

SCIENCE OR SCIENCE FICTION?

Facts, Myths and Propaganda In the Debate Over Depleted Uranium Weapons

Dan Fahey

March 12, 2003

This publication may be reproduced in whole or in part in any form for educational or non-profit purposes without special permission from the author provided acknowledgment of the source is made.

Acknowledgements

The author acknowledges his debt to the WISE Uranium Project, the National Gulf War Resource Center, Veterans for Common Sense, Swords to Plowshares Veterans Rights' Organization, Bill Motto Veterans of Foreign Wars Post 5888, Alexander Hamilton American Legion Post 448, Veterans' Speakers Alliance, Veterans for Peace, and the Military Toxics Project. He is most grateful to Peter Diehl and other reviewers for suggesting improvements to the text without in any way committing themselves to the opinions and conclusions in the report.

Dan Fahey earned a master's degree in international relations from the Fletcher School of Law and Diplomacy at Tufts University, and a bachelor's degree in government from the University of Notre Dame. He served in the U.S. Navy in 1990-91, including service in the Persian Gulf in July 1991, and graduated from the Navy's Tomahawk cruise missile school, Phalanx Close-In Weapons System school, and Surface Warfare Officer's School, among others. He served on the Board of Directors of the National Gulf War Resource Center from 1996-98, and he currently serves on the board of Veterans for Common Sense. He is a contributing author to "International Law and the Use of Depleted Uranium Munitions," forthcoming 2003. He lives in Berkeley, California and can be contacted at duweapons@hotmail.com.

SCIENCE OR SCIENCE FICTION?

Table of Contents

1. Summary	3
2. Introduction	5
3. Background Information	6
3.1. Uses	6
3.2. Effects	8
4. Common Myths and Propaganda about Depleted Uranium	11
4.1. Depleted uranium is harmless because it is “depleted”	11
4.2. DU has caused thousands of cancer deaths, birth defects and other illnesses among civilians in Iraq, the Balkans, and Afghanistan	11
4.2.1. Iraq	12
4.2.2. The Balkans	16
4.2.3. Afghanistan	20
4.3. There have been no cancers among US Gulf War veterans exposed to DU	23
4.4. The use of DU munitions saved thousands of American lives during the Gulf War	25
4.5. The use of DU munitions is an act of genocide	26
4.6. Over 900,000 kg (2,000,000 lbs.) of DU have been released in Afghanistan	27
4.7. The US government has secretly substituted natural uranium for DU in its weapons	28
4.8. DU was first used in combat by the Israeli Defense Force in the 1973 Yom Kippur War	29
4.9. Israel is using DU against the Palestinian people	30
4.10. Fill in the blank: During the 2003 war in Iraq, U.S. and British forces shot ____ (a few metric tons/thousands of metric tons) of DU, resulting in ____ (no/thousands of) cancers and birth defects	30
5. Conclusion	33
6. Recommendations	34
7. Recommended Web Sites and Reports	35

SCIENCE OR SCIENCE FICTION?

1. SUMMARY

One overlooked but significant consequence of the Bush administration's plans to invade Iraq is the renewed debate about weapons containing depleted uranium (DU). During the last decade, international interest in the effects of the use of DU munitions has ebbed and flowed with the tides of war. In the debate's present revival, the most zealous defenders and critics of DU munitions advance old and new claims that mix facts with fiction and propaganda, creating myths and misperceptions that obscure sensible assessments of DU's serious health and environmental effects.

Depleted uranium is a toxic heavy metal used in armor-piercing ammunition because its extreme density enables it to penetrate thick tank armor. The US A-10 aircraft has shot over 85 percent of the DU ammunition known to have been used in warfare, but other US jets and US and British tanks have also shot DU rounds during combat in Iraq and Kuwait, the Balkans, and perhaps Afghanistan. The impact of DU ammunition against a hard target contaminates the local area with respirable-size DU dust, which may be inhaled or ingested by friend and foe alike, during and after a battle.

At one extreme in the DU debate, the US Department of Defense (DoD) has overstated the importance of DU munitions and understated their adverse effects. In order to ensure the continued use of DU munitions and avoid responsibility for environmental cleanup and health care costs, DoD spokesmen have lied about the health of US Gulf War veterans exposed to DU and exaggerated the importance of DU rounds. In addition, the US government has so far refused to conduct a thorough study of the health of the thousands of Gulf War veterans it acknowledges were exposed to DU, enabling DoD spokesmen to plausibly but deceptively deny the existence of evidence linking DU to veterans' health problems.

By mixing facts with propaganda, DoD spokesmen have masked several important truths:

- The real "tank killer" in the US arsenal during the 1991 Gulf War was the Maverick missile, not the DU round;
- Fewer than one in seven tanks destroyed in the Gulf War was hit by DU rounds, and DU rounds destroyed few or no Yugoslav tanks during the Kosovo conflict; and
- The vast majority – perhaps 80 to 90 percent – of the DU rounds shot during various conflicts missed their targets and deposited relatively intact in the local environment, thereby minimizing the creation of harmful DU dust.

These facts simultaneously betray the inflated claims about the supremacy of DU rounds and expose the probability that the health hazards of DU were restricted to the locations where DU rounds actually impacted hard targets such as tanks.

At the other extreme of the debate, some anti-DU activists, the governments of Iraq and the former-Yugoslavia, Yasser Arafat, and Taliban sympathizers have worked jointly and independently to promote an apocalyptic vision of DU's effects. Their claims are often based on a mix of fact, fiction and propaganda, and they run the spectrum from the plausible to the absurd. Several of these claims are currently getting an undue amount of media attention:

SCIENCE OR SCIENCE FICTION?

- DU has caused thousands of cancer deaths, birth defects and other illnesses among civilians in Iraq, the Balkans, and Afghanistan;
- The use of DU munitions is an act of genocide;
- Over 900,000 kg (2 million lbs.) of DU have been released in Afghanistan; and
- The US government has secretly substituted natural uranium for DU in its weapons.

Since most of these claims are built upon speculation and lack any credible supporting evidence, they are easily discredited and discounted, but they have nonetheless stirred public concern and spurred very limited political action.

Just as enemies in war may each claim “god” is on their side, both extremes in the DU debate assert “science” supports their claims. In the dozen years since US forces first used DU munitions in the 1991 Gulf War, there have been scores of scientific studies and reports about DU. Based on this body of scientific evidence, several tentative conclusions can be drawn that chart a middle course between the extremists’ claims:

- DU can cause cancer, central nervous system damage, reproductive effects, and other health problems in laboratory rats;
- Evidence of human health effects caused by DU is inconclusive, due largely to the fact that the health status of only a few dozen people with verified exposures has been assessed; and
- After DU munitions have been used in combat, the presence of DU in soil and water, or on equipment and in buildings, may present short- and long-term hazards to the health of local populations.

Laboratory research on DU is ongoing, but the many uncertainties about the use and effects of DU munitions are unlikely to be resolved in the near future.

Although a decade of debate has advanced knowledge about DU, the polarized claims have also had the undesirable effect of limiting credible scientific studies of human populations with known or suspected DU exposures. Activists lack the funds and legitimacy to conduct such assessments, and governments with potentially large exposed populations have been reluctant to allow or undertake comprehensive health studies that might challenge their claims of extreme harm (Iraq) or absolute safety (US). In addition, the focus on the use of DU weapons by the US and British militaries may be obscuring the proliferation and use of DU ammunition by Russia, Pakistan, and other governments.

DU munitions are neither the benign wonder weapons promoted by Pentagon propagandists nor the instruments of genocide decried by hyperbolic anti-DU activists. While the political effects of using DU munitions are perhaps more apparent than their health and environmental effects, science and common sense dictate it is unwise to use a weapon that distributes large quantities of a toxic waste in areas where people live, work, grow food, or draw water. There’s no end in sight to the DU debate, but debunking the false claims from both extremes is an important first step in creating the conditions necessary for constructive dialogue and sensible scientific studies.

2. INTRODUCTION

Ever since U.S. veterans started reporting health problems after the 1991 Gulf War, interest in the use and effects of DU munitions has steadily increased. Some investigations have proclaimed DU virtually harmless, but other inquiries have blamed DU for thousands of cancers and other effects. While emerging scientific opinion appears to be carving out a middle-ground position that DU can cause significant health and environmental effects depending on a variety of conditions, the polar extremes continue to dominate public discussions about DU munitions.

This report is intended to inform the public debate about DU munitions by presenting factual information about their use and effects. This information is presented in the context of an analysis of some of the common unproven or false claims about DU made by the US Department of Defense, the governments of Iraq and the former-Yugoslavia, anti-DU activists, Yasser Arafat, and Taliban sympathizers. The goal of this paper is to try to dispel some of myths and propaganda about DU in order to promote serious investigation of the health and environmental effects of DU munitions by objective individuals and credible organizations.

3. BACKGROUND INFORMATION

3.1 Uses

There are three main reasons DU is used in munitions:

- DU exists in large quantities (700,000 metric tons in the USA¹) that are controlled by governments in countries that enrich uranium for weapons and power;²
- Its use in munitions relieves governments of their fiscal and legal responsibilities to properly store DU; and
- DU's extreme density (1.7 times that of lead), pyrophoricity (it burns when it fragments), and resistance to deformation (when alloyed with a small amount of titanium) enable it to effectively penetrate tank armor.³

DU ammunition is shot from large caliber tank guns, and small caliber guns mounted on aircraft, tanks, and fighting vehicles.

Six firms are known to currently manufacture or sell large caliber DU tank rounds:

- BAE Systems, Royal Ordnance Defence (UK) – 105mm, 120mm;⁴
- Giat Industries (France) – 120mm;⁵
- General Export for Defense (CIS) – 125mm;⁶
- Alliant Techsystems (USA) – 120mm;⁷
- Primex Technologies (USA) – 105mm, 120mm;⁸ and
- Pakistani National Development Complex (Pakistan) – 105mm, 125mm.⁹

General Export for Defense has also marketed a shaped charge high explosive tank round encased in a DU liner for “enhanced killing power.”¹⁰ BAE Systems has experimented with the use of shaped charge tank rounds encased in DU.¹¹

¹ U.S. Department of Energy, “Depleted UF6 Conversion EIS,” undated
<http://web.ead.anl.gov/uranium/duf6eis/index.cfm>.

² See e.g., Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME), Ad Hoc Working Group for Depleted Uranium, “Special Report: Medical and Environmental Evaluation of Depleted Uranium,” (Richland, WA, 1974) Vol. I: 1, 2.

³ The Royal Society, The health hazards of depleted uranium munitions, Part I, (London, 2001) p. 2; R. Pengelley, “The DU Debate: what are the risks,” *Jane’s Defence Weekly*, 15 January 2001).

⁴ T. Gander and C. Cutshaw, Eds., Jane’s Ammunition Handbook, 9th Edition, 2000-2001 (Surrey: Jane’s Information Group Limited, 2000) 189, 230.

⁵ T. Gander and C. Cutshaw, Eds., Jane’s Ammunition Handbook, 9th Edition, 2000-2001 (Surrey: Jane’s Information Group Limited, 2000) 226-227.

⁶ T. Gander and C. Cutshaw, Eds., Jane’s Ammunition Handbook, 9th Edition, 2000-2001 (Surrey: Jane’s Information Group Limited, 2000) 231-232. International Exhibition of Weapons and Military Technology, “125mm 3BEK17 Tank Ammunition with 36K216 Heat Projectile of Enhanced Killing Power,” General Export for Defense, Moscow (Abu Dhabi, United Arab Emirates, 1993). The 3BM32 round containing a 7.1 kg DU penetrator is compatible for use by T-64, T-72, T-80, T-84 and T-90 main battle tanks. C. Foss, Ed., Jane’s Armour and Artillery, 2000-2001, 21st Edition (Surrey: Jane’s Information Group Limited, 2000) 76.

⁷ “ATK Defense – Ammunition,” <http://www.army-technology.com/contractors/ammunition/alliant/index.html>.

⁸ Primex Technologies, “1999 Annual Report” (St. Petersburg, Florida, 1999) 1.

⁹ “Pakistan joins DU producer nations,” Jane’s Land Forces (9 May 2001)
http://www.janes.com/defence/land_forces/news/.

