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AEP
INDIANA
MICHIGAN
POWER

June 8, 2000

C0600-11
10 CFR 50.90

Docket Nos.: 50-315
50-316

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2
LICENSE AMENDMENT REQUEST TO PERMIT USE OF PROBABILISTIC RISK ASSESSMENT TECHNIQUES TO EVALUATE THE NEED FOR TORNADO-GENERATED MISSILE BARRIERS

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c), of changes to the CNP design and licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR) that involve an unreviewed safety question. The change will allow the use of probabilistic risk assessment (PRA) techniques in evaluating the need for tornado-generated missile barriers. This change is requested to provide an alternative to installing physical missile protection for those structures, systems, or components that are not physically protected from tornado-generated missiles. The specific methodology to be used is based on methodology that has been accepted by the Nuclear Regulatory Commission (NRC) staff at other plants.

I&M has identified components that are not protected from tornado-generated missiles. These include external components associated with emergency diesel generators (ventilation, combustion air intake, and engine exhaust), external components associated with switchgear room heating, ventilation, and air conditioning intake systems, walls and roof enclosing the east end of the Fuel Handling Building, and openings in the roof on the east and west end of the Fuel Handling Building.

NRR-057

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To resolve these issues, I&M proposes to use the Electric Power Research Institute (EPRI) tornado missile methodology contained in EPRI NP-2005, Volumes 1 and 2, "Tornado Missile Simulation and Design Methodology," August 1981, to assess the need for positive missile protection for specific safety-related plant features. NRC safety evaluation report dated November 29, 1983, "Electric Power Research Institute (EPRI) Reports (EPRI NP-768, 769 and 2005, Volumes 1 and 2) Concerning Tornado Tornado [sic] Missile Probabilistic Risk Assessment (PRA) Methodology and Corresponding Safety Evaluation Report," found the methodology contained in EPRI NP-2005 to be an acceptable approach for demonstrating compliance with the requirements of General Design Criteria (GDC) 2 and 4. These GDCs address protection of safety-related plant features from the effects of tornado and high wind generated missiles. NRC acceptance of an application of the EPRI methodology is subject to appropriate resolution of specific concerns related to input parameters and restricts the use of the methodology to specific plant features where additional costly tornado missile protective barriers and alternative systems are under consideration. Use of PRA methodologies to resolve similar issues have been accepted by the NRC staff for use at other nuclear power plants.

Attachment 1 provides a detailed description in support of the proposed change. Attachment 2 addresses the resolution of specific concerns related to input parameters. Attachment 3 provides a markup of the UFSAR that reflects this proposed change. Attachment 4 describes the evaluation performed in accordance with 10 CFR 50.92(c), which concludes that no significant hazard is involved. Attachment 5 provides the environmental assessment. Attachment 6 identifies those actions committed to by I&M in this submittal.

I&M requests approval of this request by August 1, 2000, in order to support restart of Unit 1. If this amendment is approved, I&M requests a 30 day implementation period from the date of issuance.

Copies of this letter and its attachments are being transmitted to the Michigan Public Service Commission and Michigan Department of Environmental Quality, in accordance with the requirements of 10 CFR 50.91.

Should you have any questions, please contact Mr. Robert C. Godley, Director of Regulatory Affairs, at (616) 466-2698.

Sincerely,

R. P. Powers
Vice President

/dms

Attachments

c: J. E. Dyer
MDEQ - DW & RPD
NRC Resident Inspector
R. Whale

AFFIRMATION

I, Robert P. Powers, being duly sworn, state that I am Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this Request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

R. P. Powers

Robert P. Powers
Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 8th DAY OF June, 2000

Patricia A. Eddie
Notary Public

My Commission Expires _____

PATRICIA A. EDDIE
NOTARY PUBLIC - BERRIEN CO. MICH
MY COMMISSION EXPIRES
NOVEMBER - 5 - 2000

ATTACHMENT 1 TO C0600-11

DESCRIPTION OF THE PROPOSED CHANGE

A. Summary of the Proposed Change

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c), of changes to the CNP design and licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR) that involve an unreviewed safety question. The change will allow the use of probabilistic risk assessment (PRA) techniques in evaluating the need for tornado-generated missile barriers. This change is requested to provide an alternative to installing physical missile protection for those structures, systems, or components (SSCs) that are not physically protected from tornado-generated missiles. The specific methodology to be used is based on methodology that has been accepted by the Nuclear Regulatory Commission (NRC) staff at other plants.

I&M has identified components that are not protected from tornado-generated missiles. These include external components associated with emergency diesel generators (EDG); (ventilation, combustion air intake, and engine exhaust), external components associated with switchgear room heating, ventilation, and air conditioning (HVAC) intake systems; walls and roof enclosing the east end of the fuel Handling Building; and openings in the roof on the east and west end of the Fuel Handling Building.

