July 5, 2000

Mr. James A. Hutton
Director-Licensing, MC 62A-1
PECO Energy Company
Nuclear Group Headquarters
Correspondence Control Desk
P.O. Box No. 195
Wayne, PA 19087-0195

SUBJECT: RESOLUTION OF UNRESOLVED SAFETY ISSUE (USI) A-46, SUPPLEMENT NO. 1 TO GENERIC LETTER 87-02, PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 (TAC NOS. M69469 AND M69470)

Dear Mr. Hutton:

The staff of the U.S. Nuclear Regulatory Commission has completed its review of PECO Energy Company's program to resolve Unreviewed Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants," for the Peach Bottom Atomic Power Station, Units 2 and 3, which was provided in your submittal dated May 7, 1997, as supplemented on September 3, 1997, August 17, 1998, October 6, 1999, and February 28, 2000.

On the basis of our review of the information you provided in your submittals, we have concluded that, when completed by December 31, 2000, your corrective actions and physical modifications for the resolution of outliers will provide sufficient basis to close the USI A-46 review for your facility.

The staff's findings and conclusions are provded in the enclosed safety evaluation. This completes our effort on this issue, and we are, therefore, closing TAC Nos. M69469 and M69470.

Sincerely,

/RA/

Bartholomew C. Buckley, Sr. Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure: Safety Evaluation

cc w/encl: See next page

July 5, 2000

Mr. James A. Hutton
Director-Licensing, MC 62A-1
PECO Energy Company
Nuclear Group Headquarters
Correspondence Control Desk
P.O. Box No. 195
Wayne, PA 19087-0195

SUBJECT: RESOLUTION OF UNRESOLVED SAFETY ISSUE (USI) A-46, SUPPLEMENT NO. 1 TO GENERIC LETTER 87-02, PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 (TAC NOS. M69469 AND M69470)

Dear Mr. Hutton:

The staff of the U.S. Nuclear Regulatory Commission has completed its review of PECO Energy Company's program to resolve Unreviewed Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants," for the Peach Bottom Atomic Power Station, Units 2 and 3, which was provided in your submittal dated May 7, 1997, as supplemented on September 3, 1997, August 17, 1998, October 6, 1999, and February 28, 2000.

On the basis of our review of the information you provided in your submittals, we have concluded that, when completed by December 31, 2000, your corrective actions and physical modifications for the resolution of outliers will provide sufficient basis to close the USI A-46 review for your facility.

The staff's findings and conclusions are provded in the enclosed safety evaluation. This completes our effort on this issue, and we are, therefore, closing TAC Nos. M69469 and M69470.

Sincerely,
/RA/

Bartholomew C. Buckley, Sr. Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278
Enclosure: Safety Evaluation
cc w/encl: See next page
DISTRIBUTION:

PUBLIC	JClifford	EImbro	OGC
PDI-2 Reading File	BBuckley	KManoly	ACRS
EAdensam	RHernan	MO'Brien	MOprendek, RI

DOCUMENT NAME: G:\PDI-2\PeachBottom\LTR69469 - USI A-46.wpd
To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	PDI-2:PM		PDI-2:LA		EMEB:SC		PDI-2:SC	
NAME	BBuckley:cn		MO'Brien		SE dtd 04/13/00		VNerses for JClifford	
DATE	06/ 9/00		06/9/00				07/3/00	

OFFICIAL DOCUMENT COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO USI A-46 PROGRAM IMPLEMENTATION

PECO ENERGY COMPANY

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

1.0 BACKGROUND

In December of 1980, the U.S. Nuclear Regulatory Commission (NRC) designated "Seismic Qualification of Equipment in Operating Plants" as Unresolved Safety Issue (USI) A-46. The safety concern was that equipment in nuclear plants for which construction permit applications had been docketed before about 1972 had not been reviewed according to the 1980-81 licensing criteria for the seismic qualification of equipment (i.e., Regulatory Guide (RG) 1.100 (Reference 1), Institute of Electrical and Electronics Engineers (IEEE) Standard 344-1975 (Reference 2), and Section 3.10 of the Standard Review Plan (NUREG-0800, July 1981) (Reference 3). To address USI A-46, affected utilities formed the Seismic Qualification Utility Group (SQUG) in 1982.

The NRC staff issued Generic Letter (GL) 87-02 (Reference 4) in February 1987 to provide guidance for the resolution of USI A-46. The GL concluded that the seismic adequacy of certain equipment in operating nuclear power plants should be reviewed to seismic criteria not in use when these plants were being constructed. In letters dated April 10 and October 9, 1987, SQUG, representing its member utilities, committed to develop a Generic Implementation Procedure (GIP) for implementing the resolution of USI A-46. SQUG requested a deferment of GL 87-02's 60-day response period until after the issuance of NRC's final safety evaluation report (SER) on the final version of the GIP.

On May 22, 1992, the staff issued Supplement No. 1 to GL 87-02 which transmitted its final SER (SSER No. 2) (Reference 5) on the then final version of the GIP (GIP Revision 2, as corrected on February 14, 1992, or simply GIP-2) (Reference 6). In the supplement to GL 87-02, the staff requested that USI A-46 licensees, who are members of SQUG, to either provide a commitment to use both the SQUG commitments and the implementation guidance described in GIP-2, as supplemented by the staff's SSER No. 2, or else to provide an alternative method for responding to GL 87-02. PECO Energy Company (PECO), the licensee for Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom 2 and 3), and a member of SQUG, provided its response to GL 87-02 in a letter dated September 18, 1992 (Reference 7). This letter outlined its proposed approach and schedule for resolution. The NRC subsequently approved the approach and schedule in a letter dated November 17, 1992 (Reference 8).

