February 8th, 2017

Re: 2.206 for Byron and Braidwood Units 1 & 2 High Energy Line Break

Dear Mr. McCree,

This is a petition for enforcement and other actions related to concerns with High Energy Line Breaks (HELB) outside containment (at Byron/Braidwood) as well SCWE concerns (Byron).

Summary of Concerns:

1. The analysis of record (AOR) for the Main Steam Isolation Valve (MSIV) room pressurization following a HELB is deficient,
2. Corrective actions to resolve an issue in the AOR are long overdue (8 years) and improperly tracked,
3. A proposed revision to the AOR shows that the MSIV room roof slabs will be ejected by the high pressures in the MSIV rooms becoming potential missiles, and
4. Engineering management is dismissive of dissenting views such that operability issues are not promptly addressed and a Safety Conscious Work Environment is not assured.

Detailed Discussion:

1. <u>Deficient AOR</u>

Revision 3 of calculation 3C8-0282-001, *Main Steam Tunnel Pressure Study for Main Steam Line Break*, forms a partial basis for UFSAR Section C3.6 *Main Steamline Break in Main Steam Tunnel*. There are two deficiencies. First, the Unit 1 break enthalpies shown in Table 4 of UFSAR Section C3.6 are actually the thermodynamic internal energy of the steam, not the enthalpy. Since in the range of interest, the internal energy is about 13% less than the correct enthalpy, the energy flow to the areas of concern is nonconservative.

The second concern relates to neglecting the steam flow from secondary piping. UFSAR Section 6.2.1.1.3, *Design Evaluation*, describes the inputs for the response of containment pressure to a main steam line break inside containment:

> "The piping volumes from the plant layout between the affected steam generator and the various steamline isolation valves and feedwater isolation valves and control valves are the following. The maximum volume between the affected steam generator and: (1) the main steam isolation valve is 766 ft^3 for Unit 1 and 749 ft^3 for Unit 2, (2) the main steam isolation valves for the intact steam generators is 11,575 ft^3 for Unit 1 and 11,358 ft^3 for Unit 2, …"

The *inside* containment analysis appropriately includes the large volume of secondary piping between the SGs and the main turbine; no such inclusion exists in the AOR for breaks outside containment. This is nonconservative as it will result in lower calculated peak pressures.

2. Untimely Corrective Actions

The issue with the wrong break enthalpies in item 1 was documented on 6/30/08 in Issue Report 792213, *MSLB Calc Energy Release Error*. No Corrective Action (CA) type assignment was created to resolve the issue. Eight years on, the AOR still contains the non-conservative break enthalpies.

3. MSIV Roof Slab Ejection

Vendor 1 was contracted in late 2013 or early 2014 to complete Revision 4 to the AOR. Vendor 2 provided updated mass and energy releases, in part to correct the improper enthalpy used in Revision 3 of the AOR. A previous issue with the potential lifting of the MSIV room roof slabs during a tornado sensitized vendor 1 to the fact that the internal pressures due to a HELB could cause lifting/ejection of the MSIV room roof slabs. Vendor 1 determined that the 5,125 lb_m roof slab would be ejected with a velocity of 32 ft/sec. This is contrary to UFSAR Section 3.6.1.2.1 *Potential Sources and Locations of Piping/Environmental Effects*, which states "There are no credible secondary missiles formed from the postulated break of piping."

Disagreement existed within Exelon as to the validity of Vendor 1's results. The contentious issue was that Vendor 1 had used a break location in the MSIV room, even though that was the same break locations used in previous versions of the AOR. I maintained that a break in the MSIV room was required.

In late August, 2015 I began extended FMLA to deal with a medical issue. In September 2015, Exelon contracted Vendor 3 to perform a new analysis related to MSIV room and MS tunnel pressurization. Vendor 3 was directed to perform the analysis using as its basis for break size and location FSAR Question 010.4. The mass and energy flows used were from Vendor 4. The lower break flows and break locations gave results that showed the MSIV room roof slabs do not eject.

4. "Cherry picking" by Exelon Engineering Management

I returned to work in late April, 2016 and was assigned a high-priority task which did not complete until mid-October 2015. I then began to reacquaint myself with what had happened to the concerns I expressed in 2014.

