nuclear sciences

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EXCAVATION

Shale bogs down canal plan

A plan to blast a sea-level canal across the Isthmus of Panama with nuclear explosives has been complicated by the discovery of soft clay shale. Any material when blasted with a row of charges tends to form a ditch with steep slopes, but with weak rock the slope may slide back into the excavation.

Lt. Col. Bernard C. Hughes, director of the U.S. Army Engineer nuclear cratering group, says that the unexpected find has forced engineers to consider combining nuclear excavation and conventional dredging methods. In the long run, nuclear methods are more economical.

One way blasting could still be used would be to plant three rows of charges to create a relatively flat slope. The outside rows in this triple-pass method are detonated first, then the inside row.

A preliminary cost estimate indicated that straight nuclear blasting of the proposed route, which is 170 miles southeast of the present Panama Canal, would cost $1.1 billion, while the combination approach would run $2.6 billion. About half the 46-mile route is clay shale.

Another route, through northeast Colombia, is 78 miles of muck and soft rock and 22 miles of hard rock. A nuclear conventional scheme there would cost $1.65 billion.

RADIATION

Young females most susceptible

Young female rats are more susceptible to radiation damage than any other age-sex group, according to tests performed by Dr. William H. Strain of the University of Rochester.

Older female and male rats and young males did not absorb and retain as much radiation as the young females. Hence the young males, and older males and females, showed less internal organ damage. Isotopes of strontium, zinc, iron, calcium, manganese, cobalt and chromium were used in the tests.

Although the effect of age was known for strontium, scientists did not realize that other isotopic radiation was similarly absorbed and retained.

The effect of sex differences on radiation in the body suggests to Dr. Strain the direct use of hormones to promote the removal of radioactivity from people exposed to nuclear medical procedures.

FAST REACTORS

Nitride fuel under test

A low cost way to make a richer fast reactor fuel has been developed, reports M.U. Goodyear of the Battelle Memorial Institute-Columbus Laboratories.

The technique uses high temperatures to compact atoms in a uranium-plutonium-nitride fuel. The nitrides make a better-performing fuel, Battelle believes, because they survive radiation better than oxides and carbides, the two other major types of fuel.

Other methods of making the U-Pu-N fuel are much more expensive, and it had been thought that U-Pu-N could not be made economically.

This fuel is now being tested in a fast nuclear reactor to see if it fulfills its promise.

Basically the process involves taking powdered nuclear fuel and reducing it to particle size by grinding it with ball crushers. The next step is to press the fuel into pellet form and then heat it. In this heating or sintering process, the fuel is subjected to a temperature range of 1,900 to 2,000 degrees C. for three hours. The resulting U-Pu-N densities increase as much as 94 to 95 percent.

SAFETY

Putting out plutonium fires

The best way to extinguish plutonium fires is to pour magnesium oxide sand over them, reports Dr. Roland E. Felt of Atlantic Richfield Hanford Company, Richland, Wash., after studying various materials and methods.

In the processing of plutonium for fuel in a nuclear reactor, a close heat source can accidently overheat it, and at 500 degrees C. it catches fire. The plutonium might then ignite other combustible materials, such as plastic panels.

The big danger from plutonium fire is that radiation containment material may be destroyed and harmful alpha radiation leak out.

The magnesium oxide sand works, not by smothering the fire (oxygen exclusion), but by absorbing the heat like a heat sink. Once the temperature drops below 500 degrees C., the fire goes out.

Other materials and their methods of application also work, but based on cost, storage, ease of application, recovery cost and effectiveness, magnesium oxide won.

ISOTOPES

Short-range collision warning

A nuclear device to prevent mid-air helicopter crashes in military operations is being developed at the Naval Air Development Center, Johnsville, Pa.

Using radiation from strontium 90, the instrument operates best at short range, where radar fails. Laser, infrared and ultrasonic guidance are inadequate under conditions of poor visibility.

The radioactive strontium emits beta rays which strike a uranium target, releasing natural X-rays. Since the intensity of the rays decreases proportionally with distance, their measured strength can be calibrated for distance, to warn a pilot when his craft is in danger of collision. Direction is also indicated by the incoming rays.

George E. Wilcox, head of the nuclear devices section at the center, foresees a maximum effective range of about half a mile, too short for high-speed jets, but useful for slower moving copters.