SCIENCE OR SCIENCE FICTION?

Depleted uranium has also been developed for use in small-caliber Gatling and machine guns (20mm, 25mm, 30mm) mounted on ships, fighting vehicles, and aircraft. In the United States, Alliant Techsystems and Primex Technologies manufacture these rounds.¹² The U.S. Marine Corps' Light Amphibious Vehicle (LAV) and AV-8B Harrier aircraft,¹³ as well as the Army's Bradley Fighting Vehicles,¹⁴ shoot 25mm DU rounds. The primary DU shooter in both the Gulf War and in the Balkans was the U.S. Air Force A-10 aircraft, which shoots a 30mm DU penetrator.¹⁵ According to Jane's Defense Weekly, no British aircraft shoot DU ammunition.¹⁶

The U.S. Navy uses 20mm DU ammunition in its Phalanx missile-defense gun. Interestingly, however, in 1989 the Navy announced it would change the Phalanx ammunition from DU to tungsten, "based on live fire tests showing that tungsten met their performance requirements while offering reduced probabilities of radiation exposure and environmental impact."¹⁷ Substantial stocks of DU ammunition remain in service with the Navy, and these are being expended rather than demilitarized. Some countries that purchased Phalanx guns from the U.S. have also discontinued the use of DU rounds.¹⁸

Despite the growth in the manufacture of DU ammunition, the great majority of the world's armies use armor-piercing ammunition made from tungsten alloy.¹⁹ In a surprising move, in January 2002 the British Ministry of Defense announced it would purchase tungsten alloy rounds for its Challenger II tanks "as an alternative to DU,"

¹⁰ International Exhibition of Weapons and Military Technology, "125mm 3BEK17 Tank Ammunition with 36K216 Heat Projectile of Enhanced Killing Power," General Export for Defense, Moscow (Abu Dhabi, United Arab Emirates, 1993).

¹¹ U.K. Ministry of Defence, "Depleted Uranium – the facts," (London, 2001) www.mod.uk.

¹² T. Gander and C. Cutshaw, Eds., *Jane's Ammunition Handbook*, 9th Edition, 2000-2001 (Surrey: Jane's Information Group Limited, 2000) 105. Primex Technologies, "1999 Annual Report" (St. Petersburg, Florida) 3; "ATK Defense – Ammunition," undated, <http://www.army-technology.com/contractors/ammunition/alliant/index.html>.

¹³ Bernard Rostker, letter to Dan Fahey, "Technical Response to FOIA Case Number 97-F-1524, Question Eleven," 11 February 1998. Both of these rounds are model PGU-20. The weight of the penetrator is 0.148 kg.

¹⁴ U.S. Army Center for Health Promotion and Preventive Medicine, *Radiological Sources of Potential Exposure and/or Contamination*, (Aberdeen Proving Ground, 10 December 1999) 117. This round, model M919, was first fielded in 1996. The weight of the depleted uranium penetrator is 0.0855 kg.

¹⁵ U.S. Army Center for Health Promotion and Preventive Medicine, *Radiological Sources of Potential Exposure and/or Contamination*, (Aberdeen Proving Ground, 10 December 1999) 117. This round is model PGU-14. The weight of the penetrator is 0.302 kg. A typical combat load for an A-10 is 1,100 rounds of 30 mm ammunition mixed at a ratio of 5 DU rounds to one high explosive round. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, *Depleted Uranium in the Gulf (II)* (Washington, DC, 2000) 104.

¹⁶ "Depleted Uranium – FAQs", *Jane's Defense Weekly* (London, 8 January 2001).

¹⁷ The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, *Depleted Uranium in the Gulf (II)* (Washington, DC, 2000) 96.

¹⁸ See e.g., Michael Smith, "Army buys 'safer' tank ammunition," *The Daily Telegraph (London)* (10 January 2002) 12.

¹⁹ "Depleted Uranium – FAQs", *Jane's Defense Weekly* (London, 8 January 2001).

SCIENCE OR SCIENCE FICTION?

although DU rounds will remain the weapon of choice in combat.²⁰ The U.S. Marine Corps has decided to forgo the use of DU rounds in favor of tungsten alloy ammunition for its Advanced Amphibious Assault Vehicle, which will be fielded in 2008. A Marine Corps spokesman stated, “We’re not considering depleted uranium anymore because of the environmental problems associated with it, be them real or perceived,”²¹ [sic].

Other military uses of DU include tank armor (for the U.S. M1 series tanks), ballast in aircraft, counterweights in helicopter blades, and about 0.1 g is used as a catalyst in certain anti-personnel mines.²² The U.S. Department of Defense also uses a DU casing in the “bunker busting” B61-11 nuclear weapon.²³ The DU casing is designed to enable the nuclear warhead to penetrate the ground before detonating, and DU casings may be used in other bunker busting weaponry.²⁴ It is possible other missiles contain DU counterweights,²⁵ but there is no reliable evidence to support the highly speculative claims that hundreds of kilograms of DU are used in missiles, rockets and bombs.

3.2 Effects

The impact of DU ammunition against a hard target creates a fine DU dust that contaminates the impact site, though small amounts of DU dust drift downwind. Test data from the United States demonstrate that, normally, about 20 percent of a DU penetrator is aerosolized on impact with a tank.²⁶ The impact of one 120 mm DU tank round could therefore create approximately 950 g of DU dust.²⁷ During a single attack by an A-10 aircraft shooting a burst of 30 mm ammunition, between five and 16 DU bullets will likely hit the target, creating 300 to 960 g of aerosol.²⁸

²⁰ Michael Smith, “Army buys ‘safer’ tank ammunition,” The Daily Telegraph (London) (10 January 2002) 12.

²¹ Peter Eisler, “Military study finds fouled weapons safe,” USA Today (24 June 2001) <http://www.usatoday.com/news/poison/2001-06-25-hotnukes-side.htm>.

²² U.S. Army Center for Health Promotion and Preventive Medicine, Radiological Sources of Potential Exposure and/or Contamination, (Aberdeen Proving Ground, 10 December 1999) 114 – 120. See also US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 40.

²³ Paul Richter, “Old-Fashioned Hide-Outs Fuel High-Tech Weaponry,” The Los Angeles Times (17 March 2002) A1; Matthew L. Wald, “U.S. Refits a Nuclear Bomb To Destroy Enemy Bunkers,” New York Times 31 May 1997: A1.

²⁴ See Paul Richter, “Old-Fashioned Hide-Outs Fuel High-Tech Weaponry,” The Los Angeles Times (17 March 2002) A1.

²⁵ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 25.

²⁶ U.S. Army testing found normally 10-35% (but up to 70%) of the round oxidizes into dust upon impact with a hard target. Twenty percent is commonly used to determine the amounts of dust created by an impact. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 203.

²⁷ The 120 mm M829A2 tank round contains a DU penetrator weighing 4.74 kg. Bernard Rostker, letter to Dan Fahey, “Technical Response to FOIA Case Number 97-F-1524, Question Eleven,” 11 February 1998.

²⁸ The number of penetrators hitting a target varies with the type of target, but 90 to 95% of the projectiles generally miss the target during air attacks. European Commission, Directorate General, Environment (EURATOM), “Opinion of the Group of Experts Established According to Article 31 of the Euratom Treaty, Depleted Uranium,” (Luxembourg, March 6, 2001) 2. “The weight of one [30 mm] penetrator is

SCIENCE OR SCIENCE FICTION?

About 90 percent of the DU dust created by the impact of a tank round against a hard target falls to the ground within 50 meters of the target,²⁹ although airborne DU has been measured out to 400 meters immediately following an impact.³⁰ The DU dust created by air attacks typically spreads over a larger area out to approximately 100 meters from the impacted target.³¹ Some DU dust may travel farther downwind, but the risk to downwind populations depends upon many factors, including the amount of DU released, its size and form, local environmental conditions, and the distance between a population and the site of release.

Although prolonged external exposure to DU metal can be hazardous,³² DU has the greatest potential to cause health effects when it enters the body. Routes of exposure to DU include:

- Injection of fragments through wounds;
- Inhalation of DU dust;
- Ingestion of DU directly or in contaminated food, soil and water;
- Wound contamination by DU dust; and
- Dermal absorption through external exposure to DU metal.

Injection of fragments and inhalation of DU dust are considered to be the routes of exposure most likely to potentially cause health effects, although the significance of each type of exposure remains unclear due to a lack of data on exposures to DU during and after armed conflict.

In locations where DU rounds hit hard targets, soldiers and civilians may be exposed to DU during combat or later, when people enter contaminated areas. Soldiers and civilians may climb on and enter destroyed equipment to salvage usable equipment,³³ and in the process cause the resuspension of DU dust that could be inhaled. Children or adults might collect the dense DU rods or fragments they find, and errant DU rounds may

approximately 300 g...A typical burst of fire occurs for two to three seconds and involves 120 to 195 rounds. These hit the ground in a straight line, one to three meters apart, depending on the angle of the approach, and cover an area of about 500 m²." United Nations Environment Programme/United Nations Centre for Human Settlements (Habitat), Balkans Task Force, Depleted Uranium in Kosovo, Post-Conflict Environmental Assessment, (Geneva, March 2001) 10. A typical combat load for an A-10 is 1,100 rounds of 30 mm ammunition mixed at a ratio of 5 depleted uranium rounds to one high explosive round. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000), 104.

²⁹ U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM), Depleted Uranium – Human Exposure Assessment and Health Risk Characterization, No. 26-MF-7555-00D (15 September 2000) R-2.

³⁰ Richard L. Fliszar, Radiological Contamination from Impacted Abrams Heavy Armor, Technical Report BRL-TR-3068 (Aberdeen Proving Ground, MD: Ballistic Research Laboratory, December 1989) 12, 37-38.

³¹ U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM), Depleted Uranium – Human Exposure Assessment and Health Risk Characterization, No. 26-MF-7555-00D (15 September 2000) R-2.

³² World Health Organization, Depleted uranium: Sources, Exposure and Health Effects (Geneva, 2001) 84.

³³ See e.g., Scott Peterson, "The Trail of a Bullet," The Christian Science Monitor, 5 October 1999, <http://www.csmonitor.com/atcsmonitor/specials/uranium/>. See also Dan Fahey, "Don't Look, Don't Find: Gulf War Veterans, the U.S. Government and Depleted Uranium, 1990-2000," Military Toxics Project, 30 March 2000, 14-19, http://www.ngwrc.org/Dulink/dont_look_dont_find.htm.

SCIENCE OR SCIENCE FICTION?

corrode in agricultural fields or water supplies.³⁴ According to a recent article in the Journal of Environmental Radioactivity, “children playing with soil may be identified as the critical population group [for DU exposure], with inhalation and/or ingestion of contaminated soil as the critical pathway.”³⁵

Once inside the body, DU may cause harm due to its chemical toxicity and/or alpha radiation. Laboratory studies on rats indicate short-term effects of internal exposure to DU may include kidney damage, while long-term effects may include cancer, central nervous system problems, immune system disorders and reproductive effects.³⁶ Given that a ten to 30 year lag may exist after a person’s exposure to DU dust and the development of cancer,³⁷ it is possible that effects may manifest over time.

Few humans exposed to DU have been studied, therefore little is known about the effects DU has had or may have in the future on exposed populations. Although there have been extensive studies of uranium mine workers, these studies have inherent weaknesses, and may have only limited applicability to studies of battlefield exposures to DU munitions.³⁸ In addition, estimates of combat and post-combat exposures to DU dust vary widely, in some cases by several orders of magnitude.³⁹ The uncertainties about the link between exposure to DU and the development of subsequent health problems may never be fully resolved, a fact made even more likely by the paucity of studies of exposed populations.

³⁴ Corrosion rates in soil are highly variable depending on locations and environments, but penetrators may completely disintegrate into particulate matter within five to 20 years. The Royal Society, The health hazards of depleted uranium munitions, Part II, (London, 2002) 21; United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Serbia and Montenegro: Post Conflict Environmental Assessment (Geneva, 27 March 2002) 27; United Nations Environment Programme, Balkans Task Force, Depleted Uranium in Kosovo. Post-Conflict Environmental Assessment (Geneva, March 2001) 27-28, 30-31. See also, Umberto Sansone, Pier Roberto Danesi, Sabrina Barbizzi, et al, “Radioecological survey at selected sites hit by depleted uranium ammunitions during the 1999 Kosovo conflict” The Science of the Total Environment, In press: accepted 22 June 2001.

