

Assessment of EFW Failure Analysis

February 2, 2000

Background

- IR 98-15, & 99-10
- February 8, 1999 Meeting
- February 24, 1999 NRC Letter
- LER 1999-01
- Management meetings of 7/31 & 10/06
- Inspection Report 99-08

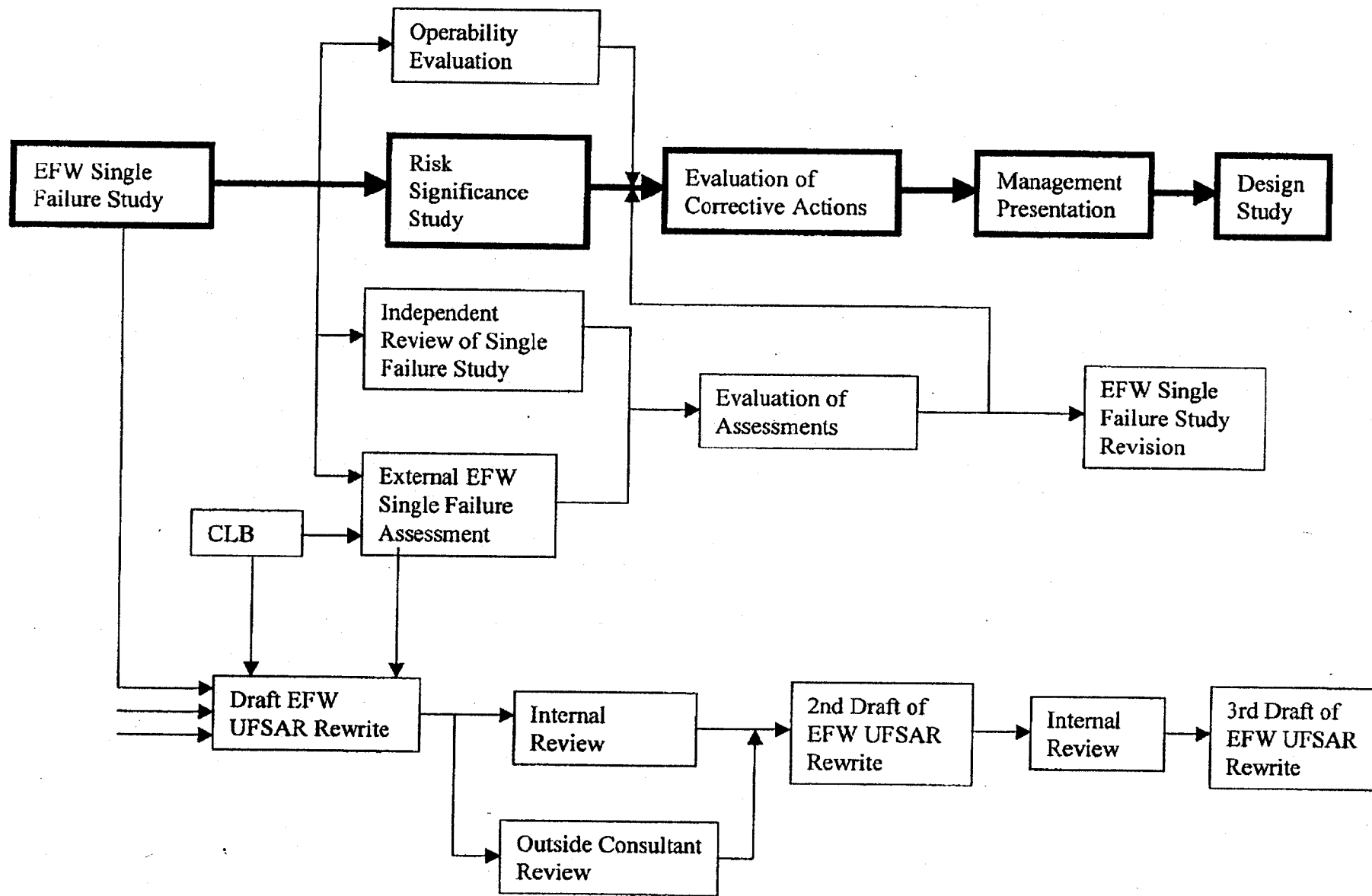
Objective of Single Failure Analysis

- Develop comprehensive understanding of EFW limitations
 - Limited to EFW proper on Unit specific basis
 - Biased away from licensing basis debate
- Identify improvements for EFW
- Provide specifics for UFSAR rewrite

Overall Approach

- Developed analytical process
- Applied process to EFW
- Two independent reviews
- Risk Significance Study
- Results input to design study & UFSAR rewrite

Oconee EFW Design Basis Efforts



Results of Single Failure Analysis

- 37 vulnerabilities identified
- Issues involve 4 general areas:
 - UST inventory
 - Pneumatic regulators for flow control valves
 - Hotwell inventory
 - Single EFW flow path
- Adequate feedwater can be delivered in all scenarios
- Confirms EFW never designed to withstand all single-failures w/o diverse & redundant options

Results of Single Failure Analysis

- UST Inventory (9 flow paths, 10 issues)
 - Only 2 of 9 flow paths normally open
 - C-187 is limiting case
 - Adequate time is available to protect EFW pumps for all other cases
- Pneumatic regulator failures affecting both EFW control valves (5 issues)
 - MFW startup flow path and SSF ASW assure feedwater delivery
 - 4 of 5 affect loss of remote manual control. Auto control remains available

Results of Single Failure Analysis

- Hotwell Inventory (9 issues)
 - Long-term inventory can be achieved by:
 - makeup to UST
 - SSF ASW System
 - Station ASW System
- EFW SG flow path (5 issues)
 - Issue is feeding unaffected SG during a SGTR or MSLB
 - MFW startup flow path and SSF ASW assure feedwater delivery
- 8 miscellaneous issues
 - No adverse impact on ability of EFW

Conclusion of Single Failure Analysis

- From deterministic perspective, C-187 issue most limiting
- EFW has limitations when considered in isolation
- ONS unique design with diversity and redundancy achieves desired level of reliability

Risk Significance

- Most failures contribute to cut sets with CDF less than $1E-8$ (including C-187)
- Failures that exceed $1E-8$ screening criterion result in CDF of $\sim 3E-8$ (0.05% of ONS CDF)
- FWLB is assumed to fail hotwell, resulting in CDF of $1.3E-7$ (0.2% of ONS CDF)

External Assessment

- Requested by ONS management
- Managed under Jim Fisicaro using industry experts
- Conducted as independent assessment versus QA audit
- Intent to identify alternative interpretations of the CLB using critical, independent perspective

External Assessment

- Assessment found ONS approach analytically sound
- CLB contains many ambiguous statements
- Assessment findings used as input to UFSAR rewrite
 - Not intended to redefine EFW licensing basis

Licensing Basis Perspective

- UFSAR does not adequately portray EFW
 - EFW unique, major evolution post-TMI
- Historical documentation commensurate with vintage
 - All CLB aspects not explicitly defined in either Duke or NRC documents
 - Allows wide range of interpretation
- Proper context essential for understanding CLB

Licensing Basis Perspective

- Inappropriate to limit CLB to NRC SER language
- EFW was never licensed to withstand all single-failures
- NRC has accepted diverse and redundant means
- No benefit to continue debate over what was understood 20 years ago

Conclusion

- Issues not safety significant
 - Number of findings not indicative of significance
- NRC fully informed
- Positive NRC assessment of corrective actions
- No benefit from continued historical debate
- ONS continuing with project to improve EFW design & licensing basis