Product of Harvest

Harwell's Harvest; its successor AVM, incorporated in a plant at Marcoule which began operation two years ago, is continuous, allowing — it is claimed — a roughly twofold saving in capital equipment costs for the same waste throughput. The AVM plant is remotely controlled, and is constructed from units none larger than 500 kg for ease of handling and replacement. The French process is thus many years ahead of its British — or any — rival.

Nevertheless there is still a question mark over BNFL's haste to conclude an agreement with Cogema. The decision to abandon Harvest is as much a political as a commercial one. At present, about 1,000 m^3 of high active waste is stored in liquid form in tanks at Windscale, and BNFL still considers that it could remain in these tanks, or new ones, for some decades. Further tanks could be built for the oncoming nuclear power programme, but it is felt that public opposition to the programme — which will be expressed in the promised PWR enquiry — may be less if vitrification work is seen to be progressing apace. The argument, however, turns a blind eye to local opposition to drilling tests, to find sites for future long-term disposal of the glass.

At Harwell, Dr Ron Flowers, who heads the chemical technology division that developed Harvest, says that he expects to close work on the project by next March, once experiments are completed and final publications prepared. Loss of the Harvest contract — which was paid for by BNFL, the Central Electricity Generating Board, and the Department of the Environment — will not be a serious blow to the division, he says.

Robert Walgate

The differences

High active waste emerges as a liquid from the reprocessing of spent fuel: it is a solution in concentrated nitric acid of the nitrates of actinides and fission products. The object of vitrification is to immobilize the radioactive elements. In the Harvest processs, which is only at the pilot stage, a simulated waste is mixed with the components of a borosilicate glass, poured into a tube, evaporated and glassified in one step in a furnace. The tube becomes the primary container for the glass. The process is a batch process. In the AVM technique, a high active liquid stream is evaporated and calcined (converted to oxides) in a rotary calciner. Each hour, the calciner accepts 40 litres of liquid waste and converts it to brown granules, which leave the furnace continuously. The granules are mixed with borosilicates and melted in a stainless steel container. Every eight hours, the container pours out 140 kg of glassified waste into storage drums. The drums are moved out, lids are welded on, and the drums moved to storage caves — all automatically.

Soviet dissidents

Another taken

Viktor Brailovskii, the Moscow Jewish mathematician who regularly hosts the Sunday seminars for refusnik scientists, was arrested last week, reportedly under Article 109/1 of the Criminal Code which deals with slander of the Soviet Union and the socialist system and the circulation of "publications known to be false".

News of the arrest, coming shortly after the opening of the Madrid review conference on implementation of the Helsinki Final Act, has caused consternation among his colleagues and friends abroad, who see it not only as a threat to Brailovskii himself, but also an adverse omen for Soviet intentions regarding "Basket 3" of the Final Act, which deals with human rights.

Brailovskii, who is a specialist in cybernetics and computer programming, first applied to emigrate to Israel in 1972. His application was refused, and he was then dismissed from his academic post. Since then, he has had no chance of obtaining any job in science.

It was to help such "refusnik" scientists keep up their academic interests that the Sunday seminars were founded in 1973 by Aleksandr Voronel'. When Voronel' and then his successor as seminar leader Mark Azbel' finally managed to emigrate, Brailovskii and his wife Irina (also a mathematician) became hosts to the seminar.

A recent Western visitor reports that in spite of a total lack of access to scientific facilities, including journals, the standard of discussion remains high, and there is considerable participation by young Jewish scientists who are attempting to carry out some kind of postgraduate study on their own.

