

Internal Contamination with Uranium Isotopes after Operation Enduring Freedom in the Civilian Population of Jalalabad and Kabul, Afghanistan*

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Our earlier studies reported an elevated total concentration of uranium isotopes in the Nangarhar-Jalalabad region of Eastern Afghanistan. The concentration of uranium was found to be up to 100 times higher than the worldwide average range of various geographical areas. One of the interpretations of our findings was unusual geographic circumstances in the areas of sample collection. In contrast, a yet unexplained relationship between these findings and the bombing raids during Operation Enduring Freedom was offered as a working hypothesis. The purpose of this study was to evaluate uranium concentration and isotopic ratios in three areas of Kabul, Afghanistan and one area of Jalalabad, as an attempt to test these hypotheses in our ongoing studies by determination of total uranium concentration and precise isotopic composition of four uranium isotopes (^{234}U , ^{235}U , ^{236}U , and ^{238}U) in the urine of civilians of three areas of Kabul and Jalalabad.

The Uranium Medical Research Centre (UMRC) field team conducted the collection of the urine samples in two separate field trips to the Jalalabad and Kabul regions in June through October, 2002. Twenty-two male subjects from three districts of Kabul and one district of Jalalabad were selected for the study by the presence of non-specific multiorgan alterations of the respiratory, musculoskeletal, urinary, immune, and neurological systems; as well as, their history of exposure to the inhalation of dust in the areas of the bombing raids. Twenty-four hour urine samples were collected under controlled conditions. Three non-symptomatic subjects who reported not to have been in the area of the bombings provided urine samples as controls. The 24-hour urine samples were prepared for analysis by co-precipitation, evaporation, oxidation of organic matter, and ion-exchange chromatography. The samples were analyzed using a Thermo-Elemental Plasma54 multicollector ICP-MS with ion counting Daly detector and multiple Faraday cups.

The mean concentration of uranium in twenty-two samples was 221.50 ± 91.05 ng/L compared to the control value of 32.06 ± 14.80 . Most subjects were in the range of 30 to 100 ng/L in Kabul and 100 to 300 ng/L in Jalalabad, however there was an exceedingly high total uranium concentration of 2031.63 ng/L in a child who was the sole survivor of a bomb hitting his family's home in a suburb of Kabul. The $^{238}\text{U};^{235}\text{U}$ ratio was 137.62 ± 0.50 consistent with natural uranium. The $^{234}\text{U};^{238}\text{U}$ ratio was $1.01 \times 10^{-4} \pm 4.53 \times 10^{-5}$. The $^{236}\text{U};^{238}\text{U}$ ratio was $7.32 \times 10^{-7} \pm 3.69 \times 10^{-7}$. The $^{234}\text{U};^{238}\text{U}$ ratio was consistent with natural uranium in Jalalabad but was highly variable in Kabul. There was a small detectable presence of ^{236}U in seven samples from Kabul.

Our results demonstrate that the civilian population of Kabul and Jalalabad has a significant elevation of total uranium compared to world-wide urinary uranium concentrations (1-20 ng/L) and civilians not in the area during the Allied Forces' bombings. Further studies of uranium isotopes in different non-conflict and post-conflict areas are clearly warranted to provide further understanding of a consistent high non-depleted uranium (NDU) levels in geographically different areas of Eastern Afghanistan.

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