

The Case for an Immediate Ban on the Military Use of Depleted Uranium

Presented by Damacio A. Lopez, Director, International Depleted Uranium Study Team (IDUST) at a meeting of the European Parliament in Brussels, Belgium, on June 10, 2003.
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Introduction

The International Depleted Uranium Study Team (IDUST) is a non-governmental organization (NGO) of international researchers, activists and scientists dedicated to stopping the use of Depleted Uranium U-238 (DU) in military weapons and in commercial products. Our focus is to increase public awareness and understanding of both the problems associated with DU in weapons and in commercial products and the need to enforce existing international humanitarian and human rights law that prohibit the use of DU in military weapons. Through our global education campaign and advocacy group networking, we believe we can achieve the elimination of this highly toxic and radioactive material that is being used across the globe.

My name is Damacio Lopez, and I am the director of IDUST. An automobile accident in 1985 forced me to abandon my career as a professional golfer and to spend several months in recovery back in my hometown of Socorro, New Mexico, USA. While there, my convalescence was frequently disturbed by tremendous explosions taking place less than three kilometers from my parents' home. After each explosion, a black cloud of smoke would rise and come over our home and over the small town of Socorro. I began to research what was causing that black cloud of smoke. It turned out to be open air testing of weaponry containing depleted uranium, or DU. And that discovery is what brings me here to speak with you. I will address some of the historical, political, legal and health issues concerning the use of DU in weaponry. Of course, the use of DU in commercial products contains the same elements of urgency.

Depleted Uranium (DU)

Depleted uranium is the radioactive and highly toxic waste product that remains after natural uranium metal has been put through the "enrichment" process. Natural uranium metal contains only 0.71% of the fissionable uranium U-235 isotope that is necessary for nuclear reactor fuel and for nuclear bombs. This concentration is too low for its effective use in either application. The enrichment process divides the metal into two groups, concentrating the U-235 isotope in one and depleting it in the other. The first batch is called "enriched uranium" and is sent off to be used by the military and nuclear industries. The second batch, in which

the U-235 isotope has been depleted to a concentration of 0.25%, is called “depleted uranium”, or DU. It is composed of 99.75% of the uranium U-238 isotope and still maintains 60% of the radioactivity found in the natural uranium metal. Over the past 55 years, over 500,000,000 kilograms of DU waste have been accumulated at nuclear processing facilities and nuclear power plants in the United States,

along with 52,000,000 kilograms of reprocessed nuclear reactor waste.

Although by itself DU emits only alpha and gamma radiation (which is similar to X-rays), over a period of a few weeks radioactive decay products build up and permanently contaminate the DU. These short-lived decay products, thorium Th-234 and protactinium Pa-234, each decay through emission of beta and gamma radiation. Thus for each alpha particle emitted from a sample of DU, two beta particles and three gamma ray photons are also emitted. The significance of this fact will become apparent in the section below that discusses the various health risks involved with exposure to DU.

Of additional significance is the confirmed fact that DU munitions contain depleted uranium obtained from “reprocessing” plants, not just enrichment facilities. When spent nuclear fuel is removed from nuclear reactors, where it has undergone years of neutron bombardment, it is sent to a reprocessing facility where such elements as plutonium, americium, and neptunium are extracted. Minute quantities of these highly toxic, non-natural radioactive materials, along with the non-naturally occurring uranium isotope U-236 (which occurs only inside a nuclear reactor), remain as contaminants. Numerous medical scientists have found traces of U-236 in the urine of veterans of the 1991 Gulf War ten years after the conflict. Thus what is being called “depleted uranium” nowadays might better be referred to as “Polluted DU”

Military Use of DU

DU is one of the densest elements known, being 1.75 times as dense as lead. This fact alone makes it an attractive substance for use in armor plating for tanks and for projectiles designed to penetrate heavy armor. In addition, DU is a pyrophoric metal. Thus when a projectile made of DU strikes a heavily armored tank, the force of impact causes the DU to ignite and burn at such intense temperature that the projectile literally melts its way through the armor. Once inside the tank, the burning metal typically ignites fuel or armaments and creates a secondary explosion that destroys the tank and kills the crew.

