Entergy

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

Michael A. Balduzzi
Site Vice President

June 30, 2006

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

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

Technical Specifications Amendment Request to Revise the Surveillance Requirements for the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems.

LETTER NUMBER: 2.06.025

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations Inc. (Entergy) hereby proposes to amend its Facility Operating License, DPR-35. The proposed changes would revise the surveillance requirements for the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems. Entergy has reviewed the proposed amendment in accordance with 10 CFR 50.92 and concludes it does not involve a significant hazards consideration.

Entergy requests approval of the proposed amendment by April 1, 2007. Once approved, the amendment shall be implemented within 90 days.

Commitments made by Entergy in this letter are contained in Attachment 2.

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

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of June, 2006.

Sincerely,

Michael A. Balduzzi

Michael A. Balduzzi

EAS/dm

Enclosure: Evaluation of the proposed change – 13 pages

Attachments: 1. Proposed Technical Specification and Bases Changes – 5 pages
2. List of Commitments -1 page

cc: Mr. James Shea, Project Manager
Plant Licensing Branch I-1
Division of Operator Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
One White Flint North O-8C2
11555 Rockville Pike
Rockville, MD 20852

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

Senior Resident Inspector
Pilgrim Nuclear Power Station

Mr. Robert Walker, Director
Massachusetts Department of Public Health
Radiation Control Program
90 Washington Street, 2nd Floor
Dorchester, MA 02121

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

ENCLOSURE

EVALUATION OF THE PROPOSED CHANGE

ENCLOSURE

Evaluation of the Proposed Change

Subject: Technical Specifications Amendment Request to Revise the Surveillance Requirements for the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems.

1. DESCRIPTION AND REASON FOR CHANGES

2. PROPOSED CHANGES

3. BACKGROUND

4. TECHNICAL ANALYSIS

5. REGULATORY SAFETY ANALYSIS

No Significant Hazards Consideration

6. ENVIRONMENTAL CONSIDERATION

1. Description and Reason for Changes

Entergy Nuclear Operations, Inc. (Entergy) is requesting to amend Operating License DPR-35 for Pilgrim Nuclear Power Station (PNPS). The proposed changes would modify the Technical Specifications (TS) surveillance requirement (SR) 4.5.C.1.d for the High Pressure Coolant Injection (HPCI) system and 4.5.D.1.d for the Reactor Core Isolation Cooling (RCIC) system. These TS SRs require a flow rate test of the respective system at 150 psig once per operating cycle. The existing TS SR 4.5.C.1.b (HPCI) and 4.5.D.1.b (RCIC), which require a flow rate test on a quarterly frequency to demonstrate operability, are not being modified by this application.

Entergy believes that routine low pressure testing is not necessary to demonstrate system operability and that performance of these tests at low pressure can present a challenge to the Operators. Therefore, these changes are proposed to modify the frequency of SRs 4.5.C.1.d and 4.5.D.1.d to require a flow rate test for each system during reactor startup only when specific circumstances warrant. In addition, these changes are proposed in order to reduce the probability of an undesirable transient which might be induced through diversion of steam when the reactor is held at low pressure.

2. Proposed Changes

Revise TS surveillance requirement 4.5.C.1.d for the High Pressure Coolant Injection (HPCI) system and TS 4.5.D.1.d for the Reactor Core Isolation Cooling (RCIC) system to require that the specified flow rate test be performed within 24 hours after exceeding 150 psig reactor pressure following maintenance activities that could have affected system flow rate performance.

Current surveillance requirements:
SR 4.5.C.1.d: Flow rate test at 150 psig. Once/operating cycle, verify that the HPCI pump delivers at least 4250 gpm for a system head corresponding to a reactor pressure of 150 psig.

SR 4.5.D.1.d: Flow rate test at 150 psig. Once/operating cycle, verify that the RCIC pump delivers at least 400 gpm at a system head corresponding to a reactor pressure of 150 psig.

Proposed surveillance requirements:
SR 4.5.C.1.d: Flow Rate Test. Verify that the HPCI pump delivers at least 4250 gpm within 24 hours after exceeding 150 psig reactor pressure during any reactor Startup following maintenance that could affect system flow rate performance.

SR 4.5.D.1.d: Flow Rate Test. Verify that the RCIC pump delivers at least 400 gpm within 24 hours after exceeding 150 psig reactor pressure during any reactor Startup following maintenance that could affect system flow rate performance.

Proposed changes to TS Bases are provided for information only.

3. Background

High Pressure Coolant Injection (HPCI) System Description

The HPCI system is one of four systems that comprise the Core Standby Cooling Systems (CSCS). The objective of the CSCS, in conjunction with other engineered safeguard systems, is to limit the release of radioactive materials to the environs during postulated accident conditions so that resulting radiation exposures are within the guideline values given in published regulations.

The purpose of the HPCI system is to ensure the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break loss of coolant accident (LOCA) in the nuclear system pressure boundary that does not result in a rapid depressurization of the reactor vessel. The HPCI system permits the reactor to be shut down while maintaining sufficient reactor vessel water inventory until the reactor vessel pressure is reduced to the pressure at which Low Pressure Coolant Injection (LPCI) operation or Core Spray System operation can maintain core cooling.

The HPCI system consists of a steam turbine assembly driving a constant flow pump assembly and system piping, valves, controls, and instrumentation. The turbine steam supply piping, located downstream of two in-series primary containment isolation valves, supplies steam to the turbine via in-series motor-operated valve, hydraulically-operated stop valve, and hydraulically-operated governor valve. Additional design details of the HPCI system are contained in UFSAR Section 6.4.1, High Pressure Coolant Injection System.

The principal HPCI system equipment is installed in the Reactor Building. The turbine-pump assembly is located in a shielded area to assure that personnel access to adjacent areas is not restricted during operation of the HPCI system. Suction piping comes from the condensate storage tank and the suppression pool. Injection water is piped to the reactor feedwater pipe at a T-connection. Steam supply for the turbine is piped from a main steam header in the primary containment. This piping is provided with an isolation valve on each side of the drywell barrier. Remote controls for valve and turbine operation are provided in the station main control room. The controls and instrumentation of the HPCI system are described, illustrated, and evaluated in detail in UFSAR Section 7.4, Core Standby Cooling Controls and Instrumentation.