By letter dated May 7, 1996 (Reference 9), the licensee submitted a report summarizing the results of its USI A-46 implementation program. In this letter, the licensee stated that it had followed GIP-2 in its entirety, and that no programmatic or significant deviations from the GIP-2 guidance were made during the USI A-46 resolution process at Peach Bottom 2 and 3. The staff reviewed the report and issued a request for additional information (RAI) on June 5, 1997 (Reference 10). The licensee subsequently submitted its response to the RAI in a letter dated September 3, 1997 (Reference 11). The staff reviewed the licensee's response and determined that further information was required from the licensee in order for the staff to complete its review. A second RAI was issued to the licensee on November 9, 1998 (Reference 12), to which the licensee responded on October 6, 1999 (Reference 13).

This report provides the staff's evaluation of the licensee's USI A-46 implementation program based on the staff's review of the summary report and the licensee's responses to the staff's RAIs.

2.0 DISCUSSION AND EVALUATION

The staff's review of the Peach Bottom 2 and 3 USI A-46 seismic evaluation report (Reference 9) consisted of a screening-level review of specific sections of the licensee's program, with emphasis placed on identification and resolution of outliers, i.e., equipment items which did not readily pass the GIP-2 screening and evaluation criteria. The report identifies a safe shutdown equipment list (SSEL) and contains summaries of the screening verification and walkdown of mechanical and electrical equipment. The report also contains relay evaluations and the evaluation of seismic adequacy for tanks and heat exchangers, cable and conduit raceways, the identification and resolution of outliers, and the proposed resolution schedule.

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

The horizontal components of the input time history for the Peach Bottom 2 and 3 seismic design basis is the S69E component of the Taft recording of the July 12, 1952, Kern County California earthquake normalized to the 0.05g peak ground acceleration of the operating basis earthquake (OBE). The safe shutdown earthquake (SSE) input motion was scaled from the OBE using a peak ground acceleration of 0.12g. The vertical components of the OBE and SSE ground motions are 2/3 of the corresponding horizontal components.

The in-structure response spectra (IRS) for the Peach Bottom 2 and 3 structures were developed, using lumped-mass structural models, by performing a time-history modal superposition analysis to calculate the response time histories for the appropriate elevations. The response time histories at these elevations were then used to calculate the IRS. The IRS were peak-spread ±15%. At the time of its review of the licensee's 120-day response, the NRC staff determined that the licensee's IRS are considered to be conservative design spectra.

2.2 Seismic Evaluation Personnel

The screening verification, walkdown, and outlier identification were performed by seismic review teams (SRTs) comprising seismic capability engineers as defined in GIP-2. GIP-2 describes the responsibilities and qualifications of the individuals who implement this generic procedure. For a complete resolution of the USI A-46 issue, the SRTs should include individuals who are capable to identify the safe shutdown equipment, perform the plant

walkdown, verify the seismic adequacy of equipment and cable/conduit raceway systems, and perform the relay screening and evaluation. This involves a number of plant and engineering disciplines including structural, mechanical, electrical, system, earthquake, and plant operations. For the implementation of USI A-46 at Peach Bottom 2 and 3 USI A-46, the SRTs were composed of PECO and VECTRA personnel. Based on the information provided in Attachment A to the seismic evaluation report and Attachment E to the relay evaluation report, of the licensee's May 7, 1996, submittal (Reference 9), the staff finds the qualifications of the individuals responsible for implementing the resolution of USI A-46 meet the criteria of GIP-2 and the staff's SSER No. 2, and are, therefore, acceptable.

2.3 Safe Shutdown Path

GL 87-02 specifies that the licensees 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 May 7, 1996 (Reference 9), the licensee addressed the following plant safety functions: reactor reactivity control, pressure control, inventory control, and decay heat removal. A primary and an alternate safe shutdown success path, 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, for 72 hours following an SSE. Attachment B to the seismic evaluation report (Reference 9) provides the SSEL.

The reactor decay heat removal function is accomplished by relieving steam from the reactor via the lifting of the main steam safety/relief valves (SRVs) at their respective setpoints into the torus. During the early stages, the reactor coolant system inventory is controlled by injecting water into the reactor by the high pressure coolant injection system which takes suction from the torus. Thereafter, the automatic depressurization system SRVs are manually operated by the control room operator to lower reactor pressure so that the low pressure coolant injection (LPCI) mode of the residual heat removal (RHR) system, which takes suction from the torus for reactor coolant inventory control, could be initiated. The decay heat removal is achieved by placing the RHR system in the torus cooling mode of operation. During the torus cooling mode, the RHR takes suction from, and discharges to, the torus via the RHR heat exchangers. Once the reactor has been depressurized below a nominal pressure of 150 psia, the RHR system can be transferred from the torus cooling mode to the alternate shutdown cooling mode. In this mode, water from the torus flows through the RHR heat exchangers to the reactor vessel via the RHR LPCI path. Water is returned to the torus via the SRVs. The high pressure service water (HPSW) system provides the capability to transfer the decay heat from the RHR system to the emergency cooling system or the Conowingo pond.

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

The staff concludes that the licensee's approach to achieve and maintain a safe shutdown of Peach Bottom 2 and 3 for 72 hours following a seismic event is acceptable for the resolution of USI A-46 as it meets the GIP-2 provisions.

2.4 Seismic Screening Verification and Walkdown of Mechanical and Electrical Equipment

The staff's evaluation focused primarily on the licensee's identification and resolution of equipment outliers, i.e., equipment items which do not comply with all of the screening guidelines provided in GIP-2. The GIP-2 screening guidelines are intended to be used as a generic basis for evaluating the seismic adequacy of equipment. If an item of equipment fails to pass these generic screens, it may still be shown to be adequate by additional evaluations.

