September 21, 2000

Mr. Guy G. Campbell, Vice President - Nuclear
FirstEnergy Nuclear Operating Company
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 - PLANT-SPECIFIC SAFETY EVALUATION REPORT FOR USI A-46 PROGRAM IMPLEMENTATION (TAC NO. M69441)

Dear Mr. Campbell:

By letter dated August 29, 1995, supplemented December 4, 1996, April 30, 1997, and March 29, 2000, Toledo Edison (now FirstEnergy Nuclear Operating Company (FENOC)), the licensee provided its response to Unresolved Safety Issue (USI) A-46 Program Implementation at Davis-Besse Nuclear Power Station (DBNPS), Unit 1. FENOC provided the Nuclear Regulatory Commission (NRC) staff its summary report, supplemental information, clarification, and documentation in response to the staff's requests for additional information. The walk-down summary report provided the implementation results of the USI A-46 program at DBNPS. It identifies a safe shutdown equipment list (SSEL) and contains a summary of the screening verification and walk-down of mechanical and electrical equipment as well as the relay evaluation. The report also contains the evaluation of seismic adequacy for tanks and heat exchangers, cable and conduit raceways, and outlier identification and resolution including proposed schedules.

The staff has reviewed the information and associated bases provided by FENOC regarding this issue. Our safety evaluation is enclosed.

Sincerely,

Stephen P. Sands, Project Manager, Section 2 ***/RA/***
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-346

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OF USI A-46 PROGRAM IMPLEMENTATION AT

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

DOCKET NO. 50-346

OPERATING LICENSE NO. NPF-3

1.0 BACKGROUND

On February 19, 1987, the 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 GL, 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 as well as detailed information, including the procedures and criteria used to generate the in-structure response spectra (IRS) to be used for Unresolved Safety Issue (USI) A-46.

The following is a chronology of licensee submitted information and staff evaluations and requests for additional information (RAI):

- Letter dated September 17, 1992 (Reference 3), Toledo Edison (now FirstEnergy Nuclear Operating Company (FENOC)), the licensee, provided its response to Supplement 1 to GL 87-02 for the Davis-Besse Nuclear Power Station (DBNPS), Unit 1. In that letter, the licensee committed to follow the SQUG commitments set forth in GIP-2, including clarifications, interpretations, and exceptions identified in SSER-2.

- Letter dated December 8, 1992 (Reference 4), the NRC staff issued its evaluation of the licensee's response.

- Letter dated August 29, 1995 (Reference 5), the licensee submitted a summary

report containing the results of the USI A-46 program implementation at DBNPS.

- Letter dated December 4, 1996, the licensee submitted a revision to the summary report (Reference 6).
- Letter dated April 30, 1997 (Reference 7), the licensee provided its response to the staff's RAI dated December 17, 1996 (Reference 8).
- Letter dated March 29, 2000 (Reference 9), the licensee provided its response to the staff's supplemental RAI, dated November 15, 1999 (Reference 10).

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, supplemental information, clarification and documentation provided by the licensee in response to the staff's requests for additional information.

2.0 DISCUSSION AND EVALUATION

The licensee's walkdown summary report (Reference 5) provides the licensee's implementation results of the USI A-46 program at DBNPS. The report identifies a safe shutdown equipment list (SSEL) and contains a summary of the screening verification and walkdown of mechanical and electrical equipment, as well as the relay evaluation. The report also contained the evaluation of seismic adequacy for tanks and heat exchangers, cable and conduit raceways, and outlier identification and resolution including proposed schedules. In Reference 5, the licensee stated that it had completed the resolution of some outliers and planned to resolve the remaining outliers no later than the end of the twelfth refueling outage (12RFO) beginning March 2000. In a telecommunication dated May 11, 2000, the licensee indicated that all outliers have been resolved as of the 12RFO.

2.1 Seismic Demand Determination

In the summary report (Reference 5), the licensee stated that the peak ground acceleration (PGA) for the SSE at DBNPS is 0.15g. The E-W accelerogram of the Helena, Montana, earthquake of October 31, 1935, was used as a time history to develop the Newmark type ground response spectra (GRS) with a PGA of 0.15g for the horizontal components of ground motion. The vertical component of the SSE ground motion is a Newmark type ground response spectra with a PGA of 0.10g.

