



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 16, 1999

SUBJECT: SUMMARY OF MEETING WITH THE SEISMIC EXPERIENCE-BASED QUALIFICATION OWNERS GROUP (SEQUAL) ON SEPTEMBER 17, 1999, TO DISCUSS USE OF SEISMIC DATA BASE FOR EQUIPMENT QUALIFICATION

Reference: Letter from Elinor G. Adensam to Neil P. Smith dated June 23, 1999

On September 17, 1999, representatives of the U.S. Nuclear Regulatory Commission (NRC) staff met in a public meeting with members of the recently-formed SEQUAL industry group at NRC Headquarters in Rockville, Maryland. The purpose of the meeting was to discuss the use of the Unresolved Safety Issue (USI) A-46 resolution document, Generic Implementation Procedure, Revision 2 (GIP or GIP-2), for certain equipment in newer nuclear power plants (to which USI A-46 did not apply) as an acceptable alternative to the Institute of Electrical and Electronics Engineers (IEEE) Standard IEEE-344-1975. USI A-46 deals with seismic adequacy of various classes of electrical and mechanical equipment relied upon to achieve hot shutdown and applies to plants licensed prior to the development of current NRC seismic design criteria. The USI A-46 resolution was imposed on those nuclear power plants affected by NRC Generic Letter (GL) 87-02, *Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46*, dated February 19, 1987.

Enclosure 1 is a list of persons attending the meeting. Enclosure 2 is a handout passed out to all attendees by SEQUAL at the beginning of the meeting.

General Issues

In general, the NRC staff does not object to the concept of using an experience-based approach for seismic qualification of certain equipment in operating nuclear power plants. During the meeting, the NRC staff pointed out that the GIP-2 procedure was approved without a detailed review of the earthquake-experience database by the Senior Seismic Review and Advisory Panel, or an in-depth review and explicit assessment by the NRC staff. The NRC staff had accepted the use of the GIP-2 methodology for replacement of equipment in USI A-46 plants (plants to which GL 87-02 applied). The primary purpose of GIP-2 was to provide an enhanced level of confidence regarding the seismic adequacy of safe shutdown equipment in older plants designed to less stringent seismic qualification requirements. Therefore, the structure of GIP-2 is that of a document to be used for assessing and enhancing the adequacy of installed components rather than a seismic qualification document.

The NRC staff pointed out that currently there are no integrated guidelines on the use of experience-based seismic qualification of equipment that can be considered as an alternative to IEEE-344 for certain equipment in non-A-46 plants. As GIP is currently structured, it is not clear which portions of GIP-2 would be maintained and to which equipment they would apply. The NRC staff suggested that SEQUAL provide an integrated report on its proposed alternate equipment seismic qualification procedure if it is deemed feasible to use experimental seismic data to satisfy the requirements of Part 100 of the *Code of Federal Regulations*.

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Although the NRC staff has provided comments on the use of procedures proposed by the Seismic Qualification Utility Group (SQUG) for new and replacement equipment and parts (NARE) for use in USI A-46 plants (reference E. Adensam letter to N. Smith, 6/23/99), the NRC staff's position on the use of GIP-2 for new and replacement equipment is that GIP-2 criteria and procedures may be applied on a case-by-case (i.e., plant-specific and equipment-specific) basis only, as stated in the NRC staff's Supplemental Safety Evaluation Report No. 2 (SSER-2). The NRC staff considers that the proposed use of the GIP-2 criteria and procedure for all equipment in non-USI A-46 plants would be a significant relaxation from the acceptable level of seismic ruggedness currently required for these plants. The NRC staff indicated that an industry standard developed by a joint American Society of Mechanical Engineers (ASME)/IEEE working group for seismic qualification of mechanical and electrical equipment is being independently finalized by ASME/Qualification of Mechanical Equipment (QME) for qualification of mechanical equipment and by IEEE for qualification of electrical equipment. When finalized, they would set forth an approach on the use of seismic experience for the qualification of mechanical and electrical equipment in nuclear power plants. The NRC staff indicated it would be beneficial if GIP was at least reconciled to the draft joint standard.

