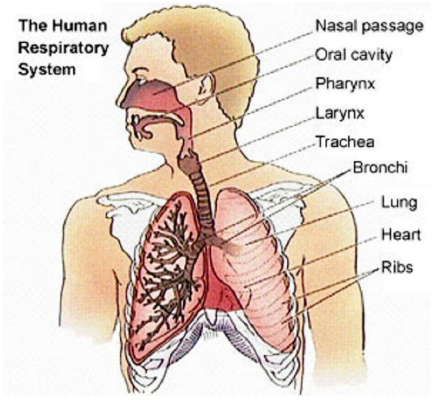
What are Natural and Depleted Uranium? (Fact Sheets)
Depleted Uranium (DU) - For Clinicians
Depleted Uranium (DU) - For Service members and their Families
Urine Testing for Depleted Uranium
U.S. Army Capstone Depleted Uranium Aerosols Study & Human Health Risk Assessment
Effects, Exposures, Programs, Research & FAQs
Health Effects
Chemical Effects
Radiation Effects
Environmental Effects and Exposures
Medical Follow-Up
Research Projects and Publications
FAQs
Studies & Reports
Scientific & Technical
U.S. Medical & Environment
International Medical & Environmental
Policies
Safety Procedures
DoD Policies on Possible DU Exposure
DU Awareness Training
Other Nations
Other Sources
Related Links
Got a Question?
FORCE HEALTH PROTECTION AND READINESS
FHP&R Home

Chemical Effects of Uranium

This section addresses the **absorption of uranium into the body** and the chemical toxicity of uranium, which is the primary health concern related to excessive exposure to either natural or depleted uranium. Although more research has been performed on the chemical effects of exposure to natural uranium than of exposure to depleted uranium, the chemical effects of the two would be the same since both forms of uranium behave the same chemically. Uranium is a metal, and like other metals, its toxicity depends on many factors, including its electronic form, chemical form, concentration, particle sizes, how exposure occurs and how the uranium enters the body, and whether it can dissolve easily in body fluids.

How does uranium enter the body?

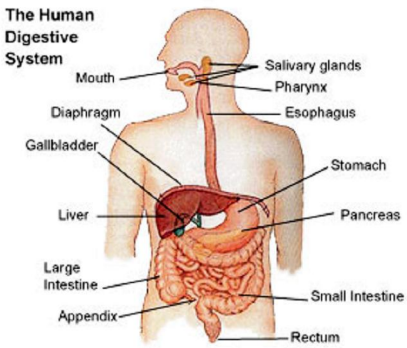


Uranium can enter the body through many routes, including by inhalation, through the mouth, or through the skin. However, regardless of the route, only a very small amount of uranium, whether natural or depleted, enters the body. On the battlefield, a Service member could be exposed to uranium in the air from the use of munitions containing DU. As these munitions penetrate armor or when DU burns, DU oxide dust is created. The Capstone Study looked at this issue. The Capstone Depleted Uranium Aerosols study looked at the concentration of DU to which a Service member might actually be exposed in such a situation, including when the Service member is inside an armored tank that is struck. The Human Health Risk Assessment of the Capstone Depleted Uranium Aerosols study determined that there would be little or no impact on the health of those breathing DU dust particles inside a tank hit by a DU projectiles. In addition to inhalation, DU exposure may also occur through ingestion of DU dust, contamination of wounds with DU dust, or from embedded DU munitions or armor fragments in the body. Although DU exposure is possible through direct contact of fired DU munitions or contaminated equipment or with the skin, this is easily avoided by wearing gloves or proper clothing.

What happens to uranium that is inhaled?

Most DU dust that is inhaled is rapidly eliminated from the body. Larger particles do not stay in the lungs, and are either coughed out or swallowed in mucus. Swallowed particles are generally passed through the gastrointestinal tract as with the oral route of exposure. One study showed that almost all inhaled uranium dust left the body by this route, without ever being absorbed.

Only smaller particles may stay in the lungs, and then will enter the circulation only if soluble. Some of these small particles may stay in the lungs for longer periods of time, and may gradually dissolve enough to be absorbed and enter the circulation. Those that are not soluble and remain in the lungs and surrounding tissues will not cause chemical toxicity, but may be associated with other concerns, such as local effects in the lungs, or radiation exposure. Depending on those factors, only about 1% to 5% of inhaled uranium dust will be absorbed into the body and enter the circulation. Most of this small amount of uranium eventually will be filtered through the kidneys for elimination from the body. Where large amounts of inhaled uranium dust have been associated with local inflammatory changes in the lungs, those effects have been difficult to separate from the effects of ordinary inhaled dust.



What happens to uranium that is taken in by mouth?

Experiments have shown that less than 5% of uranium that is taken in by mouth is absorbed into the body to reach the circulation. In fact, for soluble uranium compounds, the percent absorption may be as low as 2%, and for those that are not soluble, the percentage absorption may only be 2/10 of a percent. The remainder continues on through the intestinal tract and is eliminated from the body. Because 95-99% of inhaled uranium particles are coughed up and are also swallowed, in addition to most of the uranium taken in directly by mouth, practically all uranium that an individual takes in passes out through the gastro intestinal tract.

What happens to uranium that contacts the skin?

Absorption of uranium through the skin has not been well studied. In animals, it appears that only those forms of uranium that are soluble in body fluids can be absorbed through the skin. Some absorption can also occur through the conjuctira of the eye. Thus, some forms of uranium could be absorbed if placed in direct contact with unprotected skin, such as with picking up objects containing uranium. This type of exposure could be easily avoided with simple precautions, such as not picking up fired DU munitions without wearing protective gloves

What happens to uranium in the circulation?

Forms of the metal that are more soluble are more likely to be associated with toxic chemical effects, because if taken into the body, they can more readily enter the circulation. After absorption, soluble uranium goes mostly to the bones and kidneys. The kidneys filter chemicals from the body, and are susceptible to damage from uranium, as well as many other more common metals. Because the kidney is recognized as the organ most sensitive to uranium exposure and toxicity, exposure standards are generally designed to protect the kidneys from chemical effects, although standards have been set at even higher exposures based on radiation effects. However, at the same time, the kidneys effectively dispose of this soluble uranium in the urine. This helps to rid the body of the chemical. Within a day, about two-thirds of the uranium in the circulation passes through the kidneys and into the urine. This is why if DU or natural uranium exposure is suspected, a urine uranium test is obtained. This is where uranium exposure is easiest to detect. The amount of uranium in the urine can be compared to the amount that is commonly seen in unexposed people to determine if further investigation is indicated.

The uranium that is not in the circulation or being filtered by the kidneys is mainly found in the bones. However, as the kidneys remove uranium from the circulation for elimination from the body, the uranium in the bones slowly re -enters the circulation, where it, in turn, is filtered by the kidney and excreted in the urine. Although the process of uranium leaving the bone occurs more slowly, about half of the uranium in the bone will enter the circulation every week and a half, and from there will reach the kidneys and urine. This means that the body tends to naturally rid itself of uranium over time.

How much uranium is usually found in the urine?

Everyone has some uranium in their urine, although the amount varies greatly depending on where they live, and the type of work they perform. The National Center for Environmental Health of the U.S. Centers for Disease Control and Prevention (CDC) published data in 2005 on the amount of uranium found in the urine of men, women, and children from throughout the United States in the Third □ational Report on Human Exposure to En□ironmental Chemicals. However, people who work in uranium mines or mills may have higher levels in their urine, reflecting greater amounts of uranium in their bodies. The Occupational Safety and Health Administration has established a maximum safe level for those workers that is about 100 times higher than the average level found in the study by the CDC.