Silver Bullet: Depleted Uranium as a Military Weapon (pp. 44-57)

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Depleted uranium (DU) is a radioactive by-product of the uranium enrichment process that is used in nuclear reactors to manufacture energy. As recently as the 1991 Gulf War (Operation Desert Storm), DU was found to have certain chemical properties that made it advantageous for use in armed conflicts. DU has subsequently been used in other armed conflicts such as intervention in Bosnia-Herzegovina and in the current United States initiative to liberate Iraq. DU has come under increased scrutiny as a possible source of cancer, along with other post-war illnesses, in the regions where it was used. It has also been charged with increasing background radiation in former combat zones. Many veterans advocacy groups, as well as the natives living in these regions, say that the use of DU has not only increased the level of illness for non-combatants, but that the U.S. purposely misled the international community about the safety of DU. This essay examines the consequences of DU as a tactical weapon in warfare.

DU is not a natural compound. DU is manufactured from uranium ore, which is found in nature, and enriched through a man-made process. Metallic uranium is a silver-white, lustrous, dense, weakly radioactive element. Uranium can be found on all continents and in every river and ocean, and in 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 their mass numbers: uranium 238 (99.27% by mass), uranium 235 (0.72%), and uranium 234 (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.\textsuperscript{1}

Uranium enrichment is a critical step in transforming natural uranium into nuclear fuel to produce energy. Enrichment is the process of increasing the concentration of uranium 235 while decreasing the concentration of uranium 238. Only the uranium 235 isotope is fissionable. The type containing a greater concentration of uranium 235 is referred to as enriched uranium, while the lesser concentrations are classified as DU. Uranium can be enriched commercially using either gaseous diffusion technology, or gas centrifuge technology. In both processes, the compound uranium hexafluoride (UF6) is heated and converted from a solid to a gas. At the gaseous diffusion plant, UF6 is forced through a series of compressors and converters that contain porous barriers. Uranium 235 filters through the barriers at a slightly higher rate than the uranium 238, because uranium 235 has a slightly lighter isotopic mass than uranium 238. The gaseous diffusion process for enriching uranium was initially developed on a mass scale at the Department of Energy plant in Oak Ridge, Tennessee. Two additional plants were subsequently constructed in Kentucky and Ohio. Presently, the publicly-owned U.S. Enrichment Corporation (USEC) leases the only operating, government-owned gaseous diffusion plant in Paducah, Kentucky, and is the only domestic supplier of enriched uranium services.\textsuperscript{2}

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 DU. Under these conditions, another uranium isotope, uranium 236, may be present in DU together with very small amounts of the transuranic elements, plutonium, americium, neptunium, and the fission product technetium-99 (See Table 1, p. 36). Once DU leaves the nuclear reactor, it is either stored or collected and fashioned into tactical weapons.

DU can also be used as tank and body armor on the battlefield. DU armor is currently used on M1A1 and M1A2 tanks. DU is at the core of armor-piercing rounds fired by M1 and M60 tanks. The Bradley Fighting Vehicle, the A-10 and AV-8B aircraft, and other weapon systems also use DU munitions and armor, extensively. DU munitions
The transuranic elements (heavier than uranium) and fission products below — created inside nuclear reactors — are now known to be mixed with the uranium-238 used in depleted uranium munitions. Three hundred and twenty tons of DU were shot into Iraq and Kuwait in the 1991 bombardment; three tons into Bosnia in 1995; and 10 tons into Kosovo in 1999. Hundreds and perhaps thousands of tons have recently been shot into and around Afghanistan and Iraq. Of the roughly 720,000 tons of DU available to U.S. weapons merchants, about half is reported to be contaminated with these and other extremely radioactive, cancer-causing isotopes.