If a loss of coolant accident occurs, the reactor scrams upon receipt of a low water level signal or a high drywell pressure signal. The HPCI system starts when the water level reaches a preselected height above the core, or if high pressure exists in the primary containment. The HPCI system automatically stops when a high water level in the reactor vessel is signaled.

Accident safety analyses require that the HPCI system deliver 4250 gpm to the reactor vessel over a range of reactor pressures from 150 psig to 1000 psig, which is well within the design capability of the HPCI system. The HPCI system also serves as a backup for the RCIC system during loss of feedwater transients (i.e., no pipe break), and 320 gpm make-up is sufficient to maintain reactor water level above the top of active fuel in these events.

The HPCI system turbine is driven by steam from the reactor, which is generated by decay heat and residual heat. The steam is extracted from a main steam header upstream of the main steam line isolation valves. The two HPCI system isolation valves in the steam line to the HPCI system turbine are normally open to keep the piping to the turbine at elevated temperatures to permit rapid startup of the HPCI system. Signals from the HPCI system control system open or close the turbine stop valve.

The turbine has two devices for controlling power; a speed governor which limits turbine speed to its maximum operating level and a control governor with automatic speed set point control which is positioned by a demand signal from a flow controller to maintain constant flow over the pressure range of HPCI system operation. Manual operation of the governor is possible when in the test mode, but it is automatically repositioned by the demand signal from the flow controller if system initiation is required.

As reactor steam pressure decreases, the HPCI system turbine throttle valves open further to pass the steam flow required to provide the necessary pump flow. The capacity of the system is selected to provide sufficient core cooling to limit clad temperature while the pressure in the reactor vessel is above the pressure at which core spray and LPCI become effective.

Exhaust steam from the HPCI system turbine is discharged to the suppression pool. A drain pot at the low point in the exhaust line collects moisture present in the steam. Collected moisture is discharged through a trap to the suppression pool or bypassed to the gland seal condenser if the trap fails.

Two sources of water are available. Initially, demineralized water from the condensate storage tank is used, followed by injection from the suppression pool, if required. This provides reactor grade water to the reactor vessel for the case where the need for injection by HPCI is rapidly satisfied. Water from either source is pumped into the reactor vessel via the feedwater line. Flow is distributed within the reactor vessel through the feedwater spargers to obtain mixing with the hot water or steam in the reactor pressure vessel.

The pump assembly is located below the level of the condensate storage tank and below the water level in the suppression pool to assure positive suction head to the pumps.

Reactor Core Isolation Cooling (RCIC) System Description

The purpose of the RCIC system is to provide makeup water to the reactor vessel following reactor isolation in order to prevent the release of radioactive materials to the environment as a result of inadequate reactor core cooling. The RCIC system consists of a steam driven turbine-pump and associated valves and piping capable of delivering makeup water to the reactor vessel. The system can be operated automatically or manually, and is credited in the Pilgrim Station safety analysis for a design basis control rod drop accident. During isolation events, 320 gpm makeup from the RCIC system is sufficient to maintain reactor vessel water level above the top of active fuel. The RCIC system is capable of delivering 400 gpm to the reactor vessel over a range of reactor pressures, from 150 psig to 1126 psig.

Similar to the HPCI system, RCIC consists of a steam driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The steam supply to the turbine comes from the reactor vessel. The steam exhaust from the turbine discharges to the suppression pool. The pump normally takes suction from the demineralized water in the condensate storage tank. This supply is backed up by a supply line from the suppression pool. The pump discharges either to the feedwater line or to a full flow return test line to the condensate storage tank. A minimum flow bypass line to the suppression pool is provided. The makeup water is delivered into the reactor vessel through a connection to the feedwater line, and is distributed within the reactor vessel through the feedwater sparger. Cooling water for the RCIC turbine lube oil cooler and gland seal condenser is supplied from the discharge of the pump.

Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The steam normally flows to the main condenser through the turbine bypass or, if the condenser is isolated, through the relief valves to the suppression pool. The fluid removed from the reactor vessel can be entirely made up by the feedwater pumps or partially made up from the control rod drive system which is supplied by the control rod drive feed pumps. If makeup water is required to supplement these primary sources of water, the RCIC turbine-pump unit either starts automatically upon receipt of a reactor vessel low-low water level signal or is started by the operator from the control room by remote manual controls.

RCIC has a makeup capacity sufficient to prevent the reactor vessel water level from decreasing to the level where the core would be uncovered without the use of core standby cooling systems. The pump suction is normally lined up to the condensate storage tank. The backup supply of cooling water for the RCIC is the suppression pool. The turbine pump assembly is located below the level of the condensate storage tank and below the minimum water level in the suppression pool to assure positive suction head to the pump. Additional design details of the RCIC system are contained in UFSAR Section 4.7 Reactor Core Isolation Cooling System.

Current Surveillance Testing

The HPCI system and the RCIC system are of similar design, method of operation and function, and both are normally in stand-by status. Additionally, the PNPS Technical Specification surveillance requirements for both systems are similar. The most notable difference between the two systems is their size and functional capacity. For each system, a flow rate test is required by Technical Specifications Once per Cycle at 150 psig reactor pressure and Quarterly at 1,000 psig reactor pressure. These two test points are near each end of the design operating range thereby demonstrating the respective system can provide rated flow over the entire pressure range for which it is credited. The design flow functional test of the HPCI and RCIC systems is also quite similar and is performed during station operation by taking suction from the demineralized water in the condensate storage tank and discharging through the full flow test return line back to the condensate storage tank. For each system, the discharge valve to the feedwater line remains closed during the test. The test line for each system includes a throttling device that simulates the resistance that each system pump is required to overcome when delivering the required flow rate to the reactor vessel.

