IEEE Nuclear Power Engineering Committee
Subcommittee SC-2, Qualification

Minutes of Meeting SC2-03-1
Held April 23-24, 2003
San Francisco, California

Members Attending: See Table 2

Members Absent: See Table 2

Guests: Stephen Alexander, NRC
Robert Konnik
Thomas Koshy, NRC
Donald Moore
Ted Quinn, Business America Corp./IEC SC45A WG A9 Convenor
Brian Rolfe
Paul Shemanski, Consultant
Toni Wittamore

1. Introduction

The SC-2 Chairman, Satish Aggarwal, opened the meeting on Wednesday April 23, 2003 at approximately 1:15 pm and welcomed everyone in attendance. The meeting agenda (Attachment 1) was reviewed, and the following change was proposed:

- Item 9: The EPRI information was not available for presentation at this meeting; therefore, this item was deleted

With the inclusion of this change, the agenda was approved.

Opening remarks were made by the SC-2 Chairman in which he thanked everyone for attending the meeting, and Bechtel for hosting the meeting. Each of the attendees was asked to introduce themselves.

The SC-2 Chairman provided an overview of the SC-2 goals and objectives for this year. He noted that the subcommittee is responsible for IEEE standards related to qualification, and that these standards are international and are used by many countries. The subcommittee has an aggressive schedule to issue three standards this year; 323 on Qualification, 383 on Cables and Splices, and 344 on Seismic Qualification. To meet these goals, future meetings may be extended to 1½ days in length. The long-term goal of the subcommittee is to bring all of the qualification standards up to date in a timely manner.

The SC-2 Chairman then provided the following overview of the IEEE balloting process:

- When a Project Authorization Request (PAR) is approved for a standard, the subcommittee responsible for the standard assigns a working group to develop a draft of the standard.

- When the working group feels the draft is ready for balloting it is previewed to NPEC for approval to ballot.

- If NPEC approves the draft standard for balloting, the Chairman of the subcommittee responsible for the standard submits a suggested balloting pool. All IEEE members who are also members of the IEEE Standards Association (SA) can ballot on the draft standard. The ballot pool should be balanced with no more than 50% of the ballotters coming from any one area of industry. The working group that developed the standard does not have to ballot their own standard.

- In order for the ballot to be successful, a minimum of 75% of the ballot pool must return their ballot.

- In order for the standard to pass, a minimum of 75% of the returned ballots must be affirmative.

- The working group must address all comments submitted by the ballot pool. If they disagree with a comment and decide not to include it, a technical reason must be provided.

- IEEE then decides if the standard passes.

A comment was made that after a great deal of work by the working group members, arbitrary changes should not be made to the standards without input from the working group. The SC-2 Chairman stated that no arbitrary changes will be made to any of the standards. If NPEC requests a change be made to a standard, the working group Chairman can disagree and the standard will not pass. However, it should be noted that NPEC is the sponsor of the standards; therefore, their comments must be considered.

A suggestion was made that procedures should be developed for the various subcommittee activities, such as attendance requirements, balloting, etc. The Chairman noted that procedures will be developed for subcommittee activities that require guidance. The Vice Chairman was assigned to look into what procedures should be developed **[AI-03-1-1].**

2. Secretary=s Report

2.1 Review and Approval of Previous Meeting Minutes

The minutes of the previous SC-2 meeting 02-1 were opened for comment by the members. Hearing none, a motion was made to approve the minutes by Dave Horvath, seconded by Jim Gleason and the SC-2 members approved the minutes unanimously. It was noted that several new members did not receive the minutes from meeting 02-1; therefore, a request list was passed around and a copy of the past minutes will be sent to those names on the list **[AI-03-1-2]**.

2.2 Action Item Status

Action items from previous SC-2 meetings were reviewed at this meeting. Table 1 presents the status of past action items, along with new action items identified at this meeting.

Table 1 Action Item Status

Item No.	Description	Responsible	Status
Action Items from Meeting 02-1			
AI-02-1-1	Send out invitations to prospective new SC-2 members by December 2002.	Satish Aggarwal	CLOSED
AI-02-1-2	Appoint new officers for SC-2, and the working groups, by December 2002.	Satish Aggarwal	CLOSED
AI-02-1-3	Coordinate arrangements for the 1st SC-2 meeting in April 2003 (meeting SC2-03-1).	Satish Aggarwal	CLOSED
AI-02-1-4	Review draft of IEEE Standard 323 and provide any comments to Jim Gleason by October 15, 2002	All SC-2 members	CLOSED
AI-02-1-5	Submit revised draft of IEEE Standard 323 to SC-2 members by November 15, 2002.	Jim Gleason	CLOSED
AI-02-1-6	Prepare and present preview of IEEE Standard 323 to NPEC in January 2003.	Jim Gleason	CLOSED
AI-02-1-7	Submit the revised IEEE Standard 323 to IEEE in 2003 for balloting	Jim Gleason	CLOSED
AI-02-1-8	Resolve outstanding comments and prepare IEEE Standard 344 for balloting in 2003, including a preview to NPEC.	Jim Parello	OPEN
AI-02-1-9	Submit the revised IEEE Standard 344 to IEEE in 2003 for balloting.	Jim Parello	OPEN
AI-02-1-10	Finalize editing, have a recirculation review, and submit Draft 19 of IEEE Standard 383 for recirculation or reballoting by December 2002.	John White	CLOSED
AI-02-1-11	Submit the revised IEEE Standard 383 to IEEE in 2003 for balloting.	John White	CLOSED
AI-02-1-12	Confirm status of PAR for revising IEEE Standard 383 and write letter to Standards Board requesting an extension, if necessary.	John White	CLOSED
AI-02-1-13	Identify an author to prepare a booklet containing biographical data of SC-2 members.	Satish Aggarwal	OPEN
Action Items from Meeting 03-1			
AI-03-1-1	Identify procedures that should be developed to	Nissen Burstein	OPEN

	provide guidance on SC-2 activities.		
AI-03-1-2	Provide minutes of meeting 02-1 to members that did not receive them.	Robert Lofaro	OPEN
AI-03-1-3	Coordinate meeting arrangements for meeting 03-2.	Satish Aggarwal	OPEN
AI-03-1-4	Identify standards that might be developed jointly with IEC.	Satish Aggarwal	OPEN
AI-03-1-5	Look into sending an SC-2 representative to the IEC meeting in Montreal.	Satish Aggarwal	OPEN
AI-03-1-6	Send copies of the latest draft of standards 323 and 383 to all SC-2 members.	Satish Aggarwal	OPEN
AI-03-1-7	Develop a PAR for IEEE Standard 334 on motors by July 15, 2003.	Bill Newel	OPEN
AI-03-1-8	Provide a copy of the report discussing the use of Arrhenius to address humidity.	Kjell Spang	OPEN
AI-03-1-9	Submit a draft of Standard 344 for SC-2 review by June 2003	Jim Parello	OPEN
AI-03-1-10	Issue a new PAR for Standard 572 on connectors by July 1, 2003.	Bill Hadovski	OPEN

2.3 Alligator Fund

The alligator fund is made up of voluntary contributions from SC-2 members to defray the cost of meeting rooms, refreshments, and other meeting expenses. The previous balance was $195, which was collected at the 02-1 meeting. An expense of $25 was incurred for gratuities to the hotel staff for meeting

room arrangements at the 02-1 meeting in Scottsdale. Contributions were not requested from the members for this meeting since Bechtel hosted the meeting at their offices in San Francisco. The fund balance is now $170. Additional contributions to the fund will not be collected for 2003.

2.4 Membership

Satish noted that invitations to join SC-2 were sent out to prospective new members after the last meeting and a total of 71 people accepted membership in the subcommittee for the 2-year term 2003-2004. This closes action item AI-02-1-1. It was further noted by the Chairman that, to remain a member of the subcommittee, active participation is expected. **The attendance policy will be that if a member misses two consecutive meetings, their membership in the subcommittee will be terminated**. This policy is necessary to ensure that a quorum of members is obtained at each of the meetings. If a member cannot attend a meeting, a proxy should attend in his or her place

The subject of new officers for SC-2 and the working groups was then addressed. Satish noted that an officer's term is for 2 years, after which the term can be renewed once, giving a maximum term of 4 years. Satish then proposed the following slate of officers for SC-2 for the 2-year term 2003-2004:

- Vice-Chairman – Nissen Burstein
- Secretary – Robert Lofaro
- Assistant Secretary – Patrick Gove

A motion was made by Dennis Dellinger to approve the entire slate of officers. The motion was seconded by Jim Gleason and was approved unanimously by the SC-2 members.

3. SC-2 Chairman=s Report

3.1 NPEC Activities

It was noted that the next NPEC meeting will be in July. The subcommittees are encouraged to meet at the same time as NPEC to facilitate attendance at the NPEC meeting by the various subcommittee members.

3.2 Future Meeting Locations

The subject of future meeting locations was opened for discussion. A suggestion was made that the location alternate between the east and west coast to minimize the travel burden on the various members from each location. The attendees suggested various meeting locations and a vote was taken. It was decided that the next SC-2 meeting would be held in Florida; however, a consensus could not be reached on the exact location. It was decided that the SC-2 Chairman would select the specific location in Florida based on potential hosts for the meeting. A tentative date of October 2-3, 2003 was set for the next SC-2 meeting. Satish will coordinate the meeting arrangements, and a notice will be sent to all members once final arrangements have been made **[AI-03-1-3]**.

The Chairman opened the topic of having the next meeting in conjunction with the NPEC meeting in July

for discussion. One SC-2 member commented that, based on past experience, it appears to be more efficient for the subcommittee to meet on its own rather than with NPEC since there are more distractions when meeting with large groups. No other comments were voiced and it was decided that SC-2 would continue to meet on its own.

4. Working Group Reports

4.1 Working Group on IEEE Standard 323 (Qualification)

It was announced that Draft 5 of the standard is out for ballot and the ballot closes April 30, 2003. Comments were provided by SC-2 members and were addressed for the current draft. This closes action item [AI-02-1-4]. All comments were addressed and the draft was previewed to NPEC in January 2003. This closes action items [AI-02-1-5] and [AI-02-1-6]. The goal is still to publish the revised standard in 2003 **[AI-02-1-7]**.

Jim Gleason provided an overview of the process leading to the current draft of IEEE Std. 323:

- Over 100 comments were received from SC-2 members on Draft 2 from the request at the 02-1 meeting. Approximately 10% of the comments were non-specific and could not be addressed. Each of the remaining comments was addressed over a 2-month period. A database has been established with the comment resolutions.

- Draft 3 was previewed to NPEC in January and over 90% approved the draft for balloting.

- Two comments were received as a result of the NPEC preview 1) address mild environments in the standard, and 2) clarify that EMI, RFI and power surges are new considerations for new equipment; not for old equipment.

- The NPEC comments were incorporated and Draft 4 was submitted to the SC-2 Chairman for review.

- Satish provided additional editorial comments, which were incorporated to create Draft 5. This draft was then issued for balloting.

A working group meeting is planned for the June/July time frame to resolve ballot comments.

A comment was made that after incorporating the comments on Draft 2, Drafts 3 and 4 were not reviewed by the working group prior to being previewed to NPEC. The SC-2 Chairman noted that the process for reviewing drafts after incorporating comments will be addressed in the SC-2 procedures.

One of the more significant changes from previous versions of 323 is the deletion of the requirement for a double transient LOCA profile. Robert Lofaro and Jim Gleason gave a presentation on the technical basis for deleting the second transient (Attachment 2). The topic was then opened for discussion and the following comments were made:

- It was noted that the 1983 version of 323 allows the use of a single transient plus margin as an alternative to the double transient without margin. The reason for deleting the second peak was questioned.

- A comment was made that the second transient is needed to demonstrate the robustness of the

equipment.

- A question was raised as to whether the second transient was needed to account for multiple line breaks. The response was that it is not; multiple line breaks are addressed by developing an accident profile that envelops these conditions.

- A question was asked whether any tests have been performed both with and without the double transient to determine which method was better. The response was that this has not been done; tests are performed either one way or the other.

- A question was raised as to whether the second transient provides additional margin for jet impingement. The response was that it does not; if equipment is subjected to jet impingement, it is assumed to be failed.

- A comment was made that the second transient has been used in the past to provide additional margin. The response was that this is true, however, the use of higher temperatures and pressure in the accident profile are felt to be more appropriate.

- A comment was made that in Europe, a single peak is used since analysis has shown that a second transient is not adequate for adding margin.

Several comments were received from the attendees on the draft standard. The following is a summary of the comments provided:

- A question was raised as to how Draft 5 addresses mild environments in response to the NPEC comment. Jim Gleason responded that a section was added related to the documentation requirements for mild environment qualification. The wording was taken from 10 CFR 50.49, which provides specific guidance on the documentation requirements. In addition, the section on documentation requirements for harsh environments was expanded and more detail was provided.

