REFERENCE 31

C. L. SCHUSKE, "EXPERIMENTAL PROGRAMS AT THE DOW ROCKY FLAT NUCLEAR SAFETY LABORATORY," TRANS. AM. NUCL. SOC. 16: 157, 158 (1!

VOLUME 16
TANSAO 16 1-364 (1973)

1973 ANNUAL MEETING

CHICAGO, ILLINOIS

JUNE 10-14, 1973

AMERICAN NUCLEAR SOCIETY

TRANSACTIONS

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OF THE
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Palmer House Hotel | June 10-14, 1973 | Chicago, Illinois

3. Experimental Programs at the Dow Rocky Flats Nuclear Safety Laboratory, *C. L. Schuske (Dow-Colo)*

The Dow Nuclear Safety Facility has the primary goal of supporting the Dow-AEC production complex at Rocky Flats. This is accomplished by performing pertinent experiments to provide checks for our computational methods. These computational methods are then used to design chemical and metallurgical processing equipment and fissile storage facilities. However, some of the experiments have direct application to specific plant problems.

The lab began operations in September of 1965. Since that time, we have performed approximately 1000 criticals and critical approaches with plutonium and enriched uranium. A large number of measurements were performed with close-fitting hemispherical assemblies. These assemblies were reflected with oil and steel and oil combinations.[1-3] A description of the apparatus in which these experiments were done is given. These same hemispherical components were also used in a study in which they were immersed in tanks containing fissile solution. These experiments were performed to simulate the dissolution of metal in an acid solution.[4,5] The assembly area and a typical assembly and fissile solution vessel are described. These measurements were followed by a series in which outer shells of boron stainless steel (~1.2 wt% boron) were placed around the fissile metal,[6] thus somewhat decoupling the metal from the aqueous fissile solution. The experiments were performed to check computations and determine if economies could be realized if inner dissolution baskets of boron stainless could be developed, thus increasing plutonium metal batch sizes for dissolution.

Another series of measurements involved arrays of intersecting pipes or cylinders.[7] We referred to this series of assemblies as "trees," because there were as many as 16 arms or branches, 4 arms per layer, intersecting a central column. The central column had a square cross section ~100 in. tall and the branches were cylinders of diameters ranging from 4.5 to 6.5 in. Each of these branches was 54 in. long. This work was correlated into a simple engineering model and presented and later extended by Dickinson and Schuske to cover a much wider range of applications.[8] The information gained in this work was used to design a tree tank which would hold ~1000 liters of solution.[9] The tree tank is described.

The criticality of arrays of parallel cylinders sitting upon a fissile solution slab were investigated.[10,11] These experiments were performed under minimum reflector conditions as well as various reflector thicknesses of Plexiglas. The number of cylinders in arrays varied from 1, 4, 9, and 16. Cylinder diameters ranged from 4.5 to 8 in.

Since all our chemical processing is done in hoods or other enclosures, these experiments simulate solution leaks which could result in slabs of solution accumulated beneath process equipment.

The last experimental series discussed consists of the use of boron stainless plates to poison a large volume of fissile solution.[12] The plates contain ~1.02 wt% normal boron. The experimental setup is described. The general vessel dimensions are 59 in. tall × ~42-in. i.d. Since the boron steel plates are 47 in. long, this permitted an unpoisoned solution slab to be developed above the plates. The solution concentrations used are 50 g U/liter, 140 g U/liter, and 450 g U/liter. The work on these systems continues. One interesting point observed was that for a 400-g U/liter $UO_2(NO_3)_2$ solution, 28 vol% boron steel in the container lowered k sufficiently that the effect of this poisoned tank of solution upon the unpoisoned slab in contact at the top was about the same as a thick water reflector.

A series of measurements involving 3-kg cylinders of high-density plutonium fully water reflected and moderated is being planned.[13] The arrays will contain upwards of 200 kg of Pu metal.

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