nuclear sciences

Gathered at the meeting of the American Nuclear Society in San Francisco last week

ECOLOGY

Model for thermal effects

Thermal pollution caused by nuclear power plants is a recognized danger, but the effects of heating water on the surrounding aquatic environment is hard to predict for specific installations.

Battelle Memorial Institute's Pacific Northwest Laboratory has developed a deterministic stream temperature prediction system that will help make future site decisions more enlightened and objective.

R.T. Jaske says the system, which simulates the thermal regimen of a river or estuary, permits advance estimate of thermal effects created by a single installation or an extended series of thermal and hydro-installations with overlapping effects on a single or regionally combined watershed.

This basic system has enabled the Battelle Laboratory to project thermal effects from plants under consideration on the Illinois Waterway from 1980 and beyond.

MEASUREMENT

Total calcium loss determined

Measurement of total skeletal mass would have important medical application in determining the rate loss of calcium from the skeleton due to bone diseases or in quantifying losses that may occur during prolonged weightlessness in space flight.

Researchers at the University of Washington's School of Medicine are using a new tool in medicine and biology—neutron activation analysis—to measure total body calcium since 98 to 99 percent of the total body is within the skeleton, any change in total body calcium can be interpreted as an increase or decrease in bone mass.

Patients are bombarded with neutrons from the university's 60-inch cyclotron; some of these neutrons activate stable bone calcium to radioactive C-49, which can be counted.

The researchers, Wil B. Nelp, Robert Murano, Keith Pailthorp, H.E. Palmer, Clayton Rich, James L. Williams, Thomas G. Rudd and Gervas Hinn, report their system provides a safe, precise and reproducible method for determining changes in skeletal mass.

RADIOGRAPHY

Small source of neutrons

Considerable interest has developed recently in the use of small, nonreactor sources for performing neutron radiography. G.D. Bouchey and S.J. Gage of the University of Texas' nuclear reactor laboratory, Austin, say enough neutrons for making radiographs could be obtained from a relatively low-strength radioisotope source and a reactor of enriched uranium that was not large enough to sustain a chain reaction.

Such an assembly "provides for convenient extraction of a moderately large-sized beam of thermalized (slow-moving) neutrons and at the same time maintains the advantages of a portable, low-cost system," they say.

The cyclindrical core of the subcritical facility they have in mind would consist of a 20 percent enriched homogeneous mixture of uranium oxide and polyethylene.

EDUCATION

Sodium loop simulator

A high-temperature sodium test loop is providing chances for research and instruction in areas related to fast reactor safety at the University of California at Los Angeles. Up to now graduate students seeking practical experience with fast reactor equipment have had to make arrangements with an industrial laboratory. The device reflects changes in university nuclear engineering curricula in an effort to cope with the shift in focus of nuclear reactor research and development activity from thermal to fast reactors, say its developers.

"Significant characteristics of the loop include low cost, simplicity of design, safe operation and capability for operation with sodium at 1,400 degrees F.," say Jay E. Boudreau, Joseph C. Mills, C.B. Smith and Evan J. Vineberg of UCLA.

Sodium oxide determination and transient heat transfer experiments are performed by students taking graduate nuclear engineering courses. One proposed research project is a study of the rate of heat transfer of sodium oxide when coolant channels are blocked.

FUEL PROCESSING

One-step process for carbides

Initial development has been carried out on a continuous one-step process for producing carbides and nitrides of uranium and plutonium. These are attractive nuclear fuel materials because of their high thermal conductivity and density of fissile material.

Most approaches in the formation of this fuel material require several steps to produce feed material for the actual reaction, including production of suitable oxides from a nitrate solution, mechanical mixing of oxides with a reactive carbon, pelletizing, crushing and screening.

The process described by E.A. Coppinger and B.M. Johnson of Battelle Memorial Institute's Pacific Northwest Laboratory eliminates these steps and provides a continuous one step process in a spray reactor.

Uranyl nitrate and sugar, which provides the source of carbon, are sprayed into the top of a heated vertical tube, where they react to produce solid particles containing uranium oxide and carbon.

From this mixture of oxide and carbon, carbides or nitrides can be produced as falling powder is contacted by upward flowing argon or nitrogen at 1,500 degrees to 1,700 degrees C. A similar process can be used with plutonium instead of uranium.