Nuclear reprocessing

France avoids British problem

Do the French do their reprocessing better than the British? The answer seems to be yes, at least by the criteria of leakage from and accidents at the principal French reprocessing plant at Cap de la Hague, on the English Channel coast near Cherbourg. Even opponents of the French nuclear programme admit that leakage is no longer a problem; environmentalists have turned their attention to other matters.

Even so, La Hague may be storing up problems for the future, for much of the low and medium level waste that British Nuclear Fuels discharges into the Irish Sea from Sellafield is stored on the land in Brittany. In short, the long-term nuclear waste problem has not been solved.

Nevertheless, French emissions of radioactivity from La Hague, the principal reprocessing plant, are low. The independently supported claim is that La Hague discharges into the English Channel 220 times less alpha emission, and seven times less beta emission, than does Sellafield into the Irish Sea. And despite the large amounts of waste stored on land, the average radiation exposure of a La Hague worker is 2.5 times less than that of workers at Sellafield.

But not everything has been rosy. La Hague suffered a series of setbacks in the 1970s. As in Britain, French nuclear power began with Magnox gas-cooled reactors, and early reprocessing of this fuel was very inefficient. Process pipes shielded in concrete had constantly to be broken open, exposing workers to high levels of Purex process (in which wastes are precipitated from a solution of the spent fuel in nitric acid). In the late 1970s, throughput at the plant was only a quarter of design capacity. La Hague also suffered a serious transformer fire which closed down pumps in the plant and raised questions about safety and the redundancy of equipment. (There was no second transformer to bring on line.)

Now, most of the limited amount of French Magnox reprocessing has been transferred to a new plant at Marcoule on the Rhone, and La Hague is concentrating on reprocessing the more highly irradiated oxide fuel from the huge French collection of pressurized water reactors (PWRs). This is the connection in which La Hague is proving efficient and relatively clean.

According to COGEMA, the French nuclear fuels company for which reprocessing is a third of turnover, La Hague is currently responsible for reprocessing 80 per cent of the world's reprocessed oxide fuel (most of it French but some from Japan, Belgium, West Germany and elsewhere). COGEMA has a clear commercial interest in proving itself better than Sellafield, with which it will be competing directly in the 1990s, when the Sellafield "THORP" plant is due to be on stream.

COGEMA is a relatively secretive organization. French civil and military nuclear institutions overlap, and access to the La Hague plant is tightly controlled. But the doors have been opened, notably to a team of physicists, including nuclear opponents and headed by Professor Jacques Castaing, which reported on La Hague a couple of years ago. Moreover, many members of the antinuclear French trades union CFDT are workers at the plant, and are not slow to report accidents to their union. So although independent information on La Hague is not easy to come by, it is available. The general impression is that La Hague does not leak.

This is why the French environmentalists' attack on reprocessing is directed at the prospect of a "plutonium economy" and at the costs of reprocessing. The company claims that costs have actually fallen by some five per cent over the past year because of the smooth operation of its UP II oxide reprocessing stream, which handled 418 tonnes of fuel last year, 18 tonnes (or nearly five per cent) more than the plant's targeted 400 tonnes. Reprocessing costs would now be some FF5,000–6,000 per kg of spent oxide fuel (£500–600) according to COGEMA, but its opponents say this figure involves some sleight of hand over discount accounting, and that the true costs will turn out to be twice as much. Indeed, the critics say that the electricity utility EDF would not be able to afford the true costs. **Robet Walgate**

Fusion in Japan

Plans for second major machine

Tokyo

A NEW institute for basic studies in nuclear fusion seems likely to be built in Japan quite separately from that supporting the massive JT-60 tokamak project. An important step towards this goal was taken last week with the submission of an official recommendation from the Ministry of Education, Culture and Science (MESC)'s Science Council.

The institute is likely to be centred on the Nagoya University Institute of Plasma Physics, the largest university basic physics research facility, which has for some years been planning to move from the Nagoya University campus to more spacious grounds at Toki, in nearby Gifu prefecture. Parts of the land reserved for the move have already been bought with funds supplied by MESC.

Now that support has been gained from the Science Council (a twenty-seven member academic advisory board appointed by the ministry), MESC will spend some time considering whether an expanded institute should be built. A special committee will shortly be set up by the ministry.

The Institute of Plasma Physics has been Japan's chief plasma research institute for 25 years: it is an open institute at which scientists and engineers from all over Japan may come to do research and has helped give birth to several other large facilities, most notably Osaka University's laser fusion institute. After the move it could well undergo a change in status to that of a "national joint-use research institute". Such industries, like the High-Energy Physics Research Institute at Tsukuba and the Institute of Space and Astronautical Science in Tokyo, are quite independent and have been able to obtain research facilities that are often superior to those at universities. Conversion to "national" status would almost certainly mean that Kyoto University's Heliotron group, as well as plasma physics groups elsewhere, would be incorporated into the institute.

The new institute, whatever its status, is to have a helical conductor system as its main facility, rather than a tokamak. Japan's giant JT-60 tokamak — on the same scale as the Joint European Torus at Culham (United Kingdom) and the fusion test reactor at Princeton (United States) — is run quite separately by the Science and Technology Agency.

At JT-60, expansion is also expected following the submission of a recommendation from the Atomic Energy Commission in the middle of February. Although there are tokamaks in the universities, it is overall variety rather than scale that has been aimed at in fusion machines; in laboratories around the country can be found heliotrons, stellerators and bumpy torus machines, open-ended "magnetic bottles", reversed-field pinch torus machines and compact toroids, including spheromaks.

A conceptual design for the new helical conductor system will be worked on by a committee in the Institute of Plasma Physics. Its nearest relatives are likely to be the Advanced Toroidal Facility under construction at Oak Ridge in the United States and the "Deep Well" project at Wendelstein in West Germany.

If all goes well, purchase of the land and clearing of the site will be completed in the next fiscal year. How quickly the new institute will then be built will depend on how quickly a consensus on its form can be reached by MESC among Japan's fusion research community — and on how quickly funds can be won from the Ministry of Finance. **Alun Anderson**