To resolve these issues, I&M proposes to use the Electric Power Research Institute (EPRI) tornado missile methodology contained in EPRI NP-2005, Volumes 1 and 2, "Tornado Missile Simulation and Design Methodology," August 1981, to assess the need for positive missile protection for specific safety-related plant features. NRC safety evaluation report dated November 29, 1983, "Electric Power Research Institute (EPRI) Reports (EPRI NP-768, 769 and 2005, Volumes 1 and 2) Concerning Tornado Tornado [sic] Missile Probabilistic Risk Assessment (PRA) Methodology and Corresponding Safety Evaluation Report," found the methodology contained in EPRI NP-2005 to be an acceptable approach for demonstrating compliance with the requirements of General Design Criteria (GDC) 2 and 4. These GDCs address protection of safety-related plant features from the effects of tornado and high wind generated missiles. NRC acceptance of an application of the EPRI methodology is subject to appropriate resolution of specific concerns related to input parameters and restricts the use of the methodology to specific plant features where additional costly tornado missile protective barriers and alternative systems are under consideration. Use of PRA methodologies to resolve similar issues has been accepted by the NRC staff for use at other nuclear power plants.

The EPRI methodology is implemented using the computer program TORMIS. TORMIS determines the probability of tornado-generated missiles striking walls and roofs of buildings on which penetrations or exposed portions of systems/components are located. The probability is

calculated by simulating a large number of tornado strike events at the site for each tornado wind speed intensity scale. After the probability of striking the walls or roofs is calculated, the exposed surface areas of the particular components are factored in to determine the probability of striking a particular item. If necessary, the probability of striking a particular component may be multiplied by appropriate conditional core damage probabilities derived from the CNP specific PRA.

An example of this process is provided for the Unit 1 EDGs. In this example, specific attributes were set to conservative values to demonstrate that the overall probability is low. The probability values that have been assumed to be 1 in the example are conservative in that the use of lower, more realistic values could likely be justified. Each of the two Unit 1 EDGs has an external exhaust silencer, combustion air intake, and a diesel room air intake making a total of three potential missile targets for each EDG, or six EDG missile targets in total. These six targets are located along the exterior wall of the diesel generator rooms. The probability of a tornado-generated missile striking this wall was modeled in the TORMIS code. The potential target areas for the silencer and the combustion and room air intakes were combined for each EDG, and ratioed to the wall area. Based on the tornado missile strike frequency for the wall and each EDG's target area, a total strike probability for each engine of 5.7×10^{-7} per year was calculated. Next, it was assumed that a missile strike of any of the three targets would disable the associated EDG. This is conservative since post-strike recovery is not credited and some of the missiles in the TORMIS model (such as 4' x 4' siding) may cause no damage or only partial damage of these EDG targets. It was further conservatively assumed that one of the EDGs was out of service and could not be recovered after the tornado. Finally, it was conservatively assumed that the probability of a Loss of Offsite Power is 1.0 due to the tornado. This combination of assumptions would result in a complete loss of AC Power. Given a Station Blackout (SBO), the probability of core melt is calculated to be 0.102 using the CNP PRA. As a further conservatism, it was assumed that the probability of containment failure is 1.0. The final probability of exceeding 10 CFR 100 guidelines from a tornado missile induced EDG failure was calculated as:

Example of Process for Unit 1 EDG

Probability Value	Description
5.7×10^{-7} per year	Probability of striking one of three EDG targets based on TORMIS results and target areas
x 1	Probability assumption that a missile strike will disable the associated EDG
x 1	Probability assumption that one of the EDGs is out of service at the time of the tornado
x 1	Probability of Loss of Offsite Power given a tornado

x 0.102	Probability of core melt from CNP PRA given the occurrence on an SBO
x 1	Probability of containment failure is conservatively assumed to be 1.0
$P_{tot\ EDG} = 5.8 \times 10^{-8}$ per year per unit	Final probability of exceeding 10 CFR 100 guidelines which is significantly less than 1.0×10^{-6} per year per unit acceptance criteria for tornado-generated missiles

The resultant value estimates the probability of exposures in excess of the 10 CFR 100 guidelines due to a postulated tornado missile strike to the associated component. The sum of the probabilities of exposure for each component estimates the total probability of exposure in excess of the 10 CFR 100 guidelines due to postulated tornado missile strikes.

Upon NRC approval of the requested change, the UFSAR will be changed to allow the use of TORMIS in evaluating the need for tornado-generated missile barriers. Such changes would be acceptable when the total probability of exposure in excess of the 10 CFR 100 guidelines due to postulated tornado missile strikes is less than 1×10^{-6} per year per unit, when combined with reasonable qualitative arguments that indicate the realistic probability is actually lower. This value is established as a conservative threshold for evaluating compliance with CNP GDC specified in UFSAR Section 1.4.1.2, "Performance Standards." Existing plant configurations, as well as future changes to the facility, may be evaluated using this revised methodology. The UFSAR would be updated on the normal cycle with a list of affected plant SSCs or areas which are no longer required to be designed, fabricated, or erected to withstand the additional forces imposed by tornado-generated missile strikes. The list will be a subset of those SSCs requiring protection to satisfy UFSAR Section 1.4.1.5.1, "Missile Protection Criteria." The only SSCs known at this time for inclusion in the next UFSAR update would be the external components associated with the EDG ventilation and combustion air, and engine exhaust systems; three HVAC intake hoods located on the roof of the switchgear rooms, wall panels and roof slab enclosing the east end of the Fuel Handling Building and openings in the roof slab on the east and west ends of the Fuel Handling Building.