In Table 4.2.1 of the seismic evaluation report, the licensee provided a list of individual components which were inaccessible during the walkdowns because they are located in contaminated areas, moderate to high radiation areas, or areas which are difficult to access for inspection purposes. The licensee's proposed methods of evaluation include general area walkdowns, similarity to components in the other unit and other components on the SSEL list, and drawings review. In its RAI of June 5, 1997 (Reference 10), the staff requested the licensee's clarification on how the equipment screening and walkdowns could be accomplished based on similarity to other components. In its response of September 3, 1997 (Reference 11), the licensee provided the explanation and guidelines the SRT used to conclude that these inaccessible components were screened out in accordance with the GIP-2 criteria. The staff found the licensee's response to be acceptable for the resolution of USI A-46 at Peach Bottom 2 and 3 since it meets the GIP-2 provisions.

2.4.1 Equipment Seismic Capacity Compared to Seismic Demand

As a first screening guideline, the SRT compared the seismic capacity and seismic demand for the equipment items in the SSEL. PECO determined the seismic capacity of safe shutdown equipment using:

(1) Earthquake experience data with capacity defined by the GIP-2 bounding spectrum (BS).

(2) Generic seismic test data which have been compiled into generic equipment ruggedness spectra (GERS), for motor control centers and low voltage switchgear.

(3) Equipment-specific seismic qualification data, for some of the electrical equipment, in accordance with IEEE Std. 344-1975.

GIP-2 provides five methods for comparing equipment seismic capacity to the seismic demand. Method A.1 compares the SQUG BS to the SSE ground response spectrum (GRS). Method A.2 compares the GERS to 2.25 times the GRS. Method B.1 compares 1.5 times the BS, or the reference spectrum, to the conservative design IRS or to the realistic median-centered IRS. Method B.2 compares the GERS to conservative design SSE IRS. Method B.3 compares the GERS to 1.5 times the median center IRS. Also, the seismic design of equipment may be compared to the seismic demand as represented by the IRS.

The criteria and limitations for use of Method A.1 are: the equipment should be mounted within about 40-feet above the effective plant grade, the equipment's natural frequency should be greater than 8 Hz, and the amplification factor between the free-field GRS and the IRS will not be more than about 1.5. Method B may be used for equipment at any elevation and for equipment with any natural frequency.

In response to NRC's letter of June 5, 1997 (Reference 10), which contained an RAI, the licensee stated that they used Method A.1 for comparison of the seismic demand to capacity for some components (Reference 14). The staff review of the IRS provided in Reference 9 indicated that there are several locations where the IRS exceed 1.5 times the GRS at frequencies above about 8 Hertz and elevations below about 40-feet above effective grade level. The use of Method A.1 under these circumstances is not in accord with the GIP-2 provisions.

In Reference 12, the staff requested that PECO provide a technical justification for the use of GIP-2 Method A.1 where the IRS at elevations less than about 40-feet above grade is greater than 1.5 times the GRS. PECO responded with Reference 13 in which it makes generic and qualitative arguments as to why it was appropriate to use Method A.1 at locations where the amplification factor IRS/GRS is significantly higher than 1.5. The NRC staff reviewed the qualitative assessments provided by PECO and found some of these points germane and took them into account; but some are redundant and some are not relevant to Peach Bottom 2 and 3. The central point of their argument is that the Peach Bottom 2 and 3 design IRS are very conservative and GIP-2 allows the use of median-centered IRS.

In a telephone conference between NRC staff and PECO staff, on February 1, 2000, NRC staff members informed PECO that to resolve the concerns about the use of Method A.1, where the amplification factor is greater than about 1.5, quantitative plant-specific information would be needed. PECO responded with Reference 19. Reference 19 provided the following table which contains information PECO presented about the locations where Method A.1 was used inappropriately (i.e., where the amplification factor is greater than about 1.5).

Location	Component	Freq. (Hz)	Amp. Factor (IRS/GRS)
Diesel Generator Bldg. EL 127 feet	E-W	12	3.16
Diesel Generator Bldg. EL 151 feet	N-S	8	6.07
Diesel Generator Bldg. EL 151 feet	E-W	12	4.81
Circulating Water Pump Structure EL 116 feet	N-S	16	4.04
Circulating Water Pump Structure EL 116 feet	E-W	20	2.57

Also, PECO referred to Attachment 1 of Reference 13 in which it had presented a comparison of the margins between median-centered analyses and design-basis analyses for nuclear power plant structures at other facilities similar in construction to those at Peach Bottom 2 and 3. The median center IRS and the conservative design IRS for five reinforced concrete buildings at four nuclear power plants were obtained for SQUG by its consultant EQE International. The ratios of the conservative design IRS to the median-centered IRS are 2.53, 5.3, 3.3, 2.3, and 5.4. The mean of the above ratios is 3.77. The NRC staff had previously used this mean value to estimate what the amplification factor would have been in the R. E.

Ginna Nuclear Power Plant structures if median-centered spectra were developed for locations in Ginna where Method A.1 was used.

PECO used the procedure which the staff used for Ginna, to estimate building-specific amplification factors for Peach Bottom 2 and 3. The licensee estimated building-specific amplification factors, expressed as the ratio of median-centered IRS to the GRS for the Peach Bottom 2 and 3 buildings applying the 3.77 mean factor of conservatism to the amplifications for the conservative design spectra. This yielded estimates of the amplification factor (IRS/GRS) of about 1.5. The licensee, thus, postulated, that if there were median-centered IRS developed for the structures, the amplification factors for the IRS over the GRS, at frequencies above 8 Hertz, would be about 1.5 for the elevations where the use of GIP-2 Method A.1 was permissible. Based on the above, the staff considers the use of Method A.1 acceptable at those locations to verify the adequacy of SSEL components for USI A-46 at Peach Bottom 2 and 3.

