Depleted Uranium - FAQ Sheet

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January 2000 (rev. January 2002)

1. What is depleted uranium (DU) and how does it differ from natural uranium?

Uranium is an element found naturally in soil, water, and mineral deposits. It is a weakly radioactive substance. It is composed of 3 naturally occurring isotopes (isotopes are atoms that differ only in their number of neutrons; they have similar physical properties), ^{238}U, ^{235}U, and ^{234}U.

Depleted uranium is a man-made by-product. It is what remains after the more radioactive isotopes, ^{234}U and ^{235}U, are removed from natural uranium in order to make ***enriched uranium***. Enriched uranium, which contains more radioactive isotopes, is primarily used as fuel in nuclear reactors.

The isotopes in uranium occur in uranium and depleted uranium in the following concentrations:

	Natural Uranium	**Depleted Uranium**
Isotope	Concentration of isotopes	Concentration of isotopes
^{234}U	0.006%	0.001%
^{235}U	0.72%	0.20%
^{238}U	99.28%	99.80%
Relative Radioactivity	1.0	0.6

As you can see, ***all*** uranium, not just DU, is made up of almost all **^{238}U**.

Natural and depleted uranium differ only in their radioactivity. Depleted uranium is about half as radioactive as natural uranium. Their chemical properties, however, are the same. It is the chemical properties that are responsible for many of the health effects of concern, such as possible kidney effects.

2. Why does the 24-hour urine test measure total uranium and not DU?

The 24-hour urine test measures ***total uranium.*** A total uranium count includes DU ***plus*** any natural uranium from the food you eat and the water you drink. The chemical properties of uranium that may affect **health** are related to ***systemic body burden level***, or total uranium. Total uranium is measured by the total urinary uranium concentration in a 24-hour period.

3. Why do you use a standardized measure instead of the total measure?

In the past, some people have tried to measure urine uranium levels by just looking at the total measure of uranium present. This method is misleading because it does not take into account how diluted or concentrated the urine might be. (For example, if someone drank a large amount of water during the testing period, the urine would be diluted.) To correct for this problem, ***standardized*** measures are used.

The word "***standardized***" on the laboratory report means that the reported values for urine uranium are presented in micrograms of uranium per gram of urine creatinine, a waste product always found in urine. (A microgram is a millionth of a gram. There are about 30 grams in an ounce). This method of calculating the amount of uranium corrects for how diluted or concentrated the urine is at the time of the test. It allows one urine sample to be more accurately compared to another. The recognized standard of practice for biologic monitoring is to use standardized values.

4. Why isn't the presence of any uranium in the urine considered abnormal?

Uranium is present in the food we eat and the water we drink. We are all exposed to naturally occurring uranium. The amount of uranium in our urine is a reflection of this natural exposure. Therefore, all of us will have some uranium in our urine. The amount of uranium taken in through food and water is due to the amount of uranium in the specific areas where we live. Some geographic areas have higher concentrations of uranium in the soil and water than do others.

5. Is there a way to tell how much of the uranium in the urine is DU?

It is only possible to determine how much of the uranium present in the urine is DU **if there is enough total uranium to be detected**. For samples with total uranium levels below a certain minimum level, it is very difficult, if not impossible, to accurately measure the different amounts of natural vs. depleted uranium.

If a sample has a total uranium content that is greater than what we expect to see as a result of natural environmental exposure, it is sent for isotopic analysis to determine how much of the total uranium is DU.

6. What is isotopic analysis and why is it important?

Isotopic analysis is the measurement of the different components (isotopes) of uranium. The three isotopes making up uranium, ^{234}U, ^{235}U, and ^{238}U, occur in different proportions in natural uranium compared to DU (see question #1 of this FAQ Sheet). Since all uranium (both natural and DU) is mostly ^{238}U, it is the ***ratio*** of the amount of ^{238}U to the amount of the other isotopes (^{234}U and ^{235}U) that tells us whether there is any DU in the sample.

7. What health effects can be expected from exposure to DU?

Health effects are related not only to the presence of the uranium, but also to the ***amount of time*** or ***duration*** a person is exposed. It is unlikely that there will be long-term health effects in humans after a ***single*** exposure to uranium. It is important to note that any health effects are due to the presence of the ***total*** amount of uranium present, not just the DU.

The primary health concern is uranium's chemical toxicity, particularly its effects on the kidney. To date, there have been no reports of differences in kidney (renal) function between the group exposed to DU and the control group not exposed to DU.

8. What is the cancer risk from exposure to depleted uranium?

Uranium miners and millers are the two worker groups who have been studied to see the effects of ***long-term*** exposure to natural uranium. Although these groups exhibit a higher than normal incidence of lung cancer, we know that they have also been exposed to radon, a decay product of uranium. Radon is a known carcinogen. The higher rates of lung cancer are due to the radon present in the uranium mines.

9. But doesn't uranium break down into radon?

Any radioactive element is subject to a decay of its radiologic intensity over time. It takes thousands of years for uranium to break down enough for radon to be formed. Much of the radon that miners were exposed to was in the mines themselves. In addition, when DU is manufactured, the radiologic decay "time clock" is reset and starts over. Since the DU used during the Gulf War was made in the past 50 years, radon has not had enough time to build up.

10. Who are the people being followed at the Baltimore VA Medical Center?

The Depleted Uranium Follow-up Program at the Baltimore VA Medical Center is a ***clinical surveillance program*** started in 1993. The purpose of a clinical surveillance program is to follow a group of people over time to see how their health changes. In this program, soldiers who were in or on a vehicle when it was hit by DU during a friendly fire incident are being followed.

In 1998, the Depleted Uranium Follow-up Program added another job to its mission. The Program coordinates the urine uranium testing portion of the Gulf War Registry Examination for veterans and the Comprehensive Clinical Evaluation Program for active duty personnel. Program staff members report the results of tests to individuals and their primary care providers within VA and military health care institutions. It is the responsibility of the individual's primary care provider to discuss these results with them.

11. What health effects are present in the Baltimore group?

So far, few health effects have been found. Soldiers who still have DU shrapnel fragments have a higher than expected urine uranium level. In 1997, there were some subtle changes in ***neuropsychological*** test results. These changes are evident only at the ***group*** level. That is, we only see these differences when we compare the group with a higher than normal urine uranium value to the group with a lower urine uranium value. When looked at again in 1999, these differences between groups were no longer there.

Soldiers with injuries and those who still have shrapnel have symptoms associated with their injuries. Otherwise, the health measures of the Baltimore participants is no different from the health measures of soldiers who were in the Gulf War ***but not exposed*** to DU. This comparison group of soldiers who were not exposed to DU was examined in 1997.

One other blood measure of a neuroendocrine hormone (prolactin) was also elevated at the group level in 1997 in the high uranium group. This did not appear to be of clinical significance or to have caused a change in sexual function. In the 1999 evaluation, this finding was no longer present.

12. Can you estimate what the urine uranium level was 8 years ago from the sample taken today that is in the normal range?

Any measure of uranium taken at any given point in time is a combination of what is left from ***previous*** exposure to uranium (from any source) and from recent exposure through food and water. Most likely, the ***current*** result represents what the ***true*** value is. We can't assume that this value is an amount left over from a previous higher value.