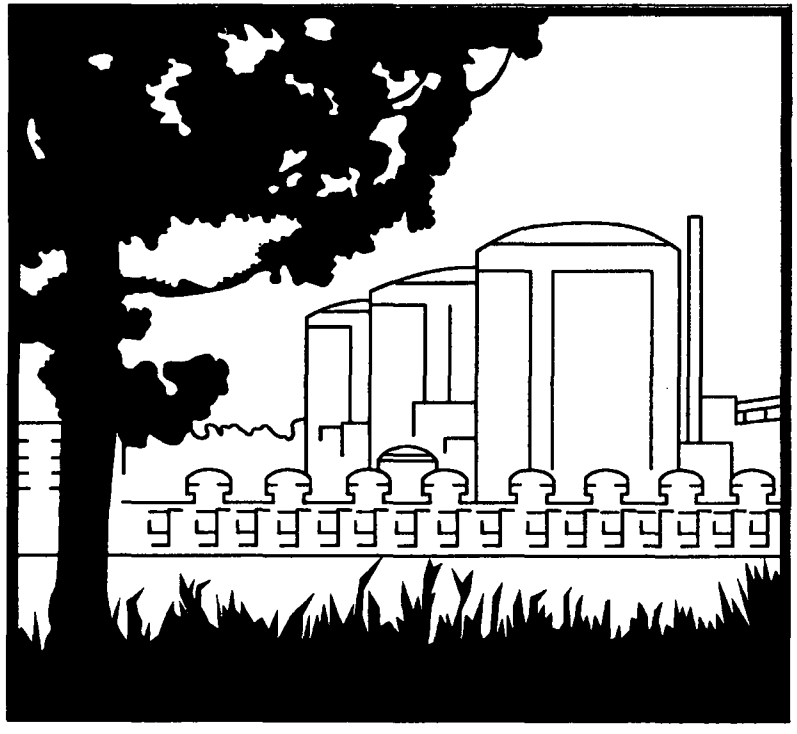
Duke Energy SM



Duke Energy
Oconee Nuclear Station
HELB/Tornado Projects
Status Meeting

NRR Offices
Rockville, MD
August 17, 2007
10:00 a.m. – 12:00 p.m.

Duke Attendees

- Mike Glover, ONS Engineering Manager
- Rich Freudenberger, Tornado/HELB Projects
- George McAninch, Tornado/HELB Design Basis
- Steve Newman, Licensing Engineer - Tornado
- Tim Brown, Project Manager - HELB

Agenda

- Opening Remarks
- Intended Application of RG 1.76, Revision 1
- Use of Blowout Panels vs. FRP
- TORMIS Submittal – Industry Experience
- MSLB Mitigation Strategy Schedule
- Status of Commitments
- Closing Remarks

Opening Remarks

- Objectives of the Tornado/HELB projects remain:
  - Improve plant safety, and
  - Establish a licensing basis that will stand the test of time.
- The purpose of today's meeting is to maintain open communication and continue the momentum that has been established.
- Overall, good progress is being made toward lasting resolution of these issues.

Intended Application of RG 1.76 Revision 1

- Difference between RG 1.76, Rev. 0 and Rev. 1, as applied to ONS
- Current License Basis includes two Tornado Design Criteria
  - UFSAR Class 1 – Original station 'safety related' structures
  - RG 1.76, Rev. 0 as applied to the Standby Shutdown Facility
- Considerations in intended adoption of Reg. Guide 1.76, Rev. 1
  - Minimize different design criteria in use
  - Optimize consistency of protection to systems

Intended Application of RG 1.76 Revision 1

- Standby Shutdown Facility Vent and Elevated Trenches
  Reg Guide 1.76, Rev. 1 design criteria

- Unit 3 Control Room North Wall
  UFSAR Class 1 design criteria

- Borated Water Storage Tanks
  UFSAR Class 1 design criteria

- Cask Decon. Tank Room (CDTR) & West Penetration Room (WPR) Walls
  Reg Guide 1.76, Rev. 1, design criteria for wind and differential pressure + TORMIS for missiles

- Protected Service Water Building and Trenches
  Reg Guide 1.76, Rev. 1, design criteria

Use of Blowout Panels vs. Fiber Reinforced Polymer

- Reconsidered design options for WPR/CDTR wall reinforcement portions of the NPBS (Natural Phenomenon Barrier System).

