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FACTSHEET: THORIUM

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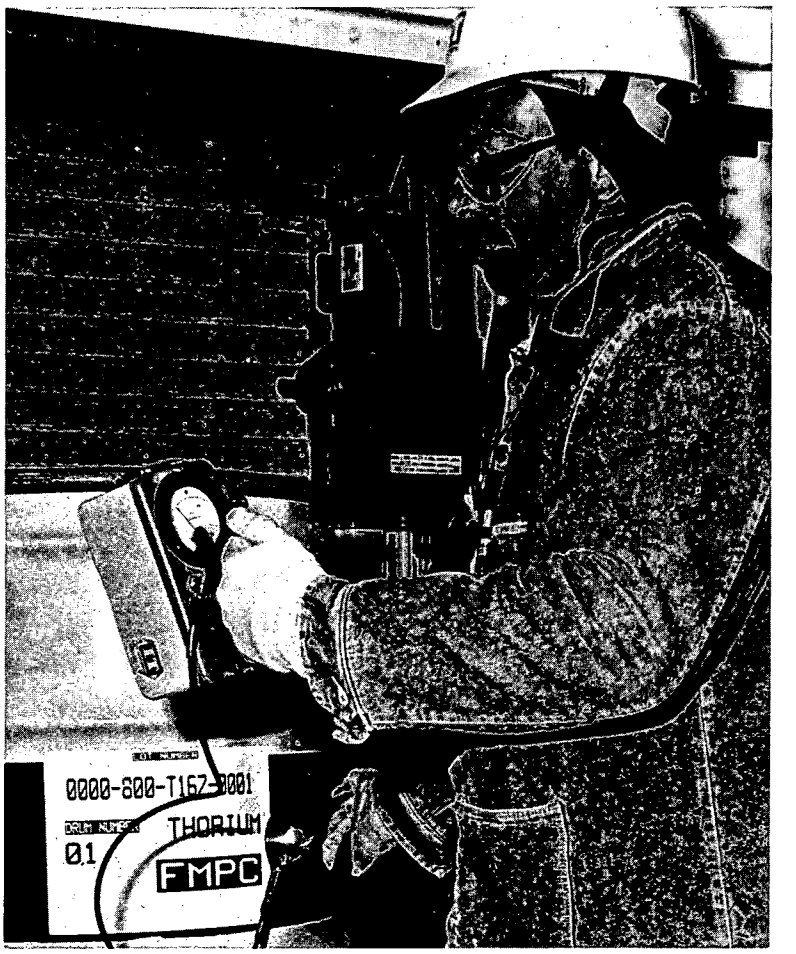
FACTSHEET

FACTSHEET Thorium

Thorium is a naturally occurring, radioactive element. Thorium has been stored at the Feed Materials Production Center (FMPC) since the mid-1960s when the United States was studying the use of a thorium/uranium fuel cycle for commercial production of electricity. Approximately two-thirds of the thorium at FMPC was processed on site, with the remaining portion originating from other DOE facilities. Over 1,316 metric tons of thorium is stored in silos and steel drums at FMPC.

The stored thorium is a mixture of thorium metal, thorium oxides, and residues. Thorium metal is silvery white and has approximately the same density as lead. Much of the stored thorium metal has reacted with oxygen and developed an oxidized surface. Thorium oxide is a white powder that is extremely dense, though not as dense as thorium metal.



FMPC is taking immediate action to improve its thorium storage facilities. After being repackaged for safe storage, thorium containers are checked for radioactivity.

