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10 CFR 50.90

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

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 License Amendment Related to the Application of the TORMIS Methodology

Reference: Letter from L. S. Rubenstein (U. S. NRC) to F. J. Miraglia (U. S. NRC), "Safety Evaluation Report – Electric Power Research Institute (EPRI) Topical Reports Concerning Tornado Missile Probabilistic Risk Assessment (PRA) Methodology," dated October 26, 1983

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," and 10 CFR 50.59, "Changes, tests, and experiments," paragraph (c)(2)(viii), Exelon Generation Company, LLC (EGC) is requesting an amendment to Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2, respectively.

The proposed changes would revise the Byron Station Updated Final Safety Analysis Report (UFSAR) to incorporate changes concerning the requirements for physical protection from tornado generated missiles for safety related and non-safety related systems and components and the methodology used to determine which systems and components require physical protection from tornado generated missiles. This probabilistic based missile strike analysis is based on the Electric Power Research Institute (EPRI) "Tornado Missile Simulation and Design Methodology (EPRI NP-2005, Volumes 1 and 2)," that received NRC approval in the above referenced safety evaluation report.

The attached amendment request is subdivided as shown below.

Attachment 1 provides an evaluation of the proposed changes.

Attachment 2 includes the marked-up UFSAR pages with the proposed changes indicated for Byron Station.

EGC requests that this proposed change be approved by March 2007.

The proposed amendment has been reviewed by the Byron Station Plant Operations Review Committee and approved by the Nuclear Safety Review Board in accordance with the requirements of the EGC Quality Assurance Program.

EGC is notifying the State of Illinois of this application for a change to the Byron Station design basis by sending a copy of this letter and its attachments to the designated State Official.

If you have any questions regarding this submittal, please contact David Chrzanowski at (630) 657-2821.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 16th day of June 2006.

Respectfully,

Keith R. Jury
Director, Licensing and Regulatory Affairs

Attachment 1: Evaluation of Proposed Changes
Attachment 2: Markup of Proposed UFSAR Page Changes for the Byron Station Application of the TORMIS Methodology

ATTACHMENT 1
Evaluation of Proposed Changes

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ATTACHMENT 1
Evaluation of Proposed Changes

1.0 DESCRIPTION

Exelon Generation Company, LLC (EGC) is proposing changes to the Byron Station Updated Final Safety Analysis Report (UFSAR) to incorporate the application of the previously NRC approved (Reference 1) probabilistic based tornado missile strike analysis (i.e., the TORMIS methodology). This methodology will be used to determine if physical protection from tornado generated missiles (TGM) is necessary for portions of certain safety related or non-safety related systems that are currently inadequately protected.

The UFSAR changes will apply the acceptance criteria of NUREG0800, "Standard Review Plan," (SRP) Section 2.2.3, "Evaluation of Potential Accidents," Revision 2, July 1981, which states that an event with an occurrence frequency of approximately 1.0E-07 per year or less need not be considered as a credible event. SRP Section 2.2.3 further states that it is acceptable to not postulate events for which the expected frequency of occurrence is 1.0E-06 per year if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower.

The changes do not include the allowance to permanently remove existing missile barriers unless it can be shown that the existing barriers unnecessarily challenge or hinder the operation of the plant; however, temporary removal of a protective feature is permitted under administrative controls, if removal is determined to be necessary for plant maintenance or configuration changes.

The NRC approved similar requests for Clinton Power Station by letter from J. B. Hopkins (U. S. NRC) to M. Reandeau (AmerGen Energy Company), "Issuance of Amendment – Clinton Power Station, Unit 1 (TAC No. MA4911)," dated February 29, 2000 and for the Joseph M. Farley Nuclear Plant by letter from F. Rinaldi (U. S. NRC) to D. N. Morey (Southern Nuclear Operating Company), "Joseph M. Farley Nuclear Plant, Units 1 and 2 RE: Issuance of Amendments (TAC Nos. MA9495 and MA9496)," dated September 26, 2001.

