

## Depleted Uranium (DU)

*For Clinicians*

### Important Facts

- Uranium is a very common heavy metal that each of us is exposed to routinely.
- Depleted uranium (DU) is 40% less radioactive than natural uranium, and it has less than 1% of the radioactivity of the highly enriched uranium used in nuclear weapons and reactors.
- Many independent studies have concluded that natural uranium does not pose a significant health risk due to radiation. Therefore, any radiation risk from DU would also be minimal.
- Service members with embedded DU fragments have shown no long-term health effects – from either radiation or heavy metal toxicity – after more than a decade of close medical monitoring.

### What are the different forms of uranium?

Uranium is a very common heavy metal that we are exposed to through the food and water we consume and the air we breathe. The average U.S. resident takes in an about 2 micrograms of uranium daily. The Agency for Toxic Substances and Disease Registry (ATSDR) estimates that down to a soil depth of one foot, there is an average of four tons of naturally occurring uranium per square mile of earth. However, this varies greatly from one locale to another.

Uranium is a mixture of three naturally occurring isotopes, U<sup>234</sup>, U<sup>235</sup>, and U<sup>238</sup>, which vary in their radioactivity by up to a factor of 20,000. U<sup>238</sup> is the least radioactive of the three isotopes. The radioactivity of natural uranium can be increased through enrichment by selectively removing U<sup>234</sup> and U<sup>235</sup> (the more radioactive isotopes). Enriched uranium is used for nuclear weapons and nuclear power plants. The uranium left over from the enriching process, containing less U<sup>234</sup> and U<sup>235</sup>, is referred to as “depleted uranium”, or “DU”. DU is 40% less radioactive than “natural uranium”, and has less than 1% of the radioactivity of highly enriched uranium. Although they differ in their levels of radioactivity, all of these forms of uranium exhibit identical chemical properties.

### What are the health risks from depleted uranium (DU)?

Because natural uranium has been used commercially for decades, there are many medical studies on the potential hazards of long-term exposures. The known health risks can

be extrapolated to the more recent low-level exposures to DU of some military members. Natural and depleted uranium exhibit the same chemical toxicity, but DU is less radioactive. Therefore, precautions used to protect industrial workers against the potential effects of natural uranium can be applied to protect military members from potential health effects of DU, though industrial workers would be expected to have higher exposures.

DU’s radiation risk is minimal, and, like natural uranium, its potential chemical toxicity is due to its heavy metal properties. Shielding in military tanks and on DU munitions to prevent contact with the skin is more than adequate to protect from potential radiation and toxicity risks.

Service members with the greatest exposures to DU are those who have embedded DU fragments in their bodies. These fragments gradually dissolve, releasing DU into the bloodstream, where it is then filtered out by the kidneys. After more than a decade of repeated, intensive medical evaluations, no clear health effects have been detected even in these veterans and service members.

### How are servicemembers evaluated for DU exposure?

DU exposure evaluations of personnel who have served in either the 1991 Gulf War or Operation Iraqi Freedom are initiated based on positive responses to the Post-Deployment Health Assessment, DD 2796, or participation in an event or with a unit that would have placed the individuals at risk of DU exposure. Those individuals are asked to complete a DU Exposure Questionnaire, which a medical provider reviews to assess their exposure level. Those who are determined to possibly have had a significant exposure submit 24-hour urine specimens to be analyzed for total uranium, depleted uranium, and creatinine. Based on the concerns of the provider or patient, health care providers may order DU testing for personnel in low exposure groups, for example those with incidental exposures. Those who have confirmed results indicating the presence of DU in their urine are offered referral to the Veterans Affairs (VA) DU Medical Follow-up Program after consultation with the Deployment Health Clinical Center (DHCC). Complete instructions are included on the DHCC

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*A collaborative effort between the Air Force Institute for Operational Health, the Deployment Health Clinical Center, Force Health Protection and Readiness, the Navy Environmental Health Center, the U.S. Army Center for Health Promotion and Preventive Medicine, and the OUSD(P&R)/Military Family and Community Policy*



website, along with checklists and the telephone number for the clinicians' help line: <http://www.pdhealth.mil/du.asp#cg>. For more information on DoD's screening program, visit [http://www.pdhealth.mil/downloads/OIF\\_DU\\_Med\\_Mgmt\\_Supp\\_Info\\_Dec05.pdf](http://www.pdhealth.mil/downloads/OIF_DU_Med_Mgmt_Supp_Info_Dec05.pdf)

