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AR Number: 00789791

Linked ARs

Aff Fac:	Braidwood	**AR Type:**	CR	**Status:**	COMPLETE
Aff Unit:	01	**Owed To:**	A8952CAP	**Due Date:**	01/21/2009
Aff System:	MS			**Event Date:**	06/20/2008
CR Level/Class:	4/D			**Disc Date:**	06/20/2008
How Discovered:	H03F			**Orig Date:**	06/24/2008

Action Request Details

Subject: POTENTIAL LOSS OF MARGIN IN MS TUNNEL PRESSURIZATION CALC

Description:

Originator: [redacted] Supv Contacted: [redacted]

Condition Description:
Based on Byrons IR#789344, Byron was reviewing calculation 3C8-0282-001, Main Steam Tunnel Pressure Study for Main Steam Line Break, for AF FSO structural margin issues. This calculation is the basis for UFSAR section C3.6 for HELBs in the MS Tunnel. The concerns arise when considering the vent paths assumed in the calculation for pressurization. The MSIV room personnel access door at elevations 401 and the HVAC blank off plates at elevation 416 are assumed to blowout at a pressure of 1.5 psid. Byron noted that security bars and screen mesh are located on the outside of the HVAC discharge damper and blowout panel area; if the blank off plates blowout they will be captured by the security grating and screen mesh greatly reducing the assumed venting capability. Also, the assumption that the blowout blank-off plates will fail at 1.5 psid such that venting occurs (it appears reasonable that the access door would fail at the required 1.5 psid). Simple calculations find that a pressure in excess of 1.5 psid is required to fail the plate itself.

A walkdown was performed at Braidwood and determined that both U-1 and U-2 A/D MSIV rooms have an approximate 92 x 46 blank-off plate, 3/16 inch thick with 5/8 diameter bolting (see M-1265 Sht 2). The U-1/U-2 B/C MSIV rooms have an approximate 33 x 45 blank-off plate, 3/16 inch thick with 5/8 diameter bolting. Simple calculations find that a pressure in excess of 1.5 psid is required to fail the plate at Braidwood also. Similar MSIV room security bars and screen mesh are installed at Braidwood, thus, this issue applies to Braidwood also.

For an MSIV room containing two MSIVs, the calculation assumes 4 vent paths; the 2 archways into the tunnel (73 ft2 each), one HVAC blowout panel at 51.3 ft2 and the remaining vent path consists of a blowout panel/401 access door combination at 75.8 ft2 for a combined vent area of 273.1 ft2. Given that the vent paths in question represent approximately 40 pct of the total vent area, a significant increase in MSIV room pressure would be expected if these paths were to fail to function (either due to capture by security grating or failure to detach from the structure). Exacerbating this is that choked flow conditions exist at one of the archways into the tunnel; this means that an increase in MSIV room pressure due to the obstructed vents will not result in a fully offsetting increase in flow out the remaining vents paths. As room pressure increases, the remaining archway flow would most likely choke.

The failure of the vent paths potentially could result in pressures greater than previously analyzed. This in turn could challenge the already marginal AF/FSO structural limits and require increasingly qualitative arguments
for AF013 operability.

There are 4 mitigating factors to offset the blowout panel concerns:

1. A recent change to the UFSAR negates the need to consider breaks in the MSIV room itself (the current limiting location). However regulatory correspondence between ComEd and NRC in an SER dated 1/07/85 still requires breaks to be postulated in the tunnel. Calculation 3C8-0282-0001 does contain results for a break in the MS tunnel and gives a peak pressure of 13 psi in the MSIV room and 16.5 psi in the tunnel just outside the MSIV room assuming that the blowout panels function. This does demonstrate that a break outside the room results in lower pressures in the room.

2. The availability of the vent path via the access door at 401 elevation to open at 1.5 psid is not in question. This is supported by review of calculation 3C8-0182-0001 for a comparable door.

3. A simplified, informal model of the MSIV rooms (without any blowout panels/HVAC dampers or door) was constructed by Corporate Engineering using an approved software (GOTHIC). The significant change made was in using more realistic mass and energy inputs from RELAP. Using this model the highest pressure in the MSIV room (for a break in the room) is 21.3 psig. Note that although this is slightly higher than the 19.7 psig currently assumed in the UFSAR the expected value for a break in the tunnel would be a few psi lower (based on paragraph 1 above).

4. Because the peak HELB impulse pressure occurs within the first few seconds of the accident, a vent path exists through the MSIV room ventilation fans that is not credited in the existing analysis. Although the discharge dampers for the MSIV room fans are failed closed, the fans would be expected to be running prior to the accident, and would continue to run with the discharge damper open for the first few seconds of the accident until the fans would eventually trip causing the damper to close.

Based on the above, Byron and Braidwood engineering believe there is reasonable assurance that structures and components will not be exposed to pressures resulting in excessive degradation or failure. Sargent and Lundy has been contacted for a more refined analysis on an expedited basis to confirm existing margin remains acceptable for existing MSIV HELB analysis.

Immediate actions taken:
Discussed with Corporate Engineering, S&L, Bwd & Byron Engineering.

Recommended Actions:
Work Group Eval to Design Engineering to document results of applicable S&L study and create actions for long term resolution of issue in calcs and drawing changes as necessary.

List of knowledgeable individuals:
[redacted]

Repeat or similar condition?
No

Operable Basis:
Based upon current calculations, there is reasonable assurance the

resulting pressure is bounded by current analysis. If reanalysis results are less conservative, reroute for further operability evaluation.

Reportable Basis:
The EXELON Reportability Reference Manual was reviewed, and no reportability requirements were identified.

Based upon current calculations, there is reasonable assurance the resulting pressure is bounded by current analysis. If reanalysis results are less conservative, reroute for further operability evaluation.

Reviewed by: [redacted] 06/26/2008 05:40:47 CDT
Reviewer Comments:
No additional comments.

SOC Reviewed by: [redacted] 06/26/2008 07:27:17 CDT
SOC Comments:
(6/26/08 [redacted]) ATI created to re-route completed WGE to MRC for review.

Department review performed by: [redacted] 07/10/2008 09:23:45 CDT
Evaluation Comments:
Condition/Problem Statement:
There are two AF tunnel covers in each Main Steam Isolation Valve (MSIV) room. The covers provide a flood barrier and a HELB barrier between the MSIV room and AF tunnel. The barrier protects the AF013 valves from the effects of flooding or a HELB in the MSIV rooms. The AF013 valves are maintained in the open position. If exposed to a harsh environment, these valves may not be able to close to provide their containment isolation function.

The covers are designed to perform a sealing function (leak-tight) between the MSIV rooms and AF tunnel for all design loads including seismic. Based on the design analysis (calculation 5.6.3.9), the CEAs for the AF tunnel cover support members do not meet the structural design criteria requirements with respect to safety factor. The design criteria require a factor of safety of 4 while the design analysis uses a factor of safety of 1. The effect of this condition is that the design margin for the CEAs is reduced. Additionally, the design analysis does not address the loading on the cover and support members due to a high energy line break. Failure of the cover or supporting members could expose the AF013 valves (located in the AF tunnel) to a harsh environment, which could adversely impact their containment isolation function.

The AF tunnel covers are required to remain intact and in place to ensure that the AF013 valves are protected against the environments due to flooding and HELB within the MSIV rooms. Additionally, the structural design criteria require a factor of safety of 4 to be maintained for CEAs.

The possible failure mechanisms associated with this condition are a catastrophic failure of the plate or supporting member, or the plastic deformation of the cover or supporting member. Either of these scenarios could expose the AF013 valves to an environment for which the AF013 valves have not been qualified.

The AF tunnel covers and associated support components have been qualified independently for the worst case HELB and the worst case flood in the MSIV room. Since worst-case conditions are used, the potential failure is not time-dependant. Additionally the potential consequences will not change over time since worst-case conditions were used.

No other OpEvals at Braidwood are associated with the AF tunnel covers. Thus, this non-conforming condition has no impact on the previously evaluated degraded conditions associated with currently open OpEvals.

Statement of Cause:
The design analysis (calculation 5.6.3.9) for evaluation of the Auxiliary Feedwater Tunnel flood seal covers did not include the effects of a High Energy Line Break (HELB) on qualification of the covers and supporting elements. Additionally, the design analysis uses a non-standard factor of safety for qualification of the concrete expansion anchors (CEAs) used to support the covers. This condition was initially identified at Byron (IR's 653093 and 620080) and was found to be applicable to Braidwood (IR 654270). This condition affects the qualification of the following covers: 1AFFSO1-6, 1AFFSO1-7, 1AFFSO1-8, 1AFFSO1-9, 2AFFSO1-6, 2AFFSO1-7, 2AFFSO1-8 and 2AFFSO1-9. Operability Determination #07-007 was performed to evaluate the degraded condition.

Revision 1 of OpEval #07-007 changed the due dates of the items listed under corrective action 1 and corrective action 2. Note that the date for full qualification (design change installation date) has not changed.

Revision 2 of OpEval #07-007 changed the due dates of the items listed under corrective action 3 and corrective action 4. This changes the implementation date of the modification to restore full qualification from 05/30/2008 to 12/31/2008 for both Unit 1 and Unit 2. This change is required to accommodate the late receipt of materials required to implement the modification (Unit 2 materials have arrived; Unit 1 materials have not yet been received). The new due date has been selected to ensure the job can be appropriately planned to minimize installation time, since the work will not be performed during a refueling outage. The degraded condition is not time-dependent; the change in implementation date is judged acceptable.

Revision 3 of OpEval #07-007 incorporates dynamic loading factors. The NRC identified a concern related to the justification of operability contained in Revisions 0 through 2 of this OpEval after reviewing Calculation 5.6.3-BRW-08-0045-S, Structural Evaluation of the Flood Seal Cover Support in the MSIV Rooms, Unit 1 Per EC 369245. This calculation supports the modification to restore full qualification of the Unit 1 AF Tunnel Flood Seals and utilized a dynamic load factor of 2.0 to address the peak HELB accident impact load condition of the flood seal cover plate and supporting members. Revisions 0 through 2 of this OpEval did not address HELB accident impact load conditions. In addition, Revision 3 of this OpEval was completely reformatted to Revision 6 of OP-AA-108-115.

Revision 4 of OpEval #07-007 addresses discrepancies identified in IR 789791 related to the HELB analysis of record, 3C8-0282-001. The HELB analysis credited vent paths via blank off plates in the MSIV Rooms. However, the physical construction of the blank off plates prevents them from acting as a vent path. In addition, a modified version on the AREVA (Framatone) computer model was used to determine the best estimate results to support operability. Further reviews of Calculation 5.6.3.9 identified additional inconsistencies in the determination of factors of safety.

Extent of Condition:
The original design analysis (Calculation 5.6.3.9) for the AF tunnel cover and supporting members was reviewed to determine the impact of the HELB loading on qualification of the plate, shelf angle CEAs, and the C6 (channel) CEAs. Per this design analysis, the minimum calculated factors of safety are as follows:

Plate = 1.34
Shelf Angle CEA = 1.08
C6 (channel) CEA = 1.47

These factors of safety are associated with a loading of 15.83 psig due to a seismic/flood loading. The AF tunnel covers were not originally designed to HELB loading conditions.

A re-evaluation of the HELB peak pressures was performed by Sargent & Lundy as a result of the discrepancies identified in IR 789791 for each unit. Preliminary results from this evaluation indicated that it may be prudent to temporarily modify the blank off plates in the MSIV rooms to provide additional relief paths in the event of a HELB. ECs 371256 (Unit 1) and 371262 (Unit 2) were issued to install foam panels to replace the existing panels as a Compensatory Measure. These installations are complete for both units. Further results from this evaluation indicated that it may also be prudent to reinforce the AF tunnel covers to provide additional margin as a Compensatory Measure. ECs 371281 (Unit 1) and 371283 (Unit 2) were issued to install tube steel bracing on the AF tunnel covers. These TCCs were designed based on a peak pressure of 20 psig with a dynamic load factor of 2.0 (effective peak pressure of 40 psig) to ensure all factors of safety are greater than 2. Both compensatory measures were initiated to enhance an operable, but degraded condition to ensure that the AF tunnel covers will continue to perform their specified safety function.

The re-evaluation of the HELB peak pressures utilized new mass-energy values as documented in EC 371293. The re-evaluation determined that the peak pressure for Unit 1 is 21.7 psig and for Unit 2 the peak pressure is 19.4 psig. Dynamic load factors consistent with the new peak pressure and load history were determined by Sargent & Lundy to be 1.01 for both units. In addition, further margin was recovered from conservatisms in Calculation 5.6.3.9. EC 371345 was approved which captures all the changes related to the HELB loading and determined the following factors of safety for the CEAs:

Unit 1 Unit 2

Shelf Angle CEA = 1.25 Shelf Angle CEA = 1.39
C6 (channel) CEA = 1.28 C6 (channel) CEA = 1.43

The above factors of safety are applicable with the blank off plates modified and prior to the installation of the tube steel bracing on the AF tunnel covers. As of the date of this OpEval revision, the tube steel bracing of the Unit 1 AF tunnel covers has been installed under EC 371281. With this EC installed all factors of safety are nearly 4 and design margin is restored.

As indicated above, the factors of safety for the Unit 2 CEAs are less than 2 and the installation of the tube steel bracing of the Unit 2 AF tunnel covers is pending.

Load capacities for CEAs are determined by testing numerous anchors under controlled conditions. Ultimate loads are based on a mean average of these test results and are normally reduced for design applications to account for any differences from the controlled conditions that may exist in the field. Safety factors for concrete expansion anchors are introduced to account for three key issues; 1) loose bolts/undertorque; 2) inaccurate load distribution/modeling; and 3) cyclic loading. None of these issues are applicable to the CEAs installed in the support details for the AF tunnel covers as discussed below:

Loose Bolts/Undertorque:
The anchors used in this installation were installed to the requirements of Byron/Braidwood Specification F/L-2722, Form 1778 and Specification BY/BR/CEA, the installation specifications in place at that time of installation. Conformance to the requirements of these specifications were ensured by an approved Quality Assurance program, which included inspections to ensure each anchor was installed to required specifications

including minimum embedment depth, angularity, minimum spacing, and minimum installation torque. Each of these parameters provide additional assurance that the conditions present in field are consistent with the tested conditions. Therefore, loose anchor bolts are not expected and visual inspections verified that the installed anchors show no indication of localized degradation or cracking that could adversely impact the CEA performance.

