February 23, 2000

Mr. Oliver D. Kingsley, President
Nuclear Generation Group
Commonwealth Edison Company
Executive Towers West III
1400 Opus Place, Suite 500
Downers Grove, IL 60515

SUBJECT: DRESDEN - PLANT-SPECIFIC SAFETY EVALUATION FOR USI A-46 PROGRAM IMPLEMENTATION (TAC NOS. M69442 AND M69443)

Dear Mr. Kingsley:

Enclosed is the staff's safety evaluation (SE) of the Unresolved Safety Issue (USI) A-46 implementation program at the Dresden Nuclear Power Station, Units 2 and 3.

The Commonwealth Edison Company (ComEd, the licensee) USI A-46 program at Dresden was established in response to Generic Letter (GL) 87-02 through a 10 CFR 50.54(f) letter. The staff concludes that the licensee's USI A-46 implementation program has, in general, met the purpose and intent of the criteria in Generic Implementation Procedure (GIP-2) and the staff's Supplemental Safety Evaluation Report No. 2 for the resolution of USI A-46. The staff has determined that the licensee's planned corrective actions and completed physical modifications for resolution of outliers will result in safety enhancements which, in certain aspects, 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 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 are subject to NRC inspection.

This completes the staff review of the USI A-46 program for Dresden and closes TAC Nos. M69442 and M69443.

Sincerely,

/RA/

Lawrence W. Rossbach, Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RESPONSE TO SUPPLEMENT NO. 1

GENERIC LETTER 87-02

COMMONWEALTH EDISON COMPANY

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-237 AND 50-249

1.0 BACKGROUND

In December 1980, the NRC designated "Seismic Qualification of Equipment in Operating Plants" as Unresolved Safety Issue (USI) A-46. The safety issue of concern was that equipment in nuclear plants for which construction permit applications had been docketed in approximately 1972 had not been reviewed according to the 1980-81 licensing criteria for the seismic qualification of equipment, such as Regulatory Guide 1.100 (Reference 1), 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, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors," in February 1987 (Reference 4) to provide guidance for the resolution to USI A-46. The staff concluded that the seismic adequacy of certain equipment in operating nuclear power plants should be reviewed against seismic criteria not in use when these plants were being constructed. In 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 the 60-day response, as requested in GL 87-02, until after the NRC issued its final safety evaluation report (SER) on the final version of the GIP. In 1992, SQUG developed the "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment," Revision 2 (GIP-2, Reference 5).

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 6), 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 the USI A-46 program.

By letters dated September 21, 1992 (Reference 7), January 15, 1993 (Reference 8), and March 9, 1993 (Reference 9), Commonwealth Edison Company (ComEd), the licensee for Dresden Nuclear Power Station, Units 2 & 3 (DNPS) and a member of SQUG, responded to Supplement 1 of GL 87-02. The response included a commitment to implement GIP-2, including the clarifications, interpretations, and exceptions identified in SSER-2, and a clarification and identification of procedures used in generation of the IRS. The staff's evaluation of DNPS response was issued in letters dated November 20, 1992 (Reference 10), and June 7, 1993 (Reference 11).

By letter dated June 28, 1996 (Reference 12), the licensee submitted the report summarizing the results of its USI A-46 implementation program at DNPS which includes a seismic evaluation report and a relay evaluation report. The staff reviewed the summary report and issued a request for additional information (RAI) on January 12, 1998 (Reference 13), February 20, 1998 (Reference 14), and on March 15, 1999 (Reference 15). The licensee subsequently submitted its responses to the RAIs in letters dated April 11, 1998 (Reference 16), May 20, 1998 (Reference 17), May 18, 1999 (Reference 18), and August 16, 1999 (Reference 19).

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 and clarification provided by the licensee in response to the staff's RAIs.

2.0 DISCUSSION AND EVALUATION

The staff's review of the DNPS USI A-46 summary report (Reference 12) 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 GIP-2 screening and evaluation criteria. The report identifies a safe shutdown equipment list (SSEL) and contains 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, cables and conduit raceways, and the identification and resolution of outliers, including the proposed resolution schedules.

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

The Operating Basis Earthquake (OBE) for DNPS is defined in the horizontal direction by some smoothed Housner-type ground response spectra scaled to 0.1g peak ground acceleration. The OBE in the vertical direction is defined by 2/3 of the horizontal spectra. The DNPS safe shutdown earthquake (SSE) is defined by doubling the OBE spectra. The design-basis IRS were developed using the normalized north-south component of El Centro 1940 as the time history to generate the IRS. This was performed for the OBE anchored to 0.1g and doubled for the SSE.

In a letter dated September 21, 1992 (Reference 7), ComEd provided a response to NRC's SSER-2 on GL 87-02 (Reference 6) and committed to follow the guidelines contained in GIP-2 (Reference 5) and the recommendations contained in SSER-2, for the implementation of its USI A-46 program. In the same submittal, and in a letter dated January 15, 1993 (Reference 8), the licensee provided a description of the spectra proposed for use in the USI A-46 program and the methods used to develop them. The spectra proposed for use were the plant design-basis ground response spectrum (GRS) and the associated IRS. NRC reviewed this information and, in a letter dated June 7, 1993 (Reference 11), advised the licensee that the IRS were acceptable as "conservative, design" (CD) for the purpose of verifying the adequacy of equipment in the resolution of USI A-46.

In Reference 19, the licensee discussed its justification for using Method A.1 of GIP-2. As part of the discussion, the licensee developed refined (as termed by the licensee) IRS. In the refined analysis, the input motion was based on the Housner spectral shape and the resulting input motion closely fitted the Housner ground spectrum. As the walls of the building structure are poured directly against rock up to or just below the effective grade level of 517 feet, the new building model was considered fixed to the top of the rock pocket. Also, reactor and turbine building structural damping was set at 7% of the critical damping. For all practical purposes, the refined analysis should be considered as realistic median-center (RMC) analysis. A comparison of IRS using the CD and RMC analyses indicates that, in general, RMC IRS provided 20% reduction in the spectral peaks. Thus, the staff considers the use of the IRS developed using the RMC analysis reasonable for outlier evaluation. However, the equipment anchorages need to be evaluated for 1.25 times the demand calculated from the RMC IRS. The staff considers the results reasonable, and finds the licensee's approach for determining the seismic demand consistent with the provisions of GIP-2, and therefore, acceptable for use in the USI A-46 program at DNPS.

