



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

November 21, 2011

EA-11-174

Mr. Robert G. Smith
Site Vice President
Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360-5508

SUBJECT: FINAL SIGNIFICANCE DETERMINATION OF WHITE FINDING, WITH
ASSESSMENT FOLLOW-UP; NOTICE OF VIOLATION, NRC INSPECTION
REPORT NO. 05000293/2011013, PILGRIM NUCLEAR POWER STATION

Dear Mr. Smith:

This letter provides you the final significance determination for the preliminary White finding discussed in the U.S. Nuclear Regulatory Commission (NRC) letter dated September 1, 2011 (ML112440100)¹, as well as our assessment of the current performance of the Entergy Nuclear Operations, Inc. (Entergy) Pilgrim Nuclear Power Station (Pilgrim). This updated assessment of Pilgrim supplements, but does not supersede, our mid-cycle assessment letter issued on September 1, 2011 (ML112420017).

In the preliminary determination letter dated September 1, 2011, the NRC described the finding, which was identified during an NRC special inspection conducted in response to the May 10, 2011, reactor scram event, and which was presented to you and your staff during a July 20, 2011, exit meeting. The finding involved the failure of Pilgrim personnel to adequately implement conduct of operations and reactivity control standards and procedures during a reactor startup, which resulted in a reactor scram.

As described in NRC Inspection Report No. 05000293/2011012, issued on September 1, 2011, the NRC used a qualitative assessment tool (Inspection Manual Chapter (IMC) 0609, Appendix M) to assess the significance of this finding because the event was caused, in part, by multiple human performance failures which were not easily modeled using quantitative risk assessment methods. The Appendix M assessment involved analysis of several factors including: review of six specific attributes of the finding (such as the impact the issue had on defense-in-depth, whether there was a reduction in safety margin, and the extent of condition); and consideration of any additional applicable circumstances. The relative weight of each of these inputs was determined by NRC management review.

The September 1, 2011, letter included an offer for Entergy to attend a regulatory conference or reply in writing to provide its position on the facts and assumptions the NRC used to arrive at

¹ Designation in parentheses refers to an Agency-wide Documents Access and Management System (ADAMS) accession number. Documents referenced in this letter are publicly-available using the accession number in ADAMS.

the finding and its safety significance. In response, Entergy submitted a letter dated October 3, 2011 (ML112970166), which stated that while Entergy agreed with the performance deficiency and root cause as articulated in the NRC inspection report, it had calculated a different, lower risk assessment of the event than the assessment used by the NRC to determine the need for NRC Region I to initiate a special inspection team in accordance with IMC 0309. In its letter, Entergy further requested that the NRC reassess the Appendix M factors involving how the performance deficiency affected plant equipment, and the length of time over which the performance deficiency existed. A detailed description of Entergy's requests as articulated in its response letter and the NRC assessment are provided in the enclosed "Assessment of Entergy's Written Response" (Enclosure 2).

After considering the information developed during the inspection in addition to the statements presented in Entergy's response letter, the NRC concluded that the inspection finding is of low to moderate safety significance, and is therefore appropriately characterized as White. The major considerations used by the NRC in reaching this conclusion include: (1) during the event, several operators failed to adequately control plant parameters involving reactivity. This led to the Reactor Protection System being relied upon to terminate the inadvertent power excursion, rather than operators proactively monitoring reactor conditions to ensure a controlled, safe startup of the reactor; (2) the performance issues demonstrated during the event involved multiple personnel, including operators, management, and reactor engineers; and, (3) operator performance and causal factors associated with the event existed for a considerable time in advance of the event, as stated in both the NRC's inspection report, and the Entergy root cause assessment.

Regarding the NRC's decision to initiate the special inspection team in response to the event, this decision relied on a number of factors, including a risk assessment. Although the NRC's risk assessment of the event, as described in the aforementioned inspection report, informed the decision to initiate the special inspection, it was only one factor amongst a number of more heavily-weighted qualitative factors, such as concerns with operational performance and possible adverse generic implications, per IMC 0309 deterministic factors. Of note is the fact that the NRC estimate of core damage probability was relatively close to Entergy's assessment, as was discussed with Entergy staff at the time.

The NRC recognizes that actuation of the Reactor Protection System, as occurred in this event, can occur for a multitude of reasons and is designed to place the plant in a safe condition. In many instances, other performance deficiencies at other sites have led to an automatic reactor shutdown, and the NRC has assessed those findings as having very low safety significance (Green). Green findings have also involved latent demonstrations of weaknesses which existed for a prior period of time. What the NRC found was differentiating in this case was the inadequate monitoring of important reactivity parameters by multiple levels of operators and supervision; parameters that operators should be monitoring and controlling very carefully, that eventually led to a reactor protective system actuation being used to ensure safety during a reactor startup. Also, the occurrence of this event at a time when reactivity management should have been the main focus of the operating crew revealed a number of underlying issues involving training and operator fundamentals that are more than anomalous.

