

RELATIVE HAZARDS OF FISSION PRODUCTS IN THE ENVIRONMENTAL HAZARDS EVALUATION OF NUCLEAR REACTORS

J. TADMOR and H. GALRON

Soreq Nuclear Research Centre, Israel Atomic Energy Commission,
Yavneh, Israel

Abstract—The fission products and their decay products which accumulate in the fuel during the operation of a nuclear reactor consist of about 300 isotopes of different physical, chemical and biological properties. However, only a relatively small number of these isotopes contribute significantly to the hazard to the population, in the event of an accidental release of fission products into the environment.

The relative hazard of the fission products in the environmental hazards evaluation of nuclear reactors was calculated in order to ascertain which fission products must be taken into account. Consideration was given to (1) the various ways in which the population might be subjected to irradiation (external cloud radiation, external radiation from contaminated land, and internal irradiation due to inhalation); (2) the properties of the fission products (fission yield, percentage of release from the fuel in an accident, energy of radiation, physical and biological half-life, velocity of deposition); and (3) the critical organ in the human body in which the fission product concentrates.

Although several studies deal with the relative hazards of various radioisotopes in general and of fission products in particular, no comprehensive study has been made so far concerning the specific aspect of environmental hazards evaluation of nuclear reactors.

In our study, the relative hazards of the fission products were calculated for external cloud radiation, external radiation from contaminated land and internal radiation from inhalation, assuming a reactor power of 1 MW (th) and an accident occurring after 3 years of operation. The hazards were calculated for different times after the occurrence of the accident and for different distances from the point of release of the fission product.

The importance of using the individual γ -energies rather than the average energy of all the fission products is shown and the contribution of the fission product daughters formed during the travel of the cloud is also evaluated. The study summarizes the sequence of importance of the different fission products in the framework of the hazards evaluation of nuclear reactors.