**From:** Lawrence Rossbach
**To:** Allan.haeger@Exeloncorp.com
**Date:** 6/17/01 4:02PM
**Subject:** Some Plant Systems questions for EPU

Attached are several questions from our plant systems reviewers for the EPU submittals. Our plant systems review is continuing. I expect we will identify additional questions in the plant systems area. We would like to arrange a call with your staff to discuss the attached questions when your staff is available.

**CC:** Anthony Mendiola; Jon Hopkins; Ralph Architzel; Stewart Bailey

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

DRESDEN AND QUAD CITIES EXTENDED POWER UPRATE

REQUEST FOR ADDITIONAL INFORMATION - PLANT SYSTEMS

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

1. During a telephone call on April 30, 2001, your staff noted that changes were being planned in the feedwater and condensate systems to improve the trip avoidance capability of the plant from transients initiated in these systems at the extended power uprate (EPU) full power conditions. These changes were not described in your application. For both Dresden and Quad Cities, describe the various existing features and planned changes (e.g., delayed tripping of a main feedwater pump on low suction pressure; reactor recirculation pump runbacks) which will minimize plant trips from these conditions. Describe plant startup testing and/or post modification testing which will examine these modifications.

2. Provide additional discussion of the effect of the EPU on the feedwater system, including your plans for handling additional flow in the system including heater drains. Are the line and valve sizing and system characteristics adequate for EPU conditions or are changes required? The regulatory concern is challenges to operators and safety systems caused by loss of feedwater heater strings and challenges to fuel integrity caused by the transients associated with loss of feedwater heating.

3. State the rerated conditions for the feedwater heaters.

4. With the proposed modifications to the steam dryers, will the moisture carryover remain within the original design bases following EPU? If not, what reviews have been conducted to evaluate the increased moisture carryover?

5. You have requested a significant increase in the magnitude of a main steam line break that will not be isolable automatically by the main steam isolation signal. You requested to raise the main steam isolation flow from 120% pre-EPU to125% post-EPU for Dresden Unit 2; 120% pre-EPU to 140% post-EPU for Dresden Unit 3; and 138% pre-EPU to 254.3 psid for Quad Cities. The stated basis in NEDC-32424P-A for the increased magnitude of a main steam line break is to keep the same basis (expressed as a percentage of steam flow) to assure that reactor trip avoidance is maintained. For Dresden and Quad Cities, with a 17% power uprate, this corresponds to an increase of 20% flow if the same percentage of steam line flow were maintained as addressed in the topical report.

   What analyses have been performed for the safety impact (e.g., on core damage frequency or on high energy line break (HELB) analyses) of this additional range of steam line breaks (beyond the increase addressed in the EPU topical report), that is no longer automatically isolable? Provide the basis for the additional requested steam line break flow.

6. Provide short term and long term results (curves or tables of calculated values as a function of time) of calculations for:

- drywell short term pressure and temperature,
- suppression pool short term temperature
- wetwell atmosphere short term pressure and temperature
- suppression pool long term temperature
- wetwell atmosphere long term pressure and temperature

If the long term calculation results are different from those used for calculating NPSH, provide the suppression pool long term temperature and wetwell atmosphere long term pressure and temperature used for the NPSH calculation.

7. For Quad Cities, provide additional detail of the confirmatory calculations validating the SHEX computer code (ELTR1 SER Section 2.6(a)).

8. Dresden proposed Technical Specification bases section B 3.6.1.4 is changed to reflect a reduced calculated peak drywell pressure of 43.9 psig for the limiting event. Additionally, the listed reference is changed to Updated Final Safety Analysis Report (UFSAR) Section 6.2.1.3, which was not provided in the application. Provide the referenced UFSAR Section or a draft of the section if it has not been revised for the EPU uprate.

9. Provide the emergency core cooling system (ECCS) pumps net positive suction head (NPSH) calculations to support the requested additional credit for overpressure. Discuss the increased need for containment overpressure for NPSH following a design basis accident. Describe the procedures or equipment in place that will allow continued cooling flow with the drywell potentially depressurized to atmospheric conditions and the suppression chamber at the most conservative pressure associated with vacuum breaker operation (limiting case either torus/drywell or torus/reactor building).

10. ELTR2 section 4.1.8.5 notes that the higher vapor pressure associated with increased suppression pool temperatures will reduce the NPSH available to the RHR and LPCS pumps and as a result the adequacy of the RHR and LPCS pumps will be evaluated at these increased temperature conditions. Were alternatives other than increased credit for overpressure considered, such as other means to enhance suction pressure, pump replacement or modification?

