March 5, 1999

I. Introduction
   A. Risk and Safety Level at decommissioned plants
      1. During operation, SFP accident risk not greater than risk from reactor
         a. During shutdown, SFP accident risk no longer bounded by reactor risk
      2. Current level of protection for operation
      3. Decreasing risk over time after shutdown
      4. Probability of several accidents not changed
      5. Credit for detection, mitigation, and/or prevention features

II. Decrease in Risk when permanently shutdown
   A. Decreasing decay power
      1. Increasing time to boil
         a. Generally takes 10 days for full core offload
         b. From 10 to 60 days; decrease in decay power by factor of 2 for last core
         c. From 10 days to 17 months; decease in decay power by factor of 10 for last core
      2. When air-cooled, increasing time to heat up to oxidation temperature
   B. Short-lived radioisotopes decayed significantly
      1. Decrease in early fatalities/high consequences if offsite release
         a. I-131
   C. Possible increase in controls (PDTS) for spent fuel pool parameters

III. Increase in Risk when permanently shutdown
   A. Decreased number of plant personnel
   B. Decreased need to maintain quality of SFP environment
      1. RCS quality no longer a concern
   C. Increase in daughter products in first year
         a. Sr-90; Cs-137; Pu
   D. Possible decrease in assurance for electrical power
      1. possibly no diesels

Detection systems

IV. Same Risk when permanently shutdown as operation
   A. Occurrence of seismic event
      1. Mean of E-6/RY (NUREG/CR-4982)
      2. Range 2.6E-4 to 1.6E-10 (PWR) and 6.5E-5 to 4E-11 (BWR)
   B. Systems designed to prevent drainage by siphon

What did Steve's report say? How many siphon problems?

V. Detection, Mitigation, and Prevention Features
   A. SFP level indicators and alarms
      1. During and in preparation of fuel movement (suggested PDTS)
      2. During periods of no fuel movement **(STS)**
   B. SFP temperature (suggested PDTS) and cooling system (DSAR)
   C. Power sources (suggested PDTS?)
   D. SFP coolant chemistry (suggested PDTS program)
   E. Radiation monitors (DSAR)
   F. SFP makeup source (DSAR)
   G. SFP liner leak detection (DSAR)

Mitigation
Building DF

are PWRs different from BWRs?

Q145

VI. Radiation Protection (EP rule only)
   A. Change in type of radiological release
      1. Significant decrease in short-lived, high-consequence isotopes (e.g., I-131)

VII. Allowance for ad hoc EP actions (EP rule only)
   A. 10 hours to start of release is adequate time to credit ad hoc off-site actions

VIII. Types of accidents for SFPs
   A. Extended loss of SFP cooling
   B. Rapid reduction in SFP level (e.g., siphon) w/ loss of SFP cooling
   C. SFP structural failure due to external phenomena (e.g., seismic)
   D. Cask drop

IX. Extended Loss of SFP cooling
   A. Probability of accident
      1. Maintenance on system changed (Maint. Rule)?
      2. Possibly new Tss
      3. Possibly no backup/on-site power
      4. Maintenance of makeup sources (?)
   B. Detection / Prevention / Mitigation Features
      1. Temperature indication
      2. Makeup sources
      3. Level detection
      4. Radiation monitors
      5. On-site power
   C. Consequences of accident (reduces with time)
      1. System not required as much since less decay heat
      2. If lost, time to boil increases as decay heat decreases
      3. Boil-off rate decreased so rate of makeup required is reduced

X. Rapid reduction in SFP level (e.g., siphon) w/ loss of SFP cooling
   A. Probability of accident
      1. Design of piping into pool has not changed
      2. Temporary equipment may increase probability (Big Rock Pt)
      3. Same as extended loss of SFP cooling accident
   B. Detection / Prevention / Mitigation Features
      1. Maintenance of makeup sources (?)
      2. Level detection
      3. Radiation monitors
   C. Consequences of accident (reduces with time)
      1. Same as extended loss of SFP cooling accident

XI. SFP structural failure due to external phenomena (e.g., seismic)
- A. Probability of accident (same)
  1. No change from operation
  2. Failure of structure generically dominates risk
     a. 2.6E-4 to 1.6E-10 PWR and 6.5E-5 to 4E-11 BWR (NUREG/CR-4982 (BNL))
     b. may not be dominate for each site
  3. SFPs generically can withstand larger than SSE
     a. 4 - 19 times stronger than design SSE (source?)
- B. Detection / Prevention / Mitigation Features
  1. Maintenance of radiation monitors
- C. Consequences of accident (reduces with time)
  1. Reduced decay heat to cause a Zircaloy fire over time (2-4 years)

XII. Cask drop what if it hits wall? Not in pool.
- A. Probability of accident
  1. Significant uncertainity if damage will occur
  2. Possibly reduced since less/no movement until final pool offload to ISFSI or offsite
- B. Detection / Prevention / Mitigation Features
  1. Maintenance of makeup sources (?)
  2. Level detection
  3. Radiation monitors
- C. Consequences of accident
  1. No change from operation on draindown time
  2. If full draindown, reduced decay heat to cause a Zircaloy fire over time (2-4 years)

XIII. Conclusions