³⁵ Christina Giannardi and Daniele Dominici, “Military use of depleted uranium: assessment of prolonged exposure,” Journal of Environmental Radioactivity 64 (2003) 227-236: 233.

³⁶ See D.E. McClain, et al, “Biological effects of embedded depleted uranium (DU): summary of Armed Forces Radiobiology Research Institute research,” The Science of the Total Environment (2001) 274: 117; Fletcher F. Hahn, Raymond A. Guilmette, and Mark D. Hoover, “Implanted Depleted Uranium Fragments Cause Soft Tissue Sarcomas in the Muscles of Rats,” Environmental Health Perspectives (2002) 110: 51; D.E. McClain, “Project Briefing: Health Effects of Depleted Uranium,” U.S. Armed Forces Radiobiology Research Institute (Bethesda, MD, 1999).

³⁷ N.D. Priest, “Toxicity of depleted uranium,” The Lancet (27 January 2001) 357: 245; Hong Xia et al, “Spatio-Temporal Models with Errors in Covariates: Mapping Ohio Lung Cancer Mortality,” Statistics in Medicine (1998) 17: 2038.

³⁸ U.S. Institute of Medicine, Gulf War and Health, “Volume 1, Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines,” (Washington, DC: National Academy Press, 2000) 159.

³⁹ See The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 9, 49, 224, 233, 244; The Royal Society, The health hazards of depleted uranium munitions, Part I, (London, 2001) 43, Annexe C. Read Annexe C of the Royal Society Report online at http://www.royalsoc.ac.uk/policy/du_c.pdf.

4. COMMON MYTHS AND PROPAGANDA ABOUT DEPLETED URANIUM

4.1 Depleted uranium is harmless because it is “depleted”

I first heard this story in October 1990 while I was in school learning how to operate the Navy’s Phalanx gun, which shoots a 20mm DU round. “Depleted uranium isn’t dangerous because it’s ‘depleted,’” the instructor told the class. What he meant is that DU is depleted of most of the highly radioactive U-235 isotope, which is removed from natural uranium to create enriched uranium for use in nuclear fuel and weapons. The waste product of the uranium enrichment process is called “depleted” uranium, but the choice of adjective should not be interpreted as meaning DU is harmless.

After the uranium enrichment process, DU emits approximately 40% less alpha radiation (high energy particles that travel only a few centimeters in air) than natural uranium. DU emits about 15% less gamma radiation than natural uranium. The beta radiation of DU is nearly identical to that of natural uranium, and the chemical toxicity is exactly the same as natural uranium as it is independent of the isotopic composition of uranium.

DU may cause adverse health effects, but as with all toxic substances, the risk depends upon the amount released in a given area, local environmental conditions, that age and health of the exposed person, the amount a person is exposed to, the route of exposure, and an array of other factors. The adjective “depleted” by no means diminishes the chemical and radioactive properties of DU, but it can affect how people perceive DU’s risks.

4.2 DU has caused thousands of cancer deaths, birth defects and other illnesses among people living in Iraq, the Balkans, and Afghanistan

Sources: The governments of Iraq and Yugoslavia, along with anti-DU activists and Taliban sympathizers

It is possible and even probable that some soldiers and civilians in some countries where DU munitions have been used have developed health problems as a result of exposure to DU. It is clear US forces have used DU munitions in Iraq and the Balkans; the use of munitions containing DU in Afghanistan remains uncertain.⁴⁰ At this time, however, there are no credible studies linking exposure to DU with any cancers or illnesses among people in Iraq, the Balkans or Afghanistan.

Although the claims about widespread and severe health effects are not backed up by credible studies, one British military expert on DU notes:

It would be wrong to dismiss such fears as wholly irrational and on such matters [the US and British] governments are of set habit highly economical with the truth. But much of the commentary has suffered from lack of accurate

⁴⁰ See WISE Uranium Project, “Current Issues – Depleted Uranium Weapons in Afghanistan,” <http://www.antenna.nl/wise/uranium/dissaf.html>.

SCIENCE OR SCIENCE FICTION?

information, and material put out by pressure groups is often willfully misleading.⁴¹

While there is a dearth of evidence supporting these claims, the absence of evidence should not be interpreted as evidence of absence; few studies have examined the health status of human populations exposed to DU. This issue will only be resolved when more health studies are conducted on exposed populations, but in the meantime assessments of the impacts of DU should avoid relying upon claims rooted more in science fiction than actual science.

4.2.1 Iraq

During the Gulf War, US tanks and aircraft shot approximately 286 metric tons of DU in Kuwait and Iraq (see Table 1). It is worth noting that for all that DoD has hyped the importance of DU munitions during the Gulf War, it has not released any estimate of the quantity of Iraqi tanks destroyed by DU rounds.⁴² In fact, a large variety of guided missiles, cluster bombs, and bullets destroyed approximately 3,700 Iraqi tanks,⁴³ but DU rounds accounted for only around 500 of this total. The real “tank killer” in the Gulf War was the Maverick missile – not the DU round:

- A-10s destroyed 900 Iraqi tanks with Maverick missiles but just 100 with 30mm DU ammunition;⁴⁴
- US tanks destroyed approximately 400 Iraqi tanks,⁴⁵ mainly with DU rounds;
- AV-8Bs primarily targeted Iraqi artillery with cluster bombs, but artillery as well as some tanks and other targets were likely targeted by DU ammunition.⁴⁶

Therefore, perhaps only one out of every seven destroyed tanks on the battlefield had been hit by DU rounds.

⁴¹ General Hugh Beach, “The military hazards of depleted uranium,” ISIS Briefing Paper No. 78, January 2001, para. 44, http://www.isisuk.demon.co.uk/0811/isis/uk/regpapers/no78long_paper.html#16.

⁴² See e.g. Tab F, “DU Use in the Gulf War,” of DoD’s 2000 report on DU: The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC: U.S. Department of Defense, 2000) 99-104; http://www.gulflink.osd.mil/du_ii/du_ii_tabf.htm.

⁴³ James F. Dunnigan and Austin Bay, From Shield to Storm, (New York: William Morrow, 1992) 284-286.

⁴⁴ According to From Shield to Storm, the A-10 aircraft destroyed 1,000 tanks. The DoD report to Congress notes, “In fact, more than 90 percent of the tank kills credited to the A-10 were achieved with IR Mavericks and not with its 30mm GAU-8 gun.” US Department of Defense, Conduct of the Persian Gulf War: Final Report to Congress, 1992: 139.

⁴⁵ James F. Dunnigan and Austin Bay, From Shield to Storm, (New York: William Morrow, 1992) 284-286.

⁴⁶ “AV-8B targets included artillery, tanks, armor vehicles, ammunition storage bunkers, convoys, logistics sites, troop locations, airfields, and known antiaircraft artillery/surface-to-air missile (SAM) locations. AV-8Bs expended 7,175 Mk-20 Rockeye cluster bombs, 288 Mk-83 bombs, 4,167 Mk-82 bombs, and 83,373 rounds of 25-mm machine gun ammunition.” US Department of Defense, Conduct of the Persian Gulf War: Final Report to Congress, 1992: 672. *n.b.* - The AV-8B fired a 4/5 mix of DU/high explosive rounds, which resolves the discrepancy between the amount above and the amount listed in Table 1.

SCIENCE OR SCIENCE FICTION?

Table 1. DU Ammunition Used in the 1991 Gulf War

Branch	Weapon System	Ammo Size	Quantity of DU Rounds	Weight of DU (kg)
US Army	M1 tank	105 mm	504 ⁴⁷	1,930
	M1A1 tank	120 mm	9,048 ⁴⁸	37,293
US Air Force	A-10 jet	30 mm	782,514 ⁴⁹	236,319
	A-16 jet	30 mm	1,000 ⁵⁰	302
US Marine Corps	AV-8B Harrier	25 mm	67,436 ⁵¹	9,981
	M60A3, M1A1	105, 120 mm	Unknown ⁵²	Unknown
US Navy	Phalanx gun	20 mm	Unknown ⁵³	Unknown
UK Army	Challenger tank	120 mm	88 ⁵⁴	408
Totals			Tanks – 9,640 Jets – 850,950	Tanks - 39,631 Jets – 246,602 Total – 286,233

Table compiled by Dan Fahey

⁴⁷ M1 tanks shot the M900 model DU round, which contains a DU penetrator weighing 3.83 kg. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 104.

⁴⁸ M1A1 tanks shot 6,700 M829 rounds (3.94 kg/DU), and 2,348 M829A1 rounds (4.64 kg/DU). The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 104.

⁴⁹ Each 30 mm GAU-8 (PGU-14) round contains 302 grams of depleted uranium. Bernard Rostker, letter to Dan Fahey, “Technical Response to FOIA Case Number 97-F-1524, Question Eleven,” 11 February 1998. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 104.

⁵⁰ The F-16 can be modified to an A-16 (“A” signifying “Attack”) with the addition of the GPU30 gun pod for close air support. Flown only by the New York National Guard’s 174th Tactical Fighter Wing, the A-16 flew only one Gulf War mission (on February 26, 1991), firing approximately 1,000 30mm DU rounds. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 99-100.

⁵¹ Each 25 mm GAU/12 (PGU/20) round contains 148 grams of DU. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 105.

⁵² “Initially, these tanks used pre-positioned, shipboard munitions stocks, which included DU ammunition. As the Marine M1A1s used up the shipboard stocks, they drew resupply rounds from Army munitions stocks.” The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 105. The U.S. Marine Corps used 210 M60A3 tanks and 76 M1A1 tanks during Operation Desert Storm. U.S. Department of Defense, Conduct of the Persian Gulf War, Final Report to Congress, (Washington, DC: April 1992) 750.

⁵³ Ships fired DU rounds during testing into the Persian Gulf, and a Naval frigate accidentally shot 4 or 5 DU shells in response to the launch of a shore-based anti-ship missile. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 105.

⁵⁴ Bernard Rostker, letter to Dan Fahey, “Responses to Depleted Uranium Questions from Mr. Dan Fahey,” 4 November 1997.

SCIENCE OR SCIENCE FICTION?

Although DoD has released a map of the general areas where DU munitions were expended,⁵⁵ the precise locations are unknown. An Iraqi report claims most of the DU was shot in Iraq near the southern city of Basra:

According to the personal communication with number [sic] of Iraqi Army Field Commanders, it was estimated that about 65% of the hit targets by these weapons [sic] were in the Iraqi side of the conflict and 75-80% of the above ratio were found in Al-Basrah War Zone.⁵⁶

The Department of Defense has not released an estimate of how many tanks or other vehicles were destroyed by DU inside Kuwait versus in Iraq.

Several pieces of evidence indicate the vast majority the DU rounds shot during the war probably deposited relatively intact in the local environment:

- Aircraft accounted for approximately 86 percent (by weight) of the DU shot during the war (see Table 1);
- A strafing attack from an aircraft typically results in few DU rounds (5-10 percent) hitting a target;⁵⁷
- Tank rounds accounted for approximately fourteen percent (by weight) of the total DU released, but more than half this quantity was shot on practice ranges in Saudi Arabia,⁵⁸ and in combat “eighty to ninety percent of the tank rounds fired will hit the target and remain in or near it.”⁵⁹
- Rounds that hit a soft target or the ground tend to stay intact or break into a few large fragments.⁶⁰

In the absence of evidence to the contrary, it is plausible that well over 80 percent (by weight) of the DU shot during the war did not hit a hard target,⁶¹ thereby minimizing the creation of respirable-size DU dust, and reducing the immediate post-war health risks posed by DU in Kuwait and Iraq.

⁵⁵ See a copy of the map at http://www.ngwrc.org/Dulink/DU_Map.htm.

