Depleted Uranium on Radioactive Battlefields
- The Risk of Proliferation of Nuclear Materials for Radiological Dispersal Devices (RDDs)

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Introduction

Radiological dispersal devices (RDDs) used in a terrorist scenario in a densely populated urban area are a major current security concern (1), especially after threats of this kind have been repeatedly mediated by terrorist groups or evidence preparing for it was found (2). Any kind of nuclear proliferation is therefore a major concern and draws attention not only to the illegal trafficking of nuclear material, but also to nuclear material left on today's radioactive battlefields (3).

Uranium Legacy on Radioactive Battlefields

Modern weapon systems containing depleted uranium (DU) were used in Gulf War I, Iraq, Afghanistan, the Balkans and more recently in Libya and Syria. It is estimated, for example, that 350 tons of depleted uranium were dispersed during Gulf War I, 1700 tons during the Gulf War II, 1000 tons in the Balkan war and a total estimated radioactivity of 1.3 x 10^14 Bq compared to 1.9 x 10^18 Bq for the Chernobyl nuclear disaster. Significant trace amounts of uranium have been found in the environment on or near battlefields of Iraq and Afghanistan after its dispersion (4). Uranium penetrators and shrapnel have been spread on the surface or deposited in the ground in areas of military conflict. Buried penetrators were detected by metal detectors and dug up for research purposes, in for example, Kosovo (5).

Depleted Uranium

Once mined, uranium ore is refined into concentrated packets of almost pure uranium metal. It is this highly concentrated "natural" uranium which is processed to produce enriched uranium. The enrichment process increases the isotope 235U concentration to create uranium which is more easily fissionable for use in nuclear weapons and reactors. This process also creates depleted uranium (DU) as a byproduct. DU is pyrophoric, consists of approximately 99.79% 238U, and is depleted in 235U with only ca. 0.21%. In the course of one year, 1 milligram of uranium emits 390 million alpha particles or missed the target. These can be located with metal detectors and dug up to be deposited in a safer, controlled environment.

Health Effects

The internal contamination of veterans from the Gulf wars and civilian populations of the battlefields has been proven (6,7,8,9) but also denied (10,11). Contamination levels correlate with negative health effects due to its chemical, radiological and genotoxicity after inhalation (12,13,14) with a high carcinogenic risk as research has shown (15). Low level radiation concentrated in the lung and uranium particles deposited in the cells or cell tissue, for example, poses a much higher level of radiation (16) due to a high impact of the very kinetic energy of alpha particles exceeding the amount required to damage important macromolecules such as DNA, RNA, enzymes and proteins. The breaking of molecular bonds and chemical reactions alter or destroy the shape, organization, and function of these molecules. A variety of other isotopes such as trace amounts above normal levels of the man-made 239U and even plutonium were found in urine samples of soldiers, soil, water and in buried penetrators, in Kosovo (17), for example. Some research (18) vehemently denies the adverse health effects of the inhalation of uranium dust (19). Medical health effects of uranium were first studied in 1825 at the University of Tübingen, Germany, and since then has been very well documented by the scientific community for almost 200 years through numerous experiments with animals and medical assessments of contaminated humans starting with sick uranium miners (20). Further more, a growing body of independent international research keeps providing further evidence of its chemical and radiological genotoxicity based on latest research findings (21,22,23,24), which underline the potential public health hazards of an RDD in a civilian terrorist scenario containing radioactive isotopes such as uranium.

Uranium penetrators, Shrapnel and Dust

Upon impact 10-30% or more of the material may aerosolize into fine particles, posing a respiratory threat. Some penetrators are buried in the ground if they passed through or missed the target. These can be located with metal detectors and dug up to be deposited in a safer, controlled environment.

Hundreds of tons of uranium metals in the form of penetrators or shrapnel either are still buried in the areas of former battles or have already gradually found their way into the scrap metal market where it can be acquired for cash and is being circulated.

Conclusion

The clean-up procedure and sequestration of uranium metals will contribute to a safer environment by reducing availability of radioactive dispersal devices. Renewed attention to this issue is warranted.

References