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### Table 1. Depleted Uranium Weapons Spiked With Plutonium

Source: Nukewatch.© Nukewatch

<table>
<thead>
<tr>
<th>ISOTOPE</th>
<th>RADIOACTIVE HALF-LIFE</th>
<th>RADIATION EMITTED</th>
<th>VULNERABLE ORGANS</th>
<th>SPECIAL CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americium-241</td>
<td>432.2 years</td>
<td>alpha &amp; gamma</td>
<td>bone &amp; lung</td>
<td>Created only in reactors, where uranium is bombarded with neutrons</td>
</tr>
<tr>
<td>Americium-243</td>
<td>7,370 years</td>
<td>alpha &amp; gamma</td>
<td>bone &amp; lung</td>
<td>Created only in reactors; decays to the more radioactive Pu-239</td>
</tr>
<tr>
<td>Neptunium-237</td>
<td>2.14 million years</td>
<td>alpha &amp; gamma</td>
<td>bone surface</td>
<td>Created only in reactors</td>
</tr>
<tr>
<td>Neptunium-239</td>
<td>2.35 days</td>
<td>beta &amp; gamma</td>
<td>liver, intestines, kidney, spleen, brain</td>
<td>Created only in reactors; decays to Pu-239</td>
</tr>
<tr>
<td>Uranium-236</td>
<td>24 million years</td>
<td>alpha &amp; gamma</td>
<td>kidneys, lung, liver</td>
<td>Created only in reactors</td>
</tr>
<tr>
<td>Plutonium-239 (Pu-239)</td>
<td>24,110 years</td>
<td>alpha</td>
<td>lymph, liver, gonads &amp; bone</td>
<td>Created only in reactors; 200,000 times more radioactive than uranium-238</td>
</tr>
<tr>
<td>Plutonium-238 (Pu-238)</td>
<td>88 years</td>
<td>alpha</td>
<td>lymph, liver, gonads &amp; bone</td>
<td>Created only in reactors; 300 times as radioactive as Pu-239</td>
</tr>
</tbody>
</table>

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Table 1. Depleted Uranium Weapons Spiked With Plutonium. Source: Nukewatch.

destroyed approximately 1,400 Iraqi tanks and other equipment during the 1991 Gulf War. Due to U.S. weapons sales, Great Britain, France, and Russia acquired DU munitions and it rapidly spread through their respective arsenals. In a way, the wars in Iraq and Bosnia served as great advertisements for the future of tank warfare. DU’s dominance of the battlefield allowed it to command any price on the open market.

DU has a high level of kinetic energy for its volume, and sustains its own combustion when ignited, which enables it to literally melt and
"sharpen" as it penetrates armor, increasing its destructive capabilities. The standard 105mm tank shell has roughly the kinetic energy of seven Honda sedans crashing into a target at 65 miles per hour, simultaneously. In DU's case, that energy "sharpens" as it penetrates armor. The U.S. military has certainly made the most of this advantage. The Pentagon estimates that tanks fired 14,000 shells, and A-10 “Warthog” jets fired another 940,000 30mm rounds containing DU in support operations, during the 1991 Gulf War alone, which roughly totals 320 tons.³

A new line of guns had to be developed in order for the U.S. to keep its competitive edge with the innovation and improvement of tank armor. To defeat tank armor, shells had to be made of materials that would not shatter upon impact and possess sufficient kinetic energy to push through the armor. Previous armor-piercing rounds had mixed results on the battlefield. Anti-tank guns and their armor-piercing rounds needed to be mobile enough to be able to track enemy tanks' movement effectively. To keep up with the tanks they were trying to destroy, anti-tank guns could only become so large. As of the mid 1980s, cannons were made out of forged steel because stronger and more exotic metals, such as titanium and tungsten, were not readily available. Research turned to making harder and faster projectiles.

A major innovation in armor-piercing technology was the introduction of a small aerodynamic penetrator surrounded by a large bore collar. These "Sabot" (French for "shoe") rounds placed far less stress on the cannons than did the "squeeze guns," yet transferred the same amount of energy to the penetrator. Once the projectile leaves the gun, the sabot "petals" fall away and the penetrator continues to the target.⁴ By the end of World War II, sabot penetrators were made of forged tungsten. Tungsten was the densest, hardest metal available. Despite improvements in metallurgy and advances in tank performance, anti-tank guns became so large that they were either too heavy to keep up (if they were towed) or carried too few rounds of ammunition to be efficient in combat. The Soviet-built IS-3 heavy tank, equipped with a 122mm cannon, only carried 10 rounds of anti-tank ammunition.

