Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Station
600 Rocky Hill Road
Plymouth, MA 02360

Stephen J. Bethay
Director, Nuclear Assessment

April 6, 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket 50-293
License No. DPR-35

Response to NRC Request for Additional Information,
Deletion of Requirement from LCO 3/4.10.D, Multiple Control Rod Removal

REFERENCE:

1. Entergy Letter, 2.02.064, Request for Amendment to the Technical Specifications, Deletion of Requirement from LCO 3/4.10.D, "Multiple Control Rod Removal" dated, August 16, 2002
2. Entergy Letter, 2.03.035, Request for Amendment to the Technical Specifications, Deletion of Requirement from LCO 3/4.10.D, "Multiple Control Rod Removal" dated, March 25, 2003
3. NCR Letter, 1.04.001, Request for Additional Information RE: Deletion of Requirement from Technical Specification, Limiting Condition for Operation3/4.10.D, Multiple Control Rod Removal (TAC No. MB6214), dated December 24, 2003.

LETTER NUMBER: 2.04.024

Dear Sir or Madam:

By letter dated December 24, 2003, the NRC identified that additional information was needed with respect to completing their review of Entergy's Request for Amendment to Technical Specifications 3/4.10.D, "Multiple Control Rod Removal, " References 1 and 2. Entergy has reviewed the information request and the associated concerns relative to ensuring a geometrically safe core-loading configuration.

Entergy's response is provided in Attachment 1. Our response demonstrates that our proposed technical specification ensures a safe core-loading configuration consistent with standard technical specifications as they relate to Refueling Operations with multiple control rods withdrawn.

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This response does not invalidate the no significant hazard conclusions previously submitted in the original submittal (Reference 1).

This letter contains no commitments.

If you have any questions or require additional information, please contact Mr. Bryan Ford, Licensing Manager, at (508) 830-8403.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 6th of April 2004.

Sincerely,

Stephen J. Bethay

Attachment: 1. Response to Request for Additional Information - 7 pages

cc: Mr. Travis Tate, Project Manager
Office of Nuclear Reactor Regulation
Mail Stop: 0-8B-1
U.S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

U.S. Nuclear Regulatory Commission
Region 1
475 Allendale Road
King of Prussia, PA 19406

Senior Resident Inspector
Pilgrim Nuclear Power Station

Mr. Robert Walker
Radiation Control Program
Commonwealth of Massachusetts
Exec Offices of Health & Human Services
174 Portland Street
Boston, MA 02114

Ms. Cristine McCombs, Director
Mass. Emergency Management Agency
400 Worcester Road
P.O. Box 1496
Framingham, MA 01702

ATTACHMENT 1

LETTER NUMBER 2.04.024

Response to Request for Additional Information

Deletion of Requirement from LCO 3/4.10.D, Multiple Control Rod Removal

Response to Request for Additional Information:

NRC Concerns and Information Requested:

The NRC indicated that "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 does not provide an effective means to prevent withdrawal of a second control rod from a loaded fuel cell" and that "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."

Response:

After review of the identified concerns listed in the RAI, PNPS has re-evaluated our technical specification change request, standard technical specifications and associated bases, and other approved licensee technical specifications, and believes that PNPS refueling controls, consisting of technical specifications, station procedures and work practices will provide the necessary protection to prevent inadvertent removal of a second control rod. The following information is provided to demonstrate the adequacy of the proposed technical specification (TS) change:

Outage Controls

PNPS performs fuel handling and rod withdrawal operations during refuel outages when the reactor head is removed and the mode switch is locked in the "Refuel" mode. There are two distinct fuel move iterations performed during the outage. The first series of fuel moves are performed during the "maintenance offload" task and the second series of moves are performed during the "fuel shuffle/reload" task. These two distinct fuel move tasks accomplish separate functions and are performed at different times during the outage. The maintenance offload task removes fuel from the vessel and offloads it to the spent fuel pool such that internal vessel maintenance can be performed. No internal fuel shuffling takes place during the fuel offload. The fuel shuffle/reload task is performed after in-vessel maintenance and inspections are complete. The purpose of this task is to shuffle fuel within the core, to reload fuel that was offloaded, and to load new fuel into the core. Performance of these separate fuel move tasks is controlled via the outage schedule.