B. Description of the Current Requirements

UFSAR Section 1.4.1.2, "Performance Standards," states "[t]hose structures, systems and components of reactor facilities which are essential to the prevention, or to the mitigation of the consequences, of nuclear accidents which could cause undue risk to the health and safety of the public shall be designed, fabricated, and erected to performance standards that enable such structures, systems and components to withstand, without undue risk to the health and safety of the public, the forces that might reasonably be imposed by the occurrence of an extraordinary natural phenomenon such as earthquake, tornado, flooding condition, high wind or heavy ice.

The design bases so established shall reflect: (a) appropriate consideration of the most severe of these natural phenomena that have been officially recorded at the site and the surrounding area and (b) an appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design."

UFSAR section 1.4.1.5.1 states, CNP "is designed so that missiles from external or internal sources:

1. Will not cause or increase the severity of a loss of coolant accident (LOCA).
2. Will not damage engineered safety features such that the minimum required safety functions are jeopardized.
3. Will not cause a break in the Seismic Class I portion of a steam or feedwater pipe.
4. Will not prevent safe shutdown and isolation of the reactor.
5. Will not damage fuel stored in the Spent Fuel Pit."

UFSAR Section 1.4.1.5.3, "Missile Protection Methods," describes methods used for preventing damage from missiles. These methods are as follows:

1. Compartmentalization
   Enclosing equipment in missile protected compartments.
2. Barriers
   Erecting barriers to stop potential missiles either at the source or at the location of the equipment to be protected.
3. Separation
   Sufficient separation of redundant systems so that a potential missile cannot impair both systems.
4. Restraints
   Limiting generation of potential missiles by means of restraints.
5. Equipment Design
   Designing the structure or component to withstand a missile, without loss of function.
6. Strategic Orientation
   Orienting equipment, or parts of equipment, in a direction that directs the potential missile paths away from safety-related equipment.
7. Distance
   Locating equipment beyond the range of potential missiles.

Only methods 1, 2, 3, 4, and 5 are germane to tornado-generated missiles.

C. Bases for the Current Requirements

As described in the UFSAR, physical protection involves the use of "Compartmentalization," "Barriers," and "Equipment Design" to protect equipment from the effects of tornado-generated

missiles. The physical protection features ensure that those SSCs which are important to safety are erected to standards that enable such SSCs to withstand the forces that might reasonably be imposed by a tornado generated missile. "Separation" assures that a tornado generated missile cannot damage redundant systems or components, and "Restraints" assure that an object cannot be picked up by tornado winds and become a potential missile.

D. Description of the Change and the Need for Revision of the Requirement

I&M has identified some SSCs, requiring protection from tornado-generated missiles, where the existing physical protection features are not adequate to protect the SSCs from tornado-generated missiles. Resolution of these issues in accordance with the current licensing basis would require installation of additional physical missile protection features at significant expense. The use of an NRC approved methodology for evaluating the risk associated with tornado-generated missiles has established that the risk of the as-built configurations is acceptably low, and eliminates the need for installation of additional physical missile protection features.
The proposed change modifies the CNP design and licensing basis as described in the UFSAR to allow the use of the EPRI tornado missile methodology contained in EPRI NP-2005, Volumes 1 and 2, "Tornado Missile Simulation and Design Methodology," August 1981, to assess the need for positive missile protection for specific safety-related plant features. Additionally, the proposed change establishes the acceptance limit for use of this new methodology.

E. Bases for the Proposed Change

An evaluation using the EPRI methodology was conducted to determine the risks associated with postulated tornado-generated missile strikes on the exposed EDG external components, the exposed HVAC intakes and exhaust components, the pre-cast concrete panels and concrete root enclosing the east end of the Fuel Handling Building, and openings in the roof on the east and west end of the Fuel Handling Building. The evaluation determined the probability of potential exposures in excess of 10 CFR 100 guidelines occurring as a result of tornado-generated missile strikes on the subject SSCs is approximately 1.477×10^{-7} per reactor year for Unit 1 and 1.481×10^{-7} per reactor year for Unit 2.

The results were evaluated against [1]NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports For Nuclear Power Plants LWR Edition," Section 3.5.1.4, "Missiles Generated by External Phenomena," using the acceptance criteria specified in Standard Review Plan (SRP) Section 2.2.3, "Evaluation of Potential Accidents." Table 1 provides comparison of the SRP provisions and the proposed licensing basis for CNP.

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[1] CNP's current licensing basis does not include conformance to the provisions of NUREG-0800. Results of the evaluation are only provided for comparison.

Table 1 SRP and CNP Proposed Licensing Basis Acceptance Criteria Comparison	
1. SRP 3.5.1.4, Revision 2, Missiles Generated by Natural Phenomena	The methodology of identification of appropriate design basis missiles generated by natural phenomena shall be consistent with the acceptance criteria defined for the evaluation of potential accidents from external sources in SRP Section 2.2.3.
2. SRP 2.2.3, Revision 2, Evaluation of Potential Accidents	The expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of approximately 1 x 10^{-6} per reactor year is acceptable. When combined with reasonable qualitative arguments, the realistic probability can be shown to be lower.
3 CNP Unit Nos. 1 and 2 Proposed Licensing Basis	Tornado-generated missile protection is not required for systems, structures, components or areas designed to satisfy UFSAR Section 1.4.1.2, "Performance Standards," or UFSAR Section 1.4.1.5.2, "Missile Protection Criteria," if the resultant aggregate probability of exposures in excess of 10 CFR 100 guidelines is less than or equal to 1 x 10^{-6} per reactor year. When combined with reasonable qualitative arguments, the realistic probability can be shown to be lower.

