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A Treatise on Military Weapons Containing the Radioactive Material: Depleted Uranium

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ABSTRACT

A look at the historical, legal, health and political issues surrounding the use of radioactive waste in military weapon**.** The United States (U.S.) and many other countries use the radioactive metal uranium-238, so-called "depleted uranium," or DU, in military weapons systems, such as armor-piercing bullets, casings for bombs, shielding on tanks, counterweights and penetrators on missiles, and in cluster bombs, anti-personnel mines, and other anti-personnel weapons called dirty bombs. Beside uranium-238, DU also contains reprocessed nuclear reactor waste which is itself highly toxic and radioactive.

Introduction
by Marilyn Gayle Hoff

Atomic secrecy has corrupted American democracy. The rationale for this corroding secrecy has always been national security, the need to keep powerful information from falling into the hands of the current U.S. enemy. Nuclear scientists even today regard the level Q top secret security clearance as a badge of honor, even while it signifies a determination not to spill the truth.

But now secrecy has mutated into an instrument of self-preservation, not for the security of the nation but for the profits of the nuclear industry. The hoarding of secrets has evolved into the telling of lies. And the deception is being perpetrated not on the enemies of the U.S. but on its tax-paying citizens, whose contributions finance U.S. atomic atrocities and line the coffers of nuclear profiteers.

The reason for this secrecy and deception has also changed. The nuclear industry's greatest fear is no longer of an "enemy." It fears instead that the truth about the environmental and health effects of radiation, if fully conveyed to the American people, will result in the collapse of the nuclear

industry with its obscene profits. It especially fears what will happen when the American public learns the truth about depleted uranium (DU) munitions.

To keep the American public and the world in the dark, U.S. officials and nuclear industrialists repeatedly and strategically misrepresent depleted uranium's deadly impact on nature and humanity. They claim that DU is too feebly radioactive to be harmful to life. They claim that DU cannot be considered a poison, because their weaponry exploits only its hardness and its readiness to catch fire and not its radioactivity or its heavy metal toxicity. They emphasize that DU is "depleted," since a tiny fraction of a more radioactive isotope has been removed. They claim that their only source of DU is mined uranium minus that fissionable isotope. They ignore how easily radioactive dust can be inhaled and claim that DU radiation cannot reach the bone marrow to cause leukemia, because it cannot penetrate the skin. They keep the medical records of sick Gulf War veterans locked in secrecy, and they suggest that the "Gulf War Syndrome" is a figment of the imaginations of over **8,000** dead and 250,000 sick veterans.

Out of many half-truths, they have constructed one huge, deliberate lie, because they know and they have always known the extreme danger of DU. They care more about continuing to exploit its destructive potential than about protecting their own citizens, their soldiers, and the entire world of living things from its devastating effects. In "A Treatise on Military Weapons Containing the Radioactive Material: Depleted Uranium," Dr. Albrecht Schott, Damacio A. Lopez, and John M. LaForge have a horrifying truth to tell.

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Treatise on Depleted Uranium

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ABSTRACT
A look at the historical, legal, health and political issues surrounding the use of radioactive waste in military weapon.

Background

The United States (U.S.) and many other countries use the radioactive metal uranium-238, so-called "depleted uranium," or DU, in military weapons systems, such as armor-piercing bullets, casings for bombs, shielding on tanks, counterweights and penetrators on missiles, and in cluster bombs, anti-personnel mines, and other anti-personnel weapons called dirty bombs. Beside uranium-238, DU also contains reprocessed nuclear reactor waste which is itself highly toxic and radioactive.

Weapons containing DU are appealing to military planners because of their pyrophoric qualities, which cause them to friction-burn on impact. When a DU penetrator strikes a hard target, it burns and creates respirable-sized radioactive dust particles that contaminate surrounding soil, water, flora, and fauna, as well as the human body. Explosives also are used to disperse this radioactive dust that poisons people, inflicting illnesses, injuries, and sometimes a lingering death. DU is an immune system killer.

A recent report entitled "VA Confirms Massive 1991 Casualties" states that 206,861 of the 696,778 U.S. Gulf War veterans have filed claims for veterans' benefits based on service-connected injuries and illnesses; 159,238 have been granted benefits. Since the end of the Gulf War, over 8,000 returning veterans have died in what has become known as the Gulf War syndrome.[1],[2]

There is urgency as each new battle erupts. The possibility that DU will again be used is very real. According to recent statements of the Ministry of Defense, United Kingdom, DU weapons will be used again if necessary. History indicates that governments using DU weapons are unlikely to warn local civilian populations, despite evidence that DU contaminates food and water supplies, as we will show below. Prior to the Gulf War, the U.S. Army was aware that DU contamination had the potential to cause health problems among civilian populations. However, during and after the Gulf War, the U.S. 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, U.S. Army reports discussed below express more concern about public backlash and future restrictions on the use of DU weapons. Up to now, there have been no official reports confirming the use of DU in Afghanistan. It remains to be seen

whether a second U.S. invasion of Iraq will be followed by another epidemic of Gulf War Syndrome.