In the 1970s, the Soviet Union began making anti-tank rounds out of a material that had been unavailable prior to World War II: DU. DU's metallic properties made it ideal for use in armor-penetrating
missiles and bombs. At 19.3 grams per cubic centimeter, DU is 70% denser than lead and 15% denser than tungsten. Osmium and iridium are both harder and denser than tungsten, but are more difficult to work with and are not available in large quantities. DU penetrators are manufactured at a fraction of the cost it would take to manufacture a similar tungsten penetrator. In addition, at high temperatures DU becomes “pyrophoric,” meaning that super-heated fragments will sustain combustion, further increasing the destructive potential of the material. Probably the most essential aspect of DU’s proliferation in war is its availability in large quantities. The U.S. alone has stored DU since the Carter administration.

The first combat use of DU by the U.S. occurred during the 1991 Gulf War. American M1A1 Abrams tanks used the 120mm M829A2 Armor Piercing, Fin Stabilized, Discarding Sabot-Tracer (APFSDS-T), which was known as the “Silver Bullet.” American A-10 Thunderbolt II aircraft used DU-cored PGU-14/B API (Armor Piercing Incendiary) in their 30mm cannons. The U.S. combat vehicles enjoyed an important technological advantage over Iraq’s older, mostly Russian-designed armored vehicles. Superior U.S. cannon systems were stabilized, so they could fire accurately while on the move. U.S. forces could select, load, and fire munitions far more rapidly than their Iraqi counterparts. Most importantly, the use of DU rounds allowed U.S. tanks to engage the enemy from extended ranges and with unprecedented lethal effect. Saddam Hussein’s most formidable weapons were the Iraqi Republican Guard T-72 tanks. The Iraqis used 125mm cannons with a maximum effective range of 1,800 meters. The U.S. M1A1 tanks routinely scored kills at twice that distance. In addition, Iraqi tanks, anti-tank guided missiles, and infantry anti-tank weapons failed to penetrate the DU armor of any of the 594 Heavy Armor M1A1s that saw action in the Gulf War, even when firing from within their supposed “lethal” range and scoring direct hits. The result was one of the most unbalanced victories in modern military history. Iraq lost in excess of 4,000 armored vehicles to U.S. air and ground fire, while a vehicle-by-vehicle review of U.S. battle damage reports indicated fewer than ten combat vehicles were destroyed or disabled by hostile fire. A small number of U.S. tanks were damaged or destroyed by mines; more tanks were disabled by
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mines than by rounds from Iraqi tanks due to the increased use of DU armor. Richard Koffinke’s report using declassified military accounts of engagements with the enemy described what happened and how powerful these weapons were when American soldiers were involved in a friendly fire incident:

During the course of a maneuver, the vehicle commander attempted to pull the Bradley out of the fight to fix the gun and reload the top-mounted TOW missile launcher. While trying to fix his gun the A-24 was hit by a 120mm DU sabot round fired from an Abrams tank. The single DU sabot round struck the Bradley fighting vehicle and almost immediately the vehicle was engulfed in flames. The DU sabot round entered the left side of the turret section and exited the right side, mortally wounding the gunner. In another encounter two 120mm DU sabots struck a tank in the right hull under the turret, exited the left hull behind the driver’s seat, and wounded all eight soldiers aboard. Some soldiers suffered severe burns and/or fragment wounds as a result of the friendly fire.8

These DU rounds had sliced through reinforced armor and still inflicted major damage. Enemy combatants with inferior armor would not have stood a chance when faced against such superior weaponry. As recently as 2003, Pentagon officials showed pictures from the 1991 Gulf War of an Iraqi tank completely destroyed by a 105mm round made of DU. The round had pierced the tank’s thick armor, leaving only a burned out shell. Even more impressive, U.S. soldiers told of a DU round penetrating a sand dune, demolishing an Iraqi tank behind it. DU-tipped munitions ignite after being fired and the shells are so heavy and hot that they easily rip through steel. The uranium-tipped warhead explodes inside the target. The penetrator is a flying rod of solid uranium, eighteen inches long and three-quarters of an inch in diameter. In some cases, DU explosions burned Iraqi soldiers so badly that U.S. soldiers dubbed them “crispy critters.” Often the incineration was so quick and complete that the individual was fixed in the exact position they were in prior to the missile striking the vehicle.
“That’s how much of an edge it gives us, and we don’t want to give that up,” Col. James Naughton of the Army Materiel Command said at a Pentagon briefing to explain the uses and health effects of DU on the battlefield. Dr. Michael Kilpatrick, Deputy Director of Deployment Health Support Directorate, Office of the Deputy Assistant Secretary of Defense for Force Health Protection and Readiness, claimed there was no substantial evidence to suggest that DU was the source of any particular illness from the Gulf War or that it carried any environmental hazard. He cited studies by the Department of Defense, the World Health Organization, the U.N. Environmental Programme, and the Agency for Toxic Substances to substantiate his claim. During the 2003 invasion and current occupation of Iraq, U.S. and British troops have reportedly used more than five times as many DU bombs and shells than the total number used during the 1991 war.