⁵⁶ Republic of Iraq, Ministry of Higher Education and Scientific Research, “Conference on the Effects of the Use of Depleted Uranium Weaponry on Human and Environment [sic] in Iraq,” (26-27 March 2002) 8, posted at the web site of the International Depleted Uranium Study Team, <http://www.idust.org/>.

⁵⁷ European Commission, Directorate General, Environment (EURATOM), “Opinion of the Group of Experts Established According to Article 31 of the Euratom Treaty, Depleted Uranium,” (Luxembourg, March 6, 2001) 2. In U.S. Air Force tests prior to the Gulf War, ammunition shot from A-10 aircraft had an approximate miss rate of 90 percent, an approximate hit rate of 10 percent, and a kill rate of just 2 percent. U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM), Depleted Uranium – Human Exposure Assessment and Health Risk Characterization, No. 26-MF-7555-00D (15 September 2000) R-4. In the Gulf War, the miss rate was likely in excess of 90 percent because “of the Iraqi AAA threat, which forced the aircraft to operate at altitudes where the gun was less effective.” US Department of Defense, Conduct of the Persian Gulf War: Final Report to Congress, 1992: 139.

⁵⁸ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 79.

⁵⁹ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 80.

⁶⁰ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 42-43.

⁶¹ See e.g. General Hugh Beach, “The military hazards of depleted uranium,” ISIS Briefing Paper No. 78, January 2001, para. 18, 19, http://www.isisuk.demon.co.uk/0811/isis/uk/regpapers/no78long_paper.html#16.

SCIENCE OR SCIENCE FICTION?

Equipment hit by DU rounds did constitute a health hazard after the war. The US military rejected for shipment to the United States at least three Iraqi vehicles that were contaminated by DU rounds,⁶² but it did retrieve and ship home 23 contaminated US tanks and fighting vehicles for decontamination and disposal.⁶³ Kuwait paid foreign nationals to consolidate destroyed equipment in an area of its western desert, except for some equipment if left in place at the Udairi Training Range that has been used by US and other soldiers during the last decade for training exercises.⁶⁴ It is not known if the work crews or the training soldiers and marines took any protective measures, whether they were exposed to DU and at what levels, or if they have developed health problems as a result of exposure to DU or other exposures. DU exposures and health effects among the Kuwaiti population are also not known.⁶⁵

The Iraqi government has apparently made no effort to clean up its battlefield areas, even after it was known these areas may have been contaminated by DU. It is likely that many surviving Iraqi soldiers may have been exposed to DU on the battlefield, and circumstantial and anecdotal evidence suggests many Iraqi civilians may have been exposed to DU when they climbed on and/or entered contaminated equipment in the days, months, and years after the war to retrieve usable items, or in the case of children, to play.⁶⁶ As noted above, however, perhaps only one out of every seven tanks destroyed in Iraq was contaminated by DU.

The Iraqi government, often using its scientists and doctors as spokespeople, has attributed widespread and severe health effects to DU.⁶⁷ Claims about 12-fold increases in childhood leukemia and cancer and 10-fold increase in birth defects are very alarming,⁶⁸ but the Iraqi studies simply lay the blame on DU without providing evidence

⁶² US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 83-85.

⁶³ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 80-89. See also US Army Armament, Munitions and Chemical Command, Memorandum to Senior Command Representative, "Vehicle Assessment Report: Depleted Uranium Contamination," 14 May 1991. An additional three US tanks were shipped back to the US for decontamination after the July 11, 1991 munitions fire at the US Army base at Doha, Kuwait. The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC: U.S. Department of Defense, 2000) 109, 154.

⁶⁴ See Dan Fahey, "Don't Look, Don't Find: Gulf War Veterans, the U.S. Government and Depleted Uranium, 1990-2000," Military Toxics Project, 30 March 2000, 25-27, http://www.ngwrc.org/Dulink/dont_look_dont_find.htm.

⁶⁵ The International Atomic Energy Agency is expected to release a report about DU in Kuwait in Summer 2003 that may address this issue.

⁶⁶ See e.g., Scott Peterson, "A rare visit to Iraq's radioactive battlefield," The Christian Science Monitor, 29 April 1999, <http://csmweb2.emcweb.com/durable/1999/04/29/fp13s1-csm.shtml>.

⁶⁷ See e.g. Republic of Iraq, Ministry of Higher Education and Scientific Research, "Conference on the Effects of the Use of Depleted Uranium Weaponry on Human and Environment [sic] in Iraq," 26-27 March 2002, posted at the web site of the International Depleted Uranium Study Team, <http://www.idust.org/>. Read the Bush administration's statement about the Iraqi claims at "Depleted Uranium Scare," <http://www.whitehouse.gov/ogc/apparatus/suffering.html>.

⁶⁸ See e.g., William Thomas, "Invading Hiroshima," 4 February 2003, <http://www3.bc.sympatico.ca/Willthomas/action/InvadingHiroshima.htm>.

SCIENCE OR SCIENCE FICTION?

that study subjects were ever near DU, let alone exposed to it.⁶⁹ Moreover, they do not analyze possible alternative causes, such as industrial pollution, malnutrition, or the Iraqi use of chemical weapons during the Iran-Iraq war.⁷⁰

When I questioned the accuracy of the Iraqi government's claims in November 2001 during a DU conference in Spain, several Iraqi government officials in the audience bristled with anger and vehemently denounced me at the end of my presentation. They proclaimed there could be no cause other than DU for the sharp increase in illnesses affecting their population. These government officials were escorting several Iraqi scientists and doctors, who later echoed the party line; one also presented a slide show of medical horrors she attributed to DU.

Despite the obvious limitations with the Iraqi studies, anti-DU activists and Iraqi doctors have misleadingly pointed to the Iraqi studies and claims as proof that the effects of the use of DU are equivalent to effects of the Chernobyl nuclear reactor accident. The comparison to the Chernobyl accident, which has had quantifiable, widespread and serious health and environmental effects,⁷¹ is inaccurate and inappropriate. Nonetheless, among others, anti-DU activist Leuren Moret has claimed, "The use of depleted uranium by the Department of Defense has created a slow Chernobyl in the Middle East."⁷² Iraqi doctor Huda Ammash has even claimed the release of DU in Iraq is equivalent to 100 Chernobyl accidents.⁷³

If or when the Iraqi government changes, UN agencies should undertake a rapid assessment of the health status of the Iraqi people. This assessment should include identification of the environmental exposures that may be causative or contributing factors in the illnesses affecting the population, including but not limited to DU. Until studies with legitimacy and credibility in the international community are conducted, Iraq's claims of harm from DU will and should be perceived more as propaganda than proof.

4.2.2 The Balkans

By the time of the Kosovo conflict in 1999, there was considerable international interest in DU munitions. This interest had several effects, including enabling claims about the

⁶⁹ See e.g., Republic of Iraq, Ministry of Higher Education and Scientific Research, "Conference on the Effects of the Use of Depleted Uranium Weaponry on Human and Environment [sic] in Iraq," 26-27 March 2002, posted at the web site of the International Depleted Uranium Study Team, <http://www.idust.org/>.

⁷⁰ See e.g., Muhammad M. Al – Shammosy, "Neural tube defects in Diwaniyah: Increasing incidence," undated (found in the 'Health Effects' section of <http://www.pandoraproject.org/>); "Impact of Depleted Uranium on Man and Environment in Iraq," conference notes, (Baghdad, Iraq: December 2-3, 1998); and Dr. Alim Yacoup et al, College of Medicine, Basra University, "Further Evidence on Relation between Depleted Uranium, Incidence of Malignancies among Children in Basra, Southern Iraq," undated. See also R. F. Mould, "Depleted uranium and radiation-induced lung cancer and leukemia", Commentary, The British Journal of Radiology, August 2001, 680-681.

⁷¹ See <http://www.chernobyl.info/>.

⁷² Leuren Moret, letter to The Honorable Jim McDermott, 21 February 2003, <http://traprockpeace.org/LettertoMcDermott.pdf>.

⁷³ Felicity Arbuthnot, "Poisoned Legacy," New Internationalist, Issue 316, September 1999, <http://www.newint.org/issue316/poisoned.htm>.

SCIENCE OR SCIENCE FICTION?

effects of DU to reach a large international audience through a media focused on the war. For example, within two months of the end of the conflict in Kosovo – even before the quantity and locations of DU expenditure were known – British scientist Roger Coghill was quoted by the BBC as claiming “the American’s use of depleted uranium weapons in the war with Serbia is likely to cause 10,000 extra deaths from cancer.”⁷⁴

This and other frightful claims prompted governments and international organizations to conduct health and environmental assessments of DU. These assessments have produced a large body of literature and data about DU that have significantly advanced understanding about the use of DU munitions. Where the assessments’ findings have clashed with activists’ claims, however, conspiracy theories have grown and myths have flourished.

US aircraft shot DU rounds during two conflicts in the Balkans. In 1994-95, A-10 aircraft shot approximately 10,800 DU rounds in Bosnia,⁷⁵ releasing 3,260 kg of depleted uranium into the environment.⁷⁶ In 1999, A-10s shot approximately 31,300 DU rounds,⁷⁷ containing 9,450 kg of DU, at targets in Kosovo, Serbia and Montenegro.⁷⁸

A variety of evidence suggests that few of the DU rounds hit hard targets, thus minimizing both the creation of large amounts of DU dust and the potential for widespread and serious short-term health effects. As in the Gulf War, A-10s often shot their guns from high altitudes to avoid anti-aircraft fire, making it likely the miss rate of DU rounds was greater than the normal 90 percent. During the Kosovo conflict, US aircraft destroyed only a few dozen Yugoslav tanks and other equipment⁷⁹ using a variety of guided missiles, cluster bombs, and possibly DU rounds, so there was no battlefield strewn with contaminated equipment. Because the vast majority of the DU rounds likely deposited in the local environment, the immediate health risks appear to be small, making it unlikely that either large numbers of people were heavily exposed to DU dust or that DU caused rapidly developing illnesses including cancers.

Extensive studies of soldiers and limited studies of local civilian populations have not found evidence of health problems related to DU. A study of 122 German soldiers deployed to the Balkans found no evidence any of the soldiers had incorporated DU into

⁷⁴ Alex Kirby, “Depleted uranium ‘threatens Balkan cancer epidemic,” *BBC News*, 30 July 1999, <http://news.bbc.co.uk/1/hi/sci/tech/408122.stm>.

⁷⁵ On several occasions, A-10s shot DU munitions either within the 20km exclusion zone around Sarajevo or near Han Pijesak, which was the headquarters of the Bosnian Serb army. North Atlantic Treaty Organization, “Briefing by NATO Acting Spokesman Mark Laity and Statement by Ambassador Daniel Speckhard, Chairman Ad Hoc Committee on Depleted Uranium” (Brussels, Belgium: 24 January 2001).

⁷⁶ U.S. Department of Defense, news briefing by Mr. Kenneth Bacon, 4 January 2001.

⁷⁷ Angela Ashton-Kelley, U.S. Air Force 11th Wing, letter to Dan Fahey (31 January 2000).

⁷⁸ A-10s conducted 112 strikes with DU rounds against 85 targets in Kosovo, ten targets in Serbia, and one target in Montenegro. United Nations Environment Programme, Post-Conflict Assessment Unit, *Depleted Uranium in Serbia and Montenegro: Post Conflict Environmental Assessment in the Federal Republic of Yugoslavia* (Geneva, 27 March 2002) 168.

⁷⁹ Associated Press, “Postwar review found far fewer Serb weapons hit in Kosovo,” 9 May 2000.

SCIENCE OR SCIENCE FICTION?

their bodies.⁸⁰ Other assessments conducted by NATO countries with troops in the Balkans did not find evidence of either widespread DU exposure or DU-related health effects.⁸¹ Interestingly, one study found traces of DU in the urine of civilians from Bosnia-Herzegovina and Kosovo, but at levels less than the amount of natural uranium normally found in the human body.⁸² This finding suggests civilians living near DU impact sites may have been exposed to DU dust, while soldiers who deployed into battlefield areas after the cessation of hostilities were largely spared exposure.