The proposed acceptance limit is consistent with criteria described in the SRP and has been approved for use at other nuclear power plants.

Discussion of Accident Analyses

The CNP UFSAR does not evaluate accident consequences for events associated with tornado-generated missiles.

Related Industry Initiatives

Several other licensees have proposed similar approaches to utilize PRA techniques in evaluating the need for tornado-generated missile barriers (References 1, 2, and 3). NRC has found these approaches acceptable (References 4, 5, and 6).

F. Impact on Previous Submittals

No previous submittals are affected by this request.

G. References

1. Baltimore Gas and Electric, Calvert Cliffs Nuclear Power Plant, submittal to NRC dated October 13, 1994, "Use of NUREG-0800, Standard Review Plan Guidance in Evaluating the Need for Tornado-Generated Missiles"

2. Centerior Energy, Perry Nuclear Power Plant, submittal to NRC dated August 14, 1997, "10 CFR 50.59 and 10 CFR 50.90 Request Regarding Tornado Missiles"

3. Illinois Power, Clinton Power Station, submittal dated March 1, 1999, "Clinton Power Station Proposed Amendment of Facility Operating License No. NPF-62 (LS-98-009)"

4. NRC letter to Baltimore Gas and Electric dated May, 1995, "Licensing Basis Change for Evaluating the Need for Tornado-Generated Missile Barriers - Calvert Cliffs Nuclear Power Plant"

5. NRC letter to Centerior Services Company dated November 4, 1997, "Amendment No. 90 to Facility Operating License No. NPF-58 Perry Nuclear Power Plant, Unit 1"

6. NRC letter to Clinton Power Station dated February 29, 2000, "Issuance of Amendment - Clinton Power Station"

ATTACHMENT 2 TO C0600-11

RESOLUTION OF THE SPECIFIC CONCERNS RELATED TO INPUT PARAMETERS

NRC safety evaluation report (SER) dated November 29, 1983, "Electric Power Research Institute (EPRI) Reports (EPRI NP-768, 769 and 2005, Volumes 1 and 2) Concerning Tornado Tornado [sic] Missile Probabilistic Risk Assessment (PRA) Methodology and Corresponding Safety Evaluation Report," found that the methodology contained in EPRI NP-2005 is an acceptable approach for demonstrating compliance with the requirements of General Design Criteria (GDC) 2 and 4. These GDC address protection of safety-related plant features from the effects of tornado and high wind generated missiles.

NRC acceptance of an application of the EPRI methodology is subject to appropriate resolution of specific concerns identified in the SER that are related to input parameters. These additional concerns and approach used to address the concerns for the Donald C. Cook Nuclear Plant (CNP) are provided below.

SER Concern 1

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

CNP Approach to SER Concern 1

Based on broad region data, the probability of tornadoes with wind speed greater than 73 miles per hour, the minimum wind speed for a Fujita F1 tornado, occurring at the site is 3.74×10^{-4} per year. The local (small) region data indicates the probability of wind speeds greater than 73 miles per hour occurring at the site is 2.99×10^{-4} per year. The more conservative broad region information is used in the CNP evaluation.

SER Concern 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 F-scale tornado classifications should therefore be used in order to obtain conservative results."

CNP Approach to Concern 2

Fujita F-scale wind speed intensities from WASH-1300, "Technical Basis for Interim Regional Tornado Criteria," are used in the CNP evaluation. WASH-1300 does not specify wind speeds for F6 scale tornadoes. Therefore, a wind speed range of 313 - 360 mph is used for the F6 scale

tornado to include consideration of the highest wind speeds in Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants."

SER Concern 3

"Reductions in tornado wind speed near the ground due to surface friction 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 based on observed damage at lower elevations. Therefore users should calculate the effect of assuming ground velocity profiles with ratios V0 (speed at ground level)/V33 (speed at 33 feet elevation) higher than at the EPRI study. Discussions of sensitivity of the results of the changes in the modeling of the tornado wind speed profile near the ground should be provided."

CNP Approach to Concern 3

For CNP, the tornado wind field parameters are selected so that the ratio of velocity at ground level to that at 33 feet is 0.82. The following provides an explanation of why this is a conservative approach and how it compares to the concept discussed in the NRC SER of using a higher ratio of V0/V33 (speed at ground level/speed at 33 feet elevation).

As discussed in the EPRI study (volume II, section II.E) the standard "synthesized" tornado missile (TORMIS) computer code model of the wind speeds was determined to be non-conservative at near-ground elevations when it was compared against several other windfield models. Therefore, the report performed sensitivity studies by varying several parameters to increase and decrease near-ground velocities. These were documented in EPRI-2005, Figure II-12. The recommendation of the report was to use parameters that increase the near-ground windfields of the synthesized windfield model so that the rotational velocity at the ground is increased to 225 miles per hour. This results in a V0/V33 value of 225/300 = 0.75. The TORMIS computer code used for the CNP analysis includes these parameters. It was noted in a review of several other plants' submittals that a value of V0/V33 of 0.82 was used in their analysis and subsequently approved by the NRC. The V0/V33 value of 0.82 used in the CNP analysis results in a velocity at ground level of 246 miles per hour (246/300 = 0.82). This parameter selection has been previously accepted by NRC for the Perry Nuclear Power Plant in the SER associated with amendment number 90, issued on November 4, 1997.