The U.S. was once again the first to attain and harness a new and superior weapon of war. Some military analysts have debated that the military application of DU might be as important as the development of the atomic bomb. Problems would soon arise as to the future use of DU on the battlefield. Soldiers began to report strange and sudden illnesses. Unusual cancers and strange birth defects increased in some of the areas where DU had been used. DU shell holes along the “Highway of Death” were 1,000 times more radioactive than background radiation. Tests for radioactivity were conducted by Dr. Khajak Vartaanian, a nuclear medicine expert from the Iraq Department of Radiation Protection in Basra, and Col. Amal Kassim of the Iraqi Navy.

Equally troubling is the serious hazard created when a DU round hits its target. As much as 70% of the projectile can burn up on impact, creating a firestorm of ceramic DU oxide particles, which can be spread by the wind. It can be inhaled and absorbed into the human body and absorbed by plants and animals, soon becoming part of the food chain. When asked of the probability that DU might cause these strange illnesses, the World Health Organization stated that it was unlikely. It cited a number of studies on uranium miners, which demonstrated an increased risk of lung cancer, but this has been attributed to exposure from radon decay products. However, because pure DU is only weakly radioactive, very large amounts of dust (on the order of grams) would
have to be inhaled for an additional risk of lung cancer to be detectable in an exposed group. Risks for other radiation-induced cancers, including leukemia, are considered to be much lower than lung cancer.\(^\text{11}\)

In regard to cancers, epidemiologists classify recent occurrences as a series of "clusters." Cancer clusters have been identified for more than a century, and a large number involve leukemia. "Except for occupational settings, health researchers almost invariably do not get the cause," says Michael Thun, the American Cancer Society’s Chief of Epidemiological Research. One accepted theory of cancer development is the "two-hit" hypothesis. Cancer generally results from an accumulation of damage — five or six "hits" — to the genes. Some experts think leukemia may need only two. If that is so, that may also explain why the disease appears relatively quickly. The idea that perhaps an infectious agent, such as a virus, is the second "hit" would be possible.\(^\text{12}\) The toxic environment that was created by the Iraqi army setting fire to oil wells as they retreated during the Gulf War can not be disregarded as a possible link as to the cause of illness. In Europe, the publicity created by DU was rekindled with word of a U.S. official’s admission that DU contained plutonium and other reactor-borne fission products, which made DU warheads far more radioactive and carcinogenic than uranium 238. The discovery of uranium 236 contamination in spent munitions used in the war in Kosovo revealed that DU was not obtained before the nuclear reaction process. The Pentagon, NATO, and the British Ministry of Defense have always downplayed the danger of DU saying it was "less radioactive than uranium ore."

This statement is indeed true, 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 weapon-grade plutonium). This leaves the resulting DU salted with fission products and impure.\(^\text{13}\) "If it has been through a reactor, it does change our idea on DU," says Dr. Michael Repacholi of the World Health Organization, which demanded to know how much plutonium is in DU ammunition. The U.S. Department of Energy (DOE) still has not declassified or announced the actual composition of the DU it uses in the manufacturing of wartime munitions. However, as early as January 2000, the DOE admitted that its DU munitions were spiked with
plutonium, neptunium, and americium from inside nuclear reactors. This admission was extremely disturbing because americium decays into plutonium 239, which is more radioactive than the original americium. DU "contains a trace amount of plutonium," said the DOE’s Assistant Secretary David Michaels. "Recycled uranium, which came straight from one of our production sites, would routinely contain transuranics at a very low level," Michaels wrote. He concluded by saying, "We have initiated a project to characterize the level of transuranics in the various DU inventories." Plutonium 239 is 200,000 times more radioactive than uranium 238. Plutonium, according to Dr. Arjun Makhijani, President of IEER, "is probably the most carcinogenic substance known." On January 19, 2001, after a one-week "investigation," NATO officials said, "traces of highly radioactive elements such as plutonium and americium were not relevant to soldiers' health because of their minute quantities." Later, the Associated Press reported on February 3, 2001, "U.S. officials have said the shells contained mere traces of plutonium, not enough to cause harm."