In the process of this conflagration, sub-microscopic particles of uranium oxide ceramics are produced, creating an aerosol of radioactive particles that are smaller than 5 microns in diameter. Studies have shown that between 10% and 75% of the DU in the penetrator can be converted to these minute particles. Particles smaller than 5 microns can become permanently lodged deep within the lungs when inhaled. And because these uranium oxide ceramics have very low solubility, they remain in the body for decades.

Other weapons in which DU may be found include cruise missiles, both as counterweights for control surfaces and as penetrator warheads, and in the so-called “bunker buster” bombs that gained notoriety in Afghanistan and in the “Shock and Awe” campaign against Baghdad in 2003. The US government and others maintain that the purpose for using DU is to pierce armor and other uses involving its heavy metal and pyrophoric qualities. However, DU has a dual use because it does in fact poison personnel and civilian populations alike.

DU penetrators were used extensively in the First Gulf War in 1991. The U.S. Department of Defense has acknowledged that 320 tons of DU munitions were expended, whereas the nuclear research foundation LAKA, of Holland, estimates that the total amount of DU used in Iraq and Kuwait exceeded 800 tons. The International Committee of Radiological Protection estimates that enough DU was used "to cause 500,000 potential deaths, if it were inhaled."

DU munitions were also used by the U.S. and U.K. in Kosovo and Bosnia. There is evidence that they may have been used in Afghanistan. They have definitely been used in the recent invasion of Iraq by the U.S. and U.K. forces. And unless effective international action is taken, more devastating weapons such as mini-nukes will follow.

Unfortunately, if the past is any guide, local civilian populations are unlikely to be warned when DU weapons are used even if DU contaminates their food or water supplies. Prior to the Gulf War, the US army was aware of the potential for DU contamination to cause health problems among civilian populations. Yet the Department of Defense did nothing to warn the inhabitants of Kuwait, Saudi Arabia and Iraq about DU contamination of their air, soil and water. Rather, US army reports expressed more concern about public outcry and future restrictions on the use of DU weapons than about contaminating lands at home and abroad and poisoning soldiers and civilians.

These weapons have also been tested since the 1970's at domestic firing ranges and bombing sites in many countries including the United States, United Kingdom, Japan and Puerto Rico to name a few. Every time DU has been used it has left contamination and human suffering.

Historical Perspective

The first use of uranium in munitions occurred in World War II. Albert Speer, author of *Inside the Third Reich* and former Nazi Munitions Minister, makes this statement concerning the shortage of ammunition material in Nazi Germany and the subsequent use of their uranium stock as solid-core ammunition: "In the summer of 1943, wolframite imports from Portugal were cut off, which created a critical situation for the production of solid-core ammunition. I thereupon ordered the use of uranium cores for this type of ammunition." For the first time in history, solid-core ammunition made of radioactive material was used in military combat.

Also in 1943, the US War Department proposed research into the "Use of Radioactive Material as a Military Weapon" to General L.R. Grove who headed the Manhattan Project in Los Alamos, New Mexico. One of the possible military uses of radioactive materials against enemy personnel would be as a gas warfare agent. The material would be ground into particles of microscopic size and would be distributed in the form of dust or smoke by ground-fired projectiles, land vehicles, airplanes, or aerial bombs. In this form, it would be inhaled by personnel. It could also be dissolved in liquid. In 1990 the U.S. Army Foreign Service and Technology Center warned of the possibility that, "conventional explosives could be used by threat force to disseminate radioactive materials (e.g., from reactor waste or radium and radioactive isotopes of cesium and cobalt from radiotherapy sources) on the battlefield."

