Commonwealth Edison Company
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ComEd

May 6, 1997

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Byron Nuclear Power Station, Units 1 & 2
Facility Operating Licenses NPF-37 & NPF-66
NRC Docket No. 50-454 and 50-455

"Ultimate Heat Sink"

Pursuant to Title 10, Code of Federal Regulations, Part 50, Section 90 (10 CFR 50.90), Commonwealth Edison Company (ComEd) proposes to amend Appendix A, Technical Specifications, for Facility Operating Licenses NPF-37 and NPF-66 for Byron Nuclear Power Station, Units 1 & 2 (Byron).

Please note that although the proposed Technical Specifications amendment is applicable to Byron Unit 1 only, this license amendment request is being docketed to reflect Byron Units 1 and 2 and due to common Technical Specification pages being used for both units.

ComEd proposes to revise Technical Specification (TS) 3/4.7.5, "Ultimate Heat Sink," and the associated bases to support steam generator replacement and incorporate recent Ultimate Heat Sink (UHS) design evaluations. ComEd will be replacing the original Westinghouse D4 steam generators (OSGs) at Byron with Babcock & Wilcox International (BWI) steam generators. The replacement steam generators (RSGs) have a larger primary side volume which results in a larger mass/energy release to the containment in the event of a loss of coolant accident (LOCA), and a corresponding increase in the heat load to the UHS.

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This package consists of the following:

Attachment A: Description and Safety Analysis of Proposed Changes to Appendix A

Attachment B: Proposed Changes to the Technical Specification Pages for Byron Station

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Attachment C: Evaluation of No Significant Hazards

Attachment D: Environmental Assessment

Please note the affected improved Technical Specifications (ITS) pages will be prepared and submitted at a later date showing the proposed changes for Byron.

The proposed changes in this license amendment have been reviewed and approved by both On-Site and Off-Site review in accordance with ComEd procedures.

ComEd is notifying the State of Illinois of our application for this license amendment request by transmitting a copy of this letter and its attachment to the designated State Official.

The Byron Unit 1 Steam Generator Replacement Outage (SGRO) is scheduled during the eighth refuel outage (B1R08). ComEd respectively requests the NRC Staff review and approve this license amendment request no later than November 3, 1997, to support the current outage schedule for the lead station, Byron Unit 1.

I affirm that the control of this transmittal is true and correct to the best of my knowledge, information and belief.

Please address any comments or questions regarding this matter to Marcia Lesniak, Nuclear Licensing Administrator at (630) 663-6484.

Sincerely,

John B. Hosmer

John B. Hosmer
Vice President

OFFICIAL SEAL
JACQUELINE T EVANS
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES: 12/15/97

Signed before me on this 6th day of May, 1997 by

Jacqueline T. Evans
Notary Public

Attachment A:	Description and Safety Analysis of the Proposed Changes
Attachment B:	Proposed Changes to Appendix A, Technical Specification, for the Byron Nuclear Power Plant, Units 1 & 2
Attachment C:	Evaluation of Significant Hazards
Attachment D:	Environmental Assessment

cc: A. B. Beach, Regional Administrator - RIII
G. F. Dick, Jr., Byron/Braidwood Project Manager - NRR
S. D. Burgess, Senior Resident Inspector - Byron
Office of Nuclear Safety - IDNS

ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSES FOR PROPOSED CHANGES TO APPENDIX A, TECHNICAL SPECIFICATIONS, OF FACILITY OPERATING LICENSES NPF- 37 and NPF - 66

A. DESCRIPTION OF THE PROPOSED CHANGE

Commonwealth Edison Company (ComEd) proposes to amend Technical Specification (TS) 3/4.7.5, "Ultimate Heat Sink," and the associated Bases for Byron Nuclear Power Station, Units 1 and 2, to support steam generator replacement and incorporate recent Ultimate Heat Sink (UHS) design evaluations. ComEd will be replacing the original Westinghouse D4 steam generators at Byron Unit 1 with Babcock and Wilcox International (BWI) steam generators. The replacement steam generators have a larger primary side volume which results in a larger mass/energy release to the containment in the event of a loss of coolant accident (LOCA), and a corresponding increase in the heat load to the UHS. In addition, ComEd has recently identified several issues requiring resolution to support full qualification of the UHS. The proposed TS changes revise the following limiting conditions for operation (LCOs) for the UHS: the minimum water level in each Essential Service Water (SX) cooling tower basin, the maximum SX pump discharge temperature, and the number of fans supporting heat removal.