DU is radioactive waste from the reactor fuel and weapons-uranium refining process of natural uranium (U). “The average concentration of natural uranium in soil is about 2 ppm, which is equivalent to 2 g of uranium in 1000 kg of soil.”[3]

While natural uranium, a radioactive mineral, contains a small amount of the isotope U-235, nuclear reactors and nuclear bombs require greater concentrations of U-235 to sustain a chain reaction. The process to concentrate the U-235 is called enrichment, and the waste generated from this process is called depleted uranium (DU). DU is 40 percent less radioactive than natural uranium, and “typically contains about 99.8 percent U-238, 0.2 percent U-235, and 0.0006 percent U-234 by mass.”[4]

DU—the isotope U-238, a mostly low-level radioactive material—has a radioactive half-life of 4.5 billion years, and a uranium decay chain of daughter isotopes that emit alpha, beta, and gamma radiation. After 14 decays, the chain ends with stable lead-206. DU has accumulated in huge quantities since the dawn of the nuclear age. It is estimated that there are more than 2 million tons of DU in the world today. It is a highly toxic and radioactive waste that must be contained, monitored, and managed as such.

Managing DU in nuclear waste storage dumps would cost the U.S. Department of Energy billions of dollars. It is now provided free of charge to the military and to private industry. The U.S. Army Environmental Policy Institute says:

In addition to military weapons systems, DU is used commercially in medicine, aviation, space and petroleum exploration. Particular applications include radiation shielding for the medical field and industry; counterweight components of aircraft elevators, landing gear, rotor blades and radar antennae; ballast in satellites, missiles and other crafts; and drilling equipment used in petroleum exploration.[5]

From 1969 through 1984, the Boeing Aircraft Company used DU as counterweights on its Boeing 747 commercial aircraft, primarily on the upper rudder and on the horizontal stabilizer elevators. Each aircraft contains approximately 1,000 pounds of DU. In 1984, Boeing began using tungsten counterweights. Nevertheless, DU counterweights remain in place on approximately 550 Boeing 747 aircraft.[6]

When alloyed in military applications, DU is often used in armor penetrators. It has been used in Army systems for many years, and the Army has developed, tested, and fielded a number of weapons systems containing DU. The U.S. is not alone. The U.S. Army Environmental Policy Institute reports:

The United Kingdom, Russia, Turkey, Saudi Arabia, Pakistan, Thailand, Israel, France and others have developed or are developing DU-containing weapons systems for their inventories.

Additionally, DU munitions are sold in the world arms market.[7]

Indeed, Defense Trade News reported in 1992 that legislation in the U.S. made it permissible to sell the M-833 (or comparable anti-tank shells) containing DU penetrators, as well as individual 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.[8]

In 1994, President Bill Clinton signed a presidential order (1994 Export Financing and Related Programs Appropriation Act) providing export financing of DU to other governments. It reads:

I hereby determine that it is in the national security interest of the United States to allow funds provided in that Act or any other Act to be made available to facilitate the sale of the M-833 depleted uranium anti-tank ammunition to Bahrain and Saudi Arabia, and M-829 depleted uranium anti-tank ammunition to Saudi Arabia and Kuwait.[9]

How is it possible that DU can be sold on the world's arms market? This information comes from the U.S. International Security and Development Cooperation Act of 1980:

> … upon a finding that an export of uranium depleted in the isotope 235 is incorporated in defense articles or commodities solely to take advantage of the high density or pyrophoric characteristics unrelated to its radioactivity, such export shall be exempt from the provisions of the Atomic Energy Act of 1954 (42 U.S.C. 2001 et seq.) and of the Nuclear Non-Proliferation Act of 1978 (22 U.S.C. 3201 et seq.) when such exports are subject to the controls established under the Arms Export Control Act (22 U.S.C. 2751 et seq.) or the Export Administration Act of 1979 (50 App. U.S.C. 2401 et seq.).[10]

Health Hazards

There are severe health hazards associated with exposure, inhalation, or ingestion of DU. A 1995 article in the International Journal of Occupational Medicine and Toxicology included this information on DU health hazards in the 1991 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 5 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.[11]

As it decays, DU emits alpha, beta, and gamma radiation. An understanding of how DU's emissions may harm human health can be drawn from existing knowledge of how radiation in general causes health effects.[12] The Institute of Medicine explains radiation's health effects in its report, "Potential Radiation Exposure in Military Operations":

Ionization and other radiation-induced effects, such as excitation and free radical formation, cause chemical changes in components of the living cell, including chemicals, such as deoxyribonucleic acid (DNA), the genetic material that is located in the chromosomes within the cell nucleus. Alpha radiation colliding with atoms gives up its energy in a very short distance, such as the thinness of a piece of paper, less than the thickness of the skin, or a few centimeters of air. Consequently, alpha particles emitted by radioactive materials are not likely to be harmful when striking the outside of the human body that is protected by clothing and the outermost dead layer of skin. However, when the same alpha-emitting radionuclides are taken into the body their emission can directly irradiate nearby cells of tissue in which they are deposited and may cause cellular changes. Such changes may result in adverse health effects in the short and long term, depending on the nature of the changes.

