Department of Defense (DoD) Depleted Uranium Information Website

Document Excerpt #1

WHAT IS IT?
Uranium is a weakly radioactive element that occurs naturally in the environment. The Agency for Toxic Substances and Disease Registry (ATSDR) for the Department of Health and Human Services estimates there are an average of 4 tons of uranium in the top foot of soil in every square mile of land. A heavy metal similar to tungsten and lead, uranium occurs in soils in typical concentrations of a few parts per million (equivalent to about half a teaspoon of uranium in a typical 8-cubic yard dump truck-load of dirt). Each of us ingests and inhales natural uranium every day from our air, water, food, and soil. The amount varies depending on the amount found where you live, and where the food you eat and the water you drink are produced. Consequently, each of us has some uranium in our body, and we eliminate some in our urine every day.

Depleted Uranium - This very dense metal (1.7 times as dense as lead) is a by-product of the process by which uranium is enriched to produce reactor fuel and nuclear weapons components. The leftover uranium, 40% less radioactive than natural uranium, is called "depleted uranium," or DU. The Department of Energy (DOE) recently reported that the DU it provided to DoD for manufacturing armor plates and munitions may contain trace levels (a few parts per billion) of contaminants including neptunium, plutonium, americium, technitium-99 and uranium-236. From a radiological perspective, these contaminants in DU add less than one percent to the radioactivity of DU itself. Medical scientists consider this insignificant.

HOW AND WHY IS DEPLETED URANIUM USED?
DU can be used by DoD to engage the enemy at greater distances than tungsten penetrators or high explosive anti-tank (HEAT) rounds because of improved ballistic properties. When they strike a target, tungsten penetrators blunt while DU has a self-sharpening property. DU ammunition routinely provides a 25 percent increase in effective range over traditional kinetic energy rounds. The illustration below is an artist's depiction of the sharpening effect of DU versus the mushrooming effect with a tungsten penetrator.

Depleted uranium is also used in numerous commercial applications requiring a very dense material. These include: ballast and counterweights; balancing control devices on aircraft; balancing and vibration damping on aircraft; machinery ballast and counterweights; gyrorotors and other electromechanical counterweights; shielding for medicine and industry; shipping container shielding for radiopharmaceuticals; chemical catalyst; pigments; and, x-ray tubes.

DU – HEALTH CONCERNS
Chemical - The major health concerns about DU relate to its chemical properties as a heavy metal rather than to its radioactivity, which is very low. As with all chemicals, the hazard depends mainly upon the amount taken into the body. Medical science recognizes that uranium at high doses can cause kidney damage. However, those levels are far above levels soldiers would have encountered in the Gulf or the Balkans.

Radiation - Because depleted uranium emits primarily alpha radiation, it is not considered a serious external radiation hazard. The depleted uranium in armor and rounds is covered, further reducing the radiation dose. When breathed or eaten, small amounts of depleted uranium are carried in the blood to body tissues and organs; much the same as the more radioactive natural uranium.

Despite this, no radiological health effects are expected because the radioactivity of uranium and depleted uranium are so low.

WHAT DO THE EXPERTS SAY ON CANCER RISK?
RAND, 1999. "(N)o evidence is documented in the literature of cancer or any other negative health effect related to the radiation received from exposure to natural uranium, whether inhaled or ingested, even at very high doses."

Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR) in 1999 Toxicological Profile for Uranium. "No human cancer of any type has ever been seen as a result of exposure to natural or depleted uranium."

United Kingdom Royal Society in May 2001. "Even if the estimates of risk are one hundred times too low, it is unlikely that any excess of fatal cancer would be detected within a group of 10,000 soldiers followed over 50 years."

European Commission March, 2001 report. "Taking into account the pathways and realistic scenarios of human exposure, radiological exposure to depleted uranium could not cause a detectable effect on human health (e.g. cancer)."

World Health Organization April, 2001 report. "The radiological hazard is likely to be very small. No increase of leukemia or other cancers has been established following exposure to uranium or DU."

