COMMENTARY & OPINION

Depleted Uranium Weapons and Acute Post-War Health Effects: An IPPNW Assessment

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The US-led military coalition that fought the 1991 Gulf War is reported to have used about 300 tons of ammunition containing depleted uranium (DU) against Iraqi tanks and other armored vehicles. During the 1999 war in the Balkans, NATO forces used about 11 tons of DU in missiles that were fired into the former Yugoslavia.[1] DU weapons have military utility because the density and tensile strength of uranium (which is relatively cheap and abundant) give it unusual armor-piercing capabilities. Concerns about the potential health effects of DU weapons arise primarily from immediate and long term uranium contamination in the areas where they are used. On penetration, for example, about 20% of the DU burns spontaneously, creating a fine aerosol smoke of uranium oxide that can be easily inhaled and lodge itself in the lungs. Fragments of DU weapons are scattered around battlefields, and can become embedded as shrapnel in human and animal flesh.

In the months and years following both of these armed conflicts, a large number of soldiers, UN peacekeepers, and civilians have exhibited unexpected and unexplained health problems, including excess leukemias and other cancers, neurological disorders, birth defects, and a constellation of symptoms loosely gathered under the rubric "Gulf War Illnesses." Depleted uranium, because of its radioactivity and chemical toxicity, has been linked to these acute health effects in the press and in public forums. Some opponents of DU weapons have categorically asserted that exposure to depleted uranium is the direct cause of these excess cancers. US and NATO officials, citing the published research on the health effects of uranium, have dismissed DU as a potential cause of the acute health effects for which it has been blamed.

IPPNW deplores the use of depleted uranium weapons and supports the calls in the European Union and elsewhere for a ban on their use. We urge caution, however, in making categorical assertions or denials about health effects until systematic, independent, peer-reviewed studies of depleted uranium exposure have been conducted. The US government and NATO have an absolute obligation to provide independent, unbiased researchers with the funding, data, and access required to conduct such studies. The World Health Organization (WHO) has requested $2 million as an immediate payment toward a four-year $20 million clinical study of DU health effects in Iraq and the Balkans. The US and NATO have an obligation to promptly and unconditionally fund the WHO's work in this area.

While the peer-reviewed studies of health effects from natural uranium exposure are weighted against the probability that DU exposure, in and of itself, is likely to have caused an increase in leukemias or other cancers in the relatively short time since it has been dispersed in the Balkans environment,

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the science is controversial and the possibility cannot be ruled out. The Office of the Special Assistant for Gulf War Illnesses, which reports to the US Department of Defense, has itself stated that DU can pose a chemical toxicity and radiological hazard under specific conditions.[2] Moreover, any impurities that may have found their way into the DU munitions used in either the Gulf or the Balkans—including plutonium, actinides, and the highly radioactive manufactured isotope U-236[3]—pose unquestionably serious health threats, and the extent to which at-risk populations may have been exposed to these substances must be studied promptly and thoroughly by unbiased investigators.

Allied soldiers and Iraqi soldiers and civilians were exposed to many other health hazards before, during, and after the Gulf War. These included multiple vaccines, insecticides, and chemical weapon protectives. Any chemical weapons released as a result of the bombing of Iraqi munitions-dumps would be an additional hazard (as would chemical weapon residues from the prior Iran-Iraq war). The petrochemical fires that raged for weeks at the conclusion of the war added to the toxic burden. In the former Yugoslavia, chemical factories were targeted and destroyed during NATO air strikes, and large amounts of toxic chemicals, some of them known carcinogens, were released. Risk factors can interact (e.g., smoking compounds the risk of radiation exposure among uranium miners).

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The *British Medical Journal*, in a recent editorial, concluded that "the argument for uranium being the cause of leukaemia in peacekeeping forces is thin, notwithstanding the short latencies implied, even by the standards of haematological malignancies," and that, with regard to non-cancer illnesses, "no single candidate hazard...serves as its unifying explanation, depleted uranium included."[4] To point to these other exposures as possible contributors to post-war health problems is not to exonerate DU weapons in the absence of independent clinical study of the populations that were actually exposed.

Depleted Uranium: The Facts in Brief

Natural uranium is composed of three isotopes: U-238 (99.3%), U-235 (0.7%), and U-234 (0.006%). These isotopes decay at different rates, expressed in scientific parlance as half lives. A shorter half life means more intense radiation and, in general, greater potential to damage or destroy cells. The half life of U-238—the time in which its radioactivity is reduced by half—is 4.5 billion years; that of U-235 is 710 million years; and that of U-234 is 250 thousand years. For comparison, the half life of plutonium—which can be lethal in even microscopic amounts—is 24,000 years.[5]

Depleted uranium is the byproduct of a process known as uranium enrichment—the manufacture of uranium with a concentration of highly radioactive U-235 for use in nuclear weapons and in nuclear power plants. DU, which has been depleted of its U-235 and U-234, is about 60% as radioactive as natural uranium. Most of that radiation—about 95%—is emitted as alpha particles that cannot penetrate the skin. A minute amount of beta and gamma radiation could strike deeper cell tissue were fine particles of DU inhaled or ingested, as they could easily be by any soldier or civilian in the vicinity of a recently exploded DU shell. Even low doses of low-level radiation can cause some damage to the DNA in living cells. Whether that damage is enough to significantly increase the risk of cancer and other acute health effects is a matter of much debate, and up until now there has been no conclusive evidence of adverse health effects from exposure to natural uranium. We cannot emphasize strongly enough, however, that an absence of evidence about health effects is not evidence that there are no health effects.

