November 14, 2014

Mr. John W. Stetkar, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE DTE ELECTRIC COMPANY COMBINED LICENSE APPLICATION FOR FERMI 3

Dear Mr. Stetkar:

I am writing in response to the letter from the Advisory Committee on Reactor Safeguards (ACRS or the Committee) dated September 22, 2014, in which the ACRS reported on its safety review of the staff's advanced safety evaluation report for the DTE Electric Company combined license application for Fermi 3. This combined license application references the Economic Simplified Boiling-Water Reactor Design Certification. The ACRS undertook this review to fulfill the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 52.87, "Referral to the Advisory Committee on Reactor Safeguards (ACRS)."

In its letter, the ACRS concluded that there is reasonable assurance that Fermi 3 can be built and operated without undue risk to public health and safety. The ACRS letter also identified three generic issues related to seismic reevaluations, mitigating strategies, and spent fuel pool instrumentation. In addition, the ACRS letter discussed an issue related to the protection of equipment from tornado-generated missiles. The enclosure to this letter contains the staff's response to these items.

The staff appreciates the Committee's efforts on this matter. We thank the ACRS for its time and its valuable input, and we look forward to working with the Committee in the future.

Sincerely,

/RA Michael R. Johnson Acting for/

Mark A. Satorius
Executive Director
for Operations

Enclosure:
Staff Response to ACRS Letter

cc: Chairman Macfarlane
Commissioner Svinicki
Commissioner Ostendorff
Commissioner Baran
Commissioner Burns
SECY

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Letter to John W. Stetkar from Mark A. Satorius dated November 14, 2014

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Staff Response to the Advisory Committee on Reactor Safeguards Letter on the Combined License Application for Fermi 3

In a letter dated September 22, 2014, under Agencywide Documents Access and Management System (ADAMS) Accession No. ML14252A294, the Advisory Committee on Reactor Safeguards (ACRS or the Committee) concluded that:

> 1. There is reasonable assurance that Fermi Unit 3 can be built and operated without undue risk to the health and safety of the public. The COLA [Combined License Application] for Fermi Unit 3 should be approved following its final version.
>
> 2. There is reasonable assurance that the ESBWR [Economic Simplified Boiling-Water Reactor] design and the Fermi Unit 3 site satisfy the requirements resulting from the Fukushima Near-Term Task Force recommendations. However, this review has identified generic issues related to seismic reevaluations, mitigating strategies, and spent fuel pool instrumentation. Further action by the staff is needed to resolve these issues not only for Fermi Unit 3, but also for currently operating plants and other combined license applicants.

The following provides the staff's assessment of, and response to, the three generic issues identified in the ACRS letter. In addition, the ACRS letter discussed an issue related to the protection of equipment from tornado-generated missiles. The staff's assessment of, and response to, the tornado-generated missile issue is also provided below.

Seismic Reevaluations

In regard to the seismic reevaluation, the ACRS letter states that:

> We agree that the ESBWR seismic design requirements provide adequate margins above the Fermi Unit 3 site-specific hazard. However, we have observed anomalies in the calculated variations of uncertainty with ground motion frequency at Fermi and other sites. We will work with the staff to better understand the analysis methods and computations, since they can affect the seismic hazard assessments for currently operating plants and other combined license applicants.

The staff acknowledges the Committee's observations regarding the incorporation of uncertainties into the probabilistic seismic hazards analysis (PSHA) process. Staff from the Office of New Reactors (NRO) and Office of Nuclear Regulatory Research plan to brief the Committee on November 17, 2014, to further explain how PSHA incorporates uncertainties. The incorporation of uncertainties in a PSHA is a complex process. It relies on expert elicitation to ensure that uncertainties associated with each parameter of the PSHA (e.g., source models, ground motion models) are properly incorporated into the overall PSHA. The development of the "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities" (CEUS SSC) project (NUREG-2115), as well as other large scale projects such as the Yucca Mountain project and the PEGASOS project in Switzerland, all relied on processes of this type to ensure that uncertainty was properly incorporated. NRO staff relied on this well established process in the Fermi 3 and other PSHA calculations presented to the Committee. This process is also being relied on in the seismic hazard re-evaluations for all the operating plants as part of their response to the March 12, 2012, request for information pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f). The staff looks forward to addressing the Committee's observations and clarifying the process for the members.