The licensee developed three different sets of in-structure response spectra (IRS) for the plant's buildings. They are the original (licensing basis) seismic design IRS, the realistic median-centered IRS and conservative design response IRS. Detailed explanations about each spectrum including the methodology and bases were provided in Reference 7. They are consistent with the methodology within the nuclear industry and based on common engineering practices, and the plant's licensing basis or GIP-2. The licensee stated that seismic capability engineers (SCEs) could select any of the applicable spectra when evaluating seismic demand for the equipment in the USI A-46 program. Appropriate safety factors were used depending on the spectra selected. The seismic demand used for the resolution of USI A-46 at DBNPS is acceptable, since it meets the provisions of GIP-2.

2.2 Seismic Evaluation Personnel

The project seismic review team consisted of Toledo Edison's engineering staff and engineers from EQE International. Independent reviews were provided by Dr. John D. Stevenson from S&A, and Dr. James J. Johnson of EQE International. The resumes of the SCEs and the independent reviewers were provided in Appendix A as well as in Section 10 of Reference 5.

The SSEL items were compiled in accordance with the guidelines of Section 3 "Identification of Safe Shutdown Equipment," and Appendix A, "Procedure for Identification of Safe Shutdown Equipment" of GIP-2. The licensee indicated that the DBNPS plant operations personnel who have a comprehensive understanding of the plant layout and the function and operation of the equipment and systems in the plant have also reviewed the SSEL for compatibility with the approved plant normal and emergency operating procedures (EOP) used for shutdown of the plant and associated operator training.

The staff finds that SCEs' qualifications fully satisfy the provisions of GIP-2. The staff also notes that the "Third Party" reviewers and the SCEs are recognized for their experience in the field of seismic evaluation of structures, systems and components.

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 a safe shutdown earthquake (SSE). To meet this provision, in its submittals of August 29, and December 12, 1995, 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. Appendix C of Reference 5 provides the SSEL.

The reactor decay heat removal function is accomplished by relieving steam from the steam generators (SG) via either the main steam safety valves or atmospheric vent valves. Makeup water to the SGs would be supplied by the auxiliary feedwater system (AFW) which takes suction from the service water system (SWS) since the condensate storage tanks are considered to be unavailable as a result of the seismic event. Upon reaching a reactor coolant system (RCS) temperature of 280 °F, the decay heat removal (DHR) system would be placed in operation.

The decay heat would be removed from the decay heat coolers via the component cooling water system and SWS. Lake Erie is the source of SWS. Other non-seismic water sources that can be used for makeup water to the SGs are the condensate storage tanks, condenser hotwell and the deaerator.

The plant operations department reviewed the equipment listed in Appendix C 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 a SSE.

The staff concludes that the approach to achieve and maintain safe shutdown for 72 hours during a seismic event is acceptable for USI A-46 resolution at DBNPS as it meets the provisions of GIP-2.

2.4 Seismic Screening Verification and Walkdown of Mechanical and Electrical Equipment

The seismic screening of components is documented on screening evaluation work sheets (SEWS) in accordance with the requirements of GIP-2. SEWS are sorted by the 20 classes of equipment covered in GIP-2 and the “other” equipment class not covered in GIP-2. The results are further condensed and summarized on screening verification data sheets (SVDS), sorted by equipment class and presented as Appendix D of the seismic evaluation report, Reference 5.

2.4.1 Equipment Seismic Capacity Compared to Seismic Demand

GIP-2 provides five methods for comparing equipment seismic capacity to the seismic demand. Method A.1 compares the SQUG bounding spectrum (BS) to the SSE GRS. Method A.2 compares the generic equipment ruggedness spectrum (GERS) to 2.25 times GRS. Method B.1 compares 1.5 times the BS (reference spectrum) to the conservative design IRS or to the realistic median-centered IRS. Method B.2 compares GERS to conservative design SSE IRS. Method B.3 compares GERS to 1.5 times the median centered 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 below about 40-feet above the effective plant grade, the equipment’s natural frequency should be greater than 8 Hz, and the amplification factor between 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 the staff’s RAI of December 17, 1996 (Reference 8), about the use of Method A.1, the licensee stated that they have used Method A.1 for comparison of the seismic demand to capacity for some components (Reference 7). Staff review of the SVDS indicated that the SSEL items which were evaluated based on Method A.1 are located in the auxiliary building (AB), the intake structure and the containment building. IRS provided by the licensee indicate that at elevations, where equipment evaluations were based on the Method A.1, the spectra exceed 1.5 times GRS.