Additional details regarding the NRC's review of Entergy's response are included in Enclosure 2.

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 the IMC 0609, Attachment 2, "Process for Appealing NRC Characterization of Inspection Findings." An appeal must be sent in writing to the Regional Administrator, Region I, 475 Allendale Rd., King of Prussia, PA 19406. You are not required to respond to this letter. However, if you choose to respond, you should follow the instructions specified in the enclosed Notice when preparing your response.

As a result of our review of Pilgrim's performance, specifically, this White finding in the Initiating Events Cornerstone, we have assessed Pilgrim to be in the Regulatory Response column of the NRC Action Matrix. 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 Entergy staff notifies us of your readiness for this inspection. This inspection is conducted to provide assurance that the root cause and contributing causes of risk significant performance issues are understood, the extent of condition is identified, and the corrective actions are sufficient to prevent recurrence.

In addition to the performance deficiency, the NRC has also determined that a violation of NRC regulations occurred, as cited in the enclosed Notice of Violation (Notice). The violation involves failures to conduct safety-related activities as described in written procedures related to administrative issues, general plant operations and start-up of safety-related boiling water reactor systems. In accordance with the NRC Enforcement Policy, the Notice is considered an escalated enforcement action because it is associated with a White finding.

In its response letter, Entergy provided corrective actions it has taken, and has planned, in response to the issues. These actions include, in part: (1) revising the Just in Time Training program to ensure specific aspects of start up operations are understood by the operating crew; (2) having operations department management observe the control room activities, specifically, 100% of the time during start-up activities; and, (3) coaching or re-training operations crews and reactor engineers on expectations of behavior during reactivity manipulations. The NRC believes these corrective actions are appropriately comprehensive.

The NRC has concluded that information regarding: (1) the reason for the violation; (2) the actions planned or already taken to correct the violation and prevent recurrence; and, (3) the date when full compliance was achieved, is already adequately addressed on the docket in this letter, in NRC Inspection Report 05000293/2011012, and in the Entergy response letter dated October 3, 2011. Therefore, you are not required to respond to this letter and/or the Notice unless the descriptions in the aforementioned correspondence do not accurately reflect your position. In that case, or if you choose to provide additional information, you should follow the instructions specified in the enclosed Notice.

R. Smith

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In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room located at NRC Headquarters in Rockville, MD, and from the NRC's Agency-wide 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, your response, if you choose to provide one, should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Sincerely,

A handwritten signature in black ink, appearing to read 'W. M. Dean', with a long horizontal flourish extending to the right.

William M. Dean
Regional Administrator

Docket No. 50-293
License No. DPR-35

Enclosures:

1. Notice of Violation
2. Assessment of Entergy's Written Response

cc w/encl: Distribution via ListServ

NOTICE OF VIOLATION

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station

Docket No. 50-293
License No. DPR-35
EA-11-174

During an NRC inspection, for which an exit was conducted on July 20, 2011 a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Technical Specification 5.4, "Procedures," states, in part, that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide (RG) 1.33, February, 1978.

RG 1.33, Appendix "A," requires the licensee to conduct safety-related activities as described in written procedures related to Paragraph 1 ("Administrative Procedures"); Paragraph 2 ("General Plant Operating Procedures"); and, Paragraph 4 ("Procedures for Start-up, Operation, and Shutdown of Safety-Related BWR Systems.")

Contrary to the above, prior to and during a reactor startup operation on May 10, 2011, safety-related activities were not conducted as described in written procedures, as demonstrated by the following examples:

- a. Entergy procedure EN-OP-115, "Conduct of Operations" Revision 10, Section 4.0, requires the Shift Manager (SM) to "provide oversight of activities supporting complex and infrequently performed plant evolutions such as plant heatup [and] startup." Additionally, the SM is responsible for ensuring "conservative actions are taken during unusual conditions ... when dealing with reactivity control." However, during reactor heatup, the SM did not properly oversee the activities in progress and was not present in the control room when the heatup rate was being corrected with control rod insertion. The SM did not ensure the actions taken to establish or adjust the reactor heatup rate were conservative.
- b. Pilgrim Nuclear Power Station (PNPS) procedure 1.3.34 "Operations Administrative Policies and Procedures" Revision 117, Section 6.10.1.1[4] requires that "Infrequently Performed Tests or Evolutions Briefings for the performance of procedures classified as "Infrequently Performed Tests or Evolutions" (IPTE)" be performed with Senior Line Manager oversight as specified in EN-OP-116, "Infrequently Performed Tests or Evolutions." Entergy Procedure EN-OP-116, Revision 7, Attachment 9.1 identifies "Reactor Start Up" as an IPTE. In this case, an IPTE briefing package for the reactor start up had been prepared, approved, and the briefing had been scheduled; however, the IPTE briefing was never performed as required by the procedures described above. In addition, an IPTE brief was also not performed for the startup following the reactor scram.
- c. Entergy procedure EN-OP-115, "Conduct of Operations" Revision 10, Section 5.2, requires Control Room operators to "develop and implement a plan that includes contingencies and compensatory measures;" and when implementing such a plan, the crew is required to "continuously evaluate the plan for changing conditions" and use "Human Performance (HU) tools (...peer/cross-checking, oversight, questioning

