



# INFORMATION ON DEPLETED URANIUM (DU)

## A RESOURCE FOR HEALTH CARE PROVIDERS

### ADDRESSING YOUR PATIENT'S CONCERNs ABOUT DEPLETED URANIUM

Some Veterans are concerned about the possibility that they were exposed to Depleted Uranium (DU). This fact sheet contains important information for health care providers regarding:

- Assessing the degree of exposure to DU
- Possible health risks from DU exposure
- Resources available to help address Veterans' and service members' concerns.

### WHAT IS DEPLETED URANIUM (DU)?

Uranium is a naturally occurring element that is present in air, water, soil, rocks, plants, and animals.

Depleted Uranium (DU) is a by-product of Uranium processing. DU has some of its radioactive component removed during processing. Although it has the same chemical properties as natural uranium, DU is 40% less radioactive than natural uranium.

### WHAT ARE THE MILITARY USES OF DEPLETED URANIUM?

DU is a readily available and inexpensive, very strong, heavy metal that has a high melting point. It ignites readily upon friction (pyrophoric) and is highly reactive. All of these properties make DU suitable

for use by the US and other militaries to strengthen special armor on tanks and other equipment. DU is currently the most effective metal to use in armor to protect service members. It is also used to harden munitions to penetrate targets better. The first time DU was used by the US military in large quantities was during the Persian Gulf War in the early 1990s. DU weapons and ammunition have also been used in Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND).

### HOW ARE SERVICE MEMBERS EXPOSED TO DEPLETED URANIUM?

Exposure to a hazardous substance such as DU requires that (1) there is a source of the material, and (2), that the material is able to get into the body via inhalation, ingestion, skin absorption, and/or tissue penetration.

- Just being in the vicinity of DU tanks or ammunition will not result in exposure or pose a health risk. This is often a key point to make when speaking with Veterans concerned about their possible exposure.

Exposure to DU is the highest for service members who were in or on a vehicle when it was struck by DU munitions. Service members who entered vehicles immediately after impact or those who were near fires

or explosions involving DU munitions or armor also had potential exposure to DU.

- When these fires are extremely hot, very fine dust-like DU particles can be created which can then be inhaled into the lungs, swallowed, or may contaminate open wounds. Some of this fine DU dust may settle deep in the lungs and stay there for a long time. If shrapnel which contains DU becomes embedded in tissue, it could also remain in the body for an extended period of time.

### WHAT HAPPENS TO DEPLETED URANIUM ONCE IT'S IN THE BODY?

While very small (microscopic) inhaled DU particles may settle deep in the lungs, larger particles are prevented from getting into the actual lung tissue by the nasopharyngeal filtration system. Those larger particles that are inhaled are then cleared by mucociliary action and swallowed. The DU that is swallowed is excreted in feces without ever being absorbed into the bloodstream. DU shrapnel may become embedded in tissue. This may be removed by surgery, or may need to remain in the body because of its location. The decision to remove or leave the embedded shrapnel is often made by the surgical team(s) that takes care of the injured service member. How long the DU remains in the body depends on where it is





located, the DU particle size, how much is present, and how easily the particles dissolve. DU from retained shrapnel is gradually absorbed into the blood stream, then processed by the kidney, and excreted in the urine. This process of absorption and excretion occurs over many years.

### **DETERMINING A VETERAN'S LEVEL OF EXPOSURE**

Even though research studies show that service men and women who work around DU will not experience harmful health effects, Veterans may still have concerns. In part, this may be because it is often difficult to figure out whether or not someone had an exposure and if so, the amount of exposure someone may have received. To categorize exposure levels to DU

during the Gulf War, the Department of Defense (DoD), and US Army Center for Health Promotion and Preventative Medicine (USACHPPM, now the US Army Public Health Command (USAPHC)) have classified potential exposure and associated risks into three categories. The table below provides some guidance for providers to better determine the probable burden of DU for an individual based on the different types of exposure.

### **WHAT ARE THE HEALTH EFFECTS OF DEPLETED URANIUM?**

The possibility of harmful health effects from exposure to DU is based on the amount of DU that stays in the body. Very few service men and women are exposed to

a large enough amount of DU or have enough DU left in their body to result in any health effects. Some Veterans worry about DU's radioactivity, although DU is 40% less radioactive than natural uranium. This has been studied by the World Health Organization, Department of Veterans Affairs (VA), Department of Defense (DoD), the United Kingdom Royal Society, and more recently, the National Academy of Medicine (NAM).

