GULF WAR RISK FACTOR REPORT REPRINTS

Deplete Uranium

The following article originally appeared in the September 1999 issue of the Gulf War Review *newsletter. The second article, entitled Depleted Uranium Health Effects Updated, was printed in the June 2000 issue. The third article, entitled DU Article Published, was in the May 2001 issue. For information about the newsletter, contact Mr. Donald J. Rosenblum, Deputy Director, Environmental Agents Service (131), VA Central Office, 810 Vermont Avenue, NW, Washington, DC 20420, telephone: 202-273-8580.*

VA Depleted Uranium Programs Seek to Address Veterans' Concerns

The Department of Veterans Affairs (VA) has established a Depleted Uranium (DU) screening program for Gulf War veterans who are concerned about the possible long-term health effects of DU exposure. The purpose of this communication is to describe: (1) DU and how veterans may have been exposed to it; (2) the known health effects of DU; (3) the DU screening program; and (4) the Baltimore DU Follow-up Program.

Depleted Uranium Exposure

DU is derived from the heavy metal uranium, which occurs naturally as mineral deposits that are mined and processed for use in nuclear power plants or nuclear weapons. DU is the natural uranium left over after more of the highly radioactive uranium isotopes used in these power plants and weapons are extracted. DU contains about half of the radioactivity of natural uranium. It is considered a very low-level radioactive material. However, as with other heavy metals, such as lead, uranium can be toxic to the kidneys and other organs including the lungs.

Depleted uranium was first used in the development of major weapon systems because of its high density and superior mechanical properties, and because it is relatively abundant and cost effective.

American troops in the Persian Gulf were exposed to DU in several ways. A few were injured by "friendly fire," more were crewmembers in relatively close contact with munitions in tanks or other vehicles. U.S. soldiers also may have been exposed to smoke or particulate containing DU while fighting a fire at Doha Depot or by entering or salvaging vehicles or bunkers that were hit by DU projectiles.

Limited Health Information

Information on the possible health effects of DU exposure in military settings is very limited. Most information about possible effects on humans comes from studies of uranium miners and millers and associated occupations, which are somewhat different

from Gulf War veterans. For example, miners were possibly exposed to radon and other toxic substances present in the mines, making their experience not directly comparable to Gulf War veterans. Other significant differences relate to the length and intensity of exposures. Miners are typically exposed over a long period of time while veterans typically had a short exposure period.

The miners studies did find that uranium could affect the kidneys and the respiratory system. Long-term chemical exposure is thought to affect the kidneys and long-term inhalation may cause lung problems. Uranium miners who inhaled uranium dust for extended periods showed increased risks of lung cancer. However, exposure to radon accounts for virtually all of this increase lung cancer risk. Animal studies have not conclusively demonstrated that natural uranium causes lung cancer in animals. At present, it is not known to what extent, if any, DU exposures will affect the health of Gulf War veterans.

Screening Program

Gulf War veterans who are concerned about potential DU exposure are invited to contact the Gulf War Health Registry Coordinator at their nearest VA Medical Center. Interested veterans may request a DU protocol examination that includes a complete Gulf War Registry examination (if not already done), a DU exposure questionnaire, and if needed, a 24-hour urine collection for total uranium. The 24-hour urine test measures total uranium, not DU specifically. However, this urine test would include any DU that is present. It is important to note that any possible health effects are due to total uranium concentration, not DU alone.

As noted previously, uranium is a naturally occurring metal. Because of this, uranium is present in the food and water we consume. Therefore, a certain amount of uranium is expected to be present in the urine. The amount expected would depend on how much uranium is consumed in one's daily diet. At present, there is no valid technology that is sensitive enough to accurately measure DU in a urine sample where the total uranium is low enough to be considered "normal." (Normal means that the amount of uranium would be expected based on food and water consumption.) If an individual's sample falls above the normal limits, isotopic analysis to specifically determine the amount of DU will be performed.

Baltimore DU Follow-Up Program

In 1993, the VA established the Depleted Uranium (DU) Follow-up Program at the Baltimore VA Medical Center. This clinical surveillance program was designed for identifying, characterizing and following individuals exposed to DU during the Gulf War. The goals of the follow up project are to provide an on-going clinical surveillance of Gulf War veterans who have known or suspected imbedded DU fragments, DU contaminated wounds, or significant amounts of inhaled DU. The clinical surveillance is designed to detect the health effects, if any, of DU containing shrapnel or inhalation exposure, and to

provide recommendations for treatment to participating veterans and the physicians caring for them.

The medical follow-up program is also involved in the coordination and distribution of urine analysis materials for the DU screening program. The staff assists with processing specimens, coordinating specialized tests and analysis, and reporting results to patients, physicians, and the Gulf War database.

Most of the people participating in the DU follow-up program were exposed to DU when their U.S. Army vehicle was struck by DU containing munitions. Veterans of friendly fire incidents during the Gulf War are being invited to participate in the scheduled clinical evaluations as their exposure histories and current locations are confirmed.

