# Rachel's Environment & Health News
# #788 – Depleted Uranium Weapons of Mass Destruction
# April 1, 2004

Uranium is a naturally-occurring element that is both weakly radioactive and a toxic heavy metal. Naturally-occurring uranium contains two main radioactive isotopes: U-238 (99.3%), and U-235 (0.7%). When uranium is "enriched" to make an A-bomb (which requires lots of U-235), the leftover "depleted uranium" (DU) is 99.8% U-238 and retains about 60% of the radioactivity that was present in the original natural uranium.[1, pg. 3]

Depleted uranium is created by "uranium enrichment" plants that process natural uranium to extract the U-235, but those same plants also may process spent nuclear fuel from nuclear power reactors. For this reason, some DU is known to be contaminated with very low levels of some of the most dangerous radioactive substances known to science: Plutonium-238, Plutonium-239, Plutonium-240, Americium-241, Neptunium-237 and Technicium-99.[1, pg. 6]

Radioactive decay is a natural process. Radioactive elements spontaneously emit energetic particles or rays, and in the process they change from one element into another. When U-238 spontaneously undergoes radioactive decay, it emits alpha particles (and turns into Thorium-234). You can think of an alpha particle as something like a tiny cannon ball -- it does not travel very far (a few centimeters in air), but if it hits a living cell, the damage can be enormous. Sometimes cells damaged by alpha particles die immediately, but sometimes they start to multiply uncontrollably, causing cancer. (The International Agency for Research on Cancer (IARC) has identified "internally deposited radionuclides that emit alpha particles" as Group I carcinogens, meaning substances known to cause cancer in humans.[1, pg. 85])

So, DU's alpha particles won't penetrate the outermost (dead) layer of your skin, but if you get DU inside you -- say, in your lungs -- it can have deadly consequences. Several studies of workers in uranium enrichment plants show that they get lung cancer at higher-than-normal rates.[1, pg. 86]

The half-life of U-238 is 4.5 billion years, which tells us that it does not decay rapidly and therefore that it does not emit many alpha particles per second. However, "many" is a relative term. In absolute numbers, a microgram of DU (a millionth of a gram, and there are 28 grams in an ounce) will emit slightly more than 12 alpha particles per second or 390 million alpha particles each year.[1, pg. 6] So one microgram of DU lodged in your lungs will have more than a million opportunities EACH DAY to start a cancer growing in your cells. Obviously, the hazard is greater for children because they have a longer lifetime ahead of them during which alpha particles will have an opportunity to start a cancer, plus they are very likely more sensitive to harm than adults (because they are growing, so more of their cells are dividing).

In recent decades, as we have manufactured more atomic bombs and therefore more depleted uranium, there has been growing pressure to find new uses for our huge stockpile of depleted uranium.[1, pg. 26] In my opinion, the psychology behind this is pretty simple: as it becomes crystal clear that subsidizing nuclear technologies was one of the dumbest mistakes humans have ever made, there is enormous pressure to show that something good can come from it. It is the psychology of the optimist, whom Ronald Reagan defined as the man who enters a room full of horse manure and says, "There must be a pony in here somewhere."

Because it is almost twice as dense as lead and not very radioactive, DU has been used as shielding for medical devices and in casks for transporting spent fuel from nuclear power plants. Because it is so dense (and therefore heavy), DU has also been used as ballast -- weights or counterweights -- on ships, satellites and aircraft. For example, each Boeing 747 jumbo-jet requires about 1500 pounds of ballast (or counterweights), and as many as 15,000 DU weights were manufactured for this purpose. In recent years, DU has been replaced by tungsten in aircraft ballast, perhaps to avoid questions about the wisdom of flying radioactive materials around in planes. A plane that crashed into a row of apartments in Amsterdam in 1992 was carrying 282 kg (620 pounds) of DU as ballast, and a Boeing-747 that crashed in England in 2000 was carrying 1500 kg (3,300 pounds) of DU. [1, pg. 26]