- Changes that have occurred since the scope of the project was established:
  - FRP licensing has been delayed,
  - Reg. Guide 1.76, Revision 1 has been issued, revising the allowed tornado design criteria,
  - Licensing actions associated with the adoption of Alternate Source Term have been completed, resulting in deletion of the PRV (Penetration Room Ventilation) System from TS.
    - WPR pressure boundary is no longer credited in accident analyses.

Use of Blowout Panels vs. Fiber Reinforced Polymer

- Design of the option selected relies on:
  - PRA analysis (TORMIS) for the design of missile protection of SSF cabling in the WPR & CDTR (no change),
  - Heavy-duty siding for wind loading (no change),
  - FRP for ΔP on the masonry <u>block</u> walls in the CDTRs, (no change)
  - Blowout Panel/Vent for ΔP on the masonry <u>brick</u> walls in the WPRs (change)

- Anticipate a minimum 6 month delay in the design/implementation of this portion of the project.

TORMIS Submittal – Industry Experience

- Utilities that recently submitted LARs/Result
  - Davis-Besse – withdrew LAR
  - Kewaunee – withdrew LAR
  - Byron – withdrew LAR
  - Waterford – LAR partially approved
- Utilities planning on submitting LARs
  - Oconee – January 2008 submittal
  - Monticello – sometime in 2008
  - Surry/North Anna - TBD

TORMIS Submittal – Industry Experience

- Duke understanding of reasons for withdrawals:
  - High number of complex RAIs
  - Longer than expected NRR review periods
  - LAR did not explicitly follow TORMIS SER methodology
  - Use of enhanced F-Scales
  - Additional TORMIS LAR expectations
    - Submittal of engineering analyses to substantiate assumptions
    - LAR must consider ALL vulnerabilities including non-safety interactions
    - These expectations differ from the several approved amendment requests from years 2000-2002 and the TORMIS SER

MSLB Mitigation Strategy Schedule

- We are considering a significant change to our Main Steam Line Break Mitigation Strategy.
  - Main Steam Isolation Feasibility Study is complete.
    - Branch isolations deemed not feasible to construct.
    - Header isolations were assessed as feasible.
      - Significant structural upgrades needed
      - Safety Relief Valves would need to be relocated to a 'dead leg'
  - Preliminary Safety Analyses of options is in progress.
  - Management Decision Making should support technical discussion with Staff by year end.

Status of Commitments

- Overall, good progress being made.
- FRP licensing status is impacting portions of the Natural Phenomenon Barrier System design schedule.
- Will need to revise some HELB commitments to address abandonment of 'inspections in lieu of protection' concept.
- See Attachment 1

Closing Remarks

- Questions / Discussion

Attachment 1
Tornado Commitments

No.	Commitment	Completion Date
1T	Physically protect the Unit 3 Control Room north wall from the effects of a tornado per associated UFSAR Class 1 structure tornado wind, differential pressure, and missile criteria.	12-2008 On Schedule
2T	Physically protect the Standby Shutdown Facility (SSF) diesel fuel vents from the effects of a tornado per associated UFSAR SSF tornado wind, differential pressure and missile criteria.	12-2007 Complete
3T	Analyze and/or protect as required, the elevated/exposed portions (at the north end of the of the Standby Shutdown Facility (SSF) and where the SSF and CT-5 trenches intersect) of the SSF cable/pipe trench from the effects of a tornado per associated UFSAR SSF tornado wind, differential pressure and missile criteria.	12-2007 On Schedule
4T	Analyze and protect as required, each unit's Borated Water Storage Tank and associated piping per the UFSAR Class 1 structure tornado wind, differential pressure, and missile criteria.	12-2009 Schedule in Jeopardy, construction interaction with WPR/CDTR
5T	Improve the protection of tornado mitigation equipment located within the West Penetration Room (WPR) and Cask Decontamination Tank Room (CDR) from the effects of a tornado. The WPR block walls will be upgraded to the UFSAR Class 1 structure tornado wind and differential pressure criteria using Fiber Reinforced Polymer. Duke will evaluate the need for additional missile protection for the CDR/WPR wall using TORMIS.	12-2009 Schedule impacted; FRP LAR not approved on schedule.
6T	Submit a License Amendment Request (LAR) to use Fiber Reinforced Polymer (FRP) technology for application in strengthening selected masonry walls against the effects of tornado wind and differential pressure. The LAR will commit to utilizing technical procedures to control testing of concrete substrate and installation and inspection of the FRP systems and in-service inspection of the FRP system once installed.	Complete Submitted 6/1/2006

