August 14, 2000

Mr. Mike Bellamy
Site Vice President
Entergy Nuclear Generation Company
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

SUBJECT: PLANT-SPECIFIC SAFETY EVALUATION FOR UNRESOLVED SAFETY ISSUE (USI) A-46 PROGRAM IMPLEMENTATION AT PILGRIM NUCLEAR POWER STATION (TAC NO. M69471)

Dear Mr. Bellamy:

By letter dated February 23, 2000, you provided a final status report of the USI A-46 implementation program. With the information provided in this letter, the staff was able to complete its review of the USI A-46 implementation program for the Pilgrim Nuclear Power Station (Pilgrim). Entergy Nuclear Generation Company's (Entergy/licensee), formerly Boston Edison Company, USI A-46 program at Pilgrim was established in response to Generic Letter (GL) 87-02. The staff has concluded that the licensee's A-46 implementation program has met the purpose and intent of the criteria in "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment," Revision 2 and the staff's Supplemental Safety Evaluation Report No. 2 for the resolution of USI A-46. The staff has determined that the licensee's corrective actions and completed physical modifications for resolution of outliers will result in safety enhancements that are in some respects beyond the original licensing basis. All equipment outliers have been resolved or scheduled for completion by the April 2001 refueling outage. This letter documents the Nuclear Regulatory Commission (NRC) staff's completion of the USI A-46 review at the facility. The staff concludes that the licensee's implementation program resolves USI A-46 at the facility and has adequately addressed the purpose of the requested actions in GL 87-07. Licensee activities related to the USI A-46 implementation are subject to NRC inspection.

This completes the staff's review under TAC No. M69471. If you have any questions, please contact me at 301-415-1445.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR USI A-46 PROGRAM IMPLEMENTATION

AT PILGRIM NUCLEAR POWER STATION

FACILITY OPERATING LICENSE NO. DPR-35

DOCKET NO. 50-293

1.0 BACKGROUND

On February 19, 1987, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46." In the generic letter, the NRC staff set forth the process for resolution of USI A-46, and encouraged the affected nuclear power plant licensees to participate in a generic program to resolve the seismic verification issues associated with USI A-46. As a result, the Seismic Qualification Utility Group (SQUG) developed the "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment," Revision 2 (GIP-2, Reference 1).

On May 22, 1992, the NRC issued Supplement 1 to GL 87-02 including the staff's Supplemental Safety Evaluation Report No. 2 (SSER-2, Reference 2), pursuant to the provisions of 10 CFR 50.54(f), which required that all addressees provide either (1) a commitment to use both the SQUG commitments and the implementation guidance described in GIP-2, as supplemented by the staff's SSER-2, or (2) an alternative method for responding to GL 87-02. The supplement also required that those addressees committing to implement GIP-2 provide an implementation schedule and detailed information on the procedures and criteria used to generate the in-structure response spectra (IRS) to be used for USI A-46. The licensee responded to the GL supplement with a letter dated September 21, 1992 (Reference 3). The staff's review of Reference 3 is contained in a letter from the NRC to the licensee, dated November 18, 1992 (Reference 4).

The licensee submitted its summary report for the resolution of USI A-46 by a letter, dated September 30, 1996 (Reference 5). The staff requested additional information (RAI) on the licensee's implementation program by letters dated December 16, 1997 (Reference 8) and March 24, 1998 (Reference 9). The licensee responded to these requests with letters dated June 15 and June 22, 1998 (References 6 and 7, respectively).

The staff's review of the licensee's June 15, 1998, response, indicated that further additional information and clarification for resolution of certain outliers were required with regard to the use of GIP-2 Method A.1 for the comparison of the seismic demand to the seismic capacity. The staff's concerns were discussed during telephone conference calls between Entergy Nuclear Generation Company (Entergy), and the NRC staff. By letters dated November 8, 1999 (Reference 10), and February 23, 2000 (Reference 18), Entergy provided further

additional information including supplements to the information regarding the use of GIP-2 Method A.1 and the completion schedule for resolution of the remaining USI A-46 outliers at Pilgrim.

This report provides the staff's evaluation of the licensee's USI A-46 implementation program. The evaluation is based on the staff's review of the summary report and of the supplemental information, clarifications, and documentation provided by the licensee in response to the staff's RAI.

2.0 DISCUSSION AND EVALUATION

The summary report (Reference 5) provides the licensee's implementation results for the USI A-46 program at Pilgrim. The report contains the safe shutdown equipment list (SSEL) and documents the screening verification and walkdown of mechanical and electrical equipment and the relay evaluation. The report also (1) documents the evaluation of the seismic adequacy for tanks, heat exchangers, and cable and conduit raceways, (2) identifies outliers, and (3) proposes resolutions including projected schedules.