The Post Conflict Assessment Unit (PCAU) of the United Nations Environment Program (UNEP) has led three scientific missions into the Balkans to assess the effects of DU munitions. The PCAU studies were limited by a long time lag between the cessation of hostilities and the beginning of field studies, and by limitations on the quality and quantity of the field studies due in part to the presence of mines and unexploded ordnance in the areas where DU munitions had been fired.⁸³ Nonetheless, the PCAU studies have provided the most comprehensive and accurate picture to date of the fate of DU in a battlefield environment.

At seventeen sites in Kosovo, Serbia, and Montenegro, PCAU found little evidence of widespread contamination caused by the impact of DU rounds on hard targets. This suggests the use of DU resulted in localized areas of contamination where DU rounds hit the ground that do not present any significant short-term health or environmental risks.⁸⁴

In Bosnia, PCAU found DU at three out of 14 sites it visited, including a tank repair facility, ammunition storage area and barracks. “We are concerned about the situation at the Hadzici tank repair facility and the Han Pijesak barracks,” said Pekka Haavisto, Chairman of UNEP DU projects. “The UNEP team detected DU-related materials and DU dust inside buildings that are currently used by local businesses or, in the case of Han Pijesak, by troops as storage facilities.”⁸⁵

The presence of plutonium and other transuranics in DU munitions has generated further controversy, but does not appear to add to the hazard presented by ordinary DU rounds. Penetrators recovered in the Balkans contained only trace amounts of plutonium, and

⁸⁰ P. Roth, E. Werner and H.G. Paretzke, “A study of uranium excreted in urine,” GSF – National Research Center for Environment and Health, Institute for Radiation Protection, Neuherberg, Germany, January 2001: 32.

⁸¹ See Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Medical Readiness, and Military Deployments, Information Paper: Depleted Uranium Environmental and Health Surveillance in the Balkans (Washington, DC: U.S. Department of Defense, 25 October 2001) http://www.deploymentlink.osd.mil/du_balkans/.

⁸² Nick D. Pries and M. Thirlwall, “Early results of studies on the levels of depleted uranium excreted by Balkan residents,” Archive of Oncology 2001; 9(4): 240.

⁸³ United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Kosovo, Post-Conflict Environmental Assessment, (Geneva, March 2001) 112-115.

⁸⁴ United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Serbia and Montenegro: Post Conflict Environmental Assessment (Geneva, 27 March 2002) 10.

⁸⁵ United Nations Environment Programme, Post-Conflict Assessment Unit, “UNEP identifies DU risks in Bosnia-Herzegovina,” 11 November 2002, <http://postconflict.unep.ch/pressbihdunov2002.htm>. The full report is due out in March 2003.

SCIENCE OR SCIENCE FICTION?

even the penetrator with highest reported plutonium concentrations “would only give rise to a very small increase in dose to exposed persons compared to that from the DU itself.”⁸⁶

The Post Conflict Assessment Unit’s findings suggest that DU in the Balkans may present risks to health and the environment depending on a variety of factors, but that the hazards are localized rather than widespread throughout the region, as some anti-DU activists have claimed.⁸⁷ PCAU has called attention to the potential future effects on local populations from contamination of ground and drinking water supplies by corroding DU penetrators, and the recovery and handling of corroding DU penetrators.⁸⁸ Accordingly, PCAU recommends the posting of signs and periodic testing of groundwater used for drinking at DU impact sites, along with decontamination “where feasible and justified.”⁸⁹

The use of DU in the Balkans has generated additional discussion about battlefield remediation. The British Royal Society notes: “It should be incumbent on nations using DU munitions in future conflicts to advise the local population of the potential dangers of handling fragments of penetrators.”⁹⁰ The World Health Organization has further recommended:

Where practicable, areas where significant DU contamination actually or potentially exists should be cordoned off until a survey has determined that it is safe for habitation. If levels warrant a clean-up of the area, the cordons should be retained and appropriately adjusted for actual conditions until results of a final status survey show the area is safe for unrestricted access.⁹¹

In addition, “collecting of intact or fragmented DU penetrators ... or other equipment containing DU for souvenirs or fabrication into other products should be actively discouraged.”⁹²

These actions and advisories may reflect an emerging conviction among international scientific and medical agencies on the need to warn civilian populations about areas of DU expenditure, restrict access to contaminated areas, and perform decontamination

⁸⁶ J.P. McLaughlin et al, “Actinide analysis of a depleted uranium penetrator from a 1999 target site in southern Serbia,” *Journal of Environmental Radioactivity* 64 (2003) 155.

⁸⁷ See e.g., Natasha Dokovska, “A New Chernobyl in the Balkans,” *Environmental News Service*, 13 April 1999, found at <http://www.ius.bg.ac.yu/apel/du-reports.html#ens>.

⁸⁸ United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Serbia and Montenegro: Post Conflict Environmental Assessment (Geneva, 27 March 2002) 33-34; United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Kosovo, Post-Conflict Environmental Assessment, (Geneva, March 2001) 119.

⁸⁹ United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Serbia and Montenegro: Post Conflict Environmental Assessment (Geneva, 27 March 2002) 36; United Nations Environment Programme, Post-Conflict Assessment Unit, Depleted Uranium in Kosovo, Post-Conflict Environmental Assessment, (Geneva, March 2001) 119.7, 27.

⁹⁰ Royal Society, The health hazards of depleted uranium munitions, Part I, (London, 2001) 24.

⁹¹ World Health Organization, Depleted uranium: Sources, Exposure and Health Effects (Geneva, 2001) 128.

⁹² World Health Organization, Depleted uranium: Sources, Exposure and Health Effects (Geneva, 2001) 129.

SCIENCE OR SCIENCE FICTION?

where environmental assessments find significant contamination or risks to public health or the environment.

These prescriptions are a far cry, however, from the claims that DU has caused widespread health and environmental effects in the Balkans⁹³ that have either been ignored or covered up by the international community.⁹⁴ Aside from the use of DU, there are many serious environmental health issues in the Balkans related to industrial waste and other pollution that may affect the health of the population and cause some of the health effects attributed to DU.⁹⁵ New studies of civilians – particularly involving children playing in contaminated areas and people working in contaminated buildings in Bosnia – could shed additional light on the health effects of DU, but the findings of numerous assessments and studies already completed all point to the same conclusion: the use of DU in the Balkans is unlikely to cause thousands of cancers, birth defects and other effects. In addition, many of the claimed health effects such as cancers appeared too soon after any possible exposure to be attributable to DU.

4.2.3 Afghanistan

The use of DU munitions by the US and its allies in the war in Afghanistan remains unclear. Claims about the use of DU munitions in Afghanistan have neither been confirmed by the US military, nor verified by independent investigations. Nonetheless, it appears likely that US forces may have used some DU munitions, and the Taliban and/or al Qaeda may have possessed DU rounds. Despite the absence of evidence confirming the actual use of DU munitions, claims about widespread health effects caused by DU munitions have circulated in the international press.

According to news reports, the US Air Force A-10 aircraft has shot 30mm ammunition while attacking ground targets in Afghanistan on at least seven occasions between March 2002 and February 2003.⁹⁶ While the A-10 typically shoots a mix of DU and high

⁹³ See International Court of Justice, “Case Concerning the Legality of the Use of Force (Yugoslavia v. United States of America),” Judgment of 2 June 1999, ICJ Reports 1999, General List Number 114, para. 3.

⁹⁴ See e.g., Piotr Bein, “Depleted Intelligence of Depleted Uranium Apologists,” 22 January 2001, <http://www.stopnato.org.uk/du-watch/bein/apologists.htm>.

⁹⁵ See e.g., United Nations Environment Programme, Balkans Task Force, The Kosovo Conflict – Consequences for the Environment and Human Settlements, October 1999, downloadable version found at <http://postconflict.unep.ch/publications.htm>.

⁹⁶ The reported dates of A-10 attacks are March 3-6, May 21, August 25, September 20, November 15, and December 20, 2002, and February 12, 2003. U.S. Department of Defense News Transcript, “DoD News Briefing – ASD PA Clarke and Brig. Gen. Rosa,” (5 March 2002)

http://www.defenselink.mil/news/Mar2002/t03052002_t0305asd.html. Evan Thomas, “‘Leave No Man Behind,’” Newsweek (18 March 2002) 26; Thom Shanker, “U.S. tells how rescue turned into fatal firefight,” The New York Times (6 March 2002) A1; Peter Baker, “Afghans Strengthen U.S. Force,” The Washington Post (8 March 2002) A1. Eric Schmitt, “American Planes Foil an Attack on an Airfield in Afghanistan,” The New York Times (22 May 2002) A9. Cesar G. Soriano, “U.S. to stay in Afghanistan indefinitely,” USA Today (25 August 2002). Associated Press, “U.S. base in Afghanistan attacked,” (20 September 2002). Associated Press, “U.S. Bases Under Fire,” (15 November 2002). Eric Schmitt, “Paratrooper from New Jersey dies in Afghan firefight near Pakistan border,” The New York Times (22 December 2002). Carlotta Gall, “Afghans report 17 civilian deaths in US-led bombing,” The New York Times (12 February 2003).

SCIENCE OR SCIENCE FICTION?

explosive rounds, it is not clear if DU rounds have been fired during these attacks, and if so, how many.

The Marine Corps has deployed two weapons to Afghanistan capable of shooting DU rounds. Several light armored vehicles were involved in a nighttime gunfight on 7 December 2001 near Kandahar,⁹⁷ but it is not clear whether DU rounds were used in this battle. DU-shooting AV-8Bs have also been used in combat, although apparently only to drop bombs,⁹⁸ making their use of DU ammunition uncertain.

One recent report suggests many of the missiles and bombs used by US forces in Afghanistan contain large quantities of DU.⁹⁹ There is no evidence, however, that any missiles or bombs containing DU have actually been used in Afghanistan. Moreover, claims that more than 900,000 kg (2,000,000 lbs.) of DU has been released in Afghanistan from missiles and bombs appear to be wildly exaggerated, particularly considering they are based on pure speculation about the use of DU in missiles and bombs.

The use of DU munitions by Al Qaeda, Taliban, Northern Alliance or other Afghan forces is unknown given currently available public information, although the US Department of Defence has stated that DU munitions were found in December 2001 among captured al Qaeda weapons near Kandahar. On three occasions, US Secretary of Defense Donald Rumsfeld confirmed the discovery of DU ammunition,¹⁰⁰ although the quantity, caliber, and origin of the rounds remain unclear. In March 2002, a spokesman for the US Department of Defense stated these rounds were being “tested,” and additional information would be forthcoming,¹⁰¹ but no further information has been released.

Although it is possible, and even probable, that US forces have used DU munitions in Afghanistan, it is unlikely this use has caused the effects attributed to it by anti-DU activists and Taliban sympathizers. In October 2001, as soon as US forces started attacking Taliban and al Qaeda forces, claims of babies poisoned to death by DU

⁹⁷ See Jeanette Steele, “Red Platoon’s light armor passes the test,” The San Diego Union-Tribune (20 December 2001) A5.

⁹⁸ Bill Glauber, “Marines move out of shadows and into fray,” The Baltimore Sun (4 November 2001) 15A; “Yuma-based Marines who flew combat missions over Afghanistan return home,” The Associated Press (3 March 2002).

⁹⁹ Dai Williams, “Mystery Metal Nightmare in Afghanistan?” (2002), <http://www.eoslifework.co.uk/u231.htm>.

¹⁰⁰ U.S. Department of Defense News Briefing, “Sec. Rumsfeld and Gen. Myers,” (16 January 2002) http://www.defenselink.mil/news/Jan2002/t01162002_t0116sd.html; U.S. Department of Defense News Transcript, “Secretary Rumsfeld Roundtable with Radio Media,” (15 January 2002) http://www.defenselink.mil/news/Jan2002/t01152002_t0115sdr.html; U.S. Department of Defense News Transcript, “Secretary Rumsfeld Interview with Baltimore Sun,” (27 December 2001) http://www.defenselink.mil/news/Dec2001/t12282001_t1227sun.html; See also “Current Issues – Depleted Uranium Weapons in Afghanistan,” (10 February 2002) <http://www.antenna.nl/wise/uranium/dissaf.html>.

¹⁰¹ Phone conversation with Captain Rico Player, U.S. Department of Defense Public Affairs (703.697.5131), 20 March 2002.

