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United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 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: Request for a License Amendment to Modify the Method of Controlling Unfavorable Exposure Time Related to an Anticipated Transient Without Scram Event for Byron and Braidwood Stations

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company (Exelon), LLC is requesting changes to Appendix A, Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66, for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed change will revise the method of controlling the fuel cycle unfavorable exposure time (UET) related to an anticipated transient without scram (ATWS) event. UET is defined as the time during cycle life when the reactor core reactivity feedback is not sufficient to prevent reactor coolant system pressure from exceeding 3200 psig assuming specific plant configurations during an ATWS event. Currently the method of controlling UET is described in a document referenced in TS 5.6.5, "Core Operating Limits Report (COLR)," Item b.5. The current methodology controls UET by limiting the value of the moderator temperature coefficient (MTC) inherent in the reactor core design. The proposed license amendment would utilize the Configuration Risk Management Program to administratively control the availability of ATWS risk significant equipment to minimize core UET. By removing the UET MTC constraint, reload cores may be designed with a more positive MTC as allowed by the TS. Designing reload cores with a more positive MTC results in significant benefits including reduced fuel cost, reduced outage time, and reduced amount of spent fuel.

This amendment request is subdivided as shown below.

A001

Attachment A provides a description and safety analysis of the proposed changes. Attachment A is subdivided into the following sections:

1.0 Introduction

2.0 Description of the Proposed Amendment

3.0 Background

4.0 Regulatory Requirements and Guidance

5.0 Technical Analysis

6.0 Regulatory Analysis

7.0 No Significant Hazards Consideration

This section describes our evaluation performed using the criteria in 10 CFR 50.91(a), "Notice for public comment," paragraph (1), which provides information supporting a finding of no significant hazards consideration using the standards in 10 CFR 50.92, "Issuance of amendment," paragraph (c).

8.0 Environmental Consideration

This section provides information supporting an Environmental Assessment. We have determined that the proposed changes meet the criteria for a categorical exclusion set forth in paragraph (c)(10) of 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review."

9.0 Precedent

10.0 References

Attachments B-1 and B-2 provide the marked up TS pages with the proposed change indicated for Braidwood Station and Byron Station. Attachments B-3 and B-4 provide the typed TS pages with the proposed change incorporated. The TS Bases pages associated with this proposed TS change have been included for informational purposes.

This proposed change has been reviewed and approved by the Braidwood Station and Byron Station Plant Operations Review Committees and Nuclear Safety Review Boards in accordance with the requirements of the Exelon Quality Assurance Program.

We are notifying the State of Illinois of this request for amendment by sending a copy of this letter and its attachments to the designated state official.

The anticipated core design for Braidwood Station, Unit 1 Cycle 11, commencing in early April 2003, will require use of this proposed UET methodology in order to remove the MTC constraint. The fuel assemblies for this cycle will be ordered in early September 2002; therefore, we request NRC approval of this license amendment request by September 1, 2002.

Should you have any questions regarding this submittal, please contact Mr. J. A. Bauer at (630) 657-2801.

Respectfully,

K. A. Ainger for

Keith R. Jury
Director – Licensing
Mid-West Regional Operating Group

Attachments: Attachment A, Description and Safety Analysis for Proposed Changes, including Information Supporting a Finding of No Significant Hazards; and Information Supporting an Environmental Assessment
Attachment B-1, Marked-up Pages For Proposed Changes, Braidwood Station
Attachment B-2, Marked-up Pages For Proposed Changes, Byron Station
Attachment B-3, Incorporated Proposed Changes, Typed Pages, Braidwood Station
Attachment B-4, Incorporated Proposed Changes, Typed Pages, Byron Station

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

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| **STATE OF ILLINOIS** | ) | |
| **COUNTY OF DUPAGE** | ) | |
| **IN THE MATTER OF** | ) | |
| **EXELON GENERATION COMPANY, LLC** | ) | **Docket Numbers** |
| **BYRON STATION UNITS 1 AND 2** | ) | **STN 50-454 AND STN 50-455** |
| **BRAIDWOOD STATION UNITS 1 AND 2** | ) | **STN 50-456 AND STN 50-457** |

**SUBJECT:** **Request for a License Amendment to Modify the Method of Controlling Unfavorable Exposure Time Related to an Anticipated Transient Without Scram Event for Byron and Braidwood Stations**

## AFFIDAVIT

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

K. A. Ainger
K. A. Ainger
Manager – Licensing

Subscribed and sworn to before me, a Notary Public in and

for the State above named, this 19th day of

March, 2002.

Timothy A. Byam
Notary Public

"OFFICIAL SEAL"
TIMOTHY A. BYAM
NOTARY PUBLIC STATE OF ILLINOIS
COMMISSION EXPIRES 12/04/05

## ATTACHMENT A

## BYRON STATION, UNITS 1 AND 2
## BRAIDWOOD STATION, UNITS 1 AND 2

## DESCRIPTION AND SAFETY ANALYSIS FOR PROPOSED CHANGES

### 1.0 INTRODUCTION

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (Exelon) is requesting a change to Appendix A, Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66, for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed change will revise the method of controlling the fuel cycle unfavorable exposure time (UET) related to an anticipated transient without scram (ATWS) event. UET is defined as the time during fuel cycle life when the reactor core reactivity feedback is not sufficient to prevent reactor coolant system (RCS) pressure from exceeding 3200 psig assuming specific plant configurations during an ATWS event. Currently the method of controlling UET is described in a document referenced in TS 5.6.5, "Core Operating Limits Report (COLR)," Item b.5. The current methodology controls UET by limiting the value of the moderator temperature coefficient (MTC) inherent in the reactor core design. The proposed license amendment would utilize the Configuration Risk Management Program (CRMP) to administratively control the availability of ATWS risk significant equipment to minimize core UET. By removing the UET MTC constraint, reload cores may be designed with a more positive MTC as allowed by the TS. Designing reload cores with a more positive MTC results in significant benefits including reduced fuel cost, reduced outage time, and reduced amount of spent fuel.

The proposed change would delete TS 5.6.5.b.5 and appropriately revise the discussion on ATWS in the Updated Final Safety Analysis Report (UFSAR), Section 15.8, "Anticipated Transient Without Scram." This UFSAR section will reference this license amendment request and the anticipated NRC Safety Evaluation approving the license amendment; and will specify that the CRMP will be utilized to manage the availability of ATWS risk significant equipment.

The marked-up TS pages are provided in Attachments B-1 and B-2 for Braidwood Station and Byron Station, respectively. The TS Bases pages associated with this proposed TS change have been included for informational purposes.

**Schedule Requirements**

The anticipated high reactivity core design for Braidwood Station, Unit 1 Cycle 11, will require use of this proposed UET methodology in order to remove the MTC constraint. The fuel assemblies for this cycle will be ordered in early September 2002; therefore, we request NRC approval of this license amendment request by September 1, 2002. We request that the implementation date of this amendment, for each unit at Byron Station and Braidwood Station, coincide with the startup of Braidwood Station, Unit 1 Cycle 11, scheduled to commence in early April 2003.