- A question was raised as to whether consideration is being given to addressing gas-cooled reactors in the standard. The SC-2 Chairman responded that the subcommittee is looking ahead to the future and will consider including this type of reactor.

- The issue of including condition monitoring in the standard was questioned. It was noted that this was discussed in an IAEA effort and round-robin testing was performed to evaluate the reproducibility of condition monitoring tests by different laboratories. It was found that different results were obtained between different testing laboratories. The conclusion was that, in order for condition monitoring to be effective for qualification, standardized procedures must be adopted. It was suggested that this be addressed in 323. The SC-2 Chairman noted that this would be outside the scope of the PAR for this standard. However, a formal request can be directed to this subcommittee to address this issue and, if a majority of the subcommittee members agree, a PAR will be submitted for a future revision to the standard. It was also noted the IEEE Std. 1205 includes condition monitoring.

- A comment was made that Draft 5, Section 6.3.1.7 includes a requirement to monitor the safety function control signal, whereas now only leakage current is measured. Jim Gleason responded that the NRC 79-01b reviews showed that cables had been qualified with a voltage applied, but with no consideration given to monitoring the safety function. The intent of the statement in the current draft is to eliminate that possibility.

- A comment was made that Draft 5 includes humidity as an aging factor; however, there is no accepted method of accelerating humidity effects. Jim Gleason responded that there is equipment that is susceptible to humidity, such as Conax electrical penetration assemblies. For this equipment, aging must be performed under humid conditions. This has been done in the past and is not new. It was further noted by another attendee that research has shown that humidity adds significantly to the aging effects; therefore, for equipment that will operate in a humid environment, humidity must be addressed as part of the aging.

- A question was raised as to whether 323 should address ramp rates during the accident transient. The response was that Standard-323 has never had a requirement for ramp rate. It is the user's responsibility to specify any ramp rate requirement in the accident profile, if needed.

The Chairman noted that all comments from SC-2 members will be addressed. Even if the current ballot is successful, comments from SC-2 members will be addressed. If significant changes are made to the standard it will go out for a re-ballot with a 10-day recirculation. Any additional comments should be submitted to the 323 working group Chairman, Jim Gleason.

A comment was made that for IEC standards, if an affirmative vote is submitted only editorial comments may be submitted; not technical comments. The SC-2 Chairman responded that in the IEEE process technical comments may also be submitted with an affirmative vote.

A number of SC-2 members did not receive a copy of the latest draft of Standard 323. The Chairman committed to send all members an electronic copy of the draft standard **[AI-03-1-6]**.

4.2 Working Group on IEEE Standard 334 (Motors)

It was announced that Bill Newell is the new Chairman of this working group. Members are still needed for this working group and anyone with expertise in motors was invited to contact Bill.

The SC-2 Chairman noted that this standard was last reaffirmed in 1999 and is due for its next review in 2004. A PAR for this standard is needed and must be initiated now to meet the 2004 deadline. The working group should review the standard and determine if any changes are required, or if the current version of the standard should be reaffirmed. The SC-2 Chairman requested that the working group develop a PAR for this standard by July 15, 2003 **[AI-03-1-6]**. Once the PAR is developed, it will be presented to NPEC for permission to submit it to IEEE. Bill Newel noted that he is gathering information from the working group members for the PAR.

4.3 Working Group on IEEE Standard 344 (Seismic)

The current Chairman of this working group, Jim Parello, gave a presentation on the status of the standard (Attachment 3). It was noted that the standard must be revised by 2004. The group is now working to resolve comments from a previous ballot so that the standard can be finalized and resubmitted for balloting, first within SC-2, and then at the NPEC level **[AI-02-1-8]**. The goal is to issue the revised standard in 2003 **[AI-02-1-9].**
The following comments and questions were raised:

- A question was raised as to how a subcomponent is defined. Jim responded that it depends on how the qualification is performed and how the equipment is classified to begin with. One has to look at

how it would be qualified based on past experience

- A question was raised as to whether an effort was made to address test margin in the standard. Jim responded that they have identified the need to address hydrodynamic loads. It is part of the limitations section.

The SC-2 Chairman requested that the draft of 344 be issued for SC-2 review by June 2003 **[AI-03-1-8]**. The draft will be issued electronically and 2 to 3 months will be allowed for review and comment. In July the same draft will be issued to NPEC for review. The combined comments will then be taken to the working group for consultation. NPEC authorization to ballot must be obtained in July in order to meet the December deadline. Satish will request IEEE to issue an invitation to ballot. It takes 30 days to establish a ballot pool. There is no time limit for preparing the standard for the ballot.

4.4 Working Group on IEEE Standard 382 (Motor Operated Valves)

There is currently no formal working group active for this standard; therefore, no report was provided. The SC-2 Chairman noted that a Chairman is needed for this working group. Recommendations should be submitted to Satish.

The SC-2 Chairman provided an overview of the status of this standard noting that it was last issued in 1996 and was supposed to be reaffirmed in 2001. Satish had the date extended to December 2002; however, now it must be extended again. A PAR must be prepared identifying the changes needed, or recommending reaffirmation. Recommendations should be sent to Satish via e-mail. The goal is to have a PAR ready for this standard by July 1, 2003.

Jim Gleason commented that he recently completed a 382 program and the standard does need to be revised. For example, 8910 needs to be included.

4.5 Working Group on IEEE Standard 383 (Cables and Splices)

The Chairman of the working group, John White, provided a summary of the status of this standard. He noted that Draft 20 of this standard is currently out for ballot. This closes AI-02-1-10 and AI-02-1-12. If there are any additional comments they should be directed to him. The goal is still to issue the standard in 2003 **[AI-02-1-11]**.

The SC-2 Chairman noted that many of the members from the last 383 ballot pool have lost contact with IEEE. Therefore, IEEE Headquarters advised SC-2 to start with a new ballot pool for Draft 20.

John provided the following overview of the process for issuing the draft for balloting:

- Draft 18 was balloted several years ago and the ballot met the 75/75 criteria. Eight negative ballots were received, along with positive ballots with comments.

- The working group evaluated all of the comments received and issued Draft 19.

- Draft 19 went back to the working group for review and additional comments were incorporated, along with editorial comments received from IEEE. This resulted in Draft 20, which was submitted for ballot.

- All past negative ballotters have been spoken to and their comments were incorporated. If there is any question on the resolution of a comment, contact John.

The following comments were raised regarding Draft 20 of the standard:

- Section 6.4.4.1 requires that after the DBE exposure, the cable sample must pass a 40x mandrel bend test. Past experience has shown that cables can fail during the unwinding process. This has little to do with seismic qualification. Instead, the cables should undergo a "Bake and Shake" type test. John White responded that the working group has considered these issues. In the 1974 version of the standard, the 40x mandrel bend test was equated with seismic qualification; however, it is now recognized that this was incorrect. Originally, the mandrel bend test was included in the standard to address post accident requirements and ensure that the cable was not "dead" at the end of the accident. Draft 20 of the standard clarifies the purpose of the mandrel bend test as ensuring retained flexibility.

- A question was raised as to whether another test was considered for ensuring electrical performance margin since the mandrel bend test is a potentially damaging test. John White responded that the standard has been modified to eliminate the penalty for cables constructed with extra thickness of insulation, however, there is no other option to the mandrel bend voltage withstand test.

- The SC-2 Chairman noted that the issue of the mandrel bend test was raised in Japan. It has been argued that I&C cables do not see high voltage in service. The thought was that if the cables passed this test it would demonstrate their robustness. Therefore, the mandrel bend test was considered a "catch-all" for any unforeseen circumstances.

- A further comment on the mandrel bend test noted that the NRC had a meeting with NEI to discuss the validity of the 80Volt/mil AC or 240Volt/mil DC tests. It was submitted to the IEEE for review and the consensus was to retain the test.

- It was also noted that in the past 30 years, many cables have passed the mandrel bend test. Therefore, vendors are able to make cables capable of meeting this requirement and there is no need to reduce the high quality of the cables now.

It was noted that not all of the SC-2 members received a copy of the current Draft 20. The SC-2 Chairman committed to send an electronic copy of P383/D20 to all SC-2 members **[AI-03-1-6]**.

4.6 Working Group on IEEE Standard 572 (Connectors)

It was announced that Bill Hadovski is the new Chairman of this working group.

It was noted that this standard was issued in 1985 and reaffirmed in 1992. Several years ago a PAR was to be issued to modify this standard, but the process was delayed. It was decided to reaffirm the standard then submit a PAR for the next cycle to include not only multi-pin connectors, but also the connectors previously included in 383. The standard has been balloted with 1 negative ballot and 98% approval. The goal is to submit a new PAR in time for the July NPEC meeting **[AI-03-1-10]**. The SC-2 Chairman requested that the working group review the negative comment. If they cannot resolve it, they should prepare the PAR and submit the package to him.

Bill noted that he is looking for members to join the working group. Currently, he is the only member.

4.7 Working Group on IEEE Standard 649 (Motor Control Centers)

There is currently no formal working group active for this standard; therefore, no report was provided.

The SC-2 Chairman noted that this standard was reaffirmed in 1999 and is due in 2004. A Chairman is needed for the working group. Bob James was recommended as a new member for this working group. Additional recommendations should be submitted to the SC-2 Chairman.

4.8 Working Group on IEEE Standard 650 (Battery Chargers and Inverters)

The Chairman of this working group, Dennis Dellinger, gave a summary of the status of this standard. The standard was reaffirmed in 1998 and is due for review in 2003. A PAR is in place and is good until 2005.

Dennis noted that work on the standard was held up until 323 and 383 were issued. Also, he would like to see the latest draft of 344.

The working group has 6 members. Bud Ferry was recommended as a new member for this working group.

5. Liaison Reports

5.1 NRC Liaison Report

Satish Aggarwal provided the NRC liaison report, which summarized activities related to qualification of electrical equipment in nuclear plants. Work is continuing on Generic Safety Issues 168 related to qualification of cables. He noted that a Regulatory Issue Summary (RIS) will be issued on GSI-168 that will summarize the results of the technical assessment performed. It will include a summary of condition monitoring techniques evaluated. He also noted that the technical assessment performed by the Office of Research is available from the NRC Public Document Room (PDR). If anyone is interested in obtaining it, they should send a request to Satish and he will provide the PDR identifier.

6. Technical Presentations

Periodically, technical presentations are included on the SC-2 meeting agenda. The purpose of these technical presentations is to keep members abreast of new research that is being performed and is relevant to the work of the subcommittee. During the current meeting, the following technical presentations were given:

- On Wednesday April 23, Bob Lofaro and Jim Gleason gave a presentation titled "*Single vs. Double Transient LOCA Profile in IEEE Qualification Standard 323*." This presentation discussed the technical basis for deleting the second transient from the accident profile used in qualification testing. A copy of the presentation is included as Attachment 2. Comments and questions raised during the

presentation are included in the section on working group 323.

- On Wednesday April 23, Ted Quinn gave a presentation titled "*Introduction to the Nuclear Industry Segment, International Electrotechnical Commission (IEC) Standards Activities."* It was noted that IEC is interested in developing joint standards with the IEEE. A copy of the presentation is included as Attachment 4. The following comments were made regarding this presentation:
  - The SC-2 Chairman noted that the IEC has a similar standard to IEEE Standard 323, and one of the goals is to issue this standard with a joint IEEE/IEC logo. Efforts are underway to achieve this goal.
  - A comment was made that to develop an IEC standard, 80% of the member countries must agree to participate in its development. If there is insufficient interest, a standard will not be developed. Using IEEE Std. 323 as a basis for developing an IEC standard would facilitate getting member countries to participate. It was further noted that NPEC has directed IEEE SC-6 to develop a standard on RFI/EMI. This would be another area for a potential joint effort with IEC. Also, IEEE Std. 1205 was recently revised. It is consistent with the U.S. license renewal process and it would provide a good starting point for an IEC standard.
  - The SC-2 Chairman noted that a dialogue has been opened between IEEE and IEC regarding joint standards. He will try, before the July NPEC meeting in Boston, to identify several standards to work on jointly with IEC as a trial **[AI-03-1-4]**. Currently, 323 and 344 are potential candidates for a joint effort. The Chairman will also look into sending an SC-2 representative to the IEC meeting in Montreal **[AI-03-1-5]**.