In Reference 10, the staff questioned the validity of the use of spectra peak clipping as proposed in Electric Power Research Institute (EPRI) Report NP-6041-SL (Reference 17). PECO had utilized this method to resolve the relay outliers for host cabinets located in the radwaste/turbine building at the 150-foot elevation. The licensee responded in Reference 11 by stating that it has subsequently performed an evaluation to resolve the relay outliers without the use of the IRS peak clipping method. This is acceptable to the staff since it meets the provisions of GIP-2.

PECO's comparison of the SSEL equipment items' seismic capacity to seismic demand is acceptable for the resolution of USI A-46 at Peach Bottom 2 and 3 since it meets the provisions of GIP-2.

2.4.2 Assessment of Equipment Caveats

The second screening guideline which must be satisfied to verify the seismic adequacy of an item of mechanical or electrical equipment is to confirm that (1) the equipment characteristics are generally similar to the earthquake experience equipment class or the generic seismic testing equipment class, and (2) the equipment meets the intent of the specific caveats for the equipment class. This review is necessary only when BS or GERS is used to represent the seismic capacity of an item of equipment. If equipment-specific seismic qualification data is used instead, then only the specific restrictions applicable to that equipment-specific qualification data need be applied.

As stated previously, an item of equipment should have the same general characteristics as the equipment in the earthquake experience equipment class or the generic seismic testing equipment class. This is to preclude items of equipment with unusual designs and characteristics which do not have demonstrated seismic resistant capability either from actual earthquakes or from seismic qualification testing. A set of inclusion and exclusion rules, defined as "Caveats," were, therefore, established to represent specific characteristics and features particularly important for seismic adequacy of a particular class of equipment. Appendix B of GIP-2 contains a summary of the caveats for the earthquake experience equipment class and for the generic seismic testing equipment class.

Another aspect of verifying the seismic adequacy of equipment included within the scope of this procedure is explained by the "rule of the box." For the equipment included in either the

earthquake or testing equipment class, all of the components mounted on or in this equipment are considered to be part of that equipment and do not have to be evaluated separately.

During the walkdowns, a number of equipment items did not screen based on the GIP-2 caveat criteria. Table 4.2-4 of the seismic evaluation report provides a summary of equipment evaluation categorized according to equipment classes. A number of unscreened items not meeting the caveat were identified. For example, the pump casing and the impeller shaft of HPSW and emergency service water pumps are greater than 20 feet in length, some fluid operated valves and motor-operated valves were identified as outliers due to valve operator eccentricities and/or weights which are outside the GIP-2 experience database. In addition, four sluice gate motor operators are identified as outliers because they have cast iron yokes. Other unscreened items include distribution panels where the depth of panel is less than that which is represented in the earthquake experience database. Resolution of this item is discussed in Section 2.9 of this safety evaluation (SE).

The intent of the caveats should be met when evaluating an item of equipment as they are not fixed, inflexible rules. Engineering judgment is used to determine whether the specific seismic concern addressed by the caveat is met. If an item of equipment meets the intent of the caveats, even though the specific wording of the caveat rule is not met, then that item is judged to have met the caveat. During the walkdowns at Peach Bottom 2 and 3, there were instances where the letter of the caveat was clearly not met. Table 4.2-2 provides a summary of those instances where the intent of the caveat of GIP-2 is met but not the exact wording. The staff has reviewed this information and found that the licensee's interpretations and measures meet the intent of the GIP-2 caveats acceptable for resolution of USI A-46 at Peach Bottom 2 and 3.

2.4.3 Equipment Anchorages

The licensee evaluated the anchor bolts for the Peach Bottom 2 and 3 tanks and heat exchangers, as well as cable tray supports. They were evaluated in accordance with GIP-2, Sections 7 and 8, respectively. The staff reviewed the licensee’s evaluations and found them acceptable since they are consistent with the staff-approved GIP-2 methodology. Further discussions of anchorage for the cable tray and conduit support systems, and tanks and heat exchangers, are provided in Sections 2.5 and 2.6 of this SE, respectively.

2.4.4 Seismic Spatial Interaction Evaluation

The final screening required to verify the seismic adequacy of an item of mechanical or electrical equipment is to ensure that there are no potential adverse seismic spatial interactions with nearby equipment, systems, and structures which could cause the equipment to fail to perform its intended safe shutdown function. The interactions of concern are (1) proximity effects, (2) structural failure and falling, and (3) flexibility of attached lines and cables. Guidelines for judging interaction effects when verifying the seismic adequacy of equipment are presented in Appendix D of GIP-2.

During the plant walkdowns at Peach Bottom 2 and 3, the SRT evaluated credible and significant interaction hazards for all of the SSEL items and documented them on the screening evaluation work sheets (SEWS). Since the original plant design criteria did not specifically address compliance with RG 1.29, the SRT placed additional emphasis during the walkdowns on reviewing spatial interactions to assure that no potential interactions were caused by

permanent plant commodities or structures. The SRT has identified only a few interaction concerns, primarily due to nearby inadequately restrained components or adjacent cabinets not being bolted together. Most of the identified interactions were related to proximity or housekeeping concerns. These are listed as outliers in Table 4.2-4 of the seismic evaluation report.

The licensee stated that no spatial interaction problems were identified for the tanks and heat exchangers. The primary concern for spatial interaction for the cable tray raceway is the impact of the raceway support system with hard objects such as walls, structures or heavy equipment. The SRT recorded deviations from the GIP-2 guideline in the SEWS.