In the Amsterdam crash, some 152 kilograms (334 pounds) of DU were never found, and the Dutch commission of inquiry concluded that the fiery crash may have released some of the DU in the form of a radioactive fume or dust, just as you would expect it might. DU is pyrophoric, meaning that it catches fire under some circumstances and turns into a very fine radioactive fume or dust, which can blow around.[1, pg. 44]

In the past 20 years, DU has found its way into weapons of war -- both for heavy tank armor and for armor-piercing projectiles -- again, because it is plentiful and cheap (thanks to government subsidies) and almost twice as dense as lead. As noted above, it is also pyrophoric, meaning that under some circumstances it catches on fire.

When a DU projectile strikes an armored target, such as a tank, it does not flatten on contact but instead penetrates and "self sharpens" as it passes through the armor. This occurs because as the DU projectile is penetrating its target, its outer layer catches fire, creating a very fine radioactive dust, essentially lubricating the remaining projectile, helping it penetrate further. The result is a very clean hole in the target -- which looks as if it had been drilled -- and a great deal of radioactive dust. Somewhere between 10% and 70% of a DU projectile is transformed into radioactive dust when it strikes a sufficiently hard target.[1, pg. 46]

This dust creates special problems. As noted above, if DU dust gets into your lungs, it can cause lung cancer.

DU dust is heavy and so it settles to earth within a few hundred yards of where it was created -- unless it is picked up again and moved by the wind.

To help get the health threat into perspective, in discussing DU, I prefer to express the amount of DU in micrograms, on the assumption that a few hundred micrograms (perhaps less) is a dangerous amount of DU dust. It is important to remember that not all (or even most) DU munitions strike hard targets that would cause them to catch fire and emit radioactive fumes (dust).

Ground-attack airplanes like the A-10 Warthog fire 30 mm projectiles at the rate of 70 projectiles per second, and each 30-mm projectile contains 0.27 kg (9.5 ounces, or 270 million micrograms) of DU. Heavy tanks fire 120 mm rounds, each containing 4.85 kg (10.6 pounds, or 4.8 billion micrograms) of DU.

It was reported in 1995 that U.S. arms manufacturers had produced more than 55 million 30-mm DU penetrators and 1.6 million DU penetrators for tank ammunition.[1, pg. 27] No doubt more have been manufactured since then.

The U.S. has acknowledged using DU weapons during the Gulf War against Iraq in 1991, and NATO has acknowledged using DU weapons during the Kosovo conflict of 1999. DU munitions have extensively contaminated U.S. military proving grounds and firing ranges such as the ones at Yuma, Arizona, Aberdeen, Maryland, Jefferson, Indiana, and Viecques, Puerto Rico.[1, pg. 50]

Scientists at the Los Alamos National Laboratory in New Mexico have been fooling around with DU for 60 years, during which time they have dumped an estimated 38.5 tons of DU into a mountain canyon out back, behind the lab.[1, pg. 49]

During wartime, the greatest civilian threat from DU is assumed to involve children, who have been photographed in Kosovo and Iraq playing on burned-out military vehicles including tanks disabled by DU projectiles.[1, pg. 49] Much of this equipment is heavily contaminated, inside and out, with radioactive dust.

Many children also eat dirt (9 to 96 mg/day) as a normal part of growing up, and soil contaminated with DU dust presents a special hazard in such cases, according to the World Health Organization.[1, pg. 38]

However, U.S. military officials deny that children -- or any other civilians -- are at risk from DU.[2] The Pentagon says only soldiers are at risk. It is clear that the Pentagon considers DU plenty hazardous to soldiers -- an Army training manual says that anyone who comes within 25 meters of any DU-contaminated equipment or terrain must wear respiratory and skin protection (because DU might enter the body through a scratch or other open wound).[3]

Once you get DU in your lungs, much of it will stay there for a long time, irradiating lung cells, and the World Health Organization says, "The risk of lung cancer appears to be proportional to the radiation dose received."[1, pg. 85] (In other words, the only way to have zero risk is to have zero exposure.) The British Royal Society studied DU and concluded that its use was not risk-free for anyone involved.[4] The truth is, DU has been studied remarkably little, given that we blast tons of it into areas inhabited by civilian populations for the avowed purpose of helping them. No one has studied the effects of DU on the immune system, the metabolic system, the nervous system, the reproductive system, the endocrine system (and other biological signaling mechanisms), and growth, development, and behavior. It's amazing what we don't know about DU and that -- in the face of such ignorance -- anyone could claim to know that it is safe for use near civilians.

