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Probable ^{235}U contamination of samples at McMaster Reactor

In performing INAA on a variety of acrylic samples at the reactor at McMaster University, we have discovered that they show anomalously large amounts of fission products. We have concentrated our analysis on one, ^{132}Te, which cannot be produced any other way. This isotope has two fairly prominent γ rays at 228 and 668 keV and a half-life of 78 hours. The 228-keV γ ray is virtually coincident in energy with a γ-ray from ^{239}Np (and the half-lives are not too dissimilar) so to make quantitative determinations we have used the 668 keV line.

We assume that the ^{132}Te comes from fission of ^{235}U, and determine it quantitatively by comparing the intensity of the 668 keV γ ray from the acrylic sample with the Aℓ foil which we use for calibration, assuming that the Aℓ foil has not become substantially contaminated or depleted in ^{235}U. (A standard-sized piece of Aℓ foil, 0.06 g, contains about 500 pg of ^{235}U, which is much larger than is picked up by the 8 g pieces of acrylic.) All samples of acrylic that we have tested, including our own (Rohm and Haas), Cyro, and Polycast, show levels of ^{235}U in the range 12 to 29 pg/g (which is equivalent to 1.7 to 4 ng/g of natural U). Included in our testing was a sample of pre-Chernobyl acrylic from Reynolds and Taylor which also showed 22 pg/g of ^{235}U.

The most straight-forward conclusion is that our samples are becoming contaminated in the sample loading room at the McMaster reactor, which uses 93%-enriched fuel. It is not likely to be from the pool water, because there is no evidence that our Aℓ containers have leaked. We have informed the reactor operators of our findings.

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