2.0 PROPOSED CHANGE

As discussed above, the proposed changes to the design basis of Byron Station involve:

- the use of the probabilistic based tornado missile strike/damage analysis (i.e., TORMIS) as an alternate means of assessing the need for protection against TGM,

- identifying the specific probability based acceptance criteria that will be applied in TORMIS assessments,

- revising the design acceptance criteria for twenty Byron Station targets that are currently unprotected or inadequately protected by physical structures, barriers, or other protection means from a deterministic approach to a probabilistic approach that demonstrates that the risk from TGMs for these targets is sufficiently small that adequate protection from TGMs is not required, and

- documenting, when approved, these changes and the affected components in a revision to the Byron Station UFSAR in accordance with 10 CFR 50.71, "Maintenance of records, making of reports," paragraph (e).

Proposed changes to Byron Station UFSAR are summarized below. Markups of these proposed UFSAR page changes are provided in Attachment 2.

UFSAR Section	Section Title	Comment
3.0	Table of Contents	Added line items for new sections 3.5.2.1, "Systems/Components Not Requiring Unique Tornado Missile Protection."
3.5.2.1	Systems/Components Not Requiring Unique Tornado Missile Protection	New UFSAR section describing the Byron Station probabilistic TGM strike analysis acceptance criteria.
3.5.5	References	Added references to address: NRC safety evaluation of the TORMIS methodology and the EPRI TORMIS Topical Report.

3.0 BACKGROUND

Recently, a systematic review was conducted at Byron Station to identify safety related and non-safety related components that were either not protected or inadequately protected from the strike of potential missiles generated during a design basis tornado event.

These components include:

- components in and on the Essential Service Water Cooling Towers (ESWCT),
- Essential Service Water (SX) and Well Water (WW) piping buried in the immediate vicinity of the ESWCT,
- two openings on the SX Blowdown Valve Pit,
- SX piping embedded in concrete slab at elevation 686'-6" in the River Screen House (RSH), and
- exposed SX piping at elevation 686-6" in the RSH.

An operability evaluation was performed to address some of the above listed components (i.e., SX and WW piping buried in the immediate vicinity of the ESWCT, two openings on the SX Blowdown Valve Pit, SX piping embedded in concrete slab at elevation 686'-6" in the RSH and exposed SX piping at elevation 686-6" in the RSH) and appropriate compensatory actions were established to maintain operability of those components. As an alternative to additional costly tornado missile protection structures, barriers or alternative systems, EGC is proposing to apply the probabilistic based TORMIS methodology to demonstrate that the probability of damage to these components is sufficiently small.

The remaining components (components in and on the Essential Service Water Cooling Towers (ESWCT)) were considered because during the Byron Safety System Design and Performance Capability inspection in January 2005 (Inspection Report 05000454/ 2005002(DRS);05000455/2005002(DRS)), a discrepancy was identified in that a number of SX cooling tower components were not missile protected, specifically the SX fans. These

fans have never been missile protected and the plant was originally licensed in this condition. Sections 3.5.4.1 and 9.2.5.3.2 of the Byron UFSAR describe the capability of the SX cooling towers to support shutdown loads with no fans. As discussed in the Inspection Report, the analysis provided in the Byron UFSAR was not correct due to heat load additions made during a 1992 design reconstitution. This issue was considered an unresolved item ((URI 05000454/2005002-07; URI 05000455/2005002-07) pending receipt of clarification of the design basis with respect to tornados. It is expected that addressing Items 1 through 8 of Table 4.1 under TORMIS would remove the requirement to assume that all fans and other unprotected critical components are lost due to tornado missiles and would therefore resolve the open unresolved item.