4. Technical Analysis

HPCI and RCIC Turbines

Both the HPCI system and the RCIC system consist of a steam driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. The turbines are two-stage, steam driven Terry turbines. The steam supply to the turbine comes from the reactor vessel. The most notable difference between the two systems is their size and functional capacity.

The HPCI and RCIC Terry turbines have been designed for high reliability under the design requirements of quick starting. Both turbines have adequate capacity to accept the small losses in efficiency due to any credible moisture carryover, and turbine efficiency is not of paramount importance. The casing is designed accounting for corrosion, erosion, and material fatigue. Condensate and moisture carryover are prevented from accumulating by a drain pot and a drain orifice located immediately upstream of the turbine inlet valve. When the turbine is shut down, the inlet is kept at elevated temperature and the condensate is continuously drained.

Both turbines use a solid, one piece wheel, designed to accommodate dry and saturated steam, are not affected by water slugging, and can operate over a wide range of steam pressures. The larger HPCI system uses a two wheel turbine while the smaller RCIC system uses a one wheel turbine. For each turbine, steam enters the turbine through a multi-valve governor steam chest, and is fed into steam rings. Steam leaves the steam rings through expanding nozzles at high velocity and enters wheel buckets, where its direction is reversed. The semi-circular buckets are part of the wheel, milled into the wheel periphery. For each turbine wheel there are expanding nozzles each with a corresponding reversing chamber. The nozzles are positioned so that steam enters the bucket at an angle and is reversed 180°, leaving the bucket on the other side

directed toward cast stainless steel reversing chambers, fastened to the casing at each nozzle position. The reversing chambers redirect the steam exiting the buckets back into the wheel continuously until all available energy is utilized. The work to rotate the wheel is done by the steam impulse on the buckets. The buckets, nozzles, and reversing chambers work together to help the turbine wheel extract work out of the steam. They are passive components that would have to experience degradation significant enough to reduce the ability to convert steam energy into pump horsepower to a level that exceeds the margin designed into the system.

The turbine components described above play a more important role in converting steam energy to pump horsepower at the lower end of the pressure range than at the higher end. At the higher end of the pressure range, these components are less important due to excess steam capacity and enthalpy that exists at higher pressure. As reactor steam pressure decreases, the turbine throttle valves open further to pass the steam flow necessary to provide the required pump flow. At the very low end of the pressure range the buckets and reversing chambers are more important in terms of extracting work out of the lower enthalpy steam for generating pump horsepower. However, there is still margin available at the low end of the pressure range to accommodate a reduction in efficiency of the turbine. The governor valve is sized such that it is not required to be full open during operation at 150 psig. As pump flow is developed and reaches the set point of the Flow Controller, the flow controller output signal to the turbine governor will integrate to where constant rated pump flow is achieved. The flow control system is routinely tested and calibrated as necessary to verify and ensure that it will function properly and in a reliable manner to meet the system flow rate requirements over the full range of reactor pressure.

The probability of degradation of turbine internals between system overhauls, leading to a reduction in turbine efficiency, is very low. The HPCI and RCIC systems are normally in stand-by status and operate infrequently. As stated above, the turbines are designed to accommodate poor quality steam including water slugs. Therefore, the turbine and turbine components are designed to be very rugged and reliable with sufficient margin to accommodate reduced turbine efficiency. Because these systems are not subjected to continuous service and because the Terry turbine solid wheel design has a long history of being very rugged throughout various applications, virtually no degradation of turbine components between system overhauls is expected.

Prior to operation at Pilgrim Station, tests on a production unit of the HPCI turbine were performed to verify the capability of the turbine to take low quality steam. The results confirm that the pressure integrity of the turbine housing is maintained during two-phase mixture conditions at the turbine inlet. This testing did not compromise the turbine housing pressure boundary.

<u>System Inspection and Testing History</u>

In 34 years of plant operation, system overhauls of both HPCI and RCIC systems have been conducted periodically. These periodic overhauls (dismantled inspections), required by the Nuclear Electric Insurance Limited (NEIL) Loss Control Standards, are currently performed at least every 12 years. The Loss Control Standards specify comprehensive inspection of system components during overhauls. For the HPCI and RCIC turbines these overhauls include the following: inspecting all nozzles, wheels, buckets, diaphragms, rotors, and blade rings for evidence of cracking, erosion or corrosion. Also required is inspection of all buckets or blades for cracks, looseness, corrosion or erosion; and broken, cracked, or missing shroud band or lashing wire and all couplings and bolting for signs of distress. These are just a subset of the

inspections performed on the turbines. The loss control standards require that the inspection results be documented.

Cracking, erosion, corrosion, and looseness (bolting) are the only credible modes of degradation for these passive components. Additionally, the turbines are normally in stand-by status and operate infrequently for relatively short periods of time. Therefore, the probability that degradation will manifest to a level that results in a reduction of turbine performance between overhauls is very low because the operating conditions that are required to cause and advance these types of degradation are only present infrequently and for short periods of time.

Overhauls of the HPCI system were conducted in 1987, 1993, and 2003. The overhauls of the HPCI system conducted in 1987 and 1993 revealed no degradation or breakdown of turbine components and no corrective actions were required. The HPCI system overhaul conducted during RFO 14 in 2003 did reveal cracking in one reversing chamber. Although cracks were discovered, the affected reversing chamber was intact. The affected reversing chamber was replaced as part of the overhaul. This was the only internal turbine component that required any corrective action during this overhaul. The last HPCI low pressure test prior to the 2003 overhaul was conducted near the conclusion of RFO 13 in 2001 and the test was successful with no adverse performance issues documented. Presuming the cracks were present at that time, perhaps to a lesser degree than when they were discovered during overhaul, it is concluded that the presence of the cracks did not impair system performance at low pressure. This indicates that the HPCI turbine is highly reliable and that the overhauls are effective at identifying degradation before it can reach a level that could measurably degrade performance of the overall system.

An overhaul of the RCIC system in 1993 revealed no degradation or breakdown of any internal turbine components. The next RCIC system overhaul is scheduled for RFO 16 in April 2007. The RCIC low pressure tests have repeatedly demonstrated system operability at low pressure with no degradation being identified. This further substantiates that the RCIC turbine is highly reliable.