Inaccurate Load Distribution/Modeling:
The shelf angle configuration at one edge of the plate consists of a single row of bolts resisting the vertical load from the plate. The calculations contained in Calculation 5.6.3.9 account for the vertical load and resulting moment causing both shear and tensile force on the anchors. The single row of bolts is not conducive to load distribution due to plate flexibility that is normally considered in a typical multiple bolt base plate arrangement. Similarly, the CEAs for the channel support member are loaded in direct shear and are not subject to additional forces caused by base plate flexibility.
Cyclic Loading:
The CEAs used in this application (closure plate support) experience significantly different conditions than those used in a typical piping system or equipment support applications. For example, piping supports are typically subject to cyclic loading due to changing operating conditions experienced during heat-up or cool-down, or due to flow induced vibration. For the closure plate, there are no significant loads applied during normal operation. Therefore, the installed condition of the CEAs at the time of the postulated HELB event would not be appreciably different than when they were originally installed.

A HELB load is not a normal working load or sustained load. When taking into account the higher loading conditions due to a one-time, non-recurring and short duration accident load such as a HELB event, a minimum factor of safety of 1.25 for Unit 1 and 1.39 for Unit 2 is adequate to provide reasonable assurance that the CEAs will perform as required on the AF tunnel covers. Thus, although the CEAs do not conform to the administrative limit for safety factors applicable to CEAs (safety factor of 4), operability is supported.

From Calculation 5.6.3.9, the original FOS for the plate (1.34) was based on the collapse load determined from the Formulas for Stress and Strain. As cited in the reference, the equation used to determine the collapse load used is subject to a 30% error. Therefore, based on the low FOS, further analyses is required to justify the continued acceptability of the -inch plate for the revised HELB pressure load.
Preliminary Elastic Plastic Large Displacement Time History Finite Element Analyses were performed using the pressure time histories for both Byron and Braidwood Units 1 and 2. The results of this analytical work show that there is reasonable assurance that the steam tunnel cover plates will withstand the applicable pressure loading without failure. The results of this work also show that the stress in the central section of the plate is at yield value of 36 ksi (i.e, the stress in the rest of the plate is under the material yield value of 36 ksi and additional margin exists). The maximum displacement anywhere in the plate is 0.4". Therefore, operability is supported for the -inch plate.

Operability for both the plate and the CEAs is supported. Full qualification will be restored by the installation of permanent design changes EC 369245 for Unit 1 and EC 369246 for Unit 2.

There are no followup actions required for this WGE. Any identified corrective and compensatory actions are being tracked per operability evaluation #07-007.

Evaluation of any SOC Comments:

MRC Reviewed by: [redacted] 07/21/2008 11:56:38 CDT
MRC Comments:
++++++++++++
(7/21/08 [redacted]) Per MRC (Engineering Director), Engineering to track and document past operability in CAP.
+++++++++++++

Assign #: 01					**AR #: 00789791**
Aff Fac:	Braidwood	**Assign Type:**	TRKG	**Status:**	COMPLETE
Priority:		**Assigned To:**		**Due Date:**	07/14/2008
Schedule Ref:		**Prim Grp:**	ACAPALL	**Orig Due Date:**	07/14/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: POTENTIAL LOSS OF MARGIN IN MS TUNNEL PRESSURIZATION CALC

Assignment Completion

In Progress Notes:

Completion Notes:

Assign #: 02					**AR #: 00789791**
Aff Fac:	Braidwood	**Assign Type:**	ACIT	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	07/15/2008
Schedule Ref:		**Prim Grp:**	A8901RA	**Orig Due Date:**	07/14/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Re-route completed WGE to MRC for review

Assignment Completion

In Progress Notes:

Completion Notes: The WGE has been routed to the MRC. This ATI is complete. [redacted] 7/15/08

Assign #: 03 **AR #: 00789791**

Aff Fac:	Braidwood	**Assign Type:**	OPDB	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	07/01/2008
Schedule Ref:		**Prim Grp:**	A8952DER	**Orig Due Date:**	07/01/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Revise OpEval 07-007 (Rev. 4)

Assignment Completion

In Progress Notes: 1.0 ISSUE IDENTIFICATION:

Title: AF Tunnel Cover Bolt Evaluation Uses Non-standard Safety Factor

1.1 IR #: 654270 (Rev. 0,1,2), 783849 (Rev. 3), 789791 (Rev. 4)

1.2 OpEval #: 07-007 Revision: 4

1.3 EC Number: N/A Revision: N/A

General Information:

1.4 Affected Station(s): Braidwood

1.5 Unit(s): 1 and 2

1.6 System: AF

1.7 Component(s) Affected: Unit 1 and 2 Aux. Feed Tunnel Flood Seals

1.8 Detailed description of what SSC is degraded or the nonconforming condition, by what means and when first discovered, and extent of condition for all similarly affected SSCs:

The design analysis (calculation 5.6.3.9) for evaluation of the Auxiliary Feedwater Tunnel flood seal covers did not include the effects of a High Energy Line Break (HELB) on qualification of the covers and supporting elements. Additionally, the design analysis uses a non-standard factor of safety for qualification of the concrete expansion anchors (CEA's) used to support the covers. This condition was initially identified at Byron (IR's 653093 and 620080) and was found to be applicable to Braidwood (IR 654270). This condition affects the qualification of the following covers: 1AFFSO1-6, 1AFFSO1-7, 1AFFSO1-8, 1AFFSO1-9, 2AFFSO1-6, 2AFFSO1-7, 2AFFSO1-8 and 2AFFSO1-9.

Revision 1 of this OpEval changed the due dates of the items listed under corrective action 1 and corrective action 2. Note that the date for full qualification (design change installation date) has not changed.

Revision 2 of this OpEval changed the due dates of the items listed under corrective action 3 and corrective action 4. This changes the implementation date of the modification to restore full qualification from

05/30/2008 to 12/31/2008 for both Unit 1 and Unit 2. This change is required to accommodate the late receipt of materials required to implement the modification (Unit 2 materials have arrived; Unit 1 materials have not yet been received). The new due date has been selected to ensure the job can be appropriately planned to minimize installation time, since the work will not be performed during a refueling outage. The degraded condition is not time-dependent; the change in implementation date is judged acceptable.

Revision 3 of this OpEval incorporates dynamic loading factors. The NRC identified a concern related to the justification of operability contained in Revisions 0 through 2 of this OpEval after reviewing Calculation 5.6.3-BRW-08-0045-S, Structural Evaluation of the Flood Seal Cover Support in the MSIV Rooms, Unit 1 Per EC 369245. This calculation supports the modification to restore full qualification of the Unit 1 AF Tunnel Flood Seals and utilized a dynamic load factor of 2.0 to address the peak HELB accident impact load condition of the flood seal cover plate and supporting members. Revisions 0 through 2 of this OpEval did not address HELB accident impact load conditions. In addition, Revision 3 of this OpEval was completely reformatted to Revision 6 of OP-AA-108-115.