Mitigation Strategies for Beyond-Design-Basis External Events

In regard to the mitigation strategies for beyond-design-basis external events, the ACRS letter states that:

> …the staff is silent about how RTNSS [regulatory treatment of non-safety systems] equipment survivability and operability can be assured in the transition phase following an external event that involves beyond-design-basis conditions. This lack of guidance is a generic issue that needs to be clarified not only for this applicant, but also for all currently operating plants and future combined license applicants.

Prior to addressing this comment, the staff would clarify the use of the terms "RTNSS equipment" and "the transition phase associated with mitigation strategies." RTNSS equipment is a category of equipment that is unique to new reactors that credit passive safety systems. That is to say, current operating plants and new reactors with active safety systems do not have RTNSS equipment. For this reason, the staff interprets the ACRS comment broadly and also applies it to any equipment that is relied on during the transition phase for currently operating plants, new reactors with active safety systems, and new reactors with passive safety systems. Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A736) refers to a transition phase that uses sufficient, portable, onsite equipment and consumables to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities until they can be accomplished with resources brought from off-site. Installed RTNSS equipment may also be available for new reactor designs during the transition phase, but this equipment does not fit cleanly into the reference in EA-12-049 to "portable" equipment for use during transition phase. As a result, application of mitigation strategies and associated guidance warrants appropriate consideration of the various approaches to nuclear safety reflected in the design of operating plants, new reactors with active safety systems, and new reactors with passive safety systems.

The staff published guidance for mitigation strategies in JLD-ISG-12-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (ADAMS Accession No. ML12229A174). This interim staff guidance (ISG) endorses, with clarifications, Nuclear Energy Institute (NEI) 12-06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," (ADAMS Accession No. ML12242A378) as an acceptable approach for meeting EA-12-049. NEI 12-06 provides guidance for equipment that is relied upon during the transition phase. It also provides specific information for the AP1000 design, which includes both passive safety systems and RTNSS systems. Specifically, NEI 12-06 refers to a transition from installed passive system operation to indefinite, long-term operation with support from offsite equipment and resources. Furthermore, it indicates that between 3 and 7 days after a loss of all alternating current (AC) power events, support to continue passive system cooling can be provided either by installed plant ancillary equipment or by offsite equipment using connections provided in the AP1000 design.

As it is not possible to predict the exact site conditions following a beyond-design-basis external event, the FLEX program is intended to define and deploy diverse and flexible strategies, such that they could be implemented under various conditions, thereby enhancing a plant's ability to cope with beyond-design-basis external events. One means of accomplishing this is through the siting of FLEX equipment storage locations, such that separation affords a measure of protection for the site's FLEX capability. Following this approach could result in a single storage location for FLEX equipment, which is protected from all postulated extreme external events, or it could result in multiple storage locations such that enough equipment would survive each particular event to implement the FLEX strategies. Guidance is also provided in NEI 12-06 on the protection of mitigating equipment from external hazards, including floods, seismic events, snow, ice, low temperatures, high winds, and high temperatures. Plant features and insights from beyond-design-basis evaluations are used, where feasible, to inform mitigation strategies.

In March 2012, the staff issued a request under 10 CFR 50.54(f) that licensees reevaluate the seismic and flooding hazards at their sites, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights From the Fukushima Dai-Ichi Accident," (ADAMS Accession No. ML12053A340). EA-12-049 was issued the same month and the order required the mitigation strategies equipment be reasonably protected from external events. Using the best available information at that time, the staff endorsed guidance that such equipment should be protected from the external hazards of record (i.e., the most recent hazard analysis for the facility). For operating reactor sites, the staff recognizes that the seismic and flooding hazard reevaluations being conducted may identify hazards estimates greater than the current licensing basis for some facilities. The staff is preparing a Commission paper regarding the staff's planned actions for the hazard reevaluations, order, and related mitigation of beyond-design-basis events rulemaking. The Commission's direction resulting from that paper will determine whether additional guidance or changes to existing guidance is necessary. The staff is continuing the review of licensee strategies for meeting EA-12-049, and is scheduled to meet with the ACRS in November 2014, to discuss mitigation strategies including the ACRS's generic issues.