Successful performance of the Once per Cycle test at 150 psig over the last 34 years has repeatedly confirmed that both systems are fully capable of meeting the flow rate requirements at the low end of the pressure range. For each system, repeated success of this low pressure test combined with the required system overhauls confirms that degradation is detected before it progresses to a level that could reduce the ability to meet the flow rate requirement at 150 psig. Additionally, a review of industry history identified no events caused by problems with either HPCI or RCIC turbines to provide sufficient horsepower and speed to provide the required flow at low pressure.

System Engineers currently monitor a number of variables on the HPCI/RCIC systems to verify proper performance. If the results of trending 1,000 psig test data indicates that a degradation mechanism may be present that could challenge operability at the low end of the pressure range, the condition will be entered into the Corrective Action Process. The Corrective Action Process will invoke the Operability Evaluation process as well as drive appropriate corrective actions.

<u>Basis for Low Pressure Surveillance Test</u>

In order to assure that the components are properly sized and working in concert with each other, both the HPCI and RCIC systems were tested during plant startup at various reactor pressures. These tests were performed to validate the adequacy of the system design and proved the system could operate over the required range of pressures, delivering the design flow

rate within the required time requirements. These Start Up/Acceptance Tests proved each system's ability to meet the required design parameters. Once it has been shown that a system can operate over its entire designed operating range, performance testing at a single key operating point provides a high degree of assurance that the system will operate satisfactorily over its entire range.

No basis for requiring a low pressure surveillance test could be identified. It appears that after performing the Start Up/Acceptance Tests to validate the design of HPCI/RCIC operation at both 150 psig and 1,000 psig, the requirement to perform these tests was written into plant surveillance and test programs without further basis. Neither the GE HPCI Design Specifications or the Terry Turbine Operations and Maintenance Manuals for HPCI and RCIC specify such testing. The vendor was contacted regarding low pressure testing and agreed that while such testing may be useful for providing certain performance data, it is not required on a routine frequency to demonstrate system operability.

Standard Technical Specification for Pressurized Water Reactors (NUREGs 1430, 1431, and 1432) were reviewed to determine the requirements for steam driven auxiliary feedwater (AFW) pumps. Steam driven AFW systems are similar to HPCI and RCIC because they use reactor steam to drive a turbine that in turn, drives the AFW pump. The Surveillance Requirements (SR) and Bases for the steam driven AFW systems are essentially the same in all three NUREGs and are contained in Chapter 3.7.5. There is only one SR (3.7.5.2) for testing pump developed head and it is performed at high pressure on a quarterly frequency. There is no similar SR specified to be performed at low pressure. The Bases for SR 3.7.5.2 states "This test confirms one point on the pump design curve and is indicative of overall performance. Such Inservice tests confirm component operability, trend performance, and detect insipient failures by indicating abnormal performance."

This information combined with a good inspection and testing history supports the position that routine low pressure testing is not required.

Comparison of HPCI / RCIC Operation at 1,000 psig versus 150 psig Reactor Steam Pressure

The design requirement for operation with inlet steam pressures from over 1100 psig down to as low as 85 psig defines the thermodynamic design requirements for each system. Typically, the power required at the lower pressure / lower enthalpy inlet steam condition determines the necessary steam flow capability, and in turn determines the control valve sizes, the number of steam nozzles and their size, and the number of wheels. The low-pressure design criterion yields a design with considerable excess steam flow capacity and corresponding power capability at the higher pressure / higher enthalpy steam inlet conditions. This excess power capability provides extremely rapid acceleration during startup and results in the turbine control valves operating near their respective full closed position, i.e., typically 20 to 25 percent open, or less.

Pump performance at higher pressures is indicative of pump performance at lower pressures. Once it has been shown that a system can operate over its entire design operating range, performance testing at a single key operating point provides a high degree of assurance that the system will operate satisfactorily over its entire range. This assumes that the basic operating characteristics of the system have not changed due to plant modification.

At constant flow rate the pump discharge pressure is proportional to the reactor coolant system pressure, and the required pump horsepower is directly proportional to the discharge head. Thus pump design requirements are relatively straight forward. At constant flow the head losses

remain constant and therefore, the required pump discharge pressure is the sum of the reactor pressure plus piping losses plus elevation head differences. Therefore, the conditions that exist during pump testing at higher pressure are more demanding than at lower pressure. Testing at one point on the operating curve is sufficient to demonstrate operability across the entire pressure range.

Figures 1 and 2 are curves that were developed from data collected for each system during testing to show performance of the system at each end of the design pressure range. The figures corroborate the principle that system performance at high pressure is indicative of system performance at low pressure. This principle will not change unless the system is modified or degradation is present in the system that alters its performance.

Proposed Alternate Monitoring for Turbine Degradation

Monitoring for turbine degradation can be accomplished through collection and trending of turbine vibration data. Pilgrim already has an established program that collects turbine vibration data during system operation. Turbine vibration is a parameter that is expected to remain relatively constant at given operating points and monitoring for changes in turbine vibration is a reliable means to detect turbine degradation. Because the turbine wheel is balanced and rotates at high speed, failure of turbine components is expected to be immediately obvious. Examples would be vibration resulting from bolted components that have loosened or from changes in steam flow inside the turbine due to significantly degraded or broken buckets, nozzles or reversing chambers. Vibration readings will be collected during system operation and trended. Adverse trends will be entered into the Corrective Action Process for investigation and resolution. Entergy commits to continue to collect, trend and evaluate turbine vibration data in accordance with the requirements of the PNPS Inservice Code Testing (IST) Program and the PNPS Predictive Maintenance Program, at the frequency specified in the IST program.

