From: Lawrence Rossbach
To: Allan.haeger@Exeloncorp.com
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Subject: EPU risk assessment questions

Our review of the extended power uprate (EPU) amendment requests has identified several questions in the area of risk assessment. The questions are attached. Please let me know if you would like a call to discuss them.

CC: Anthony Mendiola; Donald Harrison; Robert Lerch; Stewart Bailey

Docket Nos. 50-237, 50-249, 50-254, 50-265

DRESDEN AND QUAD CITIES EXTENDED POWER UPRATES
REQUEST FOR ADDITIONAL INFORMATION - RISK ASSESSMENT

Unless otherwise noted, all of the following questions apply to both Dresden and Quad Cities:

1. There is a modification being implemented in parallel with the extended power uprate that will install an automatic recirculation system runback following a feedwater pump trip. What is the impact of a spurious recirculation system runback at full or low power and what is the impact of a failure of the recirculation pump to runback at full or low power? How have these new events been addressed in the extended power uprate probabilistic safety assessment (PSA) model and what are their expected impacts on the trip initiating event frequency?

2. There is a modification being implemented to trip the fourth running condensate pump during a loss of coolant accident (LOCA) to prevent an electrical overload. Is this modification being hardwired to a specific condensate pump? If the pump fails to trip or its breaker(s) fails to open, what is the impact on the electrical system? Were these new potential failure modes of the electrical system explicitly modeled? If not, please explain the basis for these failures modes being considered to have a negligible impact.

3. The change in turbine trip initiating event frequency is stated to be the result of the need to operate the installed spare feedwater and condensate/condensate booster pumps.

    a. How was the change in initiating event frequency determined? Was a plant-specific loss of feedwater initiating event model explicitly revised to include the potential failure of the required operating pumps or was the initiating event "scaled" to account for the additional failure modes? If the latter, please provide a justification for the applicability of the plant-specific initiating event data used in these calculations due to the change in operating conditions and configurations.

    b. The Dresden information indicates that the loss of any single feedwater or condensate/condensate booster pump would lead to a reactor low level scram signal, but the Quad Cities information indicates that this is estimated to occur only half of the time. Please explain why there is this difference between the Dresden and Quad Cities loss of feedwater initiating event models.

4. It is expected that the time to initiate standby liquid control (SBLC) early would also be impacted, as well as its late initiation, but this impact is not identified. What was the impact on early SBLC initiation as a result of the extended power uprate in terms of available time and associated human error probability (HEP) and what was its overall impact on core damage frequency (CDF)?

5. The success criteria is stated to change in two areas: number of electromatic relief valves (ERVs) or safety relief valves (SRVs) required for reactor pressure vessel (RPV) depressurization and number of safety valves (SVs), ERVs, or SRVs required for overpressurization protection.

a. It is noted that the RPV depressurization sequences without a stuck open relief valve are dominated by operator action failures and common cause failures (CCFs). However, the CCF modeling, and thus its contribution, will be impacted due to the change in success criteria. Was the CCF modeling and associated values changed to reflect the change in success criteria for the post-uprate model? If so, what were the CCF values used in the pre- and post-uprate models and what was the quantified change in CCF contribution? If not, what is the basis for the conclusion that the impact is negligible?

b. The ATWS overpressure protection success criteria changes from 11 of 13 to 12 of 13 SVs, ERVs, or SRVs, which is stated to have a negligible impact on the results because it is dominated by CCF. Note that the post-uprate model would have to consider the CCF of any two valves, which was not considered in the pre-uprate model (it modeled the CCF combination of any three valves). Thus, the CCF contribution will be impacted due to this change in success criteria. Was the CCF modeling and associated values changed to reflect the change in success criteria? If so, what were the CCF values used in the pre- and post-uprate models and what was the quantified change in CCF contribution? If not, what is the basis for the conclusion that the impact is negligible?

6. The Dresden (Quad Cities) value for CDF is stated to change from 2.61E-6/year (4.61E-6/year) to 2.82E-6/year (4.85E-6/year) and the value for LERF is stated to change from 1.44E-6/year (3.30E-6/year) to 1.58E-6/year (3.43E-6/year). Typically, it is expected that the LERF value would be nearly an order of magnitude below the CDF value. Please explain why the LERF values at these sites are less than a factor of two below the CDF values.

7. The response to the Human Factors RAIs implies there are different values used for HEPs at the different units at the same site, but this is not clear since the information provided seems to be primarily for one unit and only one set of CDF and LERF values is provided for a site. Are there different PRA models and data used for the individual units at each site or is a common model and data employed for both units at each site?

8. Did the licensee re-perform the thermal hydraulic code analysis to establish the post-uprate PSA model success criteria and did this re-evaluation consider the numerous setpoint changes (e.g., reactor low water level, main steam line high flow, condenser vacuum), operational changes (e.g., recirculation pump runback feature, all feedwater and condensate pumps operating), and condition changes (e.g., higher decay heat load, higher ATWS peak pressures)? Did the evaluation specifically include the consideration of the operability of pumps (e.g., NPSH) that take suction from the torus, which will have a higher temperature condition as part of the extended power uprate? Please describe the supporting thermal hydraulic evaluations performed to determine the post-uprate PSA success criteria.

