SQUG

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SQUG ACTIVITIES DURING A-46 IMPLEMENTATION

by Robert P. Kassawara, EPRI and John A. MacEvoy, W&S

With the resolution of USI A-46 well underway, the nature of SQUG activities is evolving away from regulatory issues and toward cost-driven issues. As a powerful, recognized entity with considerable clout in the industry, SQUG is devoting some of its efforts to the challenges of cutting unnecessary costs in equipment seismic qualification. The most immediate response to this challenge is our effort on the use of experience data for qualification of new and replacement equipment and parts (NARE), which moved into "high gear" in 1994 with SQUG's delivery of the first NARE training course.

SQUG also intends to organize task groups to handle issues of interest to a limited number of SQUG members. These independently funded task groups which are independently funded can analyze and resolve issues at a lower per member cost than for separate resolution by each member. For example, SQUG recently formed a task group to address Wej-It Wedge expansion anchor pullout loads. SQUG will, of course, undertake these efforts in addition to the essential ongoing core tasks involved in supporting utility resolution of USI A-46. These tasks include GIP technical maintenance, post earthquake investigation, database updates, A-46 and NARE training and interaction workshops, utility information exchange through the BBS and Newsletters and interaction with the NRC as a cohesive industry group on behalf of individual members.

SQUG's information exchange programs provide fast and efficient problem identification and resolution. Through SQUG, members have a support network of workshops, newsletters, electronic mail, meetings and personal contact with subject matter experts and members to interpret the GIP, resolve technical and licensing problems, answer questions from the NRC and otherwise help resolve problems correctly and cost effectively. Furthermore, the NRC has required participation in an information exchange as part of the USI A-46 resolution. Experience with other generic resolutions, such as station blackout and environmental qualification, shows that new and important issues are likely to arise as the resolution moves into the NRC inspection and enforcement phase, especially with the introduction of new NRC personnel and viewpoints. The SQUG information exchange process, by providing advance notice of NRC concerns from A-46 inspections and licensing actions, will be an invaluable service when preparing for an inspection.

SQUG's Management Guidelines and training programs provide a framework for coherent and efficient NARE program development by members. This is a new and very cost-effective process, sure to give rise to new issues, and SQUG will keep members up-to-date through the information exchange network. Furthermore, members can use the GIP for NARE only if the GIP is kept current with recent seismic developments. SQUG will monitor these developments and will update the GIP and database accordingly.

Closing the circle, so to speak, as the USI A-46 resolution moves from implementation to inspection and enforcement, SQUG will interact with the NRC as needed on behalf of members as inspections give rise to new issues. As with GIP development issues, SQUG will be on the front line, providing generic solutions wherever possible to avoid the need for direct individual utility responses.

These are some of the ongoing and upcoming developments that mark the evolution of SQUG efforts from the USI A-46 resolution and implementation to utility support during NRC inspection and enforcement as well as long-term use of seismic experience to lower the cost of equipment qualification (i.e., NARE).

SUMMARY OF SQUG WALKDOWN AT DONALD C. COOK NUCLEAR PLANT

by T. Satyan Sharma and P. R. Krugh, AEPSC

The Donald C. Cook Nuclear Plant is a two unit, four loop Westinghouse ice condenser PWR plant. The safe shutdown equipment list (SSEL) consists of approximately 830 components per unit including heat exchangers, tanks, and optional equipment in the spent fuel pool cooling system. The SSEL was prepared by an American Electric Power Service Corporation (AEPSC) task group with engineers from various disciplines including operations engineers from the plant.

Prior to the seismic review walkdown, anchorage verification was performed by a specially trained team of engineers using written and approved procedures. The anchorage verification team noted the location of anchorages, the physical characteristics of welds, assessed the quality of the anchor-to-base connections, and performed torque testing of anchor bolts. As-built configuration sketches were also completed for each component. All of the information prepared by this anchorage verification team was assembled into anchor packages and later reviewed by the seismic review team. About one third of the anchorages inspected were noted for special evaluation by the seismic review team. This anchorage verification activity has been a full time effort for a three man team for 2-1/2 years. This preparatory work has reduced the effort required by the seismic review teams.

Stevenson & Associates (S&A) are the consultants on the project for the walkdown and seismic evaluation portion of the project. The seismic walkdown of most of the SSEL components (about 1200 items) was completed in four weeks by three seismic review teams consisting of four people each from S&A and AEPSC. Each of these four weeks was separated by a one week break. Each team had two seismic capability engineers, one electrical engineer and one mechanical engineer. Plant operations engineers and the engineer from the site office who performed the anchor verification inspection were also part of the seismic review team. The walkdown of the components outside of the containment building was performed during normal operation using an area-by-area method and also by reviewing one class at a time. Components inside the containment building and outage-related electrical equipment were walked down for both units during refueling outages.