With regard to Fermi 3, which has RTNSS equipment, the Economic Simplified Boiling Water Reactor (ESBWR) standard plant includes passive safety systems that provide core, containment, and spent fuel pool cooling capabilities for 72 hours, with no reliance on ac power. Section 19A.2.2 of the ESBWR design control document states that "the ESBWR is designed such that no operator actions or ac power are required for a station blackout event, for 72 hours," and the ESBWR is designed to successfully mitigate a station blackout event to meet the requirements of 10 CFR 50.63, "Loss of all alternating current," using safety-related systems, structures, and components. This 72-hour mitigation capability addresses the initial mitigation phase for ESBWR plants such as Fermi 3, and this mitigation capability provides adequate time to transition to final phase mitigation, without necessarily relying upon a transition phase. The transition phase is defined as the time necessary for resources to be brought from offsite, and 72 hours is sufficient to bring in offsite resources to assure core cooling, containment, and spent fuel pool (SFP) cooling capabilities are maintained or restored. Nevertheless, the ESBWR design includes permanently installed ancillary equipment (i.e., RTNSS equipment) that could potentially extend the time period for transition from the initial phase mitigation to final phase mitigation for up to 7 days. The staff's evaluation of the ESBWR RTNSS program is provided in Chapter 22, "Regulatory Treatment of Nonsafety Systems," of the ESBWR final safety evaluation report, and it includes an evaluation of the augmented design standards for RTNSS equipment to withstand external events such as earthquakes, hurricanes and their potential missiles, tornadoes, and floods. As an example, the RTNSS equipment is housed inside seismic Category I structures except for the two ancillary diesel generators and their supporting equipment, which are housed in the ancillary diesel building, a seismic Category II building. Seismic Category II structures are designed similarly to seismic Category I structures except for consideration of tornado-generated missiles.

Reliable Spent Fuel Pool Instrumentation

In regard to reliable SFP instrumentation, the ACRS letter states that:

> Order EA-12-051 also requires that the primary and backup SFP water level instrument channels be reliable at temperature, humidity, and radiation levels consistent with the SFP water at beyond-design-basis accident conditions for an extended period of time. However, while it is clear that saturation temperature and humidity conditions would exist for the SFP, we note that the staff is silent about the actual radiation levels that are required for equipment qualification in beyond-design-basis conditions. This lack of guidance is another generic issue that needs to be clarified not only for this applicant but also for operating plants and future combined licenses applicants.

The staff published guidance for reliable SFP instrumentation in JLD-ISG-2012-03, "Interim Staff Guidance: Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," (ADAMS Accession No. ML12221A339). This ISG endorses—with exceptions and clarifications—NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," (ADAMS Accession No. ML122400399). Together, these documents provide the guidance for the SFP instrumentation equipment qualification needed to implement Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," (ADAMS Accession No. ML12056A044). Section 3.4 of NEI 12-02 states the following with regard to the equipment qualification:

> The temperature, humidity and radiation levels consistent with conditions in the vicinity of the SFP and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 should be considered. Examples of post-event (beyond-design-basis) conditions to be considered are:
>
> - radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this order

This guidance is used to establish the radiation levels for SFP instrumentation equipment qualification. NEI 12-02 indicates that SFP water level 3 corresponds to a water level at the top of the spent fuel pool racks and, as such, this provides a significant radiation exposure level for which the equipment should be qualified. The staff concluded that this provides sufficient guidance for the design of SFP instrumentation with respect to radiation levels and, as such, this section of NEI 12-02 was endorsed without exception or clarification.

SFP instrumentation vendors have tested the SFP level instruments under the radiological conditions described in NEI 12-02. As part of that testing, each vendor calculated the 7-day total integrated dose that would be expected under the conditions described in the guidance, for both the sensor and the associated electronics. These calculations typically involve a high degree of conservatism. The NRC staff reviewed these testing methods and results, and concluded that they ensure that the instruments would remain functional as required by the order. The staff is scheduled to meet with the ACRS in November 2014 to discuss mitigation strategies, and will be prepared to provide additional information on reliable SFP instrumentation at that time.

