Health Physics Society
Fact Sheet
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Health Physics Society
Specialists in Radiation Safety

Depleted Uranium

Since the first Gulf War, and continuing through to modern military operations in Iraq and Afghanistan, the use of depleted uranium (DU) has caused concern among veterans. In this fact sheet, we will help explain the significance and validity of these concerns.

What Is Uranium?

Uranium (U) is a dense, weakly *radioactive** metallic element that exists naturally in our environment. While all types of U are radioactive, some are more radioactive than others. Uranium can be found everywhere in nature and particularly in rocks, soil, water, and air, as well as in all plants, animals, and humans.

Natural uranium consists of a mixture of three *radioactive isotopes*, which are identified by the mass numbers ^{238}U (99.27% of atoms), ^{235}U (0.72%), and ^{234}U (0.0054%).

Enriched uranium is used as fuel in nuclear power reactors generating electricity. The content of ^{235}U must be enriched (or increased) from 0.72% (as is found in natural uranium) to about 1.5–4.6%. This material cannot be used to make nuclear explosives. After removal of the enriched fraction, the remaining uranium contains about 99.8% ^{238}U, 0.2% ^{235}U, and 0.001% ^{234}U by mass. This is referred to as depleted uranium or DU.

Highly enriched uranium contains 20% or more ^{235}U by weight and can be used to make nuclear explosives.

Depleted uranium is uranium of almost entirely ^{238}U, due to the vast removal of the other isotopes. Depleted uranium is less radioactive than natural U and enriched U.

What Is Depleted Uranium Used For?

M1 Abrams tanks
Photo courtesy of DOD FHPR

Civilian uses—Due to its high density, almost 1.7 times more dense than lead, the main civilian uses of DU include counterweights in aircraft and as stabilizers in boats and yacht keels. Because materials with high density are excellent at shielding gamma rays, DU is also used to make shielded containers for the transport of other radioactive materials that emit gamma rays.

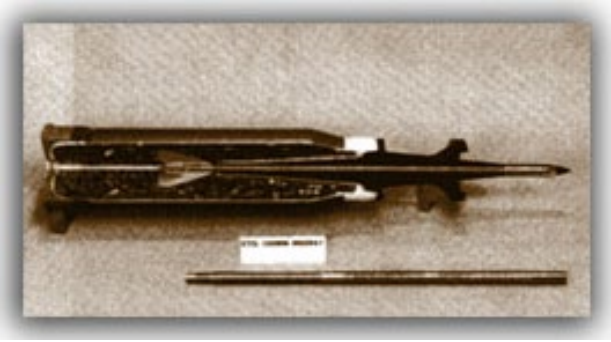
Military uses—DU is used for armor-penetrating bullets and penetrators because of its high density, its ability to self-sharpen as it penetrates its target, and its propensity to ignite on impact at temperatures exceeding 600 degrees centigrade. It is also used as defensive armor plate on the M1 Abrams tank. The use of DU as ammunition has been strictly limited since the 2003 initial invasion of Iraq, with a few exceptions in the fight against terrorists in Operation Iraqi Freedom and Operation Enduring Freedom.

*Words in italics are defined in the Glossary on page 3.

Are there any health effects associated with exposure to DU?

External to the body, DU generally does not pose a health threat. When DU enters the body through embedded fragments, wounds, inhalation, or ingestion, it can pose a chemical (toxicological) hazard to the kidney. The chemical hazard is greater with increasing exposure. In general, DU is not considered a *radiation* hazard, unless tiny insoluble particles (that is, particles incapable of being dissolved) are inhaled and lodged in the lungs. Direct (external) radiation from DU is very low and only of concern to workers who melt and cast U metal.

DU used in commercial civilian applications does not present a significant health hazard because it is usually in solid form and not available for inhalation or ingestion. Military operations with DU, however, may contaminate soil, groundwater, and breathing air. When a DU weapon impacts a target, small particles of DU may be produced. These particles have high density and most fall to the ground very close to where they are produced.



