

the FBR is far from open and shut, Mr Benn's view of international developments may persuade him to nod CFR-1 through. France, Germany, and the USA are all aiming for commercial FBR capacity by the 1990s, with Japan and Russia not far behind. UKAEA collaboration agreements already exist in one form or another with all of these countries, while the CEGB, currently chasing a minor share of the Superphénix project, also holds an interest

in the German SNR-30 FBR prototype.

UKAEA feeling is that delays with CFR-1 will not help strengthen collaboration, perhaps damaging Britain's relative position in a commercial development race that will be run anyway. One man who disagrees is John Surrey, who last month resigned as nuclear adviser to the Select Committee on Science and Technology. He has argued publicly that Britain can learn

much from the sidelines, and that restraint at this stage will allow the channelling of larger funds into other areas of energy R&D, including conservation. The UKAEA must hope that Mr Benn is unimpressed by that reasoning: it has already placed a contract with the Nuclear Power Company for design and engineering work "related" to CFR-1. On the question of a possible site, there has been official silence. □

Tracking nuclear decisions (3)

Exports: time for a stand?

Colin Norman in Washington examines the NRC's problems concerning the export of uranium to India

EARLY next month, the Nuclear Regulatory Commission (NRC) will decide whether to allow 12,261 kg of slightly enriched uranium to be exported to India. Its decision, the toughest it has yet faced, will have major foreign policy implications, for it will represent a crucial milestone in the United States' efforts to prevent the proliferation of nuclear weapons. In fact, it is the kind of foreign policy decision that is usually made by the President.

NRC is thrust into the middle of the issue because it alone has the authority to grant or deny an application for a licence to export nuclear material from the United States. Its decisions can only be overturned by an Act of Congress. In this instance, it has under consideration an application to export fuel for the giant Tarapur Atomic Reactor Station near Bombay, an American-built reactor which has been operating since the early 1960s with fuel supplied by the United States.

Understandably, NRC is treating the matter with considerable caution. Last week, it held a public hearing to receive testimony on the licence application—the first public hearing ever called to discuss a nuclear export licence—and it was given a wealth of conflicting advice. On the one hand, the State Department and the Commission's own staff recommended that the application be approved, while on the other, a powerful coalition of arms control experts, Congressmen, environmentalists and nuclear critics argued that the licence should be denied.

Underlying the debate, of course, is the fact that on May 18, 1974, Indian scientists exploded a nuclear device constructed from plutonium produced in a Canadian-supplied reactor. It was the first time that any nation had used imported technology to join the nuclear club, and as a result Canada earlier this year decided to bar any further

nuclear assistance to India. Opponents of the request to ship enriched uranium for the Tarapur reactor are urging that the United States should follow Canada's example.

Representative Clarence D. Long of Maryland for example, told NRC that "our response to India is the first test of whether the United States has a real policy of stemming the spread of nuclear weapons". Similar sentiments were also expressed by Dr Herbert Scoville, former deputy Director of the Central Intelligence Agency, and Adrian Fisher, former chief negotiator for the Nuclear Non-proliferation Treaty (NPT). Fisher argued, for example, that "the continued supply by the US of nuclear fuel for the Indian atomic program can only be looked on by other nations as tacit approval by the United States of the Indian nuclear explosive program".

The United States has been supplying enriched uranium for the Tarapur reactor for more than a decade under a unique agreement. In short, the agreement specifies that the reactor can only be operated with fuel supplied by the United States, and that such fuel cannot be used in any other facility in India. The United States also has an option to buy back spent fuel discharged from the reactor—nearly 200,000 tons have so far been accumulated—and no reprocessing of that fuel can take place in India without US permission. Moreover, operation of the Tarapur reactor is subject to monitoring by the International Atomic Energy Agency (IAEA).

But India has an extensive nuclear programme in addition to the Tarapur reactor which is not covered by the agreement and which is not subject to international safeguards. The explosive device detonated in 1974, for example, was made from plutonium produced in a Canadian-supplied research reactor and separated in a small reprocessing

plant built by the Indians themselves. And a new factor has recently been introduced because India has recently completed construction of a large reprocessing facility adjacent to the Tarapur reactor. According to State Department spokesmen at last week's NRC hearing, the facility is now undergoing tests and it will soon have the capacity to reprocess much of the spent fuel from India's entire nuclear programme. The construction of the plant has given India at least the capacity of building large numbers of explosive devices.

Opponents of the proposal to ship more fuel for Tarapur, led by the Natural Resources Defense Council, the Union of Concerned Scientists and the Sierra Club, argued at last week's hearings that, at the very least, NRC should deny the application until India has agreed to several stringent conditions. First, the Indian government should pledge not to construct further explosive devices. Second, the United States should exercise its option to buy back spent fuel already produced by the Tarapur reactor. Third, India should agree to place all its nuclear facilities under international safeguards. And fourth, India should agree not to reprocess any spent fuel, at least for the time being.

Clearly, the Indian government would not readily accept such conditions. But the opponents of the licence application point out that India would be hard pressed to find an alternative fuel supplier. The only other exporter of enriched uranium is the Soviet Union, and potential European exporters are at least ten years away from having significant export capacity. Thus, they argue that "if India wishes to avoid a shut-down of the Tarapur reactors, it may well have to deal with the United States, and the Commission has leverage to obtain non-proliferation ends".