11. The application is unclear or inconsistent regarding some of the requested changes for the license condition on containment overpressure. Clarify your request for these changes as noted in comment column of the following tables for Dresden and Quad Cities;

## Dresden Containment Overpressure Credit (psi)

| Time (seconds) | Current license condition | Requested condition | NEDC-32962P Safety Analyses Report | Comment |
|---|---|---|---|---|
| 0-240 | 9.5 | | | |
| 0-290 | | 9.5 | 9.5 | |
| 240-480 | 2.9 | | | |
| 290-5000 | | 4.8 | 4.8 | |
| 480-6000 | 1.9 | | | |
| 5000-30000 | | ~~4.25~~ 5.2 | ~~5.3~~ 5.2 | Clarify - April 13, 2001 submittal supplement revised to 5.2 psi - however difference column remains 0.8 psi |
| 6000-end | 2.5 | | | |
| 30000-end | | NA | From 30000 seconds to the end of the accident, the available pressure and require pressure decrease in parallel fashion. Minimum margin between available pressure and required pressure during this period is 2.4 psi. | Was this an omission or is no credit being requested? If no credit explain how long term NPSH availability has been achieved; considering the previous need of 2.5 psi and proposed need for 5.2 psi at 5000-30000 seconds. |

**Quad Cities Containment Overpressure Credit (psi)**

| Time (seconds) | Current amendment request | EPU Requested condition | NEDC-32961P Safety Analyses Report | Comment |
|---|---|---|---|---|
| 0-210 | 8.0 | | | |
| 0-290 | | 9.5 | 8 | clarify/correct |
| 210-600 | 2.5 | | | |
| 290-5000 | | 4.8 | 4.8 | |
| 600-10000 | 3.0 | | | |
| 5000-30000 | | 4.25 | 6.75 | Clarify/correct |
| 10000-end | 3.5 | | | |
| 30000-end | | NA | From 30000 seconds to the end of the accident, the available pressure and require pressure decrease in parallel fashion. Minimum margin between available pressure and required pressure during this period is 1.6 psi. | Was this an omission or is no credit being requested? If no credit, explain how long term NPSH availability has been achieved; considering the previous need of 3.5 psi and proposed need for 4.25 (6.75) psi at 5000-30000 seconds. |

12. Section 4.7 on post-LOCA combustible gas control notes margin changes in various parameters associated with the EPU and additional impact of GE14 fuel introduction on metal-water hydrogen production. Provide long term results (curves or tables of calculated values as a function of time) of calculations for:

- hydrogen and oxygen production,
- hydrogen and oxygen concentrations
- Nitrogen containment atmosphere dilution system nitrogen cumulative usage and capacity
- containment pressure buildup demonstrating meeting the 30-day acceptance limit

13. In many places, the bases for changing a Technical Specification relating to the extended power uprate increased power level is not provided. Selected parameters, such as the revised power level for applicability of the turbine stop valve and turbine control valve fast closure reactor trips (38.5% versus 45% currently) have stayed the

same, as measured by thermal power, to maintain the same analyses power level. Selected other changes have been addressed as acceptable at the increased thermal power associated with the existing stated percentage of reactor thermal power (RTP). For example in several places the safety analyses report NEDC-32926P notes that the technical specification surveillance applicability threshold for the rod block monitor remains with a value of 30% RTP. In other places no basis is provided for the 17% increase in requirement resulting from the EPU. For example TS SR 3.3.1.1.2 to Channel check APRMs above 25 (21.4)% RTP to verify the absolute difference is less than 2 (1.7)% RTP; the feedwater system and main turbine high water level trips required to be operable above 25 (21.4)% RTP; among others. If these changes have been addressed, provide a comprehensive cross reference to the basis for all Technical Specifications which reference RTP. If not, either provide the basis for these changes or propose changes which maintain the existing thermal power for the associated Technical Specification.

14. Section 6.4.1.1 Safety-related loads for service water system notes that increased heat load imposed on the containment cooling water system is within the existing system capacity following the most demanding design basis event. What is the increase in the heat load for the CCSW system and what is the system capacity?

15. What effect, if any, does the EPU have on the service water system heat loads for the HPCI and LPCI room coolers?

16. Section 6.4.3. The safety analyses report states that reactor building closed cooling water system heat loads do not increase significantly following EPU. Provide the pre- and post- peak EPU heat loads for the shutdown cooling heat exchanger; spent fuel pool heat exchangers; reactor recirculation pumps; the design RBBCW heat removal capability and total peak heat load post-EPU. Include consideration of the limiting single failure or no failure if this is a more limiting case.