A frequent visitor to the seminar, the traveller said, is Evgenii Chudnovskii of Khar'kov — a city where the refusal rate has always been particularly high — who is now trying to organize what he calls a "Jewish university" for young refusniks

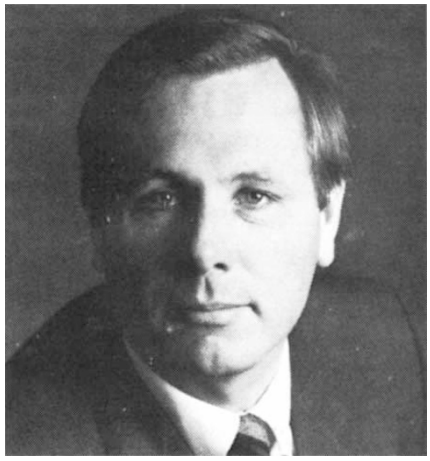
According to Mrs Brailovskaya, the seminars will continue in spite of her husband's arrest. The citation of Article 109/1 presumably refers to the *samizdat* journal *Jews in the USSR*, of which Brailovskii was for a time editor. However, this journal ceased publication in summer 1979, and the long delay before an accusation on this charge seems unreasonable.

German science

New man arrives

Germany has a new Minister for Science and Technology: 43-year-old Andreas von Bülow, who since 1976 has been Parliamentary Undersecretary of State for Defence. The Bundesministerium für Forschung und Technologie BMFT is Dr von Bülow's first ministerial appointment — as it was for his predecessor, Dr Volker Hauff. Dr Hauff now moves on to the Ministry of Transport, which is considered to be a more senior political appointment.

Dr von Bülow has had no time yet to form his policies for the BMFT, but he is expected to lean more to the right of his party, the SPD, than Dr Hauff, who attempted to use the ministry as an



instrument of economic policy (through its involvement in technology). But Dr Hauff — after seven years in some capacity at the BMFT — was said to be becoming impatient at the inertia of the research community, and particularly the big science institutions like the Karlsruhe nuclear research centre and others which had grouped themselves into a powerful lobby, the Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF). It remains to be seen what Dr von Bülow will do with that. His ministry plays a coordinating role in German science, akin to that of the Delegation Générale à Recherche Scientifique et Technique in France; but it controls a much larger budget — around DM 6 billion (£1.25 billion). This is the bulk of the federal finance applied to R&D Germany, another DM 3 billion or so being under the direct control of other ministries. (A further DM 6 billion is spent by the state governments, mostly to support universities, and DM 16 billion by industry.) The BMFT, along with the state governments, supports the institutions of the AGF, the Max Planck Gesellschaft (which runs the Max Planck institutes), the Deutsches

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Forschungs-gemeinschaft (which funds research projects in the universities), the Fraunhofer Gesellschaft (the equivalent of Max Planck, but for applied science), and other science promotion bodies. The ministry also promotes research and innovation in industry through a number of mechanisms. **Robert Walgate**

Indian environment

Shandi inverted

Bangalore

Mrs Gandhi's new government seems to have taken the environment to heart, to judge from the spate of decisions since the election at the beginning of the year and the appearance of the environment in the newly published Sixth Development Plan.

In recent years, environmental abuse in India has increased alarmingly. Urbanization, industrialization and river pollution have all conspired to make a mockery of the United Nation's slogan of "development without destruction" in a country renowned for its religious regard for the variety and greatness of nature. The repercussions of this indiscriminate assault on the ecological system are telling:

Barren hill

landslides and flash floods in the Himalayan foothills have caused heavy loss of human lives and property, top-soil erosion and growing aridity in the Ganges plains have had severe consequences for agriculture.

Successive Indian governments during the past 30 years have shown little awareness of the cardinal importance of environmental planning in developmental activities. It was only after Mrs Gandhi's return to power in early 1980 that the environment assumed significance.

Since then, work on the controversial Silent Valley hydroelectric project in the tropical rain forests of southern India has been suspended and the rate of deforestation in the Himalayan foothills has been greatly reduced.

It is a measure of the growing public ecological awareness that the last session of the Indian parliament witnessed perhaps one of the liveliest debates on the environment. Intervening in the debate, Mrs Gandhi made it clear that the nation must not repeat its earlier mistake of allowing industrial projects, despite their economic importance, to damage the delicate environmental web.