As stated earlier, both turbines use solid, one piece wheels, are designed to accommodate dry and saturated steam, are not affected by water slugging, and can operate over a wide range of steam pressures. These turbines are very rugged and are highly reliable as their operating history indicates. The buckets, nozzles, and reversing chambers are passive components that would have to experience degradation significant enough to reduce the ability to convert steam energy into pump horsepower to a level that exceeds the margin designed into the system. As stated earlier, these components can degrade in the following ways; erosion/corrosion through exposure to steam and steam impingement, stress related cracking, and loosening of bolted components. Because the HPCI and RCIC systems are normally in stand-by status, operate infrequently and only for short periods of time, they are not subjected to the conditions necessary to advance these forms of degradation to a significant degree between overhauls. Therefore, the probability that significant degradation can occur resulting in failure of these components between turbine overhauls is very low. The periodic overhauls required by the Nuclear Electric Insurance Limited (NEIL) Loss Control Standards and the turbine vendor, are effective at detecting degradation before it becomes significant enough to impact system performance.

Proposed Testing Following Maintenance

The quarterly flow rate surveillance test is adequate to demonstrate continued operability. If the design of the HPCI or RCIC and its associated steam supply and exhaust systems are not modified, then the original low pressure testing remains valid and routine performance of low pressure testing is not required. However, if maintenance, including design modifications, is performed that could affect the system flow rate performance, appropriate post-maintenance

testing (PMT) would be required to validate that system performance meets the original system design requirements.

The scope of the maintenance will determine the extent and scope of PMT. For example, PMT to ensure system operability performed following maintenance on selected system components may not require an integrated system flow rate test. Larger scope system overhauls that are more intrusive, such as those performed in accordance with the NEIL loss control standards are examples of maintenance that would require an integrated system flow rate test as PMT to demonstrate operability following system restoration.

If maintenance that could affect system flow rate performance is conducted while HPCI/RCIC is required to be OPERABLE e.g., during power operation in the Run MODE, a system flow rate test would be performed prior to declaring the system operable and exiting the LCO. This would be in addition to any other required PMT. In this example the flow rate test would be performed at 1,000 psig reactor steam pressure.

If maintenance that could affect the system flow rate performance is conducted during a Shutdown or Refueling MODE when HPCI and RCIC are not required to be OPERABLE, a system flow rate test would be performed during reactor startup within 24 hours after exceeding 150 psig. This would be in addition to any other required PMT.

At and below 150 psig reactor pressure the low pressure ECCSs are adequate to maintain core cooling; HPCI and RCIC are not necessary. The 24-hour time limitation for performance of testing is adequate for obtaining the required reactor steam conditions to permit the testing without undue risk of an undesirable transient which might be induced through diversion of steam at low reactor pressure. The 24-hour time limitation restricts the allowable time to verify operability and is considered acceptable because the system should be functional prior to testing and the probability is small that an event will occur during that short time period that would require the system in question to function. Furthermore, limiting the allowable time period to 24 hours is consistent with the completion time of TS Actions 3.5.C.3 (HPCI) and 3.5.D.3 (RCIC) to initiate a reactor shutdown and be in the Cold Shutdown Condition if the HPCI or RCIC system is inoperable and LCO 3.5.C.2 (HPCI) or 3.5.D.2 (RCIC) is not met.

Conclusion

Consistent with PWR STS for steam driven auxiliary feedwater pumps, Pilgrim SR 4.5.C.1.b for HPCI and SR 4.5.D.1.b for RCIC require testing pump developed head at high pressure on a quarterly frequency. There is no similar SR specified in PWR STS to be performed at low pressure. Quarterly testing of HPCI and RCIC in accordance with SR 4.5.C.1 and SR 4.5.D.1 respectively, is adequate to demonstrate operability.

Turbine performance is the largest contributor to system performance at low reactor pressure. The proposed monitoring and trending of turbine vibration, along with analyzing performance data against the curves contained in Figures 1 and 2 during each quarterly test of the HPCI and RCIC systems is a reliable method of monitoring for significant degradation. Over the last 34 years, the Pilgrim HPCI and RCIC turbines have demonstrated their ruggedness and reliability and system overhauls have confirmed that degradation of turbine components has a low probability of occurrence and is detected before it advances to a point that it adversely affects turbine performance.

When maintenance or modifications are performed, appropriate PMT will be performed to demonstrate operability. If maintenance or modification of these systems or their support

systems is performed that could affect the HPCI or RCIC flow rate performance, an integrated system flow rate test would be required to demonstrate operability. Additionally, trended parameters will be re-baselined as necessary following maintenance or modification.

It is concluded that routine performance of low pressure testing at a specified frequency is not necessary to demonstrate operability of the HPCI and RCIC systems.

5. Regulatory Safety Analysis

No Significant Hazards Consideration

Entergy Nuclear Operations, Inc. (Entergy) is proposing to modify the Pilgrim Technical Specifications (TS) surveillance requirement related to the once per cycle low pressure (150 psig) flow rate test for the HPCI and RCIC systems.

Entergy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No. The proposed change modifies the surveillance requirement for testing of the HPCI and RCIC systems during reactor Startup. Performance or non-performance of these tests is not an accident initiator of any accident previously evaluated. As a result, the probability of any accident previously evaluated is not affected. The HPCI and RCIC systems are still required to be OPERABLE and operability requirements are unchanged. The 24-hour time limitation for performance of testing restricts the allowable time to verify operability and is considered acceptable because the system should be functional prior to testing and the probability is small that an event will occur during that short time period that would require the system in question to function. Additionally, the 24-hour time limit is consistent with the completion time for existing Pilgrim TS Actions to initiate a reactor shutdown and be in the Cold Shutdown Condition if the HPCI or RCIC system is inoperable and certain other LCOs are not met. Therefore, there is no significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No. The proposed change does not involve any physical alteration of plant equipment or change in actuation setpoints and does not change the method by which any safety-related system performs its function. No new or different types of equipment will be installed, and the basic operation of installed equipment is unchanged. Requirements for system operability are unchanged. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No. The proposed change does not involve the modification of any plant equipment or affect system operation and does not adversely affect existing plant safety margins or the reliability of the equipment assumed to operate in the safety analysis. As such, there are no changes being made to safety analysis assumptions, safety limits or safety system settings. Operability requirements for both HPCI and RCIC systems are unchanged and operability of both systems will continue to be adequately demonstrated.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Pilgrim concludes that the proposed amendment involves no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

6. Environmental Consideration

A review has determined that the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need to be prepared in connection with the proposed amendment.

