

ILLINOIS POWER COMPANY



CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

April 18, 1986

Docket No. 50-461

Director of Nuclear Reactor Regulation
Attention: Dr. W. R. Butler, Director,
BWR Project Directorate No. 4
Division of BWR Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Clinton Power Station
SER Outstanding Issue #711
Seismic and Dynamic Qualification of Equipment

Dear Dr. Butler:

This letter is in response to the Open Item identified in NUREG-0853 Supplement No. 5 "Safety Evaluation Report Related to the Operation of Clinton Power Station, Unit No. 1," Section 3.10.1.3 and Table 3.1; and NRC requests for supplemental information during a meeting in the offices of Sargent and Lundy in Chicago on January 28 and 29, 1986. Attached for the Staff's review are Illinois Power Company's responses.

Please contact us if you have any questions on this matter.

Sincerely yours,

F. A. Spangenberg
Manager - Licensing
and Safety

MED/ckc

Attachments (15)

cc: B. L. Siegel, NRC Clinton Licensing Project Manager
NRC Resident Office
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety

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The following constitutes Illinois Power Company's responses to the Open Items in NUREG-0853 Supplement No. 5, Section 3.10.1.3 "Generic Findings" and Table 3.1 "SQRT Equipment Audit: Specific Findings", and NRC requests for supplemental information.

- * Generic 1: "As presented during the audit, the valve procurement specification does not provide adequate definition of an active component (e. g., Spec. K-2866A, Form 350-B, 2.3.3). All active valve specifications should be revised to affirm that an active valve must not experience deflection greater than a certain allowable limit."

Response: Purchasing of active valves is complete. Consequently, a revision to an existing specification is not warranted. However, the Clinton Specification for Dynamic Qualification Criteria for Nuclear Safety Related Equipment K-2836, which replaced Form 350-B, has been revised. It requires that active valves be qualified by test or a combination of test and analysis. As this standard will be used for all future specifications, assurance is provided that qualification will be supported by testing. Assurance that existing active valves will not experience deflection greater than allowable limits is discussed in response to Generic Item 4. (Attachment 2)

- * Generic 2: "The FSAR and active valve specifications allow qualification of an active valve solely by analysis. Both the FSAR and all active valve specifications should be revised requiring operability demonstration of an active valve assembly by testing, or a combination of testing and analysis, as required."

Response: The FSAR has been revised (Amendment 37) to require that active valves be qualified by test or a combination of test and analysis. (Attachment 3)

- * Generic 3: "The applicant should submit a list of all active valves indicating as a minimum their safety functions and the systems they are located in."

Response: The attached copy of SQ-CL073 contains in Tab B a list of active equipment as requested. (Attachment 5)

- * Generic 4: "The audit revealed that operability of active valves was not properly demonstrated. Testing is required to demonstrate operability of the valve assembly. A static deflection test simulating appropriate inertia and operating loads can be used to demonstrate valve operability, provided the structural integrity has already been established by analysis. The applicant should confirm the completion of such a test program for all active valves and submit some representative documents for the SQRT review and acceptance."

Related open items from the January 28 and 29, 1986, meeting between the NRC, Illinois Power Company, and Sargent & Lundy (S&L) in Chicago, Illinois are as follows:

- 1) "Review test report #MR52600-570-1-1, needed for similarity demonstration of valve #V526-6310-4C (reference group #2) and present the findings to the SQRT."
- 2) "For all active valves, the similarity analysis should be corrected, as needed, and included in the qualification package."
- 3) "Adequate test data were not provided to demonstrate operability of the following valves:
 - a) Anchor Darling Gate and Globe, Group 1
 - b) 8" Crosby Relief, Group 15

IP will be advised if additional test data is required for the above valves."

