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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Quad Cities Generating Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254and 50-265

Subject: Comments on Risk-Informed Inspection Notebook for Quad Cities Generating Station

References: (1) SECY-01-0114, "Results of the Initial Implementation of the New Reactor Oversight Process," June 28, 2001.

(2) Stewart N. Bailey (USNRC) letter to Oliver D. Kingsley, "Quad Cities Site-Specific Worksheets for Use in the Nuclear Regulatory Commission's Significance Determination Process (TAC No. MA6544)," April 23, 2001.

In Reference 1, the NRC staff presents lessons learned from the first year of implementation of the new Reactor Oversight Process (ROP). One important change identified for the reactor safety Significance Determination Process (SDP) is the development of more accurate Risk-Informed Inspection Notebooks. Those notebooks include the Phase 2 SDP worksheets used by NRC inspectors.

One step in the effort to improve SDP was the issuance of a revised notebook for Quad Cities Nuclear Generating Station (Reference 2).

A001

The "Risk-Informed Inspection notebook for Quad Cities Power Station" Revision 0, March 1, 2001, states that the notebook will be periodically updated and that all recommendations for improvement of the notebook should be forwarded to the Probabilistic Safety Assessment Branch. The attachment to this letter provides recommendations for improvements.

Should you have any questions regarding this letter or schedule for a site visit, please contact Mr. Eric Jebsen at (309) 227-3327.

Respectfully,

George P. Barnes for

Timothy J. Tulon
Site Vice President
Quad Cities Generating Station

Attachment:
Comments on Risk-Informed Inspection Notebook for Quad Cities Generating Station

cc: Regional Administrator-NRC Region III
NRC Senior Resident Inspector, Quad Cities Generating Station

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Comments on Risk-Informed Inspection Notebook for Quad Cities Generating Station (Revision 0, March 1, 2001)

Comments are given below by notebook section.

Table 1 "Categories of Initiating Events for Quad Cities Generating Station"

TPCS should be considered "Row II." As currently configured, TPCS frequency in Table 1 is identical to "Transient/Reactor Trip." This essentially removes the efficacy of the "Trans" worksheet. That is, the two worksheets differ only by credit/no credit for PCS. The frequency of loss of PCS is roughly an order of magnitude lower than the transient frequency and is more accurately represented in Row II.

The ATWS frequency has recently been re-calculated by INEEL (NUREG/CR-5500), dropping from ~ 3E-5/demand to ~ 5E-6/demand. This change should be reflected in Table 1 (i.e., moving ATWS to Row VI).

Table 2 Initiators and System Dependency for Quad Cities Generating Station

System	Comments
Reactor Vessel Pressure Control and Automatic Depressurization System	Note that the Target Rock SRV requires no air, and the other relief valves have accumulators. Four ERVs on U1 require only 125 VDC. Target Rock valves and PORVs on U2 require nitrogen, supplied by backup N2 farm, not "air" (i.e., not IA).
RHR	Pump room HVAC is not required. RHRSW not required for LPCI, only for torus cooling.
CS	CS is not dependent on SW or Room Cooling.
SSMP	Also requires 480 VAC for valves. SSMP is not dependent on SW. Normal supply is from CCST; backup is feed from Fire Pumps.
RCIC	Also requires 250 VDC for valves. RCIC is not dependent on Room HVAC.
Instrument Air	Rather than the 2 compressors for each unit shown, there is 1 compressor for each unit, a shared compressor to supply both units, and an automatic backup from service air for each unit. Compressors are cooled by TBCCW, not SW.
SLC	SLC acronym at QC is "SBLC." SBLC is not directly dependent on 125 VDC power.
Room HVAC	Normally supplied by SW. However, DGCW provides emergency supply to HPCI, RCIC, CS, and RHR room coolers.
Augmented Primary Containment Vent	The containment vent valves do not have accumulators.

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Table 3.2 SDP Worksheet for Quad Cities – Transients without PCS (TPCS)

For the Late Inventory Makeup (LI) function, only one of two CRD pumps is required, per the QC PRA. (Comment applies to other worksheets, as well.)