SCIENCE OR SCIENCE FICTION?

appeared in the Pakistani press.¹⁰² Others have suggested DU is responsible for a range of effects in Afghanistan: an increase in birth defects;¹⁰³ creation of “radioactive dust storms” and pollution of rivers;¹⁰⁴ and the sudden appearance of an array of serious, debilitating illnesses among civilians living near Jalalabad.¹⁰⁵ Anti-DU activist Dai Williams writes, “It is feared that these weapons have already started widespread and irreversible health problems for civilians and troops - a potential Afghan War Syndrome.”¹⁰⁶

There is no doubt the Afghan people have suffered tremendously during the last several decades of tyrannical rule, but there is no evidence – only unsupported speculation – that DU has affected the health of the Afghan population. As noted in the recent PCAU report, Afghanistan – Post-Conflict Environmental Assessment, the problems in Afghanistan have deep roots:

Tragically, the combined pressures of warfare, civil disorder, lack of governance and drought have taken a major toll on Afghanistan’s natural and human resources. These impacts have exacerbated a more general and long-standing process of land degradation, evidence of which is apparent throughout much of the country. As the country’s natural resource base has declined, its vulnerability to natural disasters and food shortages has increased.¹⁰⁷

Add to these conditions the abundance of landmines¹⁰⁸ and the recent introduction of more unexploded ordnance including cluster bombs,¹⁰⁹ and it is not hard to see how the unhealthy environment may affect the health of the human population. Indeed, the attribution of widespread, severe health effects in Afghanistan from DU munitions appears to stem from opposition to the United States and US foreign policy, rather than have grounding in any credible studies or analysis.

¹⁰² Sarmad Sufian, “U.S. used nuclear waste” Weekly Independent (Pakistan), Vol. 1, No. 23, 29 November – 5 December 2001, Front Page. See also, Agence France Presse, “The headlines around South Asia,” 30 October 2001.

¹⁰³ “US used more DU weapons in Afghanistan than in Persian Gulf War: Drakovic,” Tehran Times, 9 November 2002, <http://rawa.false.net/du2.htm>.

¹⁰⁴ Richard S. Ehrlich, “Depleted Uranium Toxicity in Afghanistan,” Laissez Faire Times, vol. 5, no. 44, 29 October 2001, http://www.xs4all.nl/~stgvisie/VISIE/afghan_uranium.html.

¹⁰⁵ Uranium Medical Research Centre, “Afghan Field Trip #2 Report,” undated, http://www.umrc.net/downloads/destruction_effects.pdf.

¹⁰⁶ Dai Williams, “Mystery Metal Nightmare in Afghanistan?” (2002), <http://www.eoslifework.co.uk/u231.htm>.

¹⁰⁷ United Nations Environment Programme, Post-Conflict Assessment Unit, Afghanistan – Post-Conflict Environmental Assessment, 2003: 5, <http://postconflict.unep.ch/publications.htm>.

¹⁰⁸ United Nations Department of Public Information, “UN warns Afghan civilians to steer clear of deadly landmines,” 9 November 2001.

¹⁰⁹ Agence Presse-France, “UN calls for information on cluster bomb raids in Afghanistan,” 9 November 2001.

4.3 There have been no cancers among US Gulf War veterans exposed to DU

Sources –Michael Kilpatrick and Col. Erik Daxon, and Col. Frank O’Donnell, all from U.S. Department of Defense

This lie was created by the U.S. Department of Defense in January 2001 to calm European concerns about DU ammunition used in the Balkans. At that time, news reports throughout Europe speculated that DU shot by U.S. A-10 aircraft might be causing cancer, leukemia and other health effects among NATO soldiers who served in Bosnia and Kosovo.¹¹⁰ Ironically, the U.S. Department of Defense helped create this controversy by refusing for a year and a half after the Kosovo conflict to release any information about its use of DU ammunition, a delay which provided grist for the rumor mills that created the claims about widespread DU-induced cancers and leukemia.

In an attempt to downplay concerns about DU-induced cancers, Pentagon spokesman Michael Kilpatrick made an unambiguous statement to the NATO press corps: “We have seen no cancers or leukemia in this group [participants in the DU Program], which has been followed since 1993.”¹¹¹ This denial is also contained in a Power Point presentation given by Kilpatrick and Col. Erik Daxon to the ambassadors of the North Atlantic Council.¹¹² In June 2001 at a DU conference in Germany attended by the author, U.S. Army Colonel Francis O’Donnell echoed Dr. Kilpatrick’s statement, telling scientists from a dozen European governments and several United Nations agencies that there have been no cancers among the 60 veterans examined by the DU Program.¹¹³

Despite these explicit and public denials, at least one of 50 veterans examined in 1999 by the US Department of Veterans Affairs’ (VA’s) “Depleted Uranium Follow-Up Program” (DU Program) had a lymphatic cancer: Hodgkin’s disease.¹¹⁴ The existence of this cancer was initially disclosed during an October 1999 meeting between DoD and VA

¹¹⁰ See e.g., articles by the BBC,

http://news.bbc.co.uk/1/hi/in_depth/europe/2001/depleted_uranium/default.stm and Christian Science Monitor, <http://www.csmonitor.com/atcsmonitor/specials/uranium/index.html>.

¹¹¹ Dr. Michael Kilpatrick and Col. Erik Daxon, U.S. Department of Defense, 10 January 2001, NATO Press Briefing, Brussels, Belgium, <http://www.nato.int/docu/speech/2001/s010110b.htm>. Dr. Kilpatrick is currently Director of the Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Medical Readiness, and Military Deployments.

¹¹² See “Medical Surveillance,” <http://www.nato.int/du/010110pc/frame.htm>.

¹¹³ Col. Frank O’Donnell, Expert Meeting on “Depleted Uranium in Kosovo: Radiation Protection, Public Health and Environmental Aspects,” Bad Honnef, Germany, 20 June 2001, author’s notes.

¹¹⁴ The Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, “Meeting with Dr. Melissa McDiarmid and her staff on October 15, 1999 to discuss the Baltimore DU Follow-Up Program and the Extended Follow-Up Program,” undated.

http://www.gulflink.osd.mil/du_ii/du_ii_refs/n52en651/0089_005_0000001.htm. This document confirms that one veteran had lymphoma, but Dr. McDiarmid stated it was a Hodgkin’s Lymphoma during a phone conversation with the author on February 12, 2001. Another document on the Pentagon’s Gulf War website (GulfLink) notes that the loader of a tank penetrated by a DU round later developed cancer. It is not clear if this veteran is the same veteran later examined by Dr. McDiarmid in Baltimore. See “Interview of loader for A-14,” Lead Sheet #18932, 4 November 1998, in Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, *Depleted Uranium in the Gulf (II)* (Washington, DC, 2000), http://www.gulflink.osd.mil/du_ii/du_ii_refs/n52en376/8244_006_0000002.htm.

SCIENCE OR SCIENCE FICTION?

officials. Among the meeting participants were Michael Kilpatrick and Col. O'Donnell, the very men who, fifteen and twenty months later, respectively, told public audiences at the height of the European DU controversy that no cancers had been found.

It is possible this veteran's cancer is not linked to his confirmed exposure to DU inside a vehicle when it was hit by a DU round, but then again, it's possible that it is related.

According to the U.S. Institute of Medicine report on DU:

The lymphatic system is an important potential target for uranium radiation because inhaled insoluble uranium oxides can remain up to several years in the hilar lymph nodes of the lung. Studying the effect of uranium exposure on lymphatic cancer is more difficult than studying lung cancer because lymphatic cancer is much less common.¹¹⁵

The occurrence of an uncommon lymphatic cancer among 50 DU-exposed veterans may be a cause for concern, but so too is the Pentagon's denial of its existence, and the DU Program's unexplained public silence on the matter until long after the DU controversy had died down in Europe.¹¹⁶

In addition to the veteran with cancer, a second veteran examined by the DU Program in 1999 had a bone tumor in his arm.¹¹⁷ This finding was not only omitted from the 2001 public statements of Dr. Kilpatrick, Col. Daxon and Col. O'Donnell, but also noticeably and inexplicably missing from the DU Program's published report about the findings of its 1999 examinations.¹¹⁸ According to the U.S. Institute of Medicine: "Like the lymphatic system, bone is an important potential target for the effects of uranium because uranium is distributed to the bone, replaces calcium in bone matrix, and may remain in bone for several years."¹¹⁹

In fact, the DU Program is beset by several problems in addition to having its findings manipulated by Pentagon officials, or intentionally omitted by the program administrator:¹²⁰

¹¹⁵ U.S. Institute of Medicine, Gulf War and Health, "Volume 1, Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines," (Washington, DC: National Academy Press, 2000) 142.

¹¹⁶ See Dan Fahey, "Depleted Legitimacy: The U.S. Study of Gulf War Veterans Exposed to Depleted Uranium," 4 May 2002, <http://www.ngwrc.org/conf2002/NGWRC-DU-Atlanta.pdf>

¹¹⁷ The VA's DU Program told the veteran the tumor was benign, but the tumor is not formally documented in a publicly released document. The veteran discussed his bone tumor in an interview with Akira Toshiro from the Hiroshima, Japan newspaper Chugoku Shimbun (4 April 2000): http://www.chugoku-np.co.jp/abom/uran/us_e/000404.html.

¹¹⁸ See Melissa McDiarmid, et al, "Surveillance of Depleted Uranium Exposed Gulf War Veterans: Health Effects Observed in an Enlarged 'Friendly Fire' Cohort," J Occup Environ Med (2001) 43: 991-1000.

¹¹⁹ U.S. Institute of Medicine, Gulf War and Health, "Volume 1, Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines," (Washington, DC: National Academy Press, 2000) 143.

¹²⁰ See U.S. Department of Veterans Affairs, DU Follow-Up Program, "Report on the VA Depleted Uranium Follow-Up Program," undated. This three-page report was generated in response to a 14 January 2003 letter from the author to Secretary of Veterans Affairs Anthony Principi regarding problems with DU Program. The report states that "Response to allegations of individuals' cancer and bone tumors cannot be addressed without violating patient confidentiality...However, it can be stated that all findings of clinical significance potentially related to DU exposure have been disclosed."

SCIENCE OR SCIENCE FICTION?

- In a decade of operation, the DU Program has assessed the health status of only approximately seventy of the 866 to 932 soldiers that DoD conservatively estimates may have had moderate to heavy DU exposures (above regulatory limits) during and after the Gulf War;¹²¹ and
- As noted in a 1993 VA report about the DU Program: “The small size of the [enrolled] population...[makes it] highly unlikely that definitive conclusions concerning cancer induction will be obtained from the study.”¹²²

As long as the DU Program continues to assess the health status of only a small fraction of the number of veterans exposed to DU, the significance of its finding and conclusions will remain of limited use to other investigators and analysts.

While the European fears about DU appear to have been overblown, it is hard to justify the Pentagon’s blatant lie about the health of its own veterans to further the political goal curtailing the public debate about DU munitions. DoD policies regarding DU are guided by the intent to ensure the continued use of DU munitions,¹²³ and the desire to avoid “the financial implications of long-term disability payments and health care costs” for exposed populations.¹²⁴ Nonetheless, since many governments and international organizations rely upon the findings of the DU Program to assess the health and environmental effects of DU, it is important that the DU Program be comprehensive and transparent so that its findings and conclusions can be trusted. Until the DU Program is overhauled and its leadership changed, its findings and recommendations should be regarded as specious.

4.4 The use of DU munitions saved thousands of American lives during the Gulf War

Source – Bernard Rostker, U.S. Department of Defense

For the last decade, Pentagon officials have often resorted to promoting the effectiveness of DU ammunition when faced with tough questions about DU’s health and environmental effects. DU ammunition does work well at penetrating tank armor, but Pentagon officials tend to vastly overstate its importance while downplaying the effectiveness of alternatives such as tungsten alloy ammunition. Perhaps the most exaggerated proclamation about the value of DU came from Bernard Rostker, for a time the Pentagon’s point man on DU, who stated: “DU did have an effect on the battlefield.

¹²¹ Office of the Special Assistant to the Deputy Secretary of Defense for Gulf War Illnesses, Depleted Uranium in the Gulf (II) (Washington, DC, 2000) 7.