In its response to the staff's second RAI (Reference 13), the licensee discussed how the adequacy of the rod hung supports for the cable trays were qualified with respect to spatial interaction. The licensee quoted the EPRI Report NP-7151-D (Reference 15) as a technical basis for design. The report discussed experience data which indicated that similarly designed supports which experienced high level earthquakes behaved well without damaging any adjacent equipment or itself by impacting walls or other hard objects. Tests performed by industry demonstrate the design adequacy of rod hung supports. The staff finds that the licensee has adequately demonstrated the acceptability of the rod hung cable supports.

The staff concluded that the licensee has followed the provisions of GIP-2 and, as a result, addressed the spatial interaction issue for the resolution of USI A-46 at Peach Bottom 2 and 3.

2.5 Tanks and Heat Exchangers

The licensee stated that there were no flat bottom tanks identified in the SSEL. A total of 53 tanks or heat exchangers were included as part of the SSEL (Table 4.2-4 of the seismic evaluation report). The licensee also stated that the heat exchangers were evaluated according to Section II.7.2 of GIP-2. The heat exchangers in the RHR system which are vertically mounted are not specifically covered by Section II.7 of GIP-2. The licensee declared them outliers. However, the licensee stated that the anchorage capacities for all RHR heat exchangers were reviewed for the SSE and hydrodynamic loads as part of the Peach Bottom 2 and 3 Mark I containment program. In addition, the SRT reviewed these analyses and the resulting modifications and concluded that they are addressed adequately in accordance with GIP-2 criteria. The licensee stated that all 53 tanks and heat exchangers were found to be acceptable by the SRT.

The staff concludes that the evaluation of the tanks and heat exchangers followed the GIP-2 provisions and is, therefore, acceptable for the resolution of USI A-46 at Peach Bottom 2 and 3.

Cable and Conduit Raceways

The licensee stated that the raceway review was performed as specified in GIP-2, Section 8. The review included walkdowns, and limited analytical reviews (LAR) of the selected cable tray supports. Inspections addressed such items as cable fill, support anchorages and raceway spans. Sixteen cable tray supports were selected for LAR and 15 out of 16 were found to be acceptable in accordance with GIP-2. These analyses addressed primarily anchorage of the support for both vertical and lateral earthquake loads. The licensee found that one LAR did not meet the GIP-2 acceptance criteria and it was listed as an outlier.

The licensee stated that trapeze-type and cantilevered supports were abundantly used as cable tray supports. The trapeze supports were typically five-eighths of an inch in diameter threaded rods hung from an embedded unistrut or attached to floor beam members. The licensee discussed the difficulties associated with the accessibility of the cable trays in the cable spreading room. The licensee's evaluation included review of existing plant documents and inspection from the floor and review of original design bases.

The licensee stated that conduit supports at Peach Bottom 2 and 3 are typically constructed of unistrut members. The licensee stated that conduits were well supported and their supports were typically compact and did not support a large number of conduits. At several locations, the licensee noted that some conduits were supported from the HVAC duct support angle with friction clamps which were incorrectly oriented. Some conduits located in the radwaste building, elevation 165', were identified as having interaction concerns with the overhead HVAC system.

The SRT considered these conduits to be outliers. Outliers are listed in Attachment E of Reference 9. (Cable/Conduit Raceway System Area Summary Sheet).

The licensee stated that there is one type of support, a pipe stanchion, that does not meet the lateral load criteria established in GIP-2. The pipe stanchion is typically 7 feet or higher and is attached to a base plate which utilized 4 anchor bolts. This type of support is used to carry cable and conduit across a room or corridor and is, therefore, free standing. Based on the plant-wide walkdown and area-by-area review, all locations where this type of support has been utilized were identified by the SRT. The licensee judged this type of support to be an outlier.

Based on the results of the walkdown and LARs, cable and conduit raceway systems at Peach Bottom 2 and 3 meet the criteria set forth in GIP-2 and will be acceptable for the resolution of USI A-46 at Peach Bottom 2 and 3 upon satisfactory resolution of outliers identified above.

2.7 Essential Relays

As part of the resolution of GL 87-02, it is necessary to perform a relay seismic functionality review. The purpose of this review is to assure that the plant's safe shutdown systems will not be adversely affected by relay malfunction in the event of an SSE. The licensee stated in Reference 9 that there were no significant or programmatic deviations from the GIP-2 criteria.

2.7.1 Scope and Method

The relay screening process begins with a list of electrically operated USI A-46 components from the SSEL, that require relay reviews. This includes both equipment that must change position or start to perform a safe shutdown function, and equipment whose inadvertent actuation due to contact chatter may compromise a safe shutdown function or provide misleading indications in the control room. This list of equipment is a subset of the SSEL and is included as Attachment A to the relay evaluation report.

The associated electrical schematics and/or any other applicable drawings that are required to identify relays associated with the selected electrical component were identified and obtained. The circuit was then reviewed to identify those portions of the circuit which would affect the operation of the component.

The associated contacts for each electrically operated component were evaluated. Contacts in components that are inherently rugged or solid state devices which are considered not to be vulnerable to contact chatter were identified and eliminated from further review. In addition, those relays whose contact chatter would not result in an unacceptable consequence or would not prevent the affected system from carrying out its required function (chatter acceptable) were screened from further review. A determination was also made as to whether operator action was an acceptable way of screening out the relay and, if so, what operator action would be taken. Relays which remained after the above evaluations were classified as "essential" and had their seismic capacity compared to their seismic demand.