NRC NUREG-0876, "Safety Evaluation Report Related to the Operation of Byron Station, Units 1 and 2, Docket Nos. STN 50-454 and STN 50-455," describes the evaluation criteria for determining the acceptability of the Byron Station design basis for protection against missiles generated by natural phenomena. The NRC safety evaluation relies on the criteria established in NUREG-0800, "NRC Standard Review Plan," dated July 1981 and includes conformance with General Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," and GDC 4, "Environmental and dynamic effects design bases." In this evaluation, the NRC relied on physical structures, barriers, or other protection (i.e., burial underground) as the method to establish the acceptability of the Byron Station design basis for protection against missiles generated by natural phenomena.

If in the future, additional safety related and non-safety related components at Byron Station are determined to be either not protected or inadequately protected from the strike or damage of TGM, EGC is proposing to apply the probabilistic based TORMIS as an alternative design methodology to demonstrate that the probability of damage to these components is sufficiently small and physical protection or additional physical protection from TGM is not required.

4.0 TECHNICAL ANALYSIS

The analysis for calculating the probability of TGM striking vulnerable targets or perforating protective layers encasing vulnerable targets was based on the Electric Power Research Institute (EPRI) methodology (References 4 through 7). For the purposes of the Byron Station application, the word "target" was defined as a component that is not protected or is inadequately protected from a strike or damage by a TGM.

The scope of potential TGM sources, TGM types and number of TGMs present in the vicinity of the targets listed in Table 4-1 were estimated based on Byron Station site walkdowns. The missile types considered in the TORMIS evaluation covered the spectrum of design basis TGMs currently listed in the Byron Station UFSAR Table 3.5-3, "Tornado-Generated Missiles and Their Properties."

In the Reference 1 safety evaluation, the NRC concluded that the TORMIS methodology is well conceived and well developed and can be utilized when assessing the need for positive tornado missile protection for specific safety-related plant features. At the same time, the NRC concluded that the methodology had limitations for its use and that applicants and licensees using the methodology must consider five plant-specific points and provide appropriate information regarding its use. The Byron Station site plant-specific responses to these points are provided in the following.

1. *Data on tornado characteristic should be employed for both broad regions and small areas around the site. The most conservative values should be used in the risk analysis or justification provided for those values selected.*

   The Byron plant site is located in NRC Tornado Region I (Reference 2). Therefore, the characteristics from tornado Region I are applicable for broad regions. Based on tornado occurrence information discussed in Section 2.3.1.2.2 of the Byron Station UFSAR, the probability of a tornado occurring within the one-degree square in which the Byron Station site is located is 21.0 E-04 per year. Accordingly, in the application of the TORMIS analysis, occurrence rates of Region I will be increased to yield site probability of a tornado strike equal to the local value of 21.0 E-04 per year. Therefore, the Byron Station evaluation will use the conservative characteristic of local and broad region information.

2. *The EPRI study proposes a modified tornado classification, F-scale, for which the velocity ranges are lower by as much as 25-percent than the velocity ranges originally proposed in the Fujita, F-scale. Insufficient documentation was provided in the studies in support of the reduced F-scale. The Fujita F-scale tornado classifications should therefore be used in order to obtain conservative results.*

   For the Byron Station site, the tornado wind speed ranges are based on Fujita F-Scale intensities. These are given in WASH-1300 (Reference 3). The tornado occurrences rates of EPRI, which are wind speed range dependent, will be adjusted appropriately to conform to the Fujita F-Scale.

3. *Reductions in tornado wind speed near the ground due to surface friction effects are not sufficiently documented in the EPRI study. Such reductions were not consistently accounted for when estimating tornado wind speeds at 33 feet above grade on the basis of observed damage at lower elevations. Therefore, the user should calculate the effects of assuming velocity profiles with ratios V_0 (speed at ground level)/ V_{33} (speed at 33 foot elevation) higher than that in the EPRI study. Discussion of the sensitivity of the results to changes in the modeling of the tornado wind speed profile near the ground should be provided.*

   For Byron Station, near ground wind velocity profile(s) from Figure II-12 of Reference 7 will be used that yield a ratio of near ground velocity to velocity at 33 feet above ground (i.e., V_0/V_{33}) of approximately 0.82. The NRC has previously accepted the value of 0.82 for this parameter in the TORMIS analysis performed for the Haddam Neck Power Plant (Reference 8).