Response: With the exception of the three open items listed above, this Generic Issue was closed in a meeting with the NRC on January 28 and 29, 1986, in the offices of S&L. In response to these three items, the following action was taken:

- 1) Report MR52600-570-1-1 has been reviewed and found to adequately address similarity. It has been incorporated by revision into qualification package SQ-CL218. (Attachment 4)
- 2) The similarity analysis for active valves has been reviewed, corrected as needed and incorporated into SQ-CL073. (Attachment 5)
- 3) Eleven test reports which support the analysis performed to qualify Anchor Darling Gate and Globe Valves (Group 1) have been obtained from Anchor Darling and incorporated into package SQ-CL073. These test reports conclusively demonstrate the operability of Group 1 valves. The specific reports obtained were:

<u>Valve Operator</u>	<u>Report Number</u>
1501b- 4", Flex Wedge Gate Valve, SMB-000-5	E6794-1
1501b-12", Flex Wedge Gate Valve, SMB-00-10	E6794-2
1501b-24", Flex Wedge Gate Valve, SMB-0-25	E6794-3
6001b- 4", Flex Wedge Gate Valve, SMB-00-5	E6794-4
6001b-10", Flex Wedge Gate Valve, SMB-1-25	E6794-5
9001b- 8", Flex Wedge Gate Valve, SMB-0-40	E6794-11
9001b-12", Flex Wedge Gate Valve, SMB-3-100	E6794-10
3001b- 4", Globe Valve, SMB-00-5	E6794-6
3001b-14", Globe Valve, SMB-3-80	E6794-7
9001b- 3", Globe Valve, SMB-00-5	E6794-8
9001b- 8", Globe Valve, SMB-2-60	E6794-9

A 6" Crosby Relief Valve report has been obtained and was incorporated into SQ-CL073. The addition of this report completes the qualification effort for Group 15 valves. (Attachment 5)

- * Generic 5: "Since the equipment master list is used by the staff to assess the status of the qualification program, the applicant should revise the master list to correctly report the qualification and installation status of all safety related equipment and submit an updated version every month until the program is completed."

Response: The requested list has been and is being updated and submitted monthly.

- * Generic 6: "It was observed during the audit that the dynamic interaction between closely installed cabinets was not properly addressed in the qualification package. The applicant should survey all closely installed equipment items, address such installation in the respective qualification documents, and perform field modification or attachment, as required, to preclude any dynamic impact that may otherwise jeopardize or invalidate the existing qualification."

Response: As stated in Illinois Power (IP) Letter U-600337 dated November 27, 1985, a survey of electrical, control and instrumentation cabinets has been completed and it was found that there are no cabinets outside of the main control room which are mounted adjacent to each other.

The installation of main control room cabinets is in accordance with General Electric Power Generation Control Complex Installation Instruction No. 22A4185. This instruction specifies in Articles 5.4.14 and 5.8.6 that adjacent panel modules must be bolted together. The installation of the specific control room panels (i.e., 1H13-861/862) found not bolted during the SQRT audit was incomplete. The required bolting has been completed under CWR-6465 and verified by the Equipment Qualification Task Force.

- * Generic 7: "It was observed during the audit that the wall response spectra were used instead of the floor response spectra to compare with the test response spectra of floor-mounted equipment substantially away from the wall. The applicant should verify all such cases and confirm that all floor-mounted equipment pieces are still qualified to the corresponding floor response spectra."

Response: As stated in Illinois Power Letter U-600337 dated November 27, 1985, all BOP and NSSS seismic qualification packages have been reviewed for the use of wall response spectra in the qualification of floor-mounted equipment. Only one case, in addition to the Vertical Lift Metal Clad Switchgear 1E22-S004 identified during the SQ audit, was found. Equipment seismic qualification package SQ-CL580 for H22 Local Panels uses wall response spectra. It was evaluated and found consistent with Clinton Design Criteria which state that vertical wall response spectra may be used for floor-mounted equipment when "equipment is located within a distance of $2t$ from the wall where t is the thickness of the slab." The H22 Local Panels are located 2.5 ft from a wall on a slab 3.5 ft thick. Seismic qualification package SQ-CL683 for the Vertical Lift Metal Clad Switchgear has been revised to include floor response spectra evaluation. This evaluation shows the equipment qualified.