## ATTACHMENT A

## BYRON STATION, UNITS 1 AND 2
## BRAIDWOOD STATION, UNITS 1 AND 2

## DESCRIPTION AND SAFETY ANALYSIS FOR PROPOSED CHANGES

## 2.0 DESCRIPTION OF THE PROPOSED AMENDMENT

TS Section 5.6.5.b.5 references a ComEd (now Exelon) letter from D. Saccomando to the Office of Nuclear Reactor Regulation dated December 21, 1994 (i.e., Reference 1). This letter commits Exelon to limiting the value of the MTC, as documented in the COLR, to a value that ensures the plant response to an ATWS event is "unfavorable" for not more than 5% of the total operating cycle.

TS Section 5.6.5.b.5 currently states:

> "ComEd letter from D. Saccomando to the Office of Nuclear Reactor Regulation dated December 21, 1994, transmitting an attachment that documents applicable sections of WCAP-11992/11993 and ComEd application of the UET methodology addressed in "Additional Information Regarding Application for Amendment to Facility Operating Licenses-Reactivity Control Systems.""

TS Section 5.6.5.b.5 will be deleted and the discussion on ATWS in Section 15.8 of the UFSAR will be appropriately revised to reflect the proposed methodology of controlling the UET associated with an ATWS event. This UFSAR section will reference this license amendment request and the anticipated NRC Safety Evaluation approving this license amendment; and will specify that the CRMP will be utilized to manage the availability of ATWS risk significant equipment. Specifically, a statement similar to the following will be included in the UFSAR.

> "There is no restriction on the Moderator Temperature Coefficient (MTC) due to the unfavorable exposure time (UET) associated with anticipated transient without scram (ATWS) events. The methodology used to determine and control UET is discussed in a letter from Keith R. Jury (Exelon) to the NRC, "Request for a License Amendment to Modify the Method of Controlling Unfavorable Exposure Time Related to an Anticipated Transient Without Scram Event for Byron and Braidwood Stations," dated March 15, 2002. This license amendment request was subsequently approved in NRC Safety Evaluation, "TBD," dated TBD." The Configuration Risk Management Program will be utilized to manage the availability of ATWS risk significant equipment and ensure a favorable plant response to an ATWS event."

## 3.0 BACKGROUND

The final ATWS Rule, 10 CFR 50.62, "Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants," became effective on July 26, 1984. ATWS had been the subject of a multitude of studies and regulatory activities since it was first raised as a potential safety issue in the late 1960s. In 1982, the NRC established a Task Force and Steering Group to consider the various alternatives to addressing ATWS. The results of the Task Force evaluation were documented in SECY-83-293, "Amendments to 10 CFR 50 Related to Anticipated Transients Without Scram (ATWS) Events," dated July 19, 1983, which formed the basis for the resulting ATWS Rule. The final ATWS Rule stated the following:

> "Each pressurized water reactor must have equipment from sensor output to final actuation device, that is diverse from the reactor trip system, to automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip under conditions indicative of an ATWS. This equipment must be designed to perform its function in a reliable manner and be independent (from sensor output to the final actuation device) from the existing reactor trip system."

Based on the results of the SECY-83-293 value/impact assessment, the NRC Task Force recommended installation of ATWS Mitigating Systems Actuation Circuitry (AMSAC) for Westinghouse plants. AMSAC consists of equipment to trip the turbine and initiate auxiliary feedwater diverse from the reactor trip system. The SECY-83-293 assessment used a probabilistic model which assumes that ATWS overpressure occurs if the pressure limit corresponding to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Level C service limit criterion is exceeded. This limit has been conservatively defined as 3200 psig for Westinghouse plants. The underlying premise of the SECY-83-293 study is that core damage will occur any time the RCS pressure exceeds 3200 psig. The SECY-83-293 study used an acceptable ATWS risk target of $1x10^{-5}$ per reactor year.

On March 23, 1994, ComEd (now Exelon) submitted a license amendment request (i.e., Reference 6) to the NRC requesting changes to the TS to support plant operating cycles designed with a positive MTC. Supporting analyses using a deterministic approach, as described in Section 4.3.8, "Pressure Relief (PR)," Section 4.6.8, "Pressure Relief (PR)," and Appendix B, Section B.7.1, "ATWS Critical Power Trajectory Methodology," of WCAP-11992, "Joint Westinghouse Owners Group/Westinghouse Program: ATWS Rule Administration Process," dated December 1988, was submitted to justify the specific MTC for each operating cycle. The processes described in WCAP-11992 are based on calculations submitted to the NRC in a Westinghouse letter (i.e., Reference 4) dated December 30, 1979, which provided the Westinghouse contribution to the basis for the original ATWS Rule. One of the major issues addressed in the ComEd analysis was fuel cycle UET; where UET is defined as the time during cycle life when the core reactivity feedback is not sufficient to prevent RCS pressure from exceeding 3200 psig for a given plant configuration during an ATWS event.

In the ensuing NRC Safety Evaluation, dated July 27, 1995, approving use of the proposed license amendment, the NRC stated, "The analysis must show that the UET, given the cycle design (including MTC), will be less than 5 percent, or equivalently, that ATWS pressure limit will be met for at least 95 percent of the cycle. If the limit is not met the core design would be changed until the 95 percent level is achieved." The Safety Evaluation further stated, "This 95 percent probability level for the UET is equivalent to the probability level in the reference analysis for the ATWS rule basis." TS 5.6.5.b.5 was consequently added to reference the ComEd letter from D. Saccomando to the Office of Nuclear Reactor Regulation dated December 21, 1994, which specifically committed to this requirement. The MTC limits for each cycle are maintained in the Core Operating Limits Report.

To ensure the MTC specified in the COLR for each cycle remains bounded by the Westinghouse ATWS analyses, the UET methodology specified in TS 5.6.5.b.5 is utilized for

Byron and Braidwood Stations to constrain the MTC ensuring that the UET for each reload core design is limited to less than 5% of the operating cycle life.

The 5% UET limit effectively constrains the reactor core reload design MTC to values close to that corresponding to 0 pcm/°F at the beginning of life (BOL), Hot Zero Power (HZP) condition, although TS Section 3.1.3, "Moderator Temperature Coefficient (MTC)," allows a maximum upper limit of +7 pcm/°F at the HZP condition. By removing the UET constraint, reload cores could be designed with a positive MTC while remaining within the limits established by the TS. Operation of the plant with a positive MTC satisfies all design criteria and results in significant benefits. The primary benefits of a positive MTC are given below.

1. Reduces number of burnable absorbers used to control MTC.

2. Reduces outage time by reducing burnable absorber handling requirements.

3. Reduces fuel cost; approximately $0.5 million per cycle.

4. Reduces the amount of spent fuel and burnable absorbers for waste disposal.

5. Reduces neutron fluence on all reactor vessel material including the core baffle since a loading pattern with a positive MTC can result in less leakage and lower peripheral assembly power.

6. Produces more favorable results for cool down transients such as a main steam line break.

## 4.0 REGULATORY REQUIREMENTS AND GUIDANCE

Section 15.8 of the UFSAR discusses ATWS events and notes that the effects an ATWS are not considered in the design basis transients analyzed in the Updated Final Safety Analysis (USFAR), Chapter 15, "Accident Analysis." However, 10 CFR 50.62, (i.e., the ATWS Rule), requires that each pressurized water reactor have equipment that is diverse from the reactor trip system to automatically initiate the auxiliary feedwater system and initiate a turbine trip under conditions indicative of an ATWS. The analysis documented in SECY-83-293 formed the basis for the ATWS Rule which established an acceptable ATWS risk target of $1x10^{-5}$ per reactor year.