2.2 Seismic Evaluation Personnel

The screening verification, walkdown, and outlier identification were performed by a seismic review team (SRT) comprising seismic capability engineers (SCEs) 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 seismic evaluation personnel should include individuals with sufficient expertise to identify safe shutdown equipment, perform the plant walkdown and verify the seismic adequacy of equipment and cable/conduit raceway systems, and to perform the relay screening and evaluation. This involves a number of plant and engineering disciplines including structural, mechanical, electrical, system, earthquake, and plant operations. Based on the information provided in Appendix C to the seismic evaluation report, Appendix F to the relay evaluation report (Reference 12) and in Reference 16, the staff concludes that the qualifications of the individuals responsible for implementing the resolution of the USI A-46, including the third party reviewers, meet the criteria of GIP-2 and the staff's SER-2, and are, therefore, acceptable for the resolution of the USI A-46 program at DNPS.

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, the licensee addressed the following plant safety functions in the summary report (Reference 12): 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 A of the summary report provides the SSEL.

The reactor decay heat removal function is accomplished by relieving steam from the reactor via the lifting of the main steam target rock safety/relief valve and four electromatic relief valves (ERVs) at their respective setpoints into the torus. During the early stages, the reactor coolant system (RCS) inventory is controlled by injecting water into the reactor by the high pressure coolant injection (HPCI) system which takes suction from either the condensate storage tank or the torus. The automatic depressurization system (ADS) SRVs are manually operated by the control room operator to lower reactor pressure so that the low pressure coolant injection (LPCI) system which takes suction from the torus could be initiated. The decay heat removal is achieved by the LPCI system and the containment cooling service water (CCSW) system. The LPCI system can then be aligned in the torus cooling mode. The LPCI pumps take suction from the torus, routing the water through the LPCI heat exchanger, and injecting the water back into the torus. The CCSW provides the cooling water to the LPCI heat exchanger which takes suction from the cribhouse bay.

The plant operations department reviewed the equipment listed in Appendix A to the seismic evaluation report against 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 approach to achieve and maintain a safe shutdown for 72 hours following a seismic event is acceptable for the resolution of the USI A-46 program at DNPS.

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. 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, however, it may still be shown to be adequate by additional evaluations.

2.4.1 Equipment Seismic Capacity Compared to Seismic Demand

The first screening guideline is the comparison of seismic capacity and seismic demand for the equipment involved. The licensee determined the seismic capacity of DNPS safe shutdown equipment using:

(1) Earthquake experience data with capacity defined by the SQUG bounding spectrum (BS), or 1.5 times BS (reference spectrum), depending on the demand spectrum used,

(2) Generic seismic test data which have been compiled into generic equipment ruggedness spectra (GERS), and

(3) Equipment-specific seismic qualification data, or data from similar equipment.

DNPS has the following Seismic Category I structures:

Drywell Containment structures and internals
Reactor building
Suppression chamber
Control room
310-ft chimney

The equipment in the SSEL are located in the first four structures in the above list. Seismic structural responses were determined for these structures. The buildings are founded on bedrock.

In its June 28, 1996, submittal, the licensee provided the DNPS-specific USI A-46 summary report (Reference 12) which included the SSEL, the seismic design basis for the plant and the results of the screening walkdown of SSEL equipment. In the SSEL, all the components that are needed to accomplish the safe shutdown at DNPS are identified. The licensee evaluated each component for seismic capacity versus demand, conformance to caveats, anchorage adequacy and seismic interaction effects. The evaluation results, at the walkdown screening level, are documented on the screening evaluation work sheets (SEWS) and are summarized on the screening verification data sheets (SVDS), Appendix D of the seismic evaluation report in Reference 12.

For the seismic capacity versus demand evaluation of mechanical or electrical equipment, ComEd elected to use Method A.1 of GIP-2, Section II.4.2 (BS versus design-basis SSE GRS) if the equipment fundamental natural frequency was about 8 Hz or greater and the equipment was located within about 40-feet above grade. Alternately, or if the two criteria above could not be met, ComEd used either Method B.1 (1.5 x BS versus IRS) or Method B.2 (GERS versus IRS) of GIP-2, Section II.4.2, to make the capacity versus demand comparison.

Appendix B of the summary report provides the seismic design-basis spectra used in the DNPS A-46 program. The staff’s review indicated that Method A.1 was being applied for equipment which met the above specified conditions. However, the licensee did not consider an additional limitation stated in Section II.4.2.3 of GIP-2, that the use of Method A.1 is based on an assumption that the IRS, at the elevation where the component is located, would not exceed the GRS by a factor greater than 1.5. The staff’s review indicated that this limitation was not met at a number of locations within 40-feet above grade. In Question 4 of the NRC RAI dated January 12, 1998 (Reference 13), the staff requested the licensee to provide justification for using Method A.1 when the amplified IRS is higher than 1.5 times the GRS. The licensee responded (Reference 16) by referencing a SQUG correspondence with NRC that addressed this restriction, and observed that ComEd was in compliance with GIP-2 as clarified in the SQUG letter. In the letter dated March 15, 1999 (Reference 15), NRC acknowledged the licensee response but observed that the DNPS spectra represented an unusual plant-specific situation for which the restriction applies, and therefore justification for its use at DNPS was still required. The licensee replied (Reference 18) that it will submit a response to this question 45 days after the NRC issues a safety evaluation for the Millstone Station, for which the same issue is under evaluation. The ComEd response came on August 16, 1999 (Reference 19).

