ICBUW
International Coalition to Ban Uranium Weapons

A Critical Review of

Review of the Toxicologic and Radiologic Risks to Military Personnel from Exposures to Depleted Uranium During and After Combat

Committee on Toxicologic and Radiologic Effects from Exposure to Depleted Uranium During and After Combat
Committee on Toxicology, The National Research Council
The National Academies Press, Washington, DC, 2008
www.nap.edu

The National Defense Authorization Act of 2007 signed into law by President Bush in October of 2006, contained legislation pertaining to depleted uranium. Section 716 called for a comprehensive study of the health effects of depleted uranium (DU) due to the use of DU weapons, to be completed within a year. The U.S. Department of Defense asked the National Research Council to oversee this project and the result was **The Review of Toxicologic and Radiologic Risks to Military Personnel from Exposure to Depleted Uranium During and After Combat** published by the National Academies of Sciences in 2008.

Included in this book is a 20-page evaluation of the **Capstone Report**; the Department of Defense asked the National Research Council (NRC) to do an independent review of the Capstone Study, a $1 million study of DU aerosols created from the firing of 120 mm DU shells at Abrams Tanks and Bradley Fighting Vehicles – in general one shell was fired at one tank or Bradley Fighting Vehicle per session. However, tanks may receive "multiple perforations" in battle[1]. Six members of the U.S. Army assisted in the preparation of the NRC Report.

The report leaves out over two dozen recent peer-reviewed articles, mostly indicating potentially harmful effects of DU. Specifically, the 2007 book, **Depleted Uranium: Properties, Uses and Consequences**[2], edited by Dr. Alexandra C. Miller of the Armed Forces Radiobiology Research Institute and her paper, "Leukemic transformation of hematopoietic cells in mice internally exposed to depleted uranium", **Mol. Cel. Biochem 279**, 97-104, 2005 are not listed among the references. Miller's research on leukemic mice is not discussed in the **NRC Report.**

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[1] Committee on Toxicologic and Radiologic Effects from Exposure to Depleted Uranium During and After Combat, **Review of the Toxicologic and Radiologic Risks to Military Personnel from Exposures to Depleted Uranium During and After Combat**, Washington, DU: National Academies Press, 2008,(Herein referred to as the **NRC Report**), p. 122.

[2] Alexandra C. Miller (editor), **Depleted Uranium, Properties, Uses and Consequences**, Boca Raton: CRC Press, 2007.

The **NRC Report** mentions the bystander effect but does not define it.[3] The bystander effect allows cells near targeted cells to become equally affected by the radiation that impacts the targeted cells. It may increase radiation risk.

At the end of a chapter on toxic uranium effects on organ systems, the Committee states that they do not recommend "additional studies of the hematopologic (blood-forming) or hepatotoxic (pertaining to the liver) effects of DU."[4] Research on blood-forming tissues and organs could show whether or not DU causes leukemia or lymphoma. Detoxification is an important function of the liver. Results of a recent study[5] on the liver's ability to detoxify drugs suggested that DU could alter drug metabolism in the liver during drug treatment and possibly cause hepatic toxicity.

Some of the conclusions drawn by scientists in several studies suggested that DU exposure could lead to cancer or autoimmune diseases[6] were not dealt with in the **NRC Report,** although other findings of these papers were discussed.

Studies by the Baltimore Veterans Medical Center on Gulf War veterans with embedded DU shrapnel and veterans who had also been exposed to DU, are frequently discussed in this report. The researchers reported that mutations of the HPRT gene in peripheral blood lymphocytes were statistically significant, i.e. higher, in the veterans in the high urinary uranium group compared to the low urinary uranium group. Interpretation of this finding was difficult because the statistical difference was between two exposed groups rather than between an exposed group and a non-exposed group.[7]

The summary of the chapter on the kidney touches on several indications of transient kidney abnormalities. Earlier in the chapter, the Committee stated, "The question of whether uranium exposure can cause chronic or irreversible renal disease is still open".[8] Also in the chapter, the authors mention that retinol-binding protein which when elevated indicates that the kidney is stressed, had shown increases in the urine of Gulf War veterans in two surveillance studies,[9] in 2001 and 2003 but not in 2005.

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[3] **Ibid**, p. 67
[4] **Ibid**, p. 65.
[5] M. Souidi et al., "*In vivo* effects of chronic contamination with depleted uranium on CYP3A and associated nuclear receptors PXR and CAR in the rat", **Toxicology 214**, 1-2, 113-122, 15 October 2005, doi:10.1016/j.tox.2005.06.006
[6] Wendy J. Hartsock et al., "Uranyl Acetate as a Direct Inhibitor of DNA-Binding Proteins", **Chem. Res. Toxicol. 20:** 284-798, 2007, p.787 and Bin Wan et al., "*In Vitro* Immune Toxicity of Depleted Uranium: Effects on Murine Macrophages, CD4+T Cells, and Gene Expression Profiles", **Environmental Health Perspectives 114**(1): 85-91, 2006, p. 85 (abstract).
[7] **The NRC Report**, p. 94.
[8] **Ibid**, p. 31.
[9] **Ibid**, p. 37.

In a short chapter on toxic effects of uranium on the lungs, the Committee concluded that acute lung injury is not a result of acute exposure to low concentrations of insoluble uranium compounds although chronic exposure to naturally occurring uranium dioxide dust is capable of producing pulmonary fibrosis".[10] Nevertheless, in the summary to the book, the Committee stated, "Evidence on the risk of cancer or other chronic diseases after exposure to DU in Gulf War soldiers is inadequate. Epidemiologic evidence indicates a very low risk of cancer in people exposed to uranium. However, the possibility of a radiation-induced cancer caused by inhalation or insoluble DU particles cannot be ruled out, given that alpha particles are emitted by DU".[11]

The **Capstone Report** determined that exposure to DU aerosol or re-suspended DU dust did not lead to renal disease. The Committee cited research that transient renal effects had been found at renal concentrations as low as 1 microgram per gram. The Committee stated that this finding would invalidate some of the guidelines for renal effects developed by the U.S. Army for the Capstone study. In addition, the Committee asserted that there was insufficient data to back up the Army's guidelines.[12]

As far as cancer risk assessments estimated by Capstone, their risk assessments were based solely upon alpha radiation risk.[13] The Committee found that "the radiation dose estimates are within U.S. radiation standards for occupational exposure.[14] However, Capstone may have underestimated the cancer mortality risks. It did not take internal beta radiation into account[15] or radiation from nano-particles which give off approximately a 36 times higher does than the same mass in one particle.[16]

The Committee also asserted that Capstone had not taken DU's chemical toxicity into account as potentially carcinogenic which would again increase the overall risk assessment for lung cancer.

The NRC Report does not indicate that DU weapons do real harm but it does indicate in a number of places, that there should be further investigation into the extent to which DU weapons may be harmful. However it will not lead the reader to call for a ban on the use of DU weapons.

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[10] **Ibid**, p. 47.
[11] **Ibid**, pp. 4,5.
[12] **Ibid**, p. 111.
[13] **Ibid**, p. 115
[14] **Ibid.**
[15] See Dr. Ian Fairlie, "Some Aspects of DU Risks", ICBUW Workshop, United Nations, Geneva, April 2, 2008. Available at http://www.bandepleteduranium.org/en/docs/43.pdf.
[16] This is because the material makes contact with about 3.6 times as much tissue. Source here is personal communication from Dr. Rosalie Bertell. Nano-particles are indirectly mentioned on pp. 98 and 100 in **The NRC Report.**