- On Thursday April 24, Paul Shemanski gave a presentation titled *"License Renewal and Equipment Qualification."* It was noted as part of the presentation that the current status of license renewal applications is available on the NRC web site. Applications are expected to be received at the rate of 6 to 7 per year for the next 5 to 10 years. A copy of the presentation is included as Attachment 5. The following comments were made:
  - A question was raised that the Arrhenius methodology is based on temperature. What about the synergistic effects of humidity? The response was that humidity has typically not been accounted for in past qualification tests.
  - A further comment was made that 10 CFR 50.49 does require that synergistic effects be addressed. The IEEE 323 standard does state that some materials will experience different aging effects based on sequential radiation and thermal aging. The most severe sequence should be used. This will vary based on the materials used.
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  - Kjell Spang commented that work has been performed showing that Arrhenius can be extended to address humidity by adding another term to the exponent in the Arrhenius equation. Also, work has been performed on aging of materials both with and without humidity. The results showed a significant difference in the materials degradation. In Sweden, humidity is not included in aging since the service environments are typically dry. Instead, inspections are performed to ensure the environment is not humid, for example due to leaks. Schell will summarize this work and provide a copy for SC-2 members **[AI-03-1-8]**.
  - Another comment was made that there has been a trend to eliminate materials that are susceptible to humidity; for example nylon.

- A question was raised as to whether there is any ongoing effort in IEEE to address license renewal condition monitoring technology for cables. The response was that IEEE 1205 has condition monitoring information in it. Dave Horvath offered to give a presentation on 1205 at a future meeting.
- A question was raised as to what IEEE subcommittee is responsible for standards addressing license renewal. The SC-2 Chairman responded that license renewal issues related to aging are addressed in IEEE Standard 1205, which is the responsibility of SC-3. Issues related to qualification are addressed in 323, which is the responsibility of SC-2. However, all of the subcommittees work together. If there is an issue that needs to be addressed that is outside the scope of this subcommittee, it can be brought to NPEC for assignment to another subcommittee. Also, a white paper can be developed and presented to the subcommittee. If a consensus agrees that the issue should be addressed, the white paper can be published and used as a basis for a standard revision.
- Dave Horvath, the past Chairman of SC-3 noted that IEEE Standard 1205 includes input from Calvert Cliffs and Oconee, the two lead plants for license renewal. If anyone has additional information that should be addressed in 1205, they should let Dave know since 1205 will be up for reaffirmation soon.
- It was noted that NPEC has directed SC-3 working group 3.4 to review all of the IEEE standards to determine if they need to be revised to address aging. This indicates that aging is a recognized concern.
- It was noted that the latest draft of 323 includes condition monitoring as an option for license renewal.

- On Thursday April 24, Stephen Alexander of the NRC gave a presentation titled "*Equipment Qualification through Commercial-Grade Dedication*." A partial copy of the presentation is included as Attachment 6. The full presentation will be provided upon request to the SC-2 Secretary when it is received from the author.

7. New Business

The SC-2 Chairman announced that NPEC has a publication that provides an overview of the various subcommittees and working groups. This will be updated in 2004. A copy was circulated for information.

An example of a PAR was also circulated for information, along with the format for Chairman's reports.

The Chairman requested that any lessons learned from past meetings and recommendations for future meetings should be sent to him.

The meeting was adjourned at approximately 1:15 pm on Thursday April 24, 2003.

Minutes Prepared by:
Robert Lofaro
Secretary, IEEE/SC-2

List of Attachments:
1. SC-2 Meeting 03-1 Agenda
2. Presentation by R. Lofaro and J. Gleason on Single vs. Double Transient LOCA Profile
3. Presentation by J. Parello on the status of Standard 344
4. Presentation by T. Quinn on IEC
5. Presentation by P. Shemanski on License Renewal
6. Presentation by S. Alexander on Commercial-Grade Dedication

Table 2 SC-2 Members in Attendance at Meeting 03-1in San Francisco, CA

Name/Company	Address	Dates Attended	
		4/23	4/24
Aggarwal, S. K. (Satish) – Chairman SC-2 U.S. Nuclear Regulatory Commission Tel. (301) 415-6005 Fax (301) 415-5074	Washington, DC 20555	**X**	**X**
Alonso, Javier Tel. +34-91-659-8696 Fax +34-91-659-8677	Avda. Montes de Oca 28709 San Sebastian de los Reyes Madrid, Spain	**X**	**X**
Bartonicek, B. (Bohumil) Nuclear Research Institute Rez plc Tel. +420-266-173579 Fax +420-266-173580	250 68 Husinec Rez 130 Czech Republic	**X**	**X**
Baughman, P. D. (Paul) ABS Consulting/EQE Tel. (603) 778-1144 Fax (603) 778-7495	118 Portsmouth Avenue Suite B302 Stratham, VA 03885	**X**	**X**
Bharteey, Brij Tel. (518) 382-0056 Fax (518) 382-0283	112 Erie Blvd. Suite 3 Schnectady, NY 12305		
Behera, A. K. (Anup) Kiran Consultants, Inc. Tel. (630) 515-2650, ext. 17 Fax. (630) 515-2654	1401 Branding Lane Suite 255 Downers Grove, IL 60515	**X**	**X**

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Brewington, T. (Tom) Wyle Laboratories Tel. (256) 837-4411, ext. 512 Fax (256) 837-3363	7800 Highway 20 West Huntsville, AL 35806	**X**	**X**
Brooks, C. (Candace) STP Nuclear Tel. (301) 972-8543 Fax (361) 972-7184	P.O. Box 289 MS305 Wadsworth, TX 77483	**X**	**X**
Brown, R. A. (Rufus) Tel. (770) 594-1276 Fax	1024 Saratoga Dr. Alpharetta, GA 30022		
Burstein,, N. M. (Nissen) – Vice Chairman SC-2 Framatome ANP Tel. (434) 832-2501 Fax (434) 832-2683	3315 Old Forest Rd. M/C OF54 Lynchburg, VA 24506-0935	**X**	**X**
Butcher, C. (Craig) Tennessee Valley Authority Tel. (423) 751-8250 Fax (423) 751-8247	1101 Market Street LP 4H Chattanooga, TN 37402-2801	**X**	**X**
Casadevall, S. (Steve) ASCO Valve Inc. Tel. (973) 966-2512 Fax (973) 966-2624	50 Hanour Road Floham Park, NJ 07932		
Chapman, G. V. (Garry) Trentec, Inc. Tel. (513) 528-7900 Fax (513) 528-9292	4600 East Tech Drive Cincinnati, OH 45245	**X**	**X**
		X	**X**

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Channarasappa, S. (Suresh) Westinghouse Electric Co. Tel. (724)-733-6587 Fax	1760 Golden Mile Hwy. Monroeville, PA 15746		
Chipkin M. (Marty) Nine Mile Point Nuclear Station Tel. (315) 349-2825 Fax (315) 349-1579	P.O. Box 63 Lycoming, NY 13093	**X**	**X**
Chivers, J. (Jeff) Rosemount Nuclear Tel. (952) 949-5377 Fax (952) 949-5147	8200 Market Blvd. Chanhassen, MN 55317	**X**	**X**
Choi, S. Y. (Sun Yeong) Korea Atomic Energy Research Institute Tel. +82-(42) 868-8372 Fax +82-(42) 868-8256	Box 105, Yuseong Daejeon, 305-600 Korea	**X**	**X**
Dean, J. M. (James) Applied Energy Services, Inc. Tel. (203) 730-0587 Fax (203) 744-5192	14 Eagle Rock Hill Rd. Bethel, CT 06801	**X**	**X**
Delcea, L. N. (Liviu Nicolae) Tel. +40-241-80-1658 Fax +40-723-111-627	Medgidiei St. No. 1 C.P. 42, Cernavoda 08625 Constanta, Romania	**X**	**X**
Dellinger, D. E. (Dennis) Solidstate Controls, Inc. Tel. (614) 846-7500 Fax (614) 885-3990	875 Dearborn Drive Columbus, OH 43085	**X**	**X**
Di Benedetto, P. (Philip)	123 French Farm Road		

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Tel. (978) 681-9009 Fax (978) 681-8586	North Andover, MA 01845		
Duong, Q. H. (Quang) DTE Energy Tel. (734) 586-1813 Fax (734) 586-4911	6400 N. Dixie Hwy 125 EF2-TAC Newport, MI 48166		
Drumm, F. (Frank) Tyco Electronics Tel. +49-89-6089-567 Fax +49-89-6089-445	Raychem GmbH Finsinger Feld 1 85 Ottobrunn, Germany	**P**	**P**
Esterman, J. S. (Jeffrey) Exelon Corp. Tel. (630) 657-3839 Fax (630) 512-4615	4300 Windfield Rd. Warrenville, IL 60555		
Evans, K. (Keith) Atomic Energy of Canada Tel. (905) 823-9060, ext. 6170 Fax. (905) 403-7337	2251 Speakman Drive Mississauga, Ontario L5K 1B2 Canada		
Fargo, W. D. (Wells) Southern California Edison Co. Tel. (949) 368-2525 Fax (949) 368-2122	3214 Legendario San Clemente, CA 92673-3811		
Faya, A. J. (Artur) Canadian Nuclear Safety Commission Tel. (613) 996-0023 Fax (613) 943-1292	280 Slater Road Ottawa, Ontario K1C 5S9 Canada	**X**	**X**
Francis, R. L. (Robert) Wyle Laboratories	7800 Highway 20 West Huntsville, AL 35807		

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Tel. (256) 837-4411 ext. 315 Fax (256) 837-3363			
Gleason, J. (Jim) GLS Enterprises, Inc. Tel. (256) 881-9868 Fax (256) 881-4498	1819 Cross Creek Road Huntsville, AL 35802	**X**	**X**
Gove, P. (Patrick) – Assistant Secretary SC-2 Black & Veatch Tel. (913) 458-7834 Fax. (9130 458-2491	11401 Lamar Overland Park, KS 66213	**X**	**X**
Hadovski, W. L. (William) Westinghouse Electric Co. Tel. (860) 731-6258 Fax (860) 731-6256	2000 Day Hill Road Windsor, CT 06095	**X**	**X**
Helander, P. (Peter) Tel. +46-18-51-1836 Fax +46-18-51-1894	Dag Hammarskjolds vag 13 752 37 Uppsala, Sweden		
Hencey III, T. (Tom) Scientech, Inc. Tel. (727) 669-3047 Fax (727) 669-3100	1393 Indian Trail N. Palm Harbor, FL 34683	**X**	**X**
Henley, J. C. (Jerrell) Tel. (256) 379-2920 Fax. (256) 379-2920	1359 Old Winchester Road New Market, AL 35761		
Horvath, D. (Dave) Advent Engineering Tel. (734) 930-7500	P.O. Box 555 24 Frank Lloyd Wright Blvd.	**X**	**X**

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Fax (734) 327-7501	Lobby C Ann Arbor, MI 48106		
Irish, C. S. (Craig) Nuclear Logistics, Inc. Tel. (978) 250-1684 Fax (978) 250-0245	27 Linwood Street Chelmsford, MA 01824		
Jagtiani-Krause, S. A. (Serena) Trentec Inc. Tel. (513) 528-7900 ext. 121 Fax (513) 528-9292	4600 East Tech Dr. Cincinnati, OH 45245		
Kapur, S. (Sushant) Bechtel Power Corp. Tel. (301) 228-6057 Fax (301) 631-0841	5275 Westview Drive Frederick, MD 21703-8306	**X**	**X**
Khan, M. R. (Mohsin) ARES Corp. Tel. (510) 645-5960 Fax (510) 656-5961	2101 Webster St. Suite 1650 Oakland, CA 94612	**X**	
Kopecky, G. R. (Gene) Fort Calhoun Nuclear Station Tel. (402) 533-6765 Fax. (402) 533-7390	FC 2-4 Admin. Building P.O. Box 550 Fort Calhoun, NE 68023-0550		
Kulangara, J. M. (Jacob) Tel. +01-182-119-020-4232/01-182-312-894-232 Fax +01-182-312-894-272	737-28 Tower No. 1205 Hannam Dong Yong-San Gu Seoul, Korea		
Kurt, T. (Thoma) Tel. +41-46-266-7512 Fax +41-56-266-7701	Nordostschweizerische Kraftwerke AG Beznau Nuclear Power Plant, CH-5312		

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
	Doettingen, Switzerland		
Leung, H. (Henry) Tel. (905) 567-3332 Fax	4556 Credit Pointe Dr. Mississauga, Ontario Canada L5M 3L9	**X**	**X**
Loczi, V. (Victor) U.S. Dept. of Energy Tel. (301) 903-3892 Fax (010 903-8754	NZ/Germantown Building		
Lofaro, R. J. (Bob) – Secretary SC-2 Brookhaven National Laboratory Tel. (631) 344-7191 Fax (631) 344-5569	P.O. Box 5000 Building 130 Upton, NY 11973-5000	**X**	**X**
Lory, B. M. (Bruce) Engineering & Management Specialists, Inc. Tel. (312) 327-0920, ext. 119 Fax (312) 327-0925	123 West Madison Street, Suite 1300 Chicago, IL 60602	**X**	**X**
Martin, D. R. (Darin) Southern Testing Services, Inc. Tel. (865) 966-5330 Fax.(865) 675-5399	10627 Lexington Drive Knoxville, TN 37932		
Michel, W. (Wolfgang) Framatome ANP Tel. +49-9131-18-96469/+49-171-22-88-63671 (cell) Fax +49-9131-18-96362	GmbH, Electrical Systems NGL, Freyeslebenstrasse 1 P.O. Box 3220 91050 Erlangen, Germany	**P**	**P**
Mitton, T. (Todd) RCM Technologies Tel. (905) 821-1616 Fax (905) 821-1613	6620 Kitimat Road, Unit 4 Mississauga, Ontario L5N 2B8 Canada	**X**	**X**

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Mohtashemi, E. (Edward) GE Nuclear Energy Tel. (408) 925-1844 Fax (408) 925-6261	175 Curter Avenue M/C 788 San Jose, CA 95125	X	X
Monchy-Leroy, C. (Carole) EDF Research and Development Tel. +33-1-60-73-6773 Fax +33-1-60-73-7407	Electrical Equipment Lab Les Renadieres 77818 Moret sur Loing Cedex-France		
Newell, W. (Bill) Schulz Electric Company Tel. (203) 562-5811 Fax (203) 562-1082	30 Gando Drive New Haven, CT 06513	X	X
Parello, J. (James) Westinghouse Electric Co., LLC Tel. (724) 722-5545 Fax (724) 722-5497	1000 Westinghouse Drive New Stanton, PA 15672-9606	X	X
Pavsek, J. (Janez) Milan Vidmar Electroinstitute Tel. +386-31-809-322 Fax +386-1-252-1359	SI-1000 Ljubljana Hajdrihova 2, Slovenia	X	X
Pomerening, D. J. (Daniel) Southwest Research Institute Tel. (210) 522-2318 Fax (210) 522-4506	6220 Culebra Road San Antonio, TX 78238-5166	X	X
Richards, J. M. (John) Duke Energy Co. Tel. (704) 382-3916 Fax (704) 382-3993	Mail Stop EC09H P.O. Box 1006 Charlotte, NC 28201-1006	X	X
		X	X

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Rosztoczy, Z. (Zoltan) Zeetech, Inc. Tel. (520) 297-2131 Fax (520) 297-2234	13542 Pl. Montanas De Oro Tucson, AZ 85737		
Roy, F. (Fred) Scientech Tel. (256) 722-8500 Fax (256)722-8533		**X**	**X**
Sandberg, S. (Steve) Rockbestos-Surprenant W&C Tel. (860) 653-8360 Fax (860) 653-8412	20 Bradley Park Road East Granby, CT 06026	**X**	**X**
Starck, R. G. (Richard) MPR Associates, Inc. Tel. (703) 519-0511 Fax (703) 519-0224	320 King Street Alexandria, VA 22314	**X**	**X**
Simms, R. (Roderick) Tel. (269) 465-5901 ext. 3583 Fax (269) 466-3454	One Cook Place Bridgman, MI 49106	**X**	**X**
Schinzel, G. E. (Glen) South Texas Project Tel. (361) 972-7854 Fax (361) 972-7073	P.O. Box289 Wadsworth TX 77483	**X**	**X**
Spang, K. (Kjell) Tel. +46-31-298573 Fax +46-31-694594	KS Miltek Strandskarsvagen 9 SE-42658 Vastra Frolunda, Sweden	**X**	**X**
Tengler, M. (Marek)	Labhova 8/34		

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Tel.+42-0377-386961 Fax +42-0377-386961	Pilsen 31806		
Toman, G. (Gary) EPRI Tel. (704) 547-6073 Fax (703) 717-6565	1300 W.T. Harris Blvd. Charlotte, NC 28262		
Van Uffelen, M. (Marco) Tel. +32 14-33-2638 Fax +32-14-31-1993	Boertang 200 Dept. Instrumentation Building BR3 B-2400, Mol, Belgium	**X**	**X**
Varga, L. (Laszlo) VEIKI-VNL, Ltd. Tel. +36-1-417-3157 Fax +36-1-417-3163	Vasgolyo u. 2-4. H-1158 Budapest, Hungary		
Weber, C. E. (Carl) Pacific Gas & Electric Co. Tel. (805) 545-4084 Fax (805) 545-6928	Diablo Canyon Power Plant P.O. Box 56 Avila Beach, CA 93424	**X**	**X**
Wheless, J. (John) Southern Company Tel. (205) 992-6898 Fax (205) 992-0391	40 Inverness Center Pkwy. Bin BO57 Birmingham, AL 35242	**X**	**X**
White, J. (John) TXU CPSES Tel. (254) 897-6674 Fax (254) 897-0530	P.O. Box 1002 Glen Rose, TX 76043	**X**	**X**
Wood, R. T. (Richard) Oak Ridge National Laboratory	Bethel Valley Road P.O. Box 2008	**X**	**X**

Table 2 SC-2 Members in Attendance at Meeting 03-1 in San Francisco, CA (continued)

Name/Company	Address	Dates Attended	
		4/23	4/24
Tel. (865) 574-5578 Fax (865) 576-8380	Bldg. 3500, MS 6010 Oak Ridge, TN 37831-6010		
Yamamoto, T. (Toshio) JAPEIC Tel. +81-47-380-8554 Fax +81-47-380-8556	Business Court Shin-Urayasu Bldg. 9-2 Mihama 1-Chome Urayasu-shi, Chiba 279-0011 Japan		

X = Attended
P = Proxy Attended

Attachment 1

SC-2 Meeting 03-1 Agenda

IEEE/NPEC/SC2- SUBCOMMITTEE ON QUALIFICATION
MEETING AGENDA
April 23, 2003, Wednesday, 1:00PM-5:00PM
April 24, 2003, Thursday, 8:00 AM to Noon
Bechtel HQ
50 Beale Street, Conference Room 1 & 2 (2nd Floor)
San Francisco, California

1. CALL TO ORDER

2. INTRODUCTION OF MEMBERS AND GUESTS

3. GENERAL REMARKS, REVIEW AND APPROVAL OF THE AGENDA

4. Approval of the SC2 September 2002 Meeting Minutes

5. Chairman's Report

   5.1 Brief Overview of IEEE- SA, NPEC and SC2 (Membership Term, Responsibilities) and Balloting Process
   5.2 Goals for 2003-04
   5.3 Officers (2003-2004) [Vice- Chair, Secretary and Assistant Secretary]

6. Discussion of IEEE Std. 323*: Current Status and Significant Technical Issues. Jim Gleason

7. Short Discussion about "Single" peak vs. "Double" peak in LOCA Testing Bob Lofaro/Jim Gleason

8. Discussion of IEEE Std. 383* (cables): Current Status and Significant Technical Issues. John White

9. Short Presentation about EPRI programs

   John White (Gary Toman)

10. Discussion of IEEE Std. 344* (seismic): Preview at the Subcommittee Level. James Parello

11. Commonality between IEEE & IEC standards

    IEC Representative

12. Technical Presentation: "Equipment Qualification through Commercial-Grade Dedication"

    Steve Alexander, US NRC

13. Technical Presentation: "License Renewal & Equipment Qualification"

Paul Shemanski, Consultant

14. Status of the following Standards:

IEEE Std. 334 (Motors)	William Newell
IEEE Std. 382 (MOVs)	
IEEE Std. 572 (Connectors)	
IEEE Std. 649 (MCCs)	
IEEE Std. 650 (Battery Chargers)	Dennis Dellinger

15. Next Meeting

16. Adjournment

*** A copy of the latest version of the draft standard will be available at the meeting.**

Attachment 2

Single vs Double Transient LOCA Profile

Single vs. Double Transient LOCA Profile in IEEE Qualification Standard 323

Presented by:
Jim Gleason, GLS Enterprises, Inc.
and
Robert Lofaro, Brookhaven National Laboratory

April 2003

IEEE Subcommittee 2 Meeting
San Francisco, CA

Brookhaven Science Associates
U.S. Department of Energy

BROOKHAVEN NATIONAL LABORATORY

Background

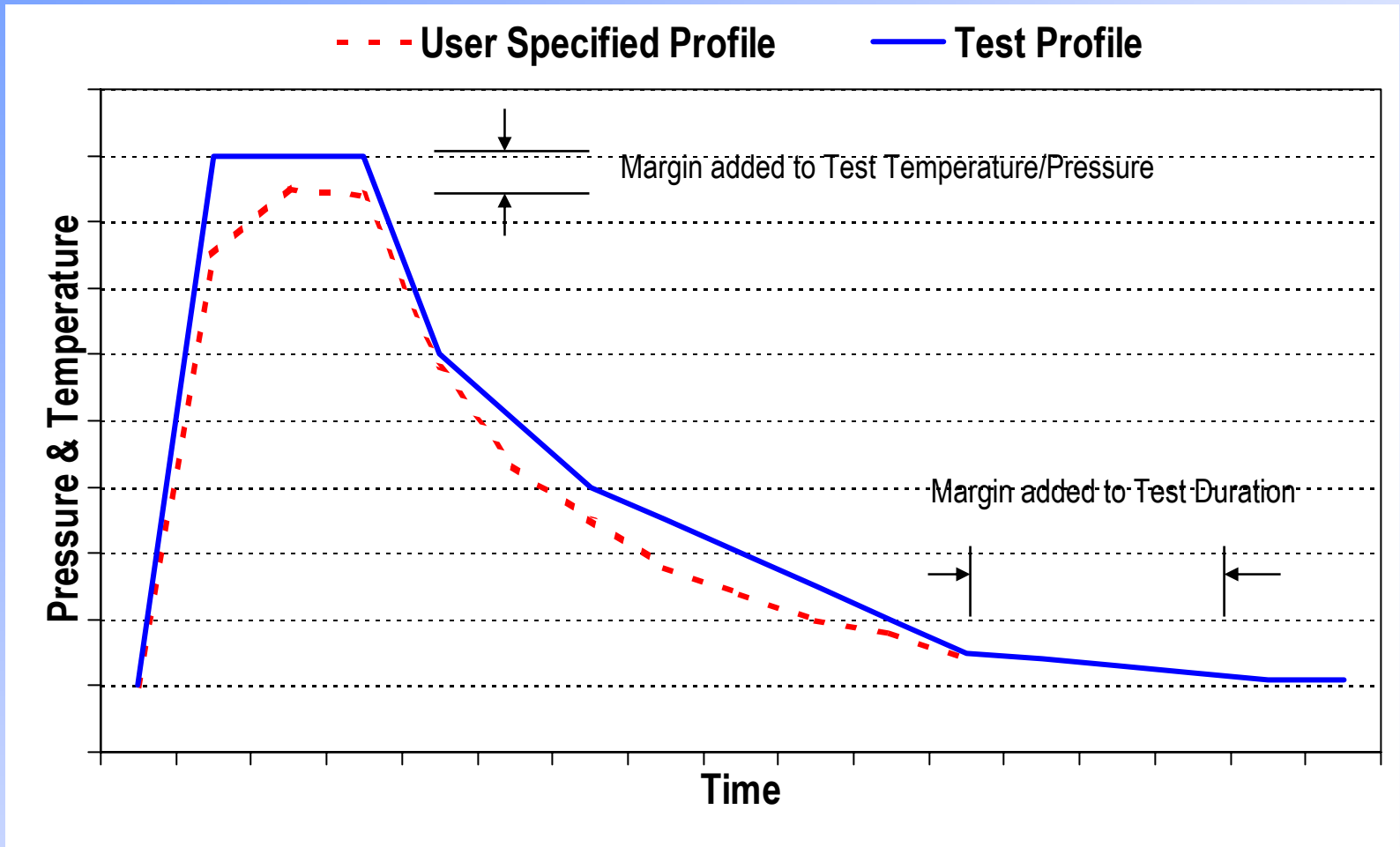
- Previous versions of IEEE Standard 323 recommended the use of a double transient LOCA profile for qualifying Class 1E equipment
  - Second transient thought to add margin on component performance
- Current draft of IEEE Standard 323 out for ballot (P323/D5) deletes the double transient and recommends a single transient
  - Past experience shows second transient is not necessary and does not add margin

Margin in IEEE Standard 323

- Margin is added to account for reasonable uncertainties in demonstrating satisfactory performance, and normal variations in commercial production of components
  - Can be built into the specified component performance characteristics or in-service operating conditions, or
  - Can be added to the qualification test

- There are several acceptable methods to add margin to a qualification test
  - Increase the severity of the test parameters
  - Increase the test duration