4. *The assumptions concerning the locations and numbers of potential missiles presented at a specific site are not well established in the EPRI studies. However, the EPRI meteorology allows site-specific information on tornado missile availability to be incorporated in the risk calculation. Therefore, users should provide sufficient information to justify the assumed missile density based on site-specific courses and dominate tornado paths of travel.*

Targets 1-19:

For Targets 1 through 19 at the Byron plant site, the missile types and missile population in each missile zones were conservatively estimated by performing two site walkdowns in the vicinity of the SX towers and RSH. A total of 100,000 missiles were postulated in 5 missile zones covering approximately 0.9 square mile of the plant area. All missiles in the total missile population are conservatively assumed to be unrestrained. In an example of the TORMIS simulation, a total of 65,550 missiles were postulated on a site of comparable site area. In this postulated population only 8,450 missiles were considered unrestrained. Based on this comparison the postulated missile population at Byron site for the TORMIS model for the ESWCT is considered to be conservative. A total of 33,600 missiles were postulated in 2 missile zones outside of the RSH covering approximately 0.9 square mile of the plant area. All missiles in the total missile population are conservatively assumed to be unrestrained. In addition, missiles were postulated within the RSH to account for the fact that the RSH is not designed for the tornado loads.

Target 20:

NUREG-0800 Standard Review Plan (SRP) 3.5.3 requires that all structures acting as barriers that provide protection to safety related components shall be designed for the local and overall effects of tornado missiles. TORMIS methodology inherently considers only the local effects of tornado missiles in the calculation of damage probabilities.

There are two barriers in the RSH that provide protection to safety related components:

- Barrier-1
  Concrete floor slab at EL. 686'-6". This barrier protects safety related components located below the grade floor.

- Barrier-2
  Concrete floor slab at EL. 702'-0". This barrier protects some safety related piping above the EL 686'-0" floor.

Using a deterministic approach, these barriers were evaluated for the overall effects of the design basis missile spectrum shown in the Byron UFSAR. The results of this evaluation showed that Barrier-1 provided adequate protection to components below this concrete floor slab but Barrier-2 failed to satisfy the ductility requirement. To mitigate this concern, a probabilistic approach was utilized to demonstrate that the probability of a tornado missile striking Barrier-2 is so small that it is not a design basis event. Therefore, Barrier-2 need not be evaluated for the overall effects of a tornado missile.

The probabilistic evaluation was performed using TORMIS methodology in which Barrier-2 was declared as a target (Target 20). The TORMIS methodology allows potential tornado missiles to be analyzed as restrained if it can be demonstrated that they are adequately restrained to meet the restraining force acceptance criteria defined in the TORMIS methodology. The restrained missiles in the RSH are structural steel shapes of the RSH superstructure. There are no missiles outside the RSH other than the boundary fence. The structural steel shapes of the RSH superstructure are the only potential missiles in the RSH and they are analyzed as restrained.

5. *Once the EPRI methodology has been chosen, justification should be provided for any deviations from the calculational approach.*

   For application to the Byron Station site there will not be any deviation from the EPRI methodology contained in References 4 through 7 except those noted above in the resolution of concerns 1 through 4.

The quantification of the TGM strike/damage probability for the various Byron Station targets is based on the following:

- The probabilities are calculated using simulations made using the TORMIS Code. As discussed above, all simulation work meets the five concerns of Reference 1 NRC safety evaluation report.
- Two separate TORMIS models were used: one centered at the Byron Station ESWCTs, the other centered at the Byron Station RSH. TGM zones within 2500 feet from the center of each model were included.
- Simulation studies included 1000 tornado simulations for each model and for tornado intensities corresponding to Fujita intensity F1 through F6. For each tornado simulation, 100 missile trajectories were traced. The probability of missile strike or perforation of each surface of concern was calculated by the program based on the described simulation results.
- The probability of TGM strike on a component was determined by reducing the surface probabilities using reduction factors calculated from ratio of the surface area of the target to the surface area of the TORMIS model surface, or the ratio of the volume of target to the volume surrounded by the TORMIS model surface, as appropriate based on configuration.

