

Mr. Charles M. Dugger
Vice President Operations
Entergy Operations, Inc.
P. O. Box B
Killona, LA 70066

September 7, 2000

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 - ISSUANCE OF AMENDMENT NO. 168 RE: AMENDMENT FOR A PREVIOUSLY UNREVIEWED SAFETY QUESTION REGARDING DESIGN BASIS CONCERNING TORNADO MISSILE (TAC NO. MA7359)

Dear Mr. Dugger:

The Commission has issued the enclosed Amendment No. 168 to Facility Operating License No. NPF-38 for the Waterford Steam Electric Station, Unit 3 (Waterford 3). The amendment consists of changes to the Final Safety Analysis Report (FSAR) in response to your application dated October 29, 1999, as supplemented by letter dated June 29, 2000.

The amendment revises FSAR Section 2.3.1.2.4, Tornadoes, with regard to design requirements for physical protection from tornado missiles for safety-related systems, structures, and components. The TORMIS methodology was used to demonstrate that specific plant features that are currently unprotected at Waterford 3 do not require additional missile protection barriers due to the low probability of a tornado missile strike.

You originally requested that the TORMIS methodology be approved to demonstrate that existing unprotected plant features did not require additional barriers, and to allow temporary removal of existing missile protection barriers. This part of the amendment request was subsequently withdrawn since the TORMIS methodology is currently not approved for justifying the temporary removal of existing barriers.

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

N. Kalyanam, Project Manager, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosures: 1. Amendment No. 168 to NPF-38
2. Safety Evaluation

cc w/encls: See next page

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RidsNrrDripRtsb (W.Beckner)

J. Tatum/D. Jackson (SPLB)

PDIV-1 r/f

L. Smith, RIV

RidsNrrLADJohnson

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R. Barrett/I. Jung (SPSB)

*SE input dated September 24, 1999, was provided and no major changes were made.

OFFICE	PDIV-1/PM	PDIV-1/LA	SPLB/DSSA*	OGC	PDIV-1/SC
NAME	NKalyanam	DJohnson	DJackson/JTatum	L.Hurley	RGramm
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UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

September 7, 2000

Mr. Charles M. Dugger
Vice President Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 - ISSUANCE OF
AMENDMENT NO. 168 RE: AMENDMENT FOR A PREVIOUSLY UNREVIEWED
SAFETY QUESTION REGARDING DESIGN BASIS CONCERNING TORNADO
MISSILE (TAC NO. MA7359)

Dear Mr. Dugger:

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N. Kalyanam, Project Manager, Section 1
Project Directorate IV & Decommissioning
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Docket No. 50-382

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2. Safety Evaluation

cc w/encls: See next page

Waterford Generating Station 3

cc:

Administrator
Louisiana Department of Environmental
Quality
P. O. Box 82215
Baton Rouge, LA 70884-2215

Vice President, Operations Support
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286

Director, Nuclear Safety & Regulatory
Affairs
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Wise, Carter, Child & Caraway
P. O. Box 651
Jackson, MS 39205

General Manager Plant Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Licensing Manager
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066-0751

Winston & Strawn
1400 L Street, NW
Washington, DC 20005-3502

Resident Inspector/Waterford NPS
P. O. Box 822
Killona, LA 70066-0751

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

Parish President Council
St. Charles Parish
P. O. Box 302
Hahnville, LA 70057

Executive VP & Chief Operating Officer
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Chairman
Louisiana Public Service Commission
Baton Rouge, LA 70825-1697



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-382

WATERFORD STEAM ELECTRIC STATION, UNIT 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 168
License No. NPF-38

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Entergy Operations, Inc. (the licensee) dated October 29, 1999, as supplemented by letter dated June 29, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended to approve changes to the Final Safety Analysis Report (FSAR) Section 2.3.1.2.4. The changes concern design requirements for physical protection from tornado missiles for safety-related systems, structures, and components. The TORMIS methodology was used to demonstrate that specific plant features that are currently unprotected at Waterford 3 do not require additional missile protection barriers due to the low probability of a tornado missile strike as set forth in the application for amendment by Entergy Operations, Inc., dated October 29, 1999, as supplemented by letter dated June 29, 2000. Entergy Operations, Inc. shall update the FSAR to reflect the revised licensing basis authorized by this amendment in accordance with 10 CFR 50.71(e).
3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance. Implementation of the amendment is the incorporation into the FSAR of the changes to the description of the facility as described in the licensee's application dated October 29, 1999, as supplemented by letter dated June 29, 2000, and evaluated in the staff's Safety Evaluation attached to this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION



Robert A. Gramm, Chief, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: September 7, 2000



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 168 TO

FACILITY OPERATING LICENSE NO. NPF-38

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By letter dated October 29, 1999, as supplemented by letter dated June 29, 2000, Entergy Operations Inc., (the licensee) requested the approval for the application of the TORMIS methodology for tornado missile risk analysis for specific plant features that are currently unprotected at the Waterford Steam Electric Station, Unit 3 (Waterford 3). Specifically, the licensee proposes to amend its Updated Final Safety Analysis Report (UFSAR) for the use of the TORMIS methodology to demonstrate that additional positive missile protection is not necessary for certain identified unprotected components that are required to operate after a tornado in accordance with Regulatory Guide (RG) 1.117.

2.0 BACKGROUND

Nuclear power plants must be designed to withstand the effects of tornado and high wind generated missiles so as not to impact the health and safety of the public in accordance with the requirements of General Design Criteria (GDC) 2 and 4. Standard Review Plan (SRP) Sections 3.5.1.4 and 3.5.2 provide review guidance for tornado missile protection. SRP Section 3.5.1.4 states that all plants should be designed to protect safety-related equipment against damage from missiles which might be generated by the design basis tornado for that plant. Further, Branch Technical Position AAB 3-2, which was originally referenced by the SRP, states that protection of structures, systems and components (SSCs) necessary to place and maintain the plant in a cold shutdown condition may generally be accomplished by designing protective barriers to preclude missile strikes. If protective barriers are not installed, the structure and components themselves should be designed to withstand the effects of a tornado. SRP Section 3.5.1.4 also includes guidance for users to estimate the probability per year of damage to the total of all important SSCs due to a specific design basis natural phenomenon capable of generating missiles. If the probability is greater than the acceptable probability in RG 1.117, then specific design provisions must be provided to reduce the estimate of damage probability to an allowable level. RG 1.117 states that the likelihood of a credible tornado strike varies from about 10^{-7} per year to values several orders of magnitude higher. The staff's criterion is that the probability of significant damage to SSCs required to

prevent a release of radioactivity in excess of 10 CFR Part 100 following a missile strike, assuming a loss of off-site power, shall be less than or equal to a median value of 10^{-7} per year or a mean value of 10^{-6} per year. Significant damage is the damage that would prevent meeting the design basis safety function. SRP Section 2.2.3 supports this probability and identifies an acceptance criterion of 10^{-6} for the expected rate of occurrence for potential exposures in excess of 10 CFR 100 guidelines per year when combined with reasonable, qualitative arguments that show the realistic probability is lower. The staff believes that the deterministic approach in the current SRP for tornados should continue to be used, with the probabilistic risk assessment (PRA) approach employed on a case by case basis for assessing specific plant features which are exceptions.

In the safety evaluation (SE), dated October 26, 1983, regarding the TORMIS methodology proposed in Electric Power Research Institute (EPRI) Report NP-2005, the staff concludes that the 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 staff 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.

In addition to the plant specific information, the Nuclear Regulatory Commission (NRC) SE prescribed limitations for the application of the TORMIS methodology. These limitations include that the use of the EPRI PRAs or any tornado missile probabilistic study be limited to the evaluation of specific plant features where additional costly tornado missile protective barriers or alternative systems are under consideration, and that the user demonstrates that the probability of damage to unprotected essential safety-related features is sufficiently small. The TORMIS methodology is not approved for justifying the removal of existing missile barriers, either temporarily or permanently.

The site plant-specific points to be considered by applicants and licensees using the EPRI methodology are:

- a. Data on tornado characteristics 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.
- b. The EPRI study proposes a modified tornado classification, F-scale, for which the velocity ranges are lower by as much as 25% less 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.
- c. 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.

- d. 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 dominant tornado paths of travel.
- e. Once the EPRI methodology has been chosen, justification should be provided for any deviations from the calculational approach.

3.0 EVALUATION

In its submittals, the licensee proposed changes to its license due to the as-found condition that involved an unreviewed safety question for tornado missile protection of certain SSCs. This evaluation addresses the licensee's application of the TORMIS code methodology and the licensee's use of the results.