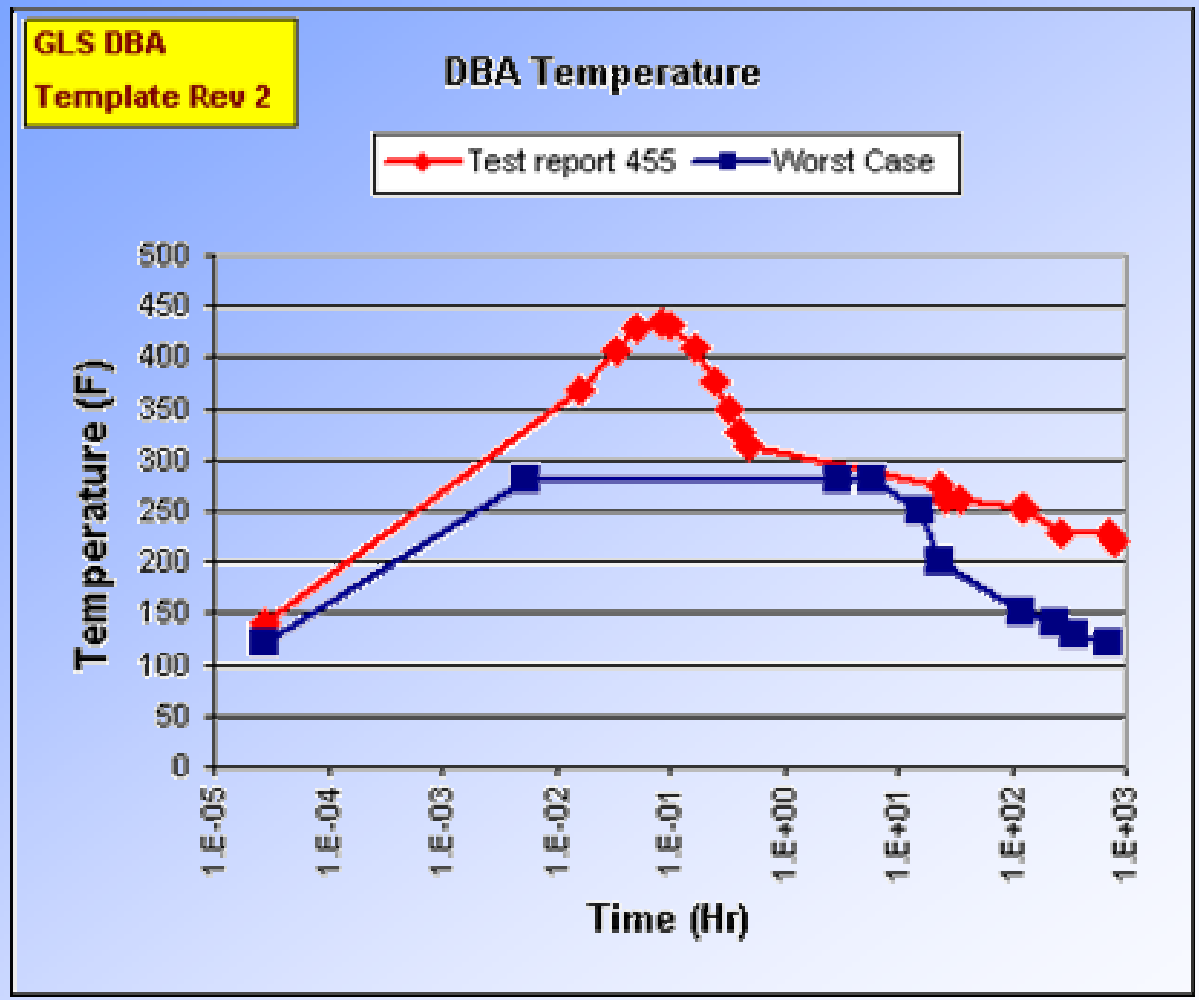
Single Transient LOCA Profile



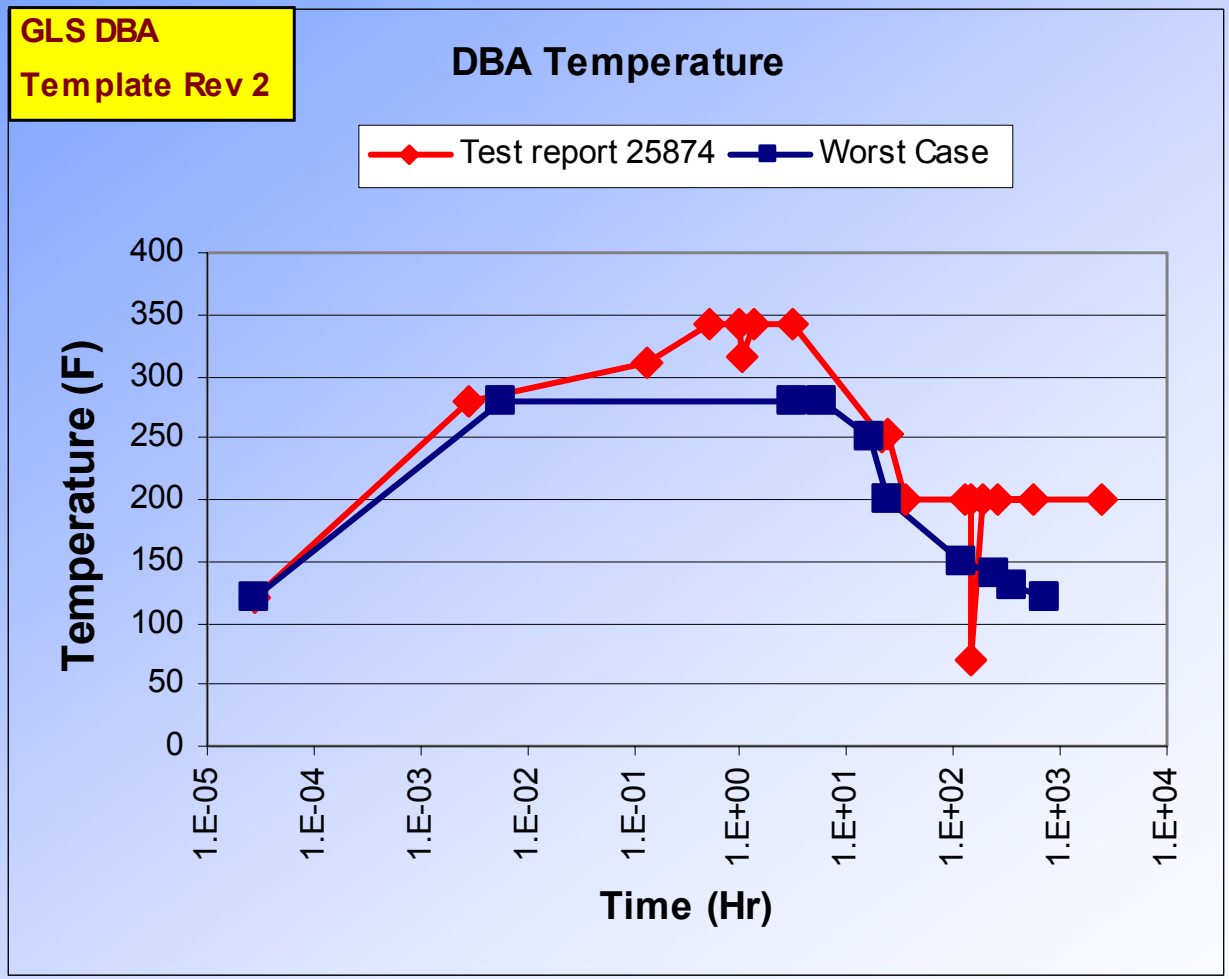
Past Experience

- DOR Guidelines did not require margin on test conditions
  - Many components were qualified using single transient LOCA profile and this was accepted
- Many past qualification tests included multiple transients, both intentionally and unintentionally due to artifacts of the test facility
  - Multiple transients had no impact on whether the components passed the qualification test
- NRC IE Bulletin 79-01b required a review of all Class 1E components to ensure qualification
  - No credit was given for 2nd transient in qualification tests

Components Qualified using Single Transient LOCA Profile Tests



Components Qualified using Single Transient LOCA Profile Tests



Basis for Deleting 2nd Peak

- Not representative of anticipated DBEs
  - DBEs include single peak only
- No credit was given in the past for 2nd peak in LOCA profile
  - Not considered "margin" in 79-01b reviews
- Qualification using single peak has been accepted for many components
  - DOR plants
- Past testing with multiple peaks shows no impact on component qualification
  - Single peak is sufficient to detect substandard components
- Margin is included in other ways
  - Component performance specifications
  - Qualification test parameters

Conclusions

- A single transient LOCA profile is sufficient to demonstrate acceptable performance of Class 1E equipment under accident conditions
- The 2nd transient is unnecessary and has been deleted from the current draft of IEEE Standard 323

Attachment 3

Status of Standard 344

IEEE P344 Project Status Report

James Parello, Chairman IEEE 344 (SC-2.5)

IEEE SC-2 Meeting

Wednesday, April 23, 2003

Bechtel Corporation

San Francisco, CA

IEEE P344 Project
Status Summary

- Background
- Scope and Purpose
- Working Group Membership
- Proposed Changes
- Experience-Based Method Process
- Significant Items/Progress to Date
- Unresolved Issues
- Action Plan

IEEE P344 Project Background

- Experience data for use in the seismic qualification of equipment has been developing over the years with Section 9 of IEEE 344-1987 Standard providing interim guidance.
- Development of the Experience-based approach has been achieved through the initial efforts of the Seismic Qualification Utility Group (SQUG) and the Senior Seismic Review and Advisory Panel (SSRAP).
- An Experience-based approach has been accepted by the U.S. Nuclear Regulatory Commission (NRC) as a verification procedure with conditions in Supplementary Safety Evaluation Reports (SSERs) in verifying the seismic adequacy of equipment in older operating nuclear power plants subjected to the NRC's Unresolved Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants."

IEEE P344 Project
Scope and Purpose

- To review, evaluate and update the IEEE 344 Standard in the area of experience-based seismic qualification.
- Develop a recommended practice for the use of experience data in verifying that Class 1E equipment can meet its performance requirements during and following a safe shutdown earthquake (SSE) preceded by a number of operating basis earthquakes (OBE).

IEEE P344 Project
Working Group Membership

- Mostafa A. Ahmed (W)
- Paul Baughman (ABS Consult.)*
- Suresh Channarasappa (W)*
- Garry Chapman (Trentec)*
- Pei-Ying Chen (USNRC)*
- Walter Djordjevic (Stevenson & Assoc.)*
- Robert Enis (TVA)
- Gregory Ferguson (Entergy)
- Gregory Hardy (ABS Consult.)
- Paul Ibanez (ANCO Eng.)
- Johnny Jenkins (Utilities Service Alliance)
- Parthasarathy Karur (WCNOC)
- Robert Kassawara (EPRI)
- Mohsin Khan (ARES Corp.)
- Bruce M. Lory (E&MS)*
- William LaPay (Consultant)
- Darren Martin (STS)
- Donald Moore (SNC)*,+
- James Parello (W), Chairman*
- Daniel J. Pomerening (SRI)
- John M. Richards (Duke Energy)*,+
- William Schmidt (Retired)
- Mark Skreiner (Consultant)
- Donald Smith (Wyle)
- Richard G. Starck (MPR)*,+

* Active Participant in Writing Group

\+ ASME-QME Dynamic Qualification Sub-Group

IEEE P344 Project
Proposed Changes

- Section 9 and relevant parts of Section 10 of IEEE 344-1987 have been expanded to incorporate experienced-based method.
  - Section 9 (Experience) defines the recommended guidelines for seismic qualification of equipment by earthquake and test experience data for a class of equipment.
  - Section 10 (Documentation) as been updated to included experience data documentation and reporting requirements.
- Appendix F was added to provide discussion on the application of the experience-base methods in contrast to the similarity method.
- Other Changes
  - Section 2 (Definitions) was updated to include terminology related to experience-base method.
  - Section 3.5 was added to clarify the need for consideration of installation features in the qualification process.
  - Reference to the experienced-base method was added to Section 6 (Analysis) and Section 8 (Combined Analysis and Testing).
  - The similarity method, previously in Section 9.3 was consolidated under Section 8.3 “Extrapolation for Similar Equipment” (new Subsection 8.3.3).

IEEE P344 Project
Experience-Based Method Process

1. Characterize the earthquake or test motions experienced by the equipment for consideration in the reference equipment class.
2. Establish the experienced-based seismic capacity of the reference equipment class.
3. Establish appropriate reference equipment class by defining a range of acceptable and shared characteristics (physical, operational, dynamic), attributes (inclusion rules, prohibited features), number of independent equipment items, functionality during the event, and special considerations / limitations.
4. Comparison of the candidate equipment to the reference equipment class to establish qualification.
5. Document the experienced-base method qualification process.