But those views are not shared by the State Department. In a long statement delivered to the NRC last week, for example, Assistant Secretary of State Myron Kratzer argued that "the credibility of the United States as a reliable supplier of nuclear materials, equipment, and services is an essential ele-

ment in achievement of our non-proliferation objectives". Kratzer argued that the US-Indian agreement covering the Tarapur reactor is sufficient to prevent diversion of its plutonium to weapons production. And he warned that if the United States refuses to ship more fuel for the reactor, the Indian government could claim that the original agreement had been broken and that the spent fuel is therefore no longer under safeguards.

Kratzer announced, however, that the State Department is looking into the possibility of taking up the option to buy back the spent fuel which has already accumulated from the Tarapur reactor.

One key issue which surfaced during last week's hearings concerns the extent to which the United States provided aid for the production of India's first explosive device. The Cirus reactor, which provided plutonium for the device, was moderated by heavy water bought from the United States on

condition that it be used only for peaceful purposes.

When Senator Abraham Ribicoff last month drew attention to the possibility that American material had helped India produce its first atomic blast, the State Department demurred. It argued that, by the time the Cirus reactor began producing plutonium for the device, the US-supplied heavy water had been replaced with heavy water manufactured in India. Kratzer confirmed last week, however, that some US-supplied heavy water was probably still in the reactors at the time India used it to manufacture plutonium for the explosive. Consequently, critics of the proposed fuel sale argued that India cannot be trusted to abide by its pledges not to develop nuclear weapons.

The nub of this whole dispute is really that the opponents of the application are arguing that the time has come for the United States to make a public demonstration that it is serious

in its efforts to deter the spread of nuclear weapons, while the State Department is arguing that abrogation of the agreement to fuel Tarapur would jeopardise those US non-proliferation policies. The four NRC commissioners will be hard put to decide which side is correct.

At this stage, it's difficult to predict with certainty what the Commissioners will decide, but at least there is a clue. Earlier this year, there were two applications outstanding for exports of fuel for Tarapur—the 12,261 kg which was the subject of last week's hearings, and a separate shipment of 9,165 kg. Because at least one shipment was required urgently to avoid shutdown of the reactors, NRC approved the export of the smaller quantity on July 2. It did so by a vote of 3 to 1, but explicitly stated that the action would not prejudice its consideration of the second licence application. Its final decision will probably be made in the first week of August. □

IN BRIEF

Stever's appointment

After weeks of uncertainty and delay, President Ford last week nominated Dr H. Guyford Stever to be his science adviser and the first Director of the new White House Office of Science and Technology Policy (OSTP). Stever's nomination must be confirmed by the Senate, but swift approval is expected. The appointment was delayed because four right-wing Republican Senators last month criticised Stever's record as Director of the National Science Foundation and urged Ford not to nominate him for the White House post. The delay has ensured that OSTP will have little influence for several months. The Ford Administration's longevity is in considerable doubt, and with the election in full swing, few people will pay attention to the office. Nevertheless, President Ford can at least claim that he has restored science advice to the White House.

The axeman cometh

The £1,000 million public expenditure cuts announced by the UK Government last week, which are due to take effect in 1977-78, have not left science-related activities unscathed. With the axe falling on capital investment programmes of the nationalised industries, the energy sector (with the exception of the British National Oil Corporation) is particularly hard hit. Coal, gas and electricity will be seeking a total saving of about £70 million through deferred projects. Apart from the

Selby coal scheme, this may involve a 12-month postponement on the Steam Generating Heavy Water Reactor and a cutback on research and development of the fast breeder reactor. A cut of £100 million is being sought from the Ministry of Defence: most of the cuts will be achieved by removing or rephrasing existing programmes, and research work may not escape. At the Department of Education and Science the science budget will be cut in 1977-78 by £5 million. Details have yet to be made known, and it is thought that advice from the Advisory Board for the Research Councils will be sought before final decisions are made.

Geothermal energy research programme

A three-year programme of geothermal research in the UK is to be supported by the Department of Energy following the publication of a report, *Geothermal Energy: the case for research in the United Kingdom* (HMSO, £1.85). The report, by Dr J. D. Garnish of the Energy Technology Support Unit (ETSU), Harwell, reckons that likely returns warrant a modest research programme of collection and refinement of data.

Interest centres on two techniques—the extraction of hot water from aquifers in sedimentary basins or near springs, and the hydrofracturing of rocks, usually granite, with a higher than average temperature. Temperatures likely to be encountered with

either technique are in the 100 to 200 °C range.

Much of the £840,000 involved in the research programme (which ETSU will supervise) will go to the Institute of Geological Sciences for data gathering, particularly in Cornwall, Durham, Bath, Bristol, the Hampshire Basin and the Midland Valley of Scotland. Imperial College and Oxford University are also likely to receive support.

Plea for prisoners

Two scientists, Sergei Kovalyov (Soviet Union) and Sandor Arancibia (Chile) were the subject of appeals by a group of distinguished biologists on the occasion of international congresses of endocrinology and biochemistry in Hamburg recently. Kovalyov, an electrophysiologist, was sentenced in December 1975 to seven years in prison and three years exile for anti-Soviet activities. Arancibia, a neuroendocrinologist, was given a life sentence—he had been a prefect in the Valdivian region before the 1973 change of regime. Signatories included A. Lwoff, F. Jacob, J.-P. Changeux, F. Gros, F. Morel, Y. Laporte, E. Baulieu, J. Nunez, C. Kordon, C. B. Anfinsen, C. deDube, G. Wald, D. Baltimore, R. Dulbecco, S. Luria, A. Szent-Györgyi, J. D. Watson, H. Krebs, H. Temin, J. Axelrod, V. Ramirez, L. Martini and J.-P. Waller. They call on Mr Brezhnev and General Pinochet to free their colleagues strictly for humanitarian purposes since "their lives are in danger and those of their families are broken".