In regard to Fermi 3, the combined operating license applicant incorporated by reference the ESBWR design. The ESBWR SFP is designed and evaluated assuming passive spent fuel cooling. The SFP level instrumentation is designed to environmental conditions consistent with boiling down to the top of the active fuel. These conditions would result in a high temperature (100 degrees Celsius), high humidity, steaming environment, loss of shielding, and high radiation doses. As such, the ESBWR safety-related level instruments are designed to accurately indicate pool level over a range from normal water level down to the top of the fuel rack at conditions that meet the recommendations of JLD-ISG-2012-03 and NEI 12-02. Therefore, the staff concluded that Fermi 3 SFP level instrumentation meets the requirements in Order EA-12-051 in regard to environmental qualification.

High Winds and Tornadoes

In regard to tornado-generated missiles, the ACRS letter states that:

> Because the ESBWR design can maintain passive core cooling, containment functions, and spent fuel cooling for at least 72 hours without any AC power, operation of RTNSS equipment is not required until approximately 72 hours after the plant is shut down. However, because of this inconsistency in the wind-driven missile analyses, it is unclear that structures which house RTNSS equipment that is credited for mitigation of beyond-design-basis external events will survive site-specific tornado-generated missiles. We note that the FLEX national response centers are intended to provide support for defense-in-depth mitigating strategies if onsite RTNSS equipment is not available after 72 hours.

The staff agrees with the ACRS that (1) the ESBWR passive safety systems, which are protected from the winds and missiles of hurricanes and tornados, are capable of ensuring safety functions for at least 72 hours; (2) after 72 hours offsite resources through the FLEX program can be provided, and; (3) there is a difference between how tornado-generated missiles are considered for passive safety systems and RTNSS equipment.

Consideration of tornado-generated missiles was addressed in the development and approval of the RTNSS policy and guidance in the mid-1990s. Some of the original RTNSS policy positions, which were subsequently applied to the ESBWR, can be found in (1) SECY-96-128, "Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standardized Passive Reactor Design," (ADAMS Accession No. ML003708224) and; (2) memorandum from L. Joseph Callan, Executive Director for Operations to Chairman Jackson, "Implementation of Staff Position in SECY 96-128, 'Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standard Pressurized Reactor Design', Related to Post-72 Hour Actions," (ADAMS

Accession No. ML003708229). Interest in these documents is the RTNSS guidance for hurricanes and tornados, and the resulting winds and wind-generated missiles. The guidance provides that RTNSS equipment and structures be designed for protection from Category 5 hurricane wind speeds and hurricane-generated missiles. The guidance excluded consideration of tornado-generated missiles for RTNSS equipment.

A tenet of the guidance is that the potential damage from a tornado is more localized than that from a hurricane or a seismic event. Therefore, the policy considerations and guidance focused on protecting RTNSS equipment from those external events which could potentially result in widespread damage to local communities such as hurricanes, floods, and seismic events. The guidance in NEI 12-06 reflects this difference in the extent of damage from a tornado, as compared to events such as hurricanes, and states that "while the damage from hurricanes can be quite widespread, the damage from tornadoes is generally relatively localized, even for extreme tornadoes." Given the timing of submission of the ESBWR application, the staff applied the RTNSS guidance that existed at that time.

Since development of the original RTNSS policy and guidance in the 1990s, the staff continued to develop, revise, and issue technical guidance including: Regulatory Guide (RG) 1.76, Revision 1, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," March 2007 (ADAMS Accession No. ML070360253); RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," October 2011 (ADAMS Accession No. ML110940300); and Standard Review Plan, NUREG-0800, Section 19.3, "Regulatory Treatment of Nonsafety Systems for Passive Advanced Light Water Reactors," June 2014 (ADAMS Accession No. ML14035A149). This new guidance provides updated approaches for evaluating the winds and missiles from hurricanes and tornadoes. In particular, the new guidance specifies that RTNSS equipment should be analyzed and designed to withstand the effects of high winds produced in hurricanes and tornadoes, including the effects of sustained winds, gusts, and associated wind-borne missiles using the guidance in RGs 1.76 and 1.221.