U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-295/81-28; 50-304/81-26

Docket Nos. 50-295; 50-304

Licenses No. DPR-39; DPR-48

Licensee: Commonwealth Edison Company P. O. Box 767 Chicago, IL 60690

Facility Name: Zion Nuclear Power Station, Units 1 and 2

Inspection At: Stone and Webster Engineering Corp., NY (December 1-2, 1981) Commonwealth Edison Company, Chicago, IL (December 8, 1981) USNRC-RIII, Glen Ellyn, IL (July 31 and December 21, 1981)

Inspection Conducted: July 31, December 1-2, 8, and 21, 1981

1/25/82

Inspector: I. T. Yin / Jin Approved By: D. H. Danielson, Chief Materials and Processes Section

Inspection Summary

8202090364 8201 PDR ADOCK 0500

3

Inspection on July 31, December 1-2, 8, and 21, 1981 (Reports No. 50-295/81-28; 50-304/81-26)

Areas Inspected: Licensee actions relative to IE Bulletin 79-14, including general discussion on NRC requirements, work procedure review, and observation of work. This inspection involved 24 inspector-hours in the A-E, the licensee, and USNRC-RIII offices by one NRC inspector.

Results: Of the areas inspected, two violations were identified - (Severity Level V - Inadequate site procedure to ensure proper torquing at the pipe clamps, Paragraph 2.a; Severity Level V - lack of engineering basis to justify slotted restraints can be modeled as rigid restraints in the computer calculations, Paragraph 3.b.)

DETAILS

Persons Contacted

Meeting at RIII on July 31, 1981

CECo

T. R. Tramm, Nuclear Licensing Administrator F. G. Lentine, Station Nuclear Engineer C. K. Richardson, Station Nuclear Engineer

SWEC-NY

E. J. Siskin, Engineering Manager P. Dunlop, Assistant Engineering Manager J. H. MacKinnon, Project Manager

SWEC-Boston

D. C. Shelton, Chief Engineer, Engineering Assurance F. B. Baldwin, Assistant QA Manager

NRC-RIII

C. E. Norelius, Director, Division of Engineering and Technical Inspection D. H. Danielson, Section Chief J. M. Hinds, Reactor Inspector I. T. Yin, Reactor Inