

Teaching Notes

Operational Reactor Safety Course

Lecture: 19 – Three Mile Island Accident

Objective:

Having now spent time in two reactor simulators, this lecture should provide a deeper appreciation of what happened at Three Mile Island and what the operators had to deal with to understand and manage the accident. The objective of this lecture is to identify what happened and why with a focus on the thermal hydraulics of the accident which drove the partial meltdown. The failure of systems and lack of operator knowledge and information is to be stressed.

Key Points to Bring Out:

<u>Slide number</u>	<u>Points</u>
2-9	This series of slides introduces the Babcock and Wilcox PWR design and describes a precursor event at the Davis Besse nuclear plant. Emphasis the difference in steam generator design and the amount of water (thermal inertia) in each. Describe briefly the integrated control system of BW designs meant to improve operations but resulted in a sensitive plant design. Point out the lack of industry information sharing about this event that could have helped TMI operators be more aware of the possible problems.
10-23	Review TMI accident sequence - key points are the acceptance of a leak in the PORV which masked the failure to close PORV which led to the accident. Point out how fast things happen in a PWR. Go over the timelines and what operators thought was going on versus what was going on. Explain the graphs from the standpoint of plant response and signals to have the students appreciate the role of systems in the plant.
24	Go over the hydrogen bubble scenario. Discuss why such an obvious technical question that could have been addressed with the consultation of any chemical engineer prolonged the public confusion and anxiety. Point out that the hydrogen in the vessel was never in any danger of exploding and why.

Show History Channel technical segment on TMI to gain an appreciation of how things unfolded in terms of NRC and industry actions. Please see disk marked TMI.

- 25-26 The photos of the extent of core melting are aimed at showing the students the enormous heat generated in the core that could cause fuel melting which up to this point in the history of nuclear power was viewed as not a credible event. Hopefully these images will make a lasting impression for those working in the industry.
- 27-28 Review public health consequences - point is that containments work.
- 29-31 Review lessons learned - good - improved understanding of core melt accidents dispelling many of the past held beliefs about vessel failure, steam explosions and the importance of water in the vessel.
- The not so good lessons are more numerous pointing out the lack of adequate instrumentation, operator training, upgrading of emergency response plans and emergency operating procedures. Brought back the importance of risk assessments in better understanding of safety of nuclear plants as opposed to hypothetical accidents used in licensing (Large Break LOCA).
- 32 Go over the bottom lines of the TMI accident - importance of the role of precursors and industry information sharing among nuclear operators. Training on nuclear fundamentals is important in addition to following procedures.

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22.091 / 22.903 Nuclear Reactor Safety
Spring 2008

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