2.1 Seismic Demand Determination (Ground Spectra and In-Structure Response Spectra)

The ground response spectra (GRS) for the Pilgrim safe shutdown earthquake (SSE) are Housner spectra with a peak ground acceleration of 0.15g as shown in the Pilgrim Updated Final Safety Analysis Report (UFSAR) (Reference 11). The licensee utilized a Taft time history recording of the 1952 Kern County earthquake, scaled to a peak ground acceleration of 0.15g, to develop in-structure response spectra (IRS). In Reference 3, the licensee demonstrated that the GRS developed using the Taft time history envelops the original licensing design basis GRS specified in the Pilgrim UFSAR.

The licensee generated IRS for equipment in the reactor building (RB), turbine building (TB), radwaste building (RADB), diesel building (DB), and intake structure (IS). The Taft time history was applied as the seismic input at the foundation level of the buildings. The method of developing the IRS, presented in Reference 3, was evaluated by NRC staff and found to be acceptable (Reference 4).

2.2 Seismic Evaluation Personnel

A multi-discipline project team conducted the A-46 seismic evaluation of Pilgrim. The team included both licensee and contractor employees. The seismic capability engineers (SCEs) for the walkdown were three engineers from Stevenson and Associates (S&A), and five licensee engineers. Team members are identified in Section 4.3 of Reference 5.

The resumes of the SCEs are provided in Appendix C of Reference 5. These SCEs have completed the "SQUG Walkdown Screening and Seismic Evaluation Training Course." An independent evaluation and peer review of the walkdown process was performed by Dr. John Stevenson of S&A. The resumes of the lead relay reviewers are in Attachment 5 to Reference 13.

The staff finds that the SCE's qualifications satisfy the provisions of GIP-2 and are acceptable for the USI A-46 program evaluation at Pilgrim.

2.3 Safe-Shutdown Path

GL 87-02 specifies that the licensee should be able to bring the plant to and maintain it in a hot shutdown condition during the first 72 hours following an SSE. To meet this provision, in its submittal of September 30, 1996, the licensee addressed the following plant safety functions: reactor reactivity control, pressure control, inventory control, and decay heat removal. Primary and alternate safe shutdown success paths with their support systems and instrumentation were identified for each of these safety functions to ensure that the plant is capable of being brought to and maintained in a hot shutdown condition following an SSE. Figures 1 through 9 in Enclosure A of Reference 12 are used to describe the safe shutdown functions, systems, and paths. Attachment A to Reference 12 provides the SSEL.

The reactor decay heat removal function is accomplished by relieving steam from the reactor to the suppression pool via safety/relief valves (SRVs), reactor core isolation cooling (RCIC) turbine exhaust, or high pressure coolant injection (HPCI) turbine exhaust. During the early stages of the shutdown, the reactor coolant system (RCS) inventory would be controlled by injecting water into the reactor by the HPCI system or RCIC system which takes suction from the condensate storage tank (CST) or the suppression pool if the CST is not available. In the latter stages, the core spray system would be relied on to provide low pressure makeup to the reactor vessel. For long term decay heat removal, the suppression pool cooling (SPC) mode of residual heat removal would be used. In this mode, water is circulated from the suppression pool through the RHR heat exchanger where the heat is transferred to the reactor building closed cooling water (RBCCW) system which in turn transfers heat to the salt service water (SSW) system at the RBCCW heat exchanger. The SSW system transfers heat from the RBCCW heat exchanger to the ultimate heat sink (Cape Cod Bay). When reactor pressure has decreased to less than 75 psig, the shutdown cooling mode of RHR is entered. This mode of RHR removes decay heat directly from the reactor coolant pressure boundary by circulating reactor coolant through the RHR heat exchanger.

The plant operations department reviewed the equipment listed in Attachment A to Reference 12 with respect to the plant operating procedures and operator training and concluded that the plant operating procedures and operator training are adequate to establish and maintain the plant in a safe shutdown condition following an SSE.

The staff concludes that the approach to achieve and maintain safe shutdown during the first 72 hours following a seismic event is acceptable for the USI A-46 resolution at Pilgrim.

2.4 Seismic Screening Verification and Walkdown of Mechanical and Electrical Equipment

The seismic screening and walkdown included the verification of more than 600 equipment items which are typical of those found in the 20 classes of equipment of the SQUG experience database covered in Appendix B of GIP-2 (Reference 1). The tanks and heat exchangers are evaluated in Section 2.5 of this evaluation report.