Revision 4 of this OpEval addresses discrepancies identified in IR 789791 related to the HELB analysis of record, 3C8-0282-001. The HELB analysis credited vent paths via blank off plates in the MSIV Rooms. However, the physical construction of the blank off plates prevents them from acting as a vent path. In addition, a modified version on the AREVA (Framatone) computer model was used to determine the best estimate results to support operability. Further reviews of Calculation 5.6.3.9 identified additional inconsistencies in the determination of factors of safety.

2.0 EVALUATION:

2.1 Describe the safety function(s) or safety support function(s) of the SSC. As a minimum the following should be addressed, as applicable, in describing the SSC safety or safety support function(s):

- Does the SSC receive/initiate an RPS or ESF actuation signal? No

- Is the SSC in the main flow path of an ECCS or support system? No.

- Is the SSC used to:

- Maintain reactor coolant pressure boundary integrity? No

- Shutdown the reactor? No.

- Maintain the reactor in a safe shutdown condition? No.

- Prevent or mitigate the consequences of an accident that could result in offsite exposures comparable to 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11 guidelines, as applicable. Yes.

- Does the SSC provide required support (i.e., cooling, lubrication, etc.) to a TS required SSC? No.

- Is the SSC used to provide isolation between safety trains, or between safety and non-safety ties? No.

- Is the SSC required to be operated manually to mitigate a design basis event?

- Have all specified safety functions described in TS been included? Yes.

- Have all safety functions of the SSC required during normal operation and potential accident conditions been included? Yes.

- Is the SSC used to assess conditions for Emergency Action Levels (EALs)? No.

There are two AF tunnel covers in each Main Steam Isolation Valve (MSIV) room. The covers provide a flood barrier and a HELB barrier between the MSIV room and AF tunnel. The barrier protects the AF013 valves from the effects of flooding or a HELB in the MSIV rooms. The AF013 valves are maintained in the open position. If exposed to a harsh environment, these valves may not be able to close to provide their containment isolation function.

2.2 Describe the following, as applicable:

(a) the effect of the degraded or nonconforming condition on the SSC safety function(s)

(b) any requirements or commitments established for the SSC and any challenges to these

(c) the circumstances of the degraded/nonconforming condition, including the possible failure mechanism(s)

(d) whether the potential failure is time dependent and whether the condition will continue to degrade and/or will the potential consequences increase

(e) the aggregate effect of the degraded or nonconforming condition in light of other open Op Evals

(a) The covers are designed to perform a sealing function (leak-tight) between the MSIV rooms and AF tunnel for all design loads including seismic. Based on the design analysis (calculation 5.6.3.9), the CEA's for the AF tunnel cover support members do not meet the structural design criteria requirements with respect to safety factor. The design criteria require a factor of safety of 4 while the design analysis uses a factor of safety of 1. The effect of this condition is that the design margin for the CEA's is reduced. Additionally, the design analysis does not address the loading on the cover and support members due to a high energy line break. Failure of the cover or supporting members could expose the AF013 valves (located in the AF tunnel) to a harsh environment, which could adversely impact their containment isolation function.

(b) The AF tunnel covers are required to remain intact and in place to ensure that the AF013 valves are protected against the environments due to flooding and HELB within the MSIV rooms. Additionally, the structural design criteria require a factor of safety of 4 to be maintained for CEA's.

(c) The possible failure mechanisms associated with this condition are a catastrophic failure of the plate or supporting member, or the plastic deformation of the cover or supporting member. Either of these scenarios could expose the AF013 valves to an environment for which the AF013 valves have not been qualified.

(d) The AF tunnel covers and associated support components have been qualified independently for the worst case HELB and the worst case flood in the MSIV room. Since worst-case conditions are used, the potential failure is not time-dependant. Additionally the potential consequences will not change over time since worst-case conditions were used.

(e) No other OpEvals at Braidwood are associated with the AF tunnel covers. Thus, this non-conforming condition has no impact on the previously evaluated degraded conditions associated with currently open OpEvals.

YES NO
2.3 Is SSC operability supported? Explain basis (e.g., analysis,
test, operating experience, ÝX¨ Ý ¨
engineering judgment, etc.):

The original design analysis (Calculation 5.6.3.9) for the AF tunnel cover and supporting members was reviewed to determine the impact of the HELB loading on qualification of the plate, shelf angle CEAs, and the C6 (channel) CEAs. Per this design analysis, the minimum calculated factors of safety are as follows:

Plate = 1.34
Shelf Angle CEA = 1.08
C6 (channel) CEA = 1.47

These factors of safety are associated with a loading of 15.83 psig due to a seismic/flood loading. The AF tunnel covers were not originally designed to HELB loading conditions.

A re-evaluation of the HELB peak pressures was performed by Sargent & Lundy as a result of the discrepancies identified in IR 789791 for each unit. Preliminary results from this evaluation indicated that it may be prudent to temporarily modify the blank off plates in the MSIV rooms to provide additional relief paths in the event of a HELB. ECs 371256 (Unit 1) and 371262 (Unit 2) were issued to install foam panels to replace the existing panels as a Compensatory Measure. These installations are complete for both units. Further results from this evaluation indicated that it may also be prudent to reinforce the AF tunnel covers to provide additional margin as a Compensatory Measure. ECs 371281 (Unit 1) and 371283 (Unit 2) were issued to install tube steel bracing on the AF tunnel covers. These TCCs were designed based on a peak pressure of 20 psig with a dynamic load factor of 2.0 (effective peak pressure of 40 psig) to ensure all factors of safety are greater than 2. Both compensatory measures were initiated to enhance an operable, but degraded condition to ensure that the AF tunnel covers will continue to perform their specified safety function.

The re-evaluation of the HELB peak pressures utilized new mass-energy values as documented in EC 371293. The re-evaluation determined that the peak pressure for Unit 1 is 21.7 psig and for Unit 2 the peak pressure is 19.4 psig. Dynamic load factors consistent with the new peak pressure and load history were determined by Sargent & Lundy to be 1.01 for both units. In addition, further margin was recovered from conservatisms in Calculation 5.6.3.9. EC 371345 was approved which captures all the changes related to the HELB loading and determined the following factors of safety for the CEAs:

Unit 1 Unit 2

Shelf Angle CEA = 1.25 Shelf Angle CEA = 1.39
C6 (channel) CEA = 1.28 C6 (channel) CEA = 1.43

The above factors of safety are applicable with the blank off plates modified and prior to the installation of the tube steel bracing on the AF tunnel covers. As of the date of this OpEval revision, the tube steel bracing of the Unit 1 AF tunnel covers has been installed under EC 371281. With this EC installed all factors of safety are nearly 4 and design margin is restored.

As indicated above, the factors of safety for the Unit 2 CEAs are less than 2 and the installation of the tube steel bracing of the Unit 2 AF tunnel covers is pending.

