Medical and environmental effects of potential nuclear disasters present a realistic concern to healthcare and management of mass casualties. The proliferation of nuclear weapons and delivery systems such as strategic air force, land and naval missiles, and tactical weapons of nuclear superpowers had kept a delicate balance since WWII with the global awareness of mutually assured destruction (MAD). The growing list of the nations in the possession and capable of production of nuclear weapons increases the risk of the tactical regional confrontation. This concern is enhanced by the possible industrial, transportation, and clandestine disasters with the constant need of medical preparedness for the treatment of acute radiation disease, combined injury, and internal contamination with radioisotopes of fission or radioactive warfare.

Acute radiation syndrome (ARS) results from a total or partial body exposure to ionizing radiation depending on the dose and the time of exposure. It manifests in hematopoietic, gastrointestinal, cardiovascular, and central nervous system alterations, all enhanced by the combined thermal, infectious, or traumatic injury, with the specific prodromal, latent, and manifest illnesses from subclinical to lethal consequences.

Internal contamination is a result of exposure to over 40 radioisotopes of nuclear fission, medically significant due to their half life, corpuscular radiation, and organospecificity. The recent advent of the use of depleted uranium (DU) in the modern battlefield presents an indiscriminate somatic and genetic hazard of single isotope contamination in the radioactive warfare.

Twenty years of research by the Uranium Medical Research Center (UMRC) of human and environmental contamination verifies the impact of radioactive warfare. UMRC has been conducting the analysis of uranium isotopes ^{234}U, ^{235}U, ^{236}U, and ^{238}U in the military and civilian population of the Persian Gulf Wars in Iraq, Afghanistan, and Gaza Strip. It includes the selective population of the Persian Gulf War I (Desert Storm), Gulf War II, Operation Iraqi Freedom (OIF), Operation Enduring Freedom in Afghanistan, and Operation Cast Lead in the Gaza Strip. The hypothesis of the inhalational pattern contamination with radioactive dust has been verified by the studies of internal contamination in the military and civilian populations in the areas of conflict. Symptomatology of the contaminated subjects includes debilitating fatigue, musculo-skeletal and joint pains, chronic headaches, neuropsychiatric and affect disorders, disorientation, confusion, visual impairment, gait disorders, lymphadenopathies, respiratory insufficiency, urinary tract disorders, impotence, and loss of memory.

The chemical toxicity of uranium and its carcinogenic properties have been recognized for over two centuries. The extensive animal experiments and the studies in humans are

conclusive about nephrotoxicity of uranium compounds. Radiation toxicity of uranium isotopes has been known for over 110 years with verified somatic, reproductive, mutagenic, and carcinogenic effects.

Methodology of the research has been conducted by the analysis of the contamination in the areas of conflict and the inhalation of radioactive dust. The urine samples were collected in the standard control conditions. The environmental impact of uranium isotopes was assessed by the analysis of water and soil of the areas of conflict. The quantitative analysis of the four isotopes of uranium was performed in the specialized radiochemistry laboratories in North America and Europe. Mass spectrometry of the samples was performed by the co-precipitation of preconcentrated urine, the isotope purification by ion-exchange chromatography, and Thermo Finnigan Neptune Multi-Collector (ICPMS). The samples of soil and water were analyzed by ion-exchange chromatography (ICP-MS) methodology.

The internal contamination with depleted uranium was initially detected in the urine samples of 27 British, Canadian, and United States Gulf War veterans exposed to radioactive dust. Uranium isotopes significantly different from natural uranium (^{236}U) were also identified in the autopsy samples of the liver, lung, kidney, and bone of a Canadian veteran. Northern Iraq symptomatic civilians from Baghdad as well as Nasiriyah and Basra were positive for DU contamination. The soil samples from the same areas were also DU positive. In addition, there was a presence of ^{236}U, the isotope not present in nature.

The results of the population of Afghanistan demonstrated concentration of uranium isotopes in the urine from 22 male subjects of Nangarhar-Jalalabad and Kabul regions, with the total uranium concentration of over 100 times higher than the global average. The urine analysis of civilians of eastern Afghanistan (Bibi Mahro region) had total uranium level up to 200 times higher than the global standard. Seven samples from Kabul region contained ^{236}U. The soil samples from the bombed area showed uranium levels of three times higher concentration than the world average. The civilians of Kabul and Jalalabad had elevated total uranium in urine. Water samples from the same area also contained elevated uranium concentration with trace amounts of DU.

The recent military conflict in Gaza Strip was analyzed in the urine samples of civilians from Jabaliya, Beit Lahia, Rafah, and Gaza City. The urine samples were analyzed at radiochemical laboratories at the Harwell Science Centre, England, by the method of HS-GWI with anticipated inconclusive results. Research by more accurate methodology of inductively

coupled plasma mass spectrometry is currently planned depending on the fiscal resources for the continuing studies.

The external acute exposure to whole body radiation in the nuclear warfare includes standard procedures of emergency management of infectious and immune system disorders, treatment of life-threatening hemorrhage and shock, and both external and internal decontamination. The treatment is based on the clinical symptoms, laboratory evaluation, and estimated radiation dose. In patients irradiated with supra-lethal doses, the therapeutic modalities include the control of hemorrhage and combined injury with the management of pancytopenia and bone marrow transplantation. Local radiation injury may require surgical intervention (radiation gangrene). Radiation emergency response teams preparedness warrant adequate response team drills with training in the use of radioprotectants and chelating agents for internal contamination. Radioactive warfare as a recent advent of the modern CBRN battlefield presents a concern not only to the healthcare, but to the very viability of the biosphere.