In a letter dated November 15, 1999 (Reference 10), to FENOC, the staff indicated 15 elevations in five DBNPS structures where GIP-2, Method A.1, had been used where the amplification factor between the GRS and the IRS are significantly higher than the magnitude of 1.5 allowed by GIP-2. The licensee was requested to provide a technical justification why the use of Method A.1 is acceptable at each of these locations.

By letter dated March 29, 2000 (Reference 9), FENOC provided a response to the RAI on Method A.1. In Reference 9, FENOC stated that as a part of the individual plant examination of external events (IPEEE) program for DBNPS, IRS were developed for each of the structures where USI A-46 SSEL items are located, based on the IPEEE-Review Level Earthquake (RLE) for the site. The RLE GRS is defined for DBNPS as the NUREG/CR-0098 (Reference 11) median (50th percentile) rock spectrum with a PGA of 0.3g. These IPEEE spectra were referred to as realistic median-centered IRS. The licensee states that there are both median and conservative elements in their IPEEE analysis process. Among the conservative aspects FENOC lists the definition of the soil properties, the way in which it developed the structural models, and the method of scaling the IPEEE spectra to obtain the A-46 spectra.

FENOC states that the IPEEE spectra were conservatively scaled to calculate the USI A-46 spectra. The scaling was conducted by determining the maximum ratio between the RLE GRS for IPEEE and the SSE GRS used for USI A-46 over all frequencies. The GRS used for the USI A-46 median-centered spectra development was a NUREG/CR-0098 84th percentile spectral shape with the design-basis SSE peak ground acceleration of 0.15g. The licensee states that the ratio of the IPEEE spectrum to the SSE spectrum varied between 2 and 1.43 over all frequencies. FENOC used the conservative reduction factor of 1.43 to scale all IPEEE spectra in order to generate the A-46 median-centered spectra. The licensee states that this conservative factor alone could represent a factor of conservatism up to 1.4 in these supposedly median-centered spectra. The licensee also states that these resulting scaled IPEEE spectra were labeled as median-centered, because they have some median-centered elements and, because of that, they do not meet the requirements to be considered truly conservative design spectra. FENOC claims that the labeling of these spectra as median-centered was appropriate and necessary since the use of median-centered spectra for USI A-46 purposes requires the use of additional factors of safety as outlined in Table 4-1 of GIP-2. It is the licensee's contention that this labeling of the spectra has indirectly led to the conclusion that the submitted spectra were truly a representation of realistic median-centered response and thus, in apparent conflict with the premise that median-centered response would result in amplification factors of about 1.5 at elevations less than forty feet above grade.

In order to further demonstrate that the USI A-46 spectra used at DBNPS have significant conservatism built in, the license had its consultant, EQE International, Incorporated (EQE), perform additional conservative response analyses on two of the five structures. These two structures were the AB Area 7 and AB Area 8. For these two structures Standard Review Plan (SRP) Section 3.7.1, Seismic Design Parameters, and Section 3.7.2, Seismic System Analysis (Reference 12) type conservative design spectra were generated for the SSE ground motion levels. The licensee states that the SRP conformances include: the use of Regulatory Guide (RG) 1.60 (Reference 13) GRS with a peak ground accelerating of 0.15g, matching of the synthetic time histories to the target spectrum, low strain soil properties are scaled by one-half for the lower bound and 2.0 for the upper bound cases, the envelope of the deconvolved motions from the 3 soil cases must envelope 60 percent of the free field ground surface target spectrum at the foundation level, modal damping values consistent with RG 1.61 (Reference 14), spectral frequency points were chosen to ensure compliance with RG 1.122 (Reference 15), and broadening of the peaks in the resulting spectra by plus and minus 15 percent.