IEEE P344 Project
Significant Items/Progress to Date

- PAR P344 is active until December 2004.
- Six IEEE 344 Working Group meetings have been held since August 2002 to address and resolve comments (technical and editorial) and edit sections of the IEEE P344 Draft.
- Numerous technical and editorial comments (>90) have been reviewed and agreements reached with the authors on the majority of comments.
- IEEE P344 Draft Ballot No. 2 was issued to Working Group membership on 12/24/02. Balloting was completed 02/14/03.

IEEE P344 Project
Ballot No. 2 Results

Ballot No. 2 Voting Summary					
Voting Results	**No. of Votes**	**Percentage**	**Min. Votes Required**	**Acceptance Criteria**	**Ballot Results**
Yes	15	65%	17.25	75%	**Not Accepted**
No	7	28%			
Abstain	1	4%			
Total Votes	23	92%	18.75	75%	**Valid**
Did Not Vote	2	8%			
Voting Pool	25				

Ballot No. 2 Comment Results	**No. of Comments**
Editorial (E)	22
Technical (T)	22
Technical Required (TR)	57
Total Comments	101

Ballot No. 2 Review Process Status	**No. of Comments**
Accepted	33
Not Accepted	19
Under Review	3
To Be Reviewed	46
Total Comments	101

IEEE P344 Project
Unresolved Issues

- The IEEE P344 Draft needs to provide additional guidance on how to establish a reference equipment class which is representative of the candidate equipment.
  - When establishing the inclusion rules for a reference equipment class, guidelines on how to establish an acceptable range of physical, dynamic and functional characteristics needs to be expanded for comparison to candidate equipment.

    [Inclusion rules along with prohibitive features and limitations are used to address items such as equipment vintage, design changes, material substitutions, manufacturing changes, etc. to be addressed by reference equipment class.]

  - Currently all equipment in the reference equipment class are not required to meet the functional requirements of the candidate equipment.

IEEE P344 Project
Unresolved Issues (Continued)

- Equipment Functionality
  - Additional guidance is required for defining the amount and type of earthquake experience data required for demonstrating the successful equipment functionality during and/or after an earthquake. Functionality depends not only on the equipment itself but also on the system and application in which it is to perform.
  - The earthquake experienced-based method relies heavily on judgement, assumptions and interpolation of data logs collected some time after the earthquake occurred. Because of this, the earthquake experienced-based method providing a level of uncertainty in the areas of aging and equipment operability.

IEEE P344 Project
Unresolved Issues (Continued)

- Earthquake-Based Experience
  - The RRS used for comparison with the earthquake experience spectrum (EES) should be the 84th percentile level in-structure response spectra, or the response spectra consistent with the plant's licensing/regulatory design basis. Presently the median-centered horizontal in-structure response spectrum is specified in the draft standard.
  - Qualification of sub-components are not clearly addressed.
- Test-Based Experience
  - Prohibit the use of test-based experience approach for seismic qualification of electrical/electronic equipment by reference equipment class. High level excitation test results are unique for a specific model of electrical/electronic equipment and are not valid for equipment seismic qualification as a class.
  - Test-based experience approach is not appropriate for complex electrical equipment. Results of testing are unique to the specific model under test and are defined by the combination of the TRS shape, equipment operability requirements, and the function and /or structural nature of the equipment.
  - Qualification of sub-components is not clearly addressed.

IEEE P344 Project
Action Plan

- Continue to resolve open comments. (On-Going)
- Issue IEEE P344 Draft to IEEE SC-2 Sub-Committee for review and comments. (June 2003)
- Issue IEEE P344 Draft for Working Group (SC-2.5) Re-balloting. (August 2003)
- Issue IEEE P344 Draft to the IEEE Technical Editors. (October 2003)
- Issue IEEE P344 Draft to the SC-2 Committee for IEEE SA Balloting. (December 2003)

Attachment 4

IEC

Introduction to the Nuclear Industry Segment **International Electrotechnical Commission (IEC) Standards Activities**

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Who is the IEC?

- **IEC** = International Electrotechnical Commission
- **MISSION**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. These serve as a basis for national standardization and as references when drafting international tenders and contracts.

Through its members, the IEC promotes international cooperation on all questions of electrotechnical standardization and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics and related technologies.

The IEC charter embraces all electrotechnologies including electronics, magnetics and electromagentics, electroacoustics, multimedia, telecommunication, and energy production and distribution, as well as associated

The IEC is comprised of diverse Technical Committees...

TC1	Terminology
TC2	Rotating Machinery
TC3	Information structures, documentation and graphical symbols
TC4	Hydraulic Turbines
TC5	Steam Turbines
TC7	Overhead Electrical Conductors
TC8	Systems Aspects for Electrical Energy Supply
TC9	Electrical Equipment and Systems for Railways
TC10	Fluids for Electrotechnical Applications
TC11	Overhead Lines
TC13	Equipment for Electrical Energy Measurement and Load Control
TC14	Power Transformers
TC15	Insulating Materials
TC16	Basic and Safety Principles for Man-Machine Interface, Marking and Identification
TC17	Switchgear and Controlgear
TC18	Electrical Installations of Ships and of Mobile and Fixed Offshore Units
TC20	Electric Cables
TC21	Secondary Cells and Batteries
TC22	Power Electronic Systems and Equipment
TC23	Electrical Accessories
TC25	Quantities and Units, and Their Letter Symbols
TC26	Electric Welding
TC27	Industrial Electroheating Equipment
TC28	Insulation Co-ordination
TC29	Electroacoustics
TC31	Electrical Apparatus for Explosive Atmospheres
TC33	Power Capacitors
TC34	Lamps and Related Equipment
TC35	Primary Cells and Batteries
TC36	Insulators
TC37	Surge Arresters
TC38	Instrument Transformers
TC39	Electronic Tubes
TC40	Capacitors and Resistors for Electronic Equipment
TC42	High-Voltage Testing Techniques

The IEC is comprised of diverse Technical Committees...

TC44 Safety of Machinery - Electrotechnical Aspects

TC45 Nuclear Instrumentation

TC46 Cables, Wires, Waveguides, R.F. Connectors, R.F. and Microwave Passive Components and Accessories

TC47 Semiconductor Devices

TC48 Connectors

TC49 Piezoelectric and Dielectric Devices for Frequency Control and Selection

TC51 Magnetic Components and Ferrite Materials

TC55 Winding Wires

TC56 Dependability

TC57 Power System Control and Associated Communications

TC59 Performance of Household Electrical Appliances

TC61 Safety of Household and Similar Electrical Appliances

TC62 Electrical Equipment in Medical Practice

TC64 Electrical Installations and Protections Against Electric Shock

TC65 Industrial-Process Measurement and Control

TC66 Safety of Measuring, Control and Laboratory Equipment

TC68 Magnetic Alloys and Steels

TC69 Electric Road Vehicles and Electric Industrial Trucks

TC70 Degrees of Protection Provided by Enclosures

TC71 Electrical Installations for Outdoor Sites Under Heavy Conditions (Including Open-cast Mines and Quarries)

TC72 Automatic Controls for Household Use

TC73 Short Circuit Currents

TC76 Optical Radiation Safety and Laser Equipment

TC77 Electromagnetic Compatibility

TC78 Live Working

TC79 Alarm Systems

TC80 Maritime Navigation and Radiocommunications Equipment and Systems

TC81 Lightning Protection

TC82 Solar Photovoltaic Energy Systems

The IEC is comprised of diverse Technical Committees...

- TC85 Measuring Equipment for Electrical and Electromagnetic Quantities
- TC86 Fibre Optics
- TC87 Ultrasonics
- TC88 Wind Turbines
- TC90 Superconductivity
- TC91 Electronics Assembly Technology
- TC93 Design Automation
- TC94 All-or-Nothing Electric Relays
- TC95 Measuring Relays and Protection Equipment
- TC96 Small Power Transformers, Reactors, Power Supply Units and Similar Products
- TC97 Electrical Installations for Lighting and Beaconing of Aerodromes
- TC98 Electrical Insulation Systems (EIS)
- TC99 System Engineering and Erection of Electrical Power Installations in Systems with Nominal Voltages Above 1kV A.C. and 1.5kV D.C., Particularly Concerning Safety Aspects
- TC100 Audio, Video and Multimedia Systems and Equipment
- TC101 Electrostatics
- TC103 Transmitting Equipment for Radiocommunication
- **TC104 Environmental Conditions, Classification and Methods of Test**
- TC105 Fuel Cell Technologies
- TC106 Methods for the Assessment of Electric, Magnetic and Electromagnetic Fields Associated with Human Exposure
- TC107 Process Management for Avionics
- TC108 Safety of Electronic Equipment Within the Field of Audio/Video, Information Technology and Communication Technology
- TC109 Insulation Co-ordination for Low-Voltage Equipment

Technical Committee 45 Addresses the Nuclear Industry Segment

SCOPE: To prepare international standards relating to electrical and electronic equipment and systems for instrumentation specific to nuclear applications

SC45A Reactor Instrumentation

Scope: To prepare standards applicable to the electronic and electrical functions and associated systems and equipment used in the instrumentation and control systems important to safety of nuclear power plants. This includes the radiation monitoring instruments used directly for plant control or safety actuation. A major consideration is the application of emerging electronic techniques to nuclear requirements, particularly computer systems and advances in information processing and control, including artificial intelligence.

SC45B Radiation Protection Instrumentation

Scope: To prepare standards covering all the fields of radiation protection instrumentation. That is, for the measurement under both normal and accident conditions of:

a) external and internal individual exposure,

b) the workplace,

c) the environment (including foodstuffs)

Current US Participants

Technical Advisory Group

- **Clark Artaud (GammaMetrics)**
  - **Upgrading & Modernization chair**
- **John Bickel (Evergreen)**
- **Bruce Cook (Westinghouse)**
- **Jay Forster (GE)**
- **Hash Hashemian (AMS)**
- **Jim Keiper (Foxboro)**
- **Ted Quinn**
  - **Instrument systems chair**
- **Bill Todt (IST Corp)**

Other Frequent Contributors

- Matt Chiramal (NRC)
- Joe Fragolia (SAIC)
- Brit Grim (GE)
- Eric Lee (NRC)
- Paul Loeser (NRC)
- John O'Hara (Brookhaven)
- Clayton Scott (Triconix)

SC45A is most similar to IEEE/NPEC in scope and charter

WG2	Sensors and measurement techniques
WG3	Application of digital processors to safety in nuclear power plants
WG5	Special process measurement and radiation monitoring
WG7	Reliability of electrical equipment in reactor safety systems
WG8	Control rooms
WG9	Instrumentation systems
WG10	Upgrading and modernization of I&C systems in NPP

SC45A Working Group 2
Sensors and measurement techniques

- **Scope:** To produce and maintain standards and reports for all sensors used for I&C systems in NPPs: neutron and gamma detectors, temperature sensors (RTDs and TCs) and in-core and ex-core measurement techniques
- **Current projects:**

  IEC 60515 Ed 2.0 “Radiation detectors for the instrumentation and protection of nuclear reactors; characteristics and test methods”

  IEC 60568 Ed 2.0 “In-core instrumentation for neutron fluence rate (flux) measurements in power reactors”

  IEC 61468 Amd .1 “Nuclear power plants – in-core instrumentation – characteristics and test methods of self-powered neutron detectors”

SC45A Working Group 3
Application of digital processors to safety

- **Scope:** To produce and maintain standards and reports for digital processor based instrumentation and controls systems which provide functions important to safety in nuclear power plants. In particular, the Working Group produces standards for overall architecture and system design, software for systems important to safety, and I&C system hardware.
- **Current projects:**
  IEC 60880 Ed 2.0 "Nuclear power plants – Instrumentation and control – Software for computers in the safety systems"
  IEC 62138 Ed 1.0 "Nuclear power plant – Instrumentation and control for systems important to safety – Software for computer-based I&C systems supporting category B and C functions"
- **Other standards:**
  IEC 60987 Ed1.0 "Programmed digital computers important to safety for nuclear power stations"
  IEC 61513 Ed1.0 "Nuclear power plants – Instrumentation and control for systems important to safety – General

SC45A Working Group 5
Special process measurements

- **Scope:** To produce and maintain standards and reports for special process measurements to be found in nuclear power and in storages and repositories of used nuclear fuel and waste, both wet and dry storage. The scope of the activities on the radiation monitoring in nuclear power plants includes the radiation monitoring instruments and systems used directly for monitoring plant processes, plant control and safety actuation.
- **Current projects:**
  IEC 62235 TR Ed 1.0 "Instrumentation and control systems (I&C) of interim storage and final repository of nuclear fuel and waste"
- **Other standards:**
  IEC 61504 Ed1.0 "Nuclear power plants – Instrumentation and control systems important to safety – Plant-wide radiation monitoring"
  IEC 61505 Ed1.0 "Nuclear reactor instrumentation – Boiling water reactors (BWR) – Stability monitoring"
  IEC 62117 Ed1.0 "Nuclear reactor instrumentation – Pressured Water Reactors (PWR) – Monitoring adequate