SER Concern 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 methodology 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 specific missile sources and dominant tornado paths of travel."

CNP Approach to Concern 4

The population of missiles used in the analysis was based on a physical walk down of non-safety-related buildings, trailers, fencing, trees, and parking lots within a 2000-foot radius of the plant. Also included were missiles from plant buildings with siding not designed for tornado winds. This walk down resulted in a potential missile population used in the PRA in excess of 55,000 objects. This value represents a conservative estimate of the number of potential missiles present at the time of the physical walk down. It does not represent a limit on the number of potential missiles that may be present within the walk down area. The number and location of potential missiles present is only limited by the results of the probabilistic analysis and the proposed acceptance limit (1×10^{-6} per reactor per year).

SER Concern 5

"Once the EPRI methodology has been chosen, justifications should be provided for any deviations from the calculational approach."

CNP Approach to Concern 5

No exceptions have been taken from the EPRI methodology except items noted under SER Concerns 1 through 4, above.

ATTACHMENT 3 TO C0600-11

MARKUP OF UFSAR TO INCORPORATE PROPOSED CHANGE

Insert 1-i

Insert 1-i

[1] The page numbers in the table of contents are subject to change but will be established at the time of incorporation into the UFSAR.

<No changes to this page>

preclude such risk, particularly in areas containing critical portions of the facility such as containment, control room, and components of engineered safety features.

Primary emphasis is directed at minimizing the risk of fire by use of thermal insulation and adhesives which do not support combustion, flame retardant wiring, adequate overload and short circuit protection, and the elimination of combustible trim and furnishings. The facility is equipped with protection systems for controlling fires which might originate in plant equipment. See Sub-Chapter 9.8 for a description of the fire protection system.

The containment and auxiliary building ventilation systems can be operated from the control room of the corresponding unit as required to limit the potential consequences of fire. Critical areas of the containment, the control room and the areas containing components of engineered safety features, have detectors to alert the control room to the possibility of fire so that prompt action may be taken to prevent significant damage.

1.4.1.4 Sharing of Systems

Criterion: Reactor facilities may share systems or components if it can be shown that such sharing will not result in undue risk to the health and safety of the public.

Two types of sharing were considered: a) sharing of systems and components between the two units and b) sharing of components among systems within a unit. For such shared systems and components, analyses confirm that there is no interference with basic function and operability of these systems due to sharing, and hence no undue risk to the health and safety of the public results. Sub-Chapter 1.3-9 identifies the shared systems and components in the plant.

1.4.1.5 Missile Protection

Criterion: Adequate protection for the engineered safety features, the failure of which would result in undue risk to the health and safety of the public, shall be provided against dynamic effects and missiles that might result from plant equipment failures.

This section discusses in general terms the missile protection criteria, missile sources, and methods of missile protection for the Donald C. Cook Nuclear Plant.

A more comprehensive discussion of missiles arising in the event of a failure of the main turbine-generator can be found in Unit 1 UFSAR Section 14.1.13.

1.4.1.5.1 Missile Protection Criteria

The Donald C. Cook Nuclear Plant is designed so that missiles from external or internal sources:

1. Will not cause or increase the severity of a loss of coolant accident (LOCA).
2. Will not damage engineered safety features such that the minimum required safety functions are jeopardized.
3. Will not cause a break in the Seismic Class I portion of a steam or feedwater pipe.
4. Will not prevent safe shutdown and isolation of the reactor.
5. Will not damage fuel stored in the Spent Fuel Pit. (Insert 1-16a)

1.4.1.5.2 Potential Missiles

Credible missiles, from sources considered capable of generating potential missiles, are defined as follows:

1(a) Tornadoes (Non-probabilistic protection methods)
   a. Bolted Wood Decking - 12 ft x 12 ft x 4 in, 450 lbs. traveling at 200 mph.
   b. Corrugated Sheet Siding - 4 ft x 4 ft, 100 lbs. traveling at 225 mph.
   c. Passenger Car - 4000 lbs. traveling along the ground at 50 mph.
   d. Small diameter Pipe - 2 1/2 in, schedule 40, steel pipe 8 ft length.

2.a Main Turbine Failure (General Electric Unit 1) (Insert 1-16b)
   a. Vane from last stage bucket - 54 lbs. traveling at 1170 ft per sec (casing exit velocity).
   b. 120° segment of last stage wheel - 8264 lbs. traveling at 409 ft per sec (casing exit velocity).

2.b Main Turbine Failure (Brown Boveri Unit 2)
   a. Vane from last stage bucket - 168 lbs. traveling at 1135 ft per sec (casing exit velocity).
   b. 120° segment of next-to-last disc - 8360 lbs. traveling at 551 ft per sec (casing exit velocity).