Depleted uranium
Photo courtesy of DOD FHPR

Studies have been conducted of workers, military personnel, and other persons who have ingested or inhaled uranium, and there is no known association between low-level DU exposure and adverse health effects, including birth defects (follow links under "Resources for More Information" at the end of this fact sheet). In large quantities, DU exposure can cause skin or lung irritation, but only soldiers in the immediate vicinity of an attack that involves DU are potentially exposed to these levels of contamination. Soldiers with wounds containing fragments of DU shrapnel may develop effects at the wound sites. The health consequences decrease quickly once the DU is removed, but it is almost impossible to remove all DU fragments. Persons exposed to very large inhalation doses of U, including DU, have shown minor, transitory kidney effects, which typically disappear within days to a few weeks after exposure. Persons inhaling insoluble particles that lodge in the lung may be at elevated risk of developing lung cancer many years later, particularly if they are smokers. But an excess of lung cancer has yet to be demonstrated in U workers or others exposed acutely or chronically to U, including DU.

Groups of Gulf War veterans who have DU fragments still in their bodies continue to be medically followed by the Department of Veterans Affairs' Depleted Uranium Follow-up Program to determine whether there will be long-term health effects. As of early 2019, only subtle but clinically insignificant changes in kidney function have been observed. One common observation is a persistent elevation in the amount of U measured in the urine. This reflects the continued presence of embedded DU in wound sites and its ongoing low-level mobilization and absorption to blood. Speculation is ongoing about a relationship between DU exposure and the so-called Persian Gulf Syndrome, with no known causal relationship to date.

In summary, minor health effects have been observed following exposure to DU, but ONLY with high levels of exposure, and these effects are caused primarily by the chemical toxicity and not the radiological hazard. Concerned veterans should contact your their Department of Veteran's Affairs facility (www.va.gov/directory/) to be screened and monitored for any health consequences.

Glossary

Radiation
Energy in the form of electromagnetic waves or particles.

Radioactive
A property of material that tends to undergo spontaneous radioactive decay and can result in the emission of ionizing radiation.

Radioactive Isotope
Unstable (radioactive) atoms of the same element that have nuclei containing the same number of protons but different numbers of neutrons.

Resources for More Information

Health.mil. The official website of the military health system. Depleted Uranium [online]. Available at https://www.health.mil/Military-Health-Topics/Health-Readiness/Environmental-Exposures/Depleted-Uranium. Accessed 22 January 2020.

Health Physics Society. *Health Physics* Journal. Series of technical articles on hazards from armor-piercing penetrators. Health Phys 96(3):207–409 [online]; 2009. Available at https://journals.lww.com/health-physics/pages/toc.aspx?year=2009&issue=03000. Accessed 23 March 2020.

International Atomic Energy Agency. Depleted Uranium [online]. Available at https://www.iaea.org/topics/spent-fuel-management/depleted-uranium. Accessed 15 January 2020.

US Department of Veterans Affairs, Office of Public Health and Environmental Hazards. Depleted uranium [online]. Available at https://www.publichealth.va.gov/exposures/depleted_uranium/index.asp. Accessed 15 January 2020.

US Department of Veterans Affairs, Office of Public Health and Environmental Hazards. Depleted uranium fact sheet [online]. Available at https://www.publichealth.va.gov/docs/depleted-uranium/du_factsheet.pdf#. Accessed 15 January 2020.

World Health Organization. Depleted uranium. Available at https://www.who.int/ionizing_radiation/pub_meet/en/DU_Eng.pdf. Accessed 23 January 2020.

The Health Physics Society is a nonprofit scientific professional organization whose mission is excellence in the science and practice of radiation safety. Formed in 1956, the Society has approximately 3,500 scientists, physicians, engineers, lawyers, and other professionals. Activities include encouraging research in radiation science, developing standards, and disseminating radiation safety information. The Society may be contacted at 950 Herndon Parkway, Suite 450, Herndon, VA 20170; phone: 703-790-1745; fax: 703-790-2672; email: HPS@BurkInc.com.