Individual fuel moves are controlled via a fuel movement schedule that is approved by Reactor Engineering. Deviations from the fuel movement schedule are only allowed if documentation is provided and both the On-duty Shift manager and a Reactor Engineer approve the change. A Refueling Services Technician (RST) uses the fuel movement schedule to identify the move sequence and from-to locations. Each move is independently verified and supervised by a Senior Reactor Operator (SRO), who has no other concurrent responsibilities during the fuel move operation. Each fuel move is communicated to the Control Room to facilitate separate Control Room fuel move tracking. These administrative controls minimize fuel move errors when fuel is

being handled. In addition to the controlled fuel movement schedule and the independent move verifications, site procedures and refueling interlocks are also used to prevent fuel movement errors.

The Rod Position Information System (RPIS) provides Control Room indication of control rod position. During control rod multiple withdrawal for control rod drive or control rod blade exchanges, it becomes necessary to provide jumpers/lifted leads to modify the system to allow normal control rod and refuel bridge movement until the drive or blade maintenance is completed and all rods are fully inserted. Station procedures are used to identify the control rod locations that require maintenance and to define the process used to control jumper installation and removal. The jumpers simulate a "Full In" indication and are installed on the input of the probe buffer card in the Rod Position Information System. Jumpers are only installed on control rod locations that require rod withdrawal to facilitate maintenance. Additionally, jumpers are only installed after applicable technical specifications are verified and after the Refuel Floor SRO verifies that all fuel assemblies are removed from the core cells surrounding the control rod. Jumpers are tracked to ensure removal and are only removed after the control rod is verified fully inserted. Control rod position indication in the Control Room is not impacted by the installation or removal of these jumpers.

Per the outage schedule fuel shuffle and core loading activities will not begin until in-vessel maintenance is completed. Per proposed Technical Specification 3.10.D no fuel will be loaded into the core when control rods are withdrawn. Per plant procedures refuel interlocks will be verified operable prior to moving fuel. Therefore, prior to initiating core reload or in-vessel fuel shuffling, all control rod drive and blade maintenance will be complete, all rod position jumpers will be removed, all control rods will be fully inserted, and the refueling platform interlocks will be tested and operable.

PNPS utilizes station procedures to evaluate outage risk and to protect key safety functions. Reactivity control is one of the key safety functions that is protected. Adherence to technical specifications ensures that outage risk is maintained at acceptable levels for each outage task. The PNPS procedures utilize information provided from guidance obtained from NUMARC 91-06 – Guidelines to Assess Industry Actions to Assess Shutdown Risk.

The above referenced controls reflect the current PNPS controls established to ensure refueling operations are performed safely and do not result in localized criticality events. In 1980 PNPS incorporated TS 3.10.D. This technical specification was established to allow maintenance to be performed on more than one control rod at a time and as such reduce outage time and reduce dose. Subsequent to issuance of TS 3.10.D, the NRC issued Information Notice (IN) 83-85 – "Fuel Movement with Control Rods Withdrawn." This IN addressed two industry events where fuel was loaded into core locations that had controls rods withdrawn. The IN referenced General Electric Service Information Letter (SIL) No. 372, which identified potential problems with moving fuel into the core with multiple control rods withdrawn and recommended that utilities adopt the concept of no fuel loading whenever multiple control rods are withdrawn. The proposed technical specification change is consistent with the GE SIL recommendation in that it will prohibit fuel loading into the core when multiple control rods are withdrawn.

Current PNPS TS Requirements

Technical Specification 3.10 identifies protective restrictions and controls that must be observed prior to making core alterations. TS 3.10.A.1 requires that the refueling equipment interlocks be operable and tested prior to fuel movement. TS 3.10.A.2 requires that when the vessel head is removed and any control rod is withdrawn, the one-rod out interlock shall be operable with the reactor mode switch in refuel. These technical specifications ensure that refueling interlocks are operable to reinforce unit procedures that prevent the reactor from achieving criticality during refueling. These interlocks function to prevent fuel movement into the vessel if any control rod is not at its full-in position, and also prevent a rod withdrawal when fuel loaded refueling equipment is positioned over the core.

Although control rod position can be bypassed (jumpered out), TS 3.10.D.1.a restricts the installation of jumpers until after all fuel assemblies are removed from the core location requiring drive withdrawal/maintenance. Station procedures reinforce these restrictions and ensure that all rods not scheduled for withdrawal (maintenance) are fully inserted.

