Presentation

Some comments on the health effects of Depleted Uranium Weapons

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Introduction

I am a physician from Japan and have some experience in the medical care of the survivors of the Atomic bomb attacks in Hiroshima and Nagasaki, and now I am studying the genetic effects of radiation. As a member of the ICBUW Science Team, I would like to make some comments on the health effects of depleted uranium (DU) weapons.

During my presentation I will discuss the following six points:
1. DU weapons cause a new type of toxic exposure and contamination
2. Time latency of late health effects after exposure to DU
3. The considerable amount of basic scientific evidence that suggests that the possible health effects of DU exist
4. DU weapons issues should be discussed based on the Precautionary Principle
5. The serious contradictions and omissions in the previous reports from the WHO
6. Our recommendations for the reports to the UN Secretary General

DU weapons cause a new type of toxic exposure and contamination

The pictures[1, 2] show very tiny particles of DU oxide. These were created at temperatures in excess of 3000^{o}C that resulted from the impact of a DU shell on a tank. They can also be produced during the manufacture of DU weapons. We have never had uranium particle compounds of this kind in history, before the production and use of DU weapons began. [ppt.1]

They are unique, first of all, because of the small size of the particles. According to a French study, most of the particles created by the attack are around 1 micron or nano-level in size, much smaller than one thousandth of 1 mm.[3]

In addition, they are unique not just because of their size but also because they are a mixture of oxides of other metals such as Ni, Al and Fe, which are part of the DU aerosol. These metals, amongst others, originally found in the structure of the tank are sublimated at the point of impact of shells on the tank's structure, due to the very high temperatures that occur when the shells hit the tank. The metals or metal alloys around the penetrating holes thus become part of the DU aerosol. These alloys may contribute to the toxicity of the DU.[4]

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[1] V. Chazel et al., Characteristic, Biokinetics, and Biological Effects of Depleted Uranium Used in Weapons and the French Nuclear Industry, Chapter 2, p.28, DEPLETED URANIUM: Properties, Uses, and Health Consequences, Edited by A.C.Miller, CRC Press, Taylor and Francis Group, 2007.
[2] Randall R. Parrish et al., "Depleted uranium contamination by inhalation exposure and its detection after approximately 20 years: implications for human health assessment", Science of the Total Environment, 2007 October 30.
[3] Footnote 1, p.27
[4] Ibid, p.27

Nano-particles of this kind can be easily inhaled and because of their small size may enter the circulation of body fluids directly. They may even enter cells and directly, or indirectly, affect intra-cellular systems including DNA, through the radioactive and chemical toxicity of uranium.[5]

The black smoke in this picture may contain huge amounts of fine particles of uranium oxide. This DU dust can easily spread over the battlefield and can be re-suspended by winds, spreading over civilian areas, sometimes even crossing international borders. [ppt.2]

So, when we think about the health effects of DU weapons, we should realize clearly that we are now facing an entirely new type of contamination to humans and the environment through these weapons. It is true that uranium is ubiquitous in the natural environment. However, the contamination and exposure from the use of DU weapons cannot be a simple analogue of these previous experiences.

Time latency of late health effects

Another important problem, which I would like to mention, is the time lag between exposure and detection of some obvious health effects. It is a common phenomenon for most toxic substances and factors including radiation.

As for acute health effects, we can detect them quite clearly immediately after exposure or at the very least within a few months. They are usually caused by a very high dose exposure.

However, in the case of DU weapons, the main problems for the affected populations are late health effects. For the late health effects, such as cancer and other chronic diseases, it usually takes more than several years and it may take decades before researchers detect statistically significant increases in these diseases through follow-up studies of large populations. Additionally, it is still quite difficult to conduct a full-scale epidemiological study in the affected areas such as in Iraq, particularly because of the present security problems.

So, the question is: ***Is it right to continue to produce and use DU weapons, until we have statistically significant data among the exposed population?***
As you know, DU weapons have been used repeatedly, with the excuse that “no definitive conclusions have been reached” on their health effects. I would like to ask you, distinguished diplomats from various countries, to consider this question seriously.

There is a considerable amount of basic scientific evidence to suggest that the adverse health effects of DU exist

We do not as yet understand the full impact of fine particles of DU oxide on the human body. However, there is a considerable amount of basic scientific evidence from both animal and cellular studies that suggests that there are deleterious effects on human health from inhaled DU particles, through both radiological action and chemical toxicity, as well as possible synergistic effects from the radioactivity and chemical toxicity of DU combined.

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[5] G. Oberdorster, et al., Nanotoxicology: An emerging discipline evolving from studies of ultrafine particles, Environ. Health Perspect. 113 (7), 823-829, 2005.