Load capacities for CEAs are determined by testing numerous anchors under controlled conditions. Ultimate loads are based on a mean average of these test results and are normally reduced for design applications to account for any differences from the controlled conditions that may exist in the field. Safety factors for concrete expansion anchors are introduced to account for three key issues; 1) loose bolts/undertorque; 2) inaccurate load distribution/modeling; and 3) cyclic loading. None of these issues are applicable to the CEAs installed in the support details for the AF tunnel covers as discussed below:

Loose Bolts/Undertorque:
The anchors used in this installation were installed to the requirements of Byron/Braidwood Specification F/L-2722, Form 1778 and Specification BY/BR/CEA, the installation specifications in place at that time of installation. Conformance to the requirements of these specifications were ensured by an approved Quality Assurance program, which included inspections to ensure each anchor was installed to required specifications including minimum embedment depth, angularity, minimum spacing, and minimum installation torque. Each of these parameters provide additional assurance that the conditions present in field are consistent with the tested conditions. Therefore, loose anchor bolts are not expected and visual inspections verified that the installed anchors show no indication of localized degradation or cracking that could adversely impact the CEA performance.

Inaccurate Load Distribution/Modeling:
The shelf angle configuration at one edge of the plate consists of a single row of bolts resisting the vertical load from the plate. The calculations contained in Calculation 5.6.3.9 account for the vertical load and resulting moment causing both shear and tensile force on the anchors. The single row of bolts is not conducive to load distribution due to plate flexibility that is normally considered in a typical multiple bolt base plate arrangement. Similarly, the CEAs for the channel support member are loaded in direct shear and are not subject to additional forces caused by base plate flexibility.
Cyclic Loading:
The CEAs used in this application (closure plate support) experience significantly different conditions than those used in a typical piping system or equipment support applications. For example, piping supports are typically subject to cyclic loading due to changing operating conditions experienced during heat-up or cool-down, or due to flow induced vibration. For the closure plate, there are no significant loads applied during normal operation. Therefore, the installed condition of the CEAs at the time of the postulated HELB event would not be appreciably different than when they were originally installed.

A HELB load is not a normal working load or sustained load. When taking into account the higher loading conditions due to a one-time, non-recurring and short duration accident load such as a HELB event, a minimum factor of safety of 1.25 for Unit 1 and 1.39 for Unit 2 is adequate to provide reasonable assurance that the CEAs will perform as required on the AF tunnel covers. Thus, although the CEAs do not conform to the administrative limit for safety factors applicable to CEAs (safety factor of 4), operability is supported.

From Calculation 5.6.3.9, the original FOS for the ?" plate (1.34) was based on the collapse load determined from the Formulas for Stress and Strain. As cited in the reference, the equation used to determine the collapse load used is subject to a 30% error. Therefore, based on the low FOS, further analyses is required to justify the continued acceptability of the ?-inch plate for the revised HELB pressure load.
Preliminary Elastic Plastic Large Displacement Time History Finite Element Analyses were performed using the pressure time histories for both Byron and Braidwood Units 1 and 2. The results of this analytical work show that there is reasonable assurance that the steam tunnel cover plates will withstand the applicable pressure loading without failure. The results of this work also show that the stress in the central section of the plate is at yield value of 36 ksi (i.e, the stress in the rest of the plate is under the material yield value of 36 ksi and additional margin exists). The maximum displacement anywhere in the plate is 0.4". Therefore, operability is supported for the ?-inch plate.

Operability for both the plate and the CEAs is supported. Full qualification will be restored by the installation of permanent design changes EC 369245 for Unit 1 and EC 369246 for Unit 2.

If 2.3 = NO, notify Operations Shift Management immediately.
If 2.3 = YES, clearly document the basis for the determination.
YES NO
2.4 Are compensatory measures and/or corrective actions required? ÝX¨ Ý ¨

See Section 3.0 for required corrective actions and compensatory measures. These actions are required in order to ensure compliance with the structural design criteria.

If 2.4 = YES, complete section 3.0 (if NO, N/A section 3.0).

2.5 Reference Documents:

2.5.1 Technical Specifications and Bases Section(s):
3.7.5 Auxiliary Feedwater (AF) System
3.6.3 Containment Isolation Valves

2.5.2 UFSAR Section(s):
3.0 Design of Structures, Components, Equipment, and Systems
3.6 Protection Against Dynamic Effects Associated with the Postulated Break of Piping
Attach. C3.6 Main Steamline Break in Main Steam Tunnel
3.11 Environmental Design of Mechanical and Electrical Equipment
15.1.5 Steam System Piping Break at Zero Power
15.1.6 Steam System Piping Break at Full Power

2.5.3 Other:
Dwg S-895, Rev AD
Dwg S-896, Rev. W
Dwg S-969 Rev. AF
Dwg S-970, Rev AB
Dwg S-1062, Rev. X
Dwg S-1088, Rev. N
Dwg S-1093, Rev. U
Dwg S-1502, Rev. G
Calc. 5.6.3, Rev. 005 Section 9
Calc. 5.6.3-BRW-96-608, Rev. 001
Calc. 3C8-0282-001, Rev. 003
DIT S040-BRW/BYR-8011, Dynamic Load Factors For Aux. Feedwater Hatch Cover

EC 371293, B/B MSLB Outside Containment Mass and Energy Releases
EC 371345, Evaluation of Auxiliary Feedwater Tunnel Flood Barrier for

Revised HELB Loads - Operability Review
Specification F/L-2722, Concrete Structures
DIT S040-BYR/BRW-8013, Analysis of Line Break in Lower Safety Valve Room
DIT S040-BRW/BYR-8012, Aux Feedwater Tunnel Hatch Cover Operability for Byron and Braidwood.
Formulas for Stress and Strain, Young - 5th Edition.
EC 369245, AF Tunnel Flood Seal Cover Modification, Unit 1
EC 369246, AF Tunnel Flood Seal Cover Modification, Unit 2

3.0 ACTION ITEM LIST:

If, through evaluating SSC operability, it is determined that the degraded or nonconforming SSC does not prevent accomplishment of the specified safety function(s) in the TS and the intention is to continue operating the plant in that condition, then record below, as appropriate, any required compensatory measures to support operability and/or corrective actions required to restore full qualification. For corrective actions, document when the actions should be completed (e.g., immediate, within next 13 week period, next outage, etc.) and the basis for timeliness of the action. Corrective action timeframes longer than the next refueling outage are to be explicitly justified as part of the OpEval or deficiency tracking documentation being used to perform the corrective action.