Uranium decays and external exposure to alpha particles is not as dangerous as exposure to other radioactive elements. Ingestion of high concentrations of uranium, however, can cause severe health effects, such as cancer of the bone or liver. Inhaling large concentrations of uranium can cause lung cancer, and ingestion of uranium can cause kidney damage. Alpha particles generally carry more energy than gamma or beta particles and deposit that energy quickly while passing through tissue. Alpha particles can be stopped by a thin layer of light material, such as a sheet of paper, and cannot penetrate the outer, dead layer of skin. When alpha-emitting atoms are inhaled or swallowed, they are especially damaging because they transfer relatively large amounts of ionizing energy to living cells.

According to Dr. Dan Bishop:

1 mg of DU (a barely visible dust particle) fires not 1 but 850 alpha bullets every minute, or over 8 million bullets in a single week. Not only that, if the DU particle resides in your body for over a week, sufficient thorium and protactinium have built up to also fire their beta bullets. This would bring the bombardment
count to 24 million hits per week. However, this increases the risk of biological damage by only 10%. This is because it is currently believed that the larger, more highly charged alpha particles are 20 times more effective at damage than beta particles. If the DU is contaminated by other radioactive isotopes, such as plutonium or americium, the odds of radioactive particles causing critical biological damage becomes significantly greater.19

Soldiers were never adequately trained to deal with exposure to this radiological environment. Soldiers in the Gulf War were not warned of DU's toxicity. Hundreds and perhaps thousands of GIs were exposed to seriously toxic substances without their knowledge or protection. The Pentagon, at least once, rephrased the description of DU ammunition to hide its radioactivity.

In another study, the Defense Department's Armed Forces Radiobiology Research Institute (AFRRI) scientists discovered that DU leads to the occurrence of oncogenes. Oncogenes are the tumorous growths believed to be the precursors to cancerous growth in cells. DU is believed to kill suppressor genes. Scientists also found that embedded DU, unlike most metals, dissolves and spreads through the body. It has been found in deposits in the spleen and the brain. In some experiments, a pregnant female rat will passes DU along to a developing fetus.20 There is not a fail-safe way to use contaminated DU in warfare. According to the Army Environmental Policy Institute (AEPI), "as much as 70% of a DU penetrator can be aerosolized when it strikes a tank. Aerosols containing DU oxides may contaminate the area downwind and DU fragments may also contaminate the soil around the struck vehicles." AEPI went on to further state, "if DU enters the body, it has the potential to generate significant medical consequences." Once inside the human body, uranium particles tend to stay, causing illnesses such as lung cancer and kidney disease that often take decades to manifest. Leonard A. Dietz, former Knolls Atomic Power Laboratory scientist, estimated that a trapped, single uranium oxide particle can expose the surrounding lung tissue to approximately 1,360 rems per year. This is 8,000 times the annual radiation dosage permitted by federal regulations. Particles not trapped in the respiratory system may be ingested and find their way
into the kidneys and reproductive organs.\textsuperscript{21}

Iraqi physicians and veterans have produced considerable evidence that the country is experiencing a significant rise in health problems such as cancer. These occurrences seem to correlate with the frequency and strength of DU detonation. Iraq formally complained to the United Nations (UN) about the damage caused by DU, but research to substantiate the claim was met with resistance.

Proof that contaminated DU might have dangerous radiological effects came in 1980, when workers at a Jonesboro, Tennessee plant, which manufactures DU penetrators, had the highest radiation exposures of any in the nation. One DU manufacturer, National Lead Industries of New York, was forced to shut down in 1980, because their emissions exceeded 150 micro-curies (385 grams) in a given month. Citizens Research and Environmental Watch (CREW), a Concord, Massachusetts, grassroots organization concerned about local DU munitions manufacturer, Nuclear Metals Inc., had soil samples from six Concord locations analyzed for radiation. The tests found uranium levels up to eighteen times background levels as far as nine-tenths of a mile away from the plant.\textsuperscript{22}

Skepticism about the safety and epidemiological toll of DU has spurned further investigations into its destructive consequences. The specter of Agent Orange, a poisonous defoliant, and how the Government misled veterans and the public during the Vietnam War, is still fresh in the memories of many people. It took more than a quarter century for the U.S. Government to admit that Agent Orange was a causal link in a host of illnesses experienced by returning veterans. It took even longer for the government to compensate World War II veterans for radiation illnesses from the explosion of the atomic bomb. Iraq’s case for assistance from the U.S., or the rest of the international community, is further hampered by the lack of resources from years of sanctions that were in place during Saddam Hussein’s regime.