2.4.1 Equipment Seismic Capacity Compared to Seismic Demand

GIP-2 requires a comparison of the seismic capacity of the equipment in the SSEL to the appropriate seismic demand. The seismic capacity is based on the SQUG earthquake experience database as represented by the bounding spectrum (BS), 1.5 times the BS

(reference spectrum) or the generic seismic testing data as represented by the generic equipment ruggedness spectra (GERS), or it is based on the documented design information for the equipment item. The seismic demand is represented by the plant's SSE GRS and IRS. The IRS may be the conservative design spectra or more realistic less conservative spectra approved by the NRC. The licensee used four methods for the comparison of the seismic capacity to the seismic demand. It used the documented design of the equipment and compared it to the appropriate demand spectra for some equipment items. The licensee also used GIP-2 Method A.1 comparing the SQUG BS to the plant's safe shutdown GRS, Method B.1 comparing 1.5 times the BS to the IRS and Method B.2 in which it compared the GERS to the IRS.

GIP-2 places limitations on the use of Method A.1. These limitations are that the SSE GRS can be used for comparison to the BS when: (1) the equipment is mounted in the nuclear plant at an elevation below about 40-feet above the effective grade, (2) the equipment, including its supports, have a fundamental natural frequency greater than about 8 Hz, and (3) the amplification factor between the free field GRS and the IRS is not more than about 1.5. Methods B.1 and B.2 may be used for equipment at any elevation and for equipment with any natural frequency.

During its review of the summary report for resolution of USI A-46 at Pilgrim (Reference 5) the NRC staff identified locations where Method A.1 had been used to compare the seismic capacity to seismic demand, but where the amplification factor between the free field GRS and the IRS is significantly more than about 1.5. The staff raised a concern about the applicability of the use of Method A.1 at these locations during a telephone conference call between the NRC and the licensee in April 1999. The licensee submitted a response to the concern which the staff found to be too general in nature, and it did not provide specific median-centered estimates for the structures at Pilgrim where Method A.1 was inappropriately used. The licensee was informed of the staff's findings and responded in a letter dated November 8, 1999 (Reference 10).

The locations of concern to the staff are: the RB elevation 23 feet, the TB elevation 37 feet, the radioactive waste building (RWB) elevation 37 feet, and the diesel generator building (DGB) elevation 34.5 feet. In Reference 10, to justify the use of Method A.1, the licensee provided the following information.

The buildings housing SSEL components at Pilgrim are typical of nuclear plant construction. The RB is an embedded, multi-story reinforced concrete shear wall structure up to the operating floor at elevation 117 feet. The foundation consists of an 8-foot thick heavily reinforced concrete mat, founded on undisturbed soil approximately 42 feet above the bedrock elevation. The elevation at the top of the mat is (-)17.5 feet, which is approximately 40 feet below the site grade. The effective grade for A-46 implementation is the foundation elevation, and the highest floor where GIP Method A.1 was used is elevation 23 feet.

The TB is an embedded multi-story braced steel frame structure with interior reinforced concrete shear walls up to the turbine deck. The structure is founded on approximately 10 feet of compacted structural backfill over undisturbed soil. The top of the foundation is elevation 6 feet, which is approximately 16 feet below the site grade. The effective grade for A-46 implementation is the TB foundation elevation, and the highest floor using GIP Method A.1 is elevation 37 feet.

The RWB is an embedded, multi-story reinforced concrete shear wall structure. The structure is founded on compacted backfill over undisturbed soil. The top of the mat is elevation (-)1.0 feet, which is approximately 23 feet below the site grade. The effective grade for A-46 implementation is the foundation elevation, and the highest floor using GIP Method A.1 is elevation 37 feet.

The DGB is a reinforced concrete frame and shear wall structure. The top of the foundation is at plant grade, elevation 23 feet. The highest elevation at which Method A.1 was used is elevation 34.5 feet.

In Reference 16, the licensee provided the estimated conservatism of the Pilgrim IRS, expressed as the ratio of conservative Pilgrim design-basis IRS to realistic median-centered spectra based on generic approximations of the factors that are involved in the development of design IRS. These ratios are RB 3.86, TB 3.86, RWB 3.41, and DGB 2.73.

The licensee also referred to information developed by EQE International, Inc., under the auspices of SQUG, to evaluate the factors of conservatism in the original design basis IRS of nuclear power plants. This EQE International, Inc., report (Reference 17), was submitted to the NRC as part of the R. E. Ginna USI A-46 program to justify the use of Method A.1 at locations where the amplification factor is larger than about 1.5. Reference 17 contains a comparison evaluation of overall margins between median centered analysis and design basis analysis for nuclear power plant structures at other facilities similar in construction, building frequency, and damping to those at Pilgrim. The median-centered spectra and the conservative design spectra for five reinforced concrete buildings at 4 nuclear power plants were presented in Reference 17. The ratios of the conservative design spectra to median-centered spectra were 2.53, 5.3, 3.3, 2.3, and 5.4. The mean of the ratios is 3.77. The NRC staff used this mean value to estimate what the amplification factor would be in the Ginna structures if median-centered spectra were developed for locations in Ginna where Method A.1 was used.