For the AB Areas 7 and 8 these IRS developed using the SRP, at frequencies higher than about 8 Hertz, have amplification factors over GRS from 1.12 to 2.68. The licensee states that the 1.5 amplification factor referred to in GIP-2 as a limitation on the use of Method A.1 is meant to be the ratio of realistic median-centered IRS to GRS and that all IRS developed for DBNPS are considered to be conservative. FENOC states it is possible to estimate what realistic median-centered IRS would be using the procedure that was applied to reinforced concrete shear wall structures at the Ginna nuclear plant as discussed in Reference 16.

References 9 and 17 present information developed by SQUG comparing overall margins between median-centered analysis and design-basis analysis for five reinforced concrete shear wall structures at four nuclear power plants. The ratios of the conservative design spectra to median-centered spectra presented in Reference 11 were 2.53, 5.3, 3.3, 2.3 and 5.4. In Reference 16, the NRC staff considered the wide range of ratios to be due to the different methods and levels of conservatism used in the analyses of the structures rather than differences between structural configurations. The staff then used the mean value of the ratio 3.77, to estimate the amplification factor for the Ginna structures. The licensee states that the five structures at DBNPS are all concrete shear wall structures and are similar from a structural response perspective to those in References 9 and 17 and the mean of the ratios which was used in Reference 16 is also appropriate for use at DBNPS. Following this procedure, the estimates of the realistic median centered IRS, for locations where GIP-2 Method A.1 was used in the AB Areas 7 and 8, have amplification factors over the GRS of less than 1.5.

The licensee states that the analyses of these two buildings (AB Areas 7 and 8) were extensive and rather than conduct additional response analyses for the remaining three buildings (AB Area 6, Containment Internal Structure, and Intake Structure) FENOC chose an alternative method. FENOC used the data obtained from the two structures with SRP consistent IRS to estimate, via a scaling process using the ratios of SRP IRS to the conservative design IRS, and then used these to estimate what the maximum amplitudes of the IRS from an SRP analysis of the three other buildings would be, if an SRP analysis of them had been performed. FENOC states that the reduction in the IRS-to-GRS peak ratio for AB Areas 7 and 8 varies from about 1.4 to 2.5 with an average value of 1.9. The licensee used this average reduction value of 1.9, to estimate SRP IRS-to-GRS using the existing original design IRS-to-GRS ratios for the remaining three buildings: Reference 9 contains the estimated values of the building amplification factors for the AB Area 6, the Containment Internal Structure and the Intake Structure. These factors range up to a value of 1.19, which is well below the target of 1.5 for using Method A.

The spectra which were originally identified as being median-centered are, in fact, not truly median-centered from the USI A-46 Method A perspective. Thus, it would not be appropriate to expect these spectra to fall within the 1.5 amplification factor range due to conservatism in these spectra. SRP-type spectra were generated for two of the DBNPS structures and estimated for the three remaining structures. When scaled down by the factor of 3.77 (factor to estimate a median response from a conservative response) all the DBNPS structure estimates of the median-center IRS have amplification factors below 1.5 at frequencies above 8 Hertz at the locations where Method A.1 was used. The staff concludes that the procedures used by FENOC to define seismic capacities and demands to assure that seismic capacities are greater than their demands are consistent with the provisions of GIP-2 and therefore, adequate for the resolution of USI A-46 at DBNPS.

2.4.2 Assessment of Equipment "Caveats"

In order to apply the experience-based approach and use the equipment seismic capacity defined in GIP-2, the plant-specific equipment must meet some restrictions or caveats described in GIP-2. The licensee indicated in Reference 5, that the SCEs verified that the caveats listed in Appendix B of the GIP-2 for each equipment class were met for DBNPS. Caveats are the inclusion and exclusion rules, which represent specific characteristics and features particularly important for seismic adequacy of a specific class of equipment when the equipment seismic capacity is determined based on the experience-based data. The use of "meeting the intent of the caveats" is typically intended to demonstrate seismic adequacy of equipment that did not meet the specific wording in certain caveats, but is deemed seismically adequate based on the judgement of the SCE.

