SQUG

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GIP REVISION 3 SUBMITTED TO NRC

by Richard Starck, MPR

On July 31, 1995, SQUG submitted Revision 3 of the Generic Implementation Procedure (GIP-3) to the Nuclear Regulatory Commission (NRC) for review and approval. The changes proposed in this revision reflect new information obtained by SQUG and incorporate lessons learned by member utilities during the past three years while using the GIP to resolve USI A-46. Even though most of the SQUG members are nearly finished or have completed their USI A-46 programs, SQUG considers it important to formally validate the updated criteria and guidelines in GIP-3 since many of the SQUG utilities plan to continue using the GIP as an alternative for verifying the seismic adequacy of new and replacement equipment and parts for the remaining life of their plants.

SQUG is anticipating a speedy review and approval of the changes contained in GIP-3 by the NRC so that the benefits of using the updated criteria and guidelines may be realized in the remaining seismic reviews still being conducted and for future use of the GIP for new and replacement equipment.

The purpose of this article is to describe the changes included in GIP-3. These changes are grouped into three categories: changes which impose additional restrictions on the user, editorial changes, and typographical changes.

Additional Restrictions

New information has become available which shows that existing GIP-2 criteria and guidelines are not sufficiently conservative in three areas:

(1) The capacity of certain types of expansion anchors shown in GIP Table C.2-2 should be lowered while others should be raised. The makes and models of the expansion anchors which have revised capacity reduction factors (RT) are show in Table 1. These changes are based on additional test data including a wider variety of bolt types. The results of this work are documented in EPRI Report NP-5228, Revision 1, Volume 1.

(2) The minimum natural frequency of substructures in control panels and benchboards should be raised from 11 Hz to 13 Hz when an in-cabinet amplification factor of 4.5 is used from GIP Table 6-2 or when using the GENRS computer code from Screening Level 3 of GIP Section 6.4.2 for establishing the seismic demand on relays mounted on these substructures. This change to a more conservative cutoff frequency is a result of further evaluations conducted by SQUG.

(3) The allowable capacity of the base plate welds on the chairs of horizontal tanks and heat exchangers should be lowered by a factor of two as determined in the equation in Step 4 of Section 7.4.2 of the GIP. This change brings the GIP into agreement with EPRI Report NP-5228, Revision 1, Volume 4, the reference report used to establish the GIP guidelines for evaluating the seismic capacity of tanks and heat exchangers.

The SQUG members have been informed of these three additional restrictions during the course of evaluating these changes to the GIP through various SQUG meeting presentations, meeting reports, and newsletter articles.

Table 1
Changes in GIP-3 Pullout and Shear Capacity Reduction Factors (RT) by Types of Expansion Anchors

Manufacturer	Product Name	Load	Old RT	Revised RT
Star	Steel	Pullout	0.6	0.75
		Shear	0.6	1.0
	Stud	Pullout	0.6	0.75
		Shear	0.6	0.75
WEJ-IT	Stud	Pullout	0.6	0.75
		Shear	0.6	1.0
	Wedge	Pullout	0.75	0.5
		Shear	0.75	0.75
Hilti	Sleeve (3/8-inch)	Pullout	0.6	0.5
		Shear	0.6	1.0
	Sleeve (½ to 5/8-inch)	Pullout	0.6	0.75
		Shear	0.6	1.0
"Unknown"	3/8-inch	Pullout	0.6	0.5
		Shear	0.6	0.75
	> 3/8-inch	Pullout	0.6	0.75
		Shear	0.6	0.75

Editorial Changes

Extensive use of the GIP during the past three years has shown that certain portions of it may cause confusion or may be misinterpreted. Therefore SQUG decided these areas should be clarified to assure that the original intent of the GIP is clearly understood. Several of these areas were identified by SQUG member utilities during the implementation workshops conducted by SQUG. SQUG considers it desirable to revise the GIP in these areas so that users and NRC reviewers will not misapply the GIP during seismic reviews of equipment. None of the changes of this type in GIP-3 modify the original intent of GIP-2 as approved by the NRC in their Supplemental Safety Evaluation Report No. 1.

Typographical Changes

A number of typographical changes were also made to GIP-3 along with the changes described above. These include changes to the arrangement and appearance of the printed material, and changes to correct spelling, format, syntax, and inconsistent nomenclature. These changes have no effect on the meaning or intent of the criteria and guidelines in the GIP.

RESULTS OF STUDY OF EQUIPMENT FAILURES FROM 1994 NORTHRIDGE EARTHQUAKE

by Paul D. Baughman, EQE

The 1994 Northridge Earthquake has received considerable study. Several equipment failures involving equipment categories in the GIP were reported. Since these failures could potentially impact existing GIP caveats or require new caveats, SQUG has followed up with further investigation. The purpose of this article is to describe the reported equipment failures and their impact on the GIP.