DU is no different from natural uranium in its chemical toxicity. It is a heavy metal that, in its soluble form, accumulates in the kidneys (the primary target organ for uranium) and that, in sufficient quantities, can increase the risk of renal damage. The scientific evidence to date suggests that ingestion of uranium, even in unusual amounts, does not by itself cause serious or enduring health problems due to chemical toxicity. Nevertheless, like all heavy metals, DU is a risk factor that cannot be casually dismissed.

Uranium Health Studies

Studies conducted over several decades have found that populations with well-above-average occupational exposure to inhaled or ingested uranium do not suffer from increased rates of the cancers most likely to be associated with radiation, nor do they exhibit the blood disorders that might be expected as a result of chemical toxicity. Other causes, such as radon exposure among uranium miners and mill workers, have been pinpointed for certain specific illnesses,[6,7] but these studies do not account for new experimental data suggesting a role for dust toxicity in the lung. The aerosol particles generated by DU weapons are in a very hard "ceramic" state, so are likely to be retained in the lung

and its regional lymph nodes for a prolonged period, increasing the risk of cellular damage from alpha radiation. The main risk from internal radiation, whether the exposure is due to manufacturing processes or DU weapons, is from this inhaled dust.

As mentioned earlier, there is evidence that the DU munitions used in the Gulf war and in the Balkans were tainted with plutonium, U-236, and other substances far more intensely radioactive than U-238. Recent studies have pointed to the possiblility of genetic damage resulting from exposure to some forms of radiation emitted from particles such as those deposited by DU weapons.[8] Any such genomic effect, if substantiated, could point toward increased risk of cancer or leukemia in the lung or regional lymph nodes above the standard—and controversial—predictions of radiation protection models.[9] It is simply too early to say. Precisely for that reason, the health of military and civilian populations that have been exposed to DU in the Gulf and in the Balkans should be monitored closely in the years ahead.

What Should Be Done About DU Weapons?

While IPPNW generally concurs with the BMJ's assessment that the jury is still out on DU, and that the other hazards to which civilians and military personnel were exposed, individually and in combination, are themselves very likely causes of the kinds of post-war health problems from which civilians and military personnel have been suffering in the aftermath of these conflicts, we condemn the use of DU weapons and support the calls for a ban on their use.

A basic principle in radiation protection is that all exposures should be justified; that is, the benefit for those exposed should exceed the risk. This is the standard for medical radiography. The military utility of DU weapons for the users does not justify any added health risk for non-combatants, no matter how small. The precautionary principle states that in the absence of convincing proof that a substance or process is harmless, the presumption must be risk. This principle applies clearly to the use of DU weapons. Furthermore, DU weapons indiscriminately contaminate the places in which they are used, and the contamination persists long after the conclusion of hostilities, adding to the radioactive and toxic burden imposed upon civilians, wildlife, and ecosystems. From this perspective, DU weapons should be considered a form of ecological warfare prohibited by the Geneva Conventions.[10]

DU weapons may already be illegal under international law and international humanitarian law, and this case is being made in compelling fashion by members of the International Association of Lawyers Against Nuclear Arms (IALANA), who have formed a working group to study this issue. The damage caused by DU weapons cannot be contained to "legal" fields of battle; they continue to act after the conclusion of hostilities; they are inhumane because they place the health of non-combatants, including children and future generations, at risk; and they cannot be used without unduly damaging the natural environment.[11]

The fact that military authorities in both the US and NATO advise their own soldiers to take precautions when handling DU munitions and have prepared detailed training manuals and videos to ensure troop safety.[12] while issuing blanket denials of health risks to the public, strikes us as hypocritical at the very least, and reinforces our judgment that these weapons should be withdrawn from service.

Whether or not DU weapons are ultimately shown to have the health effects for which they have been blamed, they are only one example of the continuing ways in which militaries pollute our planet. They are emblematic of the unacceptable costs of contemporary armed conflict to civilian populations, who were the predominant casualties of war in the 20th century, and are likely to remain so in the 21st. They are on the spectrum of indiscriminate and inhumane weapons that includes landmines and biological and chemical weapons, and that, at its most devastating end, includes tens of thousands of nuclear weapons that jeopardize all life on Earth.