9. Based on the recent Quad Cities inspection report 2001-05, the staff has questions on how the licensee assures that the plants' PSA models and associated data adequately reflect the plants' current operating conditions, configurations, and practices.

a. Please describe how the plants assure that the system/equipment performance criteria as part of the maintenance rule implementation and the assumptions, data, and equipment unavailabilities (e.g., maintenance/testing, demand failure rates, etc.) used in the plants' PSA are consistent with one another. Also include how the methodology implemented by the plants for establishing or revising performance criteria is consistent with Regulatory Guide 1.160, which indicates that the number of maintenance preventable functional failures allowed per evaluation period should be consistent with the assumptions of the PSA.

b. Does the PSA used in support of the extended power uprate also reflect, and is it consistent with, the current maintenance rule performance criteria? Please explain any differences between the performance criteria and the pre- and post-uprate PSA models and associated data.

c. Station procedures recommend updating the PSA every two years. Please state when the PSA models and the data were last updated, describe the major changes that have occurred since the last update, and discuss the potential impact of these changes on the PSA models and data, including consideration of the extended power uprate plant conditions.

d. The recent inspection findings indicate that there has been an increase in on-line maintenance activities, which is a programmatic change. This programmatic change, which may make past operating experience invalid in establishing maintenance unavailabilities, should be reflected in the PSA. How have the plants reflected this programmatic change in the PSA models for determining the unavailabilities of systems and equipment; specifically in determining the equipment maintenance unavailabilities? In addition, how has this change been reflected in the on-line risk monitoring tool used by the licensee to meet the maintenance rule a(4) criteria and how does this programmatic change affect other operating modes such as shutdown operations?

10. (DRESDEN ONLY) The licensee has stated in the Dresden IPEEE that the concept of providing a seismically-qualified/verified makeup path to each plant unit's isolation condenser was being developed. Although the use of the isolation condenser with a verified makeup water supply source provides a means of decay heat removal for the intact reactor case, torus cooling may still be needed for the small LOCA case. The licensee indicated that a study would be performed to ensure that a small LOCA, with no torus cooling but with the isolation condenser in operation, would not result in an unacceptable torus temperature. The design changes to support these items were to be completed in conjunction with the approved schedule for resolution of USI A-46 outliers, which is still many years in the future.

a. Did the IPEEE seismic margins analysis reflect the current plant configuration and operation or did it include the consideration of proposed future modifications and changes to the plant (i.e., take credit for the resolution of some USI A-46 outliers such as having a seismically-qualified means of makeup to the isolation condenser that does not currently exist)?

b. What means of providing makeup to the isolation condenser were credited? Are these means seismically qualified? If not seismically qualified, please describe the current estimated seismic margin for these means of makeup and explain how this margin has been determined?

c. Do the means to align and provide the makeup to the isolation condenser involve any operator actions. If so, what is the probability that the operators will not be able to perform these actions in sufficient time given the conditions of the event (i.e., a large - beyond design basis - earthquake that has failed multiple systems and collapsed structures that are not seismically qualified)? Are the required operator actions in areas, and the access paths to these areas, only in structures that are seismically qualified and in which all surrounding/nearby systems are seismically qualified? Please describe the operator actions considered and the related environmental/operational conditions for the operators to perform these actions.

d. Has the study for the small LOCA case been completed? If so, please summarize the results of the study and identify the design changes, if any, that may be required to satisfy the conditions and the schedule for these changes. How would the extended power uprate affect the results of this study? If the study has not been completed, what is the basis for the seismic margins analysis acceptability for the small LOCA case, including the power uprate conditions?

11. What is the current plants' estimated seismic CDF and what is the estimated impact of the extended power uprate on this seismic CDF? Please explain the bases for deriving this estimate.

12. What is the impact of the extended power uprate on other modes of operations; specifically shutdown operations? Please describe the impacts on these operations and provide an estimate of the impact on shutdown risk (i.e., CDF and LERF).

13. The allowable values for main steam isolation flow are raised variously as 120%/125% (Dresden Unit 2); 120%/140% (Dresden Unit 3); 138%/254.3 psid (Quad Cities). The stated bases in NEDC-32424P-A is to keep the same basis (expressed as a percentage of steam flow) to assure that reactor trip avoidance is maintained. Thus, the setpoints will have the effect of significantly increasing the maximum size of steam line breaks that will go unisolated due to the increased steam flow under extended power uprate conditions. What analyses have been performed for the additional impact of this range of steam line breaks (e.g., on CDF or on HELB analyses)? How does this condition impact the accident progression for a unisolated main steam line break (e.g., how much quicker to core damage)?