

22.312

ENGINEERING OF NUCLEAR REACTORS

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**PROBLEM 11-13N**  
**CRITICAL FLOW DURING A SMALL-BREAK LOCA IN A BWR**

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A small break ( $10 \text{ cm}^2$ ) occurs at a certain location on the coolant recirculation line of a BWR. Calculate the mass flow rate at which the coolant is discharged through the break into the containment. Use the following three models:

- 1) Non-equilibrium model for an orifice ( $L/D \sim 0$ ).
- 2) Non-equilibrium model for a short discharge nozzle ( $L/D \sim 2$ ).
- 3) Equilibrium model with Moody's assumption for the slip ratio. (Use Figure 11-21 in the textbook)

Explain any difference you may see in the results of the three models.

*Assumptions:*

- The coolant inside the primary system can be modeled as saturated liquid water at 6.9 MPa (1,000 psi).
- Assume that the containment pressure remains constant at 0.1 MPa.

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22.312 Engineering of Nuclear Reactors  
Fall 2015

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