¹²² U.S. Department of Veterans Affairs, Baltimore VAMC, Department of Veterans Affairs Program for the Follow-up and Monitoring of Gulf War Veterans with Imbedded Fragments of Depleted Uranium, Draft, (23 September 1993) 11, http://www.gwu.edu/~nsarchiv/radiation/dir/mstreet/commeet/meet3/brief3.grf/tab_h/br3h1a.txt.

¹²³ See e.g. LTC M.V. Ziehm, memo to Studies and Analysis Branch, Los Alamos National Laboratory, Subject: “The Effectiveness of Depleted Uranium Penetrators,” March 1, 1991.

¹²⁴ US Army Environmental Policy Institute, Health and Environmental Consequences of Depleted Uranium Use by the U.S. Army, Technical Report (Atlanta: AEPI, 1995) 4.

SCIENCE OR SCIENCE FICTION?

It undoubtedly saved thousands of American lives,¹²⁵ (emphasis in original). Other Pentagon spokesmen have since repeated variations of this theme.

If DU did save thousands of lives during the Gulf War, why did DoD wait until 1998 to make this claim? The short answer is because there is not a shred of evidence to back it up.

DU rounds shot by tanks and aircraft did destroy approximately 500 out of the 3,700 Iraqi tanks, and DU tank armor did protect US soldiers (though only 1/3 of the US tanks used in the war had DU armor).¹²⁶ Thanks to superior fire control systems and guns, US and British tanks also had a longer reach than Iraqi tanks, often enabling them to shoot Iraqi tanks while staying out of range of the Iraqi guns. It is hard to believe, however, that in a war in which the US suffered only 148 combat deaths (13 of those by DU rounds in friendly fire incidents) and 467 wounded in action, and in which missiles and bombs accounted for 86 percent of the destroyed Iraqi tanks, that DU rounds protected the lives of thousands of American troops, or conversely, that thousands of Americans would have been killed if the US had used tungsten alloy ammunition instead of DU.

The myth that DU saved thousands of lives and the suggestion it is indispensable to the US arsenal serve to both justify the continued use of DU munitions and dampen concerns about the health and environmental effects of DU. These assertions may explain why the US Congress had devoted just one-half of one public hearing to examining the use of DU munitions,¹²⁷ out of the dozens of hearings it has held analyzing Gulf War toxic exposures. Nonetheless, this myth lives on not only because DoD's public relations team is doing a good job promoting it, but also because anti-DU activists are doing a poor job debunking it using publicly available facts.

4.5 The use of DU munitions is an act of genocide

Sources: The Federal Republic of Yugoslavia, along with Dai Williams¹²⁸ and Piotr Bein¹²⁹

This very serious claim was first made in June 1999 by the Yugoslav government against the United States government in a submission to the International Court of Justice:

...The use of weapons containing depleted uranium is having far-reaching consequences for human life. The above-mentioned acts are deliberately creating

¹²⁵ Bernard Rostker, U.S. Department of Defense, 23 March 1998, American Legion Washington Conference, Washington, DC, http://www.deploymentlink.osd.mil/du_library/statements/speeches.shtml.

¹²⁶ US Department of Defense, Conduct of the Persian Gulf War: Final Report to Congress, 1992: 750.

¹²⁷ US Congress, House Committee on Government Reform and Oversight, Subcommittee on Human Resources, 26 June 1997.

¹²⁸ Dai Williams, "Last chance to question US dirty bombs for Iraq," 7 February 2003, <http://www.eoslifework.co.uk/Uhaz7feb03/index.htm>.

¹²⁹ Piotr Bein, "Depleted Intelligence of Depleted Uranium Apologists," 22 January 2001, <http://www.stopnato.org.uk/du-watch/bein/apologists.htm>.

SCIENCE OR SCIENCE FICTION?

conditions calculated at the physical destruction of an ethnic group, in whole or in part.¹³⁰

The determinative language was taken straight from the 1948 *Convention on the Prevention and Punishment of the Crime of Genocide*, which defines genocide as "...acts committed with intent to destroy, in whole or in part, a national, ethnical, racial or religious group."¹³¹ The crimes under this convention include genocide plus attempts at genocide or complicity in acts of genocide.

There is no evidence DU has actually killed or even caused serious bodily harm to a large, defined population (other than perhaps soldiers on the battlefield), so the act of using DU cannot reasonably be considered an act of genocide. In addition, there is no evidence DU has been used with the *intent* to destroy a given population (other than soldiers on the battlefield), so neither the act of using DU nor any complicity in the use of DU munitions could reasonably be considered acts of genocide.

Aside from claims DU is already having genocidal effects by causing widespread deaths, anti-DU activist Leuren Moret has also claimed the United States has intentionally used DU munitions "to destroy the genetic future of the Iraqi people."¹³² These claims lack any grounding in credible scientific studies or assessments, but they are repeated often enough that they have come to be accepted by some as irrefutable facts. On the eve of another war in Iraq, claims of a new genocide are already circulating,¹³³ so this myth is likely to persist for the foreseeable future.

4.6 Over 900,000 kg (2,000,000 lbs.) of DU have been released in Afghanistan

Source: Dai Williams¹³⁴

This myth is based upon several large assumptions thinly tied to two facts: 1) the US has used many missiles and bombs in Afghanistan; and 2) some missiles in the US arsenal may use DU for ballast or as a casing for the explosive charge. What is missing is the link establishing that the US has in fact used missiles or bombs in Afghanistan that contain DU. And even if the US has used some missiles that contain DU, there is not a shred of evidence this use has released a quantity anywhere near 900,000 kg (2,000,000 pounds) of DU.

¹³⁰ International Court of Justice, "Case Concerning the Legality of the Use of Force (Yugoslavia v. United States of America)," Judgment of 2 June 1999, ICJ Reports 1999, General List Number 114, para. 3.

¹³¹ United Nations General Assembly, Convention on the Prevention and Punishment of the Crime of Genocide, Resolution 260 (III), 9 December 1948.

¹³² Leuren Moret, letter to The Honorable Jim McDermott, 21 February 2003, <http://traprockpeace.org/LettertoMcDermott.pdf>.

¹³³ Dai Williams, "Last chance to question US dirty bombs for Iraq?" 7 February 2003, <http://www.eoslifework.co.uk/Uhaz7feb03/sld012.htm>.

¹³⁴ Dai Williams, "Hazards of Uranium weapons in the proposed war on Iraq," 22 September 2002, <http://www.eoslifework.co.uk/u231.htm>.

SCIENCE OR SCIENCE FICTION?

This entire myth hinges on the use of dense metal alloys in some missiles and bombs to improve penetration of the ground. Though some US patents mention DU along with tungsten and steel as possible metals for penetration warheads, available evidence points to the use of DU in this way for only one missile: a nuclear missile designed for penetrating the ground or underground bunkers.¹³⁵

During the last few years, estimates of the amount of DU used in missiles have dramatically increased. For example, speculation about DU in Tomahawk cruise missiles¹³⁶ has ranged from 3 kg (6.6 lbs.),¹³⁷ to Dai Williams' improbable 454 kg (1,000 lbs.) per missile.¹³⁸ There is no source given in Williams' reports for the estimate that each Tomahawk contains this much DU; the figure is calculated based on another baseless estimate that virtually every missile, rocket and bomb used in Afghanistan contains a mass of DU equivalent to fifty to seventy-five percent of its warhead weight (equating to DU weights of between 11 kg (25 lbs.) and 2,000 kg. (4,400 lbs.) per missile).

This claim is built on one speculation after another, so the astronomical estimate should be regarded more as a work of science fiction than a product of academic analysis. Nonetheless, this myth has proven to have amazing legs, and it has supported at least two other unsupported claims: that the use of DU is an act of genocide, and the US government has secretly substituted natural uranium for DU in its weapons.

4.7 The US government has secretly substituted natural uranium for DU in its weapons

Source: Uranium Medical Research Centre

The origin of this myth is a claim by the Uranium Medical Research Centre (UMRC), headed by Dr. Asaf Durakovic. In its undated "Afghan Field Trip #2 Report: Precision Destruction – Indiscriminate Effects," UMRC claims it found high levels of natural uranium (400 to 2000 times normal) in some Afghan civilians living near sites bombed by US armed forces. UMRC dismisses several possible explanations for this finding, but claims, "It has been suggested that the US replaced Depleted Uranium with Natural

¹³⁵ P. Richter, 'Old-Fashioned Hide-Outs Fuel High-Tech Weaponry', [The Los Angeles Times](#), 17 March 2002, p. A1; M. L. Wald, 'U.S. Refits a Nuclear Bomb To Destroy Enemy Bunkers', [The New York Times](#) 31 May 1997, p. A1.

¹³⁶ A Tomahawk cruise missile (without booster) weighs approximately 2,900 pounds. Most Tomahawks carry a 1,000-pound high explosive warhead or cluster bombs plus a guidance system, fuel, rocket engine, outer shell, wings, and other components. See Tomahawk cruise missile information and diagrams at: <http://navysite.de/weapons/tomahawk.htm>, and http://www.raytheon.com/products/tomahawk/ref_docs/tomahawk.pdf.

¹³⁷ Roger Coghill, Chris Busby, Alasdair Philips et al, "The Question of depleted uranium bombing: battlefield Chernobyl," <http://www.mtvsvz.hu/du/webdu.htm>.

¹³⁸ See diagram at <http://www.eoslifework.co.uk/u23.htm>, Dai Williams, "Hazards of suspected Uranium weapons in the proposed war in Iraq (Summary)," 24 September 2002.

SCIENCE OR SCIENCE FICTION?

Uranium [in its weapons].”¹³⁹ UMRC does not name a source for the suggestion that the US has replaced DU with natural uranium (U), nor does UMRC offer any evidence that such a switch has even been contemplated. UMRC explains that the switch from DU to U “would allow for plausible deniability when the uranium was discovered (attributed to naturally occurring, geological conditions).”

Perhaps the main reason the US uses DU in munitions is that it maintains a stockpile of approximately 700,000 metric tons (1.5 billion lbs.). Natural uranium has greater value than DU because it can be processed to create enriched uranium for nuclear weapons and fuel. It doesn't make sense for the US to release large quantities of natural uranium into an adversary's territory; just a few of the errant or dud missiles and bombs used in Afghanistan could provide a foe with thousands of kilograms of natural uranium (according to Dai Williams' estimates), which could be processed to create enriched uranium for use in a nuclear weapon. Moreover, this myth is based upon the previous myth that missiles, rockets and bombs used in Afghanistan actually contain DU in any significant quantities. The lesson here is to distrust and question claims that on their face appear unrealistic, and which are not backed up by a single document or report.

4.8 DU was first used in combat by the Israeli Defense Force in the 1973 Yom Kippur War

Source: Unknown, but repeated by Doug Rokke,¹⁴⁰ Dai Williams,¹⁴¹ and Piotr Bein and Peda Zorić¹⁴²

The exact creator of this myth is unknown, but the claim seems to be based on a photograph taken by a US soldier who served in the Sinai Peninsula with the United Nations. The soldier found some rusted tanks – wreckage from the Yom Kippur War – that had holes in them. The soldier apparently claims he got sick after examining this wreckage.

From this soldier's story, the myth grew that the observed holes were caused by DU munitions shot by the Israeli Defense Forces. But that's not all: the myth contends that the US secretly gave the DU rounds to the Israeli's in order to test their battlefield effectiveness.

The only evidence supporting this myth is the soldier's story and the theories expounded by anti-DU activists: there is no objective evidence, document, or report that even remotely suggests the myth is true. The US was developing experimental DU munitions in 1973, but it did not provide them to US combat units the late 1970s, therefore it is

¹³⁹ Uranium Medical Research Centre, “Afghan Field Trip #2 Report,” undated, p. 4, http://www.umrc.net/downloads/destruction_effects.pdf.

¹⁴⁰ Doug Rokke, “The Scourge of Depleted Uranium,” 24-25 May 2001, <http://traprockpeace.org/DuRokkeGreece.pdf>

¹⁴¹ Dai Williams, quoted on Al Jazeera TV (transcript via BBC Worldwide Monitoring), 15 January 2003.

