UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE RD. SUITE 210
LISLE, ILLINOIS 60532-4352

February 23, 2015

EA-14-168

Mr. Anthony Vitale
Vice President, Operations
Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043-9530

SUBJECT: FINAL SIGNIFICANCE DETERMINATION OF A WHITE FINDING WITH ASSESSMENT FOLLOWUP AND NOTICE OF VIOLATION; NRC INSPECTION REPORT NO. 05000255/2015007; PALISADES NUCLEAR PLANT

Dear Mr. Vitale:

This letter provides you the final significance determination of the preliminary White finding discussed in our previous communication dated December 2, 2014, which included U.S. Nuclear Regulatory Commission (NRC) Inspection Report No. 05000255/2014010. This report is available in the NRC's Agencywide Documents Access and Management System (ADAMS) at accession number ML14336A624. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. The finding involved the failure of your staff to properly monitor external doses during the control rod drive (CRD) housing replacement activities in February and March 2014. This resulted in inaccurate calculation and assignment of dose for numerous workers.

At your request, a regulatory conference was held on January 13, 2015, to discuss your views on this issue. This meeting was open to the public. A copy of the Entergy presentation was placed into ADAMS at accession number ML15012A368. During the meeting, you described your assessment of the significance of the finding and the corrective actions taken to resolve it, including the root cause evaluation of the finding. You attributed the root cause of the failure to inadequacies in an Entergy procedure and determined that deficiencies in planning and field oversight by the radiation protection staff contributed. A summary of the conference, including a list of attendees and a list of questions, was provided to you under separate enclosure. This document can be found in ADAMS at accession number ML15042A458.

During the meeting, you stated that you agreed with the performance deficiency and the violation, but that you disagreed with the significance of the finding. Specifically, your staff stated that the ability to assess dose was not compromised and that a realistic dose assessment, as presented during the conference, calculated only a minimal increase in the assigned doses as compared with the initial calculation.

The NRC reviewed the additional dose reassessment information presented during the conference and concluded that the information did not change the NRC's position. The NRC was unable to credit the assumptions and results used in the alternative dose assessment as described in Enclosure 1. Specifically, the NRC concluded that your monitoring resulted in a situation where workers were allowed to leave the site and to engage in other radiological work

at other facilities without having full and complete knowledge of their actual dose. Until identified by the NRC inspector, this deficiency compromised your ability (and the ability of other subsequent licensed employers) to ensure that additional allowed worker exposures would not result in annual doses that exceeded Title 10 of the *Code of Federal Regulations (CFR)* Part 20 limits.

Therefore, after considering the information developed during the inspection and provided at the regulatory conference, the NRC has concluded that the finding is appropriately characterized as White, a finding of low to moderate risk significance.

You have 30 calendar days from the date of this letter to appeal the staff's determination of significance for the identified White finding. Such appeals will be considered to have merit only if they meet the criteria given in NRC Inspection Manual Chapter 0609, Attachment 2, "Process for Appealing NRC Characterization of Inspection Findings (Significance Determination Process Appeal Process)." An appeal must be sent in writing to the Regional Administrator, Region III, 2443 Warrenville Road, Lisle, IL 60532-4352.

The NRC has also determined that the failure of Entergy Nuclear Operations, Inc., involved two violations as cited in the Notice of Violation (Notice) found in Enclosure 2. The circumstances surrounding the violations were described in detail in NRC Inspection Report No. 05000255/2014010 and during the regulatory conference. In accordance with the NRC Enforcement Policy, the Notice is considered escalated enforcement action because it is associated with a White finding.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC review of your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

As a result of our review of Palisades' performance, including this White finding, we have assessed the plant to be in the Regulatory Response column of the NRC's Action Matrix, effective the fourth quarter of 2014. Therefore, we plan to conduct a supplemental inspection using Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," when your staff has notified us of your readiness for this inspection. This inspection procedure is conducted to provide assurance that the root cause and contributing causes of risk significant performance issues are understood, the extent of condition and the extent of cause are identified, and the corrective actions are sufficient to prevent recurrence.