No.	Commitment	Completion Date
7T	Submit a License Amendment Request (LAR) establishing a new tornado licensing basis (LB) and mitigation strategy. The LAR will address the two redundant mitigation systems, Standby Shutdown Facility (SSF) and Protected Service Water/High Pressure Injection (PSW/HPI) used in the tornado mitigation strategy. The LAR will commit to the following and include information concerning: • Basic elements of the Selected Licensee Commitments changes to ensure licensing basis clarity and systems structures and component (SSC) operability such that tornado mitigation capability is maintained. • The use of TORMIS to collectively assess certain SSCs (with the exception of the Keowee Hydro Units (KHU)) that support the Secondary Side Decay Heat Removal (SSDHR), Reactor Coolant Pump (RCP) Seal Injection or Reactor Coolant System (RCS) pressure boundary functions in the first 72 hours after the event that are not currently protected in accordance with UFSAR tornado missile criteria. • The elimination of credit for the Spent Fuel Pool to High Pressure Injection (HPI) pump flow path. • In accordance with the CLB, single active failures will not be assumed in the updated tornado mitigation strategy. • A description of the upgrade of the current low pressure Auxiliary Service Water (ASW) system to a high head PSW system that can be actuated, aligned, and controlled from the main Control Rooms (CR) for SSDHR. This system will be credited for both tornado and HELB events. • The ASW upgrade also includes the installation of new PSW switchgear with alternate power provided from the KHUs via a tornado protected, underground feeder path. The PSW switchgear and supporting equipment will be located in a new tornado protected building. Power will also be provided from the Central/Lee 100kV transmission line through a new transformer that will be located to further minimize concurrent damage of the station switchyard, KHU and the new transformer. Specifically, the modification will provide alternate power for: 1. The PSW/HPI system itself, 2. An HPI pump for RCP seal injection that can be promptly aligned from the main CRs, 3. A sufficient number of pressurizer (PZR) heaters	~~7-2007~~ 1-2008 Revised by letter dated 6/28/07.

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No.	Commitment	Completion Date
	(also operated from the main CRs) to maintain a steam bubble in the PZR for RCS pressure control, 4. The existing vital instrumentation and control battery chargers, 5. The SSF SSCs in case the SSF diesel generator is unavailable, 6. RCS High Point Vent and Reactor Vessel Head Vent valves for boration and RCS inventory control. At least one high point vent is required to control RCS inventory at Safe Shutdown conditions.	
8T	Installation of the PSW/HPI modifications.	12-2010 On Schedule
9T	A program will be developed to monitor site missile inventories.	12-2007 On Schedule
10T	Verbally notify in advance the Deputy Director, Division of Reactor Licensing of the NRC, followed by a written communication, of significant changes in the scope and/or completion dates of the commitments in Attachment 1 of this submittal. The notification will include the reason for the changes and the modified commitments and/or schedule.	As necessary, until 12-2010 In progress