Secret human radiation experiments began in 1944 to better understand the effects of radiation weapons on human health and the environment; experiments involving intentional environmental releases of radiation were designed to test human health effects of ionizing

radiation. The experiments continued until 1974. The US government deliberately dropped radioactive materials from planes or released it on the ground in New Mexico and other states. In 1947 a secret memo from the US Atomic Energy Commission had this self-incriminating statement about medical experiments on human subjects: "It is desired that no document be released which refers to experiments with humans and might have adverse affects on public opinion or result in legal suits. Documents covering such work field should be classified 'secret.'"

In the 1970's weapons containing depleted uranium began to be tested and developed on firing ranges and bombing sites across the US by the military and their civilian defense contractors. One such test site is Socorro, New Mexico, home to the New Mexico Institute of Mining and Technology, a publicly supported state university, where DU open-air testing began in 1972. The DU work is carried out by one of the school's divisions, the Energetic Materials Research and Technology Center (EMRTC), formerly known as the Terminal Effects Research and Analysis Group (TERA). Military and private defense contractors also test DU there. This test site is at the top of Socorro Mountain, from which water wells supply drinking water for the city of Socorro. Socorro's 8,000-member community is less than three kilometer downgrade and downwind from the test site. An unusual number of hydrocephalus cases appeared during the 1980s in Socorro. Three of New Mexico's 19 cases of hydrocephalus recorded between 1984 and 1988 occurred in tiny Socorro; during that same period a large increase in cancer mortality was also observed.

DU penetrator manufacturing sites in the U.S. have also had their share of problems from wide-spread contamination and resulting elevated incidence of cancer. The National Lead site in Colonie, New York was ultimately closed completely after DU was detected some 25 miles downwind from the plant. The plant near Concord, Massachusetts is now an Environmental Protection Agency Superfund Site, consuming millions of dollars for cleanup. The Jonesborough, Kentucky plant has also exhibited higher than normal cancer rates among its employees.

The Impact of DU's Radiation on Health

Is there any evidence that these radiation weapons have caused negative health effects to soldiers and civilians? In the United States over 250,000 veterans returning from the 1991 Gulf War have reported to Veterans' Hospitals asking for help in what has become known as the Gulf War Syndrome. Over 8,000 of these veterans have died. 206,000 of the 697,000 veterans of the Gulf War have filed claims for veterans' benefits based on service-related injuries and illnesses, over 159,000 have been granted disability payment. Many NATO troops stationed in Kosovo and Bosnia have become ill and dozens have died in what is being called the Balkan Syndrome.

In Iraq over 1.5 million soldiers and civilians have died of unnatural causes since the 1991 Gulf War, one-third of them children under the age of 5. Leukemia, cancer, birth defects and rare diseases have increased at an alarming rate in this country. Studies conducted by Iraqi scientists have found higher levels than that permitted by international standards for U-238 and its products in drinking water of various city water supplies and in the Tigris River. Vegetables, fish and meat in southern Iraq are showing levels of radiation contamination as well. In the US, officials have conducted studies that clearly show that DU enters the food chain and contaminates water. DU has a half-life of 4.5 billion years. If not cleaned up, it will thus continue to harm all forms of life in contaminated areas till the end of time.

What indications do we have that these illnesses are related to DU? Some understanding of how DU emissions may harm human health can be drawn from existing knowledge of how radiation in general affects human health. Dr. Marvin Resnikoff, a noted American particle physicist, writes: "When inhaled, uranium increases the probability of lung cancer. When ingested, uranium concentrates in the bone. Within the bone, it increases the probability of bone cancer, or, in bone marrow, leukemia. Uranium also resides in the soft tissue, including the gonads, increasing the probability of genetic health effects, including birth defects and spontaneous abortions."

A 1995 article in the prestigious *International Journal of Occupational Medicine and Toxicology* included this information on DU health hazards in the First Gulf War: "Depleted uranium particles can be inhaled easily in smoke resulting from the impact of armor-piercing projectiles on hard targets and the aerosolization of uranium into small particles. If even one small particle (less than five microns in diameter, 5-millionths of a meter, the size of cigarette ash) is trapped in the lungs, surrounding tissues can be exposed up to 272 times the maximum permitted dose for workers in the radiation industry."