The proposed changes are discussed in detail in Section E of this attachment. A marked-up copy of the affected current TS pages showing the proposed changes is included in Attachment B.

B. DESCRIPTION OF THE CURRENT REQUIREMENTS

TS 3.7.5.a requires a minimum UHS cooling tower water level of 50% for both basins whenever the plant is in Modes 1, 2, 3, or 4.

TS 3.7.5.c requires two operable SX makeup pumps. With one SX makeup pump not restored to operable status after the allowed 72 hour period, Action c.2) requires a verification that the same train deep well pump is operable and both UHS cooling tower basin levels are at or above 82%.

TS 3.7.5.d requires the SX pump discharge temperature to be less than or equal to 80°F or less than or equal to 96°F with 6 operable fans running in high speed. This temperature requirement is simultaneously applied to both UHS cooling tower basins.

TS 3.7.5.e requires two operable UHS cooling tower basin level switches. With one switch inoperable, Action e.1)a) requires the restoration of the switch within 72 hours or verification that both basin levels are at or above 82% within one hour and every 2 hours thereafter. With both switches inoperable, Action e.2)a) requires the restoration of one switch within one hour or the verification that both basin levels are at or above 82% within one hour and every 2 hours thereafter.

For an operable UHS, TS 3.7.5.f requires that the National Weather Service (NWS) has not forecast the Rock River water level to exceed 702.0 feet MSL. With the river level forecasted to be above 702.0 feet, Action f.1) requires verification that both deep well pumps are operable with both UHS cooling tower basins at or above 82% within one hour. At least once every two hours thereafter, the verification that both basins are at or above 82% is required. With the river level forecast to exceed 702.0 feet and one deep well pump inoperable, Action f.2) requires the restoration of both deep well pumps to operational status with both basins at or above 82% before the river level exceeds 702.0 feet MSL or within 72 hours. Then, the provisions of Action f.1) are followed.

For an operable UHS, TS 3.7.5.g requires the Rock River water level to be above 670.6 feet MSL. If the river level is at or below 664.7 feet MSL or the river flow rate is below 700 cfs, Action g.2)a) requires verification that both deep well pumps are operable with both UHS cooling tower basins at or above 82% within one hour and verification of basin levels once every two hours thereafter. If the river level is at or below 664.7 feet MSL or the flow is below 700 cfs, and one deep well pump is inoperable, Action g.2)b) requires the restoration of both deep well pumps to operational status with both basin levels at or above 82% within 72 hours. Then the provisions of Action g.2)a) are followed.

For an operable UHS, TS 3.7.5.h requires that the NWS has not issued a tornado watch that includes the Byron Site Area. If the NWS has issued a tornado watch that includes the Byron Site, Action h.1) requires verification that both deep well pumps are operable with both UHS cooling tower basins at or above the 82% level within one hour. A verification of both basin levels is then performed once every two hours thereafter. With a tornado watch issued and one deep well pump inoperable, Action h.2) requires that action be taken to restore both deep well pumps to operational status with both basin levels at or above 82% within 30 minutes. A basin level verification is then performed every two hours thereafter.

Technical Specification Surveillance Requirement TSSR 4.7.5.a requires daily verification that each basin water level is greater than or equal to 50%.

C. BASES FOR THE CURRENT REQUIREMENTS

The UHS for Byron consists of two SX mechanical draft cooling towers and the makeup system providing water to these cooling towers. The mechanical draft cooling towers are used as the heat sink for the SX system during normal operation, emergency operation, and for safe shutdown. Each of the two mechanical draft cooling towers consists of a water storage basin, four fans, four riser valves, and two bypass valves. Normal makeup is provided from the Circulating Water System. Safety-related makeup is from either of two SX makeup pumps. In the event of loss or potential loss of the normal and safety-related makeup, backup is provided by either of two deep well pumps.