Table 3.3 SDP Worksheet for Quad Cities – Loss of Service Water (LOSW)

The SSMP function should be replaced by the HPI function, as defined for the Transient initiators. HPCI and RCIC are available, given LOSW. That is, if RHR-torus cooling is successful, HPCI and RCIC are available long term. If torus cooling is not successful, HPCI and RCIC will be unavailable long term.

LPI shows no credit for CS, probably because of the assumed dependence on SW shown in Table 2. However, CS is not dependent on SW and should be included as a viable addition to LPI.

Footnote 1 of this table incorrectly states that SW cools HPCI/RCIC, CS room coolers, and instrument air compressors. Instrument air compressors are cooled by TBCCW. There is no dependence of HPCI or RCIC pumps on cooling water. Room coolers for HPCI, RCIC, CS, and RHR are normally cooled by SW, but with design backup cooling from DGCW. In the QC PRA, room cooling is not required for RCIC, CS, or RHR. It is only required for HPCI, given a gland seal leak.

Table 3.4 SDP Worksheet for Quad Cities – Loss of Instrument Air (LIA)

LIA impact at QC should be similar to loss of TBCCW and LOSW. The footnotes should add that Service Air can serve as a backup to Instrument Air. At QC the CV valves have no air accumulators, requiring a recovery action to use. However the long time until recovery is needed (~ 24 hours) make human error probability low and SDP value of 2 is judged reasonable.

Table 3.5 SDP Worksheet for Quad Cities – Loss of an AC Bus (LAC)

There are a number of significant errors in the worksheet and in the footnotes. The buses fed by the diesel-generators are 4kV buses 13-1 and 14-1. While loss of 4kV bus 13 or loss of 4kV bus 14 can cause a plant SCRAM due to balance-of-plant loads on the buses, their losses do not interfere with LPCI or CS. A loss of one bus or the other does prevent use of a respective train of RHRSW, removing one suppression pool cooling loop. Therefore, the LPI function has two trains available, not one.

Loss of 480V bus 19 does not cause a SCRAM, and it is not a special initiator in the QC PRA. Loss of 480V bus 18 causes loss of outboard MSIV room cooling and can, therefore, cause an MSIV closure. Because of RHRSW dependency of valves and room coolers on this bus, its impact on coping systems is similar to the impact of loss of bus 13.

Regardless, the contribution of loss of AC bus special initiators in the QC PRA is < 1% of calculated CDF. Per Table 2, many equipment unavailabilities require entry into this worksheet (e.g., HPCI, RHR, RHRCS, CS, etc.). It is assumed that the loss of AC bus tree will be "solved" with each particular bus assumed unavailable in turn, resulting in multiple LAC worksheet solutions. Because of the small contribution of the LAC tree to CDF at QC, and the large amount of work expected to be spent on the LAC worksheet, it is recommended that the LAC tree be deleted from the QC SDP workbook.

Table 3.6 SDP Worksheet for Quad Cities – Small LOCA (SLOCA)

For the Early Containment Control (EC) function, revise number of suppression-pool-to-drywell vacuum breakers to 12, from 8. The QC PRA requires 12/12 to remain closed for IORV, small LOCA, and medium LOCA, and 11/12 to remain closed for large LOCA. Note that "failure to remain closed" is a failure mode of infinitesimally small probability. The plant maintains a positive pressure in the drywell to lower the water level inside the downcomers, during normal operation. That pressure difference could not be maintained if a vacuum breaker leaked significantly. For needed flow in the other direction, the QC Vapor Suppression PRA Notebook states that the design flow can be achieved with 25% of the vacuum breakers closed. However, realistic success criteria would require far fewer valves. (Comment applies to other LOCA worksheets, as well.)

Table 3.7 SDP Worksheet for Quad Cities – Inadvertent Opening of Relief Valve (IORV)

For the Control Rod Drive (CRD) function, the Quad Cities PRA requires one, not two, CRD pumps for success. Applies to all worksheets.

Footnote 3 describes HEP for Depressurization function. However, DEP is not used in this worksheet, the function provided by the IORV. The footnote should be deleted.