Byron and Braidwood Stations subsequently installed the AMSAC system to meet the requirements of the ATWS Rule. In addition, compliance with the ATWS Rule was demonstrated based on the analysis presented in WCAP 11992. This WCAP is based on the calculations submitted to the NRC in Westinghouse letter, NS-TMA-2182, dated December 30, 1979, which provided the Westinghouse contribution to the original ATWS Rule. This analysis, in part, addressed the fuel cycle UET associated with an ATWS event. Subsequently, Byron and Braidwood Stations made a commitment to limit the UET to less than 5% of the fuel cycle as noted in TS 5.6.5.b.5 which references a letter from D. Saccomando to Office of Nuclear

Reactor Regulation dated December 21, 1994, (i.e., Reference 1). This commitment restrains the reactor core reload design MTC to less than that allowed by the TS.

**Impact on Previous Submittals**

No other license amendment requests currently under review by the NRC are impacted by the information presented in this license amendment request.

## 5.0 TECHNICAL ANALYSIS

An ATWS is an anticipated operational occurrence (e.g., loss of feedwater, loss of condenser vacuum, or loss of offsite power) that is accompanied by a failure of the reactor trip system to shut down the reactor. A series of generic studies addressing ATWS (see References 4 and 5) showed that acceptable consequences would result following an ATWS event provided the turbine trips and auxiliary feedwater flow is initiated in a timely manner.

**Current UET Methodology**

The calculation methodology and definition of UET are addressed in References 1, 2 and 3. WCAP-11992, "Joint Westinghouse Owners Group/Westinghouse Program: ATWS Rule Administration Process," dated December 1988, defines the term UET as the time during cycle life when the core reactivity feedback is not sufficient to prevent RCS pressure from exceeding 3200 psig for a given plant configuration during an ATWS event. The UET calculation methodology in WCAP-11992 is performed using a conservative design margin. The calculation methodology is based on a neutronics model that assumes the most positive predicted MTC for a given fuel cycle plus approximately 2 pcm/°F for conservatism; therefore, this method conservatively calculates the amount of UET during a cycle. During startup physics testing, the measured MTC result is compared to the MTC predicted by the neutronics model used in the UET calculations to ensure the UET calculation remains bounding.

The Westinghouse analyses which formed part of the basis for the ATWS Rule, assumed a hot full power (HFP) MTC value of –8 pcm/°F for the limiting ATWS events. This HFP MTC value was based on an assumed MTC value of 0 pcm/°F at the BOL, HZP condition; and a supporting analysis to show that the –8 pcm/°F HFP MTC value would not be exceeded for the entire cycle, at a 95% probability with a 95% confidence level. However, it is noted that the TS maximum upper MTC limit specified in TS Section 3.1.3, is +7 pcm/°F at HZP conditions; therefore, the HFP MTC could potentially be more positive than the –8 pcm/°F value assumed in the Westinghouse ATWS analyses and still meet the TS requirements.

Compliance with the ATWS Rule is demonstrated on a cycle-by-cycle basis by focusing on two primary topics discussed in References 2 and 3. These topics are the UET and critical trajectory methodologies. The critical trajectory and UET calculations were performed using the methodology from WCAP-11992, Section 4.3.8, "Pressure Relief (PR)," Section 4.6.8, "Pressure Relief (PR)," and Appendix B, Section B.7.1, "ATWS Critical Power Trajectory Methodology." In the application of the UET methodology, the ATWS transient point kinetics information is transferred into steady-state conditions for comparison with cycle-specific core condition calculations. During peak ATWS pressure conditions, RCS heatup is relatively slow; therefore, use of steady-state analysis is acceptable. The critical trajectories are subsequently determined from these calculations and represent the loci of data points at specific plant conditions (e.g., reactor power vs. core inlet temperature) that result in an RCS pressure of 3200 psig given an ATWS event. The UET is the period during the fuel cycle when reactivity feedback is insufficient to maintain RCS pressure below 3200 psig during an ATWS event for a given set of RCS conditions and plant equipment configuration.

The cycle-specific calculations are performed with the appropriate ATWS initial conditions of full power, all rods fully withdrawn, equilibrium xenon, and 3200 psig pressure. These calculations are compared to the critical trajectories from the transient analysis. This comparison then determines the cycle-specific design conditions that would result in transient conditions exceeding 3200 psig. Calculations considering the time in core life and corresponding MTC show the time during the fuel cycle that the core design critical trajectory is greater than the transient trajectory. The UET is subsequently determined from this calculation. As previously stated, the analysis must show that the UET, given the specific cycle design, will be less than 5% of the cycle life; or conversely, that the ATWS pressure limit of 3200 psig will be met for at least 95% of cycle life. If the pressure limit is not met, the core design is modified until the 95% criteria is achieved. Again we note that the 95% fuel cycle life criteria for UET is equivalent to the UET risk-based acceptance criteria in the analyses forming the basis for the ATWS Rule.

Note that this methodology considers only the "base case" conditions discussed in Reference 1, (i.e., 100% power-operated relief valve (PORV) capacity, 100% auxiliary feedwater (AFW) system availability, no control rod insertion capability, and AMSAC available). Other plant configurations reflecting different combinations of PORVs and/or AFW availability are not analyzed. Specifically, the core design will prevent an unfavorable condition for 95% of cycle life given the plant is maintained in this base case configuration. There are no other operational constraints put on ATWS risk-significant equipment other than TS limiting conditions for operations (LCOs). Therefore, the potential exists to have UET in addition to the “design” UET should a non-base case condition occur on an emergent basis.

**Proposed UET Methodology**

The proposed license amendment would replace the current 5% fuel cycle limit on UET with the requirement to administratively control ATWS risk significant equipment when core conditions are unfavorable. The methodology used to determine the UET will remain the same as the currently approved methodology. The Configuration Risk Management Program (CRMP), currently described in the Byron Station and Braidwood Station Technical Requirements Manual (TRM), Appendix T, will be used to manage the availability of ATWS risk significant equipment. The CRMP will provide a proceduralized process to perform a configuration risk assessment of the plant equipment configuration and availability prior to planned maintenance of the ATWS risk significant equipment and/or functions. The CRMP is currently used as a tool to manage maintenance activities to minimize any increase in the consequences of an abnormal event or accident. Development of the Byron Station and Braidwood Station CRMP is consistent with

10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," paragraph (a)(4), and is governed by Work Control Procedure, WC-AA-101, "On-Line Work Control Process."

The ATWS risk significant equipment which will be monitored by the CRMP include:

- rod control system;
- AFW system;
- pressurizer PORVs; and
- ATWS Mitigating Systems Actuation Circuitry (AMSAC).

