SEQUAL

Use of the EBSEQ Method for Equipment Seismic Qualification in Non-A46 Plants

SEQUAL Owner's Group Meeting with USNRC
Rockville, MD
August 30, 2001

Meeting Agenda

- Introduction
- Overview of SEQUAL Objectives
- NRC Acceptance Review
- Discussion/Proposed Course of Action

SEQUAL Objectives

- Maintain the level of safety while reducing costs
- Focus resources on real earthquake vulnerabilities.
  - ➢ 20 years of earthquake experience
  - ➢ EBSEQ Method focuses seismic qualification efforts on seismic risk significant issues.
  - ➢ Greater emphasis on significant seismic issues such as anchorage, brittle materials, and chatter sensitive devices.

Motivations for using EBSEQ Method

- GIP/NARE accepted by NRC for majority of U.S. nuclear plants.
- Process has matured over 20 year period
  - ➢ Extensive involvement by industry and regulatory experts
  - ➢ Experience in applying to ~70 U.S. plants: practical, effective in enhancing seismic safety of plants.
  - ➢ Over 1000 engineers have been trained in the process.
  - ➢ World-wide acceptance and use: DOE, 10 international organizations/utilities in multiple countries, U.S. codes.
- Desire for standardization of requirements among otherwise similar A-46 and non-A-46 plants.
  - ➢ Plants with A-46 and non A-46 unites on same site or utilities with A-46 and non A-46 plants.
  - ➢ Provides for consistency within and across sites.

SEQUAL/NRC Interactions

- Meetings/Discussions with Staff
- Brian Sheron letter dated August 24, 2000
  - Earthquake experiential data for SEQ is permissible in the context of Part 100
  - Identified seven technical issues to be addressed
  - Requested formal submittal
  - Suggested Risk-Informed approach
- SEQUAL Actions
  - Developed regulatory analysis
  - Developed stand alone qualification document
  - Developed Risk-Informed analysis
  - Developed technical basis to address 7 issues
  - Submitted Topical Report on April 18, 2001

NRC Acceptance Review

- Responded to SEQUAL by letter dated August 13, 2001
  - Regulatory analysis – no feedback
  - Stand alone qualification document - addressed
  - Risk-Informed evaluation – no feedback
  - Technical basis to address 7 issues - addressed
  - Added one new technical issue

Regulatory Analysis

- SEQUAL Topical
  - Described compliance with GDC-2 and 10CFR100
  - Provides reasonable assurance of adequate protection of public health and safety
- NRC Response
  - Properly applied and controlled experiential method may be viable
  - EBSEQ method does not adequately resolve all concerns
- Proposed Course of Action
  - Close outstanding technical issues, or
  - Other

Risk Informed Evaluation

- SEQUAL Topical
  - Evaluation of risk impact in accordance with RG 1.174
  - EBSEQ method provides seismic safety comparable to that provided by current SRP criteria
- NRC Response
  - Not specifically addressed except "Regardless of what is shown in Section 6 [Risk Informed Evaluation] of the Topical Report the staff concludes that ..."
- Proposed Course of Action
  - Further discussion needed

Review of Technical Concerns

1. Concurrent Loads
2. GIP Reference Spectrum
3. Method A ISRS
4. Equipment Class Definitions
5. Spectrum for Equipment Classes
6. Subassemblies
7. GIP as Qualification Document
8. Qualification for OBE

1. Concurrent Loads

- SEQUAL Topical
  - EBSEQ method addresses normal operating loads
  - Accident loads require supplemental analysis
  - EBSEQ does not cover ASME Section III pressure boundary analysis
- NRC Response
  - Needs further clarification
- Proposed Course of Action
  - Revise topical to state "if concurrent accident load is significant for equipment, EBSEQ can not be used."

2. GIP Reference Spectrum for Capacity

- SEQUAL Topical
  - Developed new ground motion estimates for sites in question
  - Demonstrated reference spectrum still valid
- NRC Response
  - Resolved
- Proposed Course of Action
  - Resolved

3. Use of Method A Demand

- SEQUAL Topical
  - Median-centered demand is appropriate based on risk analysis
  - 1.5 x ground motion is appropriate estimate of median-centered ISRS within 40 ft. of grade
  - SEQUAL plants would justify 1.5 factor, same as A-46 plants
- NRC Response
  - Regardless of risk analysis, non A-46 plants must use design basis ISRS for seismic demand developed using methods previously approved by staff
- Proposed Course of Action
  - Further understanding of NRC position is needed

4. Equipment Class Definitions

- SEQUAL Topical
  - Gave basis for GIP equipment class definitions
  - Showed definitions based on more than just equipment functions, also dimensions, weight, etc.
- NRC Response
  - Classes are too broad
  - Cursory review of data showed "very dissimilar physical characteristics" within equipment classes
  - Class definition should include number of equipment items plus average and variance on equipment parameters
- Proposed Course of Action
  - Further discussion on equipment class boundaries (dynamic similarity vs. use of bounding analyses)

5. One Reference Spectrum for all Classes

- SEQUAL Topical
  - Provided basis for use of single Reference Spectrum to represent the seismic capacity of all equipment in the database
- NRC Response
  - Agreed with technical procedure in topical basis
  - Need to document 30 independent samples
  - An earthquake experience spectrum for each of the equipment classes would provide a more accurate representation of equipment seismic capacity
  - Use a weighted average (consistent with draft QME standard)
- Proposed Course of Action
  - Prepare a Reference Spectrum for two classes to demonstrate that the GIP Reference Spectrum is realistic for all the other classes

6. Evaluation of Subassemblies

- SEQUAL Topical
  - Describes the process for using EBSEQ for subassemblies
- NRC Response
  - Agreed with topical, except for use of Generic Equipment Ruggedness Spectra (GERS) for subassemblies
- Proposed Course of Action
  - Modify topical (Section 4) to eliminate use of GERS for subassemblies

7. GIP as Qualification Document

- SEQUAL Topical
  - Developed EBSEQ procedure as a stand-alone qualification process
- NRC Response
  - Concern adequately addressed
- Proposed Course of Action
  - Issue closed

8. Qualification for OBE

- SEQUAL Topical
  - ➢ New issue; not addressed in SEQUAL topical
- NRC Response
  - ➢ EBSEQ should address consideration of fatigue loading requirements
- Proposed Course of Action
  - ➢ Topical will be revised to add wording consistent with proposed ASME QME standard, section QR-A6810 on fatigue

Discussions

Closing Comments/Remarks