The design criteria regarding the use of vertical wall response spectra for floor-mounted equipment, as stated above, limits its applicability to only equipment located "within a distance 2t from the wall." This means that all points of equipment contact with the floor are within 2t of the wall.

- * Generic 8: "It was observed during the audit that the qualification packages, especially for NSSS equipment, as presented, were generally not complete. The applicant should verify and confirm that the final qualification packages include all pertinent qualification information."

Response: As stated in Illinois Power Letter U-600404 dated January 16, 1986, all NSSS seismic qualification packages were reviewed to assure pertinent qualification information was included. In instances where the qualification appeared incomplete, additional documentation was obtained and incorporated through issuance of a qualification package revision.

- * Open Item NSSS-1.1 - "Qualification package as originally presented did not demonstrate similarity between the Clinton cabinet and the test specimen. Upon request, GE produced additional documents which should be made part of the qualification package."

Response: As stated in Illinois Power Letter U-600386 dated December 31, 1985, the qualification package for panel 1H13-861/862 (i.e., package SQ-CL594) has been revised. It now includes those GE documents which demonstrate similarity between the tested panel and that used at Clinton. A copy of the revision to SQ-CL594 is Attachment 5.

- * Open Item NSSS-1.2 - "Site inspection revealed that the subject panel was installed between the two other panels, and it was bolted to one and unattached to the other. The available documents did not address the possible impact with the unattached panel and dynamic interaction with the bolted panel."

Response: As stated in Illinois Power Letter U-600386 dated December 31, 1985, the subject panels have been bolted together in accordance with GE Drawings 866E470 and 262A7152. The condition noted was the result of incomplete work in progress.

- * Open Item NSSS-1.3 - "Door panels were found loose during the site inspection."

Response: As stated in Illinois Power Letter U-600386 dated December 31, 1985, the door panel 1H13-861/862 has been verified secured by the Illinois Power Company Equipment Qualification Task Force.

- * Open Item NSSS-2.1 - "Valve specification K2866A, Form 350-B, Section 4.1 states that the operability of an active valve can be demonstrated by analysis only. Specifications should be revised requiring operability verification by testing."

Response: As stated in response to Generic Item 1, Form 350-B has been replaced by the Clinton Specification for Dynamic Qualification Criteria for Nuclear Safety Related Equipment, K-2846. This document specifically requires qualification by testing or by a combination of testing and analysis.

- * Open Item NSSS-2.2 - "Operability of the valve assembly was not demonstrated. Testing is required."

Response: As discussed in response to Generic Item 4, additional test reports have been assembled and incorporated into the qualification package. This adequately demonstrates valve operability.

- * Open Item NSSS-3.1 - "Fatigue capabilities of components at critical locations (e.g., braces, hanger bolts, etc.) under SRV cycling was not demonstrated by the finite element analysis presented during the audit."

From NRC exit statements: "Re S&L's calculation provided during the audit, which accounts for the presence of flaws (cracks) in estimating allowable fatigue cycle will be further reviewed by the SQRT."

Response: The SQRT has not advised the applicant of any further questions concerning the Hydraulic Control Unit (HCU) fatigue. The additional calculations performed during the NRC SQRT audit to support the HCU seismic qualifications have been formalized in revision 1 to seismic qualification package SQ-CL534. (Attachment 15)

- * Open Item NSSS-3.2 - "Some of the pipes attached to the top of the unit (withdrawal lines) were loose."

Response: The subject lines were verified as being properly installed in accordance with RCI drawings CLN-002, 003, 005, 006, 016 and 100 through 113.

A review of the HCU piping determined the following:

- 1) The lines which serve the HCUs consist of drive water, exhaust, cooling and charging lines. These lines are designed to meet ANSI B31.1 for thermal and deadweight only. Since these lines are non-seismic, they do not have to be laterally restrained.
- 2) The insert, withdraw, and scram drop lines are ASME Class 2 piping. They are designed for seismic loads and are rigidly restrained in all directions.

