Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

www.exeloncorp.com

Exelon Nuclear

RS-03-004

January 23, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Response to Request for Additional Information Supporting a Relief Request for Alternative Testing of Containment Sump Suction Valves 1/2SI8811A/B

Reference: Letter from Keith R. Jury (Exelon Generation Company, LLC) to U.S. NRC, "Relief Request for Alternative Testing of Containment Sump Suction Valves 1/2SI8811A/B," dated October 18, 2002

In the referenced letter, Exelon Generation Company, LLC (EGC) requested NRC approval of a proposed alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," ASME/American National Standards Institute (ANSI) OMa-1988, "Operations and Maintenance of Nuclear Power Plants," 1987 Edition through the 1988 Addenda, Part 10, Section 4.2.1.1, for the Braidwood and Byron Stations. Specifically, ASME/ANSI OMa-1988, Part 10, Section 4.2.1.1, requires Category A and B valves to be tested nominally every three months (i.e., quarterly), unless the conditions provided under Section 4.2.1.2 are used to justify an acceptable alternate test frequency. Relief Requests RV-5 for Braidwood Station and RV-9 for Byron Station proposed to allow testing of the containment sump recirculation suction valves, without restriction on plant operating mode, while maintaining an 18-month testing frequency. Note that these valves are currently exercised and stroke time tested during refueling outages in accordance with ASME/ANSI OMa-1988, Part 10, Section 4.2.1.2(e). We had previously determined it was not practicable to exercise the valves quarterly during plant operation or cold shutdown.

A047

Subsequent to the NRC's initial review of the subject relief requests, the NRC has requested that we provide additional information to support justification of the proposed alternate valve testing frequency. Our response to the NRC's request is provided in Attachment 1.

Should you have any questions related to this matter, please contact J. A. Bauer at (630) 657-2801.

Respectfully,

J. W. Simpkin

for Keith R. Jury
Director – Licensing
Midwest Regional Operating Group

Attachment 1: Response to Request for Additional Information Regarding Braidwood Station Relief Request RV-5 and Byron Station Relief Request RV-9

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Braidwood Station
NRC Senior Resident Inspector – Byron Station
Office of Nuclear Facility Safety – Illinois Department of Nuclear Safety

Attachment 1

Response to Request for Additional Information Regarding Braidwood Station Relief Request RV-5 and Byron Station Relief Request RV-9

Question 1

Clarify the time it takes to perform the drain/test/refill evolution. According to the relief request, it takes approximately 24 hours to drain the residual heat removal (RH) and containment spray (CS) systems, perform the required valve tests, and refill and restore the systems to their normal configuration. However, Refueling Outage Justification, ROJ-4, in the Braidwood and Byron 2nd Interval inservice testing (IST) Plans states that "[t]he full stroke testing of 1/2SI8811A, B valves; in conjunction with system draining, filling and venting of each train, accounts for an additional six days (3 days per train) of scheduling requirements and increased radiation dose to operators and radiological control personnel." Also, clarify the amount of radioactive borated water required to be drained for each loop. ROJ-4 says "thousands of gallons of contaminated water" whereas the relief request says "an estimated 600 gallons of radioactive, borated water."

Response to Question 1

The original "refueling outage test frequency" justification for this valve presented in ROJ-4, was based upon the fact that major work on the RH pumps was also only performed during refueling outages. Since that time, most scheduled RH pump work has been moved from refueling outages to on-line work windows and was subjected to a probabilistic risk assessment (PRA) impact review at that time. In ROJ-4, the reference to "thousands of gallons of contaminated water" to be drained, included the volume of water required to be drained in order to perform major work on the RH pump. In this relief request, the estimate for the amount of water to be drained (i.e., 600 gallons) is based solely on the amount of water required to be drained to stroke a containment sump recirculation suction valve (i.e., an SI8811 valve).

The difference in time estimate for draining the system, (i.e., 24 hours vs. three days per train) is primarily due to the difference in the amount of water that must be drained for valve stroke time testing only as compared to RH pump maintenance.

Question 2

There is a trade-off, in risk space, between testing these valves at power (when they could be needed to mitigate the consequences of a loss of coolant accident (LOCA)) and testing them during outages (when there is a greater reliance on RHR). Please provide a risk-informed justification, either quantitative or qualitative, for why testing on-line is justifiable as compared to testing during the refueling outage. In addition, please identify any compensatory measures to be established as a risk management action to reduce the risk impact of testing with the nuclear power plant at power.