Detailed Discussion

A number of legal and technical licensing questions were discussed among the attendees regarding the issues related to the proposed use of the GIP methodology at non-A-46 plants. The main points discussed are summarized below:

- The NRC staff expressed concerns regarding whether the GIP method meets General Design Criterion 2 (GDC-2) of Appendix A to Part 50 (10 CFR 50) and Appendix A to Part 100 (10 CFR 100) of *Title 10 of the Code of Federal Regulations* (CFR).

Specifically, 10 CFR 100, Appendix A, Section VI.(a)(1) states that the "engineering method used to ensure that the required safety functions are maintained during and after the vibratory ground motion associated with the Safe Shutdown Earthquake shall involve the use of either **a suitable dynamic analysis or a suitable qualification test** [**emphasis added**] to demonstrate that the structures, systems and components can withstand the seismic and other concurrent loads" The USI A-46 resolution established by the NRC, as stated in the title of GL 87-02, is a "verification" process of installed equipment rather than a "qualification" process.

The NRC staff agreed to have further discussions with SEQUAL's counsel, Malcolm Philips, on this question. The NRC agreed, however, that whether SEQUAL's proposal meets these regulations or not, there are paths which may allow use of experiential seismic data for non-USI A-46 plants, either through the license amendment process (10 CFR 50.90) or the exemption process (10 CFR 50.12), both of which have the same acceptance standard; namely, adequate protection of the health and safety of the public.

- The NRC staff would like to be in a position to conclude that the GIP method, as approved for NARE in USI A-46 plants, is consistent with the criteria currently embodied in the IEEE/ASME draft revision of IEEE-344 and ASME/QME. The SEQUAL

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representatives expressed the view that the method is consistent with the intent of the proposed industry guidance, and agreed to investigate what would be required to demonstrate this - particularly the question of equipment representation. The SEQUAL representatives pointed out that the important test for non-USI A-46 plants is that the method meets the regulations and provides adequate protection, not that it meets a proposed industry standard that may be a year or more away from publication.

- The SEQUAL representatives expressed the opinion that the application of the GIP for NARE in non-USI A-46 plants is no different than in USI A-46 plants. In this connection, the NRC staff indicated they are waiting to see the revision to the SQUG NARE guidelines that incorporates the NRC's comments in the above reference.
- A number of other questions regarding use of the GIP for NARE, consistency of implementation of the GIP for USI A-46, comparison of the GIP approach to that of the Advanced Reactor Corporation First-of-a-Kind Engineering (ARC FOAKE) project for Advanced Light Water Reactors (ALWRs), reviews of post-1985 earthquake data and the use of GIP Method A were also discussed. With regard to Method A, the NRC staff expressed the view that it will be very difficult to justify use of Method A for non-USI A-46 plants if the calculated amplified response spectra exceeds about 1.5 times the free field ground spectra, since these plants have more modern design spectra.

Conclusions

At the conclusion of the meeting, the NRC staff and SEQUAL agreed that the main question to be addressed at this stage is whether the use of experiential seismic demand/capacity data is considered to meet the NRC regulations (GDC-2 and Appendix A of Part 100). The NRC agreed to consider the material presented by the SEQUAL representatives and the discussions at this meeting and to inform SEQUAL of the results of the staff discussions on this question.

Mr. James Fisicaro expressed SEQUAL's appreciation for the NRC's willingness to work with the SEQUAL group on this matter of considerable importance to the utility members.

Original signed by K. Jabbour for:

Ronald W. Hernan, Senior Project Manager, Section 2
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Enclosures: 1. Attendance List
2. SEQUAL Handout

cc w/enclosures: See next page

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Conclusions

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Enclosures: 1. Attendance List
2. SEQUAL Handout

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SUMMARY OF MEETING WITH THE SEISMIC EXPERIENCE-BASED QUALIFICATION OWNERS GROUP (SEQUAL) ON SEPTEMBER 17, 1999, TO DISCUSS USE OF SEISMIC DATA BASE FOR EQUIPMENT QUALIFICATION

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**NRC MEETING WITH SEQUAL OWNERS GROUP ON
USI-A-46 RESOLUTION FOR NON-A-46 PLANTS**

FRIDAY, SEPTEMBER 17, 1999

ATTENDANCE SHEET

<u>Name</u>	<u>Affiliation</u>	<u>Phone No.</u>
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Pei-Ying Chen	NRC/DE	301-415-2789
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ENCLOSURE 1