The design of the UHS satisfies the requirements of Regulatory Guide 1.27, Revision 2 - 1976, "Ultimate Heat Sink for Nuclear Power Plants," and the following General Design Criteria (GDC) of 10CFR50, Appendix A:

> GDC 2 - Design bases for protection against natural phenomena;
> GDC 4 - Environmental and dynamic effects design basis;
> GDC 5 - Sharing of structures, systems, and components;
> GDC 17 - Electric power systems;
> GDC 38 - Containment heat removal;
> GDC 44 - Cooling water;
> GDC 45 - Inspection of cooling water systems; and
> GDC 46 - Testing of cooling water systems.

The SX cooling tower maximum temperature limits resulted from an UHS design basis reconstitution effort completed in 1992. By letters dated May 17, 1993 and June 14, 1993, the NRC issued the Safety Evaluation Report (SER) for Operating License Amendment No. 54 to Byron Station, Units 1 and 2. The bases for SX cooling tower minimum water levels are provided in Amendment 32, which was approved by the NRC as documented in the SER transmitted by letter dated August 15, 1989.

The current bases are stated as follows:

> The limitations on the ultimate heat sink ensure 1) sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions and 2) adequate inventory is available to provide a 30-day cooling water supply to safety related equipment. The limiting design basis event for the UHS is a loss of coolant accident coincident with a loss of offsite power on one unit, in conjunction with the other unit proceeding to an orderly shutdown and cooldown from maximum power to Mode 5, assuming a single active failure.

The minimum UHS cooling tower basin water level of 50% indicated (873.75 feet above Mean Sea Level) and the service water pump discharge temperature limits assure that adequate thermal capacity is available in the SX water inventory to absorb the initial accident heat input. Six of eight cooling tower fans are required to be operable so that the required number of fans are available after a single active failure. The SX cooling tower basin temperature will remain less than 100°F.

A volume of 200,000 gallons in each cooling tower basin is available to supply the auxiliary feed water system. The basin inventory is also available for transporting heat from safety related equipment during normal and accident conditions. Due to evaporation, blowdown, and auxiliary feedwater supply the basin inventory alone is not adequate for the required 30-day cooling water supply, therefore makeup systems are provided to replenish the basin inventory.

Discussion of the current supporting analyses

The time dependent basin temperature calculations were performed assuming six operable fans are running at high speed at the start of the event. Initial basin temperatures ranging from 80°F to 96°F were used to analyze the post-LOCA basin temperature response following a variety of postulated failures. The post-LOCA scenario that resulted in the highest calculated peak basin temperature assumed four operating Reactor Containment Fan Coolers (RCFCs), two operating Containment Spray (CS) pumps and the single active failure of one of the six operating SX cooling tower fans. The calculated peak basin temperature remained less than 100°F with an initial basin temperature of less than or equal to 96°F. SX basin temperature and SX pump discharge temperature are essentially the same since the piping from the tower basins to the pumps is underground and the temperature increase across the SX pump at accident flow rates is negligible. Temperature is measured at the discharge of each SX pump.

Assuming there are no fans initially running in high speed, the analysis allows 10 minutes before operator action is taken to start the operable fans. One fan is assumed to fail to start as the single active failure. Calculations verify that with a SX pump discharge temperature limit of 80°F, adequate thermal capacity is available in the SX water inventory to absorb the initial postulated heat input prior to requiring operator action to open risers and start the cooling tower fans.

TS 3.7.5 specifies two UHS basin water level limits. The minimum operational UHS cooling tower water level of 50% applies to conditions where the UHS relies on the makeup capability of one SX makeup pump. The cooling tower water level of 82% applies to conditions where the UHS relies on the makeup capability of one deep well pump which has a lower capacity than the SX makeup pump. Calculations determined that adequate makeup capacity exists for these two combinations of minimum water level and makeup sources to replenish basin inventories. The calculations evaluated basin volume changes as a function of time. The calculations included a single active failure of one SX makeup pump. For the deep well makeup case, a two hour delay was assumed for the operator to start the deep well pump(s) locally and to align the system to deliver water to the basin. The calculations took into consideration basin inventory losses for the following:

- Blowdown (continuous for the SX makeup case; isolated at two hours for the deep well makeup case),
- Auxiliary Feedwater (AF) supply to the non-LOCA unit,
- Evaporation based on the meteorological conditions for the worst 24 hour period and heat load on the tower after a loss of offsite power (LOOP)/LOCA that corresponds to the highest integrated heat load for the first eight hour period, and
- UHS cooling tower drift.

