

(1) The uncoupled hydrodynamic-neutronic calculations during compression stage

The neutronic calculations were carried out using the neutronic part of the program AX-1 with Hansen and Roach 6 and 16 energy group neutron cross sections for fast critical assemblies. The density distribution obtained from the hydrodynamic calculations was used to determine values of the effective multiplication factor (k_{eff}) as a function of shock wave position across the assembly layers and down to the center.

Results of such calculations offer information on the position where the assembly state changes from subcritical to critical. Also, from the maximum obtained value of k_{eff} (after the wave reaches the center of the assembly), the amount of available reactivity can be estimated. Certainly, it should be higher than a specific level to guarantee getting the required performance of the device. Calculations were carried out for assemblies specified in Fig.(5.3.4-1) and a sample of the obtained results for k_{eff} as a function of time during compression is shown in Fig. (5.3.4-2).

(2) The coupled calculations

The coupled hydrodynamic-neutronic calculations were carried out on the available design options in order to observe changes in physical and nuclear properties of materials and their impact on the produced energy in a coupled way. The following is a discussion of results of the adopted options and conclusions drawn depending on the following factors: alpha (α), initial value of power, applied pressure parameters P_0 and pressure coefficient μ .

The behavior of (α) represents a description of the assembly under test from the hydrodynamic and netronic point of views at the same time. When its value is negative, for instance, this means that the assembly is subcritical. Beginning of compression and consequent movement of the assembly constituents towards the center is indicated as an increase in values of α ; when the value is zero, this means that the assembly has reached the critical state. In this respect, it is worth mentioning that the behavior of the results agreed with the behavior of the results for k_{eff} since the shock wave started its motion from the subcritical state and continued until the