attitude, etc.)” In addition, “When the Control Room team is faced with a time critical decision,” the team is required to “Use all available resources,” without proceeding “in the face of uncertainty...” However, in this case, the control room operators failed to develop contingency plans or compensatory measures for adjusting reactor heatup rate or addressing higher than expected reactor heatup rates, and did not develop or implement contingencies for control rods which were difficult to physically move when they were at low reactor power. Additionally, the use of HU tools was ineffective in addressing the actions or conditions that led to the unexpected reactor heatup rate or the mispositioning of control rod 30-11. Specifically, poor use of peer checking and a failure to adequately question the conditions that led to the unexpected reactor heatup rate directly contributed to the mispositioned control rod and the reactor scram. Lastly, the Control Room team did not use all available resources by failing to involve Reactor Engineering staff in its decision-making, and proceeded in the face of uncertainty by inadequately considering the consequences of the reactivity changes.

- d. Entergy procedure EN-OP-115, “Conduct of Operations” Revision 10, Section 5.4 requires that reactor operators perform reactivity manipulations “in a deliberate, carefully controlled manner while the reactor is monitored to ensure the desired result is obtained;” and, to shutdown the reactor “whenever the status of reactor criticality or approach to criticality becomes unknown.” In this case, the reactor operators did not perform reactivity manipulations in a deliberate, carefully controlled manner and adequately monitor the conditions of the reactor while attempting to establish and adjust the reactor heatup rate. Although the reactor operators were watching the response of both the IRMs and the computer point displaying a five minute average reactor heatup, they were moving control rods faster than the plant could respond and therefore taking actions to continue control rod movement before the desired result of their manipulations could be assessed. Additionally, after inserting control rods to adjust the reactor heatup rate, the operators had sufficient indications that the reactor was significantly subcritical as evidenced by the required ranging down of IRMs, the drop in SRM count rates, and the negative reactor period. Notwithstanding those indications of subcriticality, the operators did not take the required action to either shut down the reactor or re-establish a controlled return to criticality. This subsequently led to an unrecognized approach to criticality and eventual reactor scram.
- e. PNPS procedure 1.3.34 “Operations Administrative Policies and Procedures,” Revision 117, Section 6.7.5 requires that “Any relief occurring during the shift (either short-term or for the remainder of the shift) will be recorded in the CRS log.” It further requires the operators to conduct “a verbal discussion of plant status and off-normal conditions...” However, several people in watch standing positions changed from the start of the shift, and none of those changes were entered into the control room log. In addition, when the Assistant Control Room Supervisor (ACRS) was turning over to the Control Room Supervisor, there was no discussion of the mispositioning of control rod 30-11, which occurred approximately 15 minutes prior to the turnover.

- f. PNPS Procedure 2.4.11, "Control Rod Positioning Malfunctions," Revision 35, Section 5.4 defines a mispositioned control rod as "a control rod found to be left in a position other than the intended position or a control rod that moves more than one notch beyond its intended position." Attachment 4 Step 3 of this procedure requires that upon discovery of a control rod which is mispositioned greater than one notch, Reactor Engineering is to be contacted for an assessment of core conditions. Further, the procedure, in Step 5, requires that "If the control rod is determined to be mispositioned, then record the event as a condition report." However, Reactor Engineering was not contacted for an assessment of core conditions after a rod inadvertently became mispositioned by greater than one notch. In addition, the event was not recorded as a condition report.
- g. PNPS Procedure 2.1.1, "Startup from Shutdown" Revision 173, Page 53, Caution 2 requires that if "the reactor goes subcritical after achieving initial criticality" operators must "return to step [53] and re-perform the steps to restore the Reactor to a critical condition." In addition, PNPS Procedure 2.1.4, "Approach to Critical" Revision 26, Section 5.0 requires that "In the event the reactor goes subcritical after achieving initial criticality" operators must, "with Reactor Engineering guidance, re-perform Section 7.0 Steps [6] and [7] to restore the Reactor to a critical condition." However, the operators did not recognize that the reactor had become subcritical and did not re-perform the procedural steps mentioned above to restore the reactor to a critical condition in a controlled manner under the guidance of Reactor Engineering, even though there was sufficient information available to identify that the reactor had become subcritical. Reactor Engineers were available in the control room, but they were not consulted.