Entergy followed a procedure, similar to the procedure used for Ginna, to estimate building-specific amplification factors where the conservatism of the design IRS was estimated by comparing the design IRS to the median-centered IRS of similar structures. The amplification factors are expressed as the ratio of realistic median-centered IRS to the GRS, for each Pilgrim building, using a factor of conservatism for the RB and TB design IRS, based on the 3.77 mean value calculated by the NRC staff (Reference 17). For the RWB and DGB, Entergy used the factors of conservatism values estimated using the qualitative data submitted in Reference 16 (i.e., RWB: 3.41 and DGB: 2.73). The estimated median-centered IRS were then used to calculate the amplification factors using the IRS to GRS ratio.

The licensee calculated the following building-specific amplification factors using the 5% of critical damping Pilgrim licensing basis spectral acceleration digitized data published in BECo Specification C-114 for each of the associated buildings and for the ground spectrum.

RB - The IRS at elevation 23 feet compared to the GRS shows the maximum amplification is about 2.85 or less above 8 Hz. Dividing this value by 3.77 to obtain the ratio of the estimated realistic median-centered IRS to the GRS results in an amplification factor of 0.76.

TB - The IRS for elevation 37 feet compared to the GRS shows a maximum amplification of about 8.37 at 8 Hz and about 6.65 or less above 9 Hz. Dividing these values by 3.77 to obtain

the ratio of the estimated realistic median-centered IRS to the GRS results in an amplification factor of 2.22 at 8 Hz. and 1.76 or less above 9 Hz.

RWB - The IRS for elevation 37 feet compared to the GRS shows the maximum amplification above 8 Hz is about 5.32 at 14 Hz. Dividing this value by 3.41 to obtain the ratio of the estimated realistic median-centered IRS to the GRS results in an amplification factor of 1.56.

DGB - The IRS for elevation 34.5 feet compared to the GRS shows the maximum amplification above 8 Hz is about 2.42 at 12 Hz. Dividing this value by 2.73 to obtain the ratio of the estimated realistic median-centered IRS to the GRS results in an amplification factor of 0.89. Since the licensee was able to demonstrate that if there were median-centered IRS developed for these structures, the amplification factors or the IRS over the GRS would be not more than about 1.5 for the elevations where GIP-2 Method A.1 was used, the staff considers the use of Method A.1 to be acceptable at those locations to verify the adequacy of SSEL components for USI A-46.

Therefore, the staff concludes that the equipment seismic capacity to seismic demand comparison for Pilgrim is adequate for use in the USI A-46 program.

2.4.2 Assessment of Equipment Caveats

The licensee indicated in Reference 5 that the SCEs verified that the caveats listed in Appendix B of GIP-2 for each equipment class were met. The caveats are the inclusion and exclusion rules, which specify characteristics and features particularly important for seismic adequacy of a specific class of equipment when the equipment seismic capacity is determined using the experience-based data. The phrase “meeting the intent of the caveats” applies to equipment that does not meet the specific wording in certain caveats, but which is deemed to be seismically adequate based on the judgment of the SCE.

The results for equipment whose seismic adequacy was verified by meeting the caveats were documented in Appendix D of Reference 5. In many cases, items of equipment which did not meet the GIP-2 caveats were considered as outliers and were documented in Section 8 of the summary report for USI A-46 resolution. In some cases, if an item of equipment was judged to meet the intent of the caveats, but the specific wording of the caveat rule is not met, then the equipment item was considered to have met the caveat rule, in accordance with GIP-2. Equipment items that met the intent rather than the specific wording of the caveats are listed in Section 5 of Reference 5.

In its response of June 15, 1998, to the staff's RAI dated December 16, 1997, the licensee provided supplemental information for some equipment items to demonstrate how the intent of certain caveats was met rather than the wording. For valves MO3800, MO03801, MO003905, MO03806, and MO03808, whose bodies are made of cast iron, the licensee demonstrated that the stress in the valve body is about 2190 psi, which is less than 10% of the minimum tensile strength (about 40,000 psi) for the yoke material, ASTM A-48, Class 40 cast iron and, therefore, satisfies the 20-percent requirement criterion in GIP-2. The licensee also indicated that if a component did not meet the wording of a caveat, and was not found to be an outlier, the assessment and justification for meeting the intent of a caveat were noted on the screening and evaluation work sheets (SEWS).

The staff finds that the seismic adequacy determination for equipment identified in Section 5 of the summary report conforms with the GIP-2 guidance on the caveats and is acceptable for the resolution of USI A-46 at Pilgrim.

