



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

July 26, 2017

Mr. Bryan C. Hanson  
Senior Vice President  
Exelon Generation Company, LLC  
President and Chief Nuclear Officer (CNO)  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: REQUEST FOR VOLUNTARY RESPONSE TO PETITION REGARDING  
BYRON STATION, UNIT NOS. 1 AND 2, AND BRAIDWOOD STATION, UNITS  
1 AND 2 HIGH ENERGY LINE BREAK IN MAIN STEAM ISOLATION VALVE  
ROOM

Dear Mr. Hanson:

By e-mail dated February 8, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17061A127, Enclosure 2), the U.S. Nuclear Regulatory Commission (NRC) received a Petition pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 2.206 requesting enforcement action.

As Petition Manager, I would like to inform you that you have the right to submit a voluntary response to the issues identified in the Petition in accordance with NRC Management Directive 8.11, "Review Process for 10 CFR 2.206 Petitions" (ADAMS Accession No. ML041770328). If you choose to provide a voluntary response, the response will be made publicly available and will be used by the NRC to determine what, if any, additional action should be taken. Your response should include the items listed in the enclosure to this letter and should avoid using proprietary or personal privacy information that requires protection from public disclosure. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response identifying the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information).

B. Hanson

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If you choose to respond, I am asking that you provide your response within 30 days of the date of this letter.

Sincerely,

A handwritten signature in black ink that reads "Joel S. Wiebe". The signature is written in a cursive style with a large, looped "J" and "W".

Joel S. Wiebe, Senior Project Manager  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456, STN 50-457,  
STN 50-454 and STN 50-455

Enclosures:

1. Request for Voluntary Response
2. 2.206 Petition

cc w/encl:

Mr. Barry Quigley  
3512 Louisiana Road  
Rockford, IL 61108

Distribution via Listserv



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

REQUEST FOR VOLUNTARY RESPONSE

BYRON STATION, UNIT NOS. 1 AND 2,

AND

BRAIDWOOD STATION, UNITS 1 AND 2

DOCKET NOS. STN 50-454, STN 50-455,

STN 50-456 AND STN 50-457

The following information is requested to be included in your voluntary response:

- a. Provide a copy of Revision 3 to calculation 3C8-0282-001, "Main Steam Tunnel Pressure Study for Main Steam Line Break [MSLB]," and any subsequent revisions. Also provide any documents or calculations that are used as input to the calculation and are necessary to understand the calculation. The petitioner states that the piping volumes obtained from the plant layout between the affected steam generator and the various steam line isolation valves, feedwater isolation valves, and control valves given in UFSAR Section 6.2.1.1.3 were appropriately included in the analysis for the main steam line break inside containment; and were not included in the analysis of record for the breaks outside the containment. Provide the calculations that document the main steam piping volume input and assumptions used in the analysis for breaks inside the containment and for breaks outside the containment. In case the volume calculation for the break inside the containment is included in the main steam line break containment pressure response analysis, provide the calculation. Use of an electronic system that allows the NRC staff to view these documents is preferred in lieu of transmitting large amounts of paper.
- b. Provide a copy of Issue Report 792213, "MSLB Calc[ulation] Energy Release Error," dated June 30, 2008. Also provide any documents that document action taken in response to this Issue Report or provide closure of any actions. Provide any follow up or related Issue Reports or documents that document action taken or provide closure of related Issue Reports. Draft or uncompleted documents need not be provided. Provide a discussion or description of the timeline, if necessary to aid in the understanding of the sequence or extent of actions taken in response to this issue or related issues associated with this Issue Report.

- c. The petitioner questioned using an incorrect main steam line break area of 1.4 ft<sup>2</sup> instead of 5.6 ft<sup>2</sup>; and an incorrect main steam isolation valve closure time. Provide a response to the petitioner's concern documented in his following email to engineering management dated January 27, 2017:

"... Section C3.6 of the UFSAR analyzes double-ended break in the MSIV [main steam isolation valve] room; one could posit that our CLB [current licensing basis] is overly conservative but its presence cannot be denied. The table in section C3.6 lists the break size as 1.4 ft<sup>2</sup>, which may seem supportive of question 010.04 [UFSAR 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 lbm/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 lbm/ft<sup>2</sup>-sec. Dividing the initial flow of 11000 lbm/sec by 1963 gives a break area of 5.6 ft<sup>2</sup>, obviously not the 1.4 ft<sup>2</sup> listed in the table, but it does correspond to (4 SG \* 1.4 ft<sup>2</sup> 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 lbm/sec and 0.1 seconds later is has dropped substantially to 2098 lbm/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<sup>2</sup> restrictor) on the 3 non-faulted generators are isolated by their MSIVs.

Based on the above, I [the petitioner] 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<sup>2</sup> from time zero is not consistent with the CLB."