In January, 2003, the European Committee on Radiation Risk (ECRR) released their first report, "Health Effects of Ionizing Radiation Exposure at Low Doses for Protection Purposes", Chris Busby, editor. The 46 scientists who collaborated in the preparation of this report affirm through well-documented research the considerably higher risks to human health that are associated with exposure to ionizing radiation from a radioactive particle embedded within living tissue. The "linear/no-threshold" model that is currently used by governmental organizations to define exposure limits is shown to be wholly inadequate for these cases.

The Impact of DU's Chemical Toxicity on Health

In addition to presenting a radiation hazard, DU is also a highly toxic substance. As with most heavy metals, it can disrupt the normal operation of many proteins that are essential for normal body functioning. For example, uranium's interference with renal proteins in the kidneys has been known for many years and has been widely documented. In 2002, the Royal Society (UK) issued a report stating that it could be possible for tank crews sustaining "friendly fire" from a DU penetrator could absorb enough DU into their bodies to experience complete kidney failure within two days.

Also in 2002, researchers in Durham, North Carolina (USA) discovered that exposure to uranium (as uranyl acetate) produced sensorimotor deficits in rats. Interesting that lethargy is one of the common symptoms reported by 1991 Gulf War veterans. Some researchers have recently come to suspect that chemical toxicity and radiation work synergistically to enhance the devastation caused by internal exposure to DU.

Alexandra C. Miller, et alia, of the Armed Forces Radiobiology Research Institute, in Bethesda, Maryland, USA, demonstrated another avenue of chemical toxicity with DU, namely its effectiveness as a catalyst for destructive chemical reactions. Her in-vitro studies showed that DU at pH 7 can induce oxidative DNA damage through catalytic interaction with a cellular oxygen species, suggesting that in a living cell, DU can induce carcinogenic lesions through its chemical toxicity alone.

John F. Kalinich, also of the Armed Forces Radiobiology Research Institute, found that in-vitro treatment of mouse a macrophage cell line with depleted uranium (as uranyl chloride)

resulted within 24 hours in observable events associated with apoptosis (cell death), including morphological changes and DNA fragmentation.

Jose L. Domingo, of the "Rovira i Virgili" University in Reus, Spain, reported in *Reproductive Toxicology* in 2001 a detailed literature review covering research that demonstrated that uranium is a developmental toxicant when given orally or subcutaneously (SC) to mice. Decreased fertility, embryo/fetal toxicity including teratogenicity, and reduced growth of the offspring have been observed following uranium exposure at different gestation periods. Data on the toxic effects of depleted uranium on reproduction and development were also reviewed.

Inhaled uranium oxide particles have been shown to reside in the lungs for decades, causing chronic exposure of surrounding lung tissue to low-level but continuous radiation dose. During this time, the particles dissolve very slowly into the bloodstream, from which molecules of uranium oxides can then be deposited in bone tissue, gonads and lymphatic tissue. Thus it is not surprising that inhaled DU can ultimately be responsible for leukemia, sexual disorders, and genetic abnormalities in a victim's offspring.

The facts, are straightforward. DU is an anti-personnel weapon that is designed to cause superfluous injury and unnecessary suffering. If we do not act soon to ban the use of DU in weapons, humans yet unborn are going to pay a fearsome price. Radiation from DU will affect the human gene pool, bequeathing to our descendants countless inherited defects.

The Cover Up

The Pentagon, NATO, and the British Ministry of Defense have always downplayed the danger of DU, saying it was "less radioactive than uranium ore", pointing out that natural uranium is part of our environment and accounts for a certain level of background radiation to which we are exposed day in and day out. The tacit and totally unproven assumption behind this statement is that background radiation is harmless. However, lung cancer, leukemia, lymphomas and birth defects have been with us since the dawn of time. We have no idea what risk factors (i.e. deaths per 100,000 from a particular cancer or disease) are associated with background radiation. Could they be as high as 500 deaths per 100,000 per year (0.5%)? If so, can we justify adding 50 more deaths per 100,000 by intentionally increasing the radiation to which we are all exposed by "only" 10%? The data for making these decisions is simply not available.