In addition to the "base case" conditions (i.e., 100% PORV capacity, 100% AFW system availability, no control rod insertion capability, and AMSAC available) described in Reference 4, WCAP-11992 provides transient critical power trajectories for different combinations of pressurizer PORV capacity and AF system availability. WCAP-11992, Appendix B, "Event Tree Nodes Assumptions," shows transient critical power trajectories based on the reference plant from the previous Westinghouse 1979 ATWS submittal (i.e., Reference 4). Plant specific critical power trajectory calculations have been performed for Byron and Braidwood Stations, Units 1 and 2, using the same methods defined in WCAP-11992 with plant-specific input for the following parameters:

- initial conditions consistent with the Byron and Braidwood Stations uprated power level;
- RCS fluid volumes and pressure drops; and
- steam generator fluid volumes and pressure drops.

Cycle-specific design critical power trajectories and UET values, based on different combinations and availability of ATWS risk significant equipment, will be calculated using the methods described above. As an example, Table 1, "UET for a Hypothetical High Reactivity Core, One Minute of Control Rod Insertion (72 Steps)," shows six different combinations of AFW system and pressurizer PORV availability with rod motion available and the associated UET expressed in number of fuel cycle days and in percent of fuel cycle. Table 2, "UET for a Hypothetical High Reactivity Core, No Control Rod Insertion," shows six different combinations of AFW system and pressurizer PORV availability with no rod motion and the associated UET expressed in number of fuel cycle days and in percent of fuel cycle. This hypothetical high reactivity core would have a maximum HZP MTC of +3.78 pcm/°F at a burnup of 3000 Megawatt-day per Metric Tonne Uranium. The information from Tables 1 and 2 were then combined to develop a plant configuration logic matrix for equipment necessary to maintain zero UET as shown in Table 3, "Plant Configurations to Maintain No UET for a Hypothetical High Reactivity Core." Effective configuration management control will be exercised throughout the operating cycle, not solely for the "base case" UET period.

For informational purposes, Figure 1 shows the MTC profile as a function of burnup at HFP for this hypothetical high reactivity core.

The consequences of an ATWS event, during a UET period with the assumed high reactivity core, remain acceptable. Although the time to RCS overpressure and resultant loss of coolant accident (LOCA) may decrease, the consequences of the LOCA remain unchanged.

The CRMP will be used to manage the planned maintenance of the ATWS risk significant equipment through the normal Work Control Department on-line risk evaluation process. The evaluations will be performed prior to the planned removal from service of any ATWS risk significant equipment or following an unplanned removal of this equipment. This evaluation will consider the current core conditions and the current ATWS risk significant unavailable functions using a logic matrix; a hypothetical case is given in Table 3. This logic matrix will be developed on a cycle-specific basis and incorporated into the CRMP software.

As an example, using the plant equipment configurations shown in Table 3, prior to removing an AFW pump from service, the CRMP will verify that the plant response will remain favorable without credit for the AFW system as well as taking into consideration other ATWS risk significant components that are already unavailable. If all other ATWS risk significant equipment is available, an AFW pump may be removed from service after 81 effective full power days and still maintain a favorable plant response. Between 143 and 167effective full power days into the cycle, an AFW pump cannot be removed from service if one pressurizer PORV is blocked or if control rods are not available for automatic insertion.

For emergent conditions requiring equipment repair/maintenance, if the CRMP evaluation determines that the combination of core conditions and available ATWS mitigation equipment would not satisfy the 3200 psig success criteria, then the CRMP will (1) restrict further planned removal of ATWS risk significant equipment, and (2) expedite the restoration of unavailable ATWS risk significant equipment to minimize the UET period. This approach is currently addressed in procedure WC-AA-101, Step 4.5.12 which states:

> "If emergent conditions results in an orange or red risk color, or risk results are unavailable, the following compensatory measures must be enacted to mitigate the risk until such time as risk is reduced to an acceptable level.
>
> 1. Protect redundant/diverse SSCs [systems, structures and components].
>
> 2. Station Duty Manager is contacted for further direction and support.
>
> 3. At a minimum, the following compensatory actions shall be established.
>    - Shift Operations to be briefed on current plant risk configuration.
>    - Shift Operations to reduce duration of ongoing risk sensitive activities.
>    - Shift Operations to evaluate and defer upcoming activities that could adversely impact the current plant risk configuration."

Should an unplanned unavailability of an ATWS risk significant function occur, consistent with the current requirements, there will be no administrative requirement to shutdown the plant or extend an outage solely for the purpose of restoring these functions, unless prompted by an associated TS LCO action requirement.

Voluntary Unfavorable Core Conditions

Short term "unfavorable" core conditions will be allowed by the CRMP. The CRMP administrative maintenance restrictions will allow for the conduct of TS surveillances but not permit discretionary on-line maintenance that could be deferred to a "favorable" portion of the operating cycle. The appropriate Exelon procedures shall also direct operators to have the rod control system in AUTO unless activities are in progress that would require the rod control system to be placed in MANUAL for short periods of time. Some examples of situations that would require MANUAL rod control are given below.

1. Placing the rod control system in manual to prevent inadvertent rod motion to ensure fuel preconditioning limits are met during power ascension. This time period is typically 10 days.

2. Routine calibrations of inputs to AUTO rod control; rods would be placed in MANUAL for one shift.

3. During significant xenon transients due to load maneuvers, rods will be placed in MANUAL during the load change, as required, and for approximately one shift after reaching 100% power.

4. Placing the rod control system in MANUAL to move control rods for axial offset adjustment purposes. This time period will comprise only minutes of an entire fuel cycle.

5. Placing pressurizer PORVs in MANUAL and CLOSED during surveillances on instrumentation channels that provide actuation input to the pressurizer PORVs.

The CRMP administrative controls limiting maintenance of ATWS risk significant equipment will provide reasonable assurance that the ATWS mitigating functions will remain available. With ATWS mitigating equipment available, the 3200 psig RCS pressure acceptance criteria for ATWS events will be met without any MTC constraints beyond that currently in the TS.

Exelon has previously implemented an NRC approved CRMP at Byron and Braidwood Stations to manage risk associated with the emergency diesel generators. The ATWS CRMP program will be analogous to the emergency diesel risk management program. The proposed methodology for controlling the UET related to ATWS events was also previously discussed with the NRC in a January 24, 2001, meeting with members of Exelon and Westinghouse.

**Risk Information**

The current approved UET methodology utilizes a deterministic approach. The proposed change will utilize the same methodology to calculate the UET; however, in addition, the CRMP will also be utilized to manage the risk associated with performing on-line maintenance of ATWS risk significant equipment. We intend to use this methodology on an interim basis. The Westinghouse Owners Group has proposed to develop a risk-informed ATWS approach to eliminate the MTC and UET restrictions associated with ATWS. This methodology will be submitted for NRC approval in the near future. Upon NRC approval of this approach, Byron and Braidwood Stations will adopt that risk based methodology for controlling UET related to ATWS events.

As previously noted above, the current methodology considers only the "base case" conditions discussed in Reference 1, (i.e., 100% PORV capacity, 100% AFW system availability, no control rod insertion capability, and AMSAC available). Other plant configurations reflecting different combinations of PORVs and/or AFW availability are not analyzed. Specifically, the core design will only prevent an unfavorable condition for 95% of cycle life if the plant is maintained in the base case configuration. Currently, there are no other operational constraints put on ATWS risk significant equipment other than TS LCOs. Therefore, the potential exists to have UET in addition to the "design" UET should a non-base case condition occur on an emergent basis.

The proposed methodology reduces the risk of having unfavorable core conditions as effective configuration management control will be exercised throughout the operating cycle, not solely for the "base case" UET period. The CRMP program will monitor the ATWS risk significant functions using the logic presented in Table 3 and avoid planned maintenance of this equipment thereby maintaining the appropriate plant configuration to minimize UET periods during the entire fuel cycle.

## 6.0 REGULATORY ANALYSIS

The proposed method of controlling the UET related to ATWS events continues to fully meet the requirements of the ATWS Rule (i.e., 10 CFR 50.62). This existing AMSAC system and the currently approved deterministic methodology used to calculate the UET will continue to be used. The CRMP will also be utilized to manage the risk associated with performing maintenance on ATWS risk significant equipment. The CRMP utilized at Byron and Braidwood Stations is consistent with 10 CFR 50.65 and is governed by Work Control Procedure, WC-AA-101, "On-Line Work Control Process." The CRMP is contained in Byron Station and Braidwood Station TRM, Appendix T, an owner controlled document.

Currently, the restriction on UET is controlled by limiting the value of the MTC inherent in the reactor core reload design. This analysis considers only the "base case" conditions for ATWS considerations (i.e., 100% PORV capacity, 100% AFW system availability, no control rod insertion capability, and AMSAC available) and does not put any restriction on ATWS risk significant equipment other than TS LCOs. Other plant configurations reflecting different combinations of PORVs and/or AFW availability are not analyzed. Specifically, the core design will prevent an unfavorable condition for 95% of cycle life given the plant is maintained in the base case configuration. Therefore, the potential exists to have UET in addition to the "design" UET should a non-base case condition occur on an emergent basis.

The proposed change would use the CRMP to minimize the UET by effectively managing the planned on-line maintenance of ATWS risk significant equipment. The proposed composite methodology of identifying and controlling UET is a more conservative approach from a safety perspective while gaining the advantages of a reload core design with a positive MTC.

Deleting TS 5.6.5.b.5 is consistent with NUREG 1431, "Standard Technical Specifications, Westinghouse Plants," Revision 1, dated April 1995, which is the baseline document used for the Byron and Braidwood Stations Technical Specifications. It is also consistent with NUREG 1431, Revision 2, dated April 2001, (i.e., the current revision). By deleting TS 5.6.5.b.5, Byron and Braidwood Stations will also become consistent with the TS of other Westinghouse plants. Section 15.8 of the UFSAR, which discusses ATWS, will be appropriately revised to reflect the proposed methodology of controlling the UET associated with an ATWS event. This UFSAR section will reference this license amendment request and the anticipated NRC Safety Evaluation approving this license amendment; and will specify that the CRMP will be utilized to manage the availability of ATWS risk significant equipment.

Changes to the UFSAR are evaluated in accordance with the provisions of 10 CFR 50.59, "Changes, tests, and experiments." Thus, adequate control over changes to the UFSAR exists to allow the reference to the program that minimizes UET to be contained in the UFSAR.

## 7.0 NO SIGNIFICANT HAZARDS CONSIDERATION

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

> Involve a significant increase in the probability or consequences of an accident previously evaluated; or
>
> Create the possibility of a new or different kind of accident from any accident previously evaluated; or
>
> Involve a significant reduction in a margin of safety.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92 is provided below regarding the proposed license amendment.

### Overview

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (Exelon) is requesting a change to Appendix A, Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66, for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed change will revise the method of controlling the fuel cycle unfavorable exposure time (UET) related to an anticipated transient without scram (ATWS) event. UET is defined as the time during fuel cycle life when the reactor core reactivity feedback is not sufficient to prevent reactor coolant system (RCS) pressure from exceeding 3200 psig assuming specific plant configurations during an ATWS event. Currently the method of controlling UET is described in a document referenced in TS 5.6.5, "Core Operating Limits Report (COLR)," Item b.5. The current methodology controls UET by limiting the value of the moderator temperature coefficient (MTC) inherent in the reactor core design. The proposed license amendment would utilize the Configuration Risk Management Program to administratively control the availability of ATWS risk significant equipment to minimize core UET. By removing the UET MTC constraint, reload cores may be designed with a more positive MTC as allowed by the TS. Designing reload cores with a more positive MTC results in significant benefits including reduced fuel cost, reduced outage time, and reduced amount of spent fuel.

The proposed change would delete TS 5.6.5.b.5 to remove the reference to the document describing the current method of controlling UET and appropriately revise the discussion on ATWS in the Updated Final Safety Analysis Report (UFSAR), Section 15.8, "Anticipated Transient Without Scram." This UFSAR section will reference this license amendment request and the anticipated NRC Safety Evaluation approving the license amendment; and will specify that the CRMP will be utilized to manage the availability of ATWS risk significant equipment.

**The proposed TS changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.**

The change in the methodology of controlling the UET associated with an ATWS event will not increase the probability of any accident previously evaluated, including an ATWS event. All systems, including the existing ATWS Mitigating Systems Actuation Circuitry (AMSAC), will continue to be operated in accordance with current design requirements, and no new components or system interactions have been identified that could lead to an increase in the probability of any accident previously evaluated in the UFSAR.

Currently, the UET for a given fuel cycle must be less than 5% of the operating cycle under a "base case" set of plant conditions (i.e., 100% power-operated relief valve (PORV) capacity, 100% AFW system availability, no control rod insertion capability, and AMSAC available). The proposed license amendment would replace the 5% fuel cycle limit on UET with the requirement to administratively control ATWS risk significant equipment when core conditions are "unfavorable" over the entire operating cycle. The goal of the administrative control program is to minimize the UET at all times. The methodology used to determine the UET will remain the same as the currently approved methodology. The Configuration Risk Management Program (CRMP), currently described in the Byron Station and Braidwood Station Technical Requirements Manual (TRM), Appendix T, will be used to manage the availability of ATWS risk significant equipment. The CRMP will provide a proceduralized process to perform a configuration risk assessment of the plant equipment configuration and availability prior to planned on-line maintenance of the ATWS risk significant equipment and/or functions. The CRMP is currently used as a tool to manage maintenance activities to minimize any increase in the consequences of an abnormal event or accident. Development of the Byron Station and Braidwood Station CRMP is consistent with 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," paragraph (a)(4), and is governed by Work Control Procedure, WC-AA-101, "On-Line Work Control Process."

The ATWS risk significant equipment which will be monitored by the CRMP includes the:

- rod control system;
- AFW system;
- pressurizer PORVs; and
- ATWS Mitigating Systems Actuation Circuitry (AMSAC).

This change in methodology will also have no effect on the consequences of any accident previously evaluated including an ATWS event. Should an ATWS occur during an "unfavorable" fuel cycle period, the consequences of this event will remain unchanged under the new methodology which only administratively controls plant equipment availability associated with the UET. Also, the consequences of an ATWS event with the core designed with a more positive MTC remain acceptable. Although the time to RCS overpressure and resultant loss of coolant accident (LOCA) may decrease, the consequences of the LOCA remain unchanged.

Based on this evaluation, it is concluded that the proposed TS change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

**The proposed TS changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.**

The configuration, operation and accident response of the Byron Station and the Braidwood Station systems, structures or components are unchanged by the proposed TS change which would utilize an alternate method of controlling the UET of a fuel cycle. No transient event would result in a new sequence of events that could lead to a new accident scenario.

No new operating mode, safety-related equipment lineup, accident scenario, or equipment failure mode was identified as a result of utilizing the CRMP to monitor ATWS risk significant equipment. In addition, this methodology does not create any new failure modes that could lead to a different kind of accident. Software changes to the existing CRMP will be made to monitor the above mentioned ATWS risk significant equipment.

Based on this analysis, it is concluded that no new accident scenarios, failure mechanisms or limiting single failures are introduced as a result of the proposed change. The proposed TS change does not have an adverse effect on any safety-related system. Therefore, the proposed TS change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

**The proposed TS changes do not involve a significant reduction in a margin of safety.**

The newly proposed methodology of monitoring and controlling the UET during an operating cycle is more conservative than the currently approved method and; therefore, will increase the margin of safety.

Currently, the UET for a given fuel cycle is limited to less than 5% of the operating cycle and is only evaluated for a "base case" set of plant conditions (i.e., 100% PORV capacity, 100% AFW system availability, no control rod insertion capability, and AMSAC available). The UET is currently limited by constraining the value of the MTC inherent in the reload reactor core design.

The proposed methodology will utilize the CRMP as a tool to monitor the availability of ATWS risk significant equipment during the entire operating cycle. By effectively managing the planned on-line maintenance of ATWS risk significant equipment, the cycle UET will be minimized at all times. This methodology also analyzes different combinations of ATWS risk significant equipment availability in addition to the "base case" conditions. The proposed license amendment would replace the 5% fuel cycle limit on UET with the requirement to administratively control ATWS risk significant equipment when core conditions are "unfavorable" over the entire operating cycle. The goal of the administrative program is to minimize the UET at all times. The methodology used to determine the UET will remain the same as the currently approved methodology. The Configuration Risk Management Program (CRMP) currently described in the Byron Station and Braidwood Station Technical Requirements Manual (TRM), Appendix T, will be used to manage the availability of ATWS risk significant equipment. The CRMP will provide a proceduralized process to perform a configuration risk assessment of the plant equipment configuration and availability prior to planned on-line maintenance of the ATWS risk significant equipment and/or functions. The CRMP is currently used as a tool to manage maintenance activities to minimize any increase in the consequences of an abnormal event or accident. Development of the Byron Station and Braidwood Station CRMP is consistent with 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," paragraph (a)(4), and is governed by Work Control Procedure, WC-AA-101, "On-Line Work Control Process."

Based on this evaluation, the proposed TS changes do not involve a significant reduction in a margin of safety.

### Conclusion

Based upon the above analyses and evaluations, we have concluded that the proposed change to the TS involve no significant hazards consideration.

## 8.0 ENVIRONMENTAL CONSIDERATION

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (Exelon) is requesting a change to Appendix A, Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66, for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, respectively. The proposed change will revise the method of controlling the fuel cycle unfavorable exposure time (UET) related to an anticipated transient without scram (ATWS) event. UET is defined as the time during fuel cycle life when the reactor core reactivity feedback is not sufficient to prevent reactor coolant system (RCS) pressure from exceeding 3200 psig assuming specific plant configurations during an ATWS event. Currently the method of controlling UET is described in a document referenced in TS 5.6.5, "Core Operating Limits Report (COLR)," Item b.5. The current methodology controls UET by limiting the value of the moderator temperature coefficient (MTC) inherent in the reactor core design. The proposed license amendment would utilize the Configuration Risk Management Program to administratively control the availability of ATWS risk significant equipment to minimize core UET. By removing the UET MTC constraint, reload cores may be designed with a more positive MTC as allowed by the TS. Designing reload cores with a more positive MTC results in significant benefits including reduced fuel cost, reduced outage time, and reduced amount of spent fuel.

Exelon has evaluated this proposed operating license amendment consistent with the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." Exelon has determined that these proposed changes meet the criteria for a categorical exclusion set forth in paragraph (c)(9) of 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," and as such, has determined that no irreversible consequences exist in accordance with paragraph (b) of 10 CFR 50.92, "Issuance of amendment." This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," that changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation," or that changes an inspection or a surveillance requirement, and the proposed amendment meets the following specific criteria.

**(i) The proposed changes involve no significant hazards consideration.**

As demonstrated in Section 7.0, "No Significant Hazards Consideration," the proposed changes do not involve a significant hazards consideration.

**(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.**

**Non-Radiological Effluent Releases**

Utilization of the proposed methodology to control the UET during a fuel cycle will have no effect on the type or amount of non-radiological effluent releases and will have no effect on effluent discharge permit limitations or other conditions associated with the operation of the plant. None of the data contained in the Environmental Report or in the latest National Pollutant Discharge Elimination System (NPDES) Permits will be affected. The new methodology will utilize the CRMP as an administrative tool to monitor and manage the availability of ATWS risk significant equipment during the operating cycle; consequently, there is no significant change in the types or a significant increase in the amounts of non-radiological effluents that may be released offsite.

**Radiological Effluent Releases**

Utilization of the proposed methodology to control the UET during a fuel cycle will have no physical effect on the type or amount of liquid, solid or gaseous radiological effluent releases of the plant. The new methodology will utilize the CRMP as an administrative tool to monitor and manage the availability of ATWS risk significant equipment during the operating cycle and will not result in a significant change in the types or a significant increase in the amounts of radiological effluents that may be released offsite. Thus, the 10 CFR 100, "Reactor Site Criteria," limits will not be exceeded.

**(iii) There is no significant increase in individual or cumulative occupational radiation exposure.**

The proposed changes will not result in changes in the operation or configuration of the facility but will more closely monitor the availability of ATWS risk significant equipment. There will be no change in the level of controls or methodology used for the processing of radioactive effluents or the handling of solid radioactive waste, nor will the proposal result in any change in the normal radiation levels within the plant. Therefore, there will be no increase in individual or cumulative occupational radiation exposure resulting from this change.

It is therefore concluded that there will be no significant increase in individual or cumulative occupational radiation exposure resulting from this change.

**Conclusion**

Based upon the above evaluation, we have concluded that no irreversible consequences exist due to the proposed change.

## 9.0 PRECEDENT

Currently, no other licensees have TS restrictions on MTC based on UET considerations. The currently approved method of controlling the fuel cycle UET for Byron and Braidwood Stations is a deterministic based approach. The method of determining the UET will remain unchanged and the proposed change in the method of controlling UET is also a deterministic based approach with additional, more conservative administrative controls. Therefore, the NRC has previously endorsed the basis of this approach.

Deleting TS 5.6.5.b.5 is consistent with NUREG 1431, "Standard Technical Specifications, Westinghouse Plants," Revision 1, dated April 1995, which is the baseline document used for Byron and Braidwood Stations Technical Specifications. It is also consistent with NUREG 1431, Revision 2, dated April 2001, (i.e., the current revision).

The proposed methodology for controlling the UET related to ATWS events was also previously discussed with the NRC in a January 24, 2001, meeting with members of Exelon and Westinghouse.

## 10.0 REFERENCES

1. Letter from D. Saccomando to Office of Nuclear Reactor Regulation, "Additional Information Regarding Application for Amendment to Facility Operating Licenses-Reactivity Control Systems," dated December 21, 1994

2. WCAP-11992, "Joint Westinghouse Owners Group/Westinghouse Program: ATWS Rule Administration Process," dated December 1988

3. WCAP-11993, "Joint Westinghouse Owners Group/Westinghouse Program: Assessment of Compliance with ATWS Rule Basis for Westinghouse PWRs," dated December 1988

4. NS-TMA-2182, Letter from T. M. Anderson (Westinghouse) to Dr. S. H. Hanauer (NRC), "ATWS Submittal," dated December 30, 1979

5. WCAP-8330, "Westinghouse Anticipated Transients Without Trip Analysis," dated August 1974

6. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 73 for Byron Station and Amendment No. 65 for Braidwood Station, (related to positive moderator temperature coefficient), dated July 27, 1995

**Table 1**
**UET for a Hypothetical High Reactivity Core**
**One Minute of Control Rod Insertion (72 Steps)**

| Case | PORVs Available | AFW Available (%) | Cycle Length (days) | UET Start (days) | UET End (days) | Total UET (days) | UET (%) |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 100 | 500.92 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2 | 50 | 500.92 | 0.0 | 80.9 | 80.9 | 16.1 |
| 3 | 1 | 100 | 500.92 | 0.0 | 142.9 | 142.9 | 28.5 |
| 4 | 1 | 50 | 500.92 | 0.0 | 162.7 | 162.7 | 32.5 |
| 5 | 0 | 100 | 500.92 | 0.0 | 208.4 | 208.4 | 41.6 |
| 6 | 0 | 50 | 500.92 | 0.0 | 225.2 | 225.2 | 45.0 |

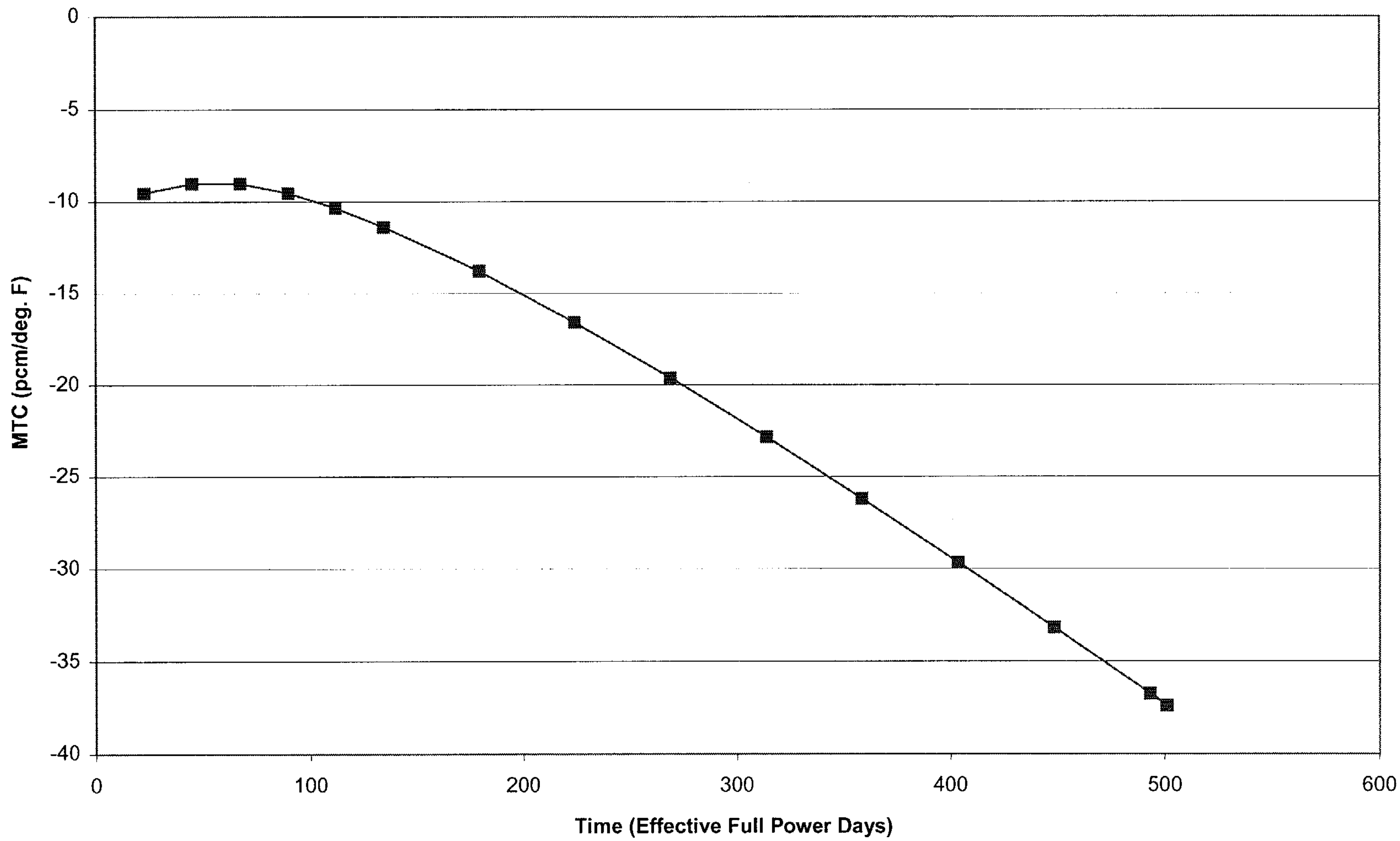
**Table 2**
**UET for a Hypothetical High Reactivity Core**
**No Control Rod Insertion**

| Case | PORVs Available | AFW Available (%) | Cycle Length (days) | UET Start (days) | UET End (days) | Total UET (days) | UET (%) |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 100 | 500.92 | 0.0 | 141.2 | 141.2 | 28.2 |
| 2 | 2 | 50 | 500.92 | 0.0 | 166.8 | 166.8 | 33.3 |
| 3 | 1 | 100 | 500.92 | 0.0 | 231.3 | 231.3 | 46.2 |
| 4 | 1 | 50 | 500.92 | 0.0 | 256.1 | 256.1 | 51.1 |
| 5 | 0 | 100 | 500.92 | 0.0 | 332.5 | 332.5 | 66.4 |
| 6 | 0 | 50 | 500.92 | 0.0 | 362.1 | 362.1 | 72.3 |