During the debate, a ruling party member, Dr Karan Singh, expressed shock over the "ruthless denudation of Himalayan vegetation by corrupt politicians, corrupt officials and corrupt contractors". He further lamented that even the Ganges had now been contaminated.

Another member, Mr Digvijaya Narain Singh, said that, as a result of top-soil erosion, 90 million hectares — equal to 28 per cent of the total land area — had now become practically barren. He urged that there should be a separate department concerned with land use, forestry, wild life, pollution control, marine ecosystems and the promotion of environmental protection.

This suggestion seems likely to be incorporated into the government's long-term environmental strategy, which will be based on the recommendations of a 14-member committee set up to suggest legislative measures and administrative machinery for environmental protection. The committee, headed by Mr Narayan Dutt Tiwari, deputy chairman of the Planning Commission, has come out strongly in favour of immediate coordinated action at both central and state levels to give environmental protection a crucial place in the country's programmes and policies.

The Indian government is also contemplating introducing a bill on the prevention of air pollution in which would be based on proposals put forward by an expert committee appointed in 1978 to study air and water pollution in the urban areas of India. Air pollution has become a major health hazard in cities such as Bombay, where the content of carbon dioxide in the atmosphere has been increasing by 4.2 per cent a year due to the 65 tonnes of dust ejected into the air each day by industry and vehicles.

B. Radhakrishna Rao

Nuclear fallout

Weapons are worst

States with substantial nuclear industries should do everything they can to avoid strategic nuclear attacks. That is one of the inevitably ironical conclusions of a study of catastrophic nuclear radiation releases by Steve Fetter and Kosta Tsipis of the Program in Science and Technology for International Security at Massachusetts Institute of Technology.

The chief objective of the study has been to compare the long-term consequences of nuclear weapons exploded in the air and on the ground, catastrophic releases of radioactivity in reactor accidents and the explosion of nuclear weapons on or near nuclear reactors or reprocessing plants. Although it is recognized that the immediate effects of weapons explosions as distinct from reactor accidents will consist largely of the death of people and the destruction of property, the calculations are aimed at estimating the area of surrounding land that will be unfit for human habitation after an explosion or some other catastrophe.

For the purposes of the calculation, the authors assume that half the energy released in a one-megaton thermonuclear explosion is provided by fusion reactions and the remainder by the fission induced in a surrounding blanket of uranium-238. For weapons burst in the atmosphere, radioactivity from the fission of uranium-238 will be the sole source of long-term contamination, and much of its debris will be distributed by stratospheric processes.

The areas rendered uninhabitable after a nuclear explosion are sensitively dependent on the criteria used for deciding what doses of radioactivity are acceptable. For a ground burst weapon whose debris is spread in the lower atmosphere by a 15-mile per hour wind, the authors calculate that 5,700 square miles of land would be uninhabitable for a year if doses greater than 2 rem per year were considered unacceptable, but that fewer than 50 square miles would be uninhabitable a year after the explosion if 100 rem per year were taken as the cut-off dose.

Inevitably the consequences of the explosion of a nuclear weapon on or near a reactor are more startling. Using the somewhat stringent criterion of a limiting dose of 2 rem per year, the authors conclude that 50,000 square miles of land would be uninhabitable for a year. The destruction of a waste storage facility would have still more horrendous consequences, putting 64,000 square miles out of action for a year. By comparison, the report concludes, the consequences of a reactor melt-down and a subsequent release of radioactivity would be comparatively small, sterilizing only 900 square miles for a period of one year.

The obvious but impractical import of these calculations, Fetter and Tsipis say, is that countries seeking to avoid devastating damage from distributed radioactivity in a nuclear war should either dispense with a nuclear industry or build reactors and reprocessing plants underground. They also point out that because the permanent damage done by a single nuclear weapon detonated on the ground is so much greater than that in the "worst conceivable nuclear reactor accident", it is hard to understand the greater anxiety of the general public about the risks of civil nuclear accidents than with the consequences of nuclear war.

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