Corrective Action #1: Determine scope and extent of change (modification), Get installation estimate. Feed this info to WC for their ATI.
Responsible Dept./Supv.: DEM
Action Due: Action Complete
Basis for timeliness of action: There is no time-dependent degradation concern with this issue. The due date is a reasonable amount of time.
Action Tracking #: 654270-03

Corrective Action #2: Determine installation completion date and generate appropriate corrective actions.
Responsible Dept./Supv.: Work Control
Action Due: Action Complete
Basis for timeliness of action: There is no time-dependent degradation concern with this issue. The due date is a reasonable amount of time.
Action Tracking #: 654270-04

Corrective Action #3: Install a design change on the Unit 1 AF tunnel covers to restore full design margin
Responsible Dept./Supv.: MMD
Action Due: 12/31/2008
Basis for timeliness of action: There is no time-dependent degradation concern with this issue. The due date is a reasonable amount of time to plan and implement the work.
Action Tracking #: 654270-05

Corrective Action #4: Install a design change on the Unit 2 AF tunnel covers to restore full design margin
Responsible Dept./Supv.: MMD
Action Due: 12/31/2008
Basis for timeliness of action: There is no time-dependent degradation concern with this issue. The due date is a reasonable amount of time to plan and implement the work.
Action Tracking #: 654270-06

Compensatory Measure #1: Install temporary design changes EC 371256 and EC 371262 to modify blank off plates in the MSIV Rooms.
Responsible Dept./Supv.: MMD
Action Due: Complete
Basis for timeliness of action: The due date is a reasonable amount of time to plan and implement the work.
Action Tracking #: N/A
Effects of the Compensatory Action: Provides an additional relief path from the MSIV rooms and margin in the analysis.

Compensatory Measure #2: Install temporary design changes EC 371281 and EC 371283 to reinforce the AF tunnel covers.
Responsible Dept./Supv.: MMD
Action Due: 07/07/2008
Basis for timeliness of action: The due date is a reasonable amount of time to plan and implement the work.
Action Tracking #: 789791-04
Effects of the Compensatory Action: Provides additional margin on all factors of safety for the plate and concrete expansion anchors.

4.0 SIGNATURES:

4.1 Preparer(s) [redacted] Date 7/1/08

4.2 Reviewer [redacted] Date 7/1/08

HU-AA-1212 was reviewed and the highest Consequence Risk Factor was MED (C.4). The probability of error was determined to be low and Existing Process Reviews are adequate. EC 371345 contains the analytical basis for operability. EC 371345 received an ITPR by an off site specialist.

4.3 Sr. Manager Design Engg/Designee Concurrence [redacted] Date 7/1/08

4.4 Operations Shift Management Approval [redacted] Date 7/1/08

4.5 Ensure the completed form is forwarded to the OEPM for processing and Action Tracking entry as appropriate.

5.0 OPERABILITY EVALUATION CLOSURE:

5.1 Corrective actions are complete, as necessary, and the OpEval is ready for closure
Date

(OEPM)
5.2 Operations Shift Management Approval
Date
5.3 Ensure the completed form is forwarded to the OEPM for processing, Action Tracking entry, and cancellation of any open compensatory measures, as appropriate.

Completion Notes:

Assign #: 04 **AR #: 00789791**

Aff Fac:	Braidwood	**Assign Type:**	CA	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	07/07/2008
Schedule Ref:		**Prim Grp:**	A8922MM	**Orig Due Date:**	07/07/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Install ECs 371281 (Unit 1) and 371283 (Unit 2). Tube steel bracing on AF tunnel covers.

Assignment Completion

In Progress Notes: ****COMPLETE FOLLOWING STEPS PRIOR TO COMPLETION OF ASSIGNMENT****

1. Prior to start of work on the completion of any CA, ensure you have reviewed the associated CR, investigation, this assignment, and if necessary contact the originator to ensure a complete understanding of the requested action.
2. Implement the requested actions. (e.g. Procedure should be implemented not submitted for change)
3. Document completion of action by completing each field in the following form or marking NA.
4. Additional guidance is provided by clicking here : Clicking Here

Record of Extensions: (Note: Record the date, justification and approval received for each extension)

Document Corrective Action: (Note: Restate the requested action)

Install ECs 371281 (Unit 1) and 371283 (Unit 2). Tube steel bracing on AF Tunnel Covers

Document the Resolution: (Note: Clearly document the implementation of the Corrective Action to the requirements of LS-AA-125 Attachment 3. "That which is not documented is not done.")

Document any changes to the intent of the original Actions (Include appropriate Department Head Approval): (Note: Document any deviation from the specific action and document the name of the Senior Manager/Director that authorized the deviation)

Document additional assignment determined during evaluation: (Note(s): Do not close to a promise - CA Type Assignments can only be closed to another CA Type Assignment on a CR)

	Quality Signoff: (Note: Document the name of the person who is accountable for the completion of this assignment.) Name: Date: Document Additional Details here:
Completion Notes:	ECs 371281 (Unit 1) and 371283 (Unit 2). INSTALLATION COMPLETED ON 07/03/08 11:59 AM.

Assign #: 05					**AR #: 00789791**
Aff Fac:	Braidwood	**Assign Type:**	ACIT	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	08/25/2008
Schedule Ref:		**Prim Grp:**	A8952DER	**Orig Due Date:**	08/22/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Per MRC, track and document past operability in CAP.

Assignment Completion

In Progress Notes: 8/20/08 ([redacted]) The results of EC 371692 support a past-operability determination of the AF013 valves for a postulated MSLB. Note that the AF Tunnel covers have since been modified to provide additional structural supports such that their current configuration represents a significant increase in margin beyond that reviewed within this evaluation. In addition, blowout panels in the upper areas of the valve rooms (neglected in this evaluation) have also been provided to minimize the pressure transient in the valve rooms.

The following text is from EC 371692:

Purpose:
The purpose of this evaluation is to determine the effect of a postulated double-ended Main Steam Line Break (MSLB) event originating in the Safety Valve Rooms, on the steel closure plate assembly protecting the floor opening between the valve room and the Auxiliary Feedwater (AF) Tunnel.

This effort represents a best-estimate evaluation to support a past-operability determination for the Byron and Braidwood Units 1 and 2 AF013 valves (1 & 2AF013A thru H).

Summary of Results:
The results of this evaluation support a past-operability determination of the AF013 valves for a postulated MSLB. Note that the AF Tunnel covers have since been modified to provide additional structural supports such that their current configuration represents a significant increase in margin beyond that reviewed within this evaluation. In addition, blowout panels in the upper areas of the valve rooms (neglected in this evaluation) have also been provided to minimize the pressure transient in the valve rooms.

Detailed Evaluation:
The AF Tunnel covers provide a closure for the access opening between the lower level of the Safety Valve Rooms at Elevation 377'and the AF Tunnel. This closure plate is intended to protect the components, specifically the AF013 valves, located in the AF Tunnel from the effects of postulated pipe breaks. The MSLB event is considered the most limiting of the pipe breaks with respect to the closure plates.

Description:
Per References 1 and 2, the floor opening closure plate assembly consists of a ?-inch thick checkered steel plate supported on all four edges. One edge of the closure plate is supported by a shelf angle attached to the tunnel wall using 3/8-inch concrete expansion anchors (CEAs). The other

three edges are supported by the 3-feet thick (minimum) concrete floor slab between the valve room and the AF Tunnel.

(Note: The shorter edge for several of the plates is supported by a 6-inch steel channel that is in turn supported at the wall and long edge of the concrete opening. The area adjacent to this channel is filled with concrete (Refs. 1f & 2F.))