D. NEED FOR REVISION OF THE REQUIREMENTS

As communicated to the Nuclear Regulatory Commission (NRC) in Licensee Event Report (LER) No. 454: 96-019S3, "SX Cooling Tower Basin Inspection Revealed Silt Build-up Exceeding Surveillance Acceptance," and the Pre-Decisional Enforcement Conference on January 24, 1997, ComEd has recently identified several issues requiring evaluation and/or corrective action to support the full qualification of the UHS. These issues include:

- Increased post-accident heat load from Unit 1 due to steam generator replacement,
- Valve leakage through closed Essential Service Water Cooling Tower (SXCT) bypass and riser valves,
- Reduced usable SX basin water volume due to observed silting on the bottom of the basins and the anti-vortex duct configuration,
- Revised SXCT blowdown flow rate and blowdown isolation time,
- New makeup scenarios for two unit plant trip from full power, and
- New temperature scenarios assuming only one SXCT fan initially out-of-service.

The original Westinghouse model D4 steam generators will be replaced with BWI feed ring type steam generators designed specifically for Byron Unit 1. The replacement steam generators have a larger primary side volume which results in a larger mass/energy release to the containment during a LOCA, and a corresponding increase in the heat load to the UHS through the SX system.

Analyses which support current TS 3/4.7.5 did not account for leakage past closed SXCT bypass and riser isolation valves. The leakage past these closed valves has the effect of decreasing the percentage of SX flow cooled by the active cooling tower cells. Additionally, each operating riser has a drain line that diverts flow to the basin. This total leakage has been quantified and factored into the SX system hydraulic analyses, which were used to compute flow rates in each of the riser and bypass lines. This more accurate representation of SX flow is used in the revised basin temperature calculations.

Analyses which support current TS 3/4.7.5 also did not account for reduced SX basin water inventory available for use due to the existence of silting in the bottom of the basins and the anti-vortex duct configuration. The effect of these items is to reduce the amount of water that can be considered available for use for heat removal and water inventory losses during emergency plant operation.

SXCT blowdown flow rate and blowdown isolation time were considered in the development of the current UHS makeup calculations. Optimization of how much water to allow for blowdown from the SX system, and when this blowdown should be isolated has been reviewed. The blowdown flow in the revised calculations is maximized to facilitate better chemistry control.

The current SX basin makeup scenarios address a LOOP/LOCA on one unit with an orderly shutdown on the non-accident unit. The current makeup calculation did not include AF supply to the LOCA unit and simply modeled AF to the non-LOCA unit as a constant flow rate. AF flow to the non-LOCA unit actually varies with time (varies with residual decay heat). The revised time dependent AF consumption rate was high enough to raise the question as to whether a two unit plant trip scenario may be more limiting for makeup than the LOOP/LOCA scenario. The two unit plant trip from full power case has been shown to be more limiting for makeup considerations.

The current SX basin temperature calculations for initial basin temperatures > 80°F and ≤ 96°F are based on six operable fans initially running in high speed. For initial basin temperatures ≤ 80°F, current SX basin temperature calculations are based on no fans initially running in high speed. Normally more than six fans are maintained operable and capable of running in high speed. Therefore, in order to provide additional operating flexibility, a new temperature limit was developed for the case with more than six operable fans initially running in high speed.

The revised UHS analyses demonstrate that changes to certain operating parameters and LCOs for the UHS are desired. In summary, the revised UHS analyses determined three viable initial SX temperatures and two required water levels:

- maximum of 80°F with fewer than six operable fans running in high speed,
- maximum of 90°F with six operable fans running in high speed,
- maximum of 96°F with more than six operable fans running in high speed,
- For scenarios using SX makeup from the river, the minimum initial UHS basin water level is 56%, and
- For scenarios using deep well makeup, the minimum initial UHS basin water level is 86%.