The data clearly indicate that the internalized uranium can cause not only lung and kidney damage, but also neurological disorders,[6] immune disorders,[7] DNA damage[8] and chromosomal aberration,[9] cancer,[10,11] effects on the gestation process and fetuses[12] and so on. I cannot discuss each of them in much detail today, but we can provide you all with a list of related peer-reviewed papers including the most up-to-date ones, if you would like them.

Experiments show that internalized DU is carcinogenic [ppt.3]
This is one example of the cellular and animal experiments that have taken place. Dr. Miller, and her group at the Armed Forces Radiobiology Research Institute in the US, demonstrated that exposure to DU compounds transformed normal human cells into a malignant phenotype, which grew into hard tumors when they were transplanted into mice.[13]

The graph shows that the transformation rate of human experimental cells is positively related to both chemical dose and radiological activity respectively.[14]

They also reported that internalized DU could be carcinogenic through causing leukemia in laboratory mice.[15]

Evidence of DNA damage from the chemical toxicity of uranium [ppt.4]
This is one of the results from research done by Professor Stearns and her colleagues at Northern Arizona University. These pictures show evidence of DNA damage through the chemical toxicity of uranium. This cell to the right was treated with Uranium and the comet-like tail is composed of the damaged fragments of DNA.[16,17]

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[6] C. Bussy, et al., Chronic ingestion of uranyl nitrate perturbs acetylcholinesterase activity and monoamine metabolism in male rat brain, Neurotoxicology, 27 (2): 245-52, 2006.
[7] B. Wan, et al., In Vitro Immune Toxicity of Depleted Uranium: Effects on Murine Macrophages, CD4+ T Cells, and Gene Expression Profiles, Environ Health Perspect. 114 (1): 85-91, 2006.
[8] Diane M. Stearns et al., "Uranyl acetate induces *hprt* mutations and uranium-DNA adducts in Chinese hamster ovary EM9 cells", Mutagenesis 20(6), 417-423, 2005.
[9] A.C. Miller, et al., Observation of radiation-specific damage in human cells exposed to depleted uranium: dicentric frequency and neoplastic transformation as endpoints, Radiat. Prot. Dosimetry, 99(1-4), 275-278, 2002.
[10] F.F. Hahn, et al., Implanted depleted uranium fragments cause soft tissue sarcomas in the muscles of rats, Envron. Health Perspect. 110, 51-59, 2002.
[11] A.C. Miller, Leukemic transformation of hematopoetic cells in mice internally exposed to depleted uranium, Mol Cell Biochem 279 (1-2): 97-104, 2005.
[12] J.L. Domingo, Reproductive and developmental toxicity of natural and depleted uranium: a review, Reproductive Toxicology 15: 603-609, 2001.
[13] D.E. McClain and A.C. Miller, Depleted Uranium Biological Effects: Introduction and Early In Vitro and In Vivo Studies, Chapter 1, p.5, DEPLETED URANIUM: Properties, Uses, and Health Consequences, Edited by A.C.Miller, CRC Press, Taylor and Francis Group, 2007.
[14] A.C. Miller, et al., Potential late health effects of the heavy metals, depleted uranium and tungsten, used in armor piercing munitions: comparison of neoplastic transformation and genotoxicity using the known carcinogen nickel. Mil. Med. 167: 120-122, 2002.
[15] Footnote 11.
[16] D.M. Stearns, et al., Uranyl acetate induces *hprt* mutations and uranium-DNA adducts in Chinese hamster ovary EM9 cells, Mutagenesis 20(6), 417-423, 2005.
[17] The pictures can be seen on this site:
http://nacrp.web.arizona.edu/research/StearnsLantzGenotoxicity.htm

Chromosomal aberrations in veterans claiming exposure to DU [ppt.5]

We also have data from a pilot study, which shows a high incidence of chromosome aberrations specific to radiation exposure in the peripheral lymphocytes of UK veterans of the Gulf and Balkan Wars. This study suggests that the veterans may have been exposed to internal radiation from DU particulates.[18]

DU weapons issues should be discussed based on the *Precautionary Principle*

We do not have scientifically reliable epidemiological evidence, which can clearly prove the health effects of DU weapons. However, the existing peer-reviewed data is a warning to us that we should take concrete measures, even without fully understanding every process and causal relationship between the use of uranium weapons and damage to human health and the ecosystem, before it is too late. The issue of DU weapons should be discussed seriously based on the 'precautionary principle'. The burden of proof should be placed on the users, the military and governments, if they continue to insist that “DU is safe”.

Some serious contradictions and omissions in the previous reports from the WHO

Unfortunately, previous reports from a number of governmental bodies and international organizations, including the WHO, have not yet fully acknowledged and referenced the scientific studies referred to above.

