10. AREAS FOR FURTHER WORK

A number of topics have been identified where further work will improve understanding and ultimately provide better estimates of activity levels for reactor maintenance and decommissioning. These topics include:

- investigations to obtain a better understanding of the deposition behaviour of corrosion products in cold-trap and pump geometries.

- an investigation of the behaviour of ^{137}Cs in liquid sodium and the cover-gas of operating plant by carrying out more mass-balance experiments in pumped loops to quantify the level of partitioning in cover-gas and liquid sodium environments. Measurements should assess the effect of surface composition (element depleted or oxidized material), metallurgical condition, carbon content of the steel and the sodium and the effect of oxide films, such as sodium chromite.

- measurements of release rates for fission products and fuel from failed pins, especially as the review has identified that current release rates are lower than those used in earlier estimates. Work should be put in hand to increase the data base and to understand the chemistry relating to failures so that proper estimates can be made for release in commercial reactors, both during reactor operation and subsequent storage, so that economic and safety arguments for operating with failed pins are properly supported.

- an investigation of methods for the safe disposal of the replacement parts of cold-traps and cesium traps and to evaluate the economics of sodium disposal during reactor decommissioning.

- the provision of a better understanding of the way ^{54}Mn deposits in sodium systems in order to establish whether its behaviour is mass-transfer controlled or whether it is affected by co-precipitation with soluble nickel in the sodium.

- a study to establish the whereabouts of cobalt isotopes in operating systems by examining fuel pins, notably the breeder sections, for deposited cobalt to establish whether this radionuclide deposits in

this part of the core along with iron. Additional investigation should include regions under the core to see whether cobalt is associated with steel particles (see topic on particles later).

- an assessment of the effect of introducing new fuel clads to reactor systems, to achieve higher burn-ups, on the release rate of corrosion products. Although current models assume a constant release rate, changes in metallurgical composition (eg addition of titanium) and structure during irradiation may induce higher selective corrosion rates due to the formation of holes in the sub-surface of the cladding. The metallurgical structure of pins exposed to reactor sodium should be examined for these effects.

- more precise measurements of tritium and hydrogen levels in reactor environments. Although Kumar for EBR.11, Tibi for Phenix and Trevillion for PFR have modified their models to accommodate the points made in Section 6 concerning tritium behaviour in LMFBRs, it is felt more measurements are needed to support and improve existing models.

- the acquisition of more data relating to activity levels and nuclide deposition rates and the boundary condition at the depositing interface to support existing codes. Experiments conducted in Phenix IHX's, should be extended to Super-Phenix and Soviet pool-type reactors.

- an assessment of the effect of entrained particles on mass transfer behaviour, especially as particles have been identified in KNK II, and in the Harwell mass transfer loop where steel particles, and particles covered wth sodium chromite, have been associated with the deposition of ^{65}Zn and ^{137}Cs respectively. It is also important to know, especially in relation to decommissioning, whether particles migrate, react and stick together in low velocity parts of the reactor and whether they eventually sink to collect in semi-static regions, such as those below the diagrid.

- an assessment of the effect of particle size on the mass-transfer behaviour of fuel particles and insoluble oxide fission products and to establish whether current models, which assume their deposition behaviour is mass-transfer controlled, are correct.

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