As discussed in Section 2.1 of this SER, the licensee provided IRS developed using a RMC analysis. A comparison of IRS for the reactor and the turbine buildings with GRS indicated that above 8 Hz, the IRS varies between 2.3 and 3.0 times the GRS spectral acceleration at those frequencies. Thus, in spite of using the refined analysis, the licensee could not demonstrate compliance with the GIP-2 limitation by its application of Method A.1. However, the licensee did demonstrate that above 8 Hz the RMC IRS were lower than 1.5 times the BS in most of the cases at the critical floor elevations (within 40 feet of the effective grade level). Therefore, the staff's acceptance of the seismic demand for DNPS is predicated on the application of Method B.1 for comparison against equipment seismic capacity.

A total of 428 equipment items, including tanks and heat exchangers, were evaluated for seismic adequacy in the DNPS A-46 program. The capacity of only eight of these equipment was determined to be inadequate. A review of the SVDS showed that Method B.1 was the most often used, Method A.1 the next most often used, and Method B.2 the least often used, method for making the seismic capacity to seismic demand comparison. In many instances Method B.1 was used even when the equipment item was within 40-feet above the grade.

As noted, the seismic capacity of eight components was determined to be inadequate and they were classified as outliers. Realistic median floor response spectra have been developed for most of these components and the licensee is evaluating these components. In addition, as indicated in Table 5.1 of the summary report, for sixteen electrical components, the demand was determined to exceed the capacity in a small frequency range. These exceedances, in the judgement of the SCEs at DNPS, were considered to be inconsequential and the components were determined to be acceptable. These were instances where the components were judged to meet the intent, but not the detail, of the caveat. The evaluations for these components are documented in SEWS.

The procedures used by ComEd to define seismic capacities and demands and to assure that component seismic capacities are greater than their demands are considered to be generally consistent with the guidelines provided in GIP-2 and the staff positions described in SSER-2 except as noted in Section 3 of this SER.

2.4.2 Assessment of Equipment Caveats

In order to apply the experience-based approach and to use the equipment's seismic capacity as defined in GIP-2, the plant-specific equipment must meet some restrictions or caveats described in GIP-2. GIP-2 also allows engineers to verify whether the plant equipment conditions satisfy the caveats specified for a particular equipment class by judging whether these conditions meet the "intent of the caveats" even if they do not necessarily meet the exact words of the caveats.

As a second screening guideline, the licensee verified the seismic adequacy of an item of mechanical or electrical equipment by confirming 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 only necessary when the BS or the 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.

The caveats are defined as a set of inclusion and exclusion rules which are 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 classes and for the generic seismic testing equipment class. The licensee stated in Reference 12 that the SRT which consists of at least two SCEs walked down all accessible SSEL equipment items to look for all applicable caveats, and documented them in SEWS.

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 experienced or tested equipment class, all of the components mounted on (or inside) this equipment are considered to be part of that equipment and do not have to be evaluated separately. However, the walkdown engineers did look for suspicious details or uncommon situations which could make the equipment item vulnerable.

When evaluating an item of equipment, SCEs often used engineering judgment to determine whether the specific seismic concern addressed by the caveat was met. They evaluated each item of equipment to determine whether it met the specific wording of the applicable caveats or their intent. If they judged an item of equipment to meet the intent, but not the specific wording of the caveats, that item was considered to have met the caveat. During the walkdowns and seismic adequacy evaluations performed at DNPS, the SRT identified some instances for which the specific wording of certain caveats was not met. ComEd summarized these in Table 5-1 of Reference 12. The staff reviewed the information provided in Table 5-1, and concluded that the SRT's judgement and the licensee's additional evaluations and measures taken to meet the intent of the GIP-2 caveats are reasonable and acceptable for the resolution of USI A-46 at DNPS.

2.4.3 Equipment Anchorages

ComEd assessed the seismic adequacy of equipment anchorage during the screening walkdowns and documented the results on SEWS, the SVDS in Appendix D, and in Appendix F of the seismic evaluation report (Reference 12). Column 14 of the SVDS provides a summary of the results while the Appendix F listing provides the results of the tightness and embedment checks.

As stated in Section 4 of the summary report, the licensee verified equipment anchorages by comparing anchorage capacity to the seismic demand, inspecting for gross installation defects, and evaluating the anchorage load path, to ensure the adequacy of anchorage stiffness and strength. ComEd used analyses to make the capacity to demand checks for large equipment items. These were performed in accordance with the guidelines in Section II.4.4 and Appendix C of GIP-2 using the ANCHOR software package. For small equipment, weighing 50 lbs. or less, the licensee used judgement and a tug test. All accessible anchorages were visually inspected. The attributes the licensee reviewed included; anchorage type, size and location, installation adequacy, embedment length, gap at threaded anchors, spacing between anchors, edge distance, concrete condition, cracks and equipment base stiffness/prying action and load path. For all accessible expansion anchors of floor-mounted equipment, the licensee performed a tightness check. In that check, torque was applied by hand, and if the nut turned less than 1/4 turn, the anchor was considered to be tight. The licensee performed embedment checks, on a random basis, to ensure that the shell anchor and equipment base were not in contact. The licensee reduced the bolt-allowable capacities to account for prying action when the equipment base stiffness was considered not adequate.

A review of the SVDS show that they do not provide any information regarding the type of anchors used for the listed equipment. ComEd's response (Reference 16) to RAI Question No. 5 (Reference 13), provided a listing of anchorage types for SSEL vibratory equipment, pumps, chillers, and air compressors. The listing showed expansion anchors were used for 17 equipment items. The factors of safety listed for these anchorages were all in excess of 10, except for one item with a factor of 9.6. These anchorages comply with the GIP-2 recommendation that a large margin between pullout load and pullout capacity exist when expansion anchors are used for vibratory equipment and the staff considers them acceptable.