E. DESCRIPTION OF THE REVISED REQUIREMENTS

In the proposed changes, the normal operating UHS basin water level with SX makeup available from the Rock River is conservatively increased to 60% in LCO 3.7.5.a, Action a, and TSSR 4.7.5.a. The minimum basin water level requirement is consevatively increased to 90% for all Actions that assume makeup availability from the deep well pumps. This includes Actions c.2), e.1)a), e.2)a), f.1), f.2), g.2)a), g.2)b), h.1) and h.2).

TS 3.7.5.b is revised to clarify that more than six fans may be operable consistent with the revisions to TS 3.7.5.d. The SX pump discharge temperature limits of TS 3.7.5.d are revised to allow an additional cooling tower fan configuration. For SX pump discharge temperatures >80°F but ≤90°F, six operable fans must be running in high speed. For SX pump discharge temperatures >90°F but ≤ 96°F, more than six operable fans must be running in high speed.

The Bases for TS 3/4.7.5 are revised to provide clarification of the temperature limits and the makeup system design basis.

F. BASES FOR THE REVISED REQUIREMENTS

The proposed changes to TS 3/4.7.5 continue to satisfy the requirements of Regulatory Guide 1.27, Revision 2 - 1976, "Ultimate Heat Sink for Nuclear Power Plants," and 10CFR50, Appendix A, GDCs 2, 4, 5, 17, 38, 44, 45, and 46.

The revised limitations on the UHS temperature and volume ensure sufficient cooling capacity is available for continued operation of safety related equipment during normal and accident conditions and adequate inventory to provide a 30-day cooling water supply to safety related equipment. The limiting design basis event for the UHS basin temperature continues to be a LOCA coincident with a LOOP on one unit, in conjunction with the non-accident unit proceeding to an orderly shutdown and cooldown from maximum power to Mode 5, assuming a single active failure. The limiting event for UHS makeup is a two unit trip from full power with loss of the normal AF supply source.

The revised minimum UHS cooling tower basin volume and the SX pump discharge temperature limits assure that adequate thermal capacity is available in the SX water inventory to absorb the initial accident heat input. Depending on SX basin temperature, six or more fans are required to be available or running so that the required number of fans are available after a single active failure to assure the basin temperature remains less than 100°F.

Discussion of the Revised Supporting Analyses

UHS Basin Temperature Evaluation:

New time dependent basin temperature calculations were performed to determine the response of the UHS with the proposed limits on number of operable fans and SX pump discharge temperature. The previous calculations were reviewed to identify the most limiting scenarios. The identified scenarios were revised to include the following inputs:

- Increase the heat load on the SX System associated with the replacement steam generators. Since the replacement steam generators have a larger primary side volume and operate at a higher secondary pressure (for the same average primary temperature), there will be a larger mass/energy release to the containment during a LOCA. This increases the initial postulated accident heat load by 37 Mbtu/hr, resulting in a new total peak initial heat load to the UHS of 971 Mbtu/hr.

- Decrease the percentage of SX flow cooled by the active cooling tower cells to conservatively account for possible valve leakby of closed SXCT bypass and riser valves. Based on measured leakage for the worst case bypass and riser valves, all closed bypass valves were assumed to have 900 gpm of leakby and all closed riser valves were assumed to have 635 gpm of leakby. Additionally, 250 gpm of bypass flow was assumed for the open drain line in each riser.

- Reduce the available SX System water inventory by the equivalent volume equal to an average of six inches of silt on the bottom of the SX cooling tower basins. Periodic basin inspections are performed on the cooling tower basins. Administrative controls are in place to assure that silt buildup will not be greater than an average of six inches in the basin.

- New scenarios were evaluated assuming seven cooling tower fans operable and running in high speed at the start of the accident (i.e., one fan out-of-service).

Initial SX basin temperatures were calculated based on maintaining the peak basin temperature less than 100°F for all evaluated scenarios. With six operable fans running in high speed, a single active failure of one of the SX cooling tower fans, and an initial basin temperature of 90°F, the calculated peak basin temperature is 99.6°F. With seven operable fans running in high speed, a single active failure of one of the SX cooling tower fans, and an initial basin temperature of 96°F, the calculated peak basin temperature is 98.8°F. SX basin temperature and SX pump discharge temperature are essentially the same since the piping from the tower basins to the pumps is underground and the temperature increase across the SX pump at accident flow rates is negligible. Temperature is measured at the discharge of each SX pump.