For essential relays, the relay manufacturer, type and model number were identified, along with whether the relay contact is normally open or normally closed while de-energized, and whether or not the relay coil is energized. The essential relays/contacts are listed in Attachment B to the relay evaluation report, and the summaries of the seismic capacity evaluations are provided in Attachment C.

2.7.2 Assumptions/Limitations

In accordance with the relay evaluation methodology outlined in GIP-2, the licensee made the following assumptions.

1. Relays/contact devices will be exposed to a 30-second duration earthquake.

2. Relays/contact devices will not be permanently damaged, with the exception of two specific models; the GEIJD (non-IE) and the English Electric YCG, as listed in Appendix E of EPRI NP-7148-SL (Reference 16).

3. "Chatter" is the inadvertent opening or closing of a contact with a sustained output of 2 milliseconds.

4. Relay/contact device failure modes or contact chatter causes inadvertent and undesired equipment actuation, and contact chatter causes failure of equipment to actuate as desired.

2.7.3 Results of Relay Evaluation

The results of the relay evaluation were presented by the licensee in terms of individual contacts where each relay may have several associated contacts.

A total of 6,075 contacts were identified as associated relays for Peach Bottom 2 and 3. Of these, a total of 1,679 contacts were identified as essential relays and are listed in Attachment B to the relay evaluation report.

All essential relays of known make and model and available capacities were evaluated based on generic equipment ruggedness spectrum or test data. The results of these evaluation are included as Attachment C to the relay evaluation report.

Certain relays required further evaluation due to the relay capacity not exceeding demand and/or lack of sufficient information to perform an evaluation. These relays were initially listed

as potential outliers pending resolution by the licensee. A listing and description of outliers is provided in Attachment F on the outlier seismic verification sheets (OSVS). These include the above-mentioned seismically sensitive relays and those with unknown seismic capacities which are addressed in Sections 2.7.4 and 2.9 of this SE. Relays contained in cabinets with potential interaction concerns are not tracked as relay outliers. The cabinets/panels which house these relays are tracked as outliers in the seismic evaluation report. The staff concludes that the relay evaluation was performed in accordance with the provisions of GIP-2, and is, therefore, acceptable for the resolution of USI A-46 at Peach Bottom 2 and 3.

2.7.4 Relay Outlier Resolution

The licensee stated in the relay evaluation report that essential relays identified as not meeting the seismic capacity versus demand screening were further evaluated in accordance with the special exception to the enveloping of seismic demand spectrum per Section 4.2 of GIP-2. This special exception involved scaling down of the IRS developed for the Individual Plant Examination of External Events program, to generate realistic, median-centered, IRS for the resolution of USI A-46 outliers.

All outliers were to be resolved by physical work, analysis and administrative control. The licensee provided in the relay evaluation report a summary status of the relay outlier resolution as follows: 55 relay contacts have been resolved by analyses, 18 by existing operator actions, 20 by evaluation of existing documentation, 16 by a previously (post-walkdown) modification, and 117 relay contacts are to be resolved by relay replacement. In Reference 13, the licensee provided an updated status for the resolution of all relay outliers. Of the total 226 relay outliers identified, 42 have been resolved by analysis, since the 13 relay-contact outliers (Agastat Model ETR14D non-energized relays with the contacts normally open) that were originally resolved by peak clipping have been resolved with the use of existing test data (Reference Section 2.1). In addition, 18 relay contacts have been resolved by existing operator actions, and 33 by evaluation of existing documentation. A review of the 16 relay-contact outliers which were previously reported to be resolved by a previous (post-walkdown) modification indicated that 8 of these contacts required replacement. Among them, the replacement for K2 and K3 relays in panels 0AG13 and 0CG 13 have been completed, while the replacement for K2 and K3 relays in panels 0BG 13 and 0DG 13 are scheduled for completion by December 2000. Finally, the 117 contacts, which were reported to be resolved by relay replacement, are located in a total of 24 GE PVD relays which are classified as low ruggedness relays. The licensee stated in Reference 13 that the outliers will be resolved by December 2000.

The licensee stated that all outliers were reviewed to determine compliance with design documentation and none were found to present a significant risk to the safety of the public. Therefore, the staff finds the above schedule for relay outlier resolution to be acceptable for the implementation of USI A-46 at Peach Bottom 2 and 3.

2.8 Human Factors Aspects

GIP-2 described the use of operator action as a means of accomplishing those activities required to achieve safe shutdown. Section II.3.2.7, "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 II.3.2.6, "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, time, and procedures are available. Section II.3.2.8, "Procedures," states, in part, that procedures should be in place for operating the selected equipment for safe shutdown and operators should be trained in their use. It is not necessary to develop new procedures specifically for compliance with the USI A-46 program.

In Section II.3.7, "Operations Department Review of SSEL," of GIP-2, SQUG also described 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 were to be used 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 walkdown of actions required by plant procedures.

The staff's review focused on verifying that the licensee had used one or more of 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 safe shutdown (e.g., resetting relays, manual operation of plant equipment).

The licensee provided information which outlined the use of the "desk-top" method by the operations department to verify that existing normal, abnormal and emergency operating procedures were 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 Peach Bottom 2 and 3 nuclear operations staff and determined that the procedures would provide adequate guidance to the operators in response to a seismic event. The licensee provided assurance that ample time existed for operators to take the required actions to safely shut down the plant. This had been accomplished during validation of the pertinent plant operating procedures related to the licensee’s Updated Final Safety Analysis Report, Chapter 14, Accident Analysis for the Loss of Offsite Power (LOOP) transient which preceded the A-46 program review. Since these plant procedures and associated operator actions had already been validated to ensure that adequate time and resources are available for operators to respond to a LOOP, it was not necessary to re-validate these procedures for the USI A-46 program.