For administrative purposes, this letter is issued as NRC Inspection Report 05000255/2015007. Additionally, apparent violation (AV) 05000255/2014010-01 is now closed and violation (VIO) 05000255/2014010-01 is opened in its place.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from ADAMS.

To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information, so that it can be made available to the Public without redaction. The NRC also includes significant enforcement actions on its Web site at http://www.nrc.gov/reading-rm/doc-collections/enforcement/actions.

Sincerely,

/RA/

Cynthia D. Pederson
Regional Administrator

Docket No. 50-255
License No. DPR-20

Enclosures:
1. Final Significance Determination
2. Notice of Violation

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FINAL SIGNIFICANCE DETERMINATION

During the regulatory conference, you provided your perspective that the first dose assessment was overly conservative in assessing the amount of dose that should be assigned to the workers involved in the activity of concern. You provided information for what you considered to be a more realistic assessment, which considered: (1) whether a sufficient dose gradient existed to warrant relocation of dosimetry; (2) development of a model to evaluate the dose at the abdomen if a sufficient gradient existed; and (3) the impact of using the tungsten vest. Based on these factors, you recalculated the effective dose equivalent dose for external radiation (EDEX) in accordance with a method described in Regulatory Guide 8.40, "Methods for Measuring Effective Dose Equivalent from External Exposure," (RG 8.40) Section C.1, using compartment weighting factors.

Entergy Position: Your staff started with an assumption that if the ratio between an individual's unmonitored abdomen dose and monitored chest dose was less than 1.5 then there was not a sufficient dose gradient to require relocation of the chest dosimeter. Your staff stated that this criteria was derived from guidance in NRC Inspection Procedure 71124.01, "Radiological Hazard Assessment and Exposure Controls," paragraph 03.05.c.

NRC Evaluation: The NRC staff evaluated this acceptance criteria assumption and noted that NRC regulation 10 CFR 20.1201(c) requires, for calculating the EDEX, that the assigned deep dose equivalent must be measured by dosimeters located at the part of the body receiving the highest exposure.

NRC Regulatory Guide 8.40 provides NRC guidance for use of multiple dosimeters, and specifies that the dosimeter for each compartment must be located at the part of the compartment receiving the highest exposure, in order to ensure compliance with 10 CFR 20.1201(c). Based on the dosimetry data and radiological surveys that you provided, the NRC determined that, for the combined thorax abdomen compartment, the dosimeter was not placed at the part of the compartment receiving the highest exposure. The NRC does not have a basis for accepting an initial assumption to place the dosimetry at a location other than the part of the compartment receiving the highest exposure as this would be non-conservative and lead to underestimating the actual dose received by a worker. The NRC reviewed Inspection Procedure 71124.01 and determined that the guidance to an inspector provided a risk informed criteria for when additional questions should be asked of a licensee to ensure that there was no missed dose. This guidance was targeted at work activities where licensees were using a single dosimeter in a non-uniform exposure situation. The guidance does not imply that observed discrepancies are acceptable. Therefore, an inspector can question placement of dosimetry whenever it appears that the part of the body receiving the highest exposure is not being monitored. Consequently, the acceptance criteria that your staff developed did not ensure that it met NRC requirements. In summary, the NRC concluded that this step did not assess whether a dose gradient existed, but whether the observed dose gradient warranted moving the dosimeter to the highest exposed portion of the compartment. The NRC does not agree that the use of the 1.5 gradient in this manner is an acceptable practice.

Entergy Position: Your staff developed a model to determine whether there was a dose gradient. Based upon aggregate data from all the workers, your staff assumed that the data best fit a straight line from the unshielded thighs to the unshielded arms, with the highest dose being from below. Your staff then assigned locations for the abdomen and chest measurements falling between the arm and thigh measurements. Specifically, your staff looked at the axial

separation between the dosimeters placed on the arms, the chest, and the thighs of a standing individual and then, based on the principle of similar triangles, determined that if the difference between the average dose of the unshielded thighs and average dose of the unshielded arms divided by the chest was greater than 1.25, the linear gradient met the criteria to warrant a separate abdomen dose assessment. If it was less than 1.25, then your staff concluded that no relocation was necessary and the chest dosimeter represented the abdomen and chest (thorax) dose.