The probability of strike on the surface of piping buried in soil was considered by converting specified soil thickness to equivalent thickness of concrete using the methodology of References 9 and 10.

Table 4-1
Byron Station Tornado Missile Targets
Evaluated by TORMIS Methodology

Target No.	Target Description	Target Probability/year
1	Pipe Risers (south)	5.759E-09
	Pipe Risers (north)	6.762E-10
2	Level Switches (south)	7.978E-10
	Level Switches (north)	9.368E-11
3	Anti Vortex Trash Racks (south)	9.827E-09
	Anti Vortex Trash Racks (north)	1.154E-09
4	Fan Motors (south)	3.745E-09
	Fan Motors (north)	1.451E-09
5	Inspection Hatches (south)	7.451E-10
	Inspection Hatches (north)	2.887E-10
6	Personnel Hatches (south)	4.483E-10
	Personnel Hatches (north)	1.185E-11
7	Fans (south)	1.457E-08
	Fans (north)	1.003E-08
8	Electrical Room Louvers (south)	3.431E-09
	Electrical Room Louvers (north)	< E-12
9	Piping – West of North ESWCT	< E-12
10	Piping – West of South ESWCT	< E-12
11	Piping – East of North ESWCT	2.492E-09
12	Piping – East of South ESWCT	6.895E-10
13	Piping – North of North ESWCT	< E-12
14	Piping – South of South ESWCT	< E-12
15	Piping – Due West of ESWCTs	< E-12
16	Piping – Due East of ESWCTs	1.198E-09
17	SX Blowdown Valve Pit	< E-12
18	Embedded Piping in RSH	2.616E-07
19	Exposed Piping in RSH	3.390E-08
20	RSH EL. 702 concrete slab (Barrier-2)	1.816E-07
	Total Byron Station Probability (Unit 1 and Unit 2)	5.345E-07

As provided in Table 4-1, the total of TGM strike probabilities for the affected Byron Station components is 5.345E-07. Based on the conservative assumptions used to evaluate the specified components, (e.g., missile types and missile population); and 19 of the 20 components assumed unrestrained missiles, the acceptance criteria of 1E-06 per reactor year is justified as allowed by SRP Section 2.2.3. The cumulative probability for the 20 components is well below the acceptance criterion of 1E-06 per reactor year and therefore new or additional physical protection is not required for these components.

The total costs associated with installing physical structures or barriers to additionally protect targets such as pipe risers, trash racks, fan motors, fans and piping would be excessive and would be disproportionate to the insignificant increase in the level of protection. In addition, the installation of missile barriers on certain of these target components would result in a degradation in the ability to efficiently and safely operate and maintain Byron Station equipment. To this concern, Byron Station is intending to use this current application of the TORMIS methodology to allow the continued use of the originally installed SX Blowdown Valve Pit hatch covers. A compensatory measure installed a steel plate structure over the existing aluminum hatch cover before the TORMIS evaluation was completed.

Operators must enter the SX Blowdown Valve Pits to isolate the SX Blowdown Valves and conserve water inventory in the ESWCT. These actions must be accomplished within two hours of tornado damage to the SX Makeup Pumps at the RSH to permit an orderly shutdown coincident with a plant transient and since access to the valve pits currently requires unbolting the hold-down bar and two individuals to move the cover plate structure these access restrictions create an operational challenge and a personnel safety concern. Restoration of access to the SX Blowdown Valve Pits using the aluminum hatch would eliminate these concerns.

5.0 REGULATORY ANALYSIS

5.1 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:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) 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.