As indicated in Section 5 of the summary report, epoxy-grouted anchor bolts are used to anchor the LPCI pumps at DNPS. In RAI Questions No. 7 and No. 2, References 13 and 15 respectively, the staff requested the licensee to verify that the allowable loads used for the epoxy-grouted anchors were justifiable. In its original response (Reference 16), ComEd attempted to justify the allowables by treating the anchors as cast in place (CIP) anchors. The staff observed that the technical basis provided was not sufficient to support that approach. In its second response (Reference 18), ComEd stated that the product used to install the grouted anchors was "Colma Fix" manufactured by Sika Corp., and provided strength data from Sika Corp. for the material. The information showed the strength of the material without aggregate to far exceed that of concrete. The strength of the material was also shown to exceed the strength of Masterflow 713 Grout, a typical non shrink grout material. This material property information is considered a sufficient basis to verify the strength of the epoxy-grouted anchors used to anchor the LPCI pumps.

A review of the SVDS indicates that the anchorage of 26 equipment items was determined to be deficient. The issues cited for anchorage include lack of anchorage, inadequate anchorage, nozzle loads unaccounted for in anchorage evaluation and anchorage not covered by or unacceptable per GIP-2. As documented in the updated outlier resolution status sheets provided in ComEd's response (Reference 18) to RAI Question No. 4 (Reference 15), all but five of the outliers have been resolved. The methods used to resolve the outliers include: modification or repair of the existing anchorage, replacement of missing parts, shimming below equipment base and the revision of anchorage evaluation to account for piping and nozzle loads. For the remaining outliers, modification of the existing anchorage is the proposed mode of resolution. Regarding the bolt tightness tests, 604 anchors were tested out of the

759 expansion anchors. In this sample only two bolts, both on electrical panels, required more than a 1/4 turn to become wrench tight. The two panels were considered outliers for spatial interaction issues, not anchorage, and will be corrected with the addition of shims to close a clearance gap.

Eight of the resolved outliers involved the anchors of the CCSW pump cooler supports. These components are anchored with lead cinch anchors, a type that is not covered by GIP-2 and, therefore, identified as outliers. To resolve these outliers, ComEd used data included in Westinghouse Report RTR 2661 to arrive at allowable loads for the anchors. The equipment loads were below the allowables and the outliers were resolved. In its response (Reference 16) to RAI Question No. 16 (Reference 13) the licensee provided a copy of the data table from the referenced report. The allowable loads exhibit a factor of safety of 4 or more when compared to the mean failure loads developed during tests and are significantly less than the manufacturers recommendations for the allowables. These test results provide a sufficient basis for allowable loads for lead cinch anchors 5/8 in. diameter or less.

The approaches used by ComEd to ensure the adequacy of equipment anchorage are consistent with the GIP-2 guidelines and the staff's SSER-2. They are considered an acceptable means for the resolution of USI A-46 at DNPS.

2.4.4 Seismic Spatial Interaction Evaluation

ComEd assessed the possibility of adverse seismic spatial interactions for the mechanical and electrical equipment reviewed during the screening walkdowns and documented the results on SEWS and on SVDS in Appendix D of the seismic evaluation report (Reference 12). A description of the review effort is provided in Section 4 of the summary report and a summary of the results is provided in column 15 of the SVDS.

As stated in Section 4 of the seismic evaluation report (Reference 12) the licensee's equipment screening evaluations at DNPS included the confirmation that no seismic spatial interactions could occur between the equipment under evaluation and nearby equipment, systems and structures which could cause the equipment to fail to perform its intended safe shutdown function. The interactions of concern included proximity effects, structural failure and the flexibility of attached lines and cables. The licensee examined overhead piping and duct work systems in all plant areas containing A-46 equipment for potential spatial interactions. Those evaluations were performed following the guidelines for potential seismic interactions provided in Section II.4.5 and Appendix D of GIP-2.

A staff review of the SVDS indicated that 75 equipment items were identified as interaction outliers. The majority of these were electrical panels, buses, and motor control centers. The interaction concerns included interaction with nearby gas bottles, interaction with overhead and unrestrained lighting, interaction with permanent and non permanent equipment, unbolted panels, and spill hazards. The licensee resolved a large fraction of these outliers quickly with the addition of restraints and the relocation of items. A staff review of the updated outlier resolution data sheets (Reference 18), indicates that there are 33 outstanding interaction outliers. The methods proposed to resolve the outstanding outliers include the addition of a second chain to restrain gas bottles, the addition of transverse restraints to overhead cable raceways, and the bolting together of adjacent panels.

ComEd's assessment of seismic interactions is consistent with the GIP-2 guidelines and the staff's SSER-2. It is considered acceptable for the resolution of USI A-46 at DNPS.

2.5 Tanks and Heat Exchangers

ComEd evaluated a total of thirty-five tanks and heat exchangers at DNPS in the A-46 program. The results of the evaluations are documented on SEWS forms and are summarized in the SVDS in Appendix D of the seismic evaluation report (Reference 12). A description of the review effort for tanks and heat exchangers is provided in Section 6 of the summary report.

As stated in Section 6 of the summary report, tanks and heat exchangers were generally evaluated in accordance with the rules and procedures given in Section 11.7 of GIP-2. Tanks having design features not covered by GIP-2 were evaluated using the same procedures and loading conditions as given in GIP-2. The evaluations involved a check for buckling of the shell of flat-bottomed vertical tanks, a verification of tank anchorage components and bolts, and a check of attached piping flexibility to withstand the postulated earthquake load. The tanks evaluated included vertical flat-bottomed tanks, buried, wall-mounted and surface-mounted horizontal storage tanks and elevated vertical heat exchangers. For the contaminated condensate storage tanks (CCSTs), vertical tanks not meeting the GIP-2 caveats, the evaluation was performed using a procedure entitled "Conservative Deterministic Failure Margin" (CDFM) in Appendix H of the Electric Power Research Institute's (EPRI) Report NP-6041. Eight tanks were identified as outliers: two CCSTs, because their ring foundations were not covered by GIP-2; the four LPCI heat exchangers, since their support steel required evaluation; and one interaction concern and missing bolt for horizontal storage tanks. As documented in the updated outlier resolution status sheets (Reference 18), all but one of the tank outliers have been resolved. The outliers for the LPCI heat exchangers were resolved with modifications to their anchorage. The modifications consisted of adding additional structural members and reinforcing connections to provide additional vertical and horizontal support. CSST outliers were resolved by analysis and the interaction concern was resolved by further review. The missing bolt outlier is still outstanding.