### What does the Veterans Affairs DU Medical Follow-up Program Consist of?

Service members who test positive for DU levels in their urine are offered the opportunity to be followed long-term by the VA DU Follow-Up Program, at the VA Medical Center in Baltimore, MD. Since 1993, the VA has been evaluating survivors of friendly fire incidents in the 1991 Gulf War. They are invited to the VA Medical Center in Baltimore for comprehensive physical evaluations every two years. Some of the veterans followed were exposed to DU through inhalation of DU particulates and, currently, about one fourth of them also have embedded DU fragments in their bodies. The urine of some of the veterans with embedded fragments contained very high levels of uranium. Treating physicians have been concerned about potential renal toxicity because of dissolving DU fragments and continuing exposures to uranium.

To date, the evaluations have detected no adverse clinical effects attributable to DU – either due to their potential radiological or toxic heavy metal effects. Findings have shown no renal damage, leukemia, bone or lung cancer, or any other uranium-related adverse health outcomes. Offspring born to this group have had no birth defects reported. Nonetheless, the VA plans to continue the DU medical surveillance indefinitely.

### What are patients' concerns over DU?

While radiation from DU may not be a significant health risk from a scientific or clinical viewpoint, it is likely to be a major concern of patients. The possibility of DU exposure can be worrisome because radiation exposure is difficult to measure or estimate without advanced knowledge and special equipment. People cannot see, feel, smell, hear, or taste the presence of radioactivity, and this can be particularly disconcerting to patients because they do not know when and how much exposure to DU has occurred or what adverse health effects might result.

Chemical toxicity from uranium is less likely to be a concern of patients. In the case of DU, as well as natural uranium, decades of research indicates potential heavy metal toxicity is actually a greater medical concern than the radiological effect.

### What are the scientific conclusions about the health risk from DU?

DoD assurances based on the scientific literature that DU does not appear to pose a significant health risk to those exposed to it may lack credibility with patients because they may not have full trust in government agencies. However, many other respected organizations have examined the issue of the safety of natural uranium and DU, all with consistent conclusions. The DoD has a collection of relevant research articles and scientific/technical reports listed in its DU Library website, which has a more complete list of references: [http://www.deploymentlink.osd.mil/du\\_library/](http://www.deploymentlink.osd.mil/du_library/). Many of the reports and studies cited in the DU Library are available in full text through the website.

### How should you address patients' DU concerns?

Clinicians are encouraged to directly address patients' concerns about DU using available scientific information. Patients should know that uranium risks vary according to its composition. What they might have read on the danger of nuclear weapons or enriched uranium does not apply to DU. Clinicians should tell patients that DU is 40% less radioactive than natural uranium, and has less than 1% of the radioactivity of highly enriched uranium.

To put this minimal radiation risk in perspective, it is important to explain that we are all constantly exposed to radiation from many sources, including cosmic rays from the sun and naturally occurring uranium in the air, soil, food, and water. In the U.S., this adds up to an average exposure of about 0.3 rems of radiation annually. In other parts of the world, people may be exposed routinely to more than double that amount because of the natural geology of those areas.

An on-going VA study found that veterans with embedded DU fragments had additional radiation exposures ranging from only 0.01 to 0.1 rems per year, depending on the amount of DU remaining in the body. This increase is a minimum additional exposure to normal background radiation (0.3 rems/yr), and no adverse health effects have been identified as a result of DU exposure (inhalation of particulates or as a result of embedded fragments) even after a decade since the initial exposures.

It is helpful to remind patients that it is the dose (the concentration, duration, and frequency of exposure) that is important when it comes to the risk of adverse health effects, and the dose of DU they received is likely well below any level that will result in adverse health effects.