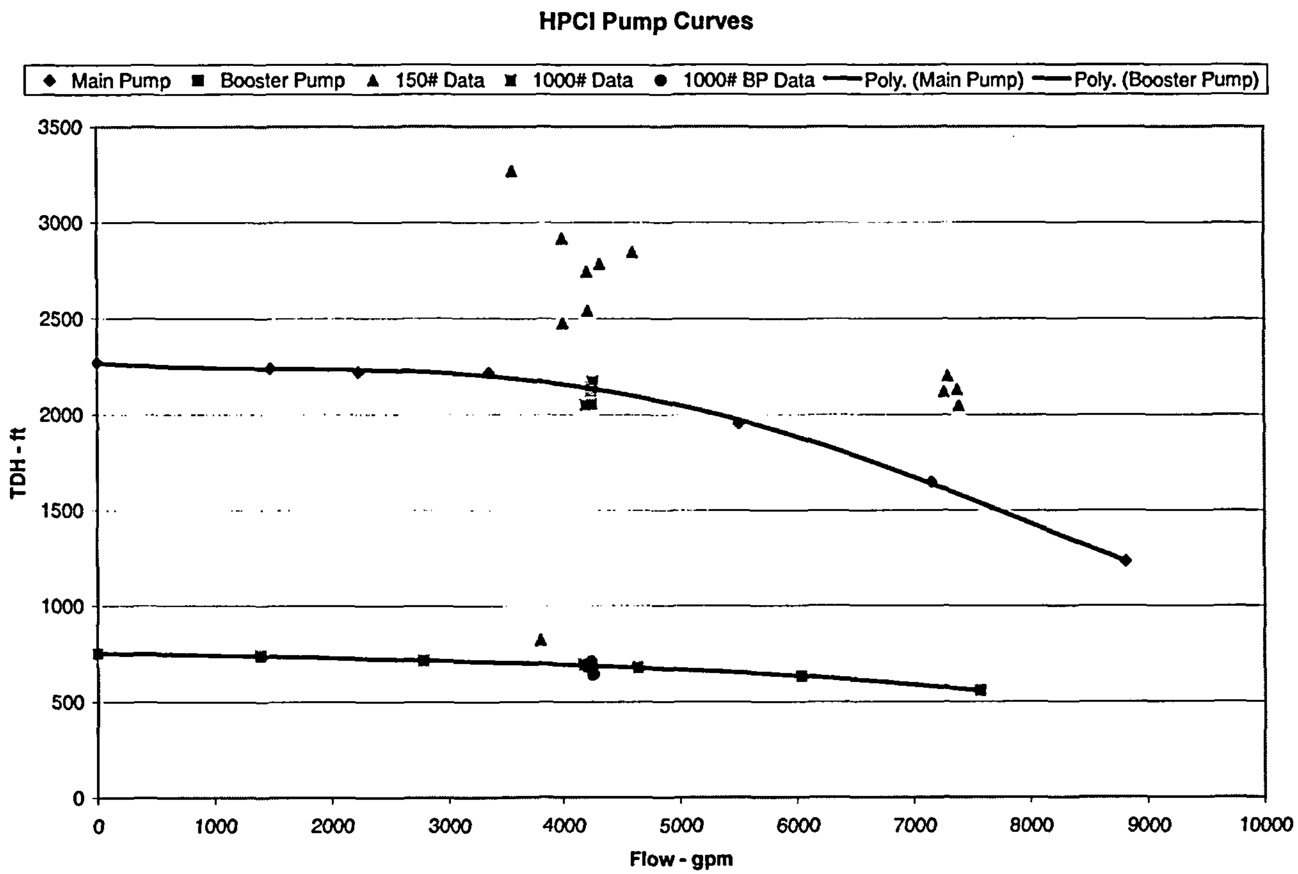
HPCI Pump Curves
Main Pump
Booster Pump
150# Data
1000# Data
1000# BP Data
Poly. (Main Pump)
Poly. (Booster Pump)
3500
3000
2500
2000
1500
1000
500
0
TDH - ft
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Flow - gpm