Response to Question 2

The actual on-line risk increase depends upon how the valve work is scheduled. RH pump work windows are already performed on-line and are monitored via the Configuration Risk

Management Program (CRMP). Typical on-line work is listed below. These periodic maintenance activities render an RH train and the recirculation portion of a CS train unavailable.

Item Name	Frequency
SI8811 motor operated valve (MOV) diagnostic test	54 months
Suction relief valve (RH8708) set point verification	36 months
RH pump motor insulation megger test	54 months
RH pump motor refurbishment	15 years
RH pump motor oil change	2 years
RH pump discharge check valve (RH8730) disassemble and inspect	12 years

Since the current RH pump work windows already result in the unavailability of the respective SI8811 valve, the risk impact of performing the valve work on-line can be categorized into three cases based on how the valve work is scheduled.

1. If the valve testing is bundled with the RH pump work window, and if the test duration is entirely encompassed by the RH work window, there will be no increase in on-line risk and an associated decrease in outage risk resulting in an overall decrease in risk to the plant.

2. If the valve testing is bundled with the RH pump work window, and if the duration of the test is greater than the original RH pump work window, then the increase in on-line risk will be equivalent to the magnitude of the RH pump work window risk increase times the extension in the work window due to the valve test. This on-line risk increase would again be offset by the decrease in the outage risk.

3. If the testing is performed outside of a normal RH pump work window, then the increase in on-line risk will be equivalent to the magnitude of the RH pump work window risk increase times the entire duration of the valve test work window. Again, this on-line risk increase would be offset by the decrease in the outage risk.

The cumulative on-line risk associated with an RH pump work window is approximately 2E-07/day. Therefore, every extra day of RH train unavailability caused by the valve testing adds approximately 2E-07 to the annual core damage frequency (CDF) which is approximately 5E-05 for Byron Station and 4E-05 for Braidwood Station for internal events assuming average equipment unavailability. If two 24-hour windows are used solely to test both trains of the SI8811 valves on an 18-month interval, the maximum increase in annual CDF would be 4E-07, or approximately 1.0% (i.e., Case 3 above). Some, if not all of this risk, will be averted during shutdown by not testing the valves during the outage. However, since the current plan is to bundle the testing with RH pump work windows, the overall risk impact on the plant is expected to be negligible.

The quantitative decrease in shutdown risk by removing this work from the outage currently cannot be calculated since Byron and Braidwood Stations do not have a shutdown PRA. However, qualitatively, some risk is incurred if this test is performed while normal RH cooling is required during an outage.

Finally, all work impacting on-line risk is monitored via the CRMP. Procedures governing the CRMP contain measures to minimize the impact of on-line risk by rescheduling other work as appropriate or by applying resources as necessary to minimize the duration of high-risk activities. The opposite train of equipment will be protected and no breach of the RH piping is permitted unless the SI8811 valve is isolated in the closed position.

Question 3

Provide information on scheduled work windows for the residual heat removal and containment spray systems, at power and during refueling outages. Can this testing be done within these work windows or does this testing extend either the shutdown or at power work windows? Specifically, what other routine maintenance would require the draining and refilling of this section of piping with the plant on-line? What is the basis for the licensee's statement that "As maintenance on the RH system often times requires the same suction line to be drained and filled, and many of these maintenance activities can now be performed on line, it is impractical to restrict the testing of these valves to a cold shutdown or refueling outage?"

Response to Question 3

In general, a work window is scheduled once per 18 months for each RH train. Addition of SI8811A/B valve work to on-line RH work windows may require a work window of longer duration depending on the amount of work scheduled in the work window and the type of critical path activities.

The following work activities are normally performed on-line and require the RH system suction header to be drained:

Item Name	Frequency
SI8811 MOV diagnostic test	54 months
Suction relief valves (RH8708A/B) set point verification	72 months
RH pump discharge check valve (RH8730) disassemble and inspect	12 years

Other typical RH maintenance work that requires draining of the suction piping during scheduled on-line work windows may include routine preventive maintenance activities (e.g., pump seal or bearing replacements, pump internal inspections, major motor inspections/preventive maintenance that require disconnecting the motor from the pump).