Unfortunately, even many crucial details about the lung cancer hazard remain missing. Although they have been making and studying DU since 1940, military scientists still don't know exactly how long inhaled DU is retained in the lung. They say that somewhere between 57% and 76% of inhaled DU stays in the lung with a half-life of "longer than 100 days" but how much longer they seem not to know.[1, pg. 64] The half-life is the amount of time it takes for half of a substance to go away. It is also not clear where inhaled DU goes after it leaves the lungs. Is it coughed up and excreted, or does it dissolve, enter the blood stream and then the urine? Or does it lodge elsewhere in the body? In male rats intentionally contaminated, uranium collects in the brain and the testicles.[1, pg. 65]

Military specialists like to point out that DU munitions that miss their target simply bury themselves in the ground. But the World Health Organization is not so sure the story ends there:

"However, in some instances the levels of contamination in food and ground water could rise after some years and should be monitored and appropriate measures taken where there is reasonable possibility of significant quantities of depleted uranium entering the food chain... Areas with very high concentrations of depleted uranium may need to be cordoned off until they are cleaned up."[1, pg. vi] Cleanup of DU-contaminated areas has not occurred in Kosovo or Iraq.

Who ever thought that DU in the ground would always stay put? Between 1970 and 1997, the Starmet Corporation, a military contractor making DU weapons, dumped DU into an unlined pit in the ground in downtown Concord, Mass. Now soil in Concord is contaminated with DU as far as a mile from the dump, and local wells are contaminated because DU has moved into groundwater. Who would have expected any other outcome? Nevertheless, we should acknowledge that the directors of Starmet are not as dumb as they might appear. Shortly before their radioactive dump was added to the national Superfund list, Starmet officials took precautionary action and declared bankruptcy. U.S. Environmental Protection Agency (EPA) accepted Starmet's bankruptcy without a peep, so U.S. taxpayers are now paying for the difficult cleanup.[5]

The U.S. Navy stores DU in San Diego, Calif.; Seal Beach, Calif.; Crane, Indiana; Indian Head, Md.; Colts Neck, N.J.; Hawthorne, Nev.; McAlister, Ok.; Charlestown, S.C.; Tooele, Utah; Dahlgren, Va.; Norfolk, Va.; Sewells Point, Va.; and Yorktown, Va., and large quantities are reportedly stored at ten other locations. When the military ships DU around the country, the containers are not marked "radioactive" even though the cargo is definitely radioactive as well as explosive. (See ACTION ALERT, below.)

In addition to being radioactive, DU is toxic; specifically it is known to be toxic to the genes of humans.[1, pg. 75] Studies of Gulf War vets living with DU shrapnel in their bodies (from "friendly fire" during the Gulf War) show evidence of genetic damage.[6] At least one military scientist -- Alexandra Miller a radiobiolgist with the Armed Forces Radiobiology Research Institute in Bethesda, Md. says DU may be more dangerous than previously believed because its chemical toxicity and its radioactivity may combine in unexpected ways to cause harm.[7]

Miller also points out that genetic damage (from chemical toxicity or radioactivity, or both) can be inherited and passed along to successive generations, so harm may not become apparent until many generations after the event that caused it.[7] This puts DU munitions squarely into the class of weapons known as "weapons of mass destruction or indiscriminate effect."