Attachment 1
High Energy Line Break Commitments

No.	Commitment	Completion Date
	HELB Piping Inspection Program	
1H	Implement an inspection program that ensures the Auxiliary Building Main Steam and Main Feedwater girth and accessible attachment welds are re-inspected at least once during each subsequent 10 year ASME Section XI In-service Inspection interval for weld flaws and thickness.	Complete
2H	Implement an inspection program that ensures the following welds are re-inspected at least once during each subsequent 10 year ASME Section XI In-service Inspection interval for weld flaws and thickness: a. Other Auxiliary Building high energy piping critical crack locations at welds. ~~b. Selected Turbine Building high energy piping girth welds.~~ c. ~~Selected Turbine Building high energy piping critical crack locations at welds.~~	Unit 1, 03-2008 Unit 2, 09-2008 Unit 3, 03-2009 On Schedule, tied to LAR preparation
3H	Complete initial ASME Section XI In-service Inspection interval ultrasonic testing of the Auxiliary Building Main Steam and Main Feedwater girth welds and accessible attachment welds for weld flaws and thickness. Accessible attachment welds are to undergo visual examination for general weld quality as well as surface examination using either a magnetic particle or a liquid penetrant test.	07-2008 On Schedule
4H	Complete initial ASME Section XI In-service Inspection interval ultrasonic testing of the following welds for weld flaws and thickness. Accessible attachment welds are to undergo visual examination for general weld quality as well as surface examination using either a magnetic particle or a liquid penetrant test: a. Other Auxiliary Building high energy piping critical crack locations at welds. ~~b. Selected Turbine Building high energy piping girth welds.~~ c. ~~Selected Turbine Building high energy piping critical crack locations at welds~~	03-2012 On Schedule

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5H	Implement an inspection program that ensures that accessible piping base metal downstream of Main Feedwater isolation valves located in the East Penetration Room and not enclosed by the guard pipe receive an ASME Section XI In-service Inspection interval ultrasonic testing inspection at least once every 10 years.	Complete
6H	Implement an inspection program that ensures the following piping base metal receive an ASME Section XI In-service Inspection interval ultrasonic testing inspection at least once every 10 years. a. Other Auxiliary Building high energy piping critical crack locations not at welds. ~~b. Selected Turbine Building high energy piping critical crack locations not at welds.~~	Unit 1, 03-2008 Unit 2, 09-2008 Unit 3, 03-2009 On Schedule, tied to LAR preparation
7H	Complete the initial ASME Section XI In-service Inspection interval ultrasonic testing inspection of piping base metal downstream of Main Feedwater isolation valves located in the East Penetration Room and not enclosed by the guard pipe.	Complete
8H	Complete initial ASME Section XI In-service Inspection interval ultrasonic testing inspection of the following piping base metal: a. Other Auxiliary Building high energy piping critical crack locations not at welds. ~~b. Selected Turbine Building high energy piping critical crack locations not at welds.~~	03-2012 On Schedule
9H	Implement an inspection program that requires external visual inspection of accessible attachment welds at the terminal ends inside the main feedwater guard pipe at least once every 10 years.	Complete
10H	Complete initial visual inspections of accessible attachment welds at the terminal ends inside the main feedwater guard pipes.	06-2007 Complete
	Repair of Electrical Penetration Enclosures Located in the EPR to the Correct Configuration	
11H	Inspect and repair the Unit 2 East Penetration Room electrical penetration termination enclosures to their correct configuration. Missing and/or damaged covers, gaskets, and fasteners will be repaired or replaced.	Complete

