

## Teaching Notes

### Operational Reactor Safety Course

#### Lecture: 15 –Boiling Water Reactors

##### Objective:

Since much of the work to this point focused on pressurized water reactors, the aim of this lecture is to gain an appreciation of the differences in boiling water reactors from an operational and safety systems point of view. This lecture will also be an important preparation for the simulator exercises at the Pilgrim nuclear plant which will occur later in the term.

##### Key Points to Bring Out:

<u>Slide number</u>	<u>Points</u>
2-6	Review the general configuration of boiling water reactors focusing on the boiling in the core, steam separators, dryer and steam drum in the top of the reactor vessel with steam going directly to the turbine. Discuss the role of the recirculation pumps as flow augmentation devices through the jet pumps. Discuss the layout of the reactor vessel pointing out that control rods are hydraulically driven into the core from below the reactor vessel.
6-9	Review function and operations of the recirculation system and jet pumps.
9	Discuss function and operation of steam separator and dryer to moisture from steam to achieve saturated steam for turbines.
10-11	Review mass flow in a BWR by explaining chimney effect allowing for more mass flow with boosts from jet pumps. Write mass balance equations to be sure students understand mass balance.
12	Discuss boiling regime in BWRs and heat addition as a function of core height.
13-15	Introduce the concepts of maintenance of nucleate boiling and not

exceeding critical power ratios ( $>1.3$ ) to avoid transition zones to film boiling where heat transfer is severely limited leading to overheating of the fuel. Review core boiling regimes in the core.

- 16-18 Review key systems of BWRs and their functions – introduce them for future detailed discussion point out the goal to depressurize the System to assure functioning of emergency core cooling systems As needed.
- 19-21 Review function of reactor control and trip systems and the importance of isolation of the reactor in a BWR.

MIT OpenCourseWare  
<http://ocw.mit.edu>

22.091 / 22.903 Nuclear Reactor Safety  
Spring 2008

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.