In comparison to alpha radiation, fast-moving electrons, which are known as beta particles, have much smaller mass and electric charge, are more deeply penetrating, and dissipate their energy over a larger volume of tissue. Even high-energy beta particles, however, will transfer most of their energy and come to a stop within about 1-centimeter of plastic, 1 to 2 centimeters of tissue, or 4 to 5 meters of air. Therefore, beta particles that strike the outside of the body will penetrate only a short distance, but they may travel far enough to damage the actively dividing cells of the skin. Beta-emitting radionuclides may be found in contamination consisting of fission products from a nuclear detonation or resulting from the dispersion of nuclear reactor waste or radiotherapy sources. Gamma rays and x-rays, which are emitted from radionuclides as well as produced by machines, are the most penetrating form of ionizing radiation and consist of electromagnetic energy. While randomly colliding with electrons in the body along a scattered path length, gamma rays may give up all or part of their energy in the tissue or, although it is unlikely, they may pass all the way through the body, without interacting. Therefore exposure to gamma rays are most commonly encountered in the use of radiation-producing equipment used in medical applications (including those in combat medical facilities).[13]

Dr. Marvin Resnikoff, a noted particle physicist, writes:

> Once inhaled, fine uranium particles can lodge in the lung alveoli and reside there for the remainder of one's life. The dose due to uranium inhalation is cumulative. A percentage of inhaled particles may be coughed up, then swallowed and ingested. Smoking is an additional factor that needs to be taken into account. Since smoking destroys the cilia, particles caught in a smoker's bronchial passage cannot be expelled. Gofman estimates that smoking increases the radiation risk by a factor of 10.

Uranium emits an alpha particle, similar to a helium nucleus, with two electrons removed. Thus, alpha radiation is a heavy particle with a double positive charge. Though this type of radiation is not very penetrating, it causes tremendous tissue damage when internalized. When inhaled, uranium increases the probability of lung cancer. When ingested, uranium concentrates in the bones. Within the bone, it increases the probability of bone cancer, or, in the 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. The relationship between uranium inhaled or ingested and the resultant radiation doses to bone marrow and specific organs (dose conversion factors) are listed in numerous references.[14]

Shortly after the Gulf War, a report by the United Kingdom Atomic Energy Authority (UKAEA) expressed concern about DU contamination in Kuwait:

> It would be unwise for people to stay close to large quantities of DU for long periods and this would obviously be of concern to the local population if they collect this heavy metal and keep it. There will be specific areas in which many rounds will have been fired where localized contamination of vehicles and the soil may exceed permissible limits and these could be hazardous to both clean-up teams and the local population. Furthermore, if DU gets into the food chain or water then this will create potential health problems.[15]

A November 10, 1991 article in The Independent (London) reported on the potential health effects, considering the amount of DU used in projectiles during the Gulf War:

> The AEA said in April the best estimates were that the U.S. tanks fired 5,000 DU rounds, U.S. aircraft many tens of thousands of rounds, and British tanks "a small number." The tank ammunition alone would contain more than 50,000 pounds of DU?, enough radioactive material, on International Committee of Radiological Protection risk estimates, to cause 500,000 potential deaths, if it were inhaled, the report says.[16]

Radiation has an immediate weakening effect on the immune system of humans when it is inhaled or ingested, creating increased susceptibility to diseases and illnesses. After radioactive weapons were used in Iraq, the United Nations

imposed sanctions that prohibited medical supplies that might be considered dual use products. This left the Iraqi medical community without the proper medicine or medical equipment to treat sick patients exposed to ionizing radiation from U.S. weaponry. Illnesses such as leukemia only have a survival rate of nine percent in Iraq, compared to the usual survival rate, with proper medical treatment, of 70 percent.[17] Many diseases that were considered rare in Iraq before the war are now common and the mortality rate is extremely high for the treatable diseases. More than 1.5 million Iraqi people have died of unnatural causes since the 1991 Gulf War, over one-third of them children under the age of five. According to Iraqi health workers, many of these deaths have been attributed to leukemia, cancers, and rare childhood diseases. In bombing Iraq and Kuwait, the U.S. and Great Britain used more that 320 tons of DU in solid-core ammunition alone. How much additional DU was expended in warheads and other explosive methods is unknown outside the Pentagon.