Table 3.11 SDP Worksheet for Quad Cities – ATWS

Focus of ATWS should be on unique ATWS attributes (e.g., "OVERP", "SBLC", etc.). The QC PRA ATWS cutsets are dominated by these types of reactivity control/ containment heat removal sequences. It is recommended that the tree be simplified to remove ATWS and core cooling sequences numbers 4, 5, and 8, leaving sequences 1, 2, 3, 6, and 7.

Table 3.12 SDP Worksheet for Quad Cities – ISLOCA/LOC

LOC contribution to CDF at QC is << 1% (i.e., 0.001%). It is recommended that the "LOC Pathways" be deleted from this worksheet.

There is very little guidance in how Table 3.12 is to be used. Additional footnotes should be provided to assist users in how to relate results from this worksheet to the "Remaining Mitigation Table" used in the SDP to determine finding "color."

Example Results:

To gain insight into the revised SDP worksheets for QC, 3 examples are presented, along with discussion of pertinent QC PRA results. The three examples investigated are: HPCI pump unavailable for 7 days, U1 EDG unavailable for 7 days, and 1 RHRSW heat exchanger unavailable for 4 days.

Example 1 – HPCI pump unavailable for 7 days:

In this example it is assumed that HPCI is found unavailable for 7 days. The current Tech Spec action time to restore HPCI is 14 days. Per QC SDP Notebook Table 2, all worksheets except LLOCA and LSW are to be completed. All worksheets result in "Green" findings, except TPCS, which results in "White." The MLOCA and LOOP worksheets both result in Green adjacent to White. However, the PRA results indicate that the "RAW" for HPCI is 1.4, below the value of 2 typically considered risk significant. Further, it does not appear appropriate to consider HPCI "White" while still within an allowed action time.

The driver of the "White" finding is the TPCS tree. As currently shown, the frequency of TPCS is the same as that of "routine" transients. The actual frequency is about 1/10 that of normal transients. It is recommended that the TPCS frequency be re-classified as "Row II." This reclassification would result in HPCI SDP findings more in line with the PRA risk worth, and consistent with the Tech Specs.

Example 2 – U1 EDG unavailable for 7 days:

In Example 2, the U1 EDG is assumed unavailable for 7 days. The Tech Spec action time to restore the EDG is currently 7 days. Per the QC SDP Notebook Table 2, only the LOOP worksheet needs to be evaluated. Per this worksheet, a 7-day U1 EDG outage results in a "C-2" Yellow finding.

A "Yellow" finding for 1 EDG unavailable for the allowed Tech Spec action time seems overly conservative. The current QC PRA Risk Achievement Worth of the U1 EDG is ~ 1.1. Even with all equipment available for greater than 30 days, the worksheet results in a "B-3 Yellow" finding. It is recommended that the EAC power credit be increased. Currently, the common cause failure probability of loss of all EDGs and the two SBO DGs is < 1E-4.

Example 3 – 1 Division RHRSW unavailable for 4 days:

Example 3 assumes 1 division of RHRSW is unavailable for 4 days. The Tech Spec action time to restore this division is 7 days. Per Table 2 of the SDP Notebook, all worksheets are investigated. Three worksheets result in "White adjacent to Yellow" findings: TCPS, LIA, and LAC (for the bus in the opposite division as the division of RHRSW of interest). Per the SDP grouping rules, these results would indicate a "Yellow" finding.

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Per the QC PRA, the RAW of 1 division of RHRSW unavailable is 5.6. If the "delta CDF" for this result is calculated:

"delta CDF" = (RAW-1) x (fraction of year unavailable) x (base CDF)

= (5.6-1) x (4/365) x (4.6E-6/yr)

~ 2E-7

Thus, the SDP worksheet result of "Yellow" appears overly conservative when viewed against the Tech Spec action time and the delta CDF calculation.

Per the recommendations given above, if the TPCS frequency is reduced to "Row II," and the LAC worksheet is deleted, the RHRSW example results will change to "White." This may still be considered conservative relative to the Tech Spec action time and the delta CDF. This conservatism may be considered acceptable by NRC, given the "screening" nature of the SDP process and the importance of containment decay heat removal for Mark I containments. However, considerable discussion is expected between QC Staff and NRC Staff for any White finding for equipment unavailable consistent with the Tech Specs.