SC45A Working Group 7
Reliability of electrical equipment

- **Scope:** To produce and maintain standards and reports for the design of high reliability instrumentation and control systems important to safety. The main focus of the group is the application of deterministic and probabilistic approaches to the overall design activity. The scope also includes the consideration of certain generic design aspects, such as the achievement of independence.
- **Current projects:**
  IEC 60709 Ed 2.0 "Nuclear power plants – Separation of I&C systems important to safety"
  IEC 61226 Ed 2.0 "Nuclear power plants – Instrumentation and control systems important for safety – Classification"
  IEC 62340 Ed 1.0 "Nuclear power plants – Instrumentation and control for systems important to safety – Requirements to cope with common cause failure (CCF)"
- **Other standards:**
  IEC 60671 Ed1.0 "Periodic tests and monitoring of the protections system of nuclear reactors"

SC45A Working Group 8
Control rooms

- **Scope:** To produce and maintain standards and reports on functions and systems for control and information in control room areas in NPP, emphasizing the main control room. This includes design methodology, human factors, evaluation, controls, information and support functions, operating and emergency procedures, alarms, communication systems, emergency control centers.
- **Current projects:**
  IEC 62241 Ed 1.0 "Nuclear power plants – Main control room – Alarm functions and presentation"
  IEC 62247 TR Ed 1.0 "Nuclear power plants – Main control room design – A review of the application of IEC 60964 (1989)"
- **Other standards:**
  IEC 60964 Ed1.0 "Design for control rooms of nuclear power plants"
  IEC 60965 Ed1.0 "Supplementary control points for reactor shutdown without access to the main control room"
  IEC 61227 Ed1.0 "Nuclear power plants – Control rooms

SC45A Working Group 9
Instrumentation systems

- **Scope:** To produce and maintain standards and reports on all aspects of instrumentation systems at the system or channel level including: electronic aspects, processing aspects, safety aspects. The working group scope currently includes Setpoints, Critical Safety Function and Performance Monitoring Functions as well as new EMI/RFI work when approved.
- **Current projects:**
  IEC 61888 Ed 1.0 "Nuclear power plants – Instrumentation important to safety – Determination and maintenance of trip setpoints"
  IEC 61971 Ed 1.0 "Nuclear power plants – Pressurized Water Reactor (PWR) – Measurement validation for critical safety functions"
- **Other standards:**
  IEC 60780 Ed2.0 "Nuclear power plants – Electrical equipment of the safety system – Qualification"
  IEC 60980 Ed1.0 "Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations"

SC45A Working Group 10
Upgrading and modernization of I&C

- **Scope:** To produce and maintain standards and reports dealing with the Modernization of Instrumentation and Control (I&C) Systems for Nuclear Power Plants. This include the replacement and upgrading of I&C systems due to obsolescence, aging, plant life extension activities and other economically, technically, or safety driven motivating factors. Standards covering issues related to the modernization of nuclear power plant I&C systems, such as the management of aging, are also include in the working group's scope.
- **Current projects:**

  IEC 62342 Ed 1.0 "Nuclear power plants – Instrumentation and control and associated equipment – Management of aging"
- **Other standards:**

  IEC 62096 TR Ed2.0 "Nuclear power plants – Instrumentation and control – Guidance for the decision on modernization"

IEC Activity in the Area of Qualification

- General Qualification – IEC 60780 Ed 2.0 “Nuclear power plants – Electrical equipment of the safety system – Qualification”
- Seismic Qualification – IEC 60980 Ed 1.0 “Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations”
- EMI/RFI – Proposed new work item

IEC 60780 Ed 2.0

- Similar in content to IEEE Std 323-1983
- First edition published in 1984
- Amendment published in 1991
- Second edition published in October, 1998
- Due for maintenance cycle review in 2005
- Relies on IEC 60068 series (a product of TC104) to establish test methodologies

IEC 60780 Ed 2.0 Table of Contents

IEC 60980 Ed 1.0

- Similar in content to ANSI/IEEE Std 344-1987
- First edition published in 1989
- Due for maintenance cycle review in 2005

IEC 60980 Ed 1.0 Table of Contents

New Work Item on EMI/RFI Testing

- Incorporate input received during previous project (IEC 61503) which was cancelled when consensus could not be achieved in the allotted time.
- Refer to IEC 61000 series for test methodologies
- NWIP to be circulated for comment and approval by September 2003, including a first draft document

SC45A published two new documents in the last year

- IEC 62096TR - Guidance for the decision on I&C modernization
  - Coordinated with IAEA guidance
- IEC 61888 - Determination and maintenance of setpoints
  - Based upon ISA standard

Three updated standards may be published in the next 18 months

- IEC 61226 Instrumentation and control systems important for safety - Classification
- IEC 60709 Separation within the reactor protection system
- IEC 61225 Requirements for electrical supplies

New work underway

- IEC 62340 Requirements to cope with common cause failure
- IEC 62138 Software aspects for class 2 & 3 I&C
- IEC 61468 Self-powered neutron detectors - testing
- IEC 6x Methods to verify performance of safety channels
- IEC 6x Control of electro-magnetic Interference
- IEC 6x RTDs for Primary Temperature Measurement in PWRs
- IEC 62235 TR I&C for spent fuel storage and repositories
- IEC 62342 Management of Ageing
- IEC 62241 Main control room alarm functions
- IEC 62247TR Review application of IEC 60964 (control rooms)
- IEC 6xTR Comparison of IEC 60964 to other guidance

Updates underway

- IEC 60880 Software in safety systems
  Simplify and focus
- IEC 60987 Programmed digital computers important to safety
- IEC 61500 Multiplexed data transmission
  Update and add annex on architecture and protocols
- IEC 60515 Radiation detectors for instrumentation and protection
- IEC 60568 In-core neutron flux measurements

Possibilities for cooperation between IEC and IEEE to establish commonality...

- Attend IEC Working Group 45A9 meetings
  - Montreal, Canada
  - October 2003
- Join commenting process via correspondence
  - US Chief Delegate to SC45A:
    - Gary Johnson
    - Lawrence Livermore National Laboratory
    - johnson27@llnl.gov
  - WG45A9 Convenor:
    - Ted Quinn
    - General Atomics
    - tedquinn@cox.net

Possibilities for co-operation between IEC and IEEE to establish commonality...

- Co-operation and License Agreement between IEC and IEEE (Administrative Circular 138/AC, 2002-12-13)
  - IEC/IEEE Dual Logo International Standards
  - IEEE may propose standard or draft for consideration by IEC
  - Should cover specific areas of electrotechnology not under consideration, within IEC's current technical work program
  - Not likely to be applicable to qualification area since published standards already exist

Attachment 5

License Renewal

License Renewal & Equipment Qualification

IEEE SC-2 Meeting

April 23-24, 2003, San Francisco

Paul Shemanski, NRC Consultant
Thomas Koshy, Senior Reactor Systems Engineer

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Agenda

- Qualification for Renewed Period
- Possibilities
- Practical Steps
- Time Limited Aging Analysis
- Cable Condition Monitoring
- Closing Remarks

Qualification For Renewed Period

Challenges:

- Replacement
  - Based on Current qualification
- Requalify
  - Additional Testing
- Extend the Qualification

Possibilities

Extending Qualification

- Examine the margins and conservatism in the initial qualification
- Compare with actual service environment
- Conduct reanalysis using Arrhenius methodology

Practical Steps

Supporting Information

- Records to support actual service environment
- Periodic Inspection Programs
- Feedback from service history

Time Limited Aging Analysis

Evaluation of Aging Management Programs

- Scope of program
- Preventive actions
- Parameters monitored
- Detection of Aging effects
- Monitoring & Trending
- Acceptance criteria
- Corrective Actions
- Confirmation process
- Administrative controls
- Operating Experience

Cable Condition Monitoring

Techniques Evaluated under GSI 168

- Visual Inspection for insulation damage from hot spots
  - Screening test to look for cracks, swelling, discoloration, flaking
- Functional Performance
- Further tests may be needed if problems are observed

Cable Condition Monitoring

Destructive Techniques Evaluated under GSI 168

- Elongation at Break
- Oxidation Induction Time Method
- Hardness

Cable Condition Monitoring

Intrusive Techniques Evaluated under GSI 168

- Fourier Transform Infrared Spectroscopy
- Indenter
- Insulation Resistance
- Dielectric loss

Cable Condition Monitoring

High Voltage Signal Cables

- Insights from Periodic Calibration / Surveillance
  - For cables that remain in the loop during the test
  - For cables that are disconnected during the test, a suitable sampling and frequency is being evaluated

Closing Remarks

- Service environment monitoring would have long tern benefits
- Need more refinements in cable condition monitoring techniques to build greater confidence
- Questions ?

Attachment 6

Commercial-Grade Dedication

U.S. NUCLEAR REGULATORY COMMISSION PRESENTATION

to the

IEEE/NPEC/SC-2 SUBCOMMITTEE on QUALIFICATION

April 23 and 24, 2003

EQUIPMENT QUALIFICATION through COMMERCIAL-GRADE DEDICATION

Stephen Alexander, Reactor Engineer
Equipment and Human Performance Branch (IEHB)
Division of Inspection Program Management
Office of Nuclear Reactor Regulation
Phone: 301-415-2995,e-mail: sda@nrc.gov, Fax: 301-415-2222

TOPICS:

- Need for Qualifying Commercial-Grade Items (CGIs)
- Overview of Commercial-Grade Dedication Concepts
- EQ as a Critical Characteristic
- Effects of RIP 50, Option 2, on EQ
- Regulatory Requirements, Staff Positions, Industry Guidance, Useful References

Need for Qualifying Commercial-Grade Items (CGIs)

- Circumstances Requiring Replacement of Qualified Equipment

- Circumstances Requiring Use of CGIs in EQ Applications

CIRCUMSTANCES POSSIBLY REQUIRING QUALIFIED EQUIPMENT REPLACEMENT - Effects on Future EQ and Dedication

- Degradation or Failures in Service - Abnormal or Harsh Environment
- Degradation or Failures in Service - Normal Service Conditions
- Events Impacting Qualification or Qualified Life
- Review of EQ for License Renewal and Plant Life Extension
- Discovery of Equipment Qualification Deficiencies
- Plant Changes Affecting Qualification of Equipment
- Equipment Reaching End of Qualified Life
- Equipment Reaching End of Design Service Life (by time or condition monitoring criteria)

CIRCUMSTANCES REQUIRING USE of CGIs in EQ APPLICATIONS

! Formerly Qualified Replacement Equipment or Essential Parts No Longer Available As Basic Components From Appendix B Supplier

- **Requires Dedication including Verification of Similarity of Current Production Equipment to Formerly Qualified Design**

- **May Require Requalification of Modified Design and Verification of Conformance to Requalified Design**

! Formerly Qualified Replacement Equipment or Essential Parts No Longer Available at All

- **Requires Qualification of Modified or New Design**

- **Requires Dedication if Alternate Replacement Not Available as Basic Component**

Types of EQ Deficiencies
Priorities and Strategies to Address Them

- **Known Equipment Deficiencies - (Primary priority: deficiencies expected to cause DBA failure, possibly common mode, Secondary: render EQ indeterminate)**

- **Qualification Deficiencies - (generally relatively lower priority, qualification not demonstrated, indeterminate DBA reliability)**

- **Procurement Deficiencies - (may be documentation or hardware related, prioritized accordingly)**

Equipment Deficiencies

- **Deficient Maintenance** - Design qualified, but installed equipment in a degraded condition (deteriorated lubricants, embrittled seals, etc.)

- **Deficient Installation** - Inconsistent with qualification or codes and standards (location, protection, mounting, process connections, electrical connections, etc.)

- **Deficient Configuration/Construction/Assembly** - Design qualified, but installed equipment inconsistent with qualified prototype (e.g., wrong wiring, materials)

- **Deficient Design** - Valid documentation shows equipment NOT qualifiable - DBA common-mode failure expected

Hardware-Oriented Response Strategies

- **Repair**, renewal, or refurbishment of degraded equipment or equipment at end of qualified life (EOQL)

- **Modification** of existing equipment (replace unqualified parts or lubricants, add seals, splices, drainage, etc.)

- **Relocation/Protection:** Relocate into mild or less severe harsh environment. Provide EQ barriers reduce severity of local environment (shielding, insulation, heat sinks, enclosures, steam dampers)

- **Replacement** with qualified (or qualifiable) equipment (or with traceability to qualification) - Plant mod - changes to design, procedures, training, etc.

- **Enhanced** condition monitoring and maintenance (more frequent lubrication, replacement of degradable parts, etc.)

Qualification Deficiencies

- **EQ test and analysis does not demonstrate qualification - DBA reliability indeterminate**
- **Erroneous Qualified Life Calculations - May result in foreshortened qualified life when corrected**
- **Similarity Analyses do not adequately cover installed equipment or configuration/formulation, etc.**

EQ Test and Analysis Deficiencies

- EQ Test specimen(s) not properly or sufficiently aged
- EQ Test DBA profile(s) do not envelope actual plant DBA profile(s), or without required margin, at all times required
- Functional performance not tested/demonstrated before, during and/or after the DBA or performance verification methods, test values and/or acceptance criteria inadequate
- Random failure or test artifact (e.g., over aging) claimed, but item not retested, or not enough specimens that passed
- Equipment description insufficiently detailed (e.g., materials list) to support similarity analyses
- Test did not cover post-DBA operating time or extension not properly calculated

Erroneous Qualified Life Calculations

- **Non-conservative assumptions of ambient service conditions**
- **Not considering heat rise from continuous energization, continuous or frequent operation**
- **Not considering heat input from process or adjacent equipment**
- **Erroneous activation energy for material, application, degradation mode, aging temperature**

"Erroneous Arrhenius"

*Qualified Life = (Aging Time)$e^{Ea/k(1/Tam-1/Tag)}$

Where "Ea" is activation energy in electron volts (eV), "k" is Boltzman's Constant (0.862 x 10E-4 eV/☜K), "Tam" is the assumed ambient temperature (local thermal environment of limiting component in degrees Kelvin), "Tag" is the accelerated thermal aging temperature in ☜K, and times are in hours.

***The time period determined with the equation above becomes a *qualified* life when the component that has been aged in accordance with the equation has performed satisfactorily for as long as required before, during and after a DBE simulation. The component may be much more durable than indicated, but the qualified life is just that amount of service life that has been proven.**

Engineering Response Strategies

Test, analyze - “sharpen the pencil” - Combinations of:

- Tests of similar equipment under less severe conditions or with degraded but acceptable application-specific performance
- Reactor de-rating? Less severe source terms with current fuel load?
- Active containment heat removal systems (e.g., fan coolers, ice condensers) not reflected in DBA profiles?
- Existing shielding, insulation or heat sinks not taken credit for in profile calculations
- Operating time versus DBA profile, thermal lag, and margin analyses
- Similarity analyses for tests of similar limiting materials in similar applications (e.g., epoxy potting)
- New qualification or re-qualification of existing equipment

Situations when it may be more cost effective to replace equipment vs. engineering remedies:

- **EQ docs not available and there is long lead time and excessive expense for new testing**
- **Manufacturer Out of Business or no longer makes and/or supports the product**
- **Manufacturer No longer has nuclear QA program/no longer has records**
- **Lack of spares and/or replacement parts not available**
- **Equipment near EOQL**

Deficient Procurement and/or Procurement Records

- Lack of adequate source information
- Lack of adequate traceability to OEM
- Lack of design, material, and manufacturing process change history
- Lack of reconciliation of EQ/Seismic with changes
- Inadequate qualification of supplier
- Inadequate OEM/supplier QA/QC
- Inadequate CGI Dedication

COMMERCIAL-GRADE DEDICATION for EQ CONCEPTS

Purpose

Underlying Assumption

Definitions

Dedication Process

PURPOSE of COMMERCIAL-GRADE DEDICATION

To provide a systematic, rigorous, controlled process for the acceptance of commercial-grade items (CGIs) [and services] for nuclear plant safety-related applications, providing reasonable assurance equivalent to that provided by design and manufacture under a nuclear (Appendix B) QA program that the CGIs will perform their design/safety functions, with no failures adverse to safety, for their design lifetime, under all design basis conditions. The process is not intended to be an alternative to Appendix B, but an equivalent alternative method of meeting the applicable criteria of 10 CFR Part 50, Appendix B.

UNDERLYING ASSUMPTION

The fundamental, underlying assumption upon which dedication is based is that most industrial products produced by reputable, well-established firms are generally of good quality and should consistently meet the manufacturer's specifications and applicable industry standards when designed and manufactured under a documented and effectively implemented commercial quality assurance (QA)/quality control (QC) program (e.g., ISO-9000). However, because even the best commercial quality programs may not be as rigorous as Appendix B programs, not only must CGIs be reviewed for suitability of application, but each CGI (or a representative sample of simple CGIs) must be verified to meet the specifications and applicable requirements of the plant-specific application.

DEFINITIONS (10 CFR 21.3)

Basic Component - When applied to NPPs licensed under 10 CFR Part 50 (and now 52) - a structure, system or component (SSC), or part thereof (that affects safety function) necessary to assure (A) the integrity of the reactor coolant pressure boundary, (B) the capability to shut down the reactor and maintain it in a safe shutdown condition, and (C) the capability to prevent or mitigate the consequences of accidents which could result in offsite release of radioactivity and potential radiation exposures, i.e., safety-related components

Also, basic components are those that are designed and manufactured under a 10 CFR Part 50, Appendix B, QA program or commercial-grade items that have successfully completed the dedication process.

Commercial-Grade Items (CGI) - (for plants licensed under Part 50), SSCs or parts thereof that affect safety functions, that were NOT designed or manufactured as basic components. CGIs do not include items for which one or more critical characteristics cannot be verified.

Critical Characteristics - When applied to plants licensed under 10 CFR Par 50, those important design, material and performance characteristics (measurable attributes) of CGIs that when verified provide reasonable assurance that the item will perform its intended safety function.

Dedication - (for Part 50 plants) - an acceptance process meant to provide reasonable assurance that CGIs to be used as basic components will perform their intended safety function(s) and in this respect is deemed to be equivalent to an item designed and manufactured under a 10 CFR Pat 50, Appendix B, QA program. This assurance is achieved by identifying and verifying critical characteristics by inspection, test, and/or analysis supplemented

as necessary by commercial-grade surveys, product inspection or witnessing at hold points at the factory and analysis of historical performance records. In all cases, the dedication process must be conducted IAW the applicable provisions of 10 CFR Part 50, Appendix B. Dedication is complete when the item is designated for use as a basic component (may require post-installation testing before process is consdered complete and the item is released for plant operation)

Dedicating Entity - The organization that performs the dedication. May be the manufacturer, the licensee or a third party (or a combined, coordinated effort). The dedicating entity is responsible for the item dedicated with regard to the requirements of 10 CFR Part 21 and must maintain auditable records of the dedication process.

DEDICATION PROCESS

- Technical Evaluation
- Procurement
- Acceptance

TECHNICAL EVALUATION
(Review for suitability of Application)

- **Similarity Analysis**
- **Safety Function(s)/Application-Specific Functional Performance Requirements/Success Criteria**
- **Design Service Conditions (normal, abnormal, harsh environment, seismic)**
- **Critical Characteristics**
- **Selection of Verification Methods**
- **Selection of application-relevant acceptance criteria**

SIMILARITY ANALYSIS

- Is the installed/to be installed equipment identical, similar or "equivalent" to the EQ test specimen? - Traceability to test item/OEM

- Consider form, fit, function, process, material, vintage, change history manufacturer/factory, model/configuration/settings/options, close or sequential serial numbers/date codes, vendor QA/QC.

- If the installed/replacement equipment is a CGI, develop critical characteristics, non-destructive verification methods and application-specific acceptance criteria to show that production units will perform as well or better than the test specimen - OEM traceability essential.

- Margin, Margin, Margin! Covers a multitude of sins (**S**imilarity **I**nsufficiencies for **N**uclear **S**ystems)

SAFETY FUNCTIONS

- Active
- Passive
- Detailed Failure Modes and Effects Analyses
- Plant and Industry Operating Experience Evaluation
- Detailed analysis of vulnerabilities/sensitivities to environmental stressors
- Detailed Material and Durability analysis
- Required Operating Times

DESIGN SERVICE CONDITIONS

- Normal - Full Range of possible values - supplied power, process, loads, environment (thermal, atmospheric, radiation, vibration and shock), duty cycles,
- Abnormal - (e.g., loss of HVAC)
- Harsh - Design Basis Events - EQ and Seismic
- Service Life
- Qualified Life

CRITICAL CHARACTERISTICS

- Measurable, Inspectable or testable attributes derived from safety functions and service conditions - performance - durability
- NP-5652, 6406, Design, Acceptance
- GL 91-05, 10 CFR Part 21
- EQ: Seismic and harsh environment performance indicators

VERIFICATION OF CRITICAL CHARACTERISTICS
(Criterion VII - Qualification of Suppliers, examination of products)

- **Methods - Non destructive but relevant to application functions and service conditions**
- **EPRI Acceptance Methods - GL 89-02**
- **EPRI JUTG Technical Evaluations**
- **Opportunities: Surveys, Source Verifications, Hold Points, receipt inspection, dedication inspection and testing, post-installation testing and inspection**
- **Sampling - Homogeneity, historical data**
- **Traceability - documented to OEM if relied upon for one or more critical characteristics**

POSSIBLE IMPACT OF RIP 50, OPTION 2 ON EQ and Dedication

- Risk-Informed Safety Classifications (RISCs)
  - RISC-1 (HSS, SR), RISC-2 (HSS, NSR)
  - RISC-3 (LSS, SR), RISC-4 (LSS, NSR)

- 10 CFR 50.49 (b)(1), (b)(2), and (b)(3)

- HSS and LSS Categories, possibly per 10CFR50.65 Implementation

- (b)(1) includes ALL RISC-1 and RISC-3 equipment

- (b)(2) includes CERTAIN RISC-2 and RISC-4 equipment

- (b)(3) includes CERTAIN RISC-2 and RISC-4 equipment

- RISC-1 and 2 equipment: most likely treated per current practice

- RISC-3 equipment: special treatment may be somewhat relaxed

- RISC-4 SSCs may be allowed to be removed from EQ scope

REGULATORY REQUIREMENTS, STAFF POSITIONS, ENDORSED INDUSTRY GUIDANCE, Other Useful References

<u>Equipment Qualification</u>

10CFR50.49
Regulatory Guide (RG) 1.89
RG 1.97
IEEE Std 323
Daughter Standards and Associated RGs
various NUREGs (e.g., Sandia Labs)
EPRI materials application and aging data
EPRI TR 100516CD - *NPP EQ Reference Manual* (August 1997)
EPRI NP-4001-4-90 - "Maintaining EQ"
Gradin, L.P., *Equipment Adequacy Demonstration for Nuclear Power and Related Facilities*
ANS, *Proceedings of the International Topical Meeting on Operability of Nuclear Power Systems in Normal and Adverse Environments* (1986),

<u>Procurement and Acceptance</u>

10 CFR Part 50, Appendix B, Criteria III, IV and VII
RG 1.28, ASME/NQA-1
ANSI/N45.2 and daughters (and associated RGs)
RG 1.31, ANSI N18.7/ANS 3.2
EPRI NP-6895, *Guidelines for the Safety Classification of Systems, Components and Parts Used in Nuclear Power Plant Applications (NCIG-17)* - February 1991
EPRI NP-6629, *Guidelines for Procurement and Receipt of Items for Nuclear Plants (NCIG-15)* - May 1990

<u>Dedication</u>
10 CFR Part 21
10 CFR Part 50, Appendix B, Criterita III, VII and other criteria necessary to control the dedication process
GL 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marketed Products" March 11, 1989
GL 91-05, "Licensee Commercial Grade Procurement and Dedication Programs," April 9, 1991
NRC IP 38703, "Commercial Grade Dedication"
EPRI NP- 5652, *Guidelines for the Utilization of Commercial Grade Items in Nuclear Safety-related Applications (NCIG-07)*

EPRI TR 102260, *Supplemental Guidance for the Application of EPRI NP-5652 on the Utilization of CGIs* - May 26, 1994
EPRI TR 1003105, *Dedicating CGIs Procured from ISO 9000 Suppliers* - December 2001
EPRI NP-6406, *Guidelines for the Technical Evaluation of Replacement Items in NPPs (NCIG-11)* - December 1989 (CCD/CCA, Parent, LfL-Stds)
EPRI NP-7218, *Guideline for the Utilization of Sampling Plans for CGI Acceptance (NCIG-19)* - May 1991
EPRI TR 017218-R1, *Guideline for Sampling in the CGI Acceptance Process* - December 30, 1998
EPRI TR 112579, *Critical Characteristics for Acceptance of Seismically Sensitive Items*, August 29, 2000
Sargent & Lundy, "Use of Other Industry Standards to Facilitate the Procurement and Dedication of CGIs", April 1994
EPRI TR 107372, *Guidelines for Reverse Engineering at NPPs* - July 1998
NUPIC, Commercial-Grade Survey Procedure and Checklist
EPRI - JUTG Technical Evaluations