Iraqi medical scientists have studied the health effects of DU in the Iraqi population. Dr. Selma A.H. Al-Taha, a geneticist, explains the results of ?her survey of clinic patients for a chromosomal study:

> In this study, those types of abnormalities that show increases are ambiguous genitalia, skeletal, chromosomal trisomies, anencephaly and hydrocephalus, and eye abnormalities. Such increases are perhaps due to the effects of depleted uranium used in manufacturing of shells that were thrown on Iraq. Other studies done in the post-war period have shown increases in skeletal malformation especially limb abnormalities as compared to results obtained from the pre-war period. Limb reduction abnormalities (phocomelia) have not been reported in the pre-war period studies, but this study as well as others (1994) have shown the occurrence of such cases in their results. Such abnormalities were originally reported in the early 1950s where some mothers consuming some sedatives and antiemetics (Thalidomide) delivered babies with phocomelia but such causes are no longer existing nowadays.[18]

Origins of the Dirty Bomb

How did it all begin? 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. My release of our uranium stocks of about twelve hundred metric tons showed that we no longer had any thoughts of producing atomic bombs.[19]

For the first time in history, solid-core ammunition made of radioactive material was used in military combat.

In a secret U.S. War Department memorandum dated October 30, 1943, Colonel K.D. Nichols sent to Brigadier General L.R. Groves a proposal for research into the "Use of Radioactive Materials as a Military Weapon." According to Nichols, the possible military uses of radioactive materials against enemy personnel would be:

> As a gas warfare instrument. The material would be ground into particles of microscopic size and would be distributed in the form of a dust or smoke or dissolved in liquid, by ground-fired projectiles, land vehicles, airplanes, or aerial bombs. In this form, it would be inhaled by personnel.[20]

The proposal also asked that the department "make theoretical studies pertaining to the methods, means and equipment for disseminating radioactive materials as a weapon of warfare."[21]

Ten years after World War II, the 280-mm howitzer nuclear projectile appeared in West Germany. S.T. Cohen, author of "Enhanced Radiation Warheads: Setting the Record Straight," in Strategic Review, comments on this nuclear warhead:

Although the Little Boy did not enter the war in Europe during World War II, less than ten years after Nazi Germany was defeated a very similar weapon made its debut in West Germany. This was in the form of a projectile for the U.S. Army's 280-mm howitzer. Designed as a battlefield weapon (albeit a cumbersome one), had it been employed to help blunt a Soviet-Warsaw Pact armored attack against NATO, for the above reasons it would have been essentially an antipersonnel device achieving its effects through prompt nuclear radiation. It is worth stressing that this warhead entered the arsenal approximately twenty-five years ago, at a time when the biological effects of radiation were sufficiently well understood to allow anyone to make the deduction that it was an antipersonnel weapon.[22]

Cohen goes on to say:

> … today's most effective conventional anti-tank weapons are designed to penetrate tank armor and produce effects which will kill or disable the tank crews. ... [T]he bulk of NATO's battlefield nuclear weapons (and perhaps also those of the Soviet Union) have their most extensive anti-tank effects in the form of nuclear radiation against tank crews.[23]

Cohen has been involved in nuclear weapons development, military applications, and policy matters since 1944. His experience includes the Manhattan Project at Los Alamos, New

Mexico, nuclear weapons planning with the U.S. Air Force, and nuclear policy consultation with the Office of Secretary of Defense. In 1958, he performed the study that led to the formation of the enhanced radiation warhead concept, which he describes in brief:

> During the last year, a major international debate has flared over the issue of development and deployment of enhanced radiation [ER] weapons. Misunderstanding has been rife with regard to the effects of these devices. Since the advent of nuclear weapons, a major emphasis has been on designing large-yield devices rather than "clean" low-yield and discriminating tactical nuclear weapons which could reduce unintended damage. ER weapons have the desirable advantage for NATO of making it possible to attack military targets without causing widespread structural damage. The outcry against ER tends to be based on erroneous assumptions and/or emotion. The addition of more discriminating weapons including ER weapons to the NATO arsenal will be a step towards a more credible tactical nuclear posture for the Alliance.[24]

Stephen M. Younger, ?associate director for nuclear weapons at Los Alamos National Laboratory, has called for so-called "lower yield" warheads to be combined with precision delivery systems. In "Nuclear Weapons in the Twenty-first Century," a piece he wrote for Los Alamos National Laboratory, June 27, 2000, he recommends "tailored output weapons that produce enhanced radiation for the destruction of chemical or biological weapons with minimum collateral damage."[25]

Human Radiation Experiments

To better understand the deadly effects of radiation weapons, the U.S. government did extensive experiments on human beings, as well as pigs and other animals. Between 1944 and May 1974, the government exposed U.S. citizens to radiation in a variety of biomedical experiments. The details, or in some cases even the existence of these experiments and deliberate radiation releases were not publicized. Many of the subjects, some of whom were from vulnerable populations such as children, the mentally ill, pregnant women, and the elderly, were not aware of the purposes and risks of being exposed to radiation. Experiments on individuals involving intentional exposure to ionizing radiation, and

> … experiments involving intentional environmental releases of radiation … (A) were designed to test human health effects of ionizing radiation; or (B) were designed to test the extent of human exposure to ionizing radiation.[26]

On October 21, 1994, the "Interim Report of the Advisory Committee on Human Radiation Experiment" was released. The committee was appointed by then President Clinton to investigate the intentional releases of radioactive materials into populated areas prior to 1963 and other human radiation experiments conducted throughout the United States. The committee's final report said, in part, "These releases were generally related to radiation warfare tests, the gathering of intelligence, and the development of instruments."[27] According to a report in the Albuquerque Tribune:

> The U.S. government deliberately dropped radioactive material from planes or released it on the ground in New Mexico and other states a dozen times after World War II. One radiation cloud was tracked 70 miles downwind from Los Alamos to Watrous.[28]

The tests released lanthanum-140, uranium, and strontium. The tests were part of a series of 250 open-air explosions conducted at the Los Alamos National Laboratory from 1944 to 1961 in Bayo Canyon. All 250 tests released radiation at levels far greater than would be allowed today.[29]

A secret 1947 memorandum from the U.S. Atomic Energy Commission signed by Colonel O.G. Haywood had this openly self-incriminating statement about medical experiments on human beings:

> It is desired that no document be released which refers to experiments with humans and might have adverse effects on public opinion or result in legal suits. Documents covering such field work should be classified "secret."[30]

In the 1950s, weapons containing DU began being tested, developed, manufactured, and stored across the U.S.[31] One such test site is Socorro, New Mexico, home to the New Mexico Institute of Mining and Technology (NMIMT), a publicly supported state university, where DU open-air testing began in 1972. The DU work is carried out by the school's Energetic Materials Research and Technology Center (EMRTC), formerly known as the Terminal Effects Research and Analysis (TERA) facility.

Among TERA's experience with gun-fire test programs are a variety of armor-penetrator experiments with different materials and designs, including a variety of heavy metals, pyrophoric metals, steel, copper, and other metals in such forms as flechettes, tubes, rods, and spheres. Experimental work has also included such programs as vulnerability studies of various types of munitions to gun-fired fragment impacts, proximity-fuse testing, tracer time studies, aerial bomb ricochet studies using gun-fired simulations, evaluation tests of prototype gun systems, and numerous tests of target vulnerability to different gun-fired projectiles.[32]

The EMRTC test site is atop Socorro Mountain, on whose slopes are located wells that supply drinking water for the city of Socorro. The 8,000-member

community is less then two miles 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 Socorro.[33]

A 1984 Uranium Traffic special report, "Uranium Bullets," had this to say about the deadliness of the DU bullets and the new flechette cartridge:

> DU bullets are soft enough that when they hit human flesh they spread out, thus entering at a tiny point but leaving a big hole on the other side. The military refers to this effect as an "explosive type wound." In order to enhance the damage done bullets have been made out of 2 cm. long needle-like darts or arrows, complete with fins, called flechettes. The flechettes curl over into a hook shape on impact, thus maximizing the explosive effects, and may have a split tip to further increase wounding power. They may be made out of steel, DU, or other metals. (Dr. M. Lunsden, "Anti-personnel Weapons," 1978, p. 299.) Flechettes are used in rockets and rifle and shotgun shells; flechette cartridges have been made for the American M-14 7.62mm rifle and the M-16 5.56mm rifle. This type of ammunition has also been made for pistols by a French manufacturer. (E. C. Ezell, "Small Arms of the World," 1977, p. 671.)[34]

DU-containing weapons continue to be manufactured, tested, and used on battlefields around the world today. The cost involved in removing the topsoil from contaminated areas could be astronomical. As an example:

> The cost of cleaning up the estimated 152,000 pounds of DU on 500 acres of the recently-closed Jefferson Proving Ground in Indiana has been placed at $4 to $5 billion. The cost of cleaning up 600,000 pounds of DU spread over hundreds of square miles in Kuwait, and Iraq could therefore easily run into the tens of billions of dollars.[35]

The Institute of Medicine reported that during Operation Desert Shield and Operation Desert Storm, 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.[36]

A July 1990 report prepared for the U.S. Army warned:

> Assuming U.S. regulatory standards and health physics practices are followed, it is likely that some form of remedial action will be required in a DU post-combat environment.[37]

However, once the scale and cost of cleaning up DU in the Persian Gulf region became clear, the U.S. Army Environmental Policy Institute informed U.S. policy makers that "no international law, treaty, regulation, or custom requires the U.S. to remediate the Persian Gulf War battlefields."[38] Former Navy officer Dan Fahey says:

> As the most powerful nation in the world today, the United States established a standard of behavior in the Gulf War which allows nations and armed forces to use depleted uranium weapons without taking any responsibility for cleanup, environmental restoration, or provision of health care to exposed combatants or civilians.[39]

Depleted Uranium and the Law

U.S. soldiers were not informed that they were using weapons containing DU until two weeks after the Gulf War ended.[40] Over 250,000 returning U.S. Gulf War troops have reported to veterans' hospitals asking for medical help for a variety of undiagnosed ailments that have collectively become known as the Gulf War Syndrome.[41]

At its 48th session, the UN Sub-Commission on Prevention of Discrimination and Protection of Minorities, in its resolution 1996/16 of August 29, 1996, wrote:

