could increase in the future, however, for two reasons. First, AEC and DOT will be subjected to increasing pressure to relax their packaging standards as the nuclear industry grows and the volume of shipment increases. "There's no question that this will happen," says Brobst. And DOT's radioactive shipments expert, Grella, says "We have those pressures already."

Second, the expensive packaging requirements may prod industry to ship in bigger containers. And the greater the volume of radioactive material found together in one location—whether in a reactor or in transit—the greater the likelihood of a major accident.

Donald A. Nussbaumer, chief of Fuel Fabrication and Transportation, in the materials-licensing division of AEC, explained the pros and cons of this question to a 1969 conference at Charlottesville, Virginia, on radioactive shipping.¶

"No accidental criticality has occurred in transportation activities, but six such accidents have occurred in fuel processing or reprocessing plants. Criticality would occur if too much fuel were assembled into one mass, or if a sufficient number of individually safe masses were brought too close together.

"Criticality is prevented in transport by controlling the quantity of fuel in any one container below specified limits and maintaining a specified built-in separation distance between individual quantities. Safety margins are incorporated into the criticality limits to take into account likely errors.

"If, in spite of all the precautions taken, an inadvertent criticality should occur, the chain reaction would likely cause its own termination. Some steam pressure could build up . . . but there would be no nuclear explosion like that of a bomb."

However, he pointed out that spent fuels—presumably including plutonium —"must be shipped inside of such massively shielded containers—called casks —and for economy, as much fuel as possible is included in each shipment. A loaded, spent fuel cask may weigh as much as 100 tons, of which the contained fuel may constitute about 3 tons."

But while officialdom is sanguine about airtight regulations and package performance, it readily admits that it doesn't have as much control over people, and that human error will be the most likely cause of the growing number of minor accidents in the future.

While, in official language, no type B or large-quantity packages have been "breached" in transit, they have leaked, rolled off cars, derailed trains, become mislabeled, misrouted, temporarily lost, and so forth, because of the failure of individuals to conform to the rules.

The best way to illustrate human error and its most likely effect on the

¶ Proceedings of the Conference on the Transportation of Radioactive Material, Sponsored by the University of Virginia Department of Conferences and Institutes, Charlottesville, 26 to 28 October 1969 (Clearinghouse for Scientific and Technical Information, Springfield, Va.).

House Votes Medical Student Aid

The House of Representatives on 18 June passed and sent to the Senate a stopgap measure to ensure that first-year medical, dental, and other health profession students are not denied federal loans and scholarships. The bill, which continues authorization of funds in fiscal 1972 at current levels, is designed to be superseded by a revision of the Health Professions Educational Act (HPEA), which is due to expire 30 June. Fear that HPEA could not clear both houses before that date prompted action on the temporary measure. Without this stopgap bill, funds could not be appropriated for new awards of financial aid. Medical students beyond the first year who have already received aid under the expiring act will remain eligible for assistance under authorization in the old law.

Senate passage of the temporary measure is expected in time to assure that approximately 4130 freshman medical students and some 5000 students enrolled in other health professions will receive needed financial aid. However, medical schools and students have been held in considerable suspense, because loans and scholarships could not be awarded prior to congressional action. Disadvantaged and minority students, whom medical schools have made special efforts to recruit, would be especially hard hit by expiration of funding authority.

The bill passed by the House would authorize scholarships of $16.8 million and loans totaling $35 million, the same amounts authorized for fiscal 1971. If HPEA is extended in the form reported by the House Interstate and Foreign Commerce Committee, it will supersede this bill and authorize loans of $40 million in fiscal 1972, $45 million in fiscal 1973, and $50 million in fiscal 1974. The Committee bill would also provide for the loan ceiling to be raised from $2500 to $3500. Scholarships would increase from $28.6 million in fiscal 1972, to $31 million in fiscal 1973, and finally to $43 million in fiscal 1974. The Nixon Administration favors legislation that would replace HPEA aid with guaranteed loans.

Congressional delay in renewing HPEA has had a different impact at different medical schools. Johns Hopkins University School of Medicine, for example, has planned to shift the bulk of private funds which were primarily for upperclassmen to aid for first-year students, and to allot all federal aid to upperclassmen. Last year HPEA funds alone accounted for one-fourth of Johns Hopkins' money given to students for scholarships.

Howard University's School of Medicine, which depends on HPEA to help one half of its students, has no private funds to rely on. With a slight increase over last year's entering class of 108, Howard has already received 64 loan applications, some of which may be offset by National Medical Association loans. But without HPEA aid, the school would be left with the desperate task of locating heretofore untapped funds.

—EDWARD P. JONES

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