As a result of the walkdown, about 100 open items were identified. The open items were classified into four different categories: (1) an open item where more documentation was required, (2) an action item which required some minor maintenance such as tightening a bolt or installing a missing nut, (3) a GIP outlier, and (4) a non-conformance to the licensing basis.

To date, about 94% of the SSEL components have been walked down. Remaining work includes anchorage analysis of some components, additional relay evaluation and corresponding circuit analysis, and a final walkdown (one week) to evaluate the remaining components and any new components identified during the relay evaluation. We are planning to complete all required analyses and evaluations and prepare the draft report by July 1995. The NRC submittal is planned for September-October 1995.

NRC VISITS 1994 NORTHRIDGE EARTHQUAKE SITES
copied from Office of Nuclear Regulatory Research publication, "Weekly Highlight"

On February 7-9, 1994, Roger M. Kenneally from RES and Pei-Ying Chen from NRR visited sites damaged by the magnitude 6.8 Northridge Earthquake of January 17, 1994. This is the same general area affected by the magnitude 6.5 San Fernando Earthquake in 1971. The NRC staff members were part of a team comprised of members from the Department of Energy, Lawrence Livermore National Laboratory, Brookhaven National Laboratory, Electric Power Research Institute and EQE Engineering. In general, the team members visited sites that contained structures, equipment, and piping similar to those found in nuclear power plants. Sites visited included the Olive View Medical Center and adjacent cogeneration plant, AES Placerita Cogeneration Station, Southern California Edison Vincent and Pardee Substations, and the City of Los Angeles Department of Water and Power Sylmar Converter Station.

The severe and widespread damage was caused by extremely strong ground motion. Estimates of free field accelerations include: 0.9g Horiz., 0.6g Vert. at the Olive View Medical Center; 0.6g Horiz., 0.3g Vert. at Pardee Substation, and 0.9g Horiz. and 0.4g Vert. at Sylmar Converter Station.

The Olive View Medical Center was built on the same site as the facility that collapsed during the 1971 earthquake. Damage due to the 1994 earthquake was principally water damage associated with the failure of the fire suppression system. A cogeneration station adjacent to the hospital did have anchorage failure in a vertical oxygen tank. The Sylmar Converter Station sustained major damage during the 1971 earthquake. Facility upgrades, for instance, cabinet anchorage and bracing, addition of dampers to the suspended supports of the electric valves, reduced damage to mostly failure of ceramic insulators. It was estimated that only 10 percent of what could have failed did fail.

In general, brittle materials such as ceramic insulators received damage consistent with other earthquakes but well engineered structures and equipment that may have experienced ground motion far in excess of their design remained functional.

LESSONS LEARNED FROM RECENT EARTHQUAKES
by Stephen J. Eder, EQE

The screening criteria used for verification of the seismic adequacy of 20 classes of equipment for resolution of USI A-46 is contained in Section 4.3 and Appendix B of the SQUG GIP. This technical guidance was developed over the span of about 10 years, involving considerable effort on the part of SQUG, their consultants, SSRAP, and the NRC. Much of the technical guidance is based on experience data collected from about 10 major earthquakes which occurred in 1985 and earlier.

Since 1985, SQUG and EPRI have investigated the response of power and industrial facilities during 15 major earthquakes which have occurred at various locations in the world. The studies of the equipment subjected to these earthquakes are being conducted as part of maintenance of the SQUG GIP, as well as to enhance the earthquake experience data base in support of utility needs as the methodology advances.

These recent earthquakes have provided a wealth of information to reinforce the basic screening criteria in the SQUG GIP, to broaden the equipment class definitions covered by the experience data base, and to provide detailed data on the performance of modern vintage equipment in strong motion earthquakes. In addition, one of the primary focuses of these earthquake investigations is to identify all known instances of damage to equipment in the facilities being evaluated. Typically, about 97% of the standard industrial equipment at these facilities performed satisfactorily during and following the earthquake. Most of the remaining 3% which failed in some manner would either not be considered a credible failure mode at a nuclear plant (e.g., failure due to ground settlement) or would be covered by the technical guidance contained in the GIP.

To date, none of the new damage cases warrant immediate revision of the SQUG GIP. However, after reviewing this data, the SQUG Steering Group identified two damage cases which should be brought to the attention of Seismic Capability Engineers as examples of the need to consider "other adverse concerns" during seismic reviews. These examples should be considered as a supplement to their SQUG training exercise. These cases involve engine generators and pumps which were affected by the 1993 Guam earthquake (Magnitude 8.0).