In the staff's SE of the application of the TORMIS methodology, the use was limited to specific plant features where additional costly tornado missile protective barriers or an alternative system are under consideration. The following safety-related SSCs were identified by the licensee as lacking the required tornado missile protection:

- the dry cooling tower fans and motors and associated conduits and electrical boxes
- component cooling water piping, accumulators, and cabinets
- main steam header supply to the emergency feedwater (EFW) pump turbine piping and the EFW pump discharge piping to the isolation valve
- plant stack
- terry turbine exhaust stack
- emergency diesel generator stacks
- containment escape hatch and doors DO51, D266, and D270
- the control room differential pressure sensing lines (2)

The licensee also identified the following non-safety related, but important components:

- sump pump motor and floor drain for sump number 2
- control room breathing air system storage tank
- main steam line relief valves' vent stacks (east and west)
- waste management piping
- main steam dump valve vent to atmosphere
- reactor building roof drains

The licensee demonstrated that the probability for a tornado missile strike for the above identified plant features was a mean value of 6.4×10^{-7} per year, which is below the acceptance criterion of a mean value of 10^{-6} per year. Additionally, the licensee included conservatism in its analysis to demonstrate qualitatively that the risk is expected to be lower, including the following:

- the targets were assumed to be damaged upon a strike
- the surface area of cylindrical targets was based on their full surface area amplified by 10%
- the surface area of electrical boxes was based on all six sides
- no shielding effect for groups of pipes or conduits
- important, non-safety-related targets were included
- the missile population was conservative including assuming all missiles were minimally restrained

The licensee addressed the five plant specific points for the application of TORMIS in its submittal.

Point One

The NRC SE for TORMIS specifies that broad and local regions near the site be evaluated and use the most conservative value or provide justification for the selected values.

Section 2.3.1.2.4 of the Waterford 3 UFSAR states that the probability of a tornado strike is 7.68×10^{-5} per year. This probability was based on 112 tornados reported within 50 nautical miles between 1950 and 1977. For the TORMIS analysis, the licensee also looked at reported tornado data from the Storm Prediction Center of the National Oceanic and Atmospheric Administration for the years of 1954 to 1995 for the 1-degree square near Waterford 3. The reported tornado data was adjusted to include unreported tornadoes in the 1-degree region. The assessment also accounts for the large bodies of water near the plant. The total site probability, 2.23×10^{-4} per year, was obtained by summing all probability values calculated for each wind speed. This licensee used the more conservative value of these two, 2.23×10^{-4} per year. The value selected by the licensee is acceptable.

Point Two

The licensee uses the F-scale tornado classification for F_0 to F_5 intensities and a wind speed range from 318 to 360 mph for the F_6 intensity. The staff finds this to be acceptable.

Point Three

To address the reductions in tornado missile speed near the ground due to surface friction effects that are not sufficiently documented in the EPRI study, the licensee used a more conservative near-ground profile than the base case in TORMIS, resulting in a higher tornado ground wind speed of approximately 246 miles per hour. The ratio of V_0/V_{33} is equal to 0.82. Additionally, the licensee injected the potential tornado missiles into the wind field above the surface of the ground, which would increase the wind speed acting on the missiles. The staff finds this acceptable.

Point Four

The licensee performed a site walkdown to identify the type and number of missiles for the plant. The walkdown included the contents of the warehouses, office buildings, sheds, trailers, parking lots, and switch yards. A total of 71,800 missiles were postulated based on the walkdown. This is a high missile density compared to some other plants (25,000 - 74,000) that use the TORMIS methodology. However, many of the lower missile density plants have a more

limited application of the TORMIS methodology. The TORMIS example contained 65,550 missiles for a single unit site. The staff finds the missile density to be acceptable.

Point Five

The licensee states that no deviation occurred from EPRI NP-2005 except as noted in Points One through Four above. The staff finds this to be acceptable.

4.0 SUMMARY

Based on the above, the staff finds that the use of TORMIS to analyze tornado missiles for the unprotected plant features that were identified by the licensee in its submittal meets the acceptance criteria of SRP Sections 3.5.1.4 and 2.3.3 for tornado missiles, and the licensee has satisfactorily addressed the limitations and plant-specific items related to the application of the TORMIS methodology. The staff further finds that the proposed changes to the licensing basis meet the requirements of GDC 2 and 4. The licensee has demonstrated that due to the low probability of tornado missile damage, the identified plant features that are unprotected are not required to have additional protective tornado missile barriers.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Louisiana State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The NRC has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (65 FR 37426, June 14, 2000). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: D. Jackson

Date: September 7, 2000