Figure 1

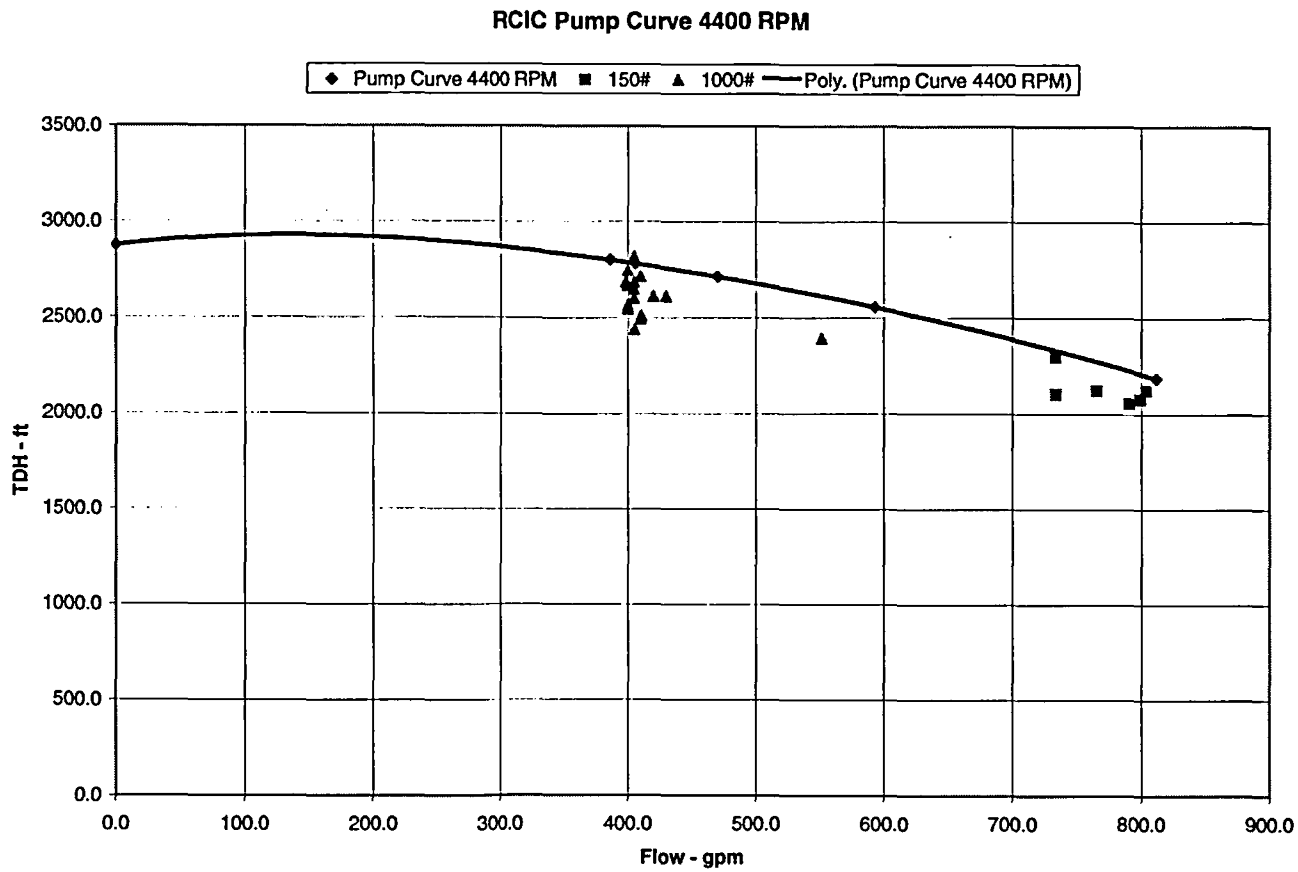
RCIC Pump Curve 4400 RPM
Pump Curve 4400 RPM
150#
1000#
Poly. (Pump Curve 4400 RPM)
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
TDH - ft
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
900.0
Flow - gpm

Figure 2

Attachment 1 to Letter No. 2.06.025

PROPOSED TECHNICAL SPECIFICATION

AND BASES CHANGES

(Note: Bases provided for information only)

LIMITING CONDITIONS FOR OPERATION

3.5 CORE AND CONTAINMENT COOLING SYSTEMS

C. HPCI System

1. The HPCI system shall be operable whenever there is irradiated fuel in the reactor vessel, reactor pressure is greater than 150 psig., and reactor coolant temperature is greater than 365°F, except as specified in 3.5.C.2 below.

2. From and after the date that the HPCI system is made or found to be inoperable for any reason, continued reactor operation is permissible only during the succeeding 14 days unless such system is sooner made operable, providing that during such 14 days all active components of the ADS system, the RCIC system, the LPCI system and both core spray systems are operable.

3. If the requirements of 3.5.C cannot be met, an orderly shutdown of the reactor shall be initiated and the reactor shall be in the Cold Shutdown Condition within 24 hours.

SURVEILLANCE REQUIREMENTS

4.5 CORE AND CONTAINMENT COOLING SYSTEMS

C. HPCI System

1. HPCI system testing shall be as follows:

a.	Simulated Automatic Actuation Test	Once/ Operating Cycle
b.	Pump Operability	When tested as specified in 3.13, verify that the HPCI pump delivers at least 4250 GPM for a system head corresponding to a reactor pressure of 1000 psig.
c.	Motor Operated Valve Operability	As Specified in 3.13
d.	Flow Rate Test ~~at 150 psig~~	~~Once/ operating cycle, verify that the HPCI pump delivers at least 4250 GPM for a system head corresponding to a reactor pressure of 150 psig.~~ INSERT: Verify that the HPCI pump delivers at least 4250 gpm within 24 hours after exceeding 150 psig reactor pressure during any reactor Startup following maintenance that could affect system flow rate performance.

The HPCI pump shall deliver at least 4250 GPM for a system head corresponding to a reactor pressure of 1000 to 150 psig.

LIMITING CONDITIONS FOR OPERATION

3.5 CORE AND CONTAINMENT COOLING SYSTEMS

D. Reactor Core Isolation Cooling (RCIC) System

1. The RCIC system shall be operable whenever there is irradiated fuel in the reactor vessel, reactor pressure is greater than 150 psig, and reactor coolant temperature is greater than 365°F, except as specified in 3.5.D.2 below.

2. From and after the date that the RCIC system is made or found to be inoperable for any reason, continued reactor operation is permissible only during the succeeding 14 days unless such system is sooner made operable, providing that during such 14 days the HPCIS is operable.

3. If the requirements of 3.5.D cannot be met, an orderly shutdown of the reactor shall be initiated and the reactor shall be in the Cold Shutdown Condition within 24 hours.

SURVEILLANCE REQUIREMENTS

4.5 CORE AND CONTAINMENT COOLING SYSTEMS

D. Reactor Core Isolation Cooling (RCIC) System

1. RCIC system testing shall be as follows:

a. Simulated Automatic Actuation Test	Once/ Operating Cycle
b. Pump Operability	When tested as specified in 3.13, verify that the RCIC pump delivers at least 400 GPM at a system head corresponding to a reactor pressure of 1000 psig.
c. Motor Operated Valve Operability	As Specified in 3.13
d. Flow Rate Test at 150 psig.	Once/ ~~operating cycle verify that the RCIC pump delivers at least 400 GPM at a system head corresponding to a reactor pressure of 150 psig.~~

INSERT

Verify that the RCIC pump delivers at least 400 gpm within 24 hours after exceeding 150 psig reactor pressure during any reactor Startup following maintenance that could affect system flow rate performance.

The RCIC pump shall deliver at least 400 GPM for a system head corresponding to a reactor pressure of 1000 to 150 psig.

