

UPDATE

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## ABSTRACT

### **Health Hazards of Uranium Dust from Radioactive Battlefields of the Balkan Conflicts, Eastern Afghanistan and Iraq after the Gulf Wars - Lessons for Civil Protection in the Terrorist Scenario of Radiological Dispersion Devices**

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#### **Purpose**

The purpose of this study is to identify key health hazards of uranium dust from the radioactive battlefields (Balkan, Middle East and Eastern Afghanistan conflicts) to draw lessons for civil protection in the terrorist scenario of radiological dispersion devices (RDD). Gulf War I (GW I) in 1991 resulted in 350 metric tons of depleted uranium (DU) deposited in the environment and 3 to 6 million grams of DU aerosol dust particles released into the atmosphere, by the most conservative estimates. Its possible legacy (Gulf War disease) continues after the military conflicts (Operation Enduring Freedom, OEF, in Afghanistan and Gulf War II in Iraq). The symptoms of the multiorgan incapacitating progressive disease have been as numerous as their names, including incapacitating fatigue, musculoskeletal and joint pains, headaches, neuropsychiatric disorders, affects changes, confusion, visual problems, changes of gait, loss of memory, lymphadenopathies, respiratory impairment, impotence, and urinary tract morphological and functional alterations. The disease is still a matter of controversy regarding etiology and pathogenesis of the syndrome commonly named Gulf War disease. It was underestimated and subsequently evolved in its clinical description through recognition of progressive symptomatology.

#### **Methods**

UMRC's studies of the human contamination with uranium isotopes were conducted with the exposed subjects of Jalalabad, Spin Gar, Tora Bora, and Kabul areas in Afghanistan after OEF as well as Samawah, Baghdad and Basrah in Iraq after GW II. The urine samples of the subjects were analysed by the plasma mass spectrometry. The analytical methodology involved pre-concentration of the uranium using co-precipitation and/or evaporation, oxidation of organic matter, purification of uranium with ion exchange chromatography, and mass spectrometry with a double focusing Thermo-Elemental Plasma54 multi-collector ICP-MS equipped with a Daly  $\square$  detector for ion counting.

## **Results**

The results demonstrate that contaminated subjects from Afghanistan contained total uranium concentrations over 100 times higher than the range of averages in the world. The results of the studies of uranium concentrations in the military personnel after GW II are conclusive proof of the presence of DU isotopic ratios in the contaminated veterans. In addition the results are further enhanced by the verified presence of the man made uranium  $^{236}\text{U}$  in the urine of symptomatic veterans. The studies have identified a correlation between uranium contamination, multiorgan non-specific illnesses similar to those encountered in GWI and the Balkan conflicts. The contamination of the exposed population by the radioactive dust inhalation has been verified by the multidisciplinary scientific reports pointing to the inhalational pathway as a major route of entry in the body internal environment. The inhalation of both respirable and non-respirable radioactive particles leading to both somatic and genetic alterations warrants further investigation in the view of ever present risk of the mass casualties in the event of the terrorist use of radiation dispersion weapons.

## **Conclusion**

The current reality of the radiological battlefield in tactical warfare of a potential clandestine use of recently introduced radiological dispersing devices in the terrorist scenario presents a new dimension of the management of mass casualties. The sustained research of internal contamination with organotropic radio nuclides, and potential mass casualties exposed to inhalational radioactive dust necessitates further research in the mechanisms, pathogenesis and treatment of the internal contamination casualties. Only a multidisciplinary and multinational effort may contribute to better preparedness for managing the casualties in the terrorist scenario. Developing methodology of detection, radiation toxicology, pathogenesis, somatic and genetic damage have been recently enhanced by the studies of internal dosimetry, karyotype chromosomal aberration studies (sky testing) which provide a sustained improvement of the assessment and management of internal contamination with medically significant radio nuclides.