



Meeting to Discuss Steam Generator  
Tube Rupture Analysis Assumptions

Ken Schrader, Chairman  
PWROG Licensing Subcommittee

November 17, 2010

# Steam Generator Tube Rupture Analysis Assumptions

- Background
  - The single failure assumptions made in the current licensing basis (CLB) analyses vary from plant to plant
  - The single failure assumptions made in the CLB analyses can be based on when a plant received construction permit
    - e.g., plants with construction permits issued prior to May 21, 1971 are pre 1971 GDC (ref: SECY-92-223)

# Steam Generator Tube Rupture Analysis Assumptions

- Background
  - CLB analyses Example, Diablo Canyon FSAR Section 3.1.1, “Single Failure” (originally submitted 1973):
    - *Each of the engineered safety features (ESF) is designed to tolerate a single failure during the period of recovery following an accident without loss of its protective function. This period of recovery consists of two segments: the short-term period and the long-term period. During the short-term period, the single failure is limited to a failure of an active component to complete its function as required.*

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill”
  - The TR was prepared following the SGTR event that occurred at Ginna in 1982 to confirm the time assumed in the SGTR analysis to isolate and terminate the break flow in the ruptured SG
  - Potential equipment failures were examined to determine the “worst case single failure” with respect to SG overfill
  - The potential equipment failures must be evaluated on a plant specific basis to determine the “worst case single failure” with respect to SG overfill

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill” (cont.)
  - The SG PORVs were identified as one of the potential equipment failures that could be the “worst case single failure” with respect to SG overfill
  - Proper operation of the SG PORVs is required to:
    - Isolate the steam flow from the ruptured steam generator to terminate primary to secondary leakage (failure of the SG PORV to close), and
    - Cooldown the RCS with the intact SG(s) if steam dump to the condenser is unavailable (failure of the SG PORV to open)

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill” (cont.)
  - An analysis was performed for a “reference plant”
  - Plant specific analyses were required, including the determination of the “worst case single failure”
  - The NRC evaluation of the methodology was issued on March 30, 1987
  - Participation in the WOG program that developed the TR was voluntary

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill” (cont.)
  - The following W NSSS plants voluntarily participated in the WOG program:
- Shearon Harris
- Byron Units 1 and 2
- Braidwood Units 1 and 2
- Catawba Units 1 and 2
- Beaver Valley Unit 2
- South Texas Units 1 and 2

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill” (cont.)
  - The following W NSSS plants voluntarily participated in the WOG program (cont.):
- Millstone Unit 3
- Diablo Canyon Units 1 and 2
- Vogtle Units 1 and 2
- Watts Bar Unit 1
- Comanche Peak Units 1 and 2
- Seabrook

# Steam Generator Tube Rupture Analysis Assumptions

- WCAP-10698-P-A, “SGTR Analysis Methodology to Determine the Margin to Steam Generator Overfill” (cont.)
  - These plants evaluated the various equipment failures identified in the WCAP-10698, including the failure of the SG PORVs, to determine the “worst case single failure,” with respect to SG overfill

# Steam Generator Tube Rupture Analysis Assumptions

- NRC Document Indicating Active Failure To Be Considered
  - NUREG/CR-4893, Technical Findings Report for Generic Issue 135: Steam Generator and Steam Line Overfill Issues, April 1991, Section 3.11.1 “Single Failure”:
    - *“The review of any new license application should include the imposition of the worst single active failure in safety-related systems on the analysis of the design basis SGTR event. The worst single failure is a plant-specific determination but is generally perceived to be a failed steam generator PORV”*

# Steam Generator Tube Rupture Analysis Assumptions

- NRC Document Indicating Active Failure To Be Considered
  - The resolution of Generic Safety Issue (GSI) 135, “Steam Generator and Steam Line Overfill,” relied on staff technical findings in NUREG/CR-4893 and concluded:
    - *“It was found that SGTR and steam line overfill events pose a relatively low public risk... Thus the issue was RESOLVED and no new requirements were established....”*
  - No new regulatory requirements resulted based on review of SGTR analysis issues

# Steam Generator Tube Rupture Analysis Assumptions

- Summary and Conclusions
  - The single failure assumptions made in CLB analyses (including the SGTR analysis) can be based on when a plant received construction permit.
  - The single failure assumptions (including those for the SG PORVs), made in the SGTR analysis vary from plant to plant
  - NUREG/CR-4893 recommended imposition of the worst single active failure in safety-related systems on the analysis of the design basis SGTR events