SEQUAL

Seismic Experience-based QUALification Owners' Group

Presentation to
USNRC

September 17, 1999

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Agenda

- Opening Remarks
 - Purpose of Meeting
 - Background/Mission of SEQUAL
 - Motivations for using GIP/NARE Method
 - Legal/licensing Bases
 - Technical Bases
 - SEQUAL Plans
 - Q&A
 - Summary, Conclusions, Agreements
- ▶ Imbro, NRC
 - ▶ J. Fisicaro, Duke
 - ▶ G. Ferguson, Entergy
 - ▶ J. Richards, Duke
 - ▶ M. Philips, W & S
 - ▶ W. Schmidt, MPR
G. Hardy, EQE
 - ▶ G. Ferguson, Entergy
 - ▶ All
 - ▶ J. Fisicaro

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Enclosure 2

Purpose of Meeting

- Describe SEQUAL
- Outline SEQUAL plans and needs
- Describe reasons/bases for plans
- Describe relationship of GIP to
 - IEEE/ASME
 - FOAKE/ALWR
- Obtain NRC feedback

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Background/Mission

- Objective: To use GIP method approved for New And Replacement Equipment (NARE) as an acceptable method for demonstrating seismic adequacy in *non-A46 plants*.
- Basis: NRC has concluded GIP method meets purpose of applicable regulations and provides an adequate level of safety.
- SEQUAL: Nuclear utility owners group; members represent non-A46 domestic nuclear plants (~45 plants).

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Background/Mission

- Background
 - ▶ Initiated discussions 3 years ago
 - ▶ Investigated legal/technical considerations
 - ▶ Held discussions/teleconferences with NRC, legal counsel, NEI, and SQUG
- Over the past several years, SEQUAL has researched the technical and licensing bases for pursuing this goal.

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Background/Mission

- There have been interactions with the NRC over the past three years:
 - ▶ Teleconference with NRC (R. Wessman), R. Enis (TVA), G. Ferguson (Entergy), and M. Philips (W&S) in 1997 to discuss process for NRC review of SEQUAL product
 - ▶ Preliminary discussions also held with NRC OGC staff
 - ▶ Discussed plan to have lead plant (Waterford 3) send a 50.59 evaluation to NRC staff for review and discussion.

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Background/Mission

- SEQUAL decided to delay further discussions and submittals until GIP method was successfully demonstrated:
 - USI A46 reviews substantially completed
 - Resolution of open issues
- Method has been demonstrated, the A46 SERs are nearing completion.
- The time has come to move forward.

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Motivations for Using GIP/NARE Method

- Accepted by NRC for 2/3 of operating nuclear plants as providing an acceptable level of safety
- Over \$100 M invested by the industry.
- Process has matured over ~ 10-year period
 - Experience in applying to ~70 U.S. plants: practical, effective in enhancing seismic safety of plants.
 - World-wide acceptance and use: DOE, 10 international organizations/utilities in 7 countries, U.S. Codes.

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Motivations for Using GIP/NARE Method

- Desire for standardization of requirements among otherwise similar A46 and non-A46 plants.
 - Plants with A-46 and non-A-46 units on same site
 - Utilities with A-46 and non A-46 plants.
 - Provides for consistency within and across sites.
- Based on equipment performance in earthquakes, GIP method focuses seismic qualification efforts on risk-significant seismic issues.

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Motivations for Using GIP/NARE Method

- Significant reduction in availability of Appendix B suppliers; GIP/NARE method increases equipment availability, avoids outage extensions
- Reduced seismic qualification costs while maintaining safety.

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Cost-Benefit of Using GIP Method for NARE

- Cost savings of GIP method over testing and/or analysis range from about **\$500 to \$2,000,000** per component
- A significant savings has resulted from critical path procurement which avoided outage extensions (*in some cases, up to 4 weeks*)

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Legal/Licensing Issues

- Objective:
Discuss with NRC Staff Legal/Licensing issues and achieve a common understanding of the “licensing landscape” identifying areas of concern
- Overview:
Legal/Licensing issues revolve around the question of “How can non-A46 licensees alter their licensing bases to use the GIP?”