NRC Evaluation: The NRC evaluated the model to determine its overall acceptability in providing a means to calculate the exposure to the unmonitored abdominal compartment. The NRC determined the model was non-conservative based on the following concerns: First, the screening assumed that the differences in the doses measured by the unshielded dosimeters resulted from a linear dose gradient that decreased with distance from an under foot source geometry (i.e., the reactor head). This assumption ignored the possibility that the observed dose gradient could be affected by self-shielding from the worker's body, the contribution of radiation sources other than the reactor head, and the non-uniform distribution of the radiation source across the reactor head surface which would not necessarily decrease as a linear function with distance from the reactor head.

Secondly, the model misrepresented the abdominal compartment in that it did not include the gonads as an appropriate location to calculate the dose to the highest exposed part of the abdomen. The model incorrectly depicted the gonads as being in the thigh compartment rather than the abdominal compartment, as defined in the approved EDEX method. Finally, the model used a premise that the workers were standing. This position placed axial separation between the non-measured abdominal dose and the measured thigh dose. Based on interviews with your staff, and information from the root cause evaluation (CR-PLP-2014-04683), the NRC determined that nearly 90 percent of the workers routinely worked in a seated or crouched position, as shown in the pictures attached to the Inspection Report. In this position, with the source of radiation from below the workers, the gonads would be unshielded by the vest and much closer to the source than assumed by your staff's model. It also would eliminate any axial separation between the thighs and the unmeasured abdominal compartment; in fact, the NRC has concluded that portions of the abdomen (gonads) could be below the top of the thighs in the seated/crouched position. Furthermore, with the workers in a seated or crouched position, there would be a reduction in axial separation between the unshielded arms and unshielded thighs. Consequently, the NRC concluded that the underlying assumptions for the model were incorrect and significantly underestimated the dose to important tissues in the abdomen, specifically the gonads.

In summary, the model used did not represent the exposure geometry of most workers. The model assumes a standing individual, which non-conservatively moves all of the whole-body compartments away from the predominate underfoot radiation source to interpolate a dose to the abdomen compartment.

Entergy Position: Your staff discussed the correction of the chest dose measurement to account for unshielded areas when the tungsten vests were worn. Your staff provided two assumptions. First, the vests covered approximately 83 percent of the chest area. The second assumption was that the tungsten vest reduced or shielded the exposure by 17 percent. Based on these assumptions, your staff calculated a correction factor for use of the vests. This correction factor was then multiplied by a value representing how frequently the vests were

worn, resulting in a final corrected chest dose. This corrected chest dose was then applied to the thorax and abdomen compartments to calculate the workers' EDEX. In response to a question during the regulatory conference, your staff indicated that reducing the effective shielding factor would provide "about the same results" as what was reported in the presentation.

NRC Evaluation: In regard to correction of the chest measurements, the NRC determined the shield effectiveness was over estimated in that it did not account for the back panel being optional, the worker size which affected the size of the side gaps, directional (lateral) radiation exposures that occurred when the worker laid on their sides to inspect the work, and, more importantly, the shield not protecting the gonads when individuals were sitting or standing. Based on the evidence that you provided, for the majority of the workers, the shielded portion was less than 83 percent. Pictures, provided previously and used during the regulatory conference also showed cases where the worker was directly exposing either the unshielded sides or the gonads to the radiation source while the chest dosimetry was shielded by the vest. Each of these factors could significantly affect the amount by which the shielded chest dosimeter represented the unshielded portion of the torso, such that the calculated correction factor appeared unwarrantedly low. Consequently, the NRC determined that the chest measurement correction was non-conservative and underestimated the actual dose received by the thorax and abdomen portions of the worker's body.

Therefore, after full evaluation of the information provided during the regulatory conference, the NRC concluded that the dose reassessment was not technically justified and did not represent the actual dose received by the workers. The dose reassessment provided at the regulatory conference would result in your recording and reporting multiple worker doses that were significantly lower than the actual doses received. The information provided does not change the condition identified by the NRC where this deficiency compromised your ability (and the ability of other subsequent licensed employers) to insure that additional allowed worker exposures would not result in annual doses that exceeded 10 CFR Part 20 limits.