¹⁴² Piotr Bein and Peda Zorić, “Propaganda for Depleted Uranium – a Crime against Humankind,” International Conference “Facts on Depleted Uranium,” Prague, Czech Republic, 24-25 November 2001.

doubtful the US would have secretly provided them to the Israeli Defense Force. Until more evidence – or rather any evidence – appears on this topic, the use of DU in the Yom Kippur War will remain nothing more than a myth.

4.9 Israel is using DU against the Palestinian people

Source: Yasser Arafat, repeated by the International Action Center¹⁴³ and others

For the last few years, Yasser Arafat has consistently accused the Israeli Defense Force of using DU munitions against Palestinians and in Palestinian territory, but he has offered no evidence to support his claim.¹⁴⁴ The Israeli government admits shooting 20mm DU rounds from ships up until the year 2000,¹⁴⁵ but it denies any use of armor-piercing DU rounds from tanks or aircraft in Palestinian areas.¹⁴⁶ Israel probably has DU tank rounds in its arsenal, but even this is not known for sure.

As part of a comprehensive analysis of environmental conditions in Palestinian territories, the UNEP Post-Conflict Assessment Unit investigated the claims about DU. The assessment unit's final report states, in part:

During the UNEP mission, the Environmental Quality Authority submitted to UNEP a report from a laboratory it had commissioned to carry out an analysis of ammunition thought to contain DU. UNEP transmitted this report and its accompanying spectrometer analysis for review to Spiez Laboratory AG, which had worked with UNEP on earlier DU assessments in the Balkans. This laboratory determined that the spectrum was consistent with a natural soil spectrum, and provided no indication of the presence of DU. Only naturally occurring radioactivity was identified.¹⁴⁷

This evidence probably isn't enough to dispel the myth, and it is possible Israel's denials are themselves myths, but at present there remains no evidence to support this claim.

4.10 Fill in the blank: During the 2003 war in Iraq, U.S. and British forces shot ___ (a few tons/thousands of tons) of DU, resulting in ___ (no/thousands of) cancers and birth defects.

At the time this paper was written, the Bush administration was amassing US military forces in the Persian Gulf region in preparation for an invasion of Iraq. Although US forces will undoubtedly use DU munitions during an invasion of Iraq, claims about the

¹⁴³ See reports at <http://www.iacenter.org/depleted/du.htm>.

¹⁴⁴ See e.g. Mark Lavie, "Palestinian killed in firefight near Jewish settlement," Associated Press, 15 February 2001; and Environment News Service, "Environmental a weapon in the Israeli-Palestinian conflict," 5 February 2001.

¹⁴⁵ Agence France Presse, "Israeli military used depleted uranium shells: newspaper," 11 January 2001.

¹⁴⁶ Nina Gilbert, "Sneh: No uranium bombs used against civilians," *The Jerusalem Post*, 22 February 2001.

¹⁴⁷ United Nations Environment Programme, Post Conflict Assessment Unit, *Desk Study on the Environment in the Occupied Palestinian Territories*, February 2003, p. 88-89, <http://www.unep.org/GoverningBodies/GC22/Document/INF-31-WebOPT.pdf>.

SCIENCE OR SCIENCE FICTION?

use and effects of DU are already stretching the boundaries of reality before the first round is shot. Public and media interest in DU has increased in anticipation of the war, enabling claims about DU to reach a broad, international audience. In the event of a war, the polar extremes dominating the DU debate will likely make predictable claims about the use and effects of DU munitions.

British anti-DU activist Dai Williams promotes perhaps the most apocalyptic vision in his “Feared US Dirty War Scenario for Iraq.”¹⁴⁸ In this scenario, US forces will release more than 1,360 metric tons (3 million lbs.) of DU in Iraq, mainly through missiles containing up to 900 kg of DU each. This is nearly 5 times more than the total amount of DU used in the 1991 war. This release will supposedly trigger three specific effects:

- Genocide – the civilian population of Iraq will be exposed to a “radioactive dust haze for months due to summer heat” that will cause a “health disaster”;
- A major refugee exodus – DU munitions will render “target areas permanently uninhabitable,” leading to a large scale population displacement; and
- Fratricide – DU dust will pose an “internal radiation risk for 200,000+ allied troops, expatriate NGOs, [and] oil workers.”

Another anti-DU voice compares invading Iraq to invading Hiroshima after its destruction by a nuclear bomb. Echoing Williams’ myth about the use of DU in missiles, William Thomas writes, “The same type of Depleted Uranium-tipped cruise missiles that have carried cancer into Bosnia and Afghanistan will only add fresh ‘rems’ to the radioactive dust of this distant desert land.”¹⁴⁹ These claims are not generating significant attention or concern, however, perhaps because they are so alarmist and unsupported by evidence.

The US Department of Defense is saying little about its possible use of DU munitions in Iraq, but based on its past behavior, it is reasonable to believe it will do several things:

- Withhold information about its use of DU munitions for a period of months or years;
- Fail to provide medical testing and surveillance to US troops who have known or suspected exposures to DU contamination on the battlefield;
- Refuse to identify and restrict public access to areas of DU expenditure; and
- Decline to take responsibility for battlefield remediation of contaminated vehicles.

In addition, the US-led administration ruling post-war Iraq is unlikely to invite UNEP’s Post-Conflict Assessment Unit or any other independent organization into Iraq to conduct health and environmental assessments that include DU munitions. The propagation of myths by anti-DU forces will only lessen the likelihood that independent investigators will be allowed to enter Iraq for the purposes of studying DU.

Nonetheless, it probably won’t be long after US forces enter Iraq that some fanatic anti-DU activists, sympathizers of Saddam Hussein, and others will claim to have evidence of widespread and severe effects caused by the use of DU munitions. The Department of

¹⁴⁸ Dai Williams, “Last chance to question US dirty bombs for Iraq?” 7 February 2003, <http://www.eoslifework.co.uk/Uhaz7feb03/sld012.htm>.

¹⁴⁹ William Thomas, “Invading Hiroshima,” 4 February 2003, <http://www3.bc.sympatico.ca/Willthomas/action/InvadingHiroshima.htm>.

SCIENCE OR SCIENCE FICTION?

Defense is likely to assist the mythmakers by withholding information about DU, and conspiracy theorists within the anti-DU movement will speculate about the reasons why the DU issue is being “ignored” by the international community. If a war takes place, it is likely DU munitions will be used, resulting in environmental contamination and exposures to soldiers and civilians, including children. The extent of the health and environmental effects of DU use, however, may be permanently obscured as the polar extremes spin the issue and create new myths that limit or prevent credible, comprehensive studies and assessments.

5. CONCLUSION

In the face of so much contradictory information about DU, it can be difficult to know where to turn for fact-based assessments and sensible recommendations. US government reports contain a wealth of valuable information about DU, but they are also laced with propaganda and lies that cast doubt upon their comprehensiveness and make their conclusions suspect. Reports and claims from anti-DU activists are similarly plagued by speculation, propaganda and lies that detract from the activists' often legitimate concerns about DU's health and environmental effects.

There are many uncertainties about the use and effects of DU munitions, but the growing body of scientific research points to the conclusion that the use of DU munitions creates environmental contamination that can affect the health of people, particularly combat soldiers and children. It is likely the US and British militaries will rely less and less upon DU ammunition, however, as they develop newer technologies that destroy tanks and other enemy targets with greater ease and from greater distances than currently afforded by DU munitions.

Most of what is known about the use of DU munitions comes from the governments of the United States and United Kingdom, but the manufacture, testing, sale and use of DU munitions by Russia and Pakistan remain shrouded in doubt. Has Russia used DU munitions in Chechnya? Has Pakistan sold DU rounds to militant groups or North Korea? Exactly who has DU munitions, and where have they been used? These and other questions deserve to be answered, but anti-DU activists are not even asking them.

Respected national and international organizations, including UNEP's Post-Conflict Assessment Unit, the World Health Organization, and the British Royal Society, have all assessed DU and clarified its possible health and environmental effects. Where uncertainties remain, they may be reasonably resolved through additional investigation and research, particularly research on the health status of exposed human populations.

The most prudent course of action for those concerned about DU to take is to press for scientific studies of exposed populations and contaminated battlefield areas, while supporting local, national, and international efforts to identify and cleanup areas contaminated with DU. The DU debate can be resolved through scientific research and political action, but such a resolution appears distant by years if not decades. In the meantime, the debate will likely continue to be dominated by claims based on both science and science fiction.

6. RECOMMENDATIONS

- In the event DU munitions are used if the Bush administration orders the US military to invade and occupy Iraq, the US Congress should ensure that the Department of Defense provides prompt medical testing and monitoring for all US servicemen and women with known or suspected exposures to DU, in accordance with military health and safety guidelines. In addition, Congress should ensure DoD takes the following actions:
 - Quickly identifies and cordons off all areas of DU expenditure;
 - Informs local populations and relief and development workers about the presence of DU contamination and ways to avoid exposure;
 - Conducts post-conflict assessments of DU contamination;
 - Undertakes battlefield remediation of all contaminated vehicles; and
 - Initiates health studies of exposed populations.
- The Secretary of the US Department of Veterans Affairs should overhaul the Depleted Uranium Follow-Up Program to create a new study, under new leadership, to determine whether the hundreds or thousands of 1991 Gulf War veterans who encountered or entered equipment impacted by DU munitions have developed health problems possibly related to their exposure. This study should include:
 - Focused monitoring of all friendly fire veterans;
 - Health questionnaires sent to veterans who served in units known to have worked in or on contaminated equipment, or had occupational specialties that may have brought them in contact with contaminated equipment or DU debris;
 - Improved coordination of research on veterans and rats; and
 - Clear, honest, and timely communication of study findings with veterans and Congressional policymakers.
- Health studies of civilians should be undertaken by the United Nations, particularly focusing on:
 - Children playing in contaminated areas;
 - Adults working in contaminated buildings or on contaminated vehicles; and
 - Combat soldiers.
- If or when the Iraqi government changes, UN agencies should undertake a rapid assessment of the health status of the Iraqi people. This assessment should include identification of the environmental exposures that may be causative or contributing factors in the illnesses affecting the population, including but not limited to DU.

7. RECOMMENDED WEB SITES AND REPORTS

Web Sites

- WISE Uranium Project: <http://www.antenna.nl/wise/uranium/#DU>
- The National Gulf War Resource Center, DU Link: http://www.ngwrc.org/Dulink/du_link.htm
- Post-Conflict Assessment Unit, United Nations Environment Programme (DU reports under “Publications”): <http://postconflict.unep.ch/>
- The World Health Organization: http://www.who.int/ionizing_radiation/env/du/en/
- The Royal Society (UK) reports on DU: <http://www.royalsoc.ac.uk/policy/index.html>
- UK Ministry of Defence: http://www.mod.uk/issues/depleted_uranium/index.htm
- US Department of Defense, Depleted Uranium Information Page: http://www.deploymentlink.osd.mil/du_library/
- US Medical Reference for Gulf War-Related Research (DU is listed under “Environmental and Occupational Health”): <http://www.gulflink.osd.mil/medsearch/>
- NATO depleted uranium information: <http://www.nato.int/du/home.htm>
- Veterans for Common Sense: www.veteransforcommonsense.org
- Depleted Uranium Information Page: www.depleteduranium.us
- The Military Toxics Project: www.miltoxproj.org
- The Christian Science Monitor, “Trail of a Bullet”: <http://www.csmonitor.com/atcsmonitor/specials/uranium/>

Reports

- Sir Hugh Beach, “The military hazards of depleted uranium,” January 2001: http://www.isisuk.demon.co.uk/0811/isis/uk/regpapers/no78long_paper.html
- Dan Fahey, “Don’t Look, Don’t Find: Gulf War Veterans, the US Government and Depleted Uranium, 1990-2000,” 30 March 2000: http://www.ngwrc.org/Dulink/dont_look_dont_find.htm
- Dan Fahey, “Depleted Legitimacy: The U.S. Study of Gulf War Veterans Exposed to Depleted Uranium,” 4 May 2002: <http://www.ngwrc.org/conf2002/NGWRC-DU-Atlanta.pdf>