

December 24, 2003

Mr. Michael Kansler
President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: PILGRIM NUCLEAR POWER STATION - REQUEST FOR ADDITIONAL
INFORMATION RE: DELETION OF REQUIREMENT FROM TECHNICAL
SPECIFICATION, LIMITING CONDITION FOR OPERATION 3/4.10.D,
MULTIPLE CONTROL ROD REMOVAL (TAC NO. MB6214)

Dear Mr. Kansler:

By application dated August 16, 2002, as supplemented by letter dated March 25, 2003, Entergy Nuclear Operations, Inc., submitted a request to delete a requirement from the Pilgrim Nuclear Power Station Technical Specifications, Limiting Condition for Operation 3/4.10.D, "Multiple Control Rod Removal."

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing your submittal and has determined that additional information is required to complete the review. The specific information requested is addressed in the enclosure to this letter and was sent to Mr. Bryan Ford, of your staff, by e-mail on December 5, 2003. The information requested in the enclosure to this letter was previously discussed during telephone conferences with Mr. Ford on March 13 and September 29, 2003.

The NRC staff requests that you provide the additional information within 45 days of the date of this letter. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-8474.

Sincerely,

/RA/

Travis L. Tate, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure: Request for Additional Information

cc w/encl: See next page

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Dear Mr. Kansler:

By application dated August 16, 2002, as supplemented by letter dated March 25, 2003, Entergy Nuclear Operations, Inc., submitted a request to delete a requirement from the Pilgrim Nuclear Power Station Technical Specifications, Limiting Condition for Operation 3/4.10.D, "Multiple Control Rod Removal."

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing your submittal and has determined that additional information is required to complete the review. The specific information requested is addressed in the enclosure to this letter and was sent to Mr. Bryan Ford, of your staff, by e-mail on December 5, 2003. The information requested in the enclosure to this letter was previously discussed during telephone conferences with Mr. Ford on March 13 and September 29, 2003.

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Travis L. Tate, Project Manager, Section 2
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Division of Licensing Project Management
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Docket No. 50-293

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

PILGRIM NUCLEAR STATION

DELETION OF REQUIREMENT FROM TECHNICAL SPECIFICATION

LIMITING CONDITION FOR OPERATION 3/4.10.D, "MULTIPLE
CONTROL ROD REMOVAL"

By application dated August 16, 2002 (Reference 1), Entergy Nuclear Operations, Inc. (Entergy or the licensee), requested to change a requirement in the Pilgrim Nuclear Power Station (Pilgrim) Technical Specifications (TSs), Limiting Condition for Operation (LCO) 3/4.10.D, "Multiple Control Rod Removal," in order to reduce the number of fuel movements or control rod drive valve manipulations during refueling operations. Specifically, Entergy requested the deletion of TS LCO 3/4.10.D.d, which requires that all control rods in a 3x3 array, centered on each of the control rods being removed: (1) to be fully inserted and electrically or hydraulically disarmed, or (2) have the surrounding four fuel assemblies removed from the core cell.

During telephone conferences with Entergy on March 13 and September 29, 2003, the Nuclear Regulatory Commission (NRC) staff expressed concerns with the proposed changes creating the possibility of prompt criticality, due to a fuel loading error while refueling under the proposed terms of TS LCO 3/4.10.D. The staff asked Entergy to demonstrate that the proposed changes will provide equivalent protection from inadvertent fuel loading errors. In a March 25, 2003, supplement (Reference 2), Entergy amended the proposed changes to TS LCO 3/4.10.D to prohibit the loading of any fuel into the core while refueling under the multiple control rod removal TS LCO 3/4.10.D.

The staff is conducting their review of Entergy's proposal in accordance with General Design Criteria 26 and 62, "Reactivity control system redundancy and capability," and "Prevention of criticality in fuel storage and handling," respectively.