3. Structures and overhead cranes which are not of Seismic Class I design.
4. Dynamic equipment failures encompassing pumps, diesel engines, and turbine drives.
5. Valve stems and bonnets of significant size, having the potential to violate any of the missile protection criteria.
6. Control rod drive mechanisms or parts thereof.
7. Pipe rupture whip, including steam/water jet forces following a pipe rupture of an adjacent pipe.
8. Miscellaneous.
   a. Reactor Vessel Nozzle Inspection Hatch Covers.
   b. Instrument wells and thimbles with mounted components

Insert 1-16a

When utilizing probabilistic risk techniques as the missile protection method, the above criteria were considered to be satisfied when the overall risk of exceeding the offsite dose guidelines of 10 CFR 100 resulting from tornado generated missiles was below the acceptance limit stated in section 1.4.1.5.5.

Insert 1.16b

1.b Tornadoes (Probabilistic protection method)

The population of missiles used in the analysis was based on a physical walk down of non-safety-related buildings, trailers, fencing, trees and parking lots within a 2000 feet radius of the plant. Also included were missiles from plant buildings with siding not designed for tornado winds. This walk down resulted in a potential missile population in excess of 55,000 objects.

With reference to Item 7, above, to determine the dynamic impact and erosive effects of high temperature pressurized water and of steam jets from ruptured pipe lines, Westinghouse conducted a series of tests with subcooled water at 2250 psia/500 °F and with saturated steam at 1030 psia, released through nozzles of 3 different diameters, impinging on reinforced concrete structures, at various angles. Evaluation of the results (Reference 2) indicates that erosion of concrete by a primary coolant or steam line break definitely does not impose a design consideration.

1.4.1.5.3 Missile Protection Methods

Protection of safety-related equipment from missiles has been accomplished by one or more of the following methods:

1. Compartmentalization
   Enclosing equipment in missile protected compartments.
2. Barriers
   Erecting barriers to stop potential missiles either at the source or at the location of the equipment to be protected.
3. Separation
   Sufficient separation of redundant systems so that a potential missile cannot impair both systems.
4. Restraints
   Limiting generation of potential missiles by means of restraints.
5. Equipment Design
   Designing the structure or component to withstand a missile, without loss of function.
6. Strategic Orientation
   Orienting equipment, or parts of equipment, in a direction that directs the potential missile paths away from safety-related equipment.
7. Distance
   Locating equipment beyond range of potential missiles.

< insert 1-17a >

1.4.1.5.4 Determination of Missile Shield Thickness

In cases where concrete or steel is used as missile protection, the calculation of the missile shield thickness required was based on the modified Petry formula, as set forth in the U. S. Navy Bureau of Yards and Docks publication, "Design of Protective Structures", Navy Docks P-51, or the Stanford Steel Penetration formula presented in Nuclear Engineering and Design, "The Design of Barricades for Hazardous Pressure Systems", C. V. Moore, 1967.

< Insert 1.17b >

Insert 1-17a

8. Probabilistic Risk Consideration

Utilization of probabilistic risk based techniques that demonstrate the overall risk resulting from exposed or partially protected targets is below a minimum criterion for exceeding the offsite dose guidelines of 10 CFR 100.

Insert 1-17b

1.4.1.5.5 Probabilistic Methodology for Determining Risk from Tornado Generated Missiles

A limited number of systems, structures and components located near openings/penetrations in Seismic Category I structures or located outside of such structures have been evaluated and do not require additional physical tornado missile protection features. These structures, systems and components have been evaluated with respect to the overall risk resulting from tornado generated missiles upon potential offsite dose consequences exceeding the guidelines of 10 CFR 100. The following structures, systems or components have been evaluated using the probabilistic risk assessment methodology and it has been established that additional physical protection was not necessary:

- Emergency diesel generator appurtenances located outside Seismic Category I structures including ventilation intake air, combustion intake air and combustion exhaust
- Intake hoods associated with switchgear room heating, ventilation, and air-conditioning (hood for 4kV switchgear room AB ventilation supply, hood for 4kV switchgear room CD ventilation supply, and hood for CRID inverter room and CRD equipment room ventilation supply)
- 6" precast concrete walls and 7" concrete slab roof enclosing the east end of the Fuel Handling Building
- Three openings in roof slab at east end of the Fuel Handling Building
- Eight openings in roof slab at west end of the auxiliary building

The CNP specific acceptance criteria is that the total probability of tornado missiles striking a target multiplied by a factor relating striking the target to the probability of offsite dose consequences exceeding the guidelines of 10 CFR 100 must be shown by analysis to be less than 1E-06 per reactor per year. In addition, the evaluation must include additional qualitative arguments that demonstrate the risk is actually lower than 1E-06 per reactor per year. Examples of such qualitative arguments include (1) consideration that a missile simply striking a target may not result in its inability to perform its safety function in all cases, (2) consideration of redundant capability, and (3) consideration that striking a penetration in a Seismic Category I structure may not result in striking a target beyond the barrier in all cases, etc.

The analysis that determines tornado generated missile impact probabilities uses a NRC-approved methodology (Reference 1.4.10.5) developed by the Electric Power Research Institute (EPRI) (Reference 1.4.10.6). The methodology is implemented using the computer program, TORMIS, which is described below.