**Table 3**
**Plant Configurations to Maintain No UET for a Hypothetical High Reactivity Core**

| Time Frame (EFPD) | Rod Control System | | AFW Maintenance Acceptable | Acceptable Number of Blocked PORVs | | |
|---|---|---|---|---|---|---|
| | Automatic | Manual | | 2 | 1 | 0 |
| 0 - 81 | X | | No | | | X |
| | | | | | | |
| 81 - 143 | X | | Yes | | | X |
| | | | | | | |
| 143 - 167 | X | | Yes | | | X |
| | X | | No | | X | X |
| | | X | No | | | X |
| | | | | | | |
| 167 - 209 | X | | Yes | | X | X |
| | | X | Yes | | | X |
| | | | | | | |
| 209 - 226 | X | | Yes | | X | X |
| | X | | No | X | X | X |
| | | X | Yes | | | X |
| | | | | | | |
| 226 - 231 | X | | Yes | X | X | X |
| | | X | Yes | | | X |
| | | | | | | |
| 231 - 256 | X | | Yes | X | X | X |
| | | X | Yes | | | X |
| | | X | No | | X | X |
| | | | | | | |
| 256 - 333 | X | | Yes | X | X | X |
| | | X | Yes | | X | X |
| | | | | | | |
| 333 - 362 | X | | Yes | X | X | X |
| | | X | Yes | | X | X |
| | | X | No | X | X | X |
| | | | | | | |
| 362 - EOC | X | | Yes | X | X | X |
| | | X | Yes | X | X | X |
| | | | | | | |

**Figure 1**
**Hot Full Power MTC for Hypothetical High Reactivity Core**



**ATTACHMENT B-1**

**MARKED-UP PAGES FOR PROPOSED CHANGES**

**BRAIDWOOD STATION**

REVISED TS PAGES

5.6-4

REVISED BASES PAGES

B 3.1.3-2

## 5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

~~5. ComEd letter from D. Saccomando to the Office of Nuclear Reactor Regulation dated December 21, 1994, transmitting an attachment that documents applicable sections of WCAP-11992/11993 and ComEd application of the UET methodology addressed in "Additional Information Regarding Application for Amendment to Facility Operating Licenses-Reactivity Control Systems."~~

5 ~~6~~. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," March 1998.

6 ~~7~~. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

7 ~~8~~. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using NOTRUMP Code," August 1985.

8 ~~9~~. WCAP-10216-P-A, Revision 1, "Relaxation of Constant Axial Offset Control - $F_Q$ Surveillance Technical Specification," February 1994.

9 ~~10~~. WCAP-8745-P-A, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions," September 1986;

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met; and

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

BASES

## BACKGROUND (continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity.

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

## APPLICABLE SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and

b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

Additionally, the limitation on MTC also ensures that the Anticipated Transient Without Scram (ATWS) risk is acceptable. A cycle specific Unfavorable Exposure Time (UET) value will be calculated to ensure < 5% of the cycle operations occur when the reactivity feedback is not sufficient to prevent exceeding an ATWS overpressurization condition of $\geq$ 3200 psig in the RCS. This UET value will be updated for each core reload and appropriately considers the effects of changes in MTC, including any variations that are more adverse than those originally modeled in the analyses supporting the basis for the final ATWS rule.

**ATTACHMENT B-2**

**MARKED-UP PAGES FOR PROPOSED CHANGES**

**BYRON STATION**

REVISED TS PAGES

5.6-4

REVISED BASES PAGES

B 3.1.3-2

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

5. ComEd letter from D. Saccomando to the Office of Nuclear Reactor Regulation dated December 21, 1994, transmitting an attachment that documents applicable sections of WCAP-11992/11993 and ComEd application of the UET methodology addressed in "Additional Information Regarding Application for Amendment to Facility Operating Licenses-Reactivity Control Systems."

5 ~~6~~. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," March 1998.

6 ~~7~~. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

7 ~~8~~. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using NOTRUMP Code," August 1985.

8 ~~9~~. WCAP-10216-P-A, Revision 1, "Relaxation of Constant Axial Offset Control - $F_Q$ Surveillance Technical Specification," February 1994.

9 ~~10~~. WCAP-8745-P-A, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions," September 1986;

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met; and

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

BASES

BACKGROUND (continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity.

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and

b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

~~Additionally, the limitation on MTC also ensures that the Anticipated Transient Without Scram (ATWS) risk is acceptable. A cycle specific Unfavorable Exposure Time (UET) value will be calculated to ensure < 5% of the cycle operations occur when the reactivity feedback is not sufficient to prevent exceeding an ATWS overpressurization condition of ≥ 3200 psig in the RCS. This UET value will be updated for each core reload and appropriately considers the effects of changes in MTC, including any variations that are more adverse than those originally modeled in the analyses supporting the basis for the final ATWS rule.~~

**ATTACHMENT B-3**

**INCORPORATED PROPOSED CHANGES**
**TYPED PAGES**

**BRAIDWOOD STATION**

<u>REVISED TS PAGES</u>

5.6-4

<u>REVISED BASES PAGES</u>

B 3.1.3-2

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

5. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," March 1998.

6. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

7. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using NOTRUMP Code," August 1985.

8. WCAP-10216-P-A, Revision 1, "Relaxation of Constant Axial Offset Control - $F_Q$ Surveillance Technical Specification," February 1994.

9. WCAP-8745-P-A, "Design Bases for the Thermal Overpower ΔT and Thermal Overtemperature ΔT Trip Functions," September 1986;

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met; and

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

BASES

BACKGROUND (continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity.

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and

b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

Reference 2 contains analyses of accidents that result in both overheating and overcooling of the reactor core. MTC is one of the controlling parameters for core reactivity in these accidents. Both the most positive value and most negative value of the MTC are important to safety, and both values must be bounded. Values used in the analyses consider worst case conditions to ensure that the accident results are bounding (Ref. 3).

The consequences of accidents that cause core overheating must be evaluated when the MTC is positive. Such accidents include the rod withdrawal transient from either zero or RTP, loss of main feedwater flow, and loss of forced reactor coolant flow. The consequences of accidents that cause core overcooling must be evaluated when the MTC is negative. Such accidents include sudden feedwater flow increase and sudden decrease in feedwater temperature.

**ATTACHMENT B-4**

**INCORPORATED PROPOSED CHANGES**
**TYPED PAGES**

**BYRON STATION**

REVISED TS PAGES

5.6-4

REVISED BASES PAGES

B 3.1.3-2

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

5. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," March 1998.

6. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

7. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model using NOTRUMP Code," August 1985.

8. WCAP-10216-P-A, Revision 1, "Relaxation of Constant Axial Offset Control - $F_Q$ Surveillance Technical Specification," February 1994.

9. WCAP-8745-P-A, "Design Bases for the Thermal Overpower $\Delta T$ and Thermal Overtemperature $\Delta T$ Trip Functions," September 1986;

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met; and

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

BASES

BACKGROUND (continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity.

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and

b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

Reference 2 contains analyses of accidents that result in both overheating and overcooling of the reactor core. MTC is one of the controlling parameters for core reactivity in these accidents. Both the most positive value and most negative value of the MTC are important to safety, and both values must be bounded. Values used in the analyses consider worst case conditions to ensure that the accident results are bounding (Ref. 3).

The consequences of accidents that cause core overheating must be evaluated when the MTC is positive. Such accidents include the rod withdrawal transient from either zero or RTP, loss of main feedwater flow, and loss of forced reactor coolant flow. The consequences of accidents that cause core overcooling must be evaluated when the MTC is negative. Such accidents include sudden feedwater flow increase and sudden decrease in feedwater temperature.