2.4.3 Equipment Anchorage

The licensee stated that the seismic adequacy of equipment anchorages was verified per GIP-2 guidelines. During the walkdowns, the seismic review teams (SRT) inspected the seismic adequacy of the anchorage installation and the connection to the base of the equipment and determined the allowable capacity of anchorage used to secure the equipment. The inspection consisted of visual checks, measurements, reviews of plant documentation and drawings, and anchor bolt tightness and embedment checks for concrete expansion anchors.

The SRT identified as outliers anchorages that (1) did not have enough capacity compared to the demand, and (2) are not covered in the GIP-2 guidelines. Section 8.2 of the summary report (Reference 5) discusses the equipment anchorage outliers identified during the A-46 walkdowns at Pilgrim. Table 9.2 of the summary report (Reference 5) discusses the resolutions for these outliers. The licensee resolved the anchorage outlier issues by tightening anchor bolts, confirming capacity of anchorages and performing detailed calculations.

Table 9.2 of the summary report (Reference 5) also shows a list of unresolved outliers and proposed methods to resolve the outlier issues. In Reference 10, the licensee stated that it plans to resolve unresolved outliers by the end of the next refueling outage (RFO 13) which is scheduled to commence approximately April 2001.

The staff concludes that the licensee's evaluation of the equipment anchorages conforms with GIP-2 guidance and is acceptable for the Pilgrim USI A-46 resolution.

2.4.4 Seismic Spatial Interaction Evaluation

The licensee performed walkdowns in order to verify the seismic adequacy of the mechanical and electrical equipment with respect to spatial interaction with nearby equipment, systems, and structures. The licensee indicated that it performed the walkdowns per GIP-2 guidelines considering the following concerns: (1) proximity effects; (2) structural failure and falling; (3) flexibility of attached lines and cables; and (4) any other possible interactions.

The licensee stated in the summary report (Reference 5) that in general, the SRT found that adjacent items are adequately spaced and overhead items are adequately supported to preclude impacts. However, the licensee identified three outliers caused by potential seismic interactions: (1) smaller than normal size chains were observed supporting overhead lights; (2) a single chain was used to support a high-pressure gas bottle; and (3) insufficient fire extinguisher supports. These interaction outliers are discussed in Section 8.1 of the summary report (Reference 5). Table 9.1 of the summary report provides the equipment descriptions and the proposed resolutions for these interaction outliers. In Reference 10, the licensee stated that it plans to resolve the unresolved outliers by the end of the next refueling outage (RFO 13) which is scheduled to commence approximately April 2001.

The staff finds the spatial interaction evaluation consistent with the provisions of GIP-2 and acceptable for the resolution of USI A-46 at Pilgrim.

2.5 Tanks and Heat Exchangers

The licensee stated that it reviewed the tanks and heat exchangers at Pilgrim in accordance with the rules and procedures described in Section 7 of the GIP-2 guidance. The licensee identified one tank and five heat exchangers as outliers. Among the five heat exchangers, three heat exchangers were declared as outliers because their anchorage capacities were smaller than the demand. The other two heat exchanger were declared to be outliers because GIP-2 Tables 7.1 and 7.6 were not applicable.

The tank was declared to be an outlier because GIP-2 Table 7.6 was not applicable. Table 6.1 of the summary report (Reference 5) shows the tank outlier description and resolution summary. The licensee resolved all tank and heat exchanger outlier issues by performing component specific evaluations. The staff finds the licensee's actions to resolve the tanks and heat exchangers issue conforms with the GIP-2 guidance and is acceptable for the resolution of USI A-46 at Pilgrim.

2.6 Cable and Conduit Raceways

The licensee stated that it had followed the guidelines and inclusion rules provided in Section 8 of the GIP-2 guidance. Based on the walkdown results, the licensee chose 25 worst case samples of raceway supports for limited analytical review (LAR). Of these 25 samples, 17 passed LAR requirements and 8 did not satisfy the vertical capacity LAR guidelines. These latter 8 samples were identified as outliers. The licensee evaluated these further using GIP-2-accepted methods and determined that they do not require any hardware modification. An outlier seismic verification sheet (OSVS) was written to document and track these outliers with the seismic interaction concern.

The licensee identified one conduit in the machine shop area of the RWB as an outlier due to a concern that the conduit may have an interaction hazard with an unanchored hot water tank located on a platform above the conduit. Table 9.2 of the summary report (Reference 5) shows the description of this remaining outlier and proposed methods to resolve the issue. The licensee stated in Reference 10 that it plans to resolve remaining outliers by the end of the next refueling outage (RFO 13) which is scheduled to commence approximately April 2001.

The staff concludes that the licensee's evaluation of the cable and conduit raceways meets the provisions of GIP-2, and is acceptable for the resolution of USI A-46 at Pilgrim.