This violation is associated with a White Significance Determination Process finding.

The NRC has concluded that information regarding: (1) the reason for the violation; (2) the actions planned or already taken to correct the violation and prevent recurrence; and, (3) the date when full compliance was achieved, is already adequately addressed on the docket in NRC Inspection Report 05000293/2011012, in the Entergy response letter dated October 3, 2011, and in the letter enclosing this Notice of Violation (Notice). However, you are required to submit a written statement or explanation pursuant to 10 CFR 2.201 if the description therein does not accurately reflect your corrective actions or your position. In that case, or if you choose to respond, clearly mark your response as a "Reply to a Notice of Violation, EA-11-174," and send it to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001 with a copy to the Regional Administrator, Region I, and a copy to the NRC Resident Inspector at Pilgrim, within 30 days of the date of the letter transmitting this Notice.

If you choose to respond, your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. Therefore, to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Notice of Violation

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

Dated this 21st day of November 2011

Enclosure 2: Assessment of Entergy's Written Response

In its October 3, 2011, written response to the preliminary White finding issued on September 1, 2011, the licensee agreed with the primary cause of the event (a lack of consistent supervisory and management enforcement of administrative procedure requirements and management expectations for command and control, roles and responsibilities, reactivity manipulations, clear communications, proper briefings and proper turnovers) and the cross cutting aspect assigned as documented in the Special Inspection Report (Human Performance, Work Practices), and did not present any new information. However, the letter documents three specific points regarding the risk assessment of the finding that Entergy requests the NRC consider.

Entergy Written Response Consideration 1

Entergy challenged the NRC's calculation of Conditional Core Damage Probability (CCDP) documented in the special inspection team (SIT) Report that was utilized in the IMC 0309 evaluation that led to the decision to conduct a Special Inspection. Entergy stated that its risk analysts developed a high E-7 range CCDP while the NRC determined CCDP at or near low E-6.

NRC Response

The difference between the NRC's and Entergy's calculation of the CCDP is small, and was discussed with Entergy staff at the early stages of the NRC's review of the event. It is recognized that the Inspection Manual Chapter (IMC) 0309 decision making for initiating a reactive inspection is "risk informed," and other deterministic criteria were also considered. Additionally, the NRC did not include the numerous human performance errors that were observed by the control room staff at Pilgrim in its CCDP calculation. The CCDP is quite sensitive to assumptions of negative licensed operator performance and would have further supported the decision to conduct a Special Inspection to better understand the facts surrounding the event, had these observations been incorporated. The NRC maintains its decision to have conducted the SIT based on information that was known at the time. In addition, the results of the inspection, specifically, identification of a performance deficiency that was determined to have low to moderate safety significance, was determined independently of the risk considerations used in the decision to initiate an SIT.

Entergy Written Response Consideration 2

Entergy challenged the IMC 0609 Appendix M section relating to "the extent of the performance deficiency affecting other equipment," stating: (1) the performance deficiency did not degrade plant equipment or challenge any fission product barriers; (2) it is speculative to conclude that the operator performance observed during the event had the potential to adversely affect other plant equipment; and, (3) during the event, no operator went outside of his assigned roles or responsibilities.

NRC Response

Weaknesses in operator human performance fundamentals exhibited during this event were observed throughout the operations organization, as discussed in the Entergy root

cause assessment of the event. The broad nature of this performance deficiency (as opposed to one which was isolated to a specific crew) demonstrates an increased probability of error that could manifest itself in any number of operational situations.

Although automatic initiation of equipment terminated the transient during this event, it was the operators themselves who were directly manipulating reactivity during startup. Operator performance is as important to nuclear safety, and to the maintenance of defense-in-depth protection, as is the performance of safety-related equipment. In this case, the performance of the individual operators and the crew negatively impacted nuclear safety. Given the additional information contained in Entergy's root cause assessment and the NRC's inspection results, the scope of issues extended to other operators and crews, as well.

Entergy Written Response Consideration 3

Entergy challenged the Appendix M section relating to the "period of time effect on the performance deficiency," stating: (1) its self assessment and corrective action reviews identified "gaps to excellence," that were observed previous to the May event and were causal factors associated with the May event; (2) its ROP performance had not indicated any negative trends in operator performance in advance of the event; and, (3) the event was not preceded by a degradation of operator performance.

NRC Response

Entergy's root-cause evaluation determined that causal factors associated with the event had existed for a considerable period of time in advance of the event, and referenced a number of condition reports and self assessments to support this conclusion. The NRC does not view a lack of procedure compliance as merely a "gap to excellence," but rather a failure to meet a license requirement.

In summary, Entergy did not present any new facts or arguments in its written response that would change the NRC's determination that the performance deficiency is appropriately characterized as having low to moderate safety significance (White).