Swedish Military Headquarters Medical Department Study, January 2003. "Questionnaires, analysis of uranium in the urine and matching with the cancer register at the National Board of Health and Welfare failed to reveal any link between service on the Balkans and cancer or any other illness." In fact, average urine uranium levels in two separate groups troops deployed for six months to the Balkans decreased by 75 percent and 90 percent during their deployment. The study attributed this decrease to the high natural uranium levels in Swedish drinking water supplies.

in the Veterans Affairs depleted uranium medical follow-up program, the medical community has yet to identify any untoward health consequences associated with depleted uranium exposures on the battlefield. Still, it is important to implement

DU MEDICAL FOLLOW UP POLICY
On May 30, 2003, new guidance was issued by OSD/Health Affairs that clarifies who, why, when, and how the military should test for possible depleted uranium during and after deployment and combat operations. The purpose of the testing is to identify those who may have been exposed to significant levels of depleted uranium while deployed. After a decade of closely following many depleted-uranium exposed Gulf War veterans who were enrolled these new guidelines which standardizes the way depleted uranium tests are performed; directs the compliance with an approved medical protocol following sound clinical practices; and helps DoD meet its obligations for ensuring the health of our deployed personnel.

“DU” Department of Defense. 20 Aug. 2006.
http://deploymentlink.osd.mil/du_library/what.shtml
http://deploymentlink.osd.mil/du_library/health.shtml
http://deploymentlink.osd.mil/du_library/how.shtml

"Is the Pentagon Giving our Soldiers Cancer?"

Hillary Johnson
Rolling Stone

Document Excerpt #2

US military relies on depleted uranium, which incinerates tanks on impact. But soldiers and civilians alike say the radioactive ammo is making them sick.

The weapons of war are quietly changing. The US military's deadliest ammunition is now packed with depleted uranium -- radioactive waste left over from nuclear bombs and reactors. These so-called "hot rounds" penetrate armored tanks like a needle pierces burlap, vaporizing steel in hell-fires of 5,000 degrees Celsius. Unlike tungsten, the armor-piercing metal used since World War II that "mushrooms" when it hits a target, depleted uranium actually sharpens itself like a pencil as it bores into tanks. Flaming radioactive particles shear off in every direction on impact, igniting fuel tanks and whatever explosives the target might be carrying. With virtually no public oversight, radioactive weapons have replaced conventional weapons as the cornerstone of American military might. Whenever US troops go to war, depleted uranium supplies the shock and awe.

In the annals of warfare, there has been nothing like DU, as it is often shorthanded. In both Iraq wars, and in Afghanistan, the US military used depleted uranium to inflict enormous harm on the enemy while incurring almost none itself. During the first Gulf War, in 1991, "tank-killing" DU rounds brought Saddam Hussein's Republican Guard to its knees in only four days. Military experts estimate that at least 10,000 Iraqis were killed, compared with 147 Americans. In the corridors of the Pentagon, DU munitions quickly earned the nickname "silver bullet", and the Defense Department turned its attention to creating even faster, more powerful weapons systems fueled by depleted uranium. "We want to be able to strike the target from farther away than we can be hit back, and we want the target to be destroyed when we shoot at it," Col. James Naughton told reporters at a Pentagon briefing last March. "We don't want to see rounds bouncing off. We don't want to fight even. We want to be ahead. And DU gives us that advantage."

Five days after the briefing, US forces launched the second war on Iraq. This time around, however, DU projectiles were exploded not only in uninhabited deserts but in urban centers such as Baghdad -- a city the size of Detroit. Stabilized in steel casings called "sabots", the shells were fired from airships, gunships, Abrams tanks and Bradley troop carriers, striking targets 1.5 miles away in a fraction of a second. The weapons contained traces of plutonium and americium, which are far more radioactive than depleted uranium.

