PUBLIC AFFAIRS

Figure 10. Fact Sheet 4: Characteristics, Hazards, and Health Considerations of Uranium

FACT SHEET 4

CHARACTERISTICS, HAZARDS, AND HEALTH CONSIDERATIONS OF URANIUM

(For Operational Commanders)

Some nuclear weapons may contain uranium. Uranium is a mild to moderately radioactive material that may be hazardous if inhaled in large quantities. In a nuclear weapon accident, the uranium in the warhead of the weapon may get dispersed into the air by fire or explosion of the HE in the weapon. (Keep in mind that this is not a nuclear detonation.) The heat and smoke from the fire or explosion may carry small particles of uranium into the air. As the smoke plume travels downwind, the particles of uranium begin to settle to the ground, leaving a track of contamination on the ground surface and vegetation. Larger particles settle out first, smaller particles may travel much further. The highest levels of uranium contamination will be in the immediate area of the accident. In general, the further away from the accident, the lower the levels of uranium contamination that may be expected.

Uranium is a heavy metal, somewhat like lead. Uranium is a naturally occurring mineral that is mildly radioactive. As found in nature, uranium consists mostly of the isotope U-238, with small quantities of U-235 and extremely small quantities of U-234. This so-called "natural uranium" is only mildly radioactive, emitting alpha and beta radiation and low levels of gamma radiation. The half-life of U-238, the major constituent of natural uranium, is 4.5 billion years. It is likely that uranium released in the circumstances of a weapons accident is in the chemical form of uranium oxide. Natural and depleted uranium are primarily chemical hazards (heavy metal toxins) rather than radiological hazards, even at relatively high exposures. The radiological hazard associated with enriched uranium is higher than for its other forms.

Uranium may be "enriched," that is, the concentration of U-235 may be increased, by many methods. Commercial nuclear reactors use uranium that has been enriched so that the U-235 makes about 5 percent of the total uranium mass (the rest is U-238). Some nuclear weapons use highly enriched uranium (HEU) in which the U-235 makes up more than 90% of the total mass of uranium, though U-234 comprises almost 97% of the total alpha radiation activity. The uranium left over from the enrichment process is called "depleted" uranium because it has only about one-third as much U-235 as natural uranium. Nuclear weapons may contain several types of uranium, from depleted to highly enriched.

Uranium may be a mild to moderate radiation hazard if it is inhaled. Uranium is not particularly hazardous if it stays outside the body. If uranium is inhaled, the lungs and other organs of the body may receive doses of radiation; however, a person must inhale a very large quantity of uranium to get a significant dose of radiation. Even if the uranium was involved in a fire or explosion, it is unlikely that anyone would get a serious radiation dose from inhalation. It is much more likely that dispersal of uranium should create more of a "nuisance" contamination problem.

Compared to plutonium (the major HAZMAT in many nuclear weapons), uranium is not very hazardous. In a nuclear weapon accident in which both plutonium and uranium have been dispersed, the hazard from plutonium is far more serious than that from uranium. Although
uranium emits alpha radiation (that may result in internal radiation doses if taken into the body) very much like plutonium, pound-for-pound, uranium is from 1,000 to 100,000 times less radioactive than plutonium. A person would have to inhale roughly 1,000 to 100,000 times as much uranium mass to get the same dose as they would from plutonium. In addition, uranium does not stay in the body as long as plutonium; therefore, the radiation dose received by the organs is somewhat lower.

Depleted and natural uranium is at least 100 times less radioactive than HEU. It is unlikely that accidents involving dispersal of depleted or natural uranium will result in any significant radiation doses. HEU contamination presents more of a problem than depleted or natural uranium, but is still far less of a problem than plutonium contamination.

If a person is directly exposed to a smoke plume from a fire or explosion involving uranium, he or she may have been exposed to significant levels of airborne uranium. If he or she is in areas where the ground was contaminated, he or she may have been exposed to a much lower level of uranium than was re-suspended into the air. If a person thinks he or she may have been exposed to uranium (as described above) he or she should contact the appropriate Federal or State authorities and let them know. The authorities will arrange for appropriate radiation detection tests to be made. These tests may include collecting urine samples and/or scheduling for a "lung count" examination. Depending on the chemical form of the uranium that has been inhaled, some part of the uranium in the body is excreted in the urine. Urine samples may be analyzed for the presence of uranium. (All people have a low concentration of uranium in their urine from the trace quantities of uranium in the normal diet.) Lung count is a procedure performed by placing very sensitive radiation detectors near a person's chest to look for low-energy X rays emitted by the uranium mixture. Typically, the person reclines on a table or in a chair while the detectors are placed near the chest wall. A lung count is not like an X-ray exam. A lung count is a completely passive exam; the detectors do not emit any radiation, and the person does not receive any radiation dose from the exam. A "quick" screening lung scan may be performed in about 10 or 15 minutes. A more sensitive exam performed at a special "whole body counting" facility typically takes about 45 to 50 minutes.

In general, uranium is more hazardous to children than adults, due to the smaller size and different metabolism of children. To assure that children are adequately protected, PAGs established by the EPA take this increased sensitivity into account.

If uranium stays outside of the body, it is not particularly hazardous. The beta and gamma radiation emitted by uranium is relatively weak, and uranium emits only low levels of this radiation. The intensity of these gamma rays is so low that the measurable radiation field from uranium only extends a few feet away from solid uranium metal. Even high levels of uranium contamination on the ground do not produce any significant external radiation hazards.