Transformer Short Circuits

Seven dry-type high voltage transformers suffered damage because of short circuits between the coils or bus bars and the metal enclosure. Three of the transformers had broken insulators; one of them caught fire. Three others had damaged bus bars. One had arcing damage only and could stay in service.

The transformers were located in industrial buildings near the epicenter of the earthquake. All of the transformers were 13.8kV to 480V, dry-type metal enclosed units. The coils of three of the transformers were supported on porcelain insulators, which had fractured. The other four transformers had coils which were not positively anchored. The probable cause of the damage was seen to be rocking and/or sliding of the coils, due to lack of positive anchorage or failure of the brittle porcelain insulators, resulting in contact of the coil or bus bar against the metal enclosure. Other transformers in the same buildings, which had internal bracing for the coils, had no damage.

The GIP contains caveats for dry-type transformers which require the coil assembly be positively anchored to the transformer enclosure framing and also require there be sufficient clearance between the coils and bus bars to preclude contact. The GIP requires that the seismic capability engineers verify the seismic adequacy of the load path for heavy internal components. Such a review would identify the vulnerability of the porcelain insulators. Therefore, it is not considered necessary to modify or add to the GIP caveats for these types of failures.

Valve Failures

Two valves in a modern hospital failed by fracture in the flange neck.

The valves were 3-inch pneumatic control valves in 4-inch chilled water lines. They were installed at the connection of the lines to the chiller. Investigation did not identify any seismic anchor motion or poor support concerns. Information reviewed indicated the valves were constructed of cast iron. The probable cause of the failures was that the anchor point stress in the piping at the chiller connection was increased because of the section reduction from 4-inch to 3-inch and exceeded the capacity of the cast iron material of the valve body. This resulted in failure because cast iron is a brittle material.

These valves are air operated. The GIP caveats preclude cast iron material in valve bodies. Therefore, there is no need to modify or add to the GIP caveats.

Switchgear Breaker Failure

A 12.5kV circuit breaker at a cogeneration facility failed to close after the earthquake.

The circuit breaker did not close because a microswitch that detects proper position (racked-in) was not actuated. The side rail alignment for the breaker is controlled by a pin. The rail is secured to the pin by an E-clip. On detailed inspection of the breaker, the E-clips were found to be missing from the pins allowing the rails to become misaligned resulting in failure to actuate the position switch. It was noted that other breakers had missing E-clips, although they had not malfunctioned.

This failure was the result of inadequate configuration management rather than a generic structural failure of the equipment or a manufacturing/installation anomaly. Because nuclear plant maintenance procedures would preclude leaving parts out of equipment, there is no need to modify or add to the GIP caveats.

Transfer Switch Failures

Several 480V transfer switches did not properly transfer from normal to emergency power during the earthquake. One switch became stuck between normal and emergency positions.

It was found that the affected facilities did not periodically test the transfer switches, or did not test under full load conditions, as part of a regular inspection and maintenance program. In contrast to this, at a financial data center located in the epicentral area that did have a good testing program, the same transfer switches functioned properly. It was concluded that the failures were due to low reliability from limited or non-existent testing and maintenance practices rather than from equipment structural vulnerabilities.

Nuclear plant inspection and maintenance programs assure high reliability and would preclude such failures. Therefore, these failures are not considered to have an impact on the GIP caveats.

Pump Bearing Damage

Bearing damage was reported on a horizontal pump at a cogeneration facility.

At a large cogeneration plant, operations personnel reported that after the earthquake a small horizontal pump did not run properly and upon disassembly was found to have flattened bearings. Upon investigation, the pump was found to be a typical horizontal pump, there were no piping anomalies and anchor motion was not evident. Several similar pumps at the same facility had no problems. It turned out that the bearings had been replaced shortly before the earthquake, and the pump had not been put into service until

after the earthquake. It was concluded that the bearing damage was most likely due to improper assembly rather than the earthquake.

Since this was a maintenance rather than a seismic problem, there is no impact on the GIP caveats.

Conclusion

Further investigation of the Northridge Earthquake equipment damage showed that the failures were either nonseismic in nature or were due to vulnerabilities which would have been detected by proper application of existing GIP caveats by trained seismic capability engineers. Therefore, no changes or new caveats are needed.