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Regulatory Landscape

- Primary Regulations of Concern
 - GDC-2 and 10 CFR Part 100 (in general, must provide reasonable assurance of seismic adequacy of necessary equipment)
 - No regulation requires seismic adequacy demonstration by “qualification testing” or compliance with IEEE 344-75
- Plant Commitments
 - Vary plant to plant

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NRC Staff Positions Regarding GIP Compliance with Regulations

- Provides an acceptable method for verifying seismic adequacy of equipment (*i.e.*, provides reasonable assurance of public health and safety)
- Regarding equipment seismic adequacy, meets the requirements of GDC-2
- Satisfies the purpose of all other NRC regulations relevant to equipment seismic adequacy, including 10 CFR Part 100

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NRC Staff Positions Regarding GIP Compliance with Regulations

- The reason given for not stating that the GIP meets Part 100 is a concern with the specific words of Appendix A stating that the “engineering method” used to insure safety functions are maintained:
“shall involve the use of either a suitable dynamic analysis or a suitable qualification test to demonstrate that structures, systems, and components can withstand the seismic and other concurrent loads. . . .” (emphasis added)

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Assessment of Section of Concern in Appendix A to Part 100

- “involved”, “suitable dynamic analysis”, “suitable qualification test”, or other characteristics of an acceptable “engineering method” are not defined
- The commission has explicitly stated that Part 100 criteria are to be applied with “deliberate flexibility.”
- Federal courts have upheld “inherent flexibility of 10 CFR 100” as well as “necessity of flexibility” in Appendix A

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*Assessment of Section of Concern in
Appendix A to Part 100*

- Attributes of “engineering method” were “not intended as a definitive treatment of the engineering aspects of seismic design”
[SECY-79-306, Encl. B at 2 (April 27, 1979)]
- A number of acceptable methods acknowledged in RG 1.100 and Sections 3.9.2 and 3.10 of SRP. Nothing limits acceptable methods to IEEE 344-75 or 87. (IEEE 344-75 notes other methods may be adequate.)
- Conclusion - Part 100 is to be interpreted flexibly.

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Does the GIP “involve . . . a suitable dynamic analysis or a suitable qualification test. . . .”?

- Of primary importance, the GIP provides adequate protection of public health and safety
- Qualification test data are used throughout the GIP, including in:
 - ▶ GIP equipment-specific requirements (caveats)
 - ▶ Relay and other equipment capacities (e.g., GERS)
 - ▶ Cable tray criteria

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Does the GIP “involve . . . a suitable dynamic analysis or a suitable qualification test. . . .”?

- Data from dynamic and static analyses are used throughout the GIP including in
 - GIP anchorage requirements
 - GIP requirements for seismic demand (> 40 ft.)
 - GIP tank criteria
- Conclusion: The GIP “involves” “qualification tests,” “dynamic analyses” and “static analyses” and satisfies the requirements of 10 CFR Part 100 related to equipment seismic adequacy

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Sound Administrative Policy Supports GIP Compliance Conclusion

- GIP provides reasonable assurance of public health and safety
- Qualitative risk-informed review supports conclusion
- Majority of industry using GIP
- NRC policy today supports sound regulatory structure that does not penalize plants without clear and convincing safety need

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*Regulatory Methodology - Use of GIP for
Non-A46 Licensees*

Case 1

- If GIP meets relevant NRC regulations to change licensing basis, licensee must do:
 - §50.59 analysis
 - for USQ, a License Amendment request
(acceptance standard is reasonable assurance of public health and safety)

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*Regulatory Methodology - Use of GIP for
Non-A46 Licensees*

Case 2

- **If GIP does not meet Part 100:**
 - **Non A-46 licensees required by regulations to meet Part 100 must seek an exemption**
 - Acceptance Standard - reasonable assurance of protection of public health and safety
 - **Non A-46 Licensees required by commitment to meet Part 100 must do § 50.59 analyses**
 - (and for a USQ, a License Amendment request)

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Legal/Licensing Issues Conclusion

- Specific words of Part 100 and staff guidance, coupled with sound administrative policy mandate conclusion that GIP satisfies the appropriate provisions of Part 100
- In that GIP satisfies appropriate NRC regulations, Licensing Basis revisions accomplished through §50.59 (and for a USQ, a License Amendment request)