TORMIS Description

TORMIS implements a methodology developed by the Electric Power Research Institute. TORMIS determines the probability of tornado generated missiles striking targets. These targets may include, but are not limited to, walls and roofs of buildings, penetrations of Seismic Category I structures, and exposed portions of systems/components. The probability is calculated by simulating a large number of tornado strike events at the site for each tornado wind speed intensity scale. This results in a calculated probability per unit area of striking any target. After the probability of striking a target is calculated, the exposed surface area of the particular component is factored in to determine the probability of striking a particular item.

The TORMIS analysis for CNP is in accordance with the TORMIS program, as described in Reference 1.4.10.6, using site specific parameters as described below:

1. The probability of a tornado strike used at CNP is based on the broad region values as this is more conservative than the local strike probability.

2. The Fujita (F-scale) wind speeds are used in lieu of the TORMIS wind speeds (F'-scale)

3. A more conservative near-ground profile was used than the base case in TORMIS, resulting in a higher tornado ground wind speed. The profile has a ground wind speed equal to 82% of the wind speed at 33 feet. (i.e., V0/V33 = 0.82).

4. The number of missiles used in the TORMIS analysis is a conservative value for CNP-specific sources. The population of missiles used in the analysis was based on a physical walk down of non-safety-related buildings, trailers, fencing, trees and parking lots within a 2000 feet radius of the plant. Also included were missiles from plant buildings with siding not designed for tornado winds. This walk down resulted in a potential missile population in excess of 55,000 objects.

containment, is provided with a valve and a blind flange which closes off the fuel transfer tube when not in use.

1.4.9 EFFLUENTS

Gaseous, liquid and solid waste disposal facilities have been designed so that the discharge of effluents and off-site shipments are in accordance with applicable governmental regulations.

Process and discharge streams are appropriately monitored and safety features are incorporated to preclude releases in excess of the limits of 10 CFR 20.

Weather conditions do not place any restrictions on the normal release of operational radioactive effluents to the atmosphere. Radioactive fluids entering the Waste Disposal System are collected in tanks until the course of subsequent treatment is determined.

Radioactive gases are pumped by compressors through a manifold to one of the waste gas storage tanks where they are held a suitable period of time for decay. Tanks are provided for the normal operations of filling, holdup for decay, and discharge. During normal operation gases are discharged intermittently at a controlled rate from these tanks through the monitored unit vent.

All solid wastes are placed in suitable containers and stored on-site until shipment off-site for disposal.

Liquid wastes are processed to remove most of the radioactive material. The spent resins from the demineralizers, the filter cartridges and the concentrates from the evaporators are packaged and stored on-site until shipment off-site for disposal. The processed water, from which most of the radioactive material has been removed, is recycled for reuse within the plant or is discharged through a monitored line into the condenser discharge.

1.4.10 REFERENCES

1. Atomic Energy Commission, Proposed General Design Criteria, Federal Register, July 11, 1967.
2. WCAP-7391, Pressurized Water and Steam Jet Effects on Concrete, (WNES Proprietary Class 2).
3. ANSI 57.2-1983, "Design Objectives for LWR Spent Fuel Storage Facility at Nuclear Power Stations."
4. Nuclear Regulatory Commission, Letter to all power reactor licensees, from B. K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

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

6. 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.

POTENTIAL MISSILES CONSIDERED IN CLASS I (SEISMIC) STRUCTURE DESIGN

Item	Description	Weight	Velocity	Impact Area	ORIGIN
Bolted Wood Decking	12' x 12' x 4"	450 lbs	200 mph	4 ft^2	Tornado Borne
Corrugated Siding	4' x 4'	100 lbs	225 mph	0.25 ft^2	Tornado Borne
Passenger Car	-	4000 lbs	50 mph traveling on the ground	10 ft^2	Tornado Borne
Schedule 40 Pipe[1]	2 1/2" Dia x 8'	46 lbs	195 ft/sec	6.5 in^2	Tornado Borne
Reactor Control Rod Drive Mechanism	-	1623 lbs	25 fps for 3 ft travel to missile shield	11.3 in^2	Reactor Coolant Pressure Driven after R. C. Housing Mech. Failure
Unit 1 Turbine[2]					
Vane of Last Stage Bucket	-	54 lbs	1170 ft/sec	0.82 ft^2	Mech. Failure During Turbine Overspeed
Last Stage Wheel Segment	120° Segment	8264 lbs	409 ft/sec	8.43 ft^2	Mech. Failure During Turbine Overspeed
Unit 2 Turbine[2]					
Vane of Last Stage Bucket	-	168 lbs	1135 ft/sec	1.87 ft^2	Mech. Failure During Turbine Overspeed

[1] Considered as a missile only for design of the Auxiliary Building east of Spent Fuel Storage Pool.
[2] Impact area for turbine items is the average of the minimum and maximum cross-section areas.

(1) Note: Miscellaneous missiles such as valve stems, bonnets, instrument wells, thimbles, and pipe rupture whip were considered in the design of the structures where applicable; however, tornado generated and turbine missiles, or radiation and structural considerations, generally, were the determining factors in the design of Class I structures.

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2 The population of missiles used in the TORMIS analysis was based on a physical walk down of non-safety-related buildings, trailers, fencing, trees and parking lots within a 2000 feet radius of the plant. Also included were missiles from plant buildings with siding not designed for tornado winds. This walk down resulted in a potential missile population in excess of 55,000 objects.