Chapter 15.4 of the Pilgrim Updated Final Safety Analysis Report (UFSAR) does not provide an analysis of inadvertent criticality during refueling when the core reactivity is being changed (control rod withdrawals or fuel movement). Instead, the Pilgrim UFSAR assumes that the refueling equipment interlocks and the one-rod-out interlock would be operable and would prevent inadvertent criticality due to an error in the refueling process.

As an additional safety feature, the control rod design makes it physically difficult to decouple and remove a control rod blade without initially removing the fuel assemblies from the corresponding fuel cell. Also, boiling water reactor cores are designed with sufficient shutdown margins to ensure that the core will remain subcritical, with the highest worth control rod withdrawn to its full-out position. With one control rod withdrawn, the one-rod-out interlock prevents the selection and the withdrawal of a second control rod. The one-rod-out interlock uses the all-rod-in signal, which is based upon the "full in" position indication from all the control

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rods, to detect a withdrawn control rod, and a rod selection signal (from the Reactor Manual Control System) to detect the selection of a different control rod. Core physics calculations indicate that the creation of two adjacent loaded uncontrolled fuel cells may result in prompt critical conditions. Two loaded uncontrolled fuel cells can be created by an inadvertent control rod withdrawal from a loaded cell that is adjacent to a loaded uncontrolled fuel cell, or by the inadvertent loading of fuel into adjacent, defueled uncontrolled fuel cells. Under certain conditions, the one-rod-out interlock and the refueling equipment interlocks prevent inadvertent: (1) fuel loading into de-fueled uncontrolled (control rod withdrawn) cells, and (2) withdrawal of a control rod from a loaded fuel cell that is adjacent to or near another loaded fuel cell, with a withdrawn control rod.

Since these interlocks are design basis requirements that prevent inadvertent fuel loading and control rod withdrawal errors, there are refueling LCOs in TS 3.10 to enforce the functions of these refueling interlocks. The refueling LCOs require that the refueling interlocks be operable, ensure that control rod withdrawals and fuel movements are not performed simultaneously, and verify that more than one control rod is not withdrawn.

However, LCO 3.10.D allows bypassing the position indication probes, which provide input to the all-rods-in permissive refueling equipment interlocks and the one-rod-out interlock. Since the control rod positions are bypassed for those control rods or control rod drives that are selected for maintenance (control rod or control rod drive removal), the refueling equipment interlocks and the one-rod-out interlock would not be operable for those control rods. All other control rods would remain under the control of the refueling equipment interlocks and the one-rod-out interlock.

Currently, Pilgrim's TS LCO 3/4.10.D.d requires that all control rods in a 3x3 array centered on each of the control rods being removed be fully inserted and be electrically or hydraulically disarmed, or have the surrounding four fuel assemblies removed from the core cell. The current requirement in TS LCO 3.10.D.d protects against the potential for establishing a geometrically unsafe core configuration by preventing the inadvertent withdrawal of a control rod from an adjacent, loaded fuel cell. This is accomplished by disarming the control rod drives in a 3X3 array of fuel cells surrounding the cell with the control rod removed or withdrawn. If a loaded, uncontrolled fuel cell is formed by inadvertently loading fuel into the central cell, then a second, adjacent loaded uncontrolled fuel cell could not be formed, since all the adjacent cells are required to be either controlled (control rod inserted and drive disarmed to prevent inadvertent withdrawal) or defueled.

Pilgrim TS LCO Section 3.10.D.d was added, among other requirements, in February 1980 as part of Amendment 41 (Reference 3), because the licensee had not provided information addressing the effects of withdrawing a second control rod (in addition to the control rod that is removed for maintenance). Instead, the licensee relied upon the UFSAR's assertion that the protection provided by the system of refueling interlocks made such evaluations unnecessary. With the addition of TS LCO 3.10.D.d, effective protection is provided when the refueling interlocks act to prevent the formation of a geometrically unsafe core configuration, even after two errors are committed (i.e., the double contingency principle).

