EN 634 – Nuclear Reactor Thermal Hydraulics and safety

Assignment -11

1. Consider a helium cooled gas reactor whose primary system volume is 1400 m^3. The initial condition of the coolant is 60 bar and 450 ^oC and the reactor was operating at a steady thermal power of 3000 MW(th.) for several months. If this reactor suffers a loss of coolant accident due to the development of a break whose area is 20 cm^2, compute the variation of system pressure and temperature with time till the pressure drops to 2 bar for the conditions prescribed. The thermal power generated from the core may be assumed to be equal to the decay power level. For simplicity assume this to be 1% of the full power level and remains constant. (a) the depressurisation may be assumed to be isothermal and (b) the depressurisation may be assumed to be adiabatic. For helium, the adiabatic index may be taken as 1.33.
2. Consider a data given on BWR in Kazimi and Todreas (pages 5, 13 and 31). Using the tables work out the free fluid volume using vessel and fuel dimensions. Further, for BWR, you may assume that the initial free surface of steam is at a height half way between the vessel top and core top (use your judgments wherever needed and clearly mention the approximations). Compute the rate of change of pressure with time for the following cases. (a) homogeneous model, (b) separated flow model with the break location below the free surface, (c) the break level above the free surface, (d) bubble rise model with the break level above the free surface,(e) bubble rise model with the break level below the free surface. You may assume that the bubble rise velocity to be a constant at 20 cm/s. Use break size of 20 cm^2, decay power of 30 MW.