

**Technical Basis to Define Soluble Uranium for Regulatory Compliance Demonstrations**

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Radiological and chemical toxicity considerations apply to occupational uranium intakes. The chemical form of uranium influences its behavior in the body as reflected by the three inhalation classes in 10 CFR 20.1003 and differing fractional uptakes to the blood. Occupational limits for soluble uranium exist to prevent chemical toxicity effects on kidney function due to uranium accumulation in the kidney and its persistence with time. In operational settings at uranium recovery facilities, uranium (excluding ore) tends to be a mixture of chemical compounds and multiple inhalation classes. For these situations, guidance is needed on which inhalation classes relate to soluble uranium so that weekly occupational intakes can be compared to the 10-mg limit specified in 10 CFR 20.1201(e). Based on biokinetic models in existing U.S. Nuclear Regulatory Commission (USNRC) guidance, calculations of the uranium concentration in the kidney were performed for various uranium compound mixtures. Inhalation and ingestion were considered for both single and continuous intakes. The results support defining soluble uranium as those chemical compounds associated with Inhalation Classes D and W and blood uptake fractions of 0.05. Class Y compounds with a blood uptake fraction of 0.002 are insoluble and provide small contributions to the maximum uranium concentration in the kidney. Neglecting the insoluble contribution to the uranium concentration in the kidney is acceptable because radiotoxicity is more limiting than chemical toxicity for inhaled mixtures of soluble and insoluble uranium with significant Class Y contributions. This abstract is an independent product of the CNWRA and does not necessarily reflect the view or regulatory position of USNRC. The USNRC staff views expressed herein are preliminary and do not constitute a final judgment or determination of the matters addressed or of the acceptability of any licensing action that may be under consideration at USNRC.