2.7 Essential Relays

The licensee performed an essential relay walkdown and mounting spot checks in the relay evaluation (Reference 13) for USI A-46 resolution. According to the GIP-2 procedure, the purpose of spot checks is to verify the relay mounting, orientation, model number, load path, possible interaction, and cable slack. Accordingly, the licensee checked essential relays to confirm that they are mounted in accordance with manufacturer recommendations and to identify any abnormal or atypical relay mounting configurations. The licensee visually inspected the mounting bolts to ensure that the relays are well secured, and relay model, manufacturer, and equipment numbers were checked against the designations listed on the electrical schematic drawings. Attachment 4 to Reference 13 provides documentation for the relay

walkdown and mounting spot checks. The licensee indicated that no anomalies were noted during the walkdowns.

The licensee identified 622 essential relays that required capacity versus demand screening. Section 6 of the USI A-46 relay evaluation report (Reference 13) identifies 110 essential relay outliers, of which 11 were due to relay manufacturers and/or model numbers being unknown, 89 were essential relays for which seismic capacity data was unavailable at the time of evaluation, 7 were GE HFA151 essential relays with a seismic demand that exceeds their capacity, and 3 were essential relays for which demand exceeds the GERS. These outliers are documented in Attachments 1 and 2 of the relay evaluation report. The licensee indicated that these relay outliers were resolved either by analysis or by comparison with similar rugged components.

The licensee provided the safety implications of outlier relays in Appendix 3 of the relay evaluation report. Appendix 3 also contains the outlier relay associated equipment, the function of the equipment, the outlier concerns, a basis for why an operability concern does not exist, and the proposed resolution. The licensee indicated in the summary report that it planned to resolve all outliers by the end of RFO 12, which was scheduled for the Spring of 1999. In Reference 10, the licensee stated that all relay work requiring replacement has been completed.

The staff finds the licensee's seismic relay evaluation to be acceptable for the USI A-46 resolution at Pilgrim as it meets the provisions of GIP-2.

2.8 Human Factors Aspect

GIP-2 describes the use of operator action as a means of accomplishing activities required to achieve a safe shutdown. Section 3.2.7 of GIP-2, "Operator Action Permitted," states, in part, that timely operator action is permitted as a means of achieving and maintaining a safe shutdown condition provided procedures are available and the operators are trained in their use. Additionally, Section 3.2.6 of GIP-2, "Single Equipment Failure," states that manual operator action of equipment, which is normally power operated, is permitted as a backup operation provided that sufficient manpower, sufficient time, and the appropriate procedures are available. Section 3.2.8, "Procedures," states, in part, that procedures should be in place for operating the selected equipment for a safe shutdown and operators should be trained in their use. It is not necessary for the licensee to develop new procedures specifically for compliance with the USI A-46 program.

Section 3.7, "Operations Department Review of SSEL," of GIP-2 describes three methods for accomplishing the operations department reviews of the SSEL against the plant operating procedures. Licensees were to decide which method or combination of methods to use for their plant-specific reviews. These methods included:

1. A "desk-top" review of applicable normal and emergency operating procedures.
2. Use of a simulator to model the expected transient.
3. Performing a limited control room and local in-plant walk-down of actions required by plant procedures.

The staff's review focused on verifying that the licensee had used one or more of the GIP-2 methods for conducting the operations department review of the SSEL, and had considered aspects of human performance in determining what operator actions could be used to achieve and maintain a safe shutdown (e.g., resetting relays, manual operation of plant equipment).

The licensee provided information which outlined the use of the desk-top and simulator review methods by the operations department to verify that existing normal, abnormal, and emergency operating procedures are adequate to mitigate the postulated transient and that operators could place and maintain the plant in a safe shutdown condition. The licensee determined that the systems and equipment selected for seismic review in the USI A-46 program are those for which normal, abnormal, and emergency operating procedures are available to bring the plant from a normal operating mode to a cold shutdown condition. The shutdown paths selected were reviewed by the Pilgrim nuclear operations staff who determined that the procedures would provide adequate guidance to the operators in response to a seismic event. However, as a result of this review, the Pilgrim Station Procedure 5.2.1, “Earthquake,” was revised to include additional guidance identifying the seismically qualified success paths, clarify some of the terminology (i.e., rugged, redundant) and identified equipment vulnerabilities, and add active equipment for drywell cooling to the SSEL. The licensee provided assurance that ample time existed for operators to take the required actions to safely shut down the plant. It accomplished this during validation of the pertinent plant operating procedures related to the licensee’s UFSAR, Chapter 15, Accident Analysis for the Loss of Offsite Power (LOOP) transient which preceded the A-46 program review, and through the A-46 simulator exercises.