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12H	Inspect and repair the Unit 1 East Penetration Room electrical penetration termination enclosures to their correct configuration. Missing and/or damaged covers, gaskets, and fasteners will be repaired or replaced.	~~12-2006~~ Complete
13H	Inspect and repair the Unit 3 East Penetration Room electrical penetration termination enclosures to their correct configuration. Missing and/or damaged covers, gaskets, and fasteners will be repaired or replaced.	Complete
14H	Create an inspection plan to select a portion of Units 1, 2 and 3 enclosures to open and inspect for signs of internal debris and corrosion.	Complete
15H	Revise station procedures and processes as needed to ensure penetration termination enclosures are maintained in their correct configurations.	03-2007 Complete
	EPR Flood Prevention Modifications	
16H	Complete the design and installation of flood outlet devices for the Unit 1 East Penetration Room.	Complete
17H	Complete the design and installation of flood outlet devices for the Unit 2 East Penetration Room.	Complete
18H	Complete the design and installation of flood outlet devices for the Unit 3 East Penetration Room.	Complete
19H	Complete the design and installation of flood impoundment and exterior door flood improvement features for the Unit 1 East Penetration Room	12-2007 On Schedule
20H	Complete the design and installation of flood impoundment and exterior door flood improvement features for the Unit 2 East Penetration Room.	12-2007 On Schedule
21H	Complete the design and installation of flood impoundment and exterior door flood improvement features for the Unit 3 East Penetration Room.	12-2007 On Schedule
	HELB Design and Licensing Basis Reconstitution	
22H 23H 24H	Submit License Amendment Requests (LARs) to establish an updated HELB Licensing Basis and HELB mitigation strategy for Oconee Nuclear Station (ONS). The LARs will address deviations from and clarifications of selected portions of References 6 (the Giambusso letter) and 7 (the Schwencer letter) and the criteria that will be substituted or clarified. Each unit LAR will include licensing basis changes based on design basis documents replacing OS 73.2. The first LAR will commit to the following and will also	Unit 1, 03-2008 Unit 2, 09-2008 Unit 3, 03-2009 On Schedule

provide the analysis results for Unit 1.

- The LAR will outline the basic elements of Selected Licensee Commitment changes to ensure licensing basis clarity and component operability such that HELB mitigation capability is maintained.
- The LAR will identify Turbine Building (TB) high energy piping girth welds and critical crack locations at welds whose failure would result in adverse interactions impacting the ability to achieve safe shutdown (SSD) or cold shutdown (CSD), as appropriate, following a HELB event. These welds are referenced in Commitment #'s 2H and 4H as "selected TB high energy piping girth welds" or "selected TB high energy critical crack locations at welds", respectively.
- The LAR will identify TB high energy critical crack locations not at welds whose failure would result in adverse interactions impacting the ability to achieve SSD or CSD, as appropriate, following a HELB event. These welds are referenced in Commitment #'s 6H and 8H as "selected TB high energy critical crack locations not at welds"
- The LAR will identify crack locations in high energy piping other than Main Steam and Main Feedwater in the Auxiliary Building (AB) per the criteria in Commitments 22H-24H. These locations are referenced in Commitment #'s 2H, 4H, 6H and 8H as "other AB high energy piping critical crack locations".
- High energy systems will be defined as those systems with operating temperatures greater than or equal to 200 F or pressures greater than or equal to 275 psig. For those systems that operate at high energy conditions less than 1% of the total plant operating time or at high energy conditions less than 2% of the total system operating time, no breaks or cracks will be postulated.
- For piping that is seismically analyzed, i.e. stress analysis information is available and the analysis includes seismic loading, intermediate breaks will be postulated in equivalent Class 2 or 3 piping at axial locations where the calculated stress for the applicable load cases exceed $0.8(S_A + S_h)$. Applicable load cases include internal pressure, dead weight (gravity), thermal, and seismic (defined as operational basis earthquake, OBE). Intermediate breaks will not be postulated at locations where the expansion stress exceeds $0.8S_A$. Thermal stress is a secondary stress, and taken in absence of other stresses, does not cause ruptures in pipe. This approach is permitted by GL 87-11 as a deviation from Reference 6.
- For piping that is not rigorously analyzed or does not include seismic loadings, intermediate breaks will be

