ATOMIC "WASTE" CAN BE VALUABLE

Residues resulting from chemical processing of irradiated fuel are in the form of liquids containing highly radioactive materials. Storage of them is a problem being solved by a number of different methods, including concentration and solidification processes. If such storage means that the elements contained in them are difficult to recover, the world may lose valuable products. This view was put forward at an Agency scientific staff meeting by Mr. L.H. Keher, who has recently returned to the Australian Atomic Energy Commission after having been a member of the IAEA Health, Safety and Waste Disposal Division.

Such residues represent more than 99.9 per cent of the radioactivity contained in the total produced by the nuclear industry, said Mr. Keher, but experience had shown that they could be contained safely. After dealing with the methods adopted in various countries for handling large quantities and concluding that management costs would not deter the development of economic nuclear power, he drew attention to the necessity for integration of effort between the fuel fabricator, the fuel processor and the waste manager. Consideration should be given to the problem which could occur with fuel reprocessing and waste management by the use of certain materials and techniques in fuel fabrication.

Mr. Keher continued: The other important point is that the materials left after fuel reprocessing are called waste. Is this correct? Some effort is being made to extract caesium and strontium as well as other isotopes, but is enough consideration or effort being given to this question? The high-level residues should not be considered as waste but as a valuable by-product of nuclear power. It may be in the interests of the whole nuclear economy to endeavour to use fuels which are more simple to process chemically, and thus make for easier recovery of isotopes.

Whilst it may be considered at present that solidification is desirable, it should also be considered that once this takes place it will be difficult to extract any elements for which it is found in the future that there are practical and economical commercial uses. I would consider that solidification should only be done at the present on those residues where there are high concentrations of non-radioactive material, or those produced from some process which it is proposed not to continue. Those being produced from processes which have given large volumes of a relatively homogeneous high-level liquid should be stored until a decision is made on what to do with them ultimately.

My own point of view is that firstly they must be considered in the long-term view to have valuable uses. Therefore they should be stored as the liquid, with little or no addition of other materials which could make the recovery of certain elements difficult later.

A further point on the recovery of isotopes is that the hazard from the isotope concerned can be reduced. As an example, strontium at present could be considered as a very great hazard, but at the Hanford processing centre, US, it has been proposed that in separation it should be converted into strontium titanium oxide. This generally insoluble compound remains chemically stable even beyond its melting point of almost 3 500°F, so that there is minimal danger of allowing the radiostrontium to be absorbed even if released from a container. The hazard is thus greatly reduced and the strontium can be used in industry with less worry than if it were in a chemically soluble form. Similarly, as part of the recovery of other isotopes, it should be considered that they be converted into less hazardous forms.

As a long-term viewpoint consideration could also be given to the possible recovery of the stable isotopes formed from decay (i.e. the eventual form of an atom after its radioactivity has been released). Not only must high-level liquids be considered, but attention must be given to the recovery of fission product gases as well.

One fission product gas, xenon, is produced by nuclear fission in quantities sufficiently high to make a possible commercial source of this rare gas. (Five fission product decay chains terminate in stable, or non-radioactive xenon isotopes; the total yield in the fission of ^{235} Uranium is about twenty per cent. Since the unstable isotopes formed during the same process are short-lived, purified xenon is, after a short period of delay, virtually non-radioactive). There are interesting commercial possibilities for xenon, exploration of which have presumably been retarded by limited supply and high cost (US$5 per gramme). The principal commercial source at the moment is the liquid air industry, but in the US the output is limited to 0.6 ton a year. The nuclear power industry can greatly increase this supply; for 1980 it is estimated that power reactors in that country will produce about 35 tons annually.

Present commercial use of xenon lies particularly in the lighting industry. Applications in medicine as an anaesthetic, and in practical chemistry following the recent discovery of the reactive behaviour of this interesting element, remain unexplored.

The hope must be that the question of high-level wastes from future nuclear programmes will be given an integrated approach by all those concerned. Mankind has in the past plundered the environment and wasted the natural resources available. In nuclear energy full technical and economic evaluation should be made before we are committed to ultimate and unrecoverable disposal of "waste" which might be put to valuable use.