Cracked Nozzles in Diesel Cooling Water Manifold

The first case involves three of eight diesel generators that suffered cracked manifold nozzles in the jacket cooling water system. The engine generators were skid-mounted on vibration isolators that appeared to be well restrained by bumpers for all directions of response. The six inch diameter cooling water lines were supported by all-thread rod members, some suspended and others cantilevered up from the floor. About 70 feet of these cooling water lines had no lateral restraint. A braided steel-reinforced, flexible coupling connected the piping to the cast iron manifolds near the top of the diesel engine. It appeared that the seismic induced piping displacements resulted in loads sufficient to cause the cracking of the manifolds.

While this failure mode potential is not specifically addressed by GIP caveats for engine-generators, it should be identified by Seismic Capability Engineers trained in similar caveats such as evaluating attached lines for adequate flexibility, being aware of the piping/nozzle load screening rules for horizontal and vertical pumps, specifically evaluating the use of cast iron components, and exercising judgment when evaluating equipment for "no other concerns".

Pump With Very Long Discharge Lines

The second damage case involves nineteen out of several hundred pumps in the water and sewage systems serving the Island of Guam. The damage included instances of leaking packing, excessive vibration during restart, motor burnout, and circuit breaker trips. One notable common characteristic of the damaged pumps was that their discharge lines were attached to water mains which had several miles of straight runs across soft soil. While the exact cause of the damage to the pumps has not been positively determined (it is being studied in more detail), it may be related to hydraulic and/or mechanical effects associated with the long discharge lines. In any case, considering that similar discharge piping configurations are not typically used in nuclear power plants, we do not believe this instance of damage is applicable to pumps typically covered by the GIP.

The results of the study of these and other damage cases will be documented when complete. This information, as well as the new detailed experience data from the recent earthquakes, is being processed and will be made available to SQUG and EPRI members via supplements to the GIP reference materials and revisions of the electronic data base.

SQUG TRAINS THE TRAINERS by
David A. Freed

A one-day Walkdown Video Course Train-the-Trainer Seminar was held on April 18, 1994, in Alexandria, Virginia. The purpose of the seminar was to train utility personnel in the administration of the video version of the A-46 Walkdown Screening and Seismic Evaluation Training Course. Seismic Capability Engineers (SCEs) and training personnel were in attendance. Some key points from the seminar are:

- *It is essential that an experienced SCE be present during most of the course.* As a <u>minimum</u>, the SCE should be available to introduce key topics and field questions at key points during the course: beginning and end (including common thread example) of the sections which cover Capacity vs. Demand, Anchorage, Caveats and Seismic Interaction); Relay Evaluation; Tanks and Heat Exchangers, Cable Trays and Conduit Raceways, and all Case Studies;

- *The 40 hours of pre-course study and completion of the pre-test is a substantial amount of preparation, for which the walkdown course trainee must be given ample time to complete;*

- *A subset of the walkdown course should be defined for utility personnel who would like to "come up to speed" on the SQUG process but do not require (or desire) full walkdown training.* As a minimum, the personnel should view Tape 1 and Tape 2 which include introduction and overview material. After these two tapes, other sections could be chosen based on the type of activity in which they may be involved.

- *The participation of an SCE and training coordinator for the duration of the course is a significant resource commitment, but necessary for successful presentation of the course.* Suggested techniques for easing the burden are: spreading the course over five weeks, one day per week; holding a single course for multi-site utilities; and, full or partial participation of one or more SQUG subject matter experts (SME); e.g., bring in a SQUG SME just for the Cable Trays section of the course.

The Train-the-Trainer Seminar attendees agreed that the seminar was very useful, especially for those who had not taken the walkdown course. Contact Dave Freed, SQUG Training Coordinator at 703-519-0200 if you are interested in attending a seminar in late 1994 or 1995.

1994 SQUG Calendar of Events

Expansion Anchor Task Group Meeting
6/1 Palo Alto, CA

Follow-up Workshops
8/15 (SSEL/Relay) Chicago, IL
8/16 (Walkdown/IPEEE) Chicago, IL

Equipment Selection/Relay Evaluation Course (Fee Charged)
7/11-7/13 (Tentative) Alexandria, VA

Seismic IPE Add-On Course (Fee Charged)
10/3 - 10/5 New Orleans, LA

New and Replacement Equipment Course
9/19 - 9/21 San Antonio, TX

Full SQUG Meetings
6/27 - 6/28 Boston, MA
12/12 - 12/13 Orlando, FL

The Seismic Qualification Utility Group (SQUG) was formed in 1982 to develop a technically sound and cost effective alternative for verifying the seismic adequacy of equipment installed in older nuclear power plants. This newsletter reports on the generic activities of the SQUG program as well as the results and lessons learned from utility implementation of the SQUG methodology.

Comments, questions, suggestions, and contribution of articles may be forwarded to:

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