> Concerned at the alleged use of weapons of mass or indiscriminate destruction both against members of the armed forces and against civilian populations, resulting in death, misery and disability, and concerned also at repeated reports on the long-term consequences of the use of such weapons upon human life and health and upon the environment, urges all states to be guided in their national policies by the need to curb the production and spread of weapons of mass destruction or with indiscriminate effect, in particular, nuclear weapons, chemical weapons, fuel-air bombs, napalm, cluster bombs, biological weaponry and weaponry containing depleted uranium.[42]

U.S. human rights attorney Karen Parker submitted the following to the UN Sub-Commission:

> The laws and customs of war include all treaties governing military operations, weapons and protection of victims as well as all customary international law on these subjects. In other words, in evaluating whether a particular weapon is legal or illegal when there is not a specific treaty, the whole of humanitarian law must be consulted. There are four rules derived from the whole of humanitarian law regarding weapons:
>
> (1) Weapons may only be used in the legal field of battle, defined as legal military targets of the enemy in the war. Weapons may not have an adverse effect off the legal field of

battle. (The “territorial” test).

(2) Weapons can only be used for the duration of an armed conflict. A weapon that is used or continues to act after the war is over violates these criteria. (The “temporal” test).

(3) Weapons may not be unduly inhumane. (The “humane-ness” test).

(4) Weapons may not have an unduly negative effect on the natural environment. (The “environmental” test).

DU weaponry fails all four tests. (1) [DU] cannot be “contained” to legal fields of battle and thus fails the territorial test. (2) [DU] continues to act after hostilities are over and thus fails the temporal test. (3) [DU] is inhumane and thus fails the humanness test. DU is inhumane because of how it can kill by cancer, kidney disease, etc. long after the hostilities are over. DU is inhumane because it causes birth (genetic) defects thus affecting children (who may never be a military target) and who are born after the war is over. The use of DU weapons may be characterized as genocidal by burdening gene pools of future generations. (4) DU cannot be used without unduly damaging the natural environment and thus fails the environment test.[43]

The use of DU weapons in combat is a violation of the Geneva Conventions and Additional Protocols. The applicable provisions are: the grave breaches provisions of the Geneva Convention: Article 147 of the Forth Geneva Convention describes a grave breach as “willful killing”; “torture or inhuman treatment, including biological experiments”; “willfully causing great suffering or serious injury to body or health.” Article 85(3) of Additional Protocol 1 also contains grave breaches relating to the conduct of hostilities known as The Hague Regulations. They are: making the civilian population or individual civilians objects of the attack; launching an indiscriminate attack affecting the civilian population or civilian objects in the knowledge that such attack will cause excessive loss of life; and injury to civilians or damage to civilian objects.

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.”[44]

Attempts to report on DU-containing weapons at the UN Sub-commission on Prevention of Discrimination and Protection of Minorities have been thwarted by political maneuvering. A report originally was to be completed in 1998, but the Rapporteur assigned to present it was absent. The report was again scheduled for presentation in 1999, 2000, and 2001, and in each case the Rapporteur was either absent or unprepared. In 2002, after the U.S. and U.K. successfully fought the re-election of Rapporteur Justice Sik Yuen, from Mauritius, to the Sub-commission, he submitted a report anyway—to the consternation of the U.S. The 2002 Sub-commission voted to have him do the 2003 follow-up, even though he was no

longer on the Sub-commission. A report is due during the August 2003 session, with Sik Yuen as Special Rapporteur.

Pentagon Denials Face Officers Breaking Ranks

Dr. Doug Rokke, who served as a lieutenant with the U.S. Army Preventative Medicine Command, led the army team that was assigned to clean up contaminated vehicles hit by "friendly" DU rounds during the 1991 bombardment of the Persian Gulf. Dr. Rokke had this to say about DU weapons:

> There can be no reasonable doubt about this: As a result of the heavy metal and radiological poison of DU, people in southern Iraq are experiencing respiratory problems, breathing problems, kidney problems and cancers. Members of my own team have died or are dying from cancer. There were two memorandums that came to us in March of 1991 as we started the cleanup of the contaminated equipment and the casualties in the Gulf. One memo was known as the Los Alamos memorandum.[45]

The Los Alamos memorandum, written by Lt. Colonel. M.V. Zieham, says in part:

> … there has been and continues to be a concern regarding the impact of DU on the environment. Therefore, if no one makes a case for the effectiveness of DU on the battlefield, DU rounds may become politically unacceptable and thus, be deleted from the arsenal. ... Keep this sensitive issue in mind when after action reports are written.[46]

Dr. Rokke's response to the memo was:

The Los Alamos memorandum specifically gave us guidance that said when we are writing a report, or reporting our findings, make sure that we don't disrupt the future use of depleted uranium munitions. [47]

On January 24, 2000, Gary Sheftick reported on a NATO DU Press Conference for the Army News Service. His article, entitled "Expert Dispels Myth about Depleted Uranium," said in part:

> Depleted uranium could not have caused leukemia in allied troops who served in Kosovo, according to a U.S. Army medical expert. Col. Eric Daxon, the DU consultant to the Army Surgeon General, was in Europe last week to convince NATO officials that there's no link between depleted uranium munitions and leukemia.