- 3) Illinois Power Letter G-500039 dated December 27, 1985, transmits excerpts from Reactor Control, Inc., ASME Class 3 piping design reports AS-7458-P-1 and SA-7458-P-2 for the safety-related riser assemblies of the HCU. These reports demonstrate that the piping to the first fixed points on the HCUs meet ASME code allowables. These reports, along with the General Electric (GE) analysis of the scram riser, satisfy the HCU interface requirements delineated in GE document 23A1906, Section 4.

The attached IP letter and the facts that 1) the associated HCU piping has been installed as designed, 2) the HCU piping stresses are within the applicable code allowables, and 3) the piping interfaces meet the HCU requirements (see Attachment 7), should resolve this issue.

- * Open Item NSSS-3.3 - "Justify the acceptability of the anomaly regarding the high-pressure water line break observed during the test."

SQRT comments during the January 28-29, 1986 meeting at S&L offices in Chicago: "IPC claims that a new specimen was tested and no failures occurred. This test report should be made available for SQRT review."

Response: As stated in Illinois Power Letter U-600370 dated December 18, 1985, the breakage of one of the high pressure water lines occurred during a 2 times Safe Shutdown Earthquake (SSE) test of test specimen S/N 4254 mounted in a rigid fixture configuration. This failure was after the specimen had been subjected, in the x-y (front-to-back) axis, to resonance search, 5 Operating Basis Earthquakes (OBE's) of 45 seconds each, and 1 SSE of 45 seconds. The failure, which occurred 20 seconds into the 2 times SSE test, is documented in Notice of Deviation 1. General Electric and Wyle agreed that the failure resulted from excessive testing, as follows:

- 5 OBE's and 1 SSE of 45 seconds duration were applied, whereas the IEEE 394-1975 requirement is only 15 seconds each. Thus each test was 3 times longer than required.
- During the 2 times SSE test the sample was subjected to twice the maximum required g levels, whereas only 1 SSE test is required after the OBE tests. So, the g levels were twice what was required, and the two SSE tests were longer than required by the standard.

After the failures, General Electric and Wyle revised the test duration to 30 seconds, and deleted the 2 times SSE test (see Notice of Deviation 2).

The test was conducted again with new test specimen S/N 0383, and no failures occurred. Thus, the HCU was shown to be qualified to the General Electric generic Required Response Spectra (RRS) curves.

Sargent & Lundy used this test result as the basis for qualifying the Clinton HCUs. Margins between the test and the Clinton RRS are summarized below, and in Table I (Attachment 8):

- The General Electric generic RRS' g-values envelop Clinton's RRS curve, with a margin of between 4 and 14.
- The first test is 20 to 30 times as severe as Clinton's RRS curve.

The test report requested during the 01/18/86 meeting in Chicago is part of the same test report reviewed by SQRT during the NRC audit at Clinton in August of 1985. Pages 3, 253 and 254 from Wyle Report 53530 describing the failure of specimen S/N 4254 and the successful retesting of specimen S/N 0383 are in Attachment 9.

* NSSS-4, 5, 6, 7, 8 (Closed)

* Open Item NSSS-9.1 - "A number of anomalies were observed during the test. GE Report 0317HA318 identifies modifications performed on the switchgear. However, 1:1 correlation between the anomalies and the modifications made to preclude recurrence of similar problems is still missing."