The applicable caveats and the results of the licensee's evaluations for conformance with the caveats were documented in SEWS and SVDS (Appendix D of Reference 5). In many cases, the licensee considered equipment which does not meet the GIP-2 caveats to be outliers, and they were documented in the outlier seismic verification sheet (OSVS) of the summary report. 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. The licensee summarized equipment items that met the intent rather than the specific wording of the caveats in Table 5.1 of the seismic evaluation report of Reference 5.

In its response of April 30, 1997 (Reference 7), to the staff's RAI, dated December 17, 1996 (Reference 8), the licensee provided supplemental information for some equipment items, to demonstrate how the intent of certain caveats was met rather than the wording. For instance, in Table 5-1 of Reference 5, the licensee stated that temperature indicating controllers (TIC), TIC 5443 and 5444, are anchored to block walls and that those anchors were judged to be acceptable due to low loads. However, GIP-2 does not provide the capacity for anchors installed in block walls. It was unclear to the staff how the licensee determined these anchorage capacities. The licensee was requested to describe how the anchorage capacities were determined and provide a comparison of the anchorage capacity with the seismic demand. In response to the staff's concern, the licensee stated that TIC 5443 and 5444 are each attached to the block wall using four ½-inch diameter anchors. The panels weigh approximately 125 pounds each and were judged to be rigid based on the small size, type of construction, and weight. The block wall is a 12-inch thick grouted concrete block wall and per DBNPS design criteria, ½-inch anchors have an allowable tension capacity of 450 pounds and an allowable shear capacity of 450 pounds when installed in this type of block wall.

Engineering judgement was originally used to evaluate the adequacy of the anchorage due to low loads and low seismic acceleration values. The licensee's recent evaluation indicated that the loads during a seismic event on the anchor bolts are 30 pounds/bolt tension and 36 pounds/bolt shear and that they are well below the seismic anchorage capacities. This confirmed the licensee's original engineering judgement that the anchorage is acceptable. In addition, the licensee stated that the anchorages for TIC 5443 and 5444 were successfully tug tested during the walkdown. The staff concurs with the licensee's assessment.

In Table 3.1 of Reference 5, the licensee indicated that pumps/motors K3-1, K3-2, P14-1, and P14-2 are installed with 1½-inch expansion anchors. Since GIP-2 only provides anchor allowables up to 1-inch diameter, the 1-inch anchor allowables were used in the licensee's analyses. The staff requested the licensee to confirm that the analyses were found to be acceptable. In response to the staff's concern, the licensee stated that the calculated shear load on these anchors is 313 pounds per anchor. The licensee also indicated that there is no tension on these anchors as a result of a seismic event since the dead weight of the skid and equipment counteracts the overturning moment due to a seismic event. The vendor catalog indicates that the allowable shear values are 14500 pounds and 8271 pounds for 1½-inch diameter anchors and 1-inch diameter anchors respectively. GIP-2 provides its own allowable values based on generic grouping of anchor bolt types and indicates a 1-inch anchor has a shear capacity of 9530 pounds. Since the calculated shear load is well within the allowable shear value for the anchors, the licensee determined that the equipment is adequately anchored. The staff concurs with the licensee's assessment.

The staff finds that the seismic adequacy determination for equipment identified in Section 5.2 of the DBNPS summary report conforms with the GIP-2 guidance on the caveats, and is acceptable in the instances where the intent rather than the wording of the caveats was met.

2.4.3 Equipment Anchorage

GIP-2 specifies the following four steps in regard to equipment anchorage verification: (1) anchorage installation inspection, (2) anchorage capacity determination, (3) seismic demand determination, and (4) comparison between capacity and demand.

In Section 5.1.3 of Reference 5, the licensee discussed the different types of equipment anchorage used at DBNPS. The licensee indicated that expansion anchors (both stud and shell types), cast-in place J bolts, thru bolts, as well as embedded channels were used. The licensee also indicated that equipment anchorage evaluation were performed per the requirements of GIP-2. The appropriate anchorage capacity reduction factors were used in determining the anchorage capacity. Expansion anchors were also checked for tightness. In accordance with GIP-2 anchorage installation inspection requirements, during the walkdown process, the licensee identified attributes relating to equipment characteristics, type of anchorage, size and location of anchorage, installation adequacy, embedment length, gaps, spacing, and edge distance on the SEWS. The licensee stated that those items of equipment whose anchors did not meet the GIP-2 screening criteria were identified as outliers. Table 5-2 of Reference 5, lists all the anchorage outliers including the outliers description and the resolution summary. As previously discussed in Section 2.0 of this Safety Evaluation Report (SER), the licensee has completed the resolution of all the outliers as of 12RFO.

