding rods.

METHODS

The properties of the tungsten rods are improved through the addition of radioactive thorium. From 1991 - 1993, as well as in 1995, we investigated the radiation exposure by using thoriated tungsten welding rods. We investigated the different exposure pathways and determined the specific activity depending on different types of welding rods. By carrying out surveys with the users, we determined the exposure pathways for the individual exposed persons: TIG-"hand-welders", TIG "machine-welders", unskilled workers and other persons. We measured the activity concentration of the breathing air during welding, during grinding the electrodes and by staying in the rooms where usually welding is carried out. ~~The size distribution of the aerosol attached activity was determined by means of cascade impactors.~~
~~The main emphasis was the comparison of the different sampling systems at the measurement of the activity concentration of the breathing air.~~

RESULTS

Figure 1 shows the market share of different electrodes.

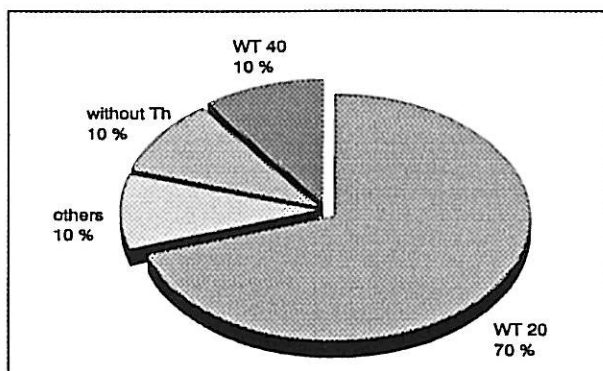


Fig. 1. Market share of different electrodes

The calculated and measured specific Th-232 activity of tungsten electrodes is shown in table 1.

Table 1. Calculated and measured specific Th-232 activity of tungsten electrodes

Codification	specific Th-232 activity [Bq/g] - calculated	specific Th-232 activity [Bq/g] - measured
WT-10	29 - 43	0
WT-20	61 - 78	69
WT-30	100 - 114	110
WT-40	136 - 150	149

For the various exposed persons, at the extern irradiation with gamma- and beta-radiation and the inhalation of radioactive aerosoles, the radiation exposure was calculated by means of experimentally determined data. In this way, a dose of approximately 5 - 20 mSv per year was estimated by using the inhalation dose coefficients according to ICRP 30 (a summary is shown in fig. 2).

Exposure pathways	Exposed persons
<ul style="list-style-type: none"> • external photon and beta radiation • inhalation of radionuclides during welding (without exhauster) • inhalation of radionuclides during grinding (with exhauster) • inhalation of radionuclides during the stay in the workroom 	<ul style="list-style-type: none"> • TIG-hand-welders • TIG-machine-welders • labourers (main occupation: grinding) • other persons

Calculated effective dose: 5 - 20 mSv per year

Fig.-2. Exposure pathways, exposed persons and calculated effective dose

The detailed results are included in reference [2].

REFERENCES

1. Becker, D. E.; Eder, E.; Reichelt, A. Radiation Exposure by Man-Modified Materials Containing Natural Radionuclides, Proceedings, IRPA 8, Montreal; May 17 - 22, 1992.
2. Reichelt, A.; Lehmann K.-H. Anthropogene Stoffe und Produkte mit natürlichen Radionukliden, Teil 2: Untersuchungen zur Strahlenexposition beim beruflichen Umgang, Studie des TÜV Bayern Sachsen im Auftrag des Bayerischen Staatsministeriums für Landesentwicklung und Umweltfragen; November 1993.
(Man-Modified Materials and Products with Natural Radionuclides, Part 2: Investigations Concerning the Occupational Radiation Exposure; Study by the Technical Inspection Agency of Bavaria and Saxony; Munich, Germany: Bavarian State Ministry for State Development and Environmental Affairs, Radiation Protection Section; 1993.)

¹ TÜV Energie- und Systemtechnik GmbH, Group TÜV Süddeutschland, Supdepartment Environmental Radioactivity, Westendstraße 199, D-80686 Munich, Germany