The Pentagon insists that the weapons pose no threat to US soldiers or to non-combatants. "DU is not any more dangerous than dirt," declares Naughton, who recently retired after years as director of Army munitions. But a broad consortium of scientists, environmentalists, and human-rights activists -- as well as thousands of US soldiers who served in the Gulf in 1991 -- cite mounting evidence that depleted uranium will cause death and suffering among civilians and soldiers alike long after the war's end. DU projectiles spew clouds of microscopic dust particles into the atmosphere when they collide with their targets. These particles, lofted far from the battlefield on the wind, will emit low-level radiation for 4.5 billion years -- the age of the solar system itself. Some doctors fear that long-term exposure to such radiation could eventually prove as deadly as a blast from a nuclear bomb -- causing lung and bone cancer, leukemia, and lymphoma (a cancer of the immune system known in medical circles as the "white death").

"This is a war crime beyond comprehension," says Helen Caldicott, a pediatrician who has campaigned against nuclear weapons for years. "This is creating radioactive battlefields for the end of time."

Others are more measured but equally concerned. "There are medical nuances I don't fully grasp," says Chris Hellman, a senior analyst at the Center for Arms Control and Non-proliferation, in Washington, D.C. "But if you're going to be fighting wars for the goal of winning hearts and minds and bringing democracy and the altruistic things we associate with the campaigns in Afghanistan and Iraq, the last thing you want to be doing is poisoning the people you're trying to help."

Military scientists became intrigued by depleted uranium in the 1940s, at the very advent of the nuclear age. But it wasn't until the 1960s that American weapons designers began inventing ways to use DU in battle. Depleted uranium is what remains after "enriched" uranium, a crucial component in nuclear bombs and reactors, is processed from uranium ore. Although its radioactive properties have diminished by forty per cent, it's hardly safe. The Nuclear Regulatory Commission has strict rules pertaining to the handling and transporting of DU in this country -- rules that don't apply to the military during battle.

Depleted uranium has long been used as ballast in military and commercial planes, but the introduction of DU onto the battlefield began modestly, without fanfare. According to a Pentagon official, US troops carried DU "penetrators" into both Grenada and Panama. "It wouldn't have been very much, because there wasn't much to shoot at," says Naughton. "The first large-scale use was Desert Storm."

By its own estimates, the military exploded as many as 320 tons of DU in sabot-encased projectiles in the deserts of Iraq and Kuwait. Gunners shot DU rounds from the cannons of Abrams tanks or from airships such as the A-10 "Warthog". Depleted uranium is the heaviest of metals, which results in its superior penetrating abilities; it is also highly pyrophoric, bursting into flames at temperatures of 170 degrees Celsius. To imagine the carnage, one need only recall Iraq's infamous "Highway of Death", a desert road between Basra and Kuwait's border that remains strewn with radioactive trucks, cars, and tanks. US soldiers found bodies inside those vehicles that were burned in such astonishing ways that they dubbed the remains "crispy critters".

Johnson, Hillary. ”Is the Pentagon Giving Our Soldiers Cancer?” *Rolling Stone* 2 Oct 2003. 12 Oct. 2008. <http://www.noduhawaii.com/DU_Rolling_Stone.html>

World Health Organization Media
Centre DU Web site

Document Excerpt #3

URANIUM
Metallic uranium (U) is a silver-white, lustrous, dense, weakly radioactive element. It is ubiquitous throughout the natural environment, and is found in varying but small amounts in rocks, soils, water, air, plants, animals and in all human beings. Natural uranium consists of a mixture of three radioactive isotopes which are identified by the mass numbers 238U (99.27% by mass), 235U (0.72%) and 234U (0.0054%). On average, approximately 90 µg (micrograms) of uranium exists in the human body from normal intakes of water, food and air. About 66% is found in the skeleton, 16% in the liver, 8% in the kidneys and 10% in other tissues. Uranium is used primarily in nuclear power plants. However, most reactors require uranium in which the 235U content is enriched from 0.72% to about 1.5-3%.