The staff finds that the licensee has followed the GIP-2 provision for verifying equipment anchorage adequacy. Therefore, the equipment anchorage evaluation is considered acceptable for the resolution of USI A-46 at DBNPS.

2.4.4 Seismic Spatial Interaction Evaluation

The licensee's seismic walkdowns included evaluation for potential seismic interaction concerns. The licensee stated that the evaluation was performed in accordance with the GIP-2 provisions in Section II.4.5 and Appendix D. The interactions of concern are 1) proximity effects, 2) structural failure and falling, and 3) flexibility of attached lines and cables, and 4) any other possible interactions with SSEL items. The SCEs evaluated the possible seismic spatial interactions for all the safe shutdown components and documented them on the SEWS. Several seismic interaction concerns including some housekeeping issues were identified during the walkdown and were identified as outliers in Table 5.5 of the seismic evaluation report of Reference 5. As previously discussed in this SER, the licensee has completed the resolution of all the outliers as of 12RFO.

The staff finds that the spatial interaction evaluation performed by the licensee meets the GIP-2 provisions and is appropriate for the resolution of USI A-46 at DBNPS.

2.5 Tanks and Heat Exchanger

The licensee stated that the tanks and heat exchangers at DBNPS were evaluated in accordance with Section II.7 of GIP-2. A total of 19 tanks and heat exchangers were evaluated: eight horizontal tanks, three vertical tanks, and eight heat exchangers. Twelve outliers were identified in Tables 6.1 and 6.2 of the summary report (Reference 5). Table 6-1 contains anchorage outliers, descriptions, and resolutions, and Table 6-2 contains interaction outliers, descriptions, and resolutions. Review of the descriptions indicated that the majority of the outliers were anchor bolts. Resolutions of the anchorage outliers were based on reevaluation of loadings and recalculation of anchor capacity. For interaction outliers, lateral supports were provided for instrument lines so that the lines do not impact with adjacent platforms in case of an earthquake. The staff found that the evaluation and resolution of the Davis-Besse tanks and heat exchangers are acceptable for resolution of USI A-46 since the evaluations followed approved GIP-2 provisions and were based on commonly used engineering practices.

2.6 Cable and Conduit Raceways

The summary report (Reference 5) stated that conduits are the main routing method for cables at DBNPS, with sizing varying up to and including 4-inch nominal diameter rigid steel. Cable trays, when used, are predominately based on 24-inch ladder type supports. The cable and conduit raceway systems consist primarily of light steel strut frame construction. Cable trays and conduits are attached to the supports using standard tray and conduit clamps. The supports are attached to the structure using expansion anchors, or are welded to structural steel and embedments.

The licensee stated that the raceway review was performed as specified in GIP-2 Section II.8. The licensee, using the provisions of the Section II.8 of GIP-2 checked the raceway system for compliance with the inclusion rule. The licensee's evaluation included a walkdown, a limited analytical review (LAR) of the representative worst-case raceway as well as examination of seismic spacial interaction with adjacent equipment and structures. The LAR, as well as inspections during the walkdown by the licensee, addressed anchorage of the raceway system extensively.

A total of 26 cable supports were selected for the LAR. The licensee found several outliers. Table 7.2 provides a list of the outliers and the corresponding resolutions. The staff reviewed the LAR and found it to be acceptable. A total of 31 outliers were identified during the cable and conduit raceway walkdown. Outliers were mainly minor in nature and the staff found that the licensee's resolutions were satisfactory since the licensee followed the GIP-2 guidelines properly for raceway system evaluations including the identification and resolution of the outliers. As indicated in Section 2.0 of this SER, the licensee has resolved all the outliers as of 12RFO.