Attachment 1

Response to Request for Additional Information Regarding Braidwood Station Relief Request RV-5 and Byron Station Relief Request RV-9

The following work activities are performed on-line but do not require the RH system suction header to be drained:

Item Name	Frequency
RH pump motor insulation megger test	54 months
RH pump motor refurbishment	15 years
RH pump motor oil change	2 years

Other activities performed on-line which do not necessarily require draining of the RH pump suction header are minor motor inspections, support system work, etc.

Not all the activities noted above are performed every work window. Only activities that need to be scheduled based upon their frequency requirements are included in any given work window. Corrective and/or elective maintenance items that can be performed with only the suction side of the RH system isolated, (i.e., upstream of pump discharge isolation valve), can also be performed during on-line work windows. These activities vary from window to window. Any work that requires draining the RH system downstream of the pump discharge isolation valve must be done during refueling outages as this renders both trains of the RH system inoperable due to the system configuration.

Generally, when the suction of the RH pump is drained for maintenance, it also makes the SI8811A/B valve for that train inoperable as well. CS pump maintenance may also be performed during these work windows since draining of the RH suction piping also makes the recirculation portion of the CS system on the same train unavailable. The intent of moving the SI8811A/B work from refueling outages to on-line is to allow bundling work into fewer work windows, thus decreasing the overall amount of system unavailability.

Specifically, the statement, "As maintenance on the RH system often times requires the same suction-line to be drained and filled, and many of these maintenance activities can now be performed on line, it is impractical to restrict the testing of these valves to a cold shutdown or refueling outage," was made to highlight the fact that there is an opportunity to stroke the SI8811 valves during the course of a normal on-line work window and eliminate the need to perform an additional unnecessary RH suction header drain down during a refueling outage period. Since the SI8811 stroke test can be accomplished on-line while the RH suction piping is drained for other on-line maintenance, as noted above, we consider it impractical to again drain the RH system during a cold shutdown or refueling outage for the sole purpose of stroke time testing the SI8811 valves.

For example, during the next Braidwood refueling outage in spring 2003, the only reason the RH suction header would be drained would be to perform SI8811 valve stroke tests; otherwise, there would be no reason to drain the RH suction header. Therefore, if this relief request were approved, the 18-month surveillance test to stroke the SI8811 valves would be performed during an on-line RH work window.

Response to Request for Additional Information Regarding Braidwood Station Relief Request RV-5 and Byron Station Relief Request RV-9

Question 4

Using prior plant-specific maintenance unavailability data, which is based on a time when little at power maintenance was performed, would non-conservatively bias the estimate of the maintenance unavailability of equipment since it would not accurately reflect the recent change in management maintenance philosophy to do more maintenance activities while at power. Updating (e.g., Bayesian update) the past maintenance unavailabilities would not be appropriate since it would not reflect the current philosophy. Rather, a new estimate of the maintenance unavailabilities needs to be developed that will reflect the increased maintenance activities at power and its basis should be documented (e.g., use plant logs, maintenance data, etc. to include in the current estimate of the maintenance unavailabilities those activities that were being performed during shutdown that will now be performed at power). Hence, this new estimate will be greater than previous estimates of the maintenance unavailabilities of the equipment. In responding to item 2 and considering the response to item 3, please state how you account for maintenance unavailability in your PRA and how your estimate reflects the management philosophy of performing more maintenance at power.

Response to Question 4

In general, Bayesian updating is not used when performing unavailability updates related to performing maintenance at power. Actual out of service duration times are determined from actual plant data over date ranges chosen to capture changes in the current on-line maintenance philosophy. Note that for the CRMP, the risk increase is calculated considering actual plant conditions versus a "zero maintenance" state, (i.e., the risk increase factor for a specific plant maintenance configuration is the ratio of the CDF in the maintenance configuration in question to the CDF with no maintenance on any system, structure or component). Therefore, estimated maintenance unavailabilities do not play a role in the CRMP.

The annual CDF for internal events calculated by the site PRA uses average equipment unavailability consistent with the current on-line maintenance philosophy. The PRA is updated on a three-year frequency and the on-line maintenance assumptions are revised as appropriate.

Question 5

Please discuss the practicality of testing these valves during cold shutdowns.

Response to Question 5

It would be impractical, from a schedule perspective, to restrict stroking the SI8811 valves during a non-refueling outage shutdown while in Mode 5 (i.e., Cold Shutdown), or in Mode 5 or Mode 6 (i.e., Refueling) during a refueling outage.

