March 31, 1999
Draft 1.3

OUTLINE OF PLAN TO DEAL WITH SPENT FUEL POOL RISK AT DECOMMISSIONED NUCLEAR POWER PLANTS

A. WHY IS THE RISK ASSESSMENT TO BE PERFORMED?

Assumption: to augment deterministic evaluation of offsite consequences from spent fuel pool Zircaloy cladding fires

B. EXPECTED USE OF THE RISK ASSESSMENT (i.e. what questions will need to be answered and what do we expect to use the risk assessment for in the rule-making process?)

Assumption: will be part of basis for proposed rule to modify how insurance and emergency planning zone are dealt with at decommissioned plants.

C. SCHEDULE

George Hubbard told me on 3/25/99, that my description of what we know about spent fuel pool risk assessment and what we plan to do is due by the end of May 1999.

D. DESCRIPTION OF SPENT FUEL POOL RISK ASSESSMENT FOR DECOMMISSIONED PLANTS

1. Examine existing evaluations of spent fuel pool risk. Completed: NUREG-1275, Vol 12;

2. Work with INEL to see if we can get information on how the AEOD risk assessment of spent fuel pools was developed.

   Spoke with Soli Khericha, INEL on March 26th. He said they had modeled spent fuel pools at four plants: Oconee, Dresden 2, Hatch, and Susquehanna. They then tried to make Susquehanna kind of generic. They still have the models that are done in Saphire. They specifically modeled operator recognition of the event.

3. Description of spent fuel pool cooling and other systems to be modeled (BWR and PWR) including instrumentation available to the operators

   Assumption: It is acceptable to model four specific spent fuel pools similar to that done for AEOD in NUREG-1275, Volume 12.

4. Initiating events to be considered including loss of inventory events and loss of cooling events. Will include consideration of heavy load drops.

Ed

8/102

5. Determine frequency of initiating events (e.g., need seismic hazard curves for sites, need frequency of heavy load drops and need to understand why the drops happen) (Need to talk to Chemical industry about frequency of draining large tanks?) Talk to navy ship yards about heavy load drops. External flooding frequency?

6. Times at which to evaluate risk assessment

   Assumption: 30 days after refuel, 365 days after refuel, and 1095 days after refuel

7. Human errors to be considered

   a. Operator pumps water out of SFP

   b. Operator diverts flow of cooled spent fuel inventory

   c. Operator opens or removes spent fuel pool gate

   d. Operator drops heavy load

   e. Operator improperly rigs load, which subsequently drops

   f. Operator turns off spent fuel pool cooling system

   g. Operator isolates spent fuel pool cooling system

   h. Operator turns off component cooling water system/service water system

   i. Operator turns off ultimate heat sink

   j. Operator ignores alarm for SFP Cooling Trouble (w/ and w/o shared annunciators)

   k. Operator ignores alarm for SFP level (w/ and w/o shared annunciators)

   l. Operator ignores alarm for SFP temperature (w/ and w/o shared annunciators)

   m. Operator ignores radiation alarm in SFP area

   n. Operator fails to start normal makeup to SFP

   o. Operator fails to initiate alternative method of making up to the SFP

8. Passive failures to be considered

5d — a. SFP gate fails

b. Crane fails

c. Pipe break in SFP cooling system, component cooling water/service water system, ultimate heat sink piping

d. Antisiphon devices

e. Gate seals

9. Attentiveness of operations and maintenance staff at a decommissioned plant and its effect on the human error rates for a decommissioned plant (Survey of resident inspectors at decommissioned plants? Need to visit plants? How much does NRC watch over decommissioned plants? Maintenance history at decommissioned plants? Reporting of problems at decomm plants?)

   a. Assumption: One year after decommissioning, most operators have been fired and there is only a skeleton crew.

   b. Assumption: One year after decommissioning, most maintenance people have been transferred offsite or have been laid off.

   c. Assumption: One year after decommissioning, there is no effective NRC day-to-day inspection of the decommissioned plant.

   d. Assumption: One year after decommissioning, the spent fuel pool is isolated from most of the rest of the nuclear plant including alternative water sources and pumps to supply water.

   e. Assumption: One year after decommissioning, the operator error rate is 10 times higher than at the beginning of the decommissioning.

10. Will comparison to operating plant risk from SFPs be necessary? If so, what has to be modeled differently for operating plants besides human factors?