DEPLETED URANIUM
The uranium remaining after removal of the enriched fraction contains about 99.8% 238U, 0.2% 235U and 0.001% 234U by mass; this is referred to as depleted uranium or DU. The main difference between DU and natural uranium is that the former contains at least three times less 235U than the latter. DU, consequently, is weakly radioactive and a radiation dose from it would be about 60% of that from purified natural uranium with the same mass.

The behavior of DU in the body is identical to that of natural uranium. Spent uranium fuel from nuclear reactors is sometimes reprocessed in plants for natural uranium enrichment. Some reactor-created radioisotopes can consequently contaminate the reprocessing equipment and the DU. Under these conditions another uranium isotope, 236U, may be present in the DU together with very small amounts of the transuranic elements plutonium, americium and neptunium and the fission product technetium-99. However, the additional radiation dose following intake of DU into the human body from these isotopes would be less than 1%.

APPLICATIONS OF DEPLETED URANIUM
Due to its high density, about twice that of lead, the main civilian uses of DU include counterweights in aircraft, radiation shields in medical radiation therapy machines and containers for the transport of radioactive materials. The military uses DU for defensive armour plate. DU is used in armour penetrating military ordnance because of its high density, and also because DU can ignite on impact if the temperature exceeds 600°C.

EXPOSURE TO URANIUM AND DEPLETED URANIUM
Under most circumstances, use of DU will make a negligible contribution to the overall natural background levels of uranium in the environment. Probably the greatest potential for DU exposure will follow conflict where DU munitions are used. A recent United Nations Environment Programme (UNEP) report giving field measurements taken around selected impact sites in Kosovo (Federal Republic of Yugoslavia) indicates that contamination by DU in the environment was localized to a few tens of metres around impact sites. Contamination by DU dusts of local vegetation and water supplies was found to be extremely low. Thus, the probability of significant exposure to local populations was considered to be very low.

A UN expert team reported in November 2002 that they found traces of DU in three locations among 14 sites investigated in Bosnia following NATO airstrikes in 1995. A full report is expected to be published by UNEP in March 2003. Levels of DU may exceed background levels of uranium close to DU contaminating events. Over the days and years following such an event, the contamination normally

becomes dispersed into the wider natural environment by wind and rain. People living or working in affected areas may inhale contaminated dusts or consume contaminated food and drinking water.

People near an aircraft crash may be exposed to DU dusts if counterweights are exposed to prolonged intense heat. Significant exposure would be rare, as large masses of DU counterweights are unlikely to ignite and would oxidize only slowly. Exposures of clean-up and emergency workers to DU following aircraft accidents are possible, but normal occupational protection measures would prevent any significant exposure.

INTAKE OF DEPLETED URANIUM

Average annual intakes of uranium by adults are estimated to be about 0.5mg (500 µg) from ingestion of food and water and 0.6 µg from breathing air. Ingestion of small amounts of DU contaminated soil by small children may occur while playing. Contact exposure of DU through the skin is normally very low and unimportant. Intake from wound contamination or embedded fragments in skin tissues may allow DU to enter the systemic circulation.

ABSORPTION OF DEPLETED URANIUM

About 98% of uranium entering the body via ingestion is not absorbed, but is eliminated via the feces. Typical gut absorption rates for uranium in food and water are about 2% for soluble and about 0.2% for insoluble uranium compounds. The fraction of uranium absorbed into the blood is generally greater following inhalation than following ingestion of the same chemical form. The fraction will also depend on the particle size distribution. For some soluble forms, more than 20% of the inhaled material could be absorbed into blood. Of the uranium that is absorbed into the blood, approximately 70% will be filtered by the kidney and excreted in the urine within 24 hours; this amount increases to 90% within a few days.

POTENTIAL HEALTH EFFECTS OF EXPOSURE TO DEPLETED URANIUM

In the kidneys, the proximal tubules (the main filtering component of the kidney) are considered to be the main site of potential damage from chemical toxicity of uranium. There is limited information from human studies indicating that the severity of effects on kidney function and the time taken for renal function to return to normal both increase with the level of uranium exposure.

