URANIUM

FACT SHEET 26-006-0616

What is it?

First discovered in pitchblende in 1789 by a German chemist, uranium is an element found naturally in rocks, soil, surface water, and groundwater. Because uranium oxidizes quickly in air, it commonly exists as an oxide in ores, such as pitchblende. Natural uranium consists predominantly of three isotopes: ^{238}U, ^{235}U, and ^{234}U, all of which are radioactive. (Isotopes of a given element have the same number of protons, but differ in their number of neutrons; their chemical properties are nearly identical.) Natural uranium is approximately 99.27% ^{238}U, 0.72% ^{235}U, and 0.0055% ^{234}U.

Properties of Uranium		
Symbol:	**Atomic Number:**	**Atomic Weight:**
U	92	238
	(protons in the nucleus)	*(naturally occuring)*
Physical Appearance:	Uranium is a heavy radioactive silvery-white metal. In air, the metal becomes coated with an oxide layer.	
Physical Properties:	It is malleable, ductile, and slightly paramagnetic. Uranium metal can be dissolved in acids, but is unaffected by alkalis. It is pyrophoric.	

Uranium decays slowly via alpha emission. ^{238}U, which makes up the majority of natural uranium, has a half-life of 4.5 billion years. Uranium is weakly radioactive with a specific radioactivity of 2.6×10^4 Bq/g (0.69 µCi/g).

Radioactive Properties of Key Uranium Isotopes and Associated Radionuclides							
Isotope	**Half-Life**	**Natural Abundance (%)**	**Specific Activity (Ci/g)**	**Decay Mode**	**Radiation Energy (MeV)**		
					Alpha (α)	**Beta (β)**	**Gamma (γ)**
^{232}U	72 yr	0	22	α	5.1	0.017	0.0022
^{233}U	160000 yr	0	0.0098	α	4.8	0.0061	0.0013
^{234}U	240000 yr	0.0055	0.0063	α	4.8	0.013	0.0017
^{235}U	7×10^8 yr	0.72	0.0000022	α	4.4	0.049	0.16
^{231}Th*	26 hr	-	540,000	β	-	0.17	0.026
^{236}U	2.3×10^7	0	0.000065	α	4.5	0.011	0.0016
^{238}U	4.5×10^9	>99	0.00000034	α	4.2	0.01	0.0014
^{234}Th*	24 days	-	23,000	β	-	0.06	0.0093
^{234m}Pa*	1.2 min	-	6.9×10^8	β	-	0.82	0.012

*Decay products of uranium. Table was adapted from Argonne National Laboratory, EVS, Human Health Fact Sheet, August 2005, *Uranium* .

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How is it used?

In 79 A.D., uranium was first used for its coloring properties. It has been used to color glass and as an orange coloring for ceramic glazes. Before it was mined for fuel, uranium was mined for its decay product radium used in luminous paint and in medicine. Today, it is almost exclusively mined for fuel in nuclear reactors and weapons. In order for uranium to be used in nuclear weapons or as fuel in nuclear reactors, enrichment of the fissionable isotope ^{235}U is required. Enriched uranium contains higher levels of ^{235}U. The byproduct of enriched uranium is depleted uranium, which contains lower levels of ^{235}U.

Where is it found?

Uranium is present in virtually all rocks and soils as well as in rivers and seawater. Uranium is commonly found in phosphate rocks (often used in the making of fertilizers) and in smaller concentrations in other rocks, such as granite and limestone. As a result, it is often found in common building materials. Uranium is also found in coal, coal ash, and other coal plant effluents. Uranium has been mined in numerous places, such as SW United States, Canada, Australia, and parts of Europe and Africa.

A small amount of uranium is in everyone from eating and drinking. Most of this uranium taken into the body is not absorbed and leaves the body in the feces. Uranium absorbed in the body leaves through the urine. Reference ranges for uranium in urine are reported in the Centers for Disease Control and Prevention, National Center for Environmental Health, *Report on Human Exposure to Environmental Chemicals.* According to August 2014 data, 95 percent of the U.S. population has less than 0.03 micrograms (µg) of uranium per liter of urine.

What are the primary health effects?

Uranium may cause adverse health effects through radiological and heavy metal toxicity. The chance of adverse health effects of uranium varies according to the amount taken into the body, route of exposure, chemical form, and specific isotope. External exposures to uranium are of little concern. If inhaled or ingested, uranium can cause chemical and radiological injury to organs and tissues. The toxicity of uranium is primarily due to its chemical health effects. Studies involving the examination of uranium milling and nuclear facilities workers have found no significant increase in cancer mortality due to external uranium exposure.

The kidneys have the highest likelihood of being damaged from the chemical effects of uranium. Once in the bloodstream, the uranium compounds are filtered by the kidneys. During this process, the kidneys may be damaged, much like they could be from any other heavy metal. The standard occupational guideline for the maximum permissible uranium concentration in the kidneys is 3 µg per gram of kidney tissue.

Where can I find additional information?

- Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Uranium*. http://www.atsdr.cdc.gov/toxprofiles/tp150.pdf.
- Centers for Disease Control and Prevention. *Fourth National Report on Human Exposure to Environmental Chemicals.* http://www.cdc.gov/exposurereport/pdf/fourthreport_updatedtables_aug2014.pdf.
- U.S. Department of Energy. *Characteristics of Uranium and Its Compounds.* http://web.ead.anl.gov/uranium/pdf/uraniumcharacteristicsfs.pdf.
- U.S. Environmental Protection Agency. Uranium. http://www.epa.gov/radiation/radionuclides/uranium.html.