The staff verified that the licensee had considered its operator training programs and verified that its training was sufficient to ensure that those actions specified in the procedures could be accomplished by the operating crews. The operations department verified that all actions necessary to safely shut down the plant were included in existing normal, abnormal, and emergency operating procedures. The licensee verified that the only additional operator actions, beyond those associated with the LOOP scenarios, which must be performed to bring the plant from a normal operating mode to a cold shutdown condition are those specifically associated with the vibratory motion of the SSE. Operator actions may be required to reset the turbine trip/throttle valve of the RCIC system turbine-driven pump. The specific actions associated with this were reviewed by the operations department, during the relay screening process and simulator exercises, to ensure that the actions could be performed in the required amount of time with normally available resources. The results of the review of these operator actions by the operations department verified that each of the actions was adequately covered by procedural guidance, and that adequate resources, including time available to take such actions, are available.

In addition, the staff requested verification that the licensee had adequately evaluated potential challenges to operators, such as loss of or diminished lighting, harsh environmental conditions, potential for damaged equipment interfering with the operators tasks, and the potential for placing an operator in unfamiliar or inhospitable surroundings. The licensee provided information to substantiate that potential challenges to the operator were explicitly reviewed during validation of the pertinent plant operating procedures related to the licensee’s UFSAR, Chapter 15, Accident Analysis for the LOOP transient which preceded the A-46 program review. In addition, the licensee explicitly evaluated the potential for local failure of architectural features and the potential for adverse spacial interactions in the vicinity of safe shutdown equipment, where local operator action may be required, as part of the GIP-2 process.

As a result of the review, some control room anomalies were observed and corrected. This included securing S-hooks on light panels, securing tie wires on ceiling tee bars, and securing light panel covers. The licensee performed seismic interaction reviews which eliminated any concerns with the plant components and structures located in the immediate vicinity of the components which had to be manipulated. Therefore the potential for physical barriers resulting from equipment or structural earthquake damage which could inhibit operator ability to access plant equipment was considered, and eliminated as a potential barrier to successful operator performance.

The licensee has provided the staff with sufficient information to demonstrate conformance with the provisions of GIP-2 and the human factors review is, therefore, acceptable for resolution of USI A-46 at Pilgrim.

2.9 Outlier Identification and Resolutions

Section 8 of Reference 5 documents the equipment outliers identified during the USI A-46 implementation effort at Pilgrim. The documentation also includes descriptions of the associated defects or inadequacies, the safety implications, and the status of outliers at the time the USI A-46 program implementation submittal was made. Relay outliers are discussed in Section 2.7 of this evaluation report. Section 9 provides a discussion of the proposed resolutions or corrective actions for the unresolved outliers identified in Section 8.

Items of equipment were identified as outliers for three reasons: equipment class caveats, inadequate anchorage, and seismic interactions. One conduit and 182 items of mechanical and electrical equipment outliers were identified during the seismic verification and analytical reviews. The significant outliers associated with anchorages, tanks and heat exchangers, and cable tray and conduit raceway supports are discussed in Sections 2.4.3, 2.5, and 2.6 of this safety evaluation.

Tables 9.1 and 9-2 of the summary report (Reference 5) show the unresolved outliers and a summary of their proposed resolution. In Reference 10, the licensee provides the status of Pilgrim USI A-46 outliers. It shows that a majority of outliers requiring modifications have been completed. The licensee stated that of the 13 remaining equipment modifications, 11 are planned for on-line implementation and 2 require shutdown conditions for implementation. The licensee stated that it plans to complete the modifications by the end of the RFO 13 which is scheduled to commence in approximately April 2001.

In its November 8, 1999, response (Reference 10) to the staff's RAI, the licensee indicated that after revising its application of GIP-2, Method A.1, 19 additional outliers were identified. At Pilgrim, the revised application of Method A.1 would consider the equipment as an outlier if the IRS is greater than 1.5 times the GIP BS for SSEL items located below 40-feet above the grade and with a fundamental natural frequency greater that 8 Hertz. By letter dated February 23, 2000 (Reference 18), the licensee indicated that of these 19 outliers, 14 have been resolved. The remaining five will be resolved by using vendor's qualification data, or performing minor modifications and inspection. The licensee has scheduled to complete resolution of all outliers by the next refueling outage (RFO 13) which is scheduled to commence in approximately April 2001.

The staff concludes that the licensee's outliers resolution is acceptable for resolution of USI A-46 at Pilgrim because they meet the provisions of GIP-2.

3.0 SUMMARY OF STAFF FINDINGS

The staff's review of the licensee's USI A-46 implementation program, as discussed above, did not find any significant or programmatic deviation from GIP-2 regarding the walkdown and the seismic adequacy evaluations at Pilgrim.