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**Reports from various agencies on the safety of natural and depleted uranium:**

Capstone Aerosols Report: Depleted Uranium Aerosol Doses and Risks: Summary of US Assessments, October 2004, <http://chppm-www.apgea.army.mil/DepletedUranium/DUpage.pdf>

Biological Monitoring and Surveillance Results of Gulf War I Veterans Exposed to Depleted Uranium, [http://www.pdhealth.mil/downloads/McDiarmid\\_article\\_on\\_2003\\_DU\\_surveillance\\_Aug\\_05\\_082205.pdf](http://www.pdhealth.mil/downloads/McDiarmid_article_on_2003_DU_surveillance_Aug_05_082205.pdf)

Committee on Health Effects Associated with Exposures During the Gulf War, Institute of Medicine, "Vol. 1, Depleted Uranium, Sarin, Pyridostigmine Bromide, Vaccines," Gulf War and Health, eds. C.E. Fulco, C.T. Liverman, and H.C. Sox, Washington, D.C., National Academy Press, 2000, [http://www.gulflink.osd.mil/iom\\_13sep00.pdf](http://www.gulflink.osd.mil/iom_13sep00.pdf)

Department of Defense, Special Assistant for Gulf War Illnesses, Environmental Exposure Report, Depleted Uranium in the Gulf (II) (2000), [http://www.deploymentlink.osd.mil/du\\_library/du\\_ii/index.htm](http://www.deploymentlink.osd.mil/du_library/du_ii/index.htm)

Department of Defense, Special Assistant for Gulf War Illnesses, Health Risk Assessment Consultation – Depleted Uranium, OSAGWI Levels I, II, and III Scenarios (2000), [http://www.gulflink.osd.mil/chppm\\_du\\_rpt\\_index.html](http://www.gulflink.osd.mil/chppm_du_rpt_index.html)

Department of Health and Human Services, Centers for Disease Control and Prevention, "Third National Report on Human Exposure to Environmental Chemicals, Uranium," NCEH Publication No. 05-0570, 67-70, July 2005, [http://www.cdc.gov/exposurereport/3rd/pdf/results\\_01.pdf](http://www.cdc.gov/exposurereport/3rd/pdf/results_01.pdf)

European Commission, March 2001 report, [http://www.deploymentlink.osd.mil/du\\_library/pdfs/opinion.pdf](http://www.deploymentlink.osd.mil/du_library/pdfs/opinion.pdf)

National Defense Research Institute, "Vol.7, Depleted Uranium, A Review of the Scientific Literature as it Pertains to Gulf War Illnesses," RAND (1999), <http://www.gulflink.osd.mil/library/randrep/du/cover.html>

**Additional information on DU:**

Deployment Health Support Directorate, DU Library, [http://deploymentlink.osd.mil/du\\_library/](http://deploymentlink.osd.mil/du_library/)

Deployment Health Clinical Center (DHCC), Depleted Uranium, <http://www.pdhealth.mil/du.asp>

Department of Veterans Affairs, Baltimore, MD, Depleted Uranium – FAQ Sheet, <http://www.va.gov/gulfwar/docs/DepletedUraniumFAQSheet.doc>

Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR), Toxicological Profile for Uranium (Update) (Sept. 1999), <http://www.atsdr.cdc.gov/toxprofiles/tp150.pdf>

The Royal Society, "The health hazards of depleted uranium munitions, Part I," May 2001, <http://www.royalsoc.ac.uk/displaypagedoc.asp?id=11496>

The Royal Society, "The health hazards of depleted uranium munitions, Part II," March 2002, <http://www.royalsociety.org/displaypagedoc.asp?id=11498>

USACHPPM Fact Sheet, Depleted Uranium – Medical, <http://chppm-www.apgea.army.mil/documents/FACT/65-051-0503.pdf>

USACHPPM Fact Sheet, Depleted Uranium – Individual, <http://chppm-www.apgea.army.mil/documents/FACT/65-050-0503.pdf>

World Health Organization, "Ionizing Radiation," [http://www.who.int/ionizing\\_radiation/pub\\_meet/ir\\_pubs/en/index.html](http://www.who.int/ionizing_radiation/pub_meet/ir_pubs/en/index.html)

**Where Do I Get More Information?**

DoD Deployment Health Clinical Center (DHCC)  
Phone: (866) 559-1627  
<http://www.pdhealth.mil/>

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM)  
Phone: (800) 222-9698  
<http://chppm-www.apgea.army.mil>

Air Force Institute for Operational Health (AFIOH)  
Phone: (888) 232-3764  
<http://www.brooks.af.mil/afioh/>

DoD Force Health Protection and Readiness (FHP & R)  
Phone: (800) 497-6261  
<http://fhp.osd.mil>

Navy Environmental Health Center (NEHC)  
Phone: (757) 953-0700  
<http://www-nehc.med.navy.mil>

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