

i) their radiolitical or chemical degradation products do not effect the extractive process and do not accumulate into the organic phase in a liquid-liquid extractive procedure.

ii) the aliphatic chain structure changes strongly the extractive capacity of some amides especially with regard to the tetravalent ions.

iii) the branching has seen to effect also the trend of the distribution curves in a different way for two ions so that it is possible to foresee a separation in certain experimental conditions of two actinides (U, Pu) at a prefixed ratio.

These advantageous characteristics induced us some years ago to start a systematic research with the aim to investigate better these compounds and to propose some of these compounds as alternative of TBP in some specific applications.

Being those compounds not for the moment commercial products, we have synthetized many of those amides for a systematic study of the effect of the structure on the chemical-physical characteristics and on the extractions behaviour.

The investigation permits us to propose some of these compounds, in original flow-sheet for the separation from the fission products of the couple U-Pu and U-Th and for their final purification.

E7

The Biological Behaviour and Toxicology of Plutonium and Transplutonics

J. C. NENOT* and H. METIVIER**

Institut de Protection et de Sûreté Nucléaire, Département de Protection Sanitaire

*BP no. 6, 92260 Fontenay-aux-Roses, France

**BP no. 12, 91680 Bruyères-le-Chatel, France

The biological behaviour of plutonium and transplutonics depends upon the physico-chemical properties of the incorporated radionuclide and upon biological factors. They can enter the body either by in-

halation, by ingestion or through wounds. Inhalation is the most likely route of accidental intake in workers, while ingestion can be considered as the pathway to the general population from discharges to the environment due to routine or accidental releases. All the transuranium elements translocated from the site of entry by the circulating blood are deposited in the same tissues and organs; they accumulate in two major organs, bone and liver, both of which represent more than 90% of the activity cleared from the blood.

Acute and medium-term effects are due to very high radiation doses which would only occur in extreme accidental situations. The level of activity deposited in the lung after inhalation of plutonium which will cause death of half of an exposed population within a few months is evaluated around 3.7 MBq (100 μ Ci). The main delayed effect is the development of cancer, which has been demonstrated in experimental animals, and which occurred mainly in the lung and in the skeleton. Those effects have been observed at levels much greater than those likely to be encountered in man. The frequency of lung cancers following inhalation of actinides increases with the dose up to a maximum and then decreases at higher doses as a result of cell sterilization and death. No evidence of hereditary effects resulting from the incorporation of actinides in the gonads has been demonstrated in any of the animal species studied.

There are no data on the development of cancers in humans as a result of incorporation of plutonium or any transplutonic. Estimates of risk have therefore been based on the results of epidemiological studies on humans exposed to external radiation, and on some available information on the development of bone and liver cancers as a result of intakes of other alpha emitters.

At present the methods for removing accidental intakes of plutonium and transplutonics from the body are moderately successful. For removing the transportable forms, the administration of the chelating agent DTPA is presently the recommended method. If insoluble forms are inhaled, broncho-pulmonary lavage is the only effective treatment.