The revised scenarios were shown to bound all scenarios previously evaluated. Therefore, the new limits on number of operable fans running in high speed and initial SX basin temperature were found to be acceptable. As identified in a previous ComEd submittal (related to Amendment 54) dated March 31, 1992, several of the assumptions used in the calculations were inherently conservative. These conservatisms, while not being quantitatively analyzed, are still applicable and provide additional margin to the 100°F SX system basin design temperature. Some of the major conservatisms are:

- Basin level used in the analysis was less than the revised TS minimum. Additionally, basin level is normally maintained higher than the TS minimum level, which would provide additional water inventory heat capacity.

- No credit was taken for ambient heat dissipation in passive cooling tower cells (i.e., those cells with riser valves open but the fans off). Any cooling that occurs from these passive cells or from fans running in low speed would further decrease basin temperature and provide more margin to the maximum allowed basin temperature.

- The 80°F basin temperature calculations, which bound operations of the tower at ≤ 80°F basin temperature, assumed 10 minutes for operator action to align riser valves and start the fans in high speed. The fans will be running in high speed earlier than the analysis assumed when started in accordance with emergency operating procedures.

No credit was taken for the cooling contribution from the makeup flow of any of the makeup systems. The makeup system for the UHS takes a suction from the Rock River or from the deep well system which typically supply water at a temperature less than 90°F.

UHS Basin Water Level Evaluation:

Time dependent basin volume calculations were performed to determine the adequacy of the SX river makeup and the deep well makeup. The results of the calculations for scenarios involving one SX river makeup pump or one deep well pump were used to determine new basin level requirements.

Two scenarios were evaluated for both the SX river makeup case and the deep well case. They are as follows:

1. Scenario 1 evaluated a LOOP/LOCA on one unit, orderly shutdown on the second unit, loss of the normal AF supply source, and a single failure (i.e., a failure of one of the makeup pumps). The accident unit was assumed to take AF suction from the SX system for the first 30 minutes of the event. The non-accident unit was assumed to use AF for a cooldown from Hot Standby to a Reactor Coolant System temperature of 350°F.

2. Scenario 2 evaluated a two unit plant trip from full power with the loss of normal AF supply source and a single active failure (i.e., a failure of one of the makeup pumps). Due to the loss of the normal AF supply source, AF suction for both units was assumed to be taken from the SX system for the first four hours of the event.

The following inputs were used in the revised UHS cooling tower water level analyses:

- A cooling tower computer model was used to determine the evaporation rate for various heat loads assuming weather conditions for the maximum one-day evaporative period. As described in the UFSAR, the maximum evaporative period was defined as the period having the maximum difference between the dry bulb temperature and the dew point temperature. The maximum one-day evaporative period was previously determined from meteorological data recorded in Springfield and Peoria from 1948 to 1977, and it occurred on July 18, 1954. The evaporation rate results were used to create an equation for maximum evaporation given the heat load. Evaporation losses for the time dependent volume calculations were calculated using this equation and the time dependent heat load on the UHS for each scenario.

Separate time dependent heat load curves were used for each scenario. For the LOOP/LOCA scenario, the same heat load curve was used for the basin temperature analysis. The peak heat load of 971 Mbtu/hr occurred approximately two minutes into the scenario. For the two unit plant trip scenario, the heat load was conservatively calculated as a constant value of 113.5 Mbtu/hr for the first four hours. After transfer to residual heat removal (RHR) shutdown cooling, the heat load peaked at 587 Mbtu/hr and then dropped over time as the decay heat load was reduced.

- The UHS cooling tower drift flow rate (spray water that does not evaporate or go into the tower basins) of 10.4 gpm was assumed to be continuous from the beginning of the event.

- The basin blowdown was assumed to be a constant flow which is intended to maintain normal system chemistry. Blowdown flow is administratively controlled and a maximum of 600 gpm was assumed. Blowdown was assumed to be isolated within two hours of an event which challenges SX basin volume. This applied to both the SX river makeup and the deep well makeup cases.