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. The specific area where operator actions

might be required is during the investigation of potential damage to rotating equipment, diesel fire systems and large tanks.

The specific actions associated with these equipment investigations were reviewed by the operations department 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 accomplish such investigations of equipment were available. The licensee further noted that most of these investigations could be supported by non-operations personnel and would not affect the operators ability to safely shut down the plant.

In addition, the staff requested verification that the licensee had adequately evaluated potential challenges to operators, such as lost or diminished lighting, harsh environmental conditions, the 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 LOOP evaluations and as part of the USI A-46 reviews. In addition, the licensee explicitly evaluated the potential for local failure of architectural features and the potential for adverse spatial 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, a potential control room interaction source was identified associated with non-restrained equipment (e.g., an unsecured locker, aperture card cabinet files and readers, small tables, coat rack, and waste barrels). The licensee stated that these issues have been corrected and procedural controls are currently being implemented to control potential interaction sources. The licensee committed to complete all implementation of procedural controls by December 31, 2000. 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 methodology outlined in GIP-2 and is, therefore, acceptable for resolution of USI A-46 at Peach Bottom 2 and 3.

2.9 Outlier Identification and Resolution

As stated previously, an outlier is defined as an item of equipment which does not meet the GIP-2 screening guidelines. However, an outlier may be shown to be adequate for seismic loadings, by performing an additional evaluation using alternate methods or the seismic qualification techniques currently being used in newer nuclear power plants. During the course of the seismic evaluation, some equipment components were found to not meet the requirements of GIP-2, and were deemed to be outliers. Table 4.2-4 of the seismic evaluation report (Reference 9) provided a summary of the screening and walkdown results for each of the mechanical and electrical outliers. Relay outliers are listed in Attachment F to the relay evaluation report. All outliers are documented on OSVS. In addition, all outliers were reviewed

to determine compliance with design documentation, and when deviations were found the plant procedures were followed to resolve the noted conditions. As the licensee stated in the seismic evaluation report, none of the outliers identified were found to violate the design basis.

In Reference 13, the licensee provided an update of the status of the unscreened components that were identified in Table 4.2-4. A number of remaining unscreened component ID's are identified, and are scheduled for complete resolution by December 31, 2000. The staff has reviewed the updated list provided by the licensee, and found it to be acceptable.
As stated in Section 2.7, there are also a number of relay-contact outliers that remain to be replaced. The licensee has provided an update of the schedule, which indicated that all would be replaced by December 31, 2000. The licensee also has determined that the remaining outliers pose no significant impact on the health and safety of the public, and that there are no outliers that will not be resolved either by analysis or proposed work.

Based on the above schedule and the fact that none of the outliers identified were found to violate the design basis, the staff determined that there will be no operability concern related to the implementation of the Peach Bottom 2 and 3 USI A-46 program.

Programmatic Solutions was contracted to perform the third-party audit of the Peach Bottom 2 and 3 USI A-46 program. The audit report was provided as Attachment B to the seismic evaluation report. The scope of the third-party audit covers all USI A-46 topics that relate to the capacity of the equipment reviewed and the seismic demand that applies to these items. Specifically, the auditor reviewed the Peach Bottom 2 and 3 seismic design bases; including site seismicity, seismic input, seismic design of mechanical and electrical equipment, seismic design of tanks, and seismic spatial interaction issues. The auditor also reviewed the entire scope of the licensee's USI A-46 evaluation, including the development of the SSELs, equipment and relay walkdown and screening, results of screening and the documentation of walkdown, and the results of outlier resolution.

Based on its independent review, the auditor concluded that the methods used for the Peach Bottom 2 and 3 USI A-46 implementation are appropriate, the methods have been correctly implemented, and the results and the recommended actions appear to be reasonable and consistent with those anticipated. This is acceptable to the staff for the resolution of USI A-46 at Peach Bottom 2 and 3.

3.0 SUMMARY OF MAJOR STAFF FINDINGS

Based on the staff's review of the licensee's submittals of May 7, 1996 (Reference 9), September 3, 1997 (Reference 11), and October 6, 1999 (Reference 13), the staff concludes that the licensee's USI A-46 program has, in general, followed the GIP-2 guidelines, and that no programmatic or significant deviations from the guidelines were made during the USI A-46 resolution process at Peach Bottom 2 and 3. In addition, as stated in Section 2.9, the licensee has presented acceptable approaches for resolving the outliers identified in the seismic evaluation report and the relay evaluation report.

The staff determines that upon completion of all the necessary corrective actions for the identified equipment and relays, the licensee's implementation program of USI A-46 will be consistent with the GIP-2 provision and is, therefore, acceptable for resolution of USI A-46 at Peach Bottom 2 and 3.

4.0 CONCLUSION

Based on the information provided by the licensee, the staff has found that the licensee has conducted the USI A-46 implementation in accordance with the guidelines of GIP-2, in verifying the seismic adequacy of mechanical and electrical equipment. The licensee's implementation report did not identify any instance where the operability of a particular component was questionable or any finding of a noncompliance with the licensing basis for the facility. The licensee's implementation of the USI A-46 program resulted in the identification of several outliers that require the licensee's actions. These are described in Section 2.9 of this report. Once these licensee's actions are completed, the Peach Bottom 2 and 3 USI A-46 program will be in general conformance with GIP-2 guidelines.

In general, the staff concludes that the information provided by the licensee in its implementation report and follow-up correspondences, has met the intent of GL 87-02 requested actions. The staff has determined that the licensee's already completed actions and commitments to complete the resolution of remaining outliers will result in safety enhancements, in certain aspects, that are beyond the original licensing basis, and as a result, provide sufficient basis to close the USI A-46 review at the facility. The staff, therefore, concludes that its findings regarding the licensee's implementation of USI A-46 do not warrant any further regulatory action under the provisions of 10 CFR 50.54(f). Licensee activities related to the USI A-46 implementation may be subject to NRC inspection.