U.S. planes, under NATO command, fired 10 tons (9 trillion micrograms) of DU projectiles at targets in Kosovo in 1999. During the Gulf War of 1991 against Iraq, the U.S. fired projectiles containing somewhere between 300 and 338 tons of DU (or 272 trillion to 302 trillion micrograms).[1, pg. 45]

The total quantity of DU munitions expended during the Iraq War of 2003 has been estimated to be 100 to 200 tons (90 trillion to 180 trillion micrograms).[8] Much of it was expended in or near urban areas where civilian populations live, work, play, draw water, and sell food.

It seems clear, then, that DU weapons produce special, continuing hazards to civilians, especially children, and that the harm from these weapons may be passed to future generations. No doubt this is why a United Nations subcommission in 1996 named DU munitions as "weapons of mass destruction or indiscriminate effect" and recommended that their use be outlawed.[9]

Tungsten alloy weapons can kill tanks and other hardened targets as effectively as DU, so continued use of DU weapons by the U.S. seems unnecessary and a slap in the face to the principles of public health, international law, world opinion, and common decency. --Peter Montague

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ACTION ALERT

By June 30, 2004, the U.S. Department of Transportation must renew (or deny) the military's exemption that allows them to ship DU weapons without marking them as radioactive or explosive. In case of accident or fire, first responders need to know this information. Here's what we can all do about it:

Contact the Department of Transportation Exemptions division and ask that the DOT immediately terminate and not renew DOT-E 9649. Depleted uranium munitions should have a "Radioactive" placard and an "Explosives" placard on shipments.

Send correspondence regarding DOT-E 9649 to: Mr. Delmer Billings DHM-31 Director, Office of Hazardous Materials Exemptions and Approvals Department of Transportation 400 7th St. SW Washington, D.C. 20590 Fax: (202) 366-3308 E-mail: delmer.billings@rspa.dot.gov

Information from:
http://www.gzcenter.org/DU.htm

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NOTES and REFERENCES


[1] Department of Protection of the Human Environment, World Health Organization, Depleted Uranium; Sources, Exposure and Health Effects (Geneva, Switzerland, April 2001). Available at http://www.who.int/ionizing_radiation/pub_meet/ir_pub/en/ .

[2] Matthew D. Sztajnkrycer and Edward J. Otten, "Chemical and Radiological Toxicity of Depleted Uranium," Military Medicine Vol. 169, No. 3 (2004), pgs. 212-216.

[3] Army manual quoted in Larry Johnson, "Activists want depleted-uranium munitions labeled; military's exemption is challenged," Seattle (Wa.) Post-Intelligencer Dec. 4, 2003.

[4] Susan Mayor, "Report suggests small link between depleted uranium and cancer," British Medical Journal Vol. 322 (June 23, 2001), pg. 1508.

[5] Ed Ericson, "Dumping on History: A Radioactive Nightmare in Concord, Massachusetts," E/The Environmental Magazine Mar. 5, 2004.

[6] Melissa A. McDiarmid and others, "Health Effects of Depleted Uranium on Exposed Gulf War Veterans: A 10-Year Follow-up," Journal of Toxicology and Environmental Health, Part A, Vol. 67 (2004), pgs. 277-296.

[7] Duncan Graham-Rowe, "Depleted uranium casts a shadow over peace in Iraq," New Scientist Vol. 178, No. 2391 (April 19, 2003), pg. 4.

[8] Dan Fahey, "The Use of Depleted Uranium in the 2003 Iraq War: An Initial Assessment of Information and Policies." Berkeley, Calif., June 24. 2003. Available at http://www.antenna.nl/wise/uranium/pdf/duiq03.pdf

[9] The United Nations Subcommission on Prevention of Discrimination and Protection of Minorities passed a resolution condemning the use of depleted uranium weapons during its 48th session in August, 1996, as described in U.N. Press Release HR/CN/755, "Subcommission on Prevention of Discrimination and Protection of Minorities Concludes Forty-Eighth Session." Relevant section available at http://southmovement.alphalink.com.au/antiwar/UNres.htm



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