Proposed TS 3.10.D requires the following:

1. Any number of control rods and/or control rod drive mechanisms may be removed from the reactor pressure vessel provided that at least the following are satisfied until all control rods and control rod drive mechanisms are reinstalled and all control rods are fully inserted in the core:
    a. The reactor mode switch is operable and locked in the Refuel position except that the position indication may be bypassed, as required, for those control rods and/or control rod drive mechanisms to be removed, after the fuel assemblies have been removed as specified below.
    b. The source range monitors are operable per Specification 3.3.B.3.
    c. The Reactivity Margin requirements of Specification 3.3.A.1 are satisfied.
    d. No fuel is loaded into the reactor core.
    e. All other control rods are fully inserted.
    f. The four fuel assemblies are removed from the core cell surrounding each control rod or control rod drive mechanism to be removed from the core and/or reactor vessel.

Standard Technical Specifications Review:

Standard Technical Specification 3.10.6 (NUREG 1443, Rev. 2) identifies that technical specifications 3.9.3, 3.9.4, and 3.9.5 may be suspended when multiple control rods are required to be withdrawn during refueling, and "full-in" position indicators may be bypassed for any number of control rods in mode 5, provided that:

A. The four fuel assemblies are removed from the core cell where the drive is to be withdrawn or removed.
B. All other core locations with one or more fuel cell installed have the blade fully inserted.
C. Fuel Cells shall only be loaded in accordance with an approved (spiral) reload sequence.

The proposed PNPS technical specification revision meets the protection provided by standard technical specifications when multiple control rods are withdrawn. The PNPS technical specification ensures that all four-fuel assemblies are removed for each core cell where the drive is to be withdrawn (TS 3.10.D.1.f); all other control rods are inserted (3.10.D.1.e); and no fuel will be loaded into the core (proposed TS 3.10.D.1.d). The other TS 3.10 D requirements provide additional clarification and restrictions to facilitate core safety when multiple control rods are withdrawn.

The proposed PNPS technical specification change does not address spiral reloading other than prohibiting fuel loading when multiple control rods are withdrawn which effectively prohibits spiral reloading in this condition.

Fuel Loading Errors and Drive Withdrawal Errors with Multiple Rods Withdrawn

The proposed change to TS 3.10.D.1.d removes the requirement to disarm all control rods in a 3X3 array centered on each of the control rods being removed (or have the fuel assemblies removed from the core cell) and replaces it with a requirement that identifies that no fuel can be shuffled in or moved into the reactor vessel when multiple rods are withdrawn for maintenance.

This change ensures that no fuel is loaded into any core location when multiple control rods are withdrawn. In addition, TS 3.10.D.1.e ensures that all control rods with fueled cells are fully inserted, and TS 3.10.D.1.f identifies that it is a requirement to remove the four fuel assemblies surrounding the control rod drive mechanism prior to withdrawing the drive for maintenance.

Station procedures and 10 CFR 50.54.m require that a licensed SRO or an SRO limited to fuel handling, directly supervise all core alterations performed while fuel is in the vessel. Prior to initiating drive removal, TS 3.10.D requirements must be verified and all operable drives must be fully inserted per TS 3.10.D.1.e. When the reactor vessel head is removed and any control rod is withdrawn (except as provided in TS 3.10.D), the one rod out interlock is required operable and would prevent additional drives from being withdrawn (TS 3.10.A.2). When multiple drives are withdrawn, the four fuel assemblies must be removed prior to withdrawing the drive (TS 3.10.D.f). Station procedures utilized to control drive maintenance reinforce these technical

specifications. These procedures require shift manager approval prior to initiating drive move evolutions. Control Room Licensed Operators are responsible to initiate and verify each drive move. These procedures also require drive moves to be communicated to the Refuel Bridge if or when offload fuel movements are being performed concurrently.

The proposed change to restrict all fuel loading into the core if control rods are withdrawn is consistent with recommendations provided in NRC IN 83-35 and GE-SIL No. 372. This IN notice and associated GE SIL address the potential for and consequences of a local criticality event resulting from loading fuel into a fueled region of the core that has withdrawn control blades. This proposed technical specification change will provide assurance that sub-criticality will be maintained throughout the refueling operation (i.e. per the GE SIL, the proposed tech spec change will reduce the probability of occurrence of the event to less than 10^{-8} per reactor year) to lower the probability of the event from occurring to where it need not be considered credible.