Regarding future use of GIP-2 in licensing 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, and the staff's letter to SQUG's Chairman, Mr. Neil Smith, on June 19, 1998 (Reference 18). The primary consideration in the licensee's determination to incorporate GIP-2 in the licensing basis is completing the resolution of outliers not yet resolved by December 31, 2000. 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 unresolved safety question (USQ) is involved is acceptable so long as any changes in specific commitments in the licensing basis have been thoroughly evaluated in reaching the overall conclusion. If the overall cumulative assessment leads a licensee to conclude that 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.

Principal Contributor: A. Lee

Date: July 5, 2000

5.0 REFERENCES

1. Regulatory Guide 1.100, “Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants,” Revision 2, 1987.

2. IEEE Standard 344-1975, “IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations,” dated January 31, 1975.

3. NRC Standard Review Plan (NUREG-0800), Section 3.10, “Seismic and Dynamic Qualification of Mechanical and Electrical Equipment,” Revision 2, July 1981.

4. NRC Generic Letter (GL) 87-02, “Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46,” February 1987.

5. “Supplemental Safety Evaluation Report No. 2 on Seismic Qualification Utility Group’s Generic Implementation Procedure, Revision 2, Corrected February 14, 1992,“ dated May 22, 1992.

6. “Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Power Plant Equipment,” Revision 2, Corrected February 14, 1992, Seismic Qualification Utility Group.

7. Letter, PECO to NRC Document Control Desk, “PBAPS Units 2 & 3 Response to GL 87-02, Supplement 1, Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, USI A-46,” dated September 18, 1992.

8. Letter, NRC to PECO, “Evaluation of PBAPS Units 2 & 3 120 Day Response to Supplement 1 to GL 87-02,” dated November 17, 1992.

9. Letter, PECO to NRC Document Control Desk, “Summary Reports for Resolution of Unresolved Safety Issue A-46,” dated May 7, 1996.

10. Letter, NRC to PECO, “Request for Additional Information,” dated June 5, 1997.

11. Letter, PECO to NRC Document Control Desk, “Response to Request for Additional Information, Resolution of Unresolved Safety Issue A-46,” dated September 3, 1997.

12. Letter, NRC to PECO, “Second Request for Additional Information,” dated November 9, 1998.

13. Letter, PECO to NRC Document Control Desk, “Response to Request for Additional Information Regarding Unresolved Safety Issue (USI) A-46,” dated October 6, 1999.

14. Letter, PECO to NRC Document Control Desk, “Response to Request for Additional Information Regarding Unresolved Safety Issue (USI) A-46," dated December 29, 1998.

15. EPRI Report NP-7151-D, “Cable Tray and Conduit System Seismic Evaluation Guideline,” dated March 1991.

16. EPRI Report NP-7148-SL, “Procedure for Evaluating Nuclear Power Plant Relay Seismic Functionality,” dated December 1990.

17. EPRI Report NP-6041-SL, “A Methodology for Assessment of Nuclear Power Plant Seismic Margin,” Revision 1, dated August 1991.

18. Letter, B. W. Sheron, NRC, to Neil Smith, SQUG, dated June 19, 1998.

19. Letter, PECO to NRC Document Control Desk, “Response to Request for Additional Information Regarding Unresolved Safety Issue (USI) A-46, Seismic Adequacy of Mechanical and Electrical Equipment," dated February 28, 2000.

Peach Bottom Atomic Power Station,
Units 2 and 3

cc:

J. W. Durham, Sr., Esquire
Sr. V.P. & General Counsel
PECO Energy Company
2301 Market Street, S26-1
Philadelphia, PA 19101

PECO Energy Company
ATTN: Mr. J. Doering, Vice President
Peach Bottom Atomic Power Station
1848 Lay Road
Delta, PA 17314

PECO Energy Company
ATTN: Regulatory Engineer, A4-5S
Peach Bottom Atomic Power Station
Chief Engineer
1848 Lay Road
Delta, PA 17314

Resident Inspector
U.S. Nuclear Regulatory Commission
Peach Bottom Atomic Power Station
P.O. Box 399
Delta, PA 17314

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

Mr. Roland Fletcher
Department of Environment
Radiological Health Program
2400 Broening Highway
Baltimore, MD 21224

A. F. Kirby, III
External Operations - Nuclear
Delmarva Power & Light Company
P.O. Box 231
Wilmington, DE 19899

PECO Energy Company
Plant Manager
Peach Bottom Atomic Power Station
1848 Lay Road
Delta, PA 17314

Chief-Division of Nuclear Safety
PA Dept. of
Environmental Resources
P.O. Box 8469
Harrisburg, PA 17105-8469

Board of Supervisors
Peach Bottom Township
R. D. #1
Delta, PA 17314

Public Service Commission of
Maryland
Engineering Division
Chief Engineer
6 St. Paul Center
Baltimore, MD 21202-6806

Mr. Richard McLean
Power Plant and Environmental
Review Division
Department of Natural Resources
B-3, Tawes State Office Building
Annapolis, MD 21401

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

Manager-Financial Control & Co-Owner
Affairs
Public Service electric and Gas
Company
P.O. Box 236
Hancocks Bridge, NJ 08038-0236

Manager-Peach Bottom Licensing
PECO Energy Company
Nuclear Group Headquarters
Correspondence Control Desk
P.O. Box No. 195
Wayne, PA 19087-0195