

The Analysis of the Uranium Isotopes Abundance and Ratios in the Civilian Population of Eastern Afghanistan as a Consequence of the Use of Radioactive Weapons in Operation Enduring Freedom (OEF)*

Asaf Durakovic†, Axel Gerdes‡, Frank Klimaschewski†, Isaac Zimmeman†

The purpose of this work was to determine the concentration and precise ratio of four uranium isotopes (^{234}U , ^{235}U , ^{236}U , ^{238}U) in the urine specimens of the civilian population in Eastern Afghanistan as a consequence of the use of radioactive weapons in Operation Enduring Freedom (OEF).

Eight symptomatic patients were chosen from Tora Bora, Bibi Mahro district of Kabul, Lal Mah village of Jalalabad, and Nangahar Province. All patients were showing symptoms of fatigue, fever, musculo-skeletal and neurological alterations, headaches, and respiratory impairment after inhalation of dust during the bombing raids in June, 2002, and had their urine samples collected under controlled conditions by the Uranium Medical Research Centre (UMRC) field team.

The analytical methodology involved pre-concentration of the uranium using co-precipitation and/or evaporation, oxidation of organic matter, purification of uranium using ion exchange chromatography, and mass spectrometry using a double focusing Thermo-Elemental Plasma54 multi-collector ICP-MS equipped with a Daly[□] detector for ion counting (for some of the smaller isotopes) and multiple faraday cups. Analytical blanks were negligible at less than 50 picograms U, and chemical recovery was > 80% in most cases. Along with the samples, analyses were conducted of a urine internal standard (with c. 11 ng/L uranium) of natural isotopic composition (atomic ratio 137.88 for ^{238}U : ^{235}U) and certified isotopic standards of uranium, both of which returned the correct values for the standards.

The mean concentration of uranium in eight samples is found to be considerably greater (273.05 ng/L, SD 136.81, SE 48.37) than what is regarded as a normal population (1-20 ng/L). The ^{238}U : ^{235}U ratio is 137.87 ± 0.20 , which is consistent with natural uranium. The ^{234}U : ^{238}U ratio for the Afghan samples is 0.000055 ± 0.000001 , also consistent with natural uranium (NU). ^{236}U , which usually forms a component of depleted uranium, was not detected (measured ^{236}U : $^{238}\text{U} < 10^{-7}$). Five of the eight male subjects from Nangahar Province have urine samples with ^{238}U : ^{235}U and ^{234}U : ^{238}U ratios consistent with natural uranium (NU) with values of 137.86 ± 0.25 and 0.000055 ± 0.000001 respectively. ^{236}U was not detected (measured ^{236}U : $^{238}\text{U} < 10^{-7}$). The five samples, repeatedly analyzed in 3-4 series, have a mean concentration of uranium of 315.37 ± 65.09 ng/L that is considerably greater than normal values of 1-20 ng/L.

Our results confirm a significantly elevated presence of uranium isotopes in the urine of Afghan civilians after Operation Enduring Freedom thus demonstrating the contamination from a source consistent with natural uranium (NU). This has resulted in total uranium concentration levels of up to 100 times higher than the normal range of various worldwide geographic and environmental areas. Possible explanation of our findings may be either a consequence of exposure due to deployment of weapons containing non-depleted uranium (NDU) or unusually high levels of natural uranium (NU) in drinking water or soil in the particular geographic areas. The cause of the urinary presence of natural uranium, however, may be consistent with our previously reported findings of uranium contamination of the Allied Forces veterans in Gulf War I, Iraqi civilians after Operation Iraqi Freedom, and United States Gulf War II soldiers by

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† Uranium Medical Research Centre

‡ Institute for Mineralogy, JW Goethe University, Frankfurt, Germany

inhalation of depleted uranium and non-depleted uranium containing aerosols. Our current investigations of critical evaluation of biological specimens and environmental samples are in progress.

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