The CDFM methodology has not been approved by NRC for the analysis of safety-related systems and components, including the resolution of mechanical, electrical, and structural equipment outliers in the USI A-46 program. In its response (Reference 16), to RAI Question No. 9 (Reference 13), ComEd explained that the CDFM method was used for the Individual Plant Examination of External Events program and that in addition to the CDFM evaluation, the CCSTs were reanalyzed in accordance with GIP-2 methodology and determined to be acceptable.

In its response (Reference 16) to RAI Question No. 11 (Reference 13), ComEd provided drawings of the CCST, the CDFM, and ring foundation analysis results for the CCSTs. The ring foundation analysis provided was the estimate of the pullout failure strength of the ring foundation. It included estimates of pullout capacity based on anchor steel yield, concrete shear cone failure and a concrete weight plus soil wedges failure mode. Although reductions for edge distance effects were not considered in the estimates of the steel and concrete pullout capacities, these were substantially greater than the concrete weight plus soil wedges pullout capacity, which controlled the analysis. This pullout capacity was determined using the method described in EPRI-TR-1 03960, "Recommended Approaches for Resolving Anchorage Outliers." Although the reference was not available for review, the computation had a simple basis. The pullout is resisted by the weight of the concrete ring and the frictional resistance of the soil in which it is embedded. This failure mode is stated to be a ductile failure mode and the ring foundation was shown to have the minimum amount of reinforcement necessary to satisfy ACI requirements. In closing its response, ComEd stated that the CCST tank capacity was recalculated in accordance with the methodology and factors given in Section 11.7 of GIP-2 and the capacity of the CCST tanks was determined to exceed the demand.

The staff finds ComEd's evaluation of tanks and heat exchangers is consistent with the GIP-2 guidelines and the staff's SSER-2. It is acceptable for the resolution of USI A-46 at DPNS.

2.6 Cable and Conduit Raceway Supports

ComEd assessed the seismic adequacy of cable tray and conduit raceway supports and documented the inspections and evaluations on the plant area summary sheets (PASS), the calculations performed for the limited analytical reviews (LARs) and the outlier seismic verification sheets (OSVS). A description of the review effort is provided in Section 7 of the seismic evaluation report (Reference 12) with a summary of the raceway outliers provided in Section 7.4.

As stated in Section 7.1 of the summary report, the raceway review was performed in accordance with the guidelines of Section II.8 of GIP-2. Raceway systems were examined during a walkdown, checked against the Inclusion Rules and Other Seismic Performance Concerns, as specified in Section 8.2 of GIP-2, and examined for spatial interactions with adjacent equipment and structures. Twelve representative worst-case raceway supports were selected and evaluated in LARs per Section II.8.3 of GIP-2. Outliers were identified and documented. Raceway systems in most elevations of the reactor buildings, vital areas of the turbine building, the cable tunnel, the control room and auxiliary electrical equipment room, and the crib house were reviewed. A summary of the PASS is presented in Table 7.1 of the summary report. It indicates that the walkdowns were divided into 18 plant areas and worst case samples were selected from 10 of these areas.

The licensee stated that the raceway systems are primarily of rod-hung or steel angle frame construction. The rod hung units vary from single to multi tiers and primarily support cable trays. The angle frame units vary from wall-mounted angle brackets to floor-ceiling-wall structures. Cable trays are primarily ladder or solid bottom type with 6-inch side rails and vary from 12- to 36-inches in width. Conduits vary in size up to 5 inches nominal diameter. The trays and conduits are secured to the supports using standard tray clamps, pipe clamps and bolting. Ceiling anchorages are primarily embedded struts while floor anchorages are welded base plates with concrete anchor bolts.

The licensee identified a total of 10 outliers as a result of the original cable tray and raceway reviews. Seven of these resulted from LARs while the other three were identified during the walkdowns. A review of Table 7.2 of the seismic evaluation report shows the LAR outliers to be the result of failure to meet the dead load check for five hanger hardware components and failure to meet hanger rod fatigue criteria in seven instances. A given analysis sample could exhibit both deficiencies. As indicated in Table 7.3 of the seismic evaluation report, five of the LAR outliers were resolved by additional analyses performed in accordance with the guidelines of Section II.8.4.8 of GIP-2 prior to the issuance of the summary report. The remaining two LAR outliers were subsequently closed, one by further analysis using actual tray loadings and the other with confirmation of its actual loading. As documented in the updated outlier resolution status sheets (Reference 18), two of the walkdown outliers remain open and one was resolved with the installation of new cable trays and cable penetration seals. The licensee proposed to resolve the two outstanding outliers by analyses.

In its response (Reference 16) to RAI Question No. 13 (Reference 13), ComEd provided the calculations for all LARs performed before the issuance of the seismic evaluation report (Reference 12). The calculations show that the LARs that did not result in outliers met the overall guidelines of Section II.8.3 of GIP-2. LARs that were initially determined to be outliers, and subsequently resolved by analysis, were resolved by satisfying limit load analysis and rod fatigue criteria. The limit load criteria were consistent with the GIP-2 guidelines but used data from DPNS cable tray component tests. The rod fatigue criteria were based on tests of DPNS threaded-end rods performed for the systematic evaluation program (SEP) and documented in EPRI Report NP-7152-D. For the two outstanding LAR outliers, one, LAR 009, remained open because the tray loadings had not been established, and the other, LAR 007, because it had failed to meet both the normal and limit load criteria, for the loadings considered.

