

## **Estimation of personal dose while processing NORM-contaminated metal scrap**

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### **Abstract**

The amount of metal scrap contaminated with naturally occurring radioactive material (NORM) and / or toxically material has grown in the last few years. This contaminated metal scrap originates from the decommissioning of natural oil and gas production plants, from the mining industry, or out of the fertilizer production and ground water extraction. In 1998 Siempelkamp Nukleartechnik started the operation of a special facility, at their Krefeld site, to handle this contaminated scrap metal. There the metal scrap is melted in order to transfer the contamination such as mercury and NORM into the slag and the dust. Through this process the decontaminated metal can be recycled. The NORM contamination of scrap is usually inflicted by Radium deposits and caused mainly by Radium 226 and its decay chain. Uranium with its complete decay chain was very rarely found. Having its origin in the production of filaments in the electrical industry and the production of welding electrodes, the Thorium contamination began with its daughter Radium 228 followed by the rest of the decay chain.

The handling of NORM is regulated by German radiation protection ordinance, which is based on the EURATOM radiation protection recommendations. An observation of working areas is necessary, if the exposition dose caused by natural radioactive materials during the whole disposal path can exceed 1 mSv/a.

To determine the workers dose exposure, a variety of dose measurements have been made since 2005. Apart from the long-term Thermoluminescence dose measurements, working areas were measured with electronic dose meters in 24 hour periods. Additionally each of the workers wore an electronic personal dose meter during the working hours. To be able to weight the daily dose for the each specific working area, the actual working time in each area was documented. Compared to the dose by direct radiation, a former study has shown that incorporation is negligible. Because of a possible mercury concentration in the air, all workers have been equipped with a respiratory protection apparatus with a filtering efficiency of 99,997%.

No incorporation was detected in the examined workers urine samples. The resulting personal doses calculated from the measurements are between approx. 0.08 mSv/a and approx. 0.3 mSv/a. This is inside the range of former results, using only TL-dose measurements.