It's been less than two years since the Kosovo air campaign. And DU is actually 40 percent less radioactive than uranium found in the natural environment, he said. Daxon, who holds a doctorate in radiation hygiene from the University of Pittsburgh and a master's degree in nuclear engineering from the Massachusetts Institute of Technology, is making it his business to dispel myths about the dangers of depleted uranium. He said the false link between DU and leukemia began with a report issued in Iraq two years ago. "If you read

the (Iraqi) report, it's just not scientifically valid," Daxon said. He pointed to studies by the National Academy of Sciences that show no evidence of an increase in leukemia due to uranium exposure. Other studies show the incidence of leukemia in soldiers deployed to the Gulf is actually the same as those not deployed, he said. But the Iraqi report has been cited by some to try and link DU ammunitions used in Kosovo to leukemia in allied soldiers there, Daxon said. "Science just doesn't support it," Daxon said. "I cannot understand from a scientific medical point of view what the furor is over this safe, effective material," he said. "It leads me to believe that this is a purposeful disinformation campaign."

"It's tactically a significant advantage," to use DU instead of tungsten in armor-piercing rounds, Daxon said. M-1 Abrams rounds with DU can effectively engage targets at 3,000 meters, he said, adding that Tungsten rounds fired by the Iraqis in the Gulf War were only effective at about 2,000 meters. (Tungsten is another heavy metal used in armor-piercing munitions, but it's lighter than depleted uranium.)

"A lot of this misinformation ... is the stringing together of true statements," Daxon said, explaining that the propaganda takes facts out of context and makes illogical conclusions.

"These misperceptions are actually hurting our soldiers and families," Daxon said. That's why he's making it his business to debunk the myths about DU health risks.[48]

A year later, at a NATO press conference on the use of DU munitions in the Balkans, NATO Secretary General Lord Robertson said, in part:

The North Atlantic Council, at its regular meeting today, gave special consideration to the possible environmental health risks associated with the use of depleted uranium munitions in the Balkans. Allies are committed to ensuring the health and safety of their servicemen and servicewomen and to avoiding any ill-effects for the civil population and personnel or non-governmental organizations as a result of NATO military operations. The Council noted in this context that there is no evidence currently available to suggest that exposure to expended depleted uranium munitions represents a significant health risk for NATO-led forces or the civil population in the Balkans.[49]

In the British documentary "Riding the Storm," which aired January 3, 1996, Brent Skowcroft, former National Security Advisor under President George H.W. Bush, said,

Depleted uranium is more of a problem than we thought when it was developed. But it was developed according to standards and was thought through very carefully. It turned out, perhaps, to be wrong.

DU Spiked with Plutonium and other Fission Products

Recent revelations about the radioactivity of DU are disturbing. Researchers at the Swiss Federal Institute of Technology discovered that DU munitions used in Kosovo were contaminated with uranium-236, an isotope of uranium not found in natural uranium ore. Numerous medical scientists have found traces of U-236 in the urine of Gulf War veterans. This means that the ingested uranium could not have come from natural sources, as claimed by the military. It also means that some DU cannot simply be naturally occurring uranium with the fissionable U-235 removed from it, as the U.S. government had claimed until recently.

U-236 is created only inside nuclear reactors, a product of the fission process for which there is no other source. Some DU has come from reprocessed reactor fuel. As quoted earlier, the Pentagon, NATO, and the British Ministry of Defense have always downplayed the danger of DU, saying it was "less radioactive than uranium ore." But at least half of the DU (250,000 metric tons) is now known to have been left over from the reprocessing of irradiated reactor fuel (done to extract weapons-grade plutonium), leaving it salted with fission products.[50] See Table 1, "Reprocessed Nuclear Reactor Waste Products," for details on this nuclear waste that has been added to the DU available to weapons manufacturers.

Table 1. Reprocessed Nuclear Reactor Waste Products

ISOTOPE	RADIOACTIVE HALF-LIFE	RADIATION EMITTED	CRITICAL ORGANS	SPECIAL CHARACTER-ISTICS
Americium-241	432.2 yr	Alpha & gamma	bone & lung	Created only in reactors when uranium is bombarded with neutrons
Americium-243	7,370 yr	Alpha & gamma	bone & lung	Created only in reactors; decays to the *more radioactive* Pu-239
Neptunium-237	2,140,000 yr	alpha & gamma		Created only in reactors
Neptunium-239	2.35 days	beta & gamma		Created only in reactors; decays to plutonium-239
Uranium-236	24 million years	alpha, gamma	kidneys, lung, liver	Created only in reactors
Uranium-238	4.5 billion yr	alpha	kidneys, lung, liver	
Plutonium-239	24,110 yr	alpha	lymph, liver, lung, gonads & bone	Created only in reactors; 200,000 times more radio-active than U-238
Plutonium-238	88 yr.	alpha	lymph, liver, lung, gonads & bone	Created only in reactors; (300 times more radio-active than Pu-239)

