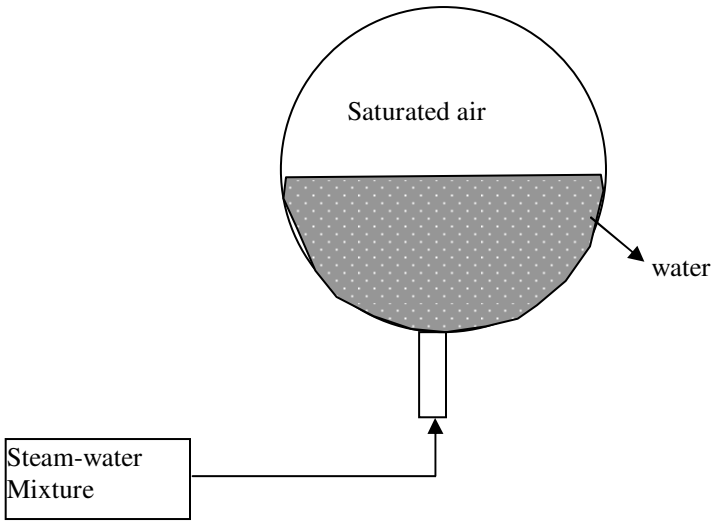
Assignment 12

1. A four loop PWR operates at 150 bars. The core pressure drop is 3.1 bars at the rated flow of 55 X 10^6 kg/hr. The pump rated head is 84 m of water at the flow conditions. The characteristic of pumps may be assumed to be $\frac{H}{H_R} = 1 - 0.2\left(\frac{\dot{m}}{\dot{m}_R}\right)^2$ If one of the loops fails, estimate the fractional reduction in core flow, assuming, (a) the loop has a check valve, (b) the loop does not have a check valve. The density of coolant may be taken as 800 kg/m^3. Assume that friction factor is constant for the system

2. Decay heat is to be removed from a three loop 1000 MWt sodium cooled fast reactor by natural convection. At full power, the coolant pump heads are 100 m of sodium and the total coolant flow is 20 x 10^6 kg/hr. The design requirement is that at 2% full power level, the natural convection must prevent the coolant temperature rise in the core from exceeding the value at full power level. Assuming that the core inlet temperature and the hydraulic resistance coefficients remain constant and that the flow is upward in the core, calculate the distance that the heat exchanger must be elevated above the core. Proceed to solve the problem systematically. State all the assumptions used to make the problem solvable. Assume that all the frictional drop is only in the core and heat exchanger
   Data: β = 2.9 x10^{-4} /K, c_p = 1.256 kJ/kg-K, ρ = 865 kg/m^3

3. Consider an experimental wet-well of a suppression pool containment as shown in the figure. The wet-well, having a total volume of 30 m^3, may be assumed to be thermally insulated. Initially it contains 1 m^3 of water. The initial state of the wet well is 35°C, 100 kPa (total pressure), 100 % relative humidity. During a simulated LOCA, 55 kg of steam water mixture enters at an average state equivalent of 700 kPa, x=0.5. Find the final temperature and pressure of the wet-well after the incident.



The course Assignment Ends! (What a relief)