	postulated at locations as provided in BTP MEB 3-1 (Section B.1.c(2)(b)(i)). This MEB 3-1 section provides more detail than the associated requirements in Reference 6, as amended by Reference 7, so that the most adverse locations can be identified as required in these references. • Terminal ends are vessel/pump nozzles, building penetrations, in-line anchors, and branch to run connections that act as essentially rigid constraints to piping thermal expansion. A branch appropriately modeled in a rigorous stress analysis with the run flexibility and applied branch line movements included and where the branch connection stress is accurately known will use the stress criteria noted above for postulating break locations as noted above in the 6th bullet. For unanalyzed branch connections or where the stress at the branch connection is not accurately known, break locations will be postulated as noted in the 7th bullet above. • Reference 6, as amended by Reference 7, provided criteria to determine pipe break orientation at break locations and specifies that longitudinal breaks in piping runs and branch runs be postulated for nominal pipe sizes greater than or equal to four inches. Circumferential breaks are to be postulated at the terminal ends. The design of existing and potentially new rupture restraints may be used to mitigate the results from such breaks, including prevention of pipe whip and alteration of the break flow. For ONS, longitudinal breaks will not be postulated at terminal ends. • For piping that is seismically analyzed (i.e. stress analysis information is available and the analysis includes seismic loading), critical cracks will be postulated in equivalent Class 2 or 3 piping at axial locations where the calculated stress for the applicable load cases exceed $0.4(S_A + S_h)$. Applicable load cases will include internal pressure, dead weight (gravity), thermal and seismic (defined as operational basis earthquake, OBE). This approach is in accordance with BTP MEB 3-1 (Section B.1.e(2)) which is deviation from the requirements of Reference 7. • For piping that is not rigorously analyzed or does not include seismic loadings, critical cracks will not be postulated since the effects of postulated circumferential and longitudinal breaks at these locations will bound the effects from critical cracks (See the 7th bullet above). • Actual stresses used for comparison to the break and crack thresholds noted above will be calculated in accordance with the ONS piping code of record, USAS B31.1.0. (1967 Edition) Allowable stress values S_A and	

	S_h will be determined in accordance with the USAS B31.1.0 or the USAS B31.7 (February 1968 draft edition with errata) code as appropriate. • Moderate energy line breaks will not be postulated. Moderate energy rules were not in place when ONS was licensed and built and the effect of moderate energy cracks have not been evaluated. • Systems and components necessary to reach CSD will not be protected from HELBs. Station repair guidelines will be employed to effect repairs as required to those systems and components necessary to reach CSD. The affected unit will remain at SSD conditions while those necessary repairs are completed. Current damage repair guidelines and procedures will be enhanced, as necessary, to extend SSD capability beyond the 72-hour Current Licensing Basis (CLB) and to establish CSD. The enhanced capability will not be part of the CLB or related to operability of the Standby Shutdown Facility (SSF). • A single active failure will be postulated in the Protected Service Water/High Pressure Injection (PSW/HPI) or SSF systems for the initial event mitigation as well as achieving and maintaining SSD. Single active failures will not be postulated during plant cooldown to CSD. The LAR will include a provision to continue reliance on the CLB regarding application of the single failure criteria to the letdown piping. • Onsite emergency power distribution systems located in the TB will not be credited for mitigation of HELBs that could occur in the TB. New switchgear, to be installed as part of the PSW system, along with the SSF will be utilized for mitigation of HELBs that could occur in the TB. • The new PSW and the East Penetration Room flood prevention modifications will be designed and constructed to the quality standards applicable to a safety-related system. • A new time critical action will be created for the operators to place the PSW system into operation within 15 minutes following a complete loss of main and emergency feedwater with a complete loss of 4160 VAC power. A single HPI pump can be aligned to the Borated Water Storage Tank and started to reestablish seal cooling for the reactor coolant pumps. A new time critical action will be created for the operators to place HPI into operation (from PSW power) within 20 minutes following a complete loss of 4160 VAC power. The new time critical actions will be time validated in accordance with the current ONS standards for emergency procedures. The operator would then maintain SSD conditions and energize pressurizer heaters as	

	necessary to maintain reactor coolant pressure within limits.	
5H	Verbally notify in advance the Deputy Director, Division of Reactor Licensing of the NRC, followed by a written communication, of significant changes in the scope and/or completion dates of the commitments in Attachment 3 to this submittal. The notification will include the reason for the changes and the modified commitments and/or schedule.	As necessary, until 03-2012 In progress