SQUG WELCOMES NEW MEMBERS

by Robert Kassawara, EPRI, and Neil Smith, ComEd

Three companies joined SQUG during the past year: **OKG AB** of Sweden, **Siemens AG** of Germany, and **Electricité de France**. Including our "veteran" European members, **Nuclear Electric** in the U.K., **Tractebel** in Belgium, and **Central Nuclear de Almarez** in Spain, SQUG now has six international partners who comprise nearly 20% of our membership. Mr. Roger Axellson will be the SQUG representative for OKG AB (Phone: 011-46-491-86278, E-mail: rax@okg.se); Mr. Karl-Christian Fraas will represent Siemens AG (Phone: 011-49-9131-18-4432, E-mail: frasskar@erls13.kwu.siemens.de); and Mr. J.P. Touret will be the SQUG representative for Electricité de France (Phone: 011-33-7282-7554). Again, to our new members, Välkommen, Wilkommen, and Bienvenue. We look forward to your active participation in SQUG activities for your benefit and to help us reach our goal of extending the use of the SQUG methodology to world-wide application.

SQUG MEMBERS TRAIN THEIR OWN SCEs

by Dave Freed, MPR

In early 1994, each SQUG member representative received a package of videotape training materials for their use in presenting the A-46 Walkdown Screening and Seismic Evaluation Training Course at their company. This package gave each SQUG member the ability to train its own personnel in the SQUG methodology both for supporting resolution of USI A-46 as Seismic Capability Engineers (SCEs), and as a prerequisite for further training on how to apply the method to New and Replacement Equipment (NARE).

To date, SQUG members have conducted over a dozen sessions of the Walkdown Course using this videotape training material. SQUG members who have presented this course include: Carolina Power and Light, Westinghouse Savannah River, ComEd, New York Power Authority, and OKG AB (Sweden). DOE has also hosted courses which were based on the SQUG video course, but were tailored to DOE facilities. In all cases, the course has been given successfully, and there has been plenty of positive feedback, both from the course participants, and the course administrators.

Feedback

Gary Driesen (Westinghouse Savannah River) told us that "SQUG should be congratulated for preparing a set of training materials that is high quality and well organized. They are a pleasure to work with. The videotapes in particular were judged to be excellent by the students. The Administrator's Manual was easy to follow and a definite aid in organizing the course presentation." **Ron Knott (Carolina Power and Light)** reported that his company has completed four sessions of the video Walkdown Course so far. Ron noted that "these video based training sessions have been easy to perform . . . The course flows well and allows for trainees to revisit an issue a number of times if needed. All the necessary guidance is included in the Administrator's [Manual]. We have had very little difficulty performing the class [ourselves]." **Bruce Lory (ComEd)** has held several sessions and has "graduated" over 30 SCEs. Bruce said that the courses at ComEd have been "very successful," and, notes that the Train-the-Trainer seminar (held in 1994) was invaluable in preparing him to hold the video course.

Tips and Lessons Learned

Members have provided valuable advice and comments for those SQUG members planning to hold sessions of the video Walkdown Course. The following is a summary of the key comments:

- The site-visit is the most useful part of the training course. Some utilities have added time to the site visit to allow more equipment to be walked down. Several members selected equipment for the trainees to walkdown which had already been inspected for USI A-46. This saved time preparing "answer" SEWS and stimulated participant discussion.

- The students must spend sufficient time to prepare for the course including completion of the pre-test. The Administrator's Manual recommends setting aside 40 man-hours for this preparation. CP&L characterizes the training as a "two-week course" so that the attendees avoid scheduling conflicts during the week prior to the course when they should be studying.

- For class sizes over about 10-15 trainees, it is highly recommended that more than one person administer the course. The logistics, course administration, and 40-hours of fielding "tough" questions can overwhelm even the most experienced course administrator!

- In order to relieve some of the scheduling burdens on attendees, some utilities presented the 5-day course over several weeks, spending 1-2 days per week.

SQUG Support

SQUG continues to support members who would like to hold sessions of the training course. Services include: filling orders for additional course materials; answering questions both before, during and after the course; and providing access to the SQUG subject matter experts (SME's) for assistance in giving the course. SQUG also assists in placing utility engineers in courses being held by other member utilities, so please contact us if you are planning a course, or wish to have people trained. If you do hold a training course at your facility, please forward the names, addresses and phone/fax numbers of the SCEs to us so that they can be placed on the SQUG mailing list for the Newsletter and other SQUG related correspondence. Also include a copy of any course evaluation forms and your comments so that we may continue to improve the course materials and inform the membership of lessons-learned.

All correspondence and questions concerning SQUG training should be sent to Dave Freed, c/o MPR Associates, 320 King St., Alexandria, VA 22314, Phone: 703-519-0200, FAX: 703-519-0224, email address: dfreed@mpra.com.

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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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