IN BRIEF

US nuclear snag

President Carter's plans to defer nuclear fuel reprocessing and to turn down the breeder reactor programme have hit a snag in the US House of Representatives and they could face a stiff challenge in the Senate. Last week, the House Committee on Science and Technology voted 38 to 0 to keep funds for a demonstration breeder reactor in the budget for the Energy Research and Development Administration (ERDA), but with the understanding that the committee will investigate the matter further and vote on the funds again before sending the ERDA budget bill to the House floor.

Committee sources note that the vote was a procedural measure which doesn't necessarily indicate the committee's final view, though they suggest that the prevailing opinion among committee members seems at present to favour rejecting Carter's request to cancel the demonstration project. In the Senate, Senator Frank Church, who heads a key energy subcommittee, said in a speech at MIT earlier this month that Carter's plutonium strategy will not work because other countries are unlikely to follow suit. In a later interview with the *Washington Post*, Church said that the United States should continue with the breeder project and with reprocessing to avoid "nuclear isolationism". The opposition to Carter's plans virtually guarantees that there will be a major debate on plutonium policy on the floor of the House and the Senate this summer.

Pipeline report

Controversial recommendations from a Canadian judge regarding proposed pipelines stretching between the Arctic and Southern Canada and the USA will not be acted upon at least until a second report is published, probably in the summer. The judge, Thomas Berger, reported on the ecological and social implications of the proposal last week, and recommended a morator-

Power sans bombs

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Enrichment cascade (Fotosmit)

BACKGROUNDER

THE heavy veils of secrecy that the French are drawing over the details of their method of enriching uranium to reactor- but not to weapons-grade make it difficult to evaluate their claims. But if their recently revealed chemical enrichment technique stands up to full scale testing and is as tamper-proof as they suggest, cheap enrichment plant should be available in the 1990s to many countries which might not have been considered responsible enough to own it.

The French announcement, at the recent IAEA nuclear fuel cycle conference in Salzburg, was neatly timed to coincide with the economic summit in London. With an undoubted shortage of enrichment plants the new process seems to offer the possibility of meeting the need without increasing the risk of proliferation. It is not clear, however, whether such enrichment facilities would allow the use of the fast breeder reactor to be postponed; that depends on whether, in the absence of the new technique, the use of uranium in thermal reactors would be limited by a shortage of enrichment facilities or by the scarcity of uranium itself—which in turn will be determined by the economics of extraction.

Enrichment used to receive a great deal of attention as a process encouraging nuclear proliferation. Concern has since focused on reprocessing the spent fuel. Natural uranium, containing 99.3% ^{238}U and 0.7% fissile ^{235}U, must be enriched to 3–4% ^{235}U for use in American LWRs and 2% for the British AGRs. The Canadian CANDU and the British Magnox reactors use natural uranium, as oxide and metal respectively. The sensitive aspect of enrichment is that an enrichment plant may be arranged so that enrichment to over 90% instead of 2–4% is achieved, enough to make a uranium bomb.

Reprocessing offers a similar opportunity, but here to make a plutonium bomb. The civil purpose of reprocessing spent reactor fuel—that is, separating plutonium from uranium and radioactive wastes—is to use the plutonium to fuel more reactors and especially the fast breeder. The French development could make it more difficult to get hold of uranium bombs, but would not affect the ease of access to plutonium bombs.

The main enrichment process in current use is gaseous diffusion, uranium hexafluoride being diffused through a porous membrane. The lighter ^{235}U atoms diffuse slightly more readily than the ^{238}U and enrichment is achieved by a large number of stages in cascade. Compression and cooling at each stage mean that energy consumption is very high (6% of the energy generated by PWR fuel). In the newer ultracentrifugation process, favoured by the British, Germans and Dutch, the diffuser is replaced by a centrifuge. The capital costs of centrifugation are very high but the electricity consumption is only 10% that of diffusion.

The chemical exchange process announced by the French is said to have the advantages of low energy consumption, rather simple technology and suitability for small-scale plants. Separation of the two uranium isotopes based on the different rates with which molecules containing them react has been explored in the past, but had been largely discounted by most workers because the very small difference in chemical reaction rate only allows extremely slow separation.

The French breakthrough apparently lies in finding two uranium compounds which undergo reactions whose rates are more markedly affected by the uranium isotope. What the molecules are has not been revealed. The enrichment process is still rather slow but this is the main safeguard against bomb manufacture; while the period of two years needed to produce 3% enriched uranium by the chemical method seems industrially feasible, it would take fully 30 years to produce bomb-grade plutonium. By contrast, bomb-grade material can be prepared in two years by gaseous diffusion and one day by ultracentrifugation.

The French say two other safeguards are built into their process. One is that the process cannot be arranged in cascades (which can, at least in theory, be manipulated to produce a small quantity of 90% enriched fuel instead of a larger quantity of 3% enriched fuel). Furthermore, if too much enrichment is attempted, the uranium risks going critical. This seems to be because a liquid phase is involved, and in a liquid there is the risk of local concentrations of very high enrichment.