Response to Request for Additional Information Regarding
Braidwood Station Relief Request RV-5
and
Byron Station Relief Request RV-9

Non-Refueling Outage Cold Shutdown Testing

Cold shutdowns, other than those associated with refueling outages, are infrequent and typically prompted by emergent equipment issues. Resources and scheduled activities during a cold shutdown are primarily devoted to recover from the shutdown and expeditiously return the unit to power. The time required to drain the RH and CS suction lines in order to stroke the SI8811 valves may delay the unit's return to power making it impractical to stroke the SI8811 valves during cold shutdowns. Extending a unit shutdown for the purpose of stroking the SI8811 valves would not have a corresponding safety benefit and would not be consistent with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," ASME/American National Standards Institute (ANSI) OMa-1988, "Operations and Maintenance of Nuclear Power Plants," Section 4.2.1.2 (g), which states: "...it is not the intent of this Part to keep the plant in cold shutdown in order to complete cold shutdown testing."

It should be noted that over the past five years Braidwood Station has not experienced an entry into Mode 5 except as part of a refueling outage sequence. Byron Station has only experienced two entries into Mode 5 over the past five years that were not part of a refueling outage sequence.

Refueling Outage Testing

During Mode 5 and Mode 6, Technical Specifications (TS) define the plant conditions when an RH train may be removed from service. TS 3.4.7, "RCS Loops – MODE 5, Loops Filled," allows one RH loop to be inoperable provided at least two steam generators (SGs) are available; and TS 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation – High Water Level," allows one RH loop to be inoperable provided the reactor cavity is flooded to ≥ 23 feet above the fuel. Both RH loops are allowed to be inoperable with the core defueled.

Upon initial entry to Mode 5 at the beginning of a refueling outage, performing stroke time testing of the SI8811 valves is not practical due to the following activities:

- Both trains of RH are needed to expeditiously cool the reactor coolant system (RCS) to < 120 °F.
- Forced oxidation of the RCS, causing a "crud burst", occurs within 12 hours of entry into Mode 5. Both trains of RH are needed in operation to recirculate the reactor coolant to prevent "dead legs" of high activity water from being trapped in the RCS loops that can subsequently result in increased dose rates.
- The RCS loop stop valves are typically isolated within 20 hours of entry into Mode 5 rendering all SGs unavailable; therefore, a 24-hour window to accommodate valve stroking is not available.

During Mode 6, the entire window of time that the reactor cavity is flooded is about 106 hours. The time that the reactor is defueled is approximately 18 hours. Based on the number of conflicting activities that either render a train of RH inoperable or require RH system support, there is insufficient time to obtain two independent 24-hour windows (i.e., one per RH train) to drain an RH train and stroke time test the associated SI8811 valve. These conflicting activities include:

- Both trains of emergency diesel generator (EDG) surveillance testing (12 hours each) - requires support from the associated RH train.
- Activities that require the draining of the RH discharge header - renders the associated train of RH inoperable.
- 4kV Engineered Safety Features bus outage (usually one every other outage) - renders the associated train of RH inoperable.
- Activities that require isolation of a train of essential service water (SX) - renders the associated train of RH inoperable due to loss of SX cooling to the RH room cooler.

During the return to power, upon entry into Mode 5 from Mode 6, after establishing SG availability, SI8811 valve strokes are also impractical. The window of time between establishing SG availability and Mode 4 entry is typically 34 hours. During this window of time, valve leakage testing is performed as required by TS 3.4.14, "RCS Pressure Isolation Valve (PIV) Leakage." Performing this valve leakage testing requires an RH train swap. Since the plant conditions required to perform these tests (i.e., RCS pressure > 350 psig and $\geq$ 1 reactor coolant pump in operation) occurs about 12 hours into the time window, there would not be sufficient time to insert even one 24-hour window into the schedule to perform the valve strokes without delaying the outage.

<u>Conclusion</u>

The above discussion identifies why it would be impractical to restrict stroking the SI8811 valves solely during a cold shutdown or refueling outage due to conflicting work activities and schedule constraints; however, there may be instances when stroking the SI8811 valves may be feasible during a cold shutdown or refueling outage based on the scheduled work scope. Therefore, as requested in the referenced letter, Byron and Braidwood Stations propose to allow testing of the SI8811 valves, without restriction on plant operating mode, while maintaining an 18-month testing frequency.