B 3/4.5 CORE AND CONTAINMENT COOLING SYSTEMS
BASES

SURVEILLANCES

The testing interval for the core and containment cooling systems is based on industry practice, quantitative reliability analysis, judgment and practicality. The core cooling systems have not been designed to be fully testable during operation. For example, in the case of the HPCI, automatic initiation during power operation would result in pumping cold water into the reactor vessel which is not desirable. To increase the availability of the core and containment cooling systems, the components which make up the system; i.e., instrumentation, pumps, valves, etc., are tested frequently. The pumps and motor operated valves are tested in accordance with ASME B&PV Code, Section XI (IWP and IWV, except where specific relief is granted) to assure their operability. The frequency and methods of testing are described in the PNPS IST program. The PNPS IST Program is used to assess the operational readiness of pumps and valves that are safety-related or important to safety. When components are tested and found inoperable the impact on system operability is determined, and corrective action or Limiting Conditions of Operation are initiated.

The surveillance requirements provide adequate assurance that the core and containment cooling systems will be operable when required.

INSERT →

A simulated automatic actuation test once each cycle (SR 4.5.C.1.a) combined with code inservice testing of the pumps (SR 4.5.C.1.b) and valves (4.5.C.1.c) is deemed to be adequate testing of these systems.

SR 4.5.C.1.b verifies that the HPCI pump's developed head at the flow test point is greater than or equal to the required developed head to ensure that HPCI pump performance has not degraded during the cycle. This test confirms one point on the pump curve and is indicative of overall performance.

Flow rate testing (SR 4.5.C.1.d) is conducted during any reactor startup only if maintenance was performed that could affect system operability, or if the quarterly SR (4.5.C.1.b) is not current. The scope of the maintenance or modification performed will determine the extent and scope of post-maintenance testing (PMT). Large scope system overhauls that are intrusive, such as those performed in accordance with the NEIL loss control standards is an example of maintenance that would require an integrated system flow rate test to demonstrate operability following system restoration.

During a reactor Startup sufficient steam flow must be available prior to the HPCI flow rate test to avoid inducing an operational transient when steam is diverted to the HPCI system. For this reason, reactor Startup is allowed prior to performing the required surveillance test. The 24-hour limitation to complete operability testing after exceeding 150 psig reactor pressure allows sufficient time to develop adequate steam flow while also limiting the time available for verifying operability. This is acceptable because the system should be functional prior to testing and the probability is small that an event will occur during that short time period that would require the HPCI system to function.

B 3/4.5 CORE AND CONTAINMENT COOLING SYSTEMS

3/4.5.D. Reactor Core Isolation Cooling (RCIC) System
BASES

BACKGROUND

The RCIC is designed to provide makeup to the nuclear system as part of the planned operation for periods when the normal heat sink is unavailable. The Station Nuclear Safety Operational Analysis, FSAR Appendix G, shows that RCIC also serves as redundant makeup system on total loss of all offsite power in the event that HPCI is unavailable. In all other postulated accidents and transients, the ADS provides redundancy for the HPCI.

SPECIFICATION

The requirement that RCIC be operable when reactor coolant temperature is greater than 365^{o} F is included in Specification 3.5.D.1 to clarify that RCIC need not be operable during certain testing (e.g., reactor vessel hydro testing at high reactor pressure and low reactor coolant temperature). 365^{o} F is approximately equal to the saturation steam temperature at 150 psig.

ACTION

Based on this and judgments on the reliability of the HPCI system, an allowable repair time of 14 days is specified.

SURVEILLANCES

The testing interval for the core and containment cooling systems is based on industry practice, quantitative reliability analysis, judgment and practicality. The core cooling systems have not been designed to be fully testable during operation. To increase the availability of the core and containment cooling systems, the components which make up the system; i.e., instrumentation, pumps, valves, etc., are tested frequently. The pumps and motor operated valves are tested in accordance with ASME B&PV Code, Section XI (IWP and IWV, except where specific relief is granted) to assure their operability. The frequency and methods of testing are described in the PNPS IST program. The PNPS IST Program is used to assess the operational readiness of pumps and valves that are safety-related or important to safety. When components are tested and found inoperable the impact on system operability is determined, and corrective action or Limiting Conditions of Operation are initiated.

The surveillance requirements provide adequate assurance that the core and containment cooling systems will be operable when required. A simulated automatic actuation test once each cycle (SR 4.5.D.1.a) combined with code inservice testing of the pumps (SR 4.5.D.1.b) and valves (4.5.D.1.c) is deemed to be adequate testing of these systems.

INSERT →

SR 4.5.D.1.b verifies that the RCIC pump's developed head at the flow test point is greater than or equal to the required developed head to ensure that RCIC pump performance has not degraded during the cycle. This test confirms one point on the pump curve and is indicative of overall performance.

Flow rate testing (SR 4.5.D.1.d) is conducted during any reactor startup only if maintenance was performed that could affect system operability, or if the quarterly SR (4.5.D.1.b) is not current. The scope

INSERT →

of the maintenance or modification performed will determine the extent and scope of post-maintenance testing (PMT). Large scope system overhauls that are intrusive, such as those performed in accordance with the NEIL loss control standards are examples of maintenance that would require an integrated system flow rate test to demonstrate operability following system restoration.

During a reactor Startup sufficient steam flow must be available prior to the RCIC flow rate test to avoid inducing an operational transient when steam is diverted to the RCIC system. For this reason, reactor Startup is allowed prior to performing the required surveillance test. The 24-hour limitation to complete operability testing after exceeding 150 psig reactor pressure allows sufficient time to develop adequate steam flow while also limiting the time available for verifying operability. This is acceptable because the system should be functional prior to testing and the probability is small that an event will occur during that short time period that would require the RCIC system to function.

Attachment 2 to Letter No. 2.06.025

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	**TYPE (Check one)**		**SCHEDULED COMPLETION DATE (If Required)**
	ONE TIME ACTION	**CONTINUING COMPLIANCE**	
Entergy commits to continue to collect, trend and evaluate turbine vibration data in accordance with the requirements of the PNPS Inservice Code Testing (IST) Program and the PNPS Predictive Maintenance Program, at the frequency specified in the IST program.		x	No later than 90 days from date of approval of license amendment