Another specious argument is that, due to the density of uranium oxide aerosol particles, they cannot travel more than a few tens of meters from the site of impact where they were created. However, DU particles were regularly detected in instruments 25 miles downwind of a DU penetrator fabrication facility in Colonie, New York. Radiation detectors in Greece and Bulgaria showed a spike in readings in the days following DU use in Kosovo. Though extremely dense, these fine particles can easily acquire a static charge and become attached to ambient dust particles and hitch-hike great distances. The effective perimeter of concern for DU contamination is much, much greater than military sources would like us to believe. The exposed civilians from even limited engagements must therefore number in the millions.

One might wonder why the military is so anxious to downplay the great risks associated with DU. It is true that anti-tank penetrators made of DU are remarkably effective. It is also true that armor plate made of DU is virtually impenetrable except when struck by a DU penetrator.

And finally, because of the great stockpile of DU, as a raw material it is available to manufacturers at virtually no cost, so it is cheap.

There may be other reasons as well. First, DU munitions have become a major commodity in the world's arms trade (see below), and arms manufacturers and dealers are powerful lobbies in many of the world's nations. Second, an admission now that DU is indeed a hazardous material and its use seriously contaminates both the environment and civilian populations could result in astronomical financial liabilities. Who should be responsible for the cleanup of battlefields and testing sites where DU has been used? Who should be responsible for medical treatment and health care of hundreds of thousands of civilians suffering from exposure to DU? And finally, what legal liability in terms of international war crimes might such an admission incur?

Worldwide Proliferation

The U.S. is not alone in making DU weapons. The United Kingdom, Russia, Turkey, Saudi Arabia, Pakistan, Thailand, Israel, France and others have followed the U.S. lead in developing DU-containing weapon systems for their inventories and selling them in the world's arms market. Legislation in the U.S. made it permissible to sell the M-833 or comparable anti-tank shells containing DU penetrators to these NATO countries: Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey and the United Kingdom. Major non-NATO allies included were Australia, Egypt, Israel, Japan, Korea and Taiwan.

How is it possible that these illegal weapons can be sold in the world's arms market? The U.S. International Security and Development Cooperative Act of 1980 states that DU may be sold upon a finding that an export of uranium depleted in the isotope U-235 is incorporated in defense articles or commodities solely to take advantage of the high density or pyrophoric characteristics unrelated to its radioactivity. Such exports shall be exempt from the provisions of the Atomic Energy Act of 1954 and from the Nuclear Non-proliferation Act of 1978. The U.S. is subverting these laws by simply saying that they are not using the uranium for its radiation effects, which are poisonous. But DU is a dual use weapon. Once in the environment, it is inevitable that it will poison personnel through inhalation and ingestion, causing illness and, in some cases, a lingering death.

International Law and DU

The United Nations Sub-commission on Human Rights in its 1996 session condemned weaponry containing depleted uranium as a weapon of mass destruction and indiscriminate use, both against members of the armed forces and against civilian populations. The Commission spoke of these weapons not only as resulting in death, misery and disability, but also as being incompatible with existing norms. The Sub-commission was also concerned about the long-term consequences on human life and the environment following use of DU on the battlefield.

In a 1996 advisory opinion, the International Court of Justice affirmed that under Humanitarian Law, "States must never use weapons that are incapable of distinguishing between civilian and military targets." The use of weapons containing DU violates Humanitarian Law, which prohibits indiscriminate or willful killing. Willful killing is a grave breach (war crime) under the "grave breach" article in each of the four Geneva Conventions.

Regarding Protocol Additional I: Articles 51 and 52 prohibit targeting the civilian population or engaging in military operations likely to have indiscriminate and undue effect on the civilian population. Article 85 makes violations of Articles 51 and 52 grave breaches (war crimes).