In its August 16, 2002, application, Entergy requested the deletion of TS LCO 3/4.10.D.d. Entergy states that removal of this requirement would reduce the number of fuel movements or control rod drive valve manipulations that would be necessary during a refueling outage that

includes maintenance or replacement of control rods. In its March 25, 2003, supplement, Entergy responded to NRC staff concerns about the possibility of creating loaded, uncontrolled fuel cells by fuel loading errors, by proposing to prohibit the loading of any fuel into the reactor core under the conditions of TS LCO 3/4.10.D. Thus, the licensee's proposal would replace the current 3x3 buffer array requirement with a requirement that no fuel be loaded into the reactor core while refueling under the requirements of TS LCO 3.10.D.

The staff is evaluating the effects of deleting the 3x3 array requirement, and adding the proposed fuel loading prohibition. During operations with multiple control rods withdrawn, the staff's concern remains focused on the possibility of creating a geometrically unsafe core configuration by: (1) inadvertently withdrawing a second control rod in a loaded adjacent fuel cell, (2) inadvertently loading fuel into an uncontrolled cell, or (3) a combination of the two. The staff has determined that Entergy's proposal to add a requirement prohibiting fuel loading while refueling under the multiple control rod LCO 3.10.D does not provide equivalent protection in comparison to the current Pilgrim TS requirements. Even if fuel loading is not allowed under LCO 3.10.D, Entergy's request to delete the 3x3 array requirement in LCO 3.10.D.d does not provide an effective means to prevent withdrawal of a second control rod from a loaded fuel cell.

The staff's determination is based on a consideration of the following scenario, under the current TS requirements. Suppose: (1) the control rod drive in one of the cells in the 3x3 array surrounding a cell that is selected for maintenance is (inadvertently) not disarmed, and (2) the defueled central cell, selected for maintenance, is inadvertently loaded with fuel, and (3) the control rod, with the armed drive, is inadvertently withdrawn. These three errors, committed in this order, would create two adjacent loaded uncontrolled fuel cells. (Since the control rod withdrawal in this scenario would also actuate the one-rod-out interlock and de-energize the refueling bridge, it must be assumed to be the last of the three errors). The current TS requirement for a 3x3 array, surrounding the cell selected for control rod maintenance, satisfies the double-contingency principle, since more than two errors are required to form a geometrically unsafe core configuration.

If the current requirements of TS LCO 3/4.10.D.d were to be replaced by a prohibition of all fuel loading, then the scenario becomes: (1) the cell that is selected for maintenance is inadvertently loaded with fuel (a TS violation), and (2) the control rod in an adjacent cell is inadvertently withdrawn. These two errors would form a geometrically unsafe core configuration. The double-contingency principle would not be met.

The scenario indicates that, when performing multiple control rod or control rod drive maintenance operations under TS LCO 3.10.D, it could be easier, and more likely, to create two adjacent loaded uncontrolled fuel cells in the core, under the proposed TS change, than it would be under the current TS requirements.

The staff believes that Entergy has, in effect, requested the removal of a TS requirement that the staff added in 1980 to compensate for the unavailability of analyses that consider the effects of withdrawing a second control rod; but, hasn't accompanied their request with those analyses. In order to continue its evaluation of the licensee's proposed TS change, the staff requests analyses to show that the core design will tolerate the withdrawal of a second control rod from an adjacent location without resulting in a geometrically unsafe core configuration.

REFERENCES

- [1] Robert M. Bellamy (Entergy Nuclear Operations, Inc.) to USNRC, "Request for Amendment to the Technical Specifications, Deletion of Requirement from TS LCO 3/4.10.D, "Multiple Control Rod Removal," dated August 16, 2002
- [2] Robert M. Bellamy (Entergy Nuclear Operations, Inc.) to USNRC, "Response to NRC Request for Additional Information, Deletion of Requirement from TS LCO 3/4.10.D, "Multiple Control Rod Removal," dated March 25, 2003
- [3] Thomas A. Ippolito (USNRC) to G. Carl Andognini, "Amendment No. 41 to Facility Operating License No. DPR-35," dated February 22, 1980