The disposition of the two outstanding LAR outliers was provided in the ComEd response (Reference 18) to RAI Question No. 3 (Reference 15). For LAR 009, the weight of the conduit bus duct was confirmed based on manufacturers data and, since the resulting load was well within the load used in the conduit support analysis, the outlier was resolved. For LAR 007, the walkdowns were expanded to adjacent areas to identify the actual worst case tray loadings, spans and configurations for this LAR type. Revised evaluations were then made for these actual worst case parameters. The hangers were determined to meet the GIP-2, Section II.8.3 dead load, ductility and fatigue checks, or in two cases, the limit load criteria for vertical capacity. Based on these results, ComEd declared the outlier to be resolved.

ComEd did not perform a check for lateral seismic loads in any of the LAR assessments. In its response (Reference 16), to RAI Question No. 14 (Reference 13), ComEd provided the criteria for this exclusion. ComEd observed that the raceway hangers at DNPS are predominantly rod hanger support systems. The rods were demonstrated to be inherently ductile in the SEP raceway program in which actual DNPS rods were tested. ComEd concluded, therefore, in accordance with Section II.8.3, GIP-2, no further review of hanger horizontal response capability was required.

The staff finds that ComEd's evaluation of cable and conduit raceway supports is consistent with the GIP-2 guidelines and the staff's SSER-2, and is acceptable for the resolution of USI A-46 at DNPS.

2.7 Essential Relays

Section 11.6 of GIP-2 provides an overview of the USI A-46 relay review criteria and methodology. The content of GIP-2 concerning relay evaluations is based on the detailed criteria, methodology, and procedure documented in EPRI Report NP-7148-SL. Accordingly, the licensee's evaluation of relays associated with the USI A-46 safe shutdown equipment for DNPS was performed and documented in accordance with the requirements of GIP-2, NRC SSER-2 on GIP-2 and the guidance of EPRI NP-7148-SL.

Due to limited available data on relay makes and models available from plant databases, a deviation in the order of evaluation was made. In order to limit the amount of equipment required to have field nameplate walkdowns performed, the licensee performed a detailed circuit evaluation and evaluation of the use of operator action.

The licensee began the relay evaluation for DNPS with the creation of a relay list which documents the detailed circuit evaluation for each piece of equipment identified in the SQUG relay review SSEL. They performed the detailed circuit evaluation to identify those relays required to function to assure availability of safe shutdown equipment, and thus included only those contacts directly involved with the operation of the specified piece of equipment. Therefore, devices controlling nonessential equipment, annunciators, and alarms were not included on the list. The licensee checked for generically rugged devices such as solid-state relays and mechanically-actuated contacts which they screened out as "not vulnerable" to chatter. The licensee screened out those contacts for which it was determined that chatter would not adversely impact equipment operation as "chatter acceptable." In addition, the licensee determined those relays for which operator action would be required, during the design seismic event, to reset/respond to the consequences of relay chatter affecting equipment availability. The staff discussed this topic in Section 2.8 of this safety evaluation under Human Factors Aspects. ComEd considered the remaining contacts to be potentially seismically vulnerable.

The licensee evaluated the seismic adequacy of the remaining relays and other contact devices by comparing the seismic capacity of the specific relay types with the plant-specific seismic demand. They determined the seismic demand by modifying the floor response spectra at the base of the cabinet or panel to account for structural amplification between the cabinet base and the location of the device mounted within the cabinet. ComEd used generic in-cabinet amplification factors and factors of safety provided in GIP-2 to account for structural amplification. The licensee identified low ruggedness or "bad actor" relays during the seismic capacity screening. Many of the devices passed the seismic capacity screening process and required no further evaluation. Some relays did not pass the seismic capacity screening because either the seismic demands on these devices were higher than their published capacities or the seismic capacity data was unavailable for the specific relay models.

The licensee considered the relays that could not be screened using the methods described above to be outliers. The licensee provided a complete list of outliers and its planned methods of resolution in Table 3-1 of the relay evaluation report, which was attached to the licensee's summary report (Reference 12).

In accordance with GIP-2 guidelines, the licensee performed walkdowns of relays and their enclosures. The purpose and scope of these walkdowns were to:

(1) Obtain, as necessary, information needed to determine cabinet types and specific in-cabinet amplification factors for seismic screening,

(2) Verify the seismic adequacy of cabinets or enclosures which contain essential relay,

(3) Spot-check mountings of essential relays to determine if they are in accordance with manufacturer's recommendations, and

(4) Confirm that the relay types and locations are consistent with the documentation sources used during the relay circuit evaluations.

Following the detailed circuit evaluation and relay walkdown, the licensee evaluated all of the remaining contacts on the composite list for seismic adequacy. The licensee stated, in the relay evaluation report, that the essential relays and other contact devices determined to have inadequate or unknown seismic capacities and which cannot be screened out using light functional screening, seismic capacity screening, detailed circuit analysis, or operator action are considered outliers. Of the approximately 5600 contacts evaluated for USI A-46, they identified 1058 as outliers. Due to the duplication of contacts being documented during the detailed circuit analysis method, these contacts are located on 533 individual devices. The outliers consist of 20 "bad actor" relays, 160 relays for which seismic demand exceeds seismic capacity, and 214 relays with unknown (unpublished) seismic capacities. In addition to the above, a set of 48 relays was identified based on the apparent age of the equipment as potentially having unique qualification. In addition, a pending modification was identified (Mod Number M12-2(3)-94-002), which replaces eight mercury-actuated Yarway level switches with an instrument trip system. The remaining 83 outliers were due to insufficient data or walkdown constraints. The licensee modified the total number of contacts reviewed and outliers declared, described above to be 5723 and 1088, respectively (see response to Question No. 2 in Reference 16). The available options for resolving outliers are provided in EPRI NP-7148-SL and GIP-2. The licensee stated that options for resolving outliers include refinement of initial seismic requirements, testing of the relay in question, circuit redesign, relocation of relays to reduce seismic demand, modification of relay installation or support structure, and replacement of relays in question with seismically-qualified models. The licensee provided a summary of the outliers and the planned resolutions is provided in Table 3-1 of the relay evaluation report in Reference 12. Details of the individual outliers are contained in Appendix E of the relay evaluation report. Appendix G provides nuclear tracking sheets indicating proposed resolutions, completion dates and nuclear tracking systems (NTS) numbers for each outlier. Operator action related to relays is addressed in Section 2.8 of this SER.