Studies on uranium manufacturers and processors (people with high exposure to uranium over a long period of time) have shown that the main short- or long-term health effect of high doses of uranium is a result of it being a heavy metal and its impact on the kidneys. High doses of uranium may affect kidney

QUESTION ABOUT EXPOSURE	POSSIBLE EXPOSURE(S)	CHANCE OF DU IN BODY
<b>Did you have contact with intact DU?</b>	Handling intact DU munitions or sitting inside or near a vehicle with intact DU armor.	The likelihood of exposure is extremely low and would be approximate to zero.
<b>Did you fire DU munitions?</b>	Loading and firing weapons that fire armor piercing ammunition made of DU. Some smoke/fumes may be present, especially in closed spaces (e.g., tanks).	Quite unlikely that there will be significant body burden of DU.
<b>Were you in close proximity to burning or exploded DU?</b>	Being in the smoke cloud of exploded DU munitions or burning DU armor, such as on an Abrams battle tank or a Bradley fighting vehicle.	Slight to moderate chance of inhalation and/or ingestion of DU particles.
<b>Do you have retained DU shrapnel in your body?</b>	Metal fragments from DU armor or DU munitions remain in the body after an attack or accident.	High chance of significant DU in the body. These Veterans may need to be evaluated further for DU exposure or other embedded fragments.



function. Kidney function can be tested easily by blood and urine analyses.

A 2008 study by the IOM included a review of over 1,000 recent research studies which examined exposure to DU and health effects (i.e. cancers and non-malignant diseases, such as neurological problems). The IOM Committee concluded there was not sufficient scientific data to determine whether or not exposure to uranium is associated with any adverse health effects.

The VA and the DoD established the Depleted Uranium Follow- Up Program at the Baltimore VA Medical Center to screen and monitor Veterans for health problems associated with exposure to DU. Since 1993, this program has followed Veterans with retained DU fragments and those exposed to DU as a result of their involvement in "friendly fire" incidents during the Gulf War. After 20 years of follow up, participants with retained DU fragments continue to have elevated urine uranium levels. However, when comparing those with high urine uranium to those with low urine uranium (those who are DU-exposed but without retained fragments), few statistically significant differences were detected. No abnormalities in kidney function were detected. However, in the two most recent evaluations of this group, there has been an indication that elevated urine uranium may be associated with lower bone mineral density (BMD). The BMD results require

further study to determine if they persist over time; researchers and clinicians continue to monitor the health of these Veterans. In addition, there has been no link between elevated urine uranium and outcomes such as cancer and birth defects. Inhalation exposure was assessed with PFT by the researchers at the Baltimore VA Medical Center to determine if the friendly fire incidents affected the lungs. There was no evidence of abnormal PFTs or lung disease in persons who had such exposures.

(*Squibb et al., 2012; Squibb & McDiarmid, 2006; McDiarmid et al., 2001, 2004, 2008, 2009, 2011, 2013, 2018, 2021*).

### TALKING ABOUT THE RISKS OF DU EXPOSURE WITH A PATIENT

How you speak with your patient about possible exposure and health risks from DU is as critical as the scientific and medical information you share. The field of risk communication provides some guidance about how to discuss environmental health risks. Among the most critical components are **TRUST** and **CREDIBILITY** of the source of information which includes you as the provider. These characteristics are often judged in the first moments of the initial interaction. Being honest and open with the Veteran about what you do and do not know is important and can set the stage for a meaningful dialogue.

Two strategies to increase trust and credibility are demonstrating that you are **LISTENING** and **EMPATHIZING** or acknowledging their concern. For example, you can demonstrate listening by reflecting back or paraphrasing what the patient is telling you- "It sounds like you're concerned about your exposure to depleted uranium because of its radioactivity... let me tell you what we know about that."

Allow the patient to completely state his or her concerns before attempting to provide factual information. This will allow you to tailor the information you have to that individual's need and gauge the extent of concern. After you have a sense of this, offer to read through the patient education sheet about DU with him or her. Together, you can assess the probable level of exposure to DU and decide on a plan of action.

### WHAT IS THE 'TEST' FOR DU AND WHAT DOES IT SHOW?

There is a spot urine collection test that measures the total uranium excreted in the urine. If the sample has enough total uranium content, an isotopic analysis is performed on the same urine sample to determine if the uranium is from natural sources or if it is DU. All urine samples are sent to the Baltimore VA Medical Center for initial processing. (For more details, contact your local Environmental Health Coordinator or visit this link: [http://www.publichealth.va.gov/exposures/depleted\\_uranium/followup\\_program.asp](http://www.publichealth.va.gov/exposures/depleted_uranium/followup_program.asp)) Results will show the





level of total uranium in the urine compared to the normal ranges and indicate if the source is natural or DU.

