



INFORMATION ON DEPLETED URANIUM (DU)

A RESOURCE FOR VETERANS, SERVICE MEMBERS, AND THEIR FAMILIES

WHAT IS DEPLETED URANIUM?

Uranium is a metal that occurs naturally in the earth's crust and is found in air, water, soil, and food. We all have trace levels of Uranium in our bodies. This natural uranium is a weakly radioactive substance. Depleted Uranium (DU) is what is left over after natural uranium is processed. DU has some of its radioactivity removed during processing. DU is 40% less radioactive than natural uranium. The type of radiation released by DU does not readily go through skin.

WHAT ARE THE SOURCES OF DU EXPOSURE FOR SERVICE MEMBERS?

Because of its density and low cost, DU is used by the US military to make armor on tanks. DU is an excellent metal to use in armor to protect service men and women. It is also used to strengthen projectiles because DU munitions penetrate targets better. The first time DU was used by the US on a large scale was during the 1991 Persian Gulf War.

HOW DOES DU GET INTO THE BODY?

"Exposure" to a substance means that there must be a source and that it gets into the body. DU cannot cause harm as long as it stays out of, and doesn't interact with the body. Just being near items made of DU, including tanks shielded by or shells

made with DU, will not result in exposure or pose a health risk. Even when DU munitions are fired close by, there is not a health threat as long as the metal stays out of the body.

Exposure to DU only occurs if it gets into the body via metal fragments that become embedded under the skin (shrapnel) or dust-like particles that are inhaled into the lungs or are swallowed.

Exposure to DU is the highest for service members who were in or on tanks and other armored vehicles when the vehicles were hit by DU munitions. These individuals were at the greatest risk of being hit by DU fragments and of inhaling fine, suspended DU particles, primarily DU oxides. In extremely hot fires involving DU munitions, very fine DU particles can be created, which can then be inhaled and taken into the body. Some of this fine DU dust may settle deep in the lungs and stay there for a long time. If shrapnel which contains DU enters the body, it could also remain in the body for an extended period of time. Service members who entered vehicles hit by DU munitions immediately after impact to rescue wounded occupants and who entered vehicles later to retrieve sensitive items and/or perform salvage and maintenance on the vehicles also had potential exposures to DU.

WHAT HAPPENS TO THE DU ONCE IT'S IN THE BODY?

The very small DU particles breathed in (inhaled) may settle in the lung, while larger particles caught in the nose, throat, and upper respiratory track can be swallowed or coughed up. The DU shrapnel that enters the body through wounds or punctures may be taken out by surgery, or may need to stay in the body due to where it is found. This is a decision best made between an individual and their healthcare provider. DU shrapnel that stays in the body is slowly absorbed into the bloodstream. The DU then leaves the body through urine. The process of DU naturally leaving the body can occur for years. How long the DU stays in the body depends on where it is, the DU particle size, how much DU there is, and how easily it dissolves. While the DU taken into the body is moving through the body, some of the DU may settle in other parts of the body and may remain in the bones, kidneys, and other soft tissues.

WHAT ARE THE POSSIBLE HEALTH EFFECTS FROM DU EXPOSURE?

There are several theoretical concerns about whether there are any long term health effects if DU stays in the body. Some Veterans are concerned about health effects from DU's radioactivity. DU is not





very radioactive. DU contains 40 percent less radioactivity than natural Uranium, which is already a weakly radioactive substance. The radioactivity of DU outside the body does not pose a health concern, including that of cancer. 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) (See details in References, below).

Studies on uranium miners and processors (people with high exposure to uranium over a long period of time) have shown that the main health effect of high doses of uranium is on the kidneys. This is largely because uranium is a heavy metal and in this regards behaves similarly to other heavy metals. High doses of uranium cause kidney function to slowly become worse. The anticipated long-term effect of high doses of DU is also on the kidneys. A person's kidney function can be tested easily by blood and urine tests.

The possibility of harmful health effects from exposure to DU is based on the amount of DU that stays in the body. The amount of DU that stays in the body is a result of the type and length of exposure. 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. All of those identified by the VA with elevated urinary DU have been victims of "friendly-fire incidents."

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. different types of cancer like renal cancer and non-malignant diseases such as neurological problems). The IOM report concluded that a large or frequent health effect is unlikely from exposure to DU. The report also emphasized that there is not enough research to state for sure that a particular health outcome can never occur.

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, there have been few clinically significant differences between those two groups. No abnormalities in kidney function were detected. However, in the two most recent evaluations of this group, there has been an indication that high 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 high urine uranium measures in this group and outcomes such as cancer and birth defects.

The same researchers at the Baltimore VA Medical Center also examined whether or not breathing in DU containing smoke/dust during friendly fire incidents affected the lungs. There was no evidence of abnormal breathing tests or lung disease in persons who had such exposures.

WHEN SHOULD AN INDIVIDUAL BE TESTED?

Current research shows that most service men and women who were exposed to DU are not likely to have harmful health effects. However, Veterans often wonder if they were exposed and how much exposure they may have had. In general, most services members have not had an exposure that would make DU testing clinically recommended.

It is still important to talk about any concerns you might have about exposure to DU with your primary care provider. He or she can discuss the type and length of your exposure to DU and the chance that you might still carry DU in your body. You can work as a team to see what steps to take next.

The easiest tests for health effects of DU exposure are simple blood and urine tests to evaluate your kidney function. Your provider may also refer you to see an Environmental Health Clinician to talk further about





your deployment exposures and health concerns, or refer you to the War Related Illness and Injury Study Center (WRIISC) for an exposure consult. We provide this evaluation in-person or by telephone. If after these discussions you are still concerned about your exposure to DU, you may request a test for DU, that is available from the VA at no charge to you.

WRIISC Contact Information:

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

Our WRIISC team will talk to you about your concerns and answer any questions you might have.

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

The test for DU is a urine sample that will look at the total uranium that leaves the body in the urine. If the sample has enough total uranium content, an additional test is performed on the same urine sample to determine if the uranium is from natural sources or if it is DU. The urine collection is sent to the Baltimore VA Medical Center for testing. Results will show the level of total uranium in the urine compared to the normal range of excretion in the general public and indicate if the source is natural or DU. It is important to know that the test does not look at kidney function. If the result indicates a high total urine uranium level or indicates that DU is present you will need to talk to your doctor about whether or not follow up is needed.

REFERENCES:

- National Academy of Medicine
 - http://www.nap.edu/catalog.php?record_id=12183#toc
 - 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.
- Squibb KS, Gaitens JM, Engelhardt SM, et al. "Surveillance of Long-Term Health Effects Associated with Depleted Uranium Exposure and Retained Embedded Fragments in US Veterans." JOEM 2012;54(6):724-732.
- 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. "Longitudinal Health Surveillance in a Cohort of Gulf War Veterans 18 Years After First Exposure to Depleted Uranium." J Toxicol Environ Health A. 2011;74(10):678-691.
- 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 KS & McDiarmid MA. "Depleted uranium exposure and health effects in Gulf War Veterans." Phil Trans R Soc 2006; 361:639-48.