The closure plate is fastened to the supporting surfaces with 1/4" minimum diameter cap screws at 24 inch maximum spacing around its perimeter. A 1/8-inch thick rubber/neoprene gasket is provided beneath the plate to provide a seal between the contact surfaces.

Loading:
The pressure loading acting downward on each of the tunnel cover plates was determined per Reference 3. The loading is represented by a time history plot of the maximum effect of a postulated MSLB. These plots were used as input to finite element analyses (FEA) performed on each of the tunnel cover assemblies.

Analysis:
Finite element analysis was performed on each of the AF Tunnel cover assemblies as documented in Reference 4. The results of these analyses are provided below:

Per Reference 4, p. 4:
Three finite element models were defined to bound all 16 flood plate openings at Byron and Braidwood stations; the models are designated Model A, Model BC, and Model D. Model A bounds all "A" openings, model BC bounds all "B" and "C" openings, and model D bounds all "D" openings. Analysis of these models concludes that the capacity of the flood plates during a pressure transient due to MSLB conditions is limited by the capacity of concrete expansion anchors supporting a single structural steel angle bolted to the wall along the long edge of the plate.
Specific results are as follows:
? The small capscrews used to secure the flood plates to the floor are not adequate to carry the full pressure loading. Deflection of the flood plates is sufficient to cause the capscrews to fail at approximately one-half of the peak transient pressure. Once the capscrews have failed, each flood plate is supported by concrete and/or grout on three edges and a shelf angle bolted with four concrete expansion anchors (CEAs) to a wall along the fourth edge.
? The detailed analyses are conducted assuming the capscrews are failed.
? Scoping evaluations were performed assuming failure of the CEAs and consequent loss of the support provided by the shelf angle. These evaluations indicate that when the flood plate is supported on only three edges, the pressure loading results in large vertical deflections that lead to eventual failure of the plate. However with the shelf angle intact, the flood plate deflections are moderate and the plate will not fail even under the maximum pressure loading. Thus, the CEAs supporting the shelf angle are the critical structural components in the flood plate closure assembly.
? The ultimate pressure capacity of the flood plate assembly is limited by the ultimate strength of the CEAs. Figures 2-1, 2-2, and 2-3 show the CEA interaction ratios vs. time, along with the pressure time-histories for the three models evaluated. The interaction ratio is an elliptical interaction equation with 1.0 defined as ultimate capacity, with no additional margin of safety. Margin to failure is the inverse of the interaction ratio.
? For grouted openings, the channels supporting the grout and the anchors supporting the channels are less limiting than the shelf angle and the shelf angle CEAs.
? The number and spacing of the shelf angle CEAs are unverified design

inputs. These parameters should be verified by Exelon. Differences between the as-built configurations and those assumed in this calculation may require additional evaluation.
The limiting anchor bolt interaction ratios for the shelf angle are provided in Table 5-1 of Reference 4. The maximum interaction ratio determined is 0.90. As discussed above, this value is with respect to ultimate anchor capacity.

Discussion:
The results summarized above demonstrate adequacy of the AF Tunnel covers to withstand the effects of a postulated MSLB; however, this evaluation requires that additional review of these results be performed. Two specific aspects of this analysis that will be further discussed are: 1) the effect of the loss of contact pressure at the corners of the plates and 2) the use of the ultimate capacity for the CEAs.

1) Loss of Contact Pressure at Corners of Plates:
Due to the momentary loss of contact pressure at the corners of the plate during the MSLB event, the possibility exists that the 1/8-inch thick rubber/neoprene gasket will be dislodged at these locations. Since the corners do not permanently deform, a maximum gap equal to the thickness of the displaced gasket was assumed to result.
The effect of postulated cover plate corner gaps following the initial MSLB pressure event was evaluated in Reference 5 to demonstrate the capability of the AF Tunnel cover to limit the environmental effects in the AF Tunnel below the cover. The results of this evaluation determined that the postulated gaps would result in a temperature no greater than approximately 233 oF.
As demonstrated in Reference 6, the AF013 valves are expected to function in an environment of 100% relative humidity and at a temperature of at least 266 oF. Therefore, the presence of the postulated gaps following the initial pressure event will not result in an environment such that the AF013 valves would not be capable of performing their design function.

2) Use of Ultimate Capacity for CEAs:
Load capacities for CEAs are determined by testing numerous anchors under controlled conditions. Ultimate loads are based on a mean of these test results and are normally reduced for design applications to account for any differences from the controlled conditions that may exist in the field. For example, tensile capacity may be reduced by the presence of cracking in the concrete in the vicinity of the anchor, with the magnitude of this effect dependent on the location, quantity and size of the cracking.

A field walkdown conducted of the concrete in the area of the Auxiliary Feedwater Tunnel hatch covers has determined that there is no cracking in the general vicinity of these hatches that would impact the CEAs. In addition, the location of the anchors is within the portion of the wall where it intersects with the floor slab (i.e., a support point for the wall). Under MSLB pressure, this portion of the wall will have no tensile forces that would tend to create or open any cracks in the concrete. Therefore, the effect of cracking on the anchor ultimate capacity is judged to be negligible.

Closely spaced anchors also negatively influence capacities. Per References 1 & 2, there are no anchors spaced closer than 14-anchor diameters. This spacing is adequate to eliminate any negative impact of spacing on anchor capacity.

Historically, industry concerns for CEA capacity have centered on three key issues; 1) loose bolts (undertorqued), 2) inaccurate base plate stiffness/rigidity and load distribution assumptions or modeling, and 3) the potentially adverse impact of cyclic loading on installed anchors. As discussed below, none of these issues are applicable to the CEA's installed in the support details for the Auxiliary Feedwater Tunnel access hatch plates. Similarly, the mixing, placement and testing of the concrete used in the structure are tightly controlled to ensure that the concrete is sound and will provide conditions similar to the tested conditions.

1) Loose Bolts/Undertorque:
The anchors used in this assembly were installed to the requirements of Byron/Braidwood Specification F/L - 2722, Form 1778 and Specification BY/BR/CEA, the installation specifications in place at that time of installation.
Conformance to the requirements of these specifications were ensured by an approved Quality Assurance program, which included inspections to ensure each anchor was installed to the required specifications including; minimum embedment length, angularity, minimum spacing, and minimum installation torque. Each of these parameters provides additional assurance that the conditions present in the field are consistent with the tested conditions.
Therefore, loose anchor bolts due to installation deficiencies are not expected.

2) Inaccurate Load Distribution/Modeling:
This concern typically results from the use of simplified models using rigid plate assumptions. The support angle was included with the models developed for the finite element analysis performed in Reference 4. Since any load redistribution due to angle or anchor stiffness will be automatically accounted for in these analyses, there is no inaccuracy introduced into the load determination for these CEAS.

3) Cyclic Loading:
The CEAs used in this application (closure plate support) experience significantly different loading conditions than those used in a typical piping system or equipment support applications. For example, piping supports are normally subject to cyclic loading whether due to changing operating conditions experienced during heat-up or cool-down, or flow-induced vibration.