The staff finds ComEd's approach in verifying the seismic adequacy of essential relays at DNPS to conform to the provision of GIP-2, and, therefore, acceptable for the resolution of the USI A-46 program at DNPS.

2.8 Human Factors Aspects

GIP-2 describes the use of operator action as a means of accomplishing those activities required to achieve safe shutdown. Section 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 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 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 3.7, "Operations Department Review of SSEL," of GIP-2, SQUG also described three methods for accomplishing the operations department reviews of the SSEL with respect to the plant operating procedures. Licensees are to decide which method or combination of methods would 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, and

3. Performing a limited control room and local in-plant walk-down of actions required by plant procedures.

The staff's evaluation of the SQUG approach for the identification and evaluation of the SSEL, including the use of operator actions, was provided in Section 11.3 of the staff's SSER. The evaluation concluded that the SQUG approach was acceptable.

The staff's review of the DNPS summary report focused on verifying that the licensee had used one or more 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" review method by the operations department to verify that existing normal, abnormal, and emergency operating procedures are adequate to mitigate the postulated transient, and that operators could place and maintain the plant in a safe shutdown condition. The licensee determined that the systems and equipment selected for seismic review in the USI A-46 program are those for which normal, abnormal, and emergency operating procedures are available to bring the plant from a normal operating mode to a hot shutdown condition. The shutdown paths selected were reviewed by the DNPS operations staff and they determined that the procedures would provide adequate guidance to the operators in response to a seismic event. The licensee provided assurance that ample time would exist 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 (UFSAR) Chapter 15, 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 would be available for operators to respond to a LOOP, it was not necessary to revalidate 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 shutdown 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 hot shutdown condition are those specifically associated with the vibratory motion of the SSE. The specific area where operator actions would be required would be to reset certain relays associated with restoration of offsite power. In each case the specific actions were reviewed by the operations department, during the relay screening process, to ensure that the actions could be performed in the required amount of time with normally available resources. The results of the review of these operator actions by the Operations department verified that each of the actions was adequately covered by procedural guidance, and that adequate resources including time available to take such actions were available.

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 operator's tasks, and the potential for placing an operator in unfamiliar or inhospitable surroundings. The licensee provided information to substantiate that potential challenges to the operator were explicitly reviewed during validation of the pertinent plant operating procedures related to the licensee's UFSAR, Chapter 15, Accident Analysis for the Loss of Offsite Power (LOOP) transient which preceded the A-46 program review. In addition, the licensee explicitly evaluated the potential for local failure of architectural features and the potential for adverse 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 some cable tray supports were identified as impact hazards within the control room. The licensee has indicated that it will resolve these adverse spatial intersections by adding cross-members to the affected cable tray supports. This will be accomplished within two refueling outages per unit following receipt of the SER on the USI A-46 issue. 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 NRC-approved review methodology outlined in GIP-2 in the human factors aspect, and is, therefore, acceptable for the resolution of the USI A-46 program at DNPS.

2.9 Outlier Identification and Resolution

As previously stated, an outlier is defined as an item of equipment which does not meet GIP-2 screening guidelines. The licensee may show an outlier to be adequate for seismic loadings by performing additional evaluations using alternate methods or seismic qualification techniques acceptable to the staff. Based on the screening criteria stated in Sections 2.4 and 2.7 of this SER, ComEd identified outliers in the twenty classes of mechanical and electrical equipment, tanks and heat exchangers, cable tray and conduit raceways and relays. The outliers for all of these, with the exception of the relays, are discussed in Section 8 of the seismic evaluation report (Reference 12). Relay outliers are addressed in Section 3 of the relay evaluation report (Reference 12). A listing of each outlier with a description of the method used, or proposed, for its resolution, is provided in Table 8.2 of the seismic evaluation report and in Table 3-1 of the relay evaluation report. A listing of proposed resolutions, completion dates and the tracking system identification number for each unresolved outlier is provided in Appendix I of the seismic evaluation report and in Appendix G of the relay evaluation report. Note 1 of Appendices I and G states ". . .outlier resolution to be completed within two (2) refueling outages per unit following receipt of NRC SER on USI A-46 Submittal."

In its response (Reference16) to Question No. 1 (Reference 13), ComEd stated that it is pursuing the resolution of all outliers. The completion schedule specified in Note 1 to Appendices I and G of the summary report (Reference 12) was observed to be consistent with the SQUG guidance that two refueling outages was an acceptable time span to resolve all outliers, and the anticipation that the NRC SER was forthcoming. With regard to assuring the operability of systems and components, ComEd stated that it has followed the guidance provided in Section 11.2.2.5 of GIP-2 in implementing its responsibility for reporting under the USI A-46 program.

In its response (Reference 18) to RAI Question No. 4 (Reference 15), ComEd provided updated outlier resolution status sheets which document the status of all outliers except relay outliers as of the date of transmittal, May 18, 1999. ComEd further stated that 65% of the outliers had been resolved. Of the remaining outliers, 50% require hardware changes for which the design and associated calculations have been performed. For the other 50%, engineering evaluation or minor fixes, as required, are in process. Regarding the completion schedule, ComEd confirmed that it would adhere to the schedule plan committed to in the summary report (Reference 12), "outliers will be resolved within two refueling outages per unit following receipt of NRC SER on USI A-46 submittal."

