

Nuclear waste

UK procedures condemned

THE Nuclear Installations Inspectorate (NII) and the Department of the Environment (DoE) this week publish separate, highly critical reports of safety procedures at the British Nuclear Fuels Limited (BNFL) reprocessing plant at Sellafield (formerly Windscale). The reports investigate incidents at the plant last November that led to widespread radioactive contamination and a public warning from the Department of the Environment against the use of beaches in the area.

BNFL's latest problems began on 11 November, when operators pumped wastes into a sea discharge tank, apparently unaware that radioactive solvent and "crud" had not first been separated off. Standing instructions for the procedure, which was being undertaken as part of the annual shut-down, were "ambiguous", says DoE's radiochemical inspectorate, and the procedure for communications between managers was "inadequate, prone to error and not sufficiently formalized". Records were kept only in manual log books and instructions were confused by contradictory suggestions made in pencil.

As soon as the mistake was detected the flow was stopped. Attempts were then made to return the solvent and crud to the treatment plant, but because the available pipeline had only a 2-inch diameter, the procedure was partly unsuccessful and the level of gamma radioactivity near the sea tank outlets necessitated evacuation of workers from the immediate vicinity of the pipes. By this time, senior management had been alerted and after further unsuccessful attempts to rescue the position they decided to flush the offending material down the sea pipeline to increase flow rates and reduce radiation dose to workers. DoE says this decision was taken "without adequate assessment of the available options": the presence of the solvent and highly active crud "does not appear to have been considered".

The company did not at this stage inform the relevant government departments because the total amount of radioactivity in the sea tank was less than the total authorized discharge; DoE says the company "would have been well advised to do so". BNFL maintains that a high proportion of the 4,500 curies of beta activity in the sea tank was returned to the plant, but NII is sceptical and thinks "a significant proportion" went to sea.

The first indication of problems outside the site was on 14 November, when divers from a ship belonging to the environmental group Greenpeace were contaminated with ruthenium 106 in solvent. Two days later, a DoE inspector was informed that ruthenium had been released but was told neither of the complex circumstances nor that more than 500 curies was likely to have been released. On 18 November, BNFL

noticed a slick of solvent at sea and attempted to disperse it, but subsequently lost the slick. The slick and associated debris were later washed up on the beach, but, according to DoE, BNFL had no effective procedure for recording and assessing results. On 20 November, BNFL advised the public that all was back to normal and that beaches could be used again. This was later contradicted by DoE, and BNFL's decision is now criticized.

DoE says that current authorizations are not adequate to deal with sudden releases of solvent and crud. Although the total amount of radioactivity released was well within authorized limits, the sticky nature of the solvent, together with the highly active crud, led to the formation of local "hot spots" of activity, mainly on flotsam, and these were the main potential hazard.

Although little damage to public health is likely to have resulted from the November incidents, there is more concern over plutonium that is routinely discharged and which, contrary to expectations when the discharge pipeline was built, appears to bind to sediments on the sea bed. DoE's radiochemical inspectorate considers that solvent discharges in the past may be responsible for the enrichment of plutonium in the sea surface and its subsequent transfer to land. The National Radiological Protection Board is investigating whether plutonium in household dust in the Sellafield area could account for a local excess of childhood leukaemias claimed in some recent studies.

NII has required BNFL to make a number of immediate changes to operating procedures, and further long-term improvements are planned. Automatic cut-offs have already been installed to prevent solvent or crud finding its way to the sea discharge tanks.

Both reports are now with the Director of Public Prosecutions. The DoE report finds possible breaches of statutory operating requirements relating to record-keeping and maintaining doses to the public that are as low as reasonably achievable.

Tim Beardsley

New man at zoo

BARRING the unlikely emergence and the even less likely victory of an alternative candidate, Sir William Henderson FRS will succeed Lord Zuckerman as president of the Zoological Society of London. Sir William, a former secretary of the Agricultural Research Council, sees his most important task as reducing the society's budget deficit, now running at £2 million a year. The society has long been plagued with financial problems and many

Seabed geology

Gloria goes west

IN a few weeks' time, the MV *Farnella* will sail for the west coast of the United States carrying the unique long-range sidescan sonar "Gloria". The voyage is the result of a new cooperative agreement between the Institute of Oceanographic Sciences (IOS), a component body of the UK Natural Environment Research Council, and the US Geological Survey. It will cost the latter over £1 million.

Gloria (Geological Long Range Inclined Asdic) will be used to survey the ocean floor in all waters more than 500 m deep within the Pacific margin of the recently created US Exclusive Economic Zone. The objective is to produce maps of the shape and texture of the seabed, the interpretation of which may reveal features of economic as well as academic interest.

Gloria was developed by IOS and is at present the only sonar of its type in the world. Using acoustic back-scattering in a manner analogous to the use of oblique illumination during aerial photography, the system produces images of the seafloor up to 30 km either side of the track of the 8-m long towfish. In its six years of service, Gloria II has mapped approximately one-fiftieth of the world ocean floor.

Geological interpretation of the Gloria data may provide clues to the petroleum potential of the Exclusive Economic Zone. Of equal interest is the possibility of discovering significant quantities of heavy metal sulphides. Hundreds of kilometres of the Gorda and Juan de Fuca ridges lie within the zone and the heat generated at these spreading centres causes large-scale circulation of seawater. This extracts elements such as manganese, zinc, copper, cadmium and silver from the fresh basalt and emerges on the seafloor as spectacular "black smokers". Contact with the cold ocean water causes precipitation of sulphide minerals which may build up economically attractive deposits.

The investigation will yield immediate returns for the academic community but in commercial terms it must be seen as a speculative investment. Peter Gambles

zoo buildings need renovating. Last year, the Department of the Environment turned down an ambitious expansion plan but agreed to write off the society's losses to the tune of £2 million a year until 1986.

Sir William is keen to preserve and enhance the society's scientific prestige: its expertise in reproductive physiology, for example, has allowed it to maintain in captivity species such as the oryx that are almost extinct in the wild. The only way to continue to finance such work will be to increase the number of visitors to the zoos.

Tim Beardsley