The UN Sub-commission on Prevention of Discrimination and Protection of Minorities is preparing a report on weapons containing DU. This report was originally to be completed in 1998 but the Rapporteur assigned to present the report was absent. The report was again scheduled for presentation in 1999, 2000, and 2001 and in each case the Rapporteur assigned the responsibility of presenting the report was either absent or not prepared. In 2002, Sik Yuen was scheduled to submit the report. He was subsequently voted off the Sub-commission and was not re-elected to the Sub-commission as a result of intensive lobbying by the U.S. and U.K. However, to the consternation of the U.S., he submitted his report anyway. And the 2002 Sub-commission voted to have him do a follow-up (due 2003) in spite of the fact that he was no longer on the Sub-commission. The report is now due at the August 2003 session with Justice Sik Yuen from Mauritius as Special Rapporteur.

DU Cleanup

Can battlefields and test ranges be cleaned? To clean up contaminated soil would require the removal of up to 12 inches of the top soil in Iraq and Kuwait that has hundreds of square miles contaminated with DU. This could easily cost tens of billions of dollars. To clean the water and air would be impossible. Last summer the New York Times reported on a DU clean-up effort in a tiny cove in Montenegro where the US fired 88 rounds of DU bullets on the last day of the Kosovo war (no one knows why). The Montenegro government, without any help from the US or NATO, has closed several acres and is trying to decontaminate the area. Wearing protective gear, several workers are sweeping the area for radioactivity, removing and packaging for storage huge amounts of contaminated soil. The effort will take years. All this because of 88 rounds of DU bullets, a trifle compared to the tons of DU used in Iraq and Kuwait. In the state of Indiana, it is estimated that it will cost between four and five billion dollars to clean up 500 acres at the recently closed Jefferson Proving Ground, where an estimated 152,000 pounds of DU has been used in tests over the years.

Conclusions and Recommendations

The controversy over DU use pits military interests against the health of citizens and soldiers around the world. The military's decision to use DU in spite of its obvious health risks displays a blatant disregard for human life and well being, and will create long-term financial consequences for producers, users, and victims of DU alike. By virtue of the world's huge stockpile of DU, it is clearly the world's largest radioactive waste problem. The use of DU in bullets, tank armor on battlefields, and DU test ranges throughout the world proliferates radioactive waste globally, endangering the health of soldiers and civilians alike.

The use of DU weapons places an unacceptable and excessive risk on human health and the environment. We must move quickly to implement the recommendations below to stop this senseless tragedy.

Recommendations

1. Establish and enforce an international agreement that bans the military use of DU in all its forms, including its use in bombs, cruise missiles, munitions and armor.
2. Require that all nations involved in the production, testing and/or use of DU munitions mitigate the environmental impact of their activities by conducting a full-scale and thorough cleanup of all sites and battlefields contaminated by their use of DU.
3. Encourage all governments to review their regulations and policies relating to the handling and disposal of radioactive waste materials and to establish appropriate cleanup procedures of sites contaminated with DU and other radioactive substances. These policies should include assurances that all personnel, whether civilian or military, working around DU be given adequate education and issued appropriate radiation protection to minimize possible health risks from radiation exposure.
4. Conduct full-scale, independent epidemiological studies of military personnel and their families, of war veterans and their families, and of civilians who have been exposed to DU, with the goal of determining more precisely the toxic and radiological effects of exposure to DU as well as the combined effects. Family studies should include examination for evidence of infertility, miscarriage, and birth abnormalities due to exposure to DU. Civilians to be included in these studies should include populations located near battlefields where DU munitions were used and civilian personnel living at or near DU manufacturing facilities and DU munitions test sites.
5. Establish a peer review committee of leading radiation health experts from the civilian sector that would act as a "Citizens Watchdog Authority" over all governmental and military studies conducted in compliance with recommendation #4 above. Such a peer review committee could ensure that appropriate rules of research are applied, that the studies are free from bias, and that they fully account for the latency of the radiological health effects of DU in the human body. The studies should be conducted over the life span of each affected person.

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