ComEd’s actions regarding outliers are consistent with the guidelines provided in GIP-2. A majority of the identified outliers have been resolved and the remainder is in the process of being resolved. ComEd’s actions are considered reasonable for the resolution of USI A-46 at DNPS.

3.0 SUMMARY OF MAJOR STAFF FINDINGS

Based on its review of the licensee’s submittals, the staff found that the licensee’s USI A-46 program has, in general, followed GIP-2 guidelines, and that no programmatic or significant deviations from the guidelines were made during the USI A-46 implementation process at

DNPS. The staff found that the licensee's approach for determining equipment seismic demand is consistent with the GIP-2 provisions and is acceptable. Specifically, based on the evaluation of the licensee's method of generating the seismic demand for equipment, the staff concludes that the application of Method B.1 instead of Method A.1 as stipulated in Table 4-1 of GIP-2 for defining the seismic demand is acceptable. The staff also finds the use of RMC spectra, as the demand spectra, for outlier evaluations acceptable.

The staff also determined that the licensee has presented acceptable approaches for resolving all the identified outliers in Tables 8.1 and 8.2 of the seismic evaluation report and Appendix G to the relay evaluation report. The licensee should resolve all remaining outliers as stated in Section 2.9, in accordance with its scheduling commitment.

The staff determined that, upon completion of all the necessary evaluations and corrective actions for the identified equipment and relays, the DNPS USI A-46 program will be in conformance with GIP-2 provisions and, therefore, will be acceptable.

4.0 CONCLUSION

ComEd's USI A-46 program at DNPS was established in response to Supplement 1 to GL 87-02 through a 10 CFR 50.54(f) letter. In general, the licensee conducted the USI A-46 implementation in accordance with GIP-2. The licensee's A-46 implementation program did not identify any instance where the operability of a particular system or component was called into question. The staff's review of the licensee's implementation program did not reveal any significant findings that would suggest inadequacy of the licensee's USI A-46 program in light of the GIP-2 guidelines. The staff concludes that the licensee's USI A-46 implementation program has, in general, met the purpose and intent of the criteria in GIP-2 and the staff's SSER No. 2 for the resolution of USI A-46. The staff has determined that the licensee's already completed actions have resulted in safety enhancements which, in certain aspects, are beyond the original licensing basis. Upon completion of outlier resolution as described in Section 2.9 of this SER, 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, Neil Smith on June 19, 1998 (Reference 20). The primary consideration in the licensee's determination to incorporate GIP-2 in the licensing basis, is completing the resolution of all the identified outliers, in accordance with its commitments and the GIP-2 provisions. Where plants have specific commitments in the licensing basis with respect to seismic qualification, these commitments should be carefully considered. The overall cumulative effect of the incorporation of the GIP-2 methodology, considered as a whole, should be assessed in making a determination under 10 CFR 50.59. An overall conclusion that no unreviewed safety questions (USQ) are 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.

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5.0 REFERENCES

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2. IEEE Standard 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1 E 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 GL 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46," February 19, 1987

5. "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Power Plant Equipment, Revision 2," corrected February 14, 1992 (GIP-2), SQUG

6. NRC "Supplement No. 1 to Generic Letter 87-02 Including 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

7. Letter, ComEd to NRC Document Control Desk, "Response to Supplement 1 to Generic Letter (GL) 87-02, Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors," SQUG Resolution of USI A-46, dated September 21, 1992

8. Letter, ComEd to NRC, NRC Evaluation of the Commonwealth Edison Response to Generic Letter 87-02, Supplement 1, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors," SQUG Resolution of USI A-46, dated January 15, 1993

9. Letter, D. Chrzanowski, ComEd, to T. Murley, NRC, "SQUG Resolution of USI A-46 in Response to GL 87-02," dated March 9, 1993

10. Letter, NRC to ComEd, "Evaluation of Dresden Nuclear Power Station, Units 2 and 3, Quad Cities Nuclear Power Station, Units 1 and 2, and Zion Nuclear Power Station, Units 1 and 2 120-day Response to Supplement No. I to Generic Letter 87-02 (TAC Nos. M69442, M69443, M69476, M69477, M69492 and M69493)," dated November 20, 1992

11. Letter, C. P. Patel, NRC, to D. C. Farrar, ComEd, "Evaluation of Dresden Nuclear Power Station, Units 2 and 3, Quad Cities Nuclear Power Station, Units 1 & 2, Procedure for Developing In-Structure Response Spectra for Resolution of USI A-46 (TAC Nos. M69442, M69443, M69476, M69477)," dated June 7,1993

12. Letter, ComEd to NRC Document Control Desk, "Summary Reports for Resolution of Unresolved Safety Issue A-46, Generic Letter 87-02, Dresden Nuclear Power Station, Units 2 & 3," dated June 28, 1996

13. Letter, NRC to ComEd, "Request for Additional Information Regarding USI A-46," dated January 12, 1998

14. Letter, NRC to ComEd, "Request for Additional Information Regarding USI A-46," dated February 20, 1998

15. Letter, NRC to ComEd, "Request for Additional Information Regarding USI A-46," dated March 15, 1998

16. Letter, ComEd to NRC Document Control Desk, "Response to Request for Additional Information - Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants, Dresden Nuclear Power Station, Units 2 & 3," dated April 11, 1998

17. Letter, ComEd to NRC Document Control Desk, "Response to Request for Additional Information - Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants, Dresden Nuclear Power Station, Units 2 & 3," dated May 20, 1998

18. Letter, ComEd to NRC Document Control Desk, "Response to Request for Additional Information - Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants, Dresden Nuclear Power Station, Units 2 & 3," dated May 18, 1999

19. Letter, ComEd to NRC Document Control Desk, "Response to Request for Additional Information - Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants, Dresden Nuclear Power Station Units 2 & 3," dated August 16, 1999

20. Letter, Brian W. Sheron (NRC) to Neil Smith (SQUG), dated June 19, 1998