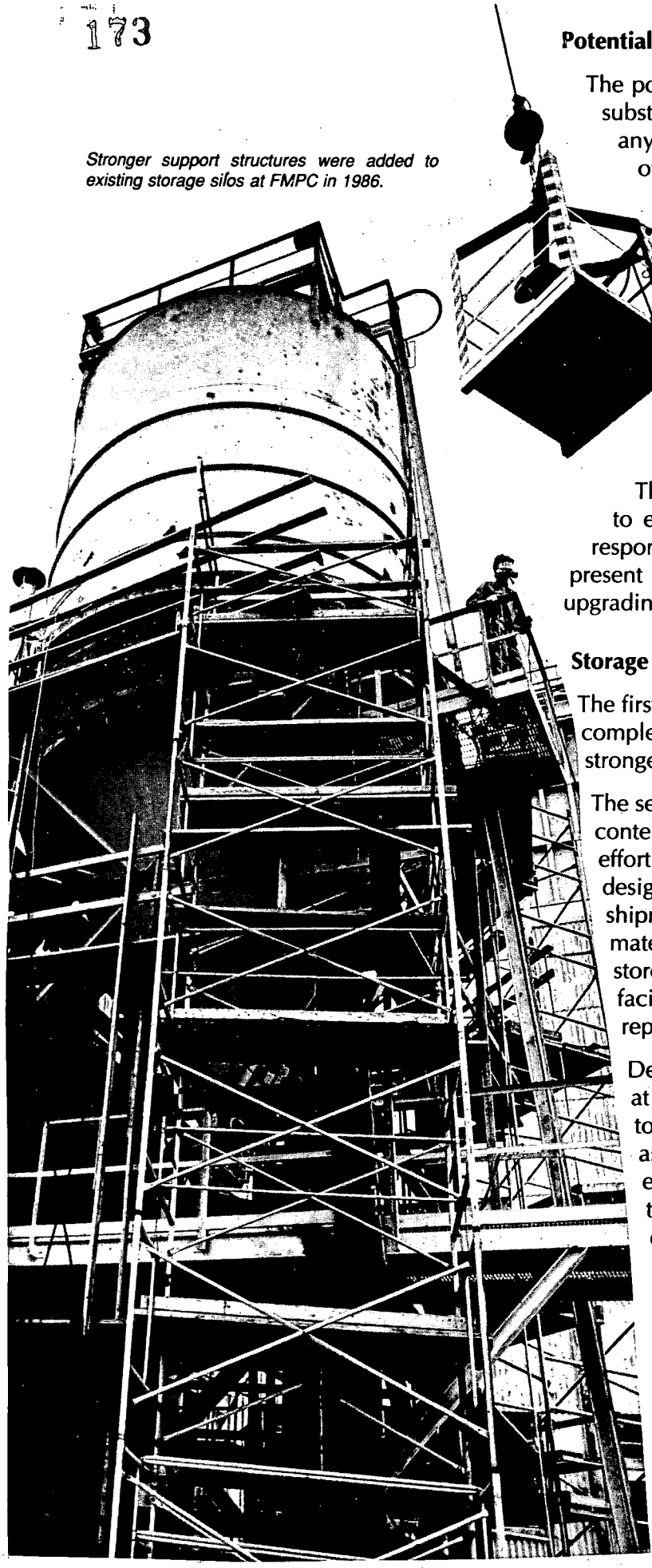
About Thorium

Thorium is common in nature, about three times more abundant in the Earth's crust than uranium. It is found in soil around the world but is most concentrated in the sands of India, Brazil, and Ceylon. Thorium deposits are located in several areas of the United States including Florida, Idaho, and the Carolinas. Chemical treatments, such as extraction and crystallization, are used to process thorium-bearing sands to prepare it for industrial use.

Uses of Thorium

Thorium was originally developed for use in manufacturing mantles for gas lamps. As electric lighting replaced gas lighting, the commercial demand for thorium declined to the current rate of about 1,000 pounds a year. Thorium is now used in gas lanterns for camping. Mantles for these lanterns are about 99 percent thorium dioxide. Small amounts of thorium are also used as an additive to produce metal alloys that are strong, lightweight, and heat resistant. Such metals are commonly used in aircraft engines and airframe construction.

In a nuclear reactor, thorium can be converted to a form of uranium that can be used as a nuclear fuel. The use of a thorium/uranium fuel cycle was studied extensively in the 1960s for its potential as an efficient energy source. Most of the thorium now stored at FMPC was originally slated for use as part of the thorium/uranium fuel cycle.



Stronger support structures were added to existing storage silos at FMPC in 1986.

Potential Hazard

The potential radiation hazard of thorium at FMPC makes the substance an environmental concern for management. Like any radioactive element, thorium gives off energy in the form of particles and rays of radiation and, in the process, changes to other elements. This process is called radioactive decay, and the resulting elements are called daughter products. One of the daughter products of thorium is thoron, a radioactive gas that is chemically identical to radon but much shorter lived (56 seconds compared with 3.8 days). Thoron is continuously generated by the stored thorium. Other daughter products also emit radiation. Because radiation presents a health hazard, exposure to it is kept to a minimum.

The stored thorium at FMPC requires careful management to ensure safety and isolation from the environment. To respond to this need, FMPC has taken action to improve the present storage facilities and is making long-term plans for upgrading the plant's storage capabilities.

Storage Update

The first step to ensure the safe storage of thorium at FMPC was completed in 1986 when the existing silos were reinforced with stronger support structures.

The second step in the storage upgrade included sampling the contents of the silos in preparation for the major repackaging effort that began in 1988. Storage containers have been designed to contain the thorium for long-term storage or for shipment. A system has been designed for overpacking the material in larger containers that will be inventoried and stored at FMPC pending final disposition. Containment facilities were erected to control emissions during the repackaging effort now underway.

Designers of the new technology for thorium management at FMPC are guided by the principle that radiation exposure to workers, the public, and the environment should be kept as low as reasonably achievable—ALARA. An environmental monitoring system continually samples the air around the isolated and secured storage site for evidence of increased radiation levels.

Upgrades in thorium storage technologies reflect the cooperative efforts of the U.S. Department of Energy and State and Federal regulatory agencies to improve the environmental protection at the site. Careful planning and action are the cornerstones of the program to control the storage and handling of thorium at FMPC.