The UN Security Council imposed economic sanctions against Iraq on August 6, 1990, after the Iraqi invasion of Kuwait. The Security Council still did not lift the sanctions even when the coalition declared victory after Operation Desert Storm. The sanctions served as leverage to press for Iraqi disarmament and other goals that were meant to
deter Iraqi aggression. The UN "Oil-for-Food Programme,"23 started in 1997 and offered some relief to Iraqis. The UN controlled all revenues from Iraq's oil sales, and contracts within the program were subject to oversight. The U.S. and Great Britain imposed political blockages on legitimate humanitarian contracts, claiming "dual-use" as military items. Washington called for and obtained the lifting of sanctions after Operation Desert Storm. This gave the U.S. occupying authority full control over Iraq's oil sales and refining industry. All members of the Security Council agreed that sanctions could end. However, many Council members were concerned that a resolution would indirectly justify the war and further legitimize the U.S. occupation. Many Council members thought Resolution 1483 diminished the UN's role in Iraq.24 Inspections to insure Iraq was free of weapons of mass destruction was not a provision of the resolution. One reason these UN inspections were disallowed might have been U.S. fears that spikes in background radiations were the result of DU usage. The U.S. would be the obvious primary user of the munitions in the Iraq war and bare the brunt of the punishment for any wrongdoing.

In order to assign guilt, a direct causal link would need to be established. The lack of access to conduct independent study, as well as the possible exposure to other biological warfare agents, native diseases, vaccines administered by the Army, and oil fire fumes can not be discounted as significant contributing factors to deteriorating health for those exposed. The Institute of Medicine stated that the information on DU is "of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence or absence of an association between an exposure to a specific agent and a health outcome in humans."25 The "two-hit" theory seems to be the most likely hypothesis for the illnesses and for the people that did not (or have not yet) developed the signs of the illness. Genetic background, resistance to disease, length of time and location in the theatre of war could also play pivotal roles in the onset or lack of onset of illness.

The AEPI continues to endorse the Army's past use and future plans to use DU. Intentionally or not, this underscores the need for a worldwide moratorium on DU, cleanup of existing sites, and better DU safety practices. Most especially, better medical attention and research
for those who have been exposed need to be the primary goal of learning and responding to the impact of DU. Unexplained illnesses are becoming more prevalent in veterans that share a common thread—namely participation in Operation Desert Storm and the conflict in Bosnia. It is not inconceivable that a new weapon implemented for the first time in history during the same two conflicts may have some causal association. The lure to further use this perfect, "new age" weapon may prove to be too strong to refrain from using it based on the human toll. Worse yet, the idea of admitting guilt and being found culpable for irradiating a large area would be a serious disincentive to admitting that DU may play a prominent role in the decline of human health.

DU is used in limited civilian capacities, but the large military and financial benefits come from the implementation and sale of DU as a weapon. The emphasis of research into the impact of DU should focus on the human impact of contaminated DU. Further research should also go into studying the environment that currently exists in Iraq, Bosnia, and any other place that DU munitions have been used. Analysis of current and past radiation levels should be made to further illuminate and guide the path of future research. Flawed experimental research and denial of facts and inquiry has impeded the progress of research to this point. Restrictions on independent research in regards to the impact of DU should not be condoned. Future use and sale of contaminated DU should be discontinued. If the implementation of DU weaponry must continue, then standards should be established to narrow the purity of DU for use in wartime munitions to 99.9% DU. The need for diplomacy should be emphasized and exhausted prior to the implementation of any DU weapon. DU appears to be another step along the line of increasing lethality and making war more attractive by the presenting the false image that war can be made quicker, easier and with less loss of military personnel. Contrary to this assumption, DU seems to have succeeded in accomplishing just the opposite.

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