- For the analyzed cases, makeup from the Rock River from a single pump was at a rate of 1350 gpm and began immediately. Makeup from a single deep well pump was at a rate of 550 gpm. The deep well pumps require manual actuation which was assumed to occur two hours into the event.

- For the LOOP/LOCA scenario, AF flow to the accident unit was assumed to be 1280 gpm for the first 30 minutes. After 30 minutes, it was assumed that AF flow will be terminated and decay heat removal will be provided by the Emergency Core Cooling System (ECCS). For the non-accident unit, the minimum time to reach hot shutdown ($T < 350°F$), assuming an orderly shutdown and cooldown from maximum power using normal operating procedures, was a total of eight hours. Main feedwater was relied on for the first four hours to place the unit in Hot Standby at 557°F from full power conditions. AF flow to the non-accident unit was assumed to be initiated after four hours and was calculated based on decay heat from full power trip with a cooldown rate of 50°F/hr. This AF supply source was assumed to be the UHS basin.

- For the two unit plant trip scenario, the time dependent AF flow was calculated based on decay heat from a full power trip and a cooldown rate of 50°F/hr. AF flow to each unit was assumed to be initiated immediately and to be terminated four hours after the start of the event, at which time decay heat removal was assumed to be provided by RHR shutdown cooling.

- The minimum usable water level was conservatively calculated to be at elevation 870'3" (2" above the top holes on the anti-vortex duct) which is approximately 10" below 0% indicated basin level. This is the minimum water level which provides adequate head through the anti-vortex duct openings to support 48,000 gpm of flow (two times the normal flow of a single SX pump).

- Due to the SX system layout, train crossties and possible combinations of pumps and riser valves, it was assumed that a mismatch in inflow and outflow existed for each basin. This resulted in a cross-flow between the basins. When the water level in the basins was above 66%, the basins were interconnected and the cross-flow had no effect on basin level. When the water level in the basins decreased below 66%, the cross-flow resulted in one basin being at 66% and continually overflowing into the lower basin. If inventory losses were greater than the makeup flow, the lower basin would continue to decrease until steps were taken by operators to equalize basin levels.

  No operator action to equalize basin level was assumed in the first 3 hours of the event. After 3 hours, operator action was assumed to equalize basin levels by matching inflow and outflow to each basin. It was reasonable to assume that the operators would take action because there would be advance warning of basin level depletion (alarms and emergency procedure guidance to check UHS level) and adequate time existed to take corrective action before one basin reached the minimum usable water level. To account for manual actions to equalize basin levels, 50,000 gallons of margin was included in the combined basin water volume requirement.

Initial basin water levels were calculated using the inputs described above. The two unit plant trip is the limiting case when relying on SX river makeup pumps. For this case, a minimum initial basin level of 56% is required. The two unit plant trip is also the limiting case when relying on deep well makeup pumps. For this case, a minimum initial basin level of 86% is required. For all cases, the level in both basins remained above the minimum usable water level throughout the event.

Several conservatisms exist in the revised analysis for initial basin water level. They include the following:

- The elevation of minimum usable water level used in the calculation (870'3") was based on an assumed flow rate for two pumps drawing from one basin (48,000 gpm). This is two times the nominal flow of one pump. Actual two pump flow would be less. Ultimately, with a single pump running, this level could be decreased.

- Evaporation losses were based on the worst-case one day evaporative rate applied for the duration of the event. Use of less limiting conditions would lower the evaporative losses.

- Two hours was assumed for isolating blowdown and starting the deep well pumps. Based on previous operator walk-through of this evolution, blowdown will be isolated and the deep well pumps started earlier than assumed in the analysis.

- Only one of the four makeup pumps (either one of the two SX makeup pumps or one of the two deep well pumps) was credited in the analyses. Usually, more than one pump is expected to be available.

G. IDENTIFICATION OF ANY SCHEDULAR NEEDS FOR THE AMENDMENT

The Byron Unit1 Steam Generator Replacement Outage (SGRO) is scheduled during the eighth refuel outage (B1R08). Approval of this change is requested by November 3, 1997 to support the current outage schedule.