ATTACHMENT 1
Evaluation of Proposed Changes

Overview

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," and 10 CFR 50.59, "Changes, tests, and experiments," paragraph (c)(2)(viii), Exelon Generation Company, LLC (EGC) is requesting an amendment to Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2, respectively.

Implementation of the request will require revision of the Byron Station Updated Final Safety Analysis Report (UFSAR) to incorporate the use of the probabilistic based tornado missile strike analysis (i.e., the TORMIS methodology). This methodology will be used to determine which safety related and non-safety related components require physical protection from tornado-generated missiles (TGM). This probabilistic based missile strike analysis is based on the NRC approved Electric Power Research Institute (EPRI) "Tornado Missile Risk Evaluation Methodology (EPRI NP-2005)."

EGC has evaluated whether or not a significant hazards consideration is involved with the proposed design basis changes by focusing on the three criteria set forth in 10 CFR 50.92 as discussed below:

Criteria

1. **Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   The probability of occurrence of the design basis tornado remains the same as originally established in the Byron Station Updated Final Safety Analysis Report (UFSAR). The request involves the use of a probability-based assessment of the need for physical tornado missile protection of specific existing features at Byron Station.

   The request is to utilize an NRC approved methodology (i.e., the Electric Power Research Institute (EPRI) Topical Report "Tornado Missile Risk Evaluation Methodology") to conclude that the acceptance criteria of NUREG-0800, "Standard Review Plan," (SRP) Section 2.2.3, "Evaluation of Potential Accidents," Revision 2, July 1981, has been met for Byron Station and that tornado missile damage of selected components at Byron Station need not be considered as a credible event.

   Per Item 2 in Section III of SRP 3.5.1.4, probability methods can be used to accept tornado missile effects provided damage to all important structures, systems and components, as discussed in Regulatory Guide 1.117 are considered. Per Section II of the SRP, the acceptance criterion of SRP 2.2.3 is applicable. Section II of SRP 2.2.3 states that the expected rate of occurrence of potential exposure in excess of 10 CFR Part 100, "Reactor Site Criteria," guidelines of approximately 1.0E-06 per reactor year is acceptable, if when combined with reasonable qualitative arguments, that the realistic probability can be shown to be smaller.

   The proposed change is not considered to constitute a significant increase in the probability of occurrence or the consequences of an accident due to the extremely low probability of damage due to tornado-generated missiles and therefore an extremely low

probability of a radiological release. Therefore, the proposed changes do not involve a significant increase in the probability or consequences of previously evaluated accidents.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   This change involves the use of an alternative methodology to assess the need for tornado missile protection on selected Byron Station components. The use of this methodology and the changes to the Byron Station UFSAR will be limited to design basis tornado applications and do not contribute to the possibility of a new or different kind of accident from those previously analyzed.

   No new or different system interactions are created and no new processes are introduced. The proposed change does not introduce any new failure mechanisms, malfunctions, or accident initiators not already considered in the design and licensing bases. Based on this evaluation, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

   Response: No.

   The changes, allowing for no additional physical protection for tornado-generated missiles for certain Byron Station components, is based on successfully meeting the acceptance criteria of NUREG-0800, "Standard Review Plan," (SRP) Section 2.2.3, "Evaluation of Potential Accidents," Revision 2, July 1981. Because of the extremely low probability of damage to these components from tornado-generated missiles, the change is not considered to constitute a significant decrease in the margin of safety.

5.2 Applicable Regulatory Requirements Criteria

As stated in 10 CFR 50.59, "Changes, tests, and experiments," paragraph (c)(2)(viii), a licensee shall obtain a license amendment pursuant to 10 CFR 50.90, "Application for amendment of license or construction permit," prior to implementing a proposed change, test, or experiment if the change, test, or experiment would result in a departure from a method of evaluation described in the UFSAR used in establishing the design bases or in the safety analyses. The use of a probability-based protection for select Byron Station systems, structures, or components from tornado-generated missiles is a different method of evaluation than physical protection from tornado generated missiles and therefore a license amendment is required.