Response: Quoting from Report No. 43581, from seismic qualification package SQ-CL683 Pages 7 and 8, the anomaly and modification are as follows:

"During test 44 the breaker did not close when the remote control signal was applied. The positive interlock lever was not in the proper position after the test. Manual tripping of the breaker unblocked the mechanism allowing the breaker to be closed. The General Electric Company made the following evaluation of the problem:

Post seismic testing and analysis by the General Electric Company determined that during Run 44 the breaker mechanism responded properly to the closed signal but could not complete the operation due to blocking by the positive interlock props. These props were rotated into the blocking position by engagement of the breaker positive interlock roller with its mating cam plate which was caused by front to back direction relative motion of the breaker with respect to the equipment

To prevent the positive interlock parts from blocking a closing operation in the raised connected position, front to back motion restrictors have been added to the design."

General Electric Letter IP-2748 dated 11/11/85 (Attachment 10) confirms that the field modifications responding to Wyle Report No. 43581-1 were incorporated in the equipment design and manufacture. The proprietary drawings of the motion restrictor were audited at General Electric's Philadelphia Plant 11/21/85. Figure 1 and Photographs 1-3 of Attachment 10 which show the motion restrictor were obtained during this audit. The Metal Enclosed Switchgear installed at Clinton Power Station was then inspected to verify motion restrictors were installed. Photographs 4-9 show the motion restrictor installation at Clinton. (Attachment 10)

- * Open Item NSSS-9.2 - "Nonconformance tags issued by QC (e.g., NCR 32343 and NCMR 2-0054) were observed during site inspection."

Response: NCR 32343 and NCMR 2-0054 have been closed.

- * Open Item NSSS-10.1 - "As installed P652 was situated between two other panels, P655 and P634. As tested, it was mounted as the end cabinet next to P653. It was not demonstrated how the test results relate to the as-installed arrangement."

Response: As stated in Illinois Power Letter U-600404 dated January 16, 1986, the Rod Action Control Panel seismic qualification package SQ-CL737, was revised to address differences between tested and field mounting. A copy of this revision is attached for your review. (Attachment 11)

- * Open Item BOP-1.1 - "Movable lifting trolley was not secured in place during the inspection and there was no means to secure it."

Response: Installation of the movable lifting trolley locking device is complete and has been verified by Illinois Power Company.

Clinton Power Station Procedure No. 8410.02, "480 Volt Power Circuit Breaker," has been revised to incorporate steps to verify use of the locking device.

- * Open Item BOP-1.2 - "The original Wyle report documenting anomalies and disposition of anomalies was not available."

Response:

(Closed per matrix of "Generic and Specific Issues" provided by the NRC in the January 28 and 29, 1986 meeting in Chicago.)

- * Open Item BOP-2.1 - "The site inspection revealed the following: a) Transmitter installation is incomplete."

Response: As stated in Illinois Power Letter U-600370 dated December 18, 1985, installation of the Rosemount transmitter associated with panel OPL43J is complete and has been verified by the Illinois Power Company.

- * Open Item BOP-2.2 - "The site inspection revealed the following: b) The panel door was open."

Response:

(Closed per matrix of "Generic and Specific Issues" provided by the NRC in the January 28 and 29, 1986, meeting in Chicago.)

- * Open Item BOP-3 (Closed)

- * Open Item BOP-4.1 - "Door screws were observed loose during the site inspection."

Response: As stated in Illinois Power Letter U-600274 dated October 23, 1985, panel door screws have been tightened. This door had been loosened to facilitate testing. Such alterations to equipment are controlled procedurally (i.e., Startup Administrative Procedure, SAP-8, "Temporary Alterations").

- * Open Item BOP-4.2 - "The equipment has been classified as passive. Applicant should verify and correct the classification if required."

SQRT comments made during the January 28 and 29, 1986 meeting at S&L offices in Chicago are as follows:

- 2a) The equipment has been classified as passive. Illinois Power should verify and correct the classification if required.
- 2b) If the equipment is safety-related, why were the modifications not implemented in the field?
- 2c) If the equipment is non safety-related, why was this equipment included in the list of safety-related items submitted to the SQRT for selection of audit items?

