Beryllium in Tissues of Former Nuclear Workers

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Beryllium and beryllium compounds widely used in nuclear power industry and weapons production are known to be human carcinogens. Currently, there is limited published data on beryllium concentrations and distribution in the human body. The US Transuranium and Uranium Registries (USTUR), established in 1968 to study the biokinetics and internal dosimetry of actinides by following up former nuclear workers with documented intakes of these elements, who volunteered their bodies for scientific use posthumously, holds detailed work history, radiation exposure, and industrial hygiene records including self-reported information on beryllium exposure. Out of 364 deceased USTUR Registrants, 92 self-reported working with beryllium, but only 73 individuals reported years of beryllium work ranging from 1 to 45 years with the average of 17 ± 13 years. Beryllium concentrations were measured using inductively-coupled plasma mass spectrometry in tissue samples from 13 USTUR cases with beryllium exposure duration ranging from 3 to 39 years. A total of 149 tissues was analyzed including 105 tissues from a whole-body donor who was potentially exposed to beryllium for 6 years. The highest concentrations were measured in thoracic lymph nodes with the range of 6 – 334 μg kg^{-1} (median: 59.1 μg kg^{-1}). For other tissues, beryllium median concentration followed the order: liver (6.84 μg kg^{-1}) > kidney (0.55 μg kg^{-1}) > lung (0.30 μg kg^{-1}) > skeleton (0.16 μg kg^{-1}). For analyzed whole-body case, the total beryllium content was estimated to be 54.8 μg, including 5.8 μg retained in the respiratory tract 22 years post-exposure. It was found that systemic beryllium primarily accumulated in the skeleton (27.3 μg), followed by the liver (11.3 μg) and other soft tissues (10.4 μg). Beryllium concentration in the liver (10.2 μg kg^{-1}) was three times higher than the average concentration in the skeleton (3.0 μg kg^{-1}) and 42 times higher than that in other soft tissues (0.24 μg kg^{-1}).

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