For the closure plate, there are no significant loads applied during normal operation. Therefore, the condition of the CEAs at the time of the postulated HELB event would not be appreciably different than when they were originally installed. Furthermore, the postulated pressure event is a one-time load of limited duration, with no cyclic component.

Document Summary:
The following documentation provides the input and results that support the various aspects of this review:
? EC 371547 - Best-Estimate Mass & Energy (M&E) Releases
? TODI No. EC-371547 - Transmittal of Results of M&E to Sargent & Lundy (S&L)
? Document # 2008-12134 - S&L Calculation of Pressure Time-History Data

? TODI No. ENSAF ID# ES0800025 - Transmittal of Pressure Time-History to MPR for Structural Analyses
? TODI No. BYR-08-027 - Transmittal of AF Tunnel Cover Details to MPR
? Calculation 3101-0025-01 - MPR Structural Analyses / FEA Modeling of AF Tunnel Cover
? EC 371656 - An Evaluation of Past Auxiliary Feedwater AF013 Valves Environment with Respect to the B/B AF Tunnel MSLB Accident Conditions

Conclusion:
It can be concluded based on the discussion provided above, reasonable evidence exists that the closure plate assemblies for the floor openings between the Safety Valve Room floor and the Auxiliary Feedwater Tunnel would have remained intact following a MSLB event originating in the

Safety Valve Room.
Furthermore, the effect of the MSLB event on the closure plates would not have resulted in any significant adverse environmental conditions that would have prevented the AF013 valves from performing their intended design function.
Thus, the results support a best-estimate past-operability determination for the AF013 valves for a postulated Main Steam Line Break.

References:
1) Byron Design Drawings
a. S-895, Rev. AA
b. S-896, Rev. U
c. S-969, Rev. AA
d. S-970, Rev. AB
e. S-1062, Rev. X
f. S-1093, Rev. Q
g. S-1502, Rev. G
2) Braidwood Design Drawings
a. S-895, Rev. AD
b. S-896, Rev. W
c. S-969, Rev. AF
d. S-970, Rev. AB
e. S-1062, Rev. X
f. S-1093, Rev. U
g. S-1088, Rev. N
3) Sargent & Lundy Document # 2008-12134, Rev. 0 "Analysis of Line Breaks in Lower Safety Valve Rooms without Blow Out Panels"
4) MPR Associates, Inc. Calculation No. 3101-0025-01, Rev. 1
5) EC# 371656, Rev. 0 "An Evaluation of Past Auxiliary Feedwater AF013 Valves Environment with Respect to the B/B AF Tunnel MSLB Accident Conditions"
6) EC# 365163, Rev. 0 "Past Operability Review of a Gap in Flood Seal 1DSFSO08"

Note: As identified in Reference 4, an unverified assumption was made regarding the spacing and number of CEAs for the support angle at the wall. Although this assumption is supported based on the information provided in the design drawings, shop (i.e, fabrication) drawings and photographs, due to access requirements, the as-built spacing and number of CEAs could not be verified at the time of this analysis.
Therefore, the verification of this information will be made as each AF Tunnel becomes accessible during planned maintenance activities requiring the removal of the covers. These verifications are being tracked via AT # 00789344-04 and -05 (Byron Unit 1 & 2) and # 00789791-06 and -07 (Braidwood Unit 1 & 2).
The DAR questions of CC-AA-102, Attachment 1A have been reviewed and none were determined to be applicable to this activity. This evaluation is for a past-operability determination of the AF013 valves and does not affect the design basis of any SSC.

Completion Notes:

Assign #: 06 **AR #: 00789791**

Aff Fac:	Braidwood	**Assign Type:**	ACIT	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	01/16/2009
Schedule Ref:		**Prim Grp:**	A8952DER	**Orig Due Date:**	12/19/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Verify CEA spacing on U1 AF Tunnel Covers-Braidwood EC # 371692 documents a structural analysis performed by MPR. The analysis used an assumption for the actual spacing on the shelf angle CEAs. This ATI is to perform verification that the actual spacing is bounded.

Assignment Completion

In Progress Notes:

Status as of 12/12/09:
.
The CEA spacing on three of four hatches has been verified. The remaining AFW tunnel hatch for the 1C MSIV room is scheduled to be performed in January 2009. The verification of the anchor bolts for the 1C hatch plate will be performed at this time. The due date for this assignment is changed to 1/16/09.
.
[redacted], Site Engineering, 12/18/08

ATI 789791-06

The field verification of CEA spacing for shelf angle supporting Aux Feed Tunnel hatch covers located in unit 1 A/B/C/D MSIV rooms is completed. The summary of results is documented below.

Tunnel Hatch No.of CEAs Minimum spacing between CEAs Maximum spacing between CEAs Remarks
1A 4 13.375" 16"
1B 4 12" 12"
1C 4 12" 12"
1D 3 18" 18"

The field information for the spacing and number of CEAs for 1A, 1B and 1C MSIV rooms tunnel hatch meets the assumption made in the MPR Analysis documented in EC 371692 to support past operability except for 1D MSIV room tunnel hatch where 3 CEAs are installed in lieu of 4. Because the assumption made in the analysis could not be validated for 1 hatch out of the four hatches, past operability could not be substantiated. IR 852425 is initiated to track this issue and determine additional corrective actions. Therefore, this ATI may be closed to IR 852425. This item is complete.

[redacted]
1/16/2009

** See next page for field information for reference.

Completion Notes: See in-progress notes for resolution.

Assign #: 07 **AR #: 00789791**

Aff Fac:	Braidwood	**Assign Type:**	ACIT	**Status:**	COMPLETE
Priority:		**Assigned To:**	[redacted]	**Due Date:**	01/21/2009
Schedule Ref:		**Prim Grp:**	A8952DER	**Orig Due Date:**	12/19/2008
Unit Condition:		**Sec Grp:**			

Assignment Details

Subject/Description: Verify CEA spacing on U2 AF Tunnel Covers - Braidwood EC# 371692 documents a structural analysis performed by MPR. The analysis used an assumption for the actual spacing on the shelf angle CEAs. This ATI is to perform verification that the actual spacing is bounded.

Assignment Completion

In Progress Notes: (1/2/09 [redacted]) ATI was reopened. The attachment will not be electronically archived since it is an attachment. If the information is critical, please document the results, otherwise delete the attachment.

ATI 789791-07

The field verification of CEA spacing for shelf angle supporting Aux Feed Tunnel hatch covers located in unit 2 A/B/C/D MSIV rooms is completed. The summary of results is documented below.

Tunnel Hatch No.of CEAs Minimum spacing between CEAs Maximum spacing between CEAs Remarks
2A 5 10" 11-1/4"
2B 3 12" 14" Total of 4 CEAs including 1st anchor at channel
2C 4 13-7/8" 15-1/4"
2D 5 12" 12-5/8"

The field information for the spacing and number of CEAs for 2A, 2B, 2C and 2D MSIV rooms tunnel hatch meets the assumption made in the MPR Analysis documented in EC 371692 to support past operability for unit 2. There are no further actions. This item is complete.

[redacted]
01/21/2009

** See next page for field information for reference.

Completion Notes: See in-progress notes for the resolution. See in-progress notes for resolution.