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Depleted Uranium: Some Other Perspectives

DU Not A High Priority for Antinuclear Movement

Two years ago, members of antinuclear-weapons groups began to ask our views about the alarm raised by the International Action Center in its book, *Metal of Dishonor*, about the use of depleted uranium (DU) penetrators in anti-armor munitions.[1] We were asked whether the hazard was so great that activists should give priority to banning DU.

We read *Metal of Dishonor* and found that, despite the contributions of physicists and radiation-effects analysts, it contained no quantitative risk estimate. We therefore decided to provide the best one we could, using information available in the literature about the health effects of uranium and ionizing radiation.

We concluded that, except for soldiers in vehicles when they are struck, or individuals who crawl around inside such vehicles without adequate respiratory protection for extended periods of time later on, the health effects of DU are likely to be very small. The radiation effects would be well below those of natural background radiation and the chemical effects would be well below the thresholds for known toxic effects.[2] Contaminated armored vehicles and pieces of depleted uranium, however, are potential hazards and should be cleaned up or buried—something which was not done in most cases after Desert Storm and is only being done now in Kosovo.

IPPNW's statement does not disagree with our conclusion—nor similar conclusions that have been arrived at by every peer-reviewed study of which we are aware. It argues, however, for a ban on the use of DU on the basis that "the military utility of DU weapons for the users does not justify any added health risk for non-combatants, no matter how small." Of course, no weapon would pass such a test. The IPPNW statement is therefore not helpful in answering the question: "How important is this issue relative to all the others confronting the anti-nuclear-weapons movement?"

The IPPNW statement urges that "the health of military and civilian populations that have been exposed to DU in the Gulf and in the Balkans should be monitored closely in the years ahead." In our view, this would be useful only for populations for which there is quantitative evidence of significant DU exposure. The best evidence is obtainable through urine tests. It is not too late to conduct such measurements for soldiers or civilians who believe they have been exposed to DU in the Balkans. Samples collected from 171 Germans before and after their service in Kosovo showed no increase in uranium concentration.[3] There is no justification for a full-scale epidemiological study of such a population.

The IPPNW statement also raises the issue "that the DU munitions used in the Gulf war and in the Balkans were tainted with plutonium, U-236, and other substances far more intensely radioactive than U-238." Here again, a quantitative perspective would be useful. The dose from inhaled DU contaminated with 1 part per million (ppm) plutonium or 0.3% U-236 would be about 50% greater than the dose from an equal amount of uncontaminated DU. The maximum contamination measurements that we have seen are about an order of magnitude lower than these levels; concentrations measured in samples of DU metal used for tank armor are several orders of magnitude lower.†[4]

In summary, the IPPNW statement pro-

† An Oak Ridge study found that the highest ratios of U-236/U-235 and Pu-239/U-238 in the solid "heels" left in containers of the enriched uranium hexafluoride produced by the Paducah enrichment plant, where uranium from US plutonium-production reactors was enriched, correspond respectively to 0.01% U-236 and 0.1 ppm Pu-239 in DU containing 0.2% U-235.

vides no basis to change our conclusions:

1) The health risks from DU are not great enough to make efforts to ban its use a high priority for the anti-nuclear-weapons movement; but

2) DU-contaminated vehicles and pieces of DU on the battlefield should nevertheless be removed or buried to minimize exposure to those who subsequently may live in or visit the area.

—Steve Fetter, PhD,
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Depleted Uranium and the Geneva Conventions

The statement on depleted uranium by the executive committee of IPPNW is balanced and useful. I have difficulties, however, with the statement that the use of DU weapons should be considered "a form of ecological warfare prohibited by the Geneva Conventions." Article 55 of Protocol I to the Geneva Conventions (1977) prohibits "the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population."

I have not found reliable evidence for the assumption that the areas contaminated with DU will be unsuitable for human habitation or agriculture because of the radioactivity. The increase in background radiation to which the population will be subject is negligible. The remaining weapons containing DU are more of a concern. Children are likely to play in the abandoned tanks containing substantial amounts of DU in the form of fine hard dust, and may collect shells and fragments containing of DU. The tanks and ammunition should be collected and removed.

Like lead, uranium is taken up and circulated in the ecosystems to a very limited degree. The chemical toxicity of the heavy metal uranium is somewhat similar to that of lead. In many countries children have suffered brain damage after eating lead in flaking paint in houses. While uranium in artillery shells is much harder than lead and the chances of ingestion are smaller, chemical toxicity is a consideration.

A careful study has been published on 29 US soldiers who were exposed to "friendly fire" that destroyed 15 US tanks in the Gulf war, and who were examined seven years later.[1] These servicemen carry DU in their bodies as dust or as fragments in amounts much larger than can be expected for the civilian population. Despite this, the increase in radioactivity in their bodies was far below the level contributed by the background. Very sensitive indicators of kidney damage were normal. In one of several tests for cognitive function there was some degree of dysfunction.

Physicians are on safe ground when we demand that DU should not be used in weapons until its possible chemical and physical toxicity is better known. We have, however, no evidence that DU is causing environmental danger of a type and degree covered by the Geneva Conventions.

—Gunnar Westberg, MD
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