

NEW MEXICO DEPLETED URANIUM PROJECT SUMMARY



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Testing Military Personnel for Depleted Uranium

During the 2007 legislative session, Senate Bill (SB) 611 allocated \$40,000 to “develop a testing protocol, develop and establish a health registry, contract with appropriate testing laboratories and coordinate affected parties in regard to a voluntary testing program for military veterans who may have been exposed to depleted uranium or other isotopes in the Persian Gulf war or in the current Iraq or Afghanistan conflict.” The Epidemiology and Response Division/Environmental Health Epidemiology Bureau (EHEB) of the New Mexico Department of Health conducted the tasks outlined in the legislation.

Since the first Gulf War, depleted uranium (DU) has been used for armor-penetrating bullets and sabots because of its high density, its ability to self-sharpen as it penetrates its target and its propensity to self-ignite. It is also used as defensive armor plating on the M1 Abrams tank. Personnel may be exposed to DU in several ways. They can breathe it in the form of dust-like particles or metal fragments through smoke from burning DU-armored vehicles or exploded DU munitions. These dust-like particles can also accumulate in indoor dust and be transferred from contaminated surfaces to the mouth or to open wounds. Personnel can also be exposed to DU through shrapnel that is embedded under the skin.

It is currently unknown how many New Mexico veterans and active duty personnel may have been exposed to DU during conflicts in the Middle East. Complicating the exposure assessment, New Mexico has a higher concentration of naturally occurring uranium in drinking water than at the national level. The goals of this project were to determine 1) how many New Mexico military personnel are interested in being tested for DU, 2) the number of military personnel with elevated concentrations of total uranium in the urine, and 3) the number of personnel with elevated DU concentrations in urine.

Exposure Assessment

Uranium is a naturally occurring element in soil, rock, water, and air. Natural uranium is a mixture of the three main isotopes, U-234, U-235, and U-238. Of these isotopes, U-238 is the least radioactive and U-234 the most. Naturally occurring uranium is only weakly radioactive because it contains mostly U-238. The uranium used for nuclear reactors and weapons is made more radioactive through a process called enrichment where U-235 and U-234 are removed from natural uranium and concentrated. What is left of the natural uranium after enrichment is called *depleted*, as the content is depleted of U-234 and U-235, the more radioactive isotopes. The depleted uranium byproduct has been used in military applications including the Persian Gulf conflicts.

Adult military personnel potentially exposed to depleted uranium were recruited from New Mexico. Participants were voluntary and self-identified. They were recruited through outreach to veterans, and public media including newspaper press releases as well as multiple radio and television news interviews.

Depleted Uranium Project Summary

The first phase of the project consisted of obtaining initial morning urine samples and a drinking water sample from participants' homes to be analyzed for total uranium at the Scientific Laboratory Division (SLD) of the Department of Health. We had 83 military personnel participate in this phase of the project. Urine and water sample collections were conducted between October 2007 and June of 2008. Of the initial 83 participants, 31 requested to participate in the second phase of testing for isotopic analysis of urine to determine depleted uranium content. All participants were invited to the second phase of the project and if their Phase One results were higher than average, they were particularly encouraged to participate in the isotopic analysis. Twenty four-hour urine collections in March 2008 – June 2008 were analyzed for isotopic ratios.

All urine and water samples were analyzed for total uranium by the SLD. GEL Laboratory, in South Carolina, was contracted to conduct the isotopic DU test since SLD does not have this capacity. Standard methods were used and laboratories met Clinical Laboratory Improvement Amendments (CLIA) and Environmental Protection Agency (EPA) standards for quality assurance and quality control.

Biomonitoring for Uranium in New Mexico

Biomonitoring is the direct analysis of human samples such as urine to quantify exposure to toxicants such as from food, air, and drinking water. Biomonitoring also assesses background exposures to naturally-occurring chemicals such as uranium and other metals. The Centers for Disease Control (CDC) has been conducting national biomonitoring studies on uranium and other metals and compounds in urine. The CDC 2001-2002 National Health and Nutrition Examination Survey (NHANES) results provide comparison values of total uranium in urine.

The New Mexico Department of Health, under a CDC grant, has also conducted a biomonitoring study to quantify concentrations of uranium and other metals in urine and their association with drinking water for more than 700 New Mexicans. This was used as a comparison value for total uranium in urine for New Mexico. Elevated uranium levels in urine and drinking water are associated with local uranium geological deposits and uranium in groundwater in New Mexico. This exposure results in levels of uranium in urine in New Mexicans that are many times those detected from a national population.

The potential for statistical analysis of project results is limited due to the small number of participants. Also, many of the results were less than the detection limit. Lastly, in order to make inferences between exposure to DU and high levels of DU in the urine, an extensive assessment of exposure sources would be required, which was beyond the scope of this project. Therefore, these analyses are mostly descriptive.

Results

The individual results of the urinalysis were presented to the participants and interpreted with regard to both the potential toxicologic significance of the urinary uranium as well as the potential for the uranium to be depleted of uranium-234 and uranium-235. This included a comparison of their results with published baseline levels obtained from unexposed populations, including CDC National Exposure Studies, and/or NM biomonitoring results. The primary purpose of this project was to provide these results and associated information directly to the project participants. Table 1 describes the relevant findings.

Depleted Uranium Project Summary

Table 1. Depleted Uranium Project Results, New Mexico, 2007-2008

Project Population	CDC National Study	NM Adults Study	NM Veterans SLD	NM Veterans Isotopic Project
50th percentile (urine uranium ug/L)	0.008	0.014	0.019	0.020
90th percentile (urine uranium in ug/L)	0.029	0.12	0.070	0.061
DU present per DOD ratios? (number of individuals)	n/a	n/a	n/a	4 likely 3 possible
Participants	2690	764	83	31

n/a= not applicable

The total uranium in urine is the result used to determine the potential for uranium to cause adverse health effects. The levels detected in the participants were consistent with those detected for other New Mexicans, although both of these are considerably higher than those detected in the national project.

The second test determined the ratio of uranium-238 to uranium-235 to assist in determining if the exposure to uranium was likely a result of DU or a result of natural uranium. A ratio value of 137.9 for the concentration of uranium-238 divided by the concentration of uranium-235 is what is expected for natural uranium. A ratio higher than this can mean that the uranium was depleted of uranium-235 and may contain DU. However, other things can affect the ratio such as natural uranium concentrations occurring in the environment at unexpected isotopic ratios. Also many sample results in our project for uranium-235 included a quality control note, meaning that the lab did not have confidence in the results and many were at a level not detectable.

The Department of Defense (DOD) uses a ratio value of greater than 145 to determine the presence of DU. A ratio between 142 and 145 is considered to possibly have DU present. Of the 31 participants, four had a ratio greater than 145 indicating likely DU exposure. An additional three participants were between 142 and 145 indicating the possible presence of DU in urine.

Conclusions and Recommendations

Much effort was made to recruit participants in this project; however, we do not know if our participants constitute a representative sample of military personnel from the Persian Gulf conflicts. Any New Mexico veteran who suspects he or she may have been exposed to DU can contact the Veteran Administration's Gulf War Registry Program at 505 265-1711, extension 5822 for more information and potential testing.