4.0 CONCLUSION

In general, the licensee conducted the USI A-46 implementation in accordance with GIP-2. The licensee's A-46 implementation program did not identify any instance where the operability of a particular system or component was called into question. The staff's review of the licensee's implementation program did not reveal any significant findings that would suggest inadequacy of the licensee's A-46 program in light of the GIP-2 guidelines. The staff concludes that the licensee's USI A-46 implementation program has, in general, met the purpose and intent of the criteria in GIP-2 and the staff's SSER No. 2 for the resolution of USI A-46. The staff has determined that the licensee's already-completed actions will result in safety enhancements, in certain aspects, that are beyond the original licensing basis. Accordingly, the licensee's actions provide sufficient basis to close the USI A-46 review at the facility. The staff also concludes that the licensee's implementation program to resolve USI A-46 at the facility has adequately addressed the purpose of the 10 CFR 50.54(f) request. Licensee activities related to the USI A-46 implementation may be subject to NRC inspection.

Regarding future use of GIP-2 in licensed activities, the licensee may revise its licensing basis in accordance with the guidance in Section I.2.3 of the staff's SSER No. 2 on SQUG/GIP-2, (Reference 2) and the staff's letter to SQUG's Chairman, Mr. Neil Smith on June 19, 1998 (Reference 15), upon receipt of the supplement to this evaluation report which confirms receipt of the licensee's completion letter. Where plants have specific commitments in the licensing basis with respect to seismic qualification, these commitments should be carefully considered. The overall cumulative effect of the incorporation of the GIP-2 methodology, considered as a whole, should be assessed in making a determination under 10 CFR 50.59. An overall conclusion that no unreviewed safety question (USQ) is involved is acceptable so long as any changes to the facility as described in the Updated Final Safety Analysis Report have been thoroughly evaluated in reaching the overall conclusion. If the overall cumulative assessment leads a licensee to conclude a USQ is involved, incorporation of the GIP-2 methodology into the licensing basis would require the licensee to seek an amendment under the provisions of 10 CFR 50.90.

5.0 REFERENCES

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2. U.S. NRC "Supplemental Safety Evaluation Report No. 2 on Seismic Qualification Utility Group's Generic Implementation Procedure, Revision 2, corrected February 14, 1992," May 22, 1992.

3. BECo letter to NRC Document Control Desk, “Response to Supplement 1 to Generic Letter 87-02, SQUG Resolution of USI A-46,” dated September 21, 1992.

4. NRC letter to BECo, “Safety Evaluation of Pilgrim Nuclear Power Station (Pilgrim), 120-Day Response to Supplement No. 1 to Generic Letter 87-02" (TAC No. M69471), November 18, 1992.

5. E.T. Boulette (BECo) letter, to NRC, “Generic Letter 87-02, Summary Report for Resolution of USI A-46,” September 30, 1996, and Enclosure B, BECo, "Pilgrim Nuclear Power Station, Seismic Evaluation Report for USI A-46," Revision 0, September 1996.

6. BECo letter to NRC, “Response to NRC’s Request for Additional Information on Pilgrim Station’s USI A-46 Implementation,” June 15, 1998.

7. BECo letter to NRC, “Response to NRC’s Request for Additional Information on Pilgrim Station’s USI A-46 Implementation,” June 22, 1998.

8. A. Wang (NRC) letter to L. J. Olivier (BECo), “Request for Additional Information on the Resolution of USI A-46,” December 16, 1997.

9. A. Wang (NRC) letter to L. J. Olivier (BECo), “Request for Additional Information on the Resolution of USI A-46,” March 24, 1998.

10. Entergy Nuclear Generation Company letter to NRC, “Response to NRC October 13, 1999, RAI Regarding GL 87-02 USI A-46,” November 8, 1999.

11. UFSAR for Pilgrim.

12. “BECo’s Pilgrim Safe Shutdown Equipment List Report for the Resolution of USI A-46," Revision 0, September 1996 (Enclosure A to the Pilgrim Summary Report for USI A-46 Resolution (Reference 5))

13. “BECo’s Pilgrim Relay Evaluation Report for the Resolution of USI A-46," Revision 0, September 1996 (Enclosure C to the Pilgrim summary report for USI A-46 resolution (Reference 5))

14. PERI NP-7148-SL, “Procedure for Evaluating Nuclear Power Plant Relay Seismic Functionality,” December 1990.

15. Letter from Brian W. Sheron to Neil Smith, dated June 19, 1998.

16. Entergy letter to NRC, “USI A-46 Supplementary Information,” dated August 6, 1999.

17. Letter from Robert C. Mecredy (Rochester Gas and Electric Corporation) to Guy Vissing (NRC), “Additional Information on Use of GIP Method A, R. E. Ginna Nuclear Power Plant, dated May 25, 1999.

18. Entergy Nuclear Generation Company letter to NRC, “USI A-46 Revised Method A Outlier Resolution Completion Schedule,” February 23, 2000.

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