2.7 Seismic Adequacy of Essential Relays

The purpose for the review of the seismic adequacy of essential relays is to determine if the plant's safe shutdown systems could be adversely affected by relay malfunction in the event of an SSE. The licensee stated that its relay evaluations were performed in accordance with the procedure outlined in GIP-2 and in EPRI NP-7148-SL. The licensee also stated that relays with low ruggedness that are similar to those identified in Table 6.2 of EPRI NP-7148-SL, were classified as outliers. These included relays for which the demand exceeds capacity and relays for which the seismic capacity is unavailable for comparison to demand. Relays for which chatter did not affect system performance and for which chatter would affect system performance, but for which operator actions would mitigate the relay chatter impact, were classified as "chatter acceptable."

In Table 4-1 of the relay evaluation report of Reference 5, the licensee listed the SSEL equipment items requiring a relay review for DBNPS. In Section 5 of the same report, the licensee provided the results of its relay evaluation. As a result of the licensee's relay evaluation, approximately 7 percent of the DBNPS relays were identified as outliers. These relay outliers were listed in Section 2.2 of Reference 5. Section 2.2 also includes a description of the proposed resolutions including some plant modifications. As previously discussed in this SER, the licensee has resolved all the outliers as of 12RFO.

The staff finds the licensee's seismic relay evaluation and planned corrective actions to be appropriate for the resolution of USI A-46 at DBNPS, since they meet the provisions of GIP-2.

2.8 Human Factors Aspect

The licensee provided information which outlined the use of both the "desk-top" review and simulator methods by the plant 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 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. During development of the shutdown paths for this program, the licensee reviewed existing procedures and found them adequate to address the shutdown requirements of this program. The licensee's approach primarily involves the use of three procedures, the symptom-based EOP, "RPS, SFAS, SFRCS Trip or SG Tube Rupture," the event-based emergency plan off-normal procedure, "Earthquake," and the normal operating

procedure, “Plant Shutdown and Cooldown,” to stabilize the plant, determine the existing conditions of structures, systems, and components, and bring the plant into a safe shutdown condition.

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, 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 regarding their evaluations to substantiate that operator actions could be accomplished in a time frame required to mitigate the transient. Specifically, the licensee provided assurance that ample time existed for operators to take the required actions to safely shut down the plant, based on the review of specific manual operator actions which must be taken both in the control room and locally in the plant. The licensee verified that existing procedures, availability of lighting equipment, and operator training were adequate to ensure that the operators could perform the required actions credited in the submittal. The licensee stated that either hand held or emergency lighting were available in the areas of the plant where local operator actions were required and that none of the equipment on the SSEL were located in areas unfamiliar to the operators. The licensee verified that all the required actions are located in structures which have been seismically analyzed for the safe shutdown earthquake and as a result no major in-plant barriers would be expected in the areas or in the routes to where local operator actions would be required. 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 would have 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 by the licensee, 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 SQUG’s GIP-2 and the human factors aspect is, therefore, acceptable.

2.9 Outlier Identification and Resolutions

The licensee identified equipment and relay outliers resulting from the A-46 implementation effort in the summary report. A detailed description of each equipment outlier was provided in Tables 5-5 through 5-6 of Section 5.3 of the seismic evaluation report of Reference 5. A detailed description of each relay outlier was provided in Section 2.2 of the relay evaluation report of Reference 5. Table 7.2 provided a description of each cable and conduit raceway outlier and its corresponding resolution. The majority of the equipment outliers are related to seismic spatial interaction issues while the relay outliers included the seismically sensitive relays and relays with unknown makes and models or with unknown seismic capacities. The outlier documentation included identification of the affected component, the description of the associated defects or inadequacies, and the proposed method of outlier resolution (e.g., modification, replacement, testing, or analysis). As previously discussed in this SER, the licensee has resolved all the outliers as of 12RFO. In Reference 7, the licensee also stated that all outliers were reviewed to determine compliance with DBNPS seismic licensing/design criteria. All were found to be in compliance and therefore, none were judged to present a significant impact on the health and safety of the public.

Based on a review of the above information, the staff determined that the licensee's proposed actions for resolution of outliers are reasonable and acceptable.