In a number of studies on uranium miners, an increased risk of lung cancer was demonstrated, but this has been attributed to exposure from radon decay products. Lung tissue damage is possible leading to a risk of lung cancer that increases with increasing radiation dose. However, because DU is only weakly radioactive, very large amounts of dust (on the order of grams) would have to be inhaled for the additional risk of lung cancer to be detectable in an exposed group. Risks for other radiation-induced cancers, including leukemia, are considered to be very much lower than for lung cancer. Erythema (superficial inflammation of the skin) or other effects on the skin are unlikely to occur even if DU is held against the skin for long periods (weeks). No consistent or confirmed adverse chemical effects of uranium have been reported for the skeleton or liver. No reproductive or developmental effects have been reported in humans. Although uranium released from embedded fragments may accumulate in the central nervous system (CNS) tissue, and some animal and human studies are suggestive of effects on CNS function, it is difficult to draw firm conclusions from the few studies reported.

“Depleted Uranium.” World Health Organization. 20 Aug. 2006.
http://www.who.int/mediacentre/factsheets/fs257/en/

"Remains of Toxic Bullets Litter Iraq"

Scott Peterson
Christian Science Monitor

Document Excerpt #4

BAGHDAD – At a roadside produce stand on the outskirts of Baghdad, business is brisk for Latifa Khalaf Hamid. Iraqi drivers pull up and snap up fresh bunches of parsley, mint leaves, dill, and onion stalks. But Ms. Hamid's stand is just four paces away from a burnt-out Iraqi tank, destroyed by - and contaminated with - controversial American depleted-uranium (DU) bullets. Local children play "throughout the day" on the tank, Hamid says, and on another one across the road.

No one has warned the vendor in the faded, threadbare black gown to keep the toxic and radioactive dust off her produce. The children haven't been told not to play with the radioactive debris. They gather around as a Geiger counter carried by a visiting reporter starts singing when it nears a DU bullet fragment no bigger than a pencil eraser. It registers nearly 1,000 times normal background radiation levels on the digital readout.
The Monitor visited four sites in the city - including two randomly chosen destroyed Iraqi armored vehicles, a clutch of burned American ammunition trucks, and the downtown planning ministry - and found significant levels of radioactive contamination from the US battle for Baghdad.

In the first partial Pentagon disclosure of the amount of DU used in Iraq, a US Central Command spokesman told the Monitor that A-10 Warthog aircraft - the same planes that shot at the Iraqi planning ministry - fired 300,000 bullets. The normal combat mix for these 30-mm rounds is five DU bullets to 1 - a mix that would
have left about 75 tons of DU in Iraq. The Monitor saw only one site where US troops had put up handwritten warnings in Arabic for Iraqis to stay away. There, a 3-foot-long DU dart from a 120 mm tank shell, was found producing radiation at more than 1,300 times background levels. It made the instrument's staccato bursts turn into a steady whine.

"If you have pieces or even whole [DU] penetrators around, this is not an acute health hazard, but it is for sure above radiation protection dose levels," says Werner Burkart, the German deputy director general for Nuclear Sciences and Applications at the UN's International Atomic Energy Agency (IAEA) in Vienna. "The important thing in any battlefield - especially in populated urban areas - is somebody has to clean up these sites." Fresh-from-the-factory DU tank shells are normally handled with gloves, to minimize the health risk, and shielded with a thin coating. The alpha particle radiation emitted by DU travels less than an inch and can be stopped by cloth or even tissue paper. But when the DU material burns (usually on impact; or as a dust, it can spontaneously ignite) protective shields disappear, and dangerous radioactive oxides are created that can be inhaled or ingested. "[The risk] depends so very much on how you handle it," says Jan Olof Snihs, of Sweden's Radiation Protection Authority in Stockholm. In most cases dangers are low, he says, unless children eat toxic and radioactive soil, or get DU oxides on their hands. Radioactive particles are a "special risk associated with a war," Mr. Snihs says. "The authorities should be aware of this, and try to decontaminate places like this, just to avoid unnecessary risk."