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GIP Method Involves Analysis and Tests

- GIP equipment-specific requirements (caveats) based on experience, expert judgment, and shake table tests.
- GIP anchorage requirements based on analysis.
- GIP requirements for seismic demand (> 40' elevation) require dynamic analysis of buildings (ISRS).
- Relay and some other equipment capacities based on shake table tests (GERs).
- Cable tray criteria based on experience, tests and analysis.
- Tank criteria based on dynamic analysis

Overall conclusion: GIP method satisfies reasonable assurance standard, is consistent with regulations and there is sufficient regulatory basis to permit its use by non-A46 plants.

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Technical Bases

- The GIP was accepted for new and replacement equipment (NARE) in A-46 plants.
- The GIP method for NARE includes appropriate administrative controls (e.g., to address newer vintage equipment).
- Application of GIP for NARE at newer non-A46 plants is no different technically than at A46 plants -- both draw from same sources of equipment.
- Experience-based SEQ per GIP is an acceptable engineering method.
- Different procurement requirements for otherwise similar units (some on same site) create unnecessary complexity, confusion.
- Experience/lessons learned in application of method to >70 units world-wide demonstrate its practicality and effectiveness.

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SQUG/FOAKE/ALWR and IEEE/ASME Initiatives Are Self-Consistent, Build on SQUG Base

- SQUG experience data and methodology developed 1982-1992 to resolve USI A-46.
 - Methodology, criteria peer reviewed by seismic experts (SSRAP) and NRC.
 - Experience data base continues to grow (e.g., through 1998).
- ARC and DOE sponsored pilot project for ALWRs under first-of-a-kind engineering (FOAKE) funding
 - Limited set of components
 - Used SQUG experience data and capacity (level A); added higher capacity for specific components
 - Extended SQUG cable tray rules directly to higher capacities
 - Developed component-specific ordering specs.

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*SQUG/FOAKE/ALWR and IEEE/ASME Initiatives
Are Self-Consistent, Build on SQUG Base*

- IEEE/ASME, recognizing wide use of experience-based SEQ, initiated IEEE/ASME Special Working Group (SWG) to revise industry standards.
 - Provide over-arching guidelines (not implementing procedures or product specs).
 - Define qualifying earthquakes, how to build data base, how to develop rules.
 - No reference to SQUG or SQUG data; but consistent with SQUG/GIP development.
 - Several years away.

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*SQUG/FOAKE/ALWR and IEEE/ASME Initiatives
Are Self-Consistent, Build on SQUG Base*

- SQUG/FOAKE, IEEE/ALWR are self-consistent, all build on SQUG data and basic approach; differ in level of detail.
 - Implementation procedure (SQUG)
 - Component-specific specification requirements (FOAKE)
 - General criteria (IEEE 344)
- Only the SQUG/GIP method has been reviewed and approved as meeting NRC reg's and is available to use now.
- Future IEEE/ASME standards not expected to be inconsistent with SQUG/GIP method.
- Conclusion: The GIP is the only experience-based method available which has been reviewed and approved as an acceptable engineering method for EBSEQ. It is needed now.

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SEQUAL Plans and Needs

- SEQUAL owners group, under EPRI charter, is organized and active.
- The group needs and plans to adopt the GIP method as an alternative method for demonstrating seismic adequacy.
- A process for adopting the GIP is needed now; e.g.,
 - Owners group generic approach
 - Lead plant docket, with other members to follow suit
- Timing - Initiate process in Fall/Winter 1999.

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Summary

- The GIP methodology is a proven, technically-acceptable engineering method for demonstrating seismic adequacy of certain equipment and raceways within its scope.
- There are no insurmountable legal/licensing barriers to its use in non-A46 nuclear plants; in fact, the NRC has judged that the GIP method meets GDC-2 and the intent of all other applicable regulations.
- Utilities have considerable technical, schedular and cost incentives to adopt the GIP/NARE methodology for all operating plants
- Adoption of the GIP/NARE method is consistent with risk-informed/performance-based principles.

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NRC Feedback/Q&A

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Conclusions and Next Actions

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Regulatory Methodology - Use of GIP for Non-A46 Licensees

