USACHPPM
Readiness thru Health

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Just the Facts...

Depleted Uranium - Medical

GENERAL INFORMATION	Uranium is an element found naturally in soil, water, and mineral deposits. It is a slightly radioactive substance composed of 3 naturally occurring isotopes (isotopes are atoms that differ only in their number of neutrons; they have similar physical properties), 238U, 235U, and 234U. All three isotopes are found together in Uranium ore. Depleted uranium is what remains after the more radioactive isotopes, 234U and 235U, are removed from uranium ore in order to make enriched uranium. Enriched uranium, which contains the more radioactive isotopes, is primarily used as fuel in nuclear reactors. All uranium, not just DU, is made up of almost all 238U. Natural and depleted uranium differ only in their radioactivity. Depleted uranium is roughly half (60%) as radioactive as natural uranium because there are less of the more radioactive isotopes (234U and 235U). The chemical properties of the isotopes are the same. It is the chemical properties that are responsible for many of the health effects of concern, such as possible kidney effects. Depleted uranium also contains trace amounts of 236U and other trace substances such as plutonium, americium and technetium. These amounts are so small that they are very difficult to measure and have no affect on health or the environment.
ROUTINE USES IN THE DEPLOYED SETTING	The United States Armed Forces have used DU in the manufacture of munitions, armor, and armor-piercing projectiles. DU projectiles are capable of readily penetrating armor. Armor constructed with DU provides a high degree of shielding and resistance to penetration. During the 1991 Gulf War (GW), depleted uranium containing munitions were used on a large scale for the first time. In the manufacture of projectiles and armor, depleted uranium is alloyed with small amounts of other metals.
EXPOSURE SCENARIOS	When a vehicle is impacted and perforated by a DU projectile, the projectile forms particles of various sizes down to very fine aerosols. The bulk of a DU projectile may pass directly through the vehicle. The inside of the damaged vehicle remains contaminated with particles of DU and its oxides after the impact. In the event of a vehicular fire, the heat of the fire might cause any onboard DU projectiles to oxidize. Personnel in, on, or near (less than 50 meters) an armored vehicle when the vehicle is being impacted by a depleted uranium projectile are considered at risk for exposure to DU that requires evaluation by urine bioassay. These types of exposure are categorized as Level (Category) I. Personnel in Level I have the highest potential for DU intakes that might exceed occupational exposure limits and guidelines. Level I personnel may internalize depleted uranium through inhalation, ingestion, wound contamination, and wounds (embedded fragments). Some crew members may be left with multiple tiny fragments of DU or DU-contaminated fragments embedded in their muscle and soft tissue. Other Soldiers may also be exposed to DU during operations to salvage combat vehicles that have been disabled by DU rounds. Personnel who routinely enter damaged vehicles in recovery operations or fight fires involving DU are categorized as exposure Level (Category) II and also require a urine bioassay. Simply riding in a vehicle with intact DU munitions or DU shielding will not result in significant intakes of DU. These and other similar scenarios are categorized as exposure Level (Category) III and urine bioassay are optional based on health care provider and patient concerns.

U.S. Army Center for Health Promotion and Preventive Medicine
Health Physics Program
5158 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5403
410-436-3502 or DSN 584-3502
http://chppm-www.apgea.army.mil/doem/

SIGNS AND SYMPTOMS OF ACUTE AND CHRONIC EXPOSURE	The major health concerns about internalized depleted uranium relate to its chemical properties as a heavy metal rather than to its radioactivity, which is very low. As with all heavy metals, the hazard depends mainly upon the chemical form, the amount taken into the body and the solubility of the DU particles within the body fluids. It has been recognized that very high uranium intakes can cause kidney damage. Chronic exposure by inhalation represents potential radiological hazard to the lung. Uranium miners have an increased risk of lung cancer after long term exposures to natural uranium and its radioactive progeny (including radon); however, this increase in lung cancer risk is attributed to radon and not to the radioactivity of uranium. DU is less radioactive than natural uranium. There are no acute health effects for Level I and II expected; however, in rare instances Level I exposures could cause acute effects to the kidney.
MEDICAL TREATMENT	Casualties may have depleted uranium contamination on their clothing and skin. Under no circumstances should casualty extraction, treatment, or evacuation be delayed due to the presence of depleted uranium. Standard aidman procedures for treating wounded personnel should be followed. Wounds and burns should be cleaned and debrided using standard surgical procedures. Normal "universal precautions" (surgical gloves, surgical mask, and throwaway surgical gowns) are more than adequate to protect medical personnel from accidental contamination with depleted uranium. Items contaminated with depleted uranium should be disposed of using standard universal precaution procedures. Embedded depleted uranium fragments should be removed using standard surgical criteria except that large fragments (greater than 1 cm) should be more aggressively removed unless the medical risk to the patient is too great. The short-term consequences of retained DU fragments do not justify an aggressive approach during the early treatment of wounds. Appropriate treatment of the wound with removal of any easily accessible fragments should be performed. In the care of acute wounds, surgical judgment should avoid the risk of harm in removal of other fragments -even when known to be DU. DU fragments may always be removed at a later date. Fragment sizes can vary from very small (several millimeters) to large (1 to 2 cm) and are readily discernible by x-ray examination. Individuals who have been potentially exposed to DU by inhalation should not have any acute symptoms and should be treated only if injured. Urine bioassay to assess exposure should be performed in accordance with existing Army and DOD policies. Individuals with chronic DU exposure will be referred to the Department of Veterans Affairs (VA) for additional surveillance.
LONG TERM MEDICAL SURVEILLANCE REQUIREMENTS OF HEALTH EFFECTS MONITORING	Since 1993, the VA has been following a number of Gulf War veterans who were seriously injured in fratricide incidents involving depleted uranium (Category I). The current cohort of Gulf War veterans contains 77 individuals. These veterans are being monitored at the Baltimore VA Medical Center. About half of this group still has fragments containing depleted uranium in their bodies. Those veterans with retained depleted uranium fragments have shown higher than normal levels of uranium in their urine since monitoring began in 1993. These veterans are being followed very carefully and numerous medical tests are being done to determine if the depleted uranium fragments are causing any health problems. For all veterans in the program (including those with retained depleted uranium fragments), all tests for kidney function have been normal (though small differences in some urinary biomarkers have been detected in the higher urinary DU group). In addition, the reproductive health of this group appears to be normal in that all babies fathered by these veterans between 1991 and 1997 had no birth defects.
SPECIAL RISK COMMUNICATION INFORMATION	Depleted uranium aerosols are only one of many potentially hazardous substances that Soldiers may be exposed to during deployment and combat operations. There are two potential hazards associated with exposure to large amounts of DU aerosols or retained fragments. The primary concern is the effect associated with heavy metal toxicity, much like that seen with tungsten, lead, and cadmium on the kidney. The second area of concern is with DU's low-level radioactivity. Follow-up of individuals with retained DU fragments have not shown evidence of adverse health effects related to internalized DU. Those individuals who show elevated DU in the screening urine bioassay are being followed as a precaution.