17. Section 6.4.5 addresses the adequacy of the ultimate heat sink. In the event of downstream dam losses, the water trapped in the intake and discharge bay becomes the UHS for Quad Cities 1&2 and the water trapped in the intake canal becomes the UHS for Dresden 2&3. Considering the increased decay heat associated with the EPU, provide details of the analyses of the available water supply trapped in these UHSs for safe shutdown for all units; addressing conformance with Regulatory Guide 1.27. Include any revised timing of required operator actions to maintain the UHS; if any.

18. Section 7.1 Considering reactor power may now be limited by main generator capability, discuss implications of potentially load cycling the reactor due to environmental changes - such as diurnal heating and cooling effects changing cycle efficiency. Will this mode result in additional radioactive wastes being generated?

19. The safety analyses report notes that the plant power may be limited by main generator output. The report notes a potential future change to equipment that would allow higher electrical output. State any impact from a safety perspective of replacing the main generator with a unit that was capable of converting the maximum EPU power under environmental conditions resulting in maximum efficiency?

20. Section 7.1 Provide the results of the evaluation of low pressure turbine missile analyses. Did these reanalyses confirm the potential need to change turbine overspeed protection settings?

21. Section 7.1 notes that for the turbine-generator; valves, control systems and other support systems were evaluated for the effects of EPU. The results of the evaluation show that modifications to the high pressure turbine and some non-safety-related equipment should ensure satisfactory turbine-generator performance. Describe these modifications.

22. Section 8.2.1 addresses the impact of the EPU on the condenser off-gas system; noting an increase of (radiolytic) hydrogen flow from 26.3 to 30.9 $lb_m$ per hour under hydrogen water chemistry conditions. Additionally, the radioactive releases to be handled (held-up) by the off-gas system are estimated to increase proportionately to the power increase of 17%. Address how the combination of these proposed changes impact the design hold up times for the off-gas system; including the ability of the system to hold up a minimum of 30 minutes under conditions associated with 100 μCi/sec/Mwt release rates for noble gases; and (2) the operational impacts associated with the increase radiation shine effects caused by the increased feedwater hydrogen injection rates/main steam flow rates. As noted in Section 8.4.1.1, the impacts of hydrogen water chemistry on source terms are considered without credit for use of the effects of the NobleChem™ process, which considerably lowers the hydrogen feedwater injection requirements. Alternately, state if the use of NobleChem™ process to limit these effects is considered as part of the EPU basis.

23. Section 8.4.3 Clarify the statement in section 8.4.3 that the EPU does not change the design noble gas release rate from the fuel, specifically with respect to SRP 11.3 which provides guidance that the source term for noble gasses is a linear function of the power level and with respect to the stated original design bases of 0.2 Ci/sec after a thirty minute delay. Does the 0.2 Ci/sec original design basis bound the effect of a linear increase in power on the instantaneous off-gas limit noted in SRP 11.3?

24. Section 8.4.3 Explain the stated expectation of no increase in fission product releases from the fuel as a result of EPU. Why won't the expected release rate increase in proportion to the reactor power level increase of 17%?

25. Section 10.1.1.1 addresses the main steam high energy line break and notes that the critical parameter affecting the HELB analyses is reactor dome pressure which is not being changed by the EPU. Do any of the HELB analyses credit isolation of the main steam lines to limit mass-energy released? If so, address the effects.

26. Section 10.1.1.2 notes that for the EPU, the feedwater system line break results in a 6% increase in feedwater mass and energy release. The safety analysis further notes that design margins within the high energy line break analyses are conservative and remain bounding. Provide details of the main steam tunnel HELB analysis that addresses these margins, including major assumptions and results.

27. Section 10.2 notes that moderate energy line break protection features are based on system parameters unchanged by the EPU. Are portions of the condensate and feedwater system considered within the scope of this analyses? If so, has the additional flow associated with operation of four condensate pumps been evaluated? Are any changes in flow or system operation being proposed for the condenser circulating water system to accommodate increased heat load of EPU, or will the EPU otherwise impact the potential for flooding from a line break in this system?

28. Section 11.3 notes that the quantity of spent fuel will not be affected by the uprate; although the short-term radioactivity will be higher but within limits. Please clarify this statement. Is there not an expectation that additional spent fuel assemblies will be required to support the 17% power increase; or is the entire power uprate accommodated in increased burn-up of fuel assemblies?

29. Is the capacity of the hardened vent sufficient to accommodate the power uprate?