All Veterans of GW1, OEF, OIF, and OND are eligible to have the urine collection test performed at no cost to them. The results of the test for uranium will be communicated directly to the Veteran by letter and the provider will be informed through the DU IFC in CPRS. It is important to know that the test does not measure any impact on kidney function or any health effect of the DU. If the result indicates elevated urine uranium, the patient may be enrolled in an ongoing program to follow the uranium excretion rate over time. This determination will be made based on discussions among the Veteran, his or her VA primary care provider, and the staff at the Baltimore DU Follow-up Program.

#### **WHEN SHOULD A VETERAN BE REFERRED TO THE WRIISC?**

If you see a Veteran with DU exposure concerns that you cannot address (or any chronic symptoms that defy diagnosis after standard work up), you can consider sending him or her to the WRIISC. Our comprehensive evaluation includes an environmental and occupational exposure evaluation or you can request this as a stand-alone service. To refer Veterans to the WRIISC you can simply enter an Interfacility Consult by visiting our Web site at:

<http://www.WarRelatedIllness.va.gov/referral.asp>

or call the WRIISC location nearest you:

- East Orange, NJ: 1-800-248-8005
- Palo Alto, CA: 1-888-482-4376
- Washington, DC: 1-800-722-8340.

#### **REFERENCES:**

- National Academy of Medicine
  - [http://www.nap.edu/catalog.php?record\\_id=12183#toc](http://www.nap.edu/catalog.php?record_id=12183#toc)
  - [http://books.nap.edu/openbook.php?record\\_id=12200&page=5](http://books.nap.edu/openbook.php?record_id=12200&page=5)
- Hines SE, Gucer P, Kligerman S, Breyer R, Centeno J, Gaitens J, Oliver M, Engelhardt S, Squibb K, McDiarmid M. Pulmonary Health Effects in Gulf War I Service Members Exposed to Depleted Uranium. *J Occup Environ Med.* 2013 Jul 24.
- McDiarmid, MA, Gaitens, JM, Hines, S, et al. "The Gulf War Depleted Uranium Cohort at 20 Years: Bioassay Results and Novel Approaches to Fragment Surveillance." *Health Physics* 2013; 104(4):347-361.
- McDiarmid, MA, Engelhardt, SM, Dorsey, CD, et al. "Surveillance results of depleted uranium-exposed Gulf War I Veterans: sixteen years of follow-up." *J Toxicol Environ Health A.* 2009;72(1):14-2989
- McDiarmid, MA, Engelhardt, SM, Oliver, M, et al. "Health surveillance of Gulf War I Veterans exposed to depleted uranium: Updating the cohort." *The Radiation Safety Journal.* 2008; 93(1):60-73.
- McDiarmid MA, Engelhardt S, Oliver M, et al. "Health effects of depleted uranium on exposed Gulf War Veterans: A 10-year follow-up." *J Tox Environ Health* 2004;67:277-96.
- McDiarmid MA, Engelhardt SM, Oliver M. "Urinary uranium concentrations in an enlarged Gulf War Veteran cohort." *Health Phys* 80; 270-273: 2001.
- McDiarmid MA, Squibb K, Engelhardt, et al. "Surveillance of depleted uranium exposed Gulf War Veterans: Health effects observed in an enlarged 'friendly fire' cohort." *JOEM* 2001;43(12):991-1000.
- McDiarmid MA, Squibb K, Engelhardt, et al. "Biological Monitoring for Urinary Uranium in Gulf War 1 Veterans." *Health Phys* 2004;87(1):51-56.
- McDiarmid MA, Cloeren M, Gaitens JM, et al. Surveillance results and bone effects in the Gulf War depleted uranium-exposed cohort. *J Toxicol Environ Health A* 2018;81:1083-1097.
- McDiarmid MA, Gaitens JM, Hines S, et al. Surveillance of Depleted Uranium-exposed Gulf War Veterans: More Evidence for Bone Effects. *Health Phys.* 2021;120:671-682. doi: 10.1097/HP.0000000000001395. PMID: 33867437.
- Squibb K & McDiarmid MA. "Depleted uranium exposure and health effects in Gulf War Veterans." *Phil Trans R Soc* 2006; 361:639-48.
- Squibb KS, Gaitens JM, Engelhart SM, et al. "Surveillance for Long-Term Health Effects Associated with Depleted Uranium Exposure and Retained Embedded Fragments in US Veterans" *J Occ and Env Med* 2012; 54(6):724-732.

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