The WHO wrote a monograph on DU, its source, exposure and health effects, in 2001,[19] together with some related short reports up to 2003.[20]

It is good, at least to some extent, that the report dealt with environmental contamination in areas where DU munitions were used and recommended monitoring of DU contamination and possible decontamination operations, and that it included warnings about young children’s possible ingestion of contaminated soil.

However, the reports from the WHO have some serious contradictions and omissions.

-They did not consider the unique aspects of DU nano-particles or the mixture of DU particles with several other toxic metals in the DU aerosol as created through the use of DU weapons.

-They mainly focus on the radiological toxicity to the lungs and the chemical toxicity to the kidneys, which came from the study of uranium miners and nuclear industry workers.

-They did not fully reference the most up-to-date peer-reviewed papers from 2001.

- Although they realized its importance, they have not yet fully assessed the risk to

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[18] H. Schroder et al., Chromosome aberration analysis in peripheral lymphocytes of Gulf War and Balkans War veterans, Radiat. Prot. Dosimetry, 103(3), 211-219, 2003.
[19] WHO, Department of Protection of Human Environment, Depleted uranium: Sources, Exposure and Health Effects, Geneva, April 2001.
[20] The most recent fact sheet on DU was devised 2003, which is available at: http://www.who.int/mediacentre/factsheets/fs257/en/

children or pregnant women, who may be more sensitive to DU contamination.[21,22]

-They have estimated radiation doses using the model of the ICRP, the International Commission on Radiological Protection, and have accepted the risks based on the International Basic Safety Standards (BSS). However, this idea of risk assessment is based on the "risk-benefit theory", which can never apply to the risk assessment of weapons. In the case of DU weapons, the affected people will never enjoy the benefit from them.

-They did recognize that there were still uncertainties in the assessment of the health effects of DU. However, they did not consider the "precautionary principle" in making their recommendations regarding the need to avoid any further contamination and deleterious health effects of DU, which could result from the continuous use of DU weapons.
They stated that "the general screening or monitoring for possible DU related health effects in the populations in the affected areas is not necessary." Such an attitude is in complete contradiction to the basic task of the WHO, which is to protect the public from environmental hazards and to prevent disease.

It is not right to rely on those previous reports, without considering these contradictions and omissions.

Our recommendations for the reports to the UN Secretary General

We would like to recommend, to delegations from UN member states, that they consider the following issues when making their reports to the UN Secretary General.

- First of all, we suggest that you refer to the results of the basic scientific research on the effects of DU.
We are ready to provide you with all the necessary information including the most up-to-date peer-reviewed papers.

- As for the epidemiological data, it might still be difficult to show scientifically reliable data, but there are some useful reports about affected populations.[23,24] It is also important to listen to the testimonies of local doctors, who have been taking care of patients, because they can sometimes be the first witnesses of the health problems in their communities, even before researchers develop "statistically significant data".

-And, please make firm recommendations based on the "precautionary principle" to prevent the possible health and environmental effects. These might include immediate clearance of contaminated remnants, monitoring of the environment and the health of people, and (hopefully) a proposal to refrain from further use of these weapons.

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[21] Foonote 19, p. 30
[22] A. Makhijani et al., "Science for the Vulnerable: Setting Radiation and Multiple Exposure Environmental Health Standards to Protect Those Most at Risk", Institute for Energy and Environmental Research (IEER), October 19, 2006. (http://www.ieer.org)
[23] K.S. Squibb and M.A. McDiarmid, Depleted uranium exposure and health effects in Gulf War veternans, Phil. Trans. R. Soc. B 361: 639-648, 2006. [This report shows some suggestive evidence of health effects including a change in an early marker of renal damage and chromosomal aberration, especially in the soldiers with DU embedded fragments.]
[24] O.S. Habib, J.K. Al-Ali, et al., Cancer Registration in Basrah 2005: Preliminary Results, Asian Pacific Journal of Cancer Prevention, Vol.8, 187-190, 2007.

Our work today is critical to prevent further contamination

I also would like to introduce a statement from physicians concerning the use of DU weapons. The statement was recently released at a workshop at the IPPNW (International Physicians for the Prevention of Nuclear War) World Congress in India in March of this year.[25] Many medical specialists in the world support it. IPPNW is a past recipient of the Nobel Peace Prize. I am also a member of IPPNW.

'Whether or not we can prevent further contamination of this planet and protect people from the possible hazardous health effects of DU weapons is dependent on our work.'

Anyone who takes this work seriously would urge implementation of these recommendations, based on sound scientific research and the precautionary principle.

[25] Statement from the workshop: Health Hazards of Use of Depleted Uranium in Wars, *18th World Congress of IPPNW, March 10, 2008, in Delhi, India.*