ATTACHMENT 4 TO C0600-11

NO SIGNIFICANT HAZARDS CONSIDERATION EVALUATION

Indiana Michigan Power Company (I&M) has evaluated this proposed amendment and determined that it does not involve a significant hazard. According to 10 CFR 50.92(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 of occurrence or consequences of an accident previously evaluated;

2. create the possibility of a new or different kind of accident from any previously analyzed; or

3. involve a significant reduction in a margin of safety.

I&M proposes to make changes to the Donald C. Cook Nuclear Plant (CNP) design basis as described in the CNP Updated Final Safety Analysis Report (UFSAR) for which an unreviewed safety question pursuant to 10 CFR 50.59(c) is involved. The change will allow the use of probabilistic risk assessment (PRA) techniques in evaluating the need for tornado-generated missile barriers. This change is requested to provide an alternative to installing physical missile protection for those structures, systems, or components (SSCs) that are not physically protected from tornado-generated missiles. The specific methodology to be used is based on methodology that has been accepted by the Nuclear Regulatory Commission staff for use in evaluating the need for positive tornado-generated missile protection for specific safety-related plant features.

The determination that the criteria set forth in 10 CFR 50.92 are met for this amendment request is indicated below.

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

The possibility of a tornado reaching the CNP site is a design basis event considered in the UFSAR. The proposed change does not affect the probability that a tornado will reach the CNP site. However, the change affects the probability assumed in the current licensing basis that missiles generated by the winds of a tornado might strike certain plant systems or components.

No other accident scenarios, new initiators, or event precursors are affected or introduced by this change. There are a limited number of safety-related components that could potentially be struck by a tornado-generated missile. The total (aggregate) probability of exceeding 10 CFR 100 guidelines resulting from tornado missile strikes remains below the acceptance criterion ensuring overall plant safety. Thus, the proposed change does not constitute a significant increase in the probability of occurrence of an accident.

This change does not result in an increase in the quantity of radioactive materials potentially available for release to the environment in the event of an accident. The principle barriers to the release of radioactive materials are not modified or affected by this change. No new release pathways are created. Thus, the proposed change does not significantly affect potential offsite dose consequences.

Therefore, the probability of occurrence or the consequences of accidents previously evaluated are not significantly increased.

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

The possibility of a tornado reaching the CNP site is a design basis event considered in the UFSAR. This change recognizes the acceptability of performing tornado missile probability calculations in accordance with established regulatory guidance. The change, therefore, deals with an established design basis event (the tornado). The change does not affect or create new accident initiators or precursors. Therefore, the change does not contribute to the possibility of a new or different kind of accident from those previously analyzed.

Therefore, the change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

The existing licensing basis for CNP, with respect to the design basis event of a tornado reaching the plant, generating missiles, and directing them toward safety-related systems and components, is to provide positive missile protection for every required SSC or area. This change recognizes the extremely low probability, below an established acceptance limit, that a limited subset of SSCs, and areas could be struck. This change from "protecting all required systems, structures, and components" to an "extremely low probability of exceeding 10 CFR 100 guidelines as a result of tornado-generated missiles," does not constitute a significant decrease in the margin of safety due to the extremely low probability.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

In summary, based upon the above evaluation, I&M has concluded that the proposed amendment involves no significant hazards consideration.

ATTACHMENT 5 TO C0600-11

ENVIRONMENTAL ASSESSMENT

Indiana Michigan Power Company (I&M) has evaluated this license amendment request against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21. I&M has determined that this license amendment request meets the criteria for a categorical exclusion set forth in 10 CFR 51.22(c)(9). 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 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, or that changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria.

(i) The amendment involves no significant hazards consideration.

As demonstrated in Attachment 2, this proposed amendment does not involve 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.

There will be no significant change in the types or significant increase in the amounts of any effluents released offsite.

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

The proposed changes will not result in significant changes in the operation or configuration of the facility. There will be no change in the level of controls or methodology used for processing of radioactive effluents or 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 significant increase in individual or cumulative occupational radiation exposure resulting from this change.

ATTACHMENT 6 TO C0600-11

COMMITMENT

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this submittal. Other actions discussed in the submittal represent intended or planned actions by I&M. They are described to the Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

Commitment	Date
Upon NRC approval of the requested change, the Updated Final Safety Analysis Report (UFSAR) will be changed to allow the use of probabilistic risk assessment techniques in evaluating the need for tornado-generated missile barriers. The probability of exposures in excess of 10 CFR 100 guidelines due to postulated tornado-generated missile strikes of less than 1×10^{-6} per year per unit will be used as the threshold for evaluating the need to consider additional physical protection features. Such changes are acceptable when the total probability of exposures in excess of the 10 CFR 100 guidelines due to postulated tornado missile strikes is less than 1×10^{-6} per year per unit, when combined with reasonable qualitative arguments that indicate the realistic probability is actually lower. The UFSAR will be updated on the normal cycle with a list of affected plant structures, systems, and components or areas which are not designed, fabricated, or erected to withstand the additional forces imposed by tornado-generated missile strikes.	Normal cycle for UFSAR update.