Pentagon officials say that DU is relatively harmless and a necessary part of modern warfare. They say that pre-Gulf War studies that indicated a risk of cancer and of causing harm to local populations through permanent contamination have been superseded by newer reports. "There is not really any danger, at least that we know about, for the people of Iraq," said Lt. Col. Michael Sigmon, deputy surgeon for the US Army's V Corps, told journalists in Baghdad last week. He asserted that children playing with expended tank shells would have to eat and then practically suffocate on DU residue to cause harm.

But there is a growing chorus of concern among United Nations and relief officials, along with some Western scientific experts, who are calling for sites contaminated with DU be marked off and made safe. "The soil around the impact sites of [DU] penetrators may be heavily contaminated, and could be harmful if swallowed by children," says Brian Spratt, chair of the working group on DU at The Royal Society, Britain's

premier scientific institution. Fragments and penetrators should be removed, since "children find them fascinating objects, and can pocket them," says Professor Spratt. "The science says there is some danger - not perhaps a huge danger - of these objects. ... We certainly do not say that these things are safe; we say that cleanup is important." The British Ministry of Defense says it will offer screening to soldiers suspected of DU exposure, and will publish details about locations and quantities of DU that British troops used in Iraq - a tiny fraction of that fired by US forces.

The Pentagon has traditionally been tight-lipped about DU: Official figures on the amount used were not released for years after the 1991 Gulf War and Bosnia conflicts, and nearly a year after the 1999 Kosovo campaign. No US official contacted could provide DU use estimates from the latest war in Iraq. "The first thing we should ask [the US military] is to remove that immediately," says Carel de Rooy, head of the UN Children's Fund in Baghdad, adding that senior UN officials need urgent advice on avoiding exposure.

The UN Environment Program last month called for field tests. DU "is still an issue of great concern for the general public," said UNEP chief Klaus Töpfer. "An early study in Iraq could either lay these fears to rest or confirm that there are indeed potential risks." During the latest Iraq conflict Abrams tanks, Bradley fighting vehicles and A-10 Warthog aircraft, among other military platforms, all fired the DU bullets from desert war zones to the heart of Baghdad. No other armor-piercing round is as effective against enemy tanks. While the Pentagon says there's no risk to Baghdad residents, US soldiers are taking their own precautions in Iraq, and in some cases have handed out warning leaflets and put up signs.

Despite the troops' bulldozing of contaminated earth away from the burnt vehicles, black piles of pure DU ash and particles are still present at the site. The toxic residue, if inhaled or ingested, is considered by scientists to be the most dangerous form of DU. One pile of jet-black dust yielded a digital readout of 9,839 radioactive emissions in one minute, more than 300 times average background levels registered by the Geiger counter. Another pile of dust reached 11,585 emissions in a minute. Western journalists who spent a night nearby on April 10, the day after Baghdad fell, were warned by US soldiers not to cross the road to this site, because bodies and unexploded ordnance remained, along with DU contamination. It was here that the Monitor found the "hot" DU tank round. This burned dart pushed the radiation meter to the far edge of the "red zone" limit. A similar DU tank round recovered in Saudi Arabia in 1991, that was found by a US Army radiological team to be emitting 260 to 270 millirads of radiation per hour. Their safety memo noted that the "current [US Nuclear Regulatory Commission] limit for non-radiation workers is 100 millirads per year."

The normal public dose limit in the US, and recognized around much of the world, is 100 millirems per year. Nuclear workers have guidelines 20 to 30 times as high as that. The depleted-uranium bullets are made of low-level radioactive nuclear-waste material, left over from the making of nuclear fuel and weapons. It is 1.7 times as dense as lead, and burns its way easily through armor. But it is controversial because it leaves a trail of contamination that has half-life of 4.5 billion years - the age of our solar system.

Peterson, Scott. “Remains of toxic bullets litter Iraq.” *Christian Science Monitor* 15 May 2003. <http://www.csmonitor.com/2003/0515/p01s02a-woiq.htm>