- d. Provide any operability evaluations performed in response to any errors found in the calculation or taken in response to conditions found while taking actions to resolve the errors. If none were performed provide an explanation.
- e. Provide a description of actions that are currently in progress to resolve any errors identified in the calculation, including the scope of the actions and target dates for completing the actions. Provide a description as to how these actions are being tracked to completion. If Issue Reports are involved in the tracking, provide the link to those identified in your response to "b," above or provide a copy, along with the supporting documents if they were not included in "b," above.
- f. Provide a description of the methodology being used for resolution of any errors found in the calculation. Provide the basis for its use and if and when the NRC has approved such methodology for this application.
- g. By letter dated August 2, 2012 (ADAMS Accession No. ML12208A338), the NRC requested in item e.1. the plan and schedule for the extent of condition review of high-energy line break areas other than the Turbine Building. Explain why the issue with calculation 3C8-0282-001 was not resolved based on the extent of condition review.

- h. Provide your evaluation of the following information from the February 8, 2017, Petition.

**Detail 1:** Exelon management stated that information in the updated final safety analysis report (UFSAR), Section C3.6, being used by the petitioner to support a technical position was excessive detail and could be removed in accordance with Nuclear Energy Institute guidance. When the petitioner stated he did not think it appropriate to remove the information, the Byron manager directed Braidwood personnel to remove the information.

**Detail 2:** During a conference call on January 31, 2017, the petitioner pointed out that the UFSAR, Section 3.6.2.1.2.1.2 is inconsistent with another section of the UFSAR in the use of the Break Exclusion Zone concept. Without discussion or review of the evidence supporting the position, the Byron manager dismissed the internal inconsistency by saying that the information supporting the position could be deleted as an UFSAR cleanup item.

**Detail 3:** Less than a month before the meeting discussed in Detail 2, there was an operability concern where Engineering management maintained a position of operability in the face of conflicting information.

**Detail 4:** Details 1 through 3, above, support a conclusion that Exelon management cherry picks information to support operability and dismisses contrary views.

The documented results of your evaluation should include sufficient information for the NRC to determine: (a) if the concern was substantiated; (b) that the organization or individual conducting the evaluation was independent of the concern and was proficient in the related functional area; (c) that the evaluation was of sufficient depth and scope to determine that the appropriate root causes and generic implications were considered; (d) that the corrective actions, both planned and completed, were sufficient to correct the specific example and generic implications and to prevent recurrence; (e) if your evaluation identified any compliance issues with NRC regulatory requirements or commitments, the corrective actions taken or planned, and the corrective action document that addressed the issues; (f) if interviews of individuals were conducted as part of your review, the basis for determining that the number and cross section of individuals interviewed, as well as the scope of the interview, was appropriate to obtain the information necessary to fully evaluate the subject concern, and the interview questions used; and (g) if your evaluation included a sample review of related documentation and/or potentially affected structures, systems, and components, your response should include the basis for determining that the selected sample size was appropriately representative and adequate to obtain the information necessary to fully evaluate the concerns. The NRC will consider these factors in reviewing the adequacy of your evaluation.

- i. In addition to the information requested above, if the technical issues in item 4 of the Petition Detailed Discussion are not addressed in items a through f, above, provide a discussion of the issue resolution, including scope and target dates if resolution is ongoing.

**ENCLOSURE 2**

**2.206 Petition Dated February 8, 2017**

**ADAMS Accession No. ML17061A127**

February 8<sup>th</sup>, 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. Deficient AOR

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<sup>3</sup> for Unit 1 and 749 ft<sup>3</sup> for Unit 2, (2) the main steam isolation valves for the intact steam generators is 11,575 ft<sup>3</sup> for Unit 1 and 11,358 ft<sup>3</sup> 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<sub>m</sub> 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<sup>2</sup>, 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<sub>m</sub>/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<sub>m</sub>/ft<sup>2</sup>-sec. Dividing the initial flow of 11000 lb<sub>m</sub>/sec by 1963 gives a break area of 5.6 ft<sup>2</sup>, obviously not the 1.4 ft<sup>2</sup> listed in the table, but it does correspond to (4 SG \* 1.4 ft<sup>2</sup> 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<sub>m</sub>/sec and 0.1 seconds later it has dropped substantially to 2098 lb<sub>m</sub>/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<sup>2</sup> 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<sup>2</sup> 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,

Barry Quigley  
3512 Louisiana Rd,  
Rockford, IL 61108

SUBJECT: REQUEST FOR VOLUNTARY RESPONSE TO PETITION REGARDING BYRON STATION, UNIT NOS. 1 AND 2, AND BRAIDWOOD STATION, UNITS 1 AND 2 HIGH ENERGY LINE BREAK IN MAIN STEAM ISOLATION VALVE ROOM DATED JULY 26, 2017.

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**ADAMS Accession No.:ML17166A362**

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