Appendix A to 10 CFR 50, "General Design Criteria for Nuclear Power Plants," Criterion 2, "Design base for protection against natural phenomena," requires that structures, systems, and components essential to safety be designed to withstand the effects of natural phenomena such as tornados, and Criterion 4, "Environmental and dynamic effects design bases," requires that these same plant features be protected against tornado generated missiles. The spectrum of missiles for a tornado in a Region 1 site is identified in Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants."

NUREG-0800, "Standard Review Plan," (SRP) Section 2.2.3, "Evaluation of Potential Accidents," Revision 2, July 1981, states that an event with an occurrence frequency of approximately 1.0E-07 per year or less need not be considered as a credible event. SRP Section 2.2.3 further states that it is acceptable to not postulate events for which the expected frequency of occurrence is 1.0E-06 per year if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change 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 would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for 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." Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from L. S. Rubenstein (U. S. NRC) to F. J. Miraglia (U. S. NRC), "Safety Evaluation Report – Electric Power Research Institute (EPRI) Topical Reports Concerning Probabilistic Risk Assessment (PRA) Methodology," dated October 26, 1983

2. NRC Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants," April 1974

3. Wash-1300 (UC-I 1), "Technical Basis for Interim Regional Tornado Criteria," May 1974

4. Electric Power Research Institute (EPRI) Report NP-768, "Tornado Missile Risk Analysis," May 1978

5. EPRI Report NP-769, "Tornado Missile Risk Analysis –Appendices," May 1978

6. EPRI Report NP-2005-CCM, "Tornado Missile Simulation and Design Methodology - Computer Code Manual," August 1981

7. EPRI Report NP-2005, "Tornado Missile Simulation and Design Methodology Volume 2: Model Verification and Data Base Updates," August 1981

8. Letter from A. Wang (US NRC) to J. F. Opeka (Northeast Nuclear Energy Company), "Haddam Neck Plant Systematic Evaluation Program Topics 111-2 and III-4A: Wind and Tornado Loadings and Missiles," dated October 21, 1992

9. C. Wayne Young, "Depth Prediction for Earth-Penetrating Projectiles," Journal of Soil Mechanics and Foundation Division of ASCE, Proceedings Vol. 95, No. SM3, May 1969

10. "Report of the ASCE Committee on Impactive and Impulsive Loads," Proceedings of the Second ASCE Conference on Civil Engineering and Nuclear Power, Vol. V, Knoxville, Tennessee, September 15-17, 1980

ATTACHMENT 2

BYRON STATION
UNITS 1 AND 2

Docket Nos. 50-454 and 50-455

License Nos. NPF-37 and NPF-66

Byron Station Application of the TORMIS Methodology

Markup of Byron Station Updated Final Safety Analysis Report Pages

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3.5.2.1 Systems/Components Not Requiring Unique Tornado Missile Protection

required minimum depth of 4 feet 1 inch, determined using Young's method.

Safety-related HVAC system air intakes and exhausts are indicated on the plant arrangement Drawings M-5, M-6, M-14, M-15 and M-22-2.

Auxiliary Building and Containment Purge (VA, VQ)

Intakes

Intake louvers are shown as listed above. Protection is provided by missile walls.

Exhaust

The exhaust stacks are shown as listed above. Vertical stack connected to horizontal exhaust tunnel affords missile protection.

Diesel-Generator Room Intake (VD)

The diesel-generator room intake is shown as listed above. Protection is provided by missile walls.

Safety-related electrical cables are adequately protected against tornado-generated missiles by the reinforced concrete ducts around them.

Control Room Intake (VC)

The control room intake is shown as listed above. Protection is provided by missile walls.