I attempted to resolve the concerns raised in item 3 beginning in 2014 without success. I tried again in December 2016 and made one final attempt to advocate my position that the Current Licensing Bases (CLB) for Byron required breaks *in* the MSIV Rooms. On 1/27/17, I sent out an e-mail to Engineering management stating:

> "… Section C3.6 of the UFSAR analyzes double-ended break in the MSIV room; one could posit that our CLB is overly conservative but its presence cannot be denied. The table in section C3.6 lists the break size as 1.4 ft^2, which may seem supportive of question 010.04. However, there are nuances to this value that are revealed upon examination of the flowrates as a function of time; the unit 2 table is used since the unit 1 has errors. At time zero, the total flow is 11,000 lb_m/sec. The flow is saturated (initially) and choked. A determination of Moody choked flow requires a pressure and

enthalpy. Since the flow is saturated the enthalpy can be used to find the pressure, doing so gives a value of 948 psia. Using the Moody critical flow tables, this corresponds to 1963 lb_m/ft^2-sec. Dividing the initial flow of 11000 lb_m/sec by 1963 gives a break area of 5.6 ft^2, obviously not the 1.4 ft^2 listed in the table, but it does correspond to (4 SG * 1.4 ft^2 flow limiter). Another salient point in the table is what happens between 10.0 and 10.1 seconds; at 10 seconds the value is 9318 lb_m/sec and 0.1 seconds later is has dropped substantially to 2098 lb_m/sec. The latter flow value is 22.5% of the former and is what would be expected when the MSIVs (each feeding through a 1.4 ft^2 restrictor) on the 3 non-faulted generators are isolated by their MSIVs.

Based on the above, I infer that the CLB break is double-ended in the MSIV room and fed by 4 SGs until MSIVs close at 10 seconds. Since the peak pressures occur with the first second, use of 1.4 ft^2 from time zero is not consistent with the CLB."

A conference call with Byron and Braidwood engineering was held on 1/31/17. When I presented my rationale, the Byron manager presented FSAR Question 010.04 again as a counterpoint. I stated that the question was not part of the CLB as it had not been incorporated into the UFSAR. Without review of the UFSAR, the manager stated that the information I was using in the UFSAR to support my position was "excessive detail" and stated that it could be removed per NEI guidance. When I stated that I would not revise the UFSAR as I did not think it appropriate, the Byron manager then directed the Braidwood personnel on the call to make the change.

Another point discussed was the concept of the "Break Exclusion Zone". UFSAR Section 3.6.2.1.2.1.2, *Fluid System Piping in Containment Penetration Areas*, does state "This section applies to the fluid system piping inside the isolation valve rooms, which includes the main steamlines and the feedwater lines, starting at the inside of the containment wall and extending to the first restraint outside the containment isolation valve."

I pointed out that the B/B UFSAR is internally inconsistent in the use of the BEZ concept since another section says that the BEZ only extends to the downstream weld of the MSIV instead of the MSIV room wall, therefore breaks *in* the MSIV room were required. Without discussion or review of the evidence supporting my position, the Byron manager dismissed the internal inconsistency by saying that the information supporting my conclusion could be deleted as an UFSAR "cleanup" item.

The above is not an isolated incident of out-of-hand dismissal of dissenting views. Less than a month earlier, there was an operability concern where Engineering management maintained a position of operability in the face of conflicting information. In addition, Engineering management relied on information that was demonstrably irrelevant.

I maintain that the above information supports a conclusion that Exelon management "cherry picks" information to support operability and dismisses contrary views.

Requested Actions:

For item 1, Issue a violation under 10CFR50, Appendix B, Criterion III, *Design Control*, in that the AOR uses incorrect values for break enthalpy and/or the analysis does not account for backflow from secondary piping.

For item 2, issue a violation under 10CFR50, Appendix B, Criterion XVI, Corrective Action, for failure to update the AOR in a timely manner to address the inappropriate break enthalpies.

For item 3, require Exelon to show that the consequences of the secondary missiles resulting from MSIV room pressurization do not have adverse consequences.

For item 4, issue a demand for information under 10 CFR 2.204 to compare and contrast the behavior of Exelon management described herein with the NRC's policy statement on the attributes of a Safety Conscious Work Environment. I request that Exelon's response be used as a basis as to whether or not NRC should issue a "chilling effects" letter.

Attachments:

1. UFSAR Attachment C3.6, Main Steamline Break in Main Steam Tunnel
2. Question 010.4
3. UFSAR Section 3.6

Regards,

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