

The Analysis of the Uranium Isotopes Abundance and Ratios in the Civilian Population of Different Regions of Iraq as a Consequence of the Use of Radioactive Weapons in Gulf War II (Operation Iraqi Freedom, OIF)*

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

The purpose of this work was to determine the concentration and precise ratios of four uranium isotopes (^{234}U , ^{235}U , ^{236}U , ^{238}U) in the urine specimens of the civilian population of different regions of Iraq as a consequence of the use of radioactive weapons in Gulf War II (Operation Iraqi Freedom, OIF).

Seven symptomatic civilians were chosen from northern Iraq's Baghdad area exposed to aerial bombings and tank battles. The subjects' most common symptoms included fatigue, intermittent fever, respiratory impairment, nocturnal diaphoresis, headaches, musculoskeletal pains, urinary tract alterations, and affect disorders. Further twelve symptomatic Iraqi civilians from southern Iraq were selected from similar sites of aerial bombings or tank battles in the cities of Nasiriyah and Al Basra. Urine samples were collected by Uranium Medical Research Centre (UMRC) field team members.

The urine specimens were analyzed using double-focusing Thermo Finnigan Neptune multi-collector ICP-MS. The analytical methodology included pre-concentration of urine samples using co-precipitation, oxidation of organic matter, uranium purification by ion-exchange chromatography, and mass spectrometry analysis. Data errors were calculated with the consideration of uncertainty of all applied corrections and reproducibility of the reference solution.

The mean concentration of total uranium in all samples from Baghdad area is found to be 23.06 ng/L. Six samples from Baghdad have a natural $^{238}\text{U}:^{235}\text{U}$ isotopic ratio of 138.31. The urine of one Baghdad civilian (142.71) contains depleted uranium (140.1). The $^{234}\text{U}:^{238}\text{U}$ ratio of these civilians is 7.20×10^{-5} . The $^{236}\text{U}:^{238}\text{U}$ ratio of the civilians (6.74×10^{-7}) indicates a presence of ^{236}U in at least three of seven samples.

Seven samples urine samples show a natural $^{238}\text{U}:^{235}\text{U}$ ratio of 138.2 ± 1.4 . Five samples show a depleted $^{238}\text{U}:^{235}\text{U}$ ratio of 142.5 ± 1.1 . The mean concentration of total uranium is 32.0 ± 24.6 ng/L in DU positive subjects and 25.2 ± 18.0 ng/L in DU negative subjects. The mean $^{234}\text{U}:^{238}\text{U}$ ratio is $6.56 \times 10^{-5} \pm 1.16 \times 10^{-5}$ in DU positive subjects and $6.82 \times 10^{-5} \pm 3.91 \times 10^{-6}$ in DU negative subjects. There is a significant presence of ^{236}U in all DU positive subjects with a mean $^{236}\text{U}:^{238}\text{U}$ ratio of 7.69×10^{-7} . There is no detectable ^{236}U in DU negative subjects. Recently reported first-time findings of ^{236}U in natural uranium show that the $^{236}\text{U}:^{238}\text{U}$ ratio can be (10^{-10} to 10^{-14}).

Our results demonstrate the presence of depleted uranium in civilians of northern and southern Iraq after Operation Iraqi Freedom (OIF). The cause of the urinary presence of depleted uranium and ^{236}U may be consistent with our previously reported findings of DU contamination of the Allied Forces veterans in Gulf War I, natural uranium (NU) contamination of Afghanistan civilians after Operation Enduring Freedom (OEF), and the contamination of United States Gulf War II soldiers by 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.

* 9th Congress of the World Federation of Nuclear Medicine and Biology, Seoul, South Korea, October 22 - 27, 2006

† Uranium Medical Research Centre

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