3.0 SUMMARY OF STAFF FINDINGS

The staff's review of the licensee's USI A-46 implementation program, as provided for in each area discussed above, did not identify any significant or programmatic deviation from the GIP-2 methodology regarding the walkdown and the seismic adequacy evaluations at DBNPS. As stated in Section 2.9, numerous equipment including equipment containing relays were classified as outliers. The licensee indicated that it has completed the resolution of all the outliers as of 12RFO.

4.0 CONCLUSION

In general, the licensee conducted the USI A-46 implementation in accordance with GIP-2. The licensee's implementation program did not identify any instance where the operability of a particular system or component was questionable. 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, in general, met the purpose and the 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 which, in certain aspects, are beyond the original licensing basis. As a result, 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 licensing activities, the licensee may revise its licensing basis in accordance with the guidance in Section 1.2.3 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. 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 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

1. "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Power Plant Equipment," Revision 2, corrected February 14, 1992, Seismic Qualification Utility Group.

2. “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.

3. Letter, Toledo Edison to NRC Document Control Desk, “Response to Supplement 1 to Generic Letter 87-02, SQUG Resolution of USI A-46,” dated September 22, 1992.

4. Letter, NRC to Toledo Edison “Evaluation of the Davis-Besse Nuclear Power Station, Unit 1, 120-Day Response to Supplement No. 1 to Generic Letter 87-02,” dated December 8, 1992.

5. Letter, Toledo Edison to NRC Document Control Desk, “Generic Letter 87-02, USI A-46 Walkdown Summary Report for Davis-Besse Nuclear Power Station, Unit 1,” dated August 29, 1995.

6. Letter, Toledo Edison to NRC Document Control Desk, “Revised Forms for Inclusion into Summary Report for Resolution of USI A-46 at Davis-Besse Nuclear Power Station, Unit 1," dated December 4, 1996.

7. Letter, Toledo Edison to NRC Document Control Desk, “Response to Request for Additional Information on the Resolution of Unresolved Safety Issue A-46 at Davis-Besse Nuclear Power Station, Unit 1,” dated April 30, 1997.

8. Letter, NRC to Toledo Edison, “Request for Additional Information on the Resolution of Unresolved Safety Issue A-46, Davis-Besse Nuclear Power Station, Unit 1,” dated December 17, 1996.

9. Letter, Guy G. Campbell (FirstEnergy Nuclear Operating Company) to United States Nuclear Regulatory Commission, “Request for Additional Information on the Resolution of Unresolved Safety Issue (USI) A-46 - Davis-Besse Nuclear Power Station, Unit 1, (TAC No. M69441),” dated March 29, 2000.

10. Letter, Stewart N. Bailey (NRC) to Guy G. Campbell (FirstEnergy Nuclear Operating Company), “Request for Additional Information on the Resolution of Unresolved Safety Issue (USI) A-46 - Davis-Besse Nuclear Power Station, Unit 1, (TAC No. M69441),” dated November 15, 1999.

11. Newmark, N. M. and W. J. Hall, “Development of Criteria for Seismic Review of Selected Nuclear Power Plants, NUREG/CR-0098, May 1978.

12. United States Nuclear Regulatory Commission, Standard Review Plan, NUREG-0800, August 1989.

13. United States Nuclear Regulatory Commission, Regulatory Guide 1.60, “Design Response Spectra for Seismic Design of Nuclear Power Plants,” December 1973.

14. United States Nuclear Regulatory Commission, Regulatory Guide 1.61, “Damping Values for Seismic Design of Nuclear Power Plants,” October 1973.

15. United States Nuclear Regulatory Commission, Regulatory Guide 1.122, Development of Floor Design Response Spectra for Seismic Design of Floor Supported Equipment or Components, Rev. 1, February 1978.

16. Letter, USNRC to RG&E, “Plant Specific Safety Evaluation of USI A-46 Program Implementation at the R. E. Ginna Nuclear Power Plant," Docket No. 50-244, dated July 17, 1999.

17. Letter, RG&E to USNRC, "Additional Information on Use of GIP Method A, R. E. Ginna Nuclear Power Plant," Docket No. 50-244, dated May 25, 1999.

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