11. Determine what backup systems will be available in the event of loss of inventory at a decommissioned nuclear power plant. (E.g., RHR)

12. Determine what is the expected presence of electricians and other maintenance workers onsite once the plant is decommissioned. What about on the back shift?

13. Will all offsite power lines continue to be maintained? Will emergency diesel generators be maintained? Will dc power systems (i.e., batteries) be maintained?

14. What are the practical effects of the SFP becoming an island?

15. How would the responses to IEB 84-03 (concerning pneumatic seal failures) be different for decommissioned plants? Operating plants said they had emergency procedures that would not require entry into spent fuel pool areas where radiation fields could be very high following loss of inventory.

16. Do fire suppression systems (i.e., water spray) have to be operable and are they seismic?

E. AREAS WHERE INFORMATION ALREADY EXISTS

F. AREAS WHERE INFORMATION NEEDS TO BE DEVELOPED

G. AREAS WHERE INFORMATION CANNOT BE OBTAINED AND FOR WHICH ASSUMPTIONS MUST BE MADE

H. ASSUMPTIONS

1. No recovery will be credited (i.e., you cannot put more water in the pool) once fuel is uncovered (less than 4 feet of water covering pool?).

2. No recovery will be credited if alarms do not sound in the control room.

3. Losses of SFP or refueling water inventory are dominated by human error.

4. Once a plant is decommissioned, the gate between the reactor cavity and the spent fuel pool will remain closed permanently.

I. PROBLEMS AND POSSIBLE SOLUTIONS

J. RECOMMENDATIONS ON WHAT DECOMMISSIONED PLANTS MAY NEED TO DO TO REDUCE RISK SO THAT EXEMPTIONS CAN BE GRANTED

1. Utility to assure that antisiphon devices are correctly designed and installed. Antisiphon devices must be included under the Maintenance Rule process.

2. Shipping cask pool drains must be ......

3. Connected systems must be evaluated to determine vulnerabilities to draining the spent fuel pool. Vulnerabilities to be reported and fixed. (Time to drain a consideration e.g., size of line??)

4. Spent fuel pool makeup sources (e.g., RWST, condensate storage tank) need to be maintained and available.

K. WHAT NEEDS TO BE BACKFIT TO ALREADY DECOMMISSIONED PLANTS? (e.g., more/better instrumentation/alarms, more/better operators, more/better maintenance?)

L. DATA

1. Frequency [loss of coolant inventory events where more than one foot of inventory was lost] < .01 event per reactor year. (NUREG-1275, Vol. 12)

2. Frequency [loss of spent fuel pool cooling where pool temperature increases more than 20 degrees F] ~ .002 per reactor year (NUREG-1275, Vol 12)

3. Frequency [siphoning of spent fuel pool occurs] = .001 per reactor year (NUREG0933, "A Prioritization of Generic Safety Issues," p. 3.82-1 to 3.82-6) based on a break in the system

4. Conditional Probability [antisiphoning check valve fails to operate] = .08 (NUREG-0933)

5. Frequency [loss of spent fuel pool cooling] = .1 per reactor year (WASH-1400)

6. Conditional Failure Probability [second cooling train fails] = .05 (WASH-1400)

7.

M. REVIEW STATUS OF HEAVY LOAD CONTROL PROGRAM

N. IMPACT OF WATER VAPOR AND POTENTIAL INTERNAL FLOODING FROM SPENT FUEL POOL BOILING OR EVAPORATION

March 31, 1999
Draft 1.3

LIMITED VS. MORE DETAILED ANALYSIS OF SFP RISK

1. A limited analysis will be particularly driven by assumptions, which will make the analysis subject to more second guessing by external experts.

2. A limited analysis will provide a quicker, but less defendable result.

3. A limited analysis may not provide an adequate basis for rulemaking.

4. Both a limited and more detailed analysis will be contain areas of significant uncertainty (e.g., human error rates at decommissioned plants versus operating plants, frequency of heavy load drops, what additional equipment will be available in a decommissioned plant beyond that guaranteed by the Technical Specifications, effect of steam environment on equipment). A more detailed look should provide better insights than a limited review.

5. Bounding analyses may result in near boiling frequencies or core damage frequencies that are quite high.

March 31, 1999
Draft 1.3

p:\decomm\action.wpd