Table 1 Sources: “Plutonium: Deadly Gold of the Nuclear Age,” by IPPNW & IEER, 1992, International Physicians Press, Cambridge; “Low-Level Radiation and Immune System Damage: An Atomic Era Legacy,” by Joseph J. Mangano, 1999, Lewis Publishers, New York; “The Menace of Atomic Energy,” by Ralph Nader & John Abbotts, 1979, WW Norton, New York; “No Immediate Danger: Prognosis for a Radioactive Earth,” by Rosalie Bertell, 1985, The Women’s Press; “The Yellow Pages,” 4th Ed., 1994, by Institute for Energy and Environmental Research, Takoma Park, MD; “After the Dust Settles” by Steve Fetter & Frank von Hippel, The Bulletin of the Atomic Scientists, Dec. 1999; “Groundswell,” Nuclear Information & Resource Service, Spring 1989, p.1.

The Pentagon officially acknowledged at a NATO press conference in February 2001 that extremely carcinogenic substances were used by the U.S. armed forces:

...shells used in the 1999 Kosovo conflict were tainted with traces of

plutonium, neptunium and americium byproducts of nuclear reactors that are much more radioactive than depleted uranium.48

In a January 2000 letter, the U.S. Department of Energy's David Michaels said, "One may normally expect that depleted uranium contains a trace amount of plutonium."49

The fission products (Table 1) created inside nuclear reactors are now known to contaminate the uranium-238 used in DU munitions. Three hundred and twenty tons of DU ammunition was shot into Iraq and Kuwait in the 1991 bombardment, three tons into Bosnia in 1995, and ten tons into Kosovo in 1999. Out of the roughly 720,000 tons of DU available to weapons merchants, some 250,000 tons are now known to be spiked with these extremely radioactive isotopes.[51]

Findings

The U.S. War Department's clear intent to use radioactive material in military weapons to poison enemy personnel can be traced back to the 1943 memorandum "Use of Radioactive Material as a Military Weapon," by General L.R. Grove, quoted earlier. The memorandum stated that one of the possible military uses of radioactive materials against enemy personnel would be as a gas warfare instrument. The material would be ground into particles of microscopic size and 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 personal. It could also be dissolved in liquid. This goal has come to fruition.

In 1990, prior to the Gulf War, the U.S. Army Foreign Service and Technology Center warned that conventional explosives could be used by the invading army to disseminate radioactive materials (e.g., from reactor waste or radium and radioactive isotopes of cesium and cobalt from radiotherapy sources) on the battlefield.[52] It is estimated that over 800 tons of DU have been dumped on Iraq and Kuwait in the form of solid-core ammunition and dirty bombs.[53] Iraqi medical scientists have found levels of radiation that are unacceptable by international standards in their drinking water, vegetables, and meat, especially in southern Iraq and in the Tigris River. In the U.S., officials have conducted many studies that clearly show that DU enters the food chain and contaminates water.

The facts are straightforward. DU (radioactive waste) is an anti-personnel weapon that is designed to cause superfluous injury and unnecessary suffering. The U.S. should not be allowed to subvert provisions of the Atomic Energy Act of 1954 and the Nuclear Non-proliferation Act of 1978 by asserting that they are not using the uranium for its poisonous radiation effects, but for the heavy weight and pyrophoric qualities of DU. However purportedly innocent their motives for

using radioactive waste, the fact remains that this material is clearly a dual use weapon, used for its heavy weight, and to poison personnel through inhalation and ingestion, causing illness and, in some cases, a lingering death. If we do not act soon to ban this radioactive material in military weapons, humans yet unborn will pay a fearsome price. Radiation from DU will affect the human gene pool, bequeathing to our descendants countless inherited defects. The World Health Organization should immediately begin health and environmental studies in Iraq, Kuwait, Saudi Arabia, and the Balkans region.

Recommendations of the Authors

1. A ban on the use, development, production, transport, storage, and possession of DU weapons and DU armor-plating, as well as all other military uses of DU.

2. Medical treatment for all victims of DU.

3. A ban on the civilian use of DU because of potential accidental exposure to uranium or its compounds.

4. Decontamination of all military and civilian equipment contaminated by DU.

5. Decontamination of all territory contaminated by DU, not only theaters of war but military practice ranges, manufacturing and fabrication facilities and all other areas where DU has been employed.

6. Conversion of the global stocks of DU from their relatively unstable uranium hexafluoride form (approximately 2-3 million tons) into an insoluble stable form, such as uranium oxide, suitable for perpetual storage in nuclear waste repositories.

7. Prosecution of the military use of DU as a war crime (in accordance with Art. 85 - 3(b) GP 1; Art. 6b IMT Statute Art. 2(c), 3(a) and (b), ICTY Statute; Art. 8-2(b), Statute of Rome).

8. Eradication of consequential damage caused by DU use according to customary liability principals of international (humanitarian) law.

9. Establishment of an international center for the study of DU problems worldwide.

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