Insert A

3.5.3 Barrier Design Procedures

Two types of structural response to missile impact have been investigated:

a. local effect in the impacted area which includes estimation of the depth of penetration and, in the case of concrete barriers, the potential for secondary missiles by spalling or scabbing; and

b. overall response of the barrier which includes the calculation of deflection due to missile impact.

The tornado-generated missile velocities presented in Table 3.5-4 are based on TVA Topical Report TVA-TR74-1. Commonwealth Edison committed to design to these velocities during the PSAR review. The staff had accepted these velocities as indicated in Revision 0 of the Standard Review Plan 3.5.1.4.

Draft Rev. 1 of SRP 3.5.1.4 states: "At the operating license stage, applicants who were not required at the construction

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3.5.2.1 Systems/Components Not Requiring Unique Tornado Missile Protection

A limited amount of safety related systems and components located near penetrations in Seismic Category I structures or located outside of such structures are evaluated as not requiring unique tornado missile protection barriers.

"Important" systems and components (as discussed in Regulatory Guide 1.117) are generally protected. The limited amount of unprotected portions of important systems and components are analyzed using a probabilistic missile strike analysis as permitted in Standard Review Plan 3.5.1.4, "Missiles Generated By Natural Phenomena". This analysis is conducted to determine the total (cumulative) probability per year of missiles striking important structures, systems, and components due to postulated tornadoes. This information is then utilized to determine the specific design provisions that must be provided to maintain the estimate of strike probability below an allowable level.

The allowable level established for the protection of such systems and components at Byron is consistent with the acceptance criteria in Standard Review Plan 2.2.3, "Evaluation of Potential Accidents", i.e., that a probability of occurrence of initiating events (those that could lead to potential consequences in excess of the 10 CFR Part 100 guidelines) of approximately $1x10^{-6}$ per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower. The Byron-specific acceptance criteria is that the total probability of tornado missiles simply striking an important system or component must be shown by analysis to be less than $1x10^{-6}$ per year.

This Byron-specific criteria contains the following inherent conservatisms:

a. It is assumed that an important system or component simply being struck by a tornado missile would result in damage sufficient to preclude it from performing its intended safety function, although this is not realistic for all cases.

b. The analysis calculates the probability of tornado missiles striking penetration openings. The openings themselves are not targets. The true targets are the safety-related components located inside the buildings. Some of the missile types listed in Table 3.5-3 cannot enter the openings and damage the components.

Insert A

c. The missile population is conservatively estimated.

d. All postulated missiles are conservatively estimated to have minimal restraints unless proven to meet the restraint criteria of the approved analysis methodology.

The analysis uses an NRC approved methodology (Reference 15) developed by the Electric Power Research Institute (EPRI)(Reference 16). The methodology is implemented using the computer program TORMIS, which is described in Section 3.5.2.2.

Should Byron evaluations using the TORMIS methodology provide results indicating that the probability of tornado damage exceeds the acceptance criteria of $1x10^{-6}$ per year, then unique barriers are utilized to reduce the total probability to below the acceptance criteria. Temporary removal of a protective feature is permitted under administrative controls, if removal is determined to be necessary.

13. A. H. Motloch, "Rotational Capacity of Hinging Regions in Reinforced Concrete Beams," from Proceedings of the International Symposium on Flexural Mechanics of Reinforced Concrete, American Society of Civil Engineers, 1965.

14. Letter from T. R. Tramm (CECo) to H. R. Denton (NRC), "Initial Response on Control of Heavy Loads with respect to the Guidelines of NUREG-0612," dated April 7, 1982 (TRT 82-83).

Insert B

15. Letter, Rubenstein (NRC) to Miraglia (NRC) entitled "Safety Evaluation Report - Electric Power Research Institute (EPRI) Topical Reports Concerning Tornado Missile Probabilistic Risk Assessment (PRA) Methodology", dated October 26, 1983.

16. Twisdale, L.A. and Dunn, W.L., EPRI NP-2005, Tornado Missile Simulation and Design Methodology, Volumes I and II, Final Report dated August 1981.