The NRC reviewed the Occupational Radiation Safety Significance Determination Process flowcharts provided in NRC Inspection Manual Chapter 0609, Appendix C. The flowchart evaluates first whether there are planning issues, then if an actual exposure occurred or there was a substantial potential for an overexposure to occur. If none of these three factors apply, the flowchart then asks whether the ability to assess dose was compromised. The NRC concluded that the ability to assess dose was compromised, as initially assessed. Therefore, the NRC assigned a safety significance of low to moderate, or White.

NOTICE OF VIOLATION

Entergy Nuclear Operations, Inc.
Palisades Nuclear Plant

Docket No. 50-255
License No. DPR-20
EA-14-168

During a U.S. Nuclear Regulatory Commission (NRC) inspection conducted from August 11 to October 30, 2014, violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

A. Title 10 of the *Code of Federal Regulations* (10 CFR) Section 20.1201(c) requires, in part, that, when the external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent (DDE) must be used in place of the effective dose equivalent (EDEX), unless the EDEX is determined by a dosimetry method approved by the NRC. The assigned DDE must be for the part of the body receiving the highest exposure.

Contrary to the above, between February 6 and March 8, 2014, during control rod drive housing replacement work activities at the Palisades Nuclear Plant, the licensee did not use the DDE and the EDEX was not determined by a dosimetry method approved by the NRC. Specifically, the licensee failed to ensure that radiation worker dosimeters (calibrated to the DDE) were located at the highest exposed portion of the respective compartment, a condition of the NRC-approved method for determining EDEX.

B. Technical Specification 5.4.1.a. states, in part, that "written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978."

NRC Regulatory Guide 1.33, Appendix A, Section 7 addresses "Procedures for Control of Radioactivity (For Limiting Materials Released to Environment and Limiting Personnel Exposure)," Section 7.e, addresses "Radiation Protection Procedures," and Subsection 7.e.(7) discusses procedures for personnel monitoring.

Radiation protection procedure EN-RP-204, "Special Monitoring Requirements," Revision 6, provides instructions and requirements for the relocation of whole body dosimeters and the use and issuance of dosimeters for EDEX monitoring.

Contrary to the above, between February 6 and March 8, 2014, the licensee failed to establish a procedure for personnel monitoring covering all practical worker positions and shielding geometries prior to implementation during control rod drive housing replacement work activities at the Palisades Nuclear Plant. Specifically, EN-RP-204 did not require locating the dosimeter at the highest exposed portion of the respective body, as required by 10 CFR 20.1201(c), nor did it account for the shielding effects caused by use of tungsten vests.

These violations are associated with a White Significance Determination Process finding.

Pursuant to the provisions of 10 CFR 2.201, you are hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator,

Region III, 2443 Warrenville Road, Lisle, IL 60532 and a copy to the NRC Resident Inspector at the Palisades Nuclear Plant, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation, EA-14-168" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 23rd day of February, 2015.

To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information, so that it can be made available to the Public without redaction. The NRC also includes significant enforcement actions on its Web site at http://www.nrc.gov/reading-rm/doc-collections/enforcement/actions.

Sincerely,

/RA/

Cynthia D. Pederson
Regional Administrator

Docket No. 50-255
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Enclosures:
1. Final Significance Determination
2. Notice of Violation

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DATE	02/09/15	02/10/15	02/12/15	02/12/15	02/20/15	02/23/15	02/23/15

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[1] OE concurrence provided via email from G. Figueroa on February 20, 2015

Letter to Anthony Vitale from Cynthia D. Pederson dated February 23, 2015

SUBJECT: FINAL SIGNIFICANCE DETERMINATION OF A WHITE FINDING WITH ASSESSMENT FOLLOWUP AND NOTICE OF VIOLATION; NRC INSPECTION REPORT NO. 05000255/2015007; PALISADES NUCLEAR PLANT

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