Identified Staff Concern

The NRC was concerned that Entergy's proposal did not provide an effective means to prevent withdrawal of a second control rod from a loaded fuel cell. The staff identified that the existing technical specification requirement for a 3X3 array surrounding the cell selected for maintenance, satisfies the double-contingency principle since more than two errors would be required to form a geometrically unsafe core configuration. The staff identified that if the 3X3 array requirement was replaced with a no fuel loading clause, then the scenario for creating an unsafe core-configuration could occur if 1) a cell that is selected for maintenance is loaded (TS violation) and 2) the control rod in the adjacent cell is inadvertently withdrawn.

A review of the proposed controls that are provided to ensure that reactivity events do not occur during refuel outages indicates that trained personnel would have to violate numerous technical specifications, deviate from station procedures, and improperly perform independent peer verifications to duplicate the scenario identified in the RAI.

Refueling interlocks and administrative controls enforced by station procedures would have to be ignored in order to initiate unauthorized fuel moves. These procedure errors would have to be requested or performed by trained refueling personnel whose sole function is to move fuel in accordance with the approved fuel movement schedule; authorized and verified by the Refuel Floor SROs whose sole function is to ensure appropriate fuel moves are performed; and accepted by a Control Room Licensed Operator who has been assigned to track each fuel move. These actions would have to occur four times to load the core cell.

The inappropriate action of loading fuel in violation of technical specifications would be annunciated in the control room via the control rod withdraw block caused by the movement of the loaded refueling mast over the core. By procedure the control room operator would investigate the unexpected alarm providing the opportunity for identification of the unauthorized move. In addition, when fuel handlers are working on the refuel bridge, the Refuel Floor SRO

and the Control Room Operators are required to communicate each fuel move or drive withdrawal. Core alterations will be stopped if communication is lost. Therefore, a minimum of three people would have to make the fuel loading error for each of the four unauthorized fuel moves.

Similarly, to remove a control rod from a fueled cell, a Control Room Licensed Operator would have to perform a control rod withdrawal action not documented on the approved control rod maintenance procedure; fail to verify fuel load status of the core location where rod is to be withdrawn (TS violation); and override the rod block signal that would have been inserted prior to initiating in-vessel shuffling or core loading. A second Control Room Licensed Operator would have to concur with the rod withdrawal action, fail to verify the acceptability of the rod withdrawal, and fail to perform a peer check prior to rod withdrawal signal initiation.

Based on the above it is clear that the multiple mistakes, well beyond two independent errors would be necessary to duplicate the unstable core configuration scenario identified by in the RAI. For this scenario to occur at PNPS, it would encompass multiple errors involving multiple technical specification violations, non-conformance with station procedures, disregard for the approved fuel movement plan, failure to independently verify core alteration actions, and failure to follow the approved outage schedule. Therefore, it appears that the proposed technical specification as requested meets the double-contingency principle referenced in the RAI and that adequate protection of refueling activities will be provided.

Summary

The event described in the RAI would require a minimum of the following errors:

- A fuel handler performs an uncontrolled fuel move (i.e., not in conformance with procedures, technical specifications or the fuel move schedule) to a core location where the control rod is withdrawn.
- An independent Refuel Floor SRO authorizing the move and/or not verifying acceptable performance of the move.
- Concurrence from the Control Room Licensed Operator that the move was performed in accordance with the approved fuel movement schedule.
- A Control Room Licensed Operator performs an uncontrolled control rod withdrawal (i.e., not in conformance with control rod maintenance procedures or technical specifications) in a core location that is loaded with fuel.
- An independent Control Room Licensed Operator concurs with the intended withdrawal action or improperly performs an appropriate peer check to ensure that the intended action occurs.

Based on the above, it appears that the number of mistakes required to duplicate the event described in the RAI is significantly greater that two independent errors.

The proposed specification prevents fuel loading during operations where multiple control rod drives are withdrawn. This proposed change in conjunction with existing technical specifications, will prevent inadvertent criticality during refueling operations when multiple control rods are withdrawn for maintenance. The proposed change is consistent with recommendations provided in NRC IN-83-35 and GE-SIL No. 372. This IN notice and GE SIL address potential for and consequences of a local criticality event resulting from loading fuel into a fueled region of the core which has withdrawn control blades. This proposed technical specification change will provide assurance that sub-criticality will be maintained throughout the refueling operation (i.e. per the GE SIL, the proposed tech spec change will reduce the probability of occurrence of the event to less than 10^{-8} per reactor year) to lower the probability of the event from occurring to where it need not be considered credible.