In addition to helping individual veterans, the information gained through the DU screening and medical follow-up programs will improve our understanding of the potential health effects of DU and expand our knowledge about fragment removal, uranium absorption and distribution, and how uranium is eliminated from the body. Program officials hope that the program will also improve methods of the evaluation of uranium dose and the detection of health effects.

The evaluation of the toxicological and radiological effects of DU are intended to improve the scientific basis for providing advice about fragment removal, and to better understand uranium absorption in the body, uranium distribution in human tissue, and how uranium is excreted. Improved methods to assess uranium dose in humans may also result from these efforts. In addition, the DU program hopes to improve ways to detect toxic effects from low dose uranium exposure.

Other Problems

Other Gulf War veterans who think that their health problems are related to service in the Gulf War, including but not limited to DU exposure, are encouraged to contact their nearest VA Medical Center for a Gulf War Registry health examination. The telephone number of the medical center can be found in local telephone directories under Department of Veterans Affairs in the "U.S. Government" listings. Gulf War veterans may wish to contact the nearest VA veteran center for readjustment counseling. Many of the counselors there are themselves military veterans. The telephone number can be found in the local directories as described above.

Veterans with service-related disabilities may wish to file a claim for disability compensation. A Veterans Benefits Counselor (VBC) at the nearest VA regional office or medical center can provide the application form and any needed assistance. The national toll-free number to reach a VBC is 1-800-827-1000.

Depleted Uranium Health Effects Updated

The September 1999 issue of the Gulf War Review *included a front page article regarding the Department of Veterans Affairs (VA) program to respond to the needs of Gulf War veterans regarding the possible long-term health consequences of exposure to depleted uranium (DU).*

Early this year, the scientific journal *Environmental Research* published a research article by scientists and physicians who are working on the VA depleted uranium program. The authors wrote, in part, that a small group of Gulf War veterans have retained fragments of depleted uranium shrapnel. The long-term health consequences of which are unclear, but subtle effects have been detected in these patients. The investigators evaluated the clinical health effects of DU exposure in Gulf War veterans comparing them to Gulf War veterans who were not exposed to DU fragments.

Medical history was taken and follow-up medical examinations were performed on 29 exposed and 38 nonexposed Gulf War veterans. The authors found persistent elevated urinary uranium seven years after first exposure. Adverse health effects in the kidney, a presumed target organ of uranium were not present. However, other effects were observed. There was a statistical relationship between urine uranium levels and lower performance on computerized tests assessing performance efficiency. Furthermore, there were small effects seen in prolactin levels, which is a hormone important to reproduction. Again, the actual health impacts of these effects are not clear.

DU Article Published

Depleted uranium (DU), a by-product of the uranium fuel enrichment process, was used in both projectiles and armor by the U.S. military because of its density and low relative cost. However, because of its radioactivity – albeit low level – and health concerns about uranium (including its toxicity to the kidneys), some veterans and the Department of Veterans Affairs (VA) officials are worried about the long-term health consequences of exposure to DU on Gulf War veterans.

A substantive front-page article regarding DU is included in the September 1999 issue of the Gulf War Review. That newsletter is available from the Environmental Agents Service (131), VA Central Office, 810 Vermont Avenue, N.W., Washington, DC 20420, many VA medical centers, regional offices, and many vets centers. It is also on-line at www.va.gov/health/environ.persgulf.htm.

In response to the concerns about health effects in Gulf War veterans, in August 1998 through the end of 1999, an already existing surveillance program following DU

"friendly fire" victims was enlarged to look at the wider veterans community's exposure to DU. A total of 169 Gulf War veterans submitted 24-hour urine samples for determination of urinary uranium concentration. Possible DU exposure was determined from 30 separate questionnaire items condensed into 19 distinct exposure scenarios. Twelve individuals (7.1 percent) had urine uranium levels in the high range, and 157 (92.9 percent) had low level. A second test for six of the twelve (the other six dropped out of the study) found three of these individuals in the low range.

The exposures scenarios of the high and low urinary uranium groups were similar, with the presence of retained shrapnel being the only predictor of high uranium levels. The researchers concluded that the study results emphasized the unlikely occurrence of an elevated urine uranium result and consequently any uranium-related health effects in the absence of retained DU metal fragments in the veterans.

The project results were described early this year in the medical journal *Health Physics* (Health Phys. 80(3):270-273; 2001) in an article entitled *Urinary Uranium Concentrations in an Enlarged Gulf War Veteran Cohort*. Melissa A. McDiarmid, Susan M. Engelhardt, and Marc Oliver authored the paper. For correspondence or reprints of the article write to M.A. McDiarmid, University of Maryland, Occupational Health Project, 405 W. Redwood Street, Baltimore, MD 21201. Dr. McDiarmid heads the VA's DU Follow-Up Program at the VA Maryland Health Care System in Baltimore.