Response: As stated in Illinois Power Letter U-600337 dated November 27, 1985, the functional classification reported on the NRC Seismic and Dynamic Qualification Summary of Equipment just prior to the SQRT audit was in error. A corrected Page 1 is attached and identifies the equipment as "Active." (Attachment 12)

- 2a) The original response addressed this issue.
- 2b) No field modifications were required, since the test anomaly involved only a non-IE device and had no impact on any safety equipment function. Refer to Pages 4-6, Run 11 and 4-31 from the seismic qualification package which discuss the test anomaly. Refer to Pages 5-1, 5-2 Recommendations and 5-2, Item 1. Field Modifications. (Attachment 13)
- 2c) This equipment is safety-related.

- * Open Item BOP-5 (Closed)

- * Open Item BOP-6.1 - "Motor (40-hp, frame 364TZ) was not installed."

Response: The Standby Liquid Control Pump Motor, 1C41-C001, has been installed.

- * Open Item BOP-7.1 - "Some panel covers were not properly installed."

Response:

(Closed per matrix of "Generic and Specific Issues" provided by the NRC in the January 28 and 29, 1986, meeting in Chicago.)

- * Open Item 7.2 - "Oil was found leaking at engine sump O-ring."

Response:

(Closed per matrix of "Generic and Specific Issues" provided by the NRC in the January 28 and 29, 1986, meeting in Chicago.)

- * Open Item BOP-7.3 - "Submit complete seismic qualification report for Agastat safety setup relay (EQ reference CQD-016225)."

Response: Illinois Power's Letter U-600274 dated October 23, 1985 stated: "All remaining Diesel Generator devices (i.e., 1600 items) have been qualified with the exception of the following two devices:

- 1) Beloit Power Systems Generator: General Electric Company is to provide a qualification report by November 30, 1985.
- 2) Speed Sense Generators: Qualification is scheduled to be complete October 31, 1985."

The qualification is now complete and the Agastat relay qualification report is provided as Attachment 14.

- * Open Item BOP-7.3 - Request for Supplemental Information - The matrix of "Generic and Specific Issues" provided by the NRC in the January 28 and 29, 1986, meeting in Chicago stated:

- a) Verify and justify the acceptability of the variation of the activation time from the time delay relay.
- b) Confirm completion of qualification of remaining devices.

Response: a) The accuracy of the time delay of Agastat model 7012, 7022 and 7024 with set delay times of 200 seconds or less is plus or minus 5%.

All of the Class 1E active timing relays are set for delay times of less than 200 seconds. Although the time-delay acceptance criteria specified in the qualification test report was 10%, the Clinton unique evaluation documented in the referenced report was to the manufacturer's requirement plus or minus 5%. While this time-delay accuracy is used to measure performance, it is not a basis for acceptance or rejection of the relay. One characteristic which is used as a basis for acceptance or rejection is repeatability of performance.

The purpose of the qualification test is to demonstrate that performance of the component is not adversely affected during abnormal operating conditions (i.e., an earthquake). This is done by comparing performance characteristics before testing, with those taken during and after testing. Table 11.0 of the qualification test report summarizes the results of the testing. For set times of 15 to 20 seconds, the switch activated at precisely the set time. For set times of 40 to 50 seconds, the switch activated consistently 2 to 3 seconds early. This is true for every phase of testing from the initial baseline functional check, through the post-LOCA functional test. Again, the plus or minus 5% acceptance criteria was used.

The results of the relay tests clearly demonstrate that the relay performance did not degrade during the test program. Based on these results, these Agastat timing relays were found to be qualified for use on the diesel generator sets.

Instrument data sheets MD347 and MD348, issued for the Agastat relays, specify an accuracy of plus or minus 5%.

b) All diesel generator devices are now qualified.

* Open Item BOP-8 (Closed)

* Open Item BOP-9.1 - "Operability of active valve was not demonstrated (see also NSSS-2)."

Response: As discussed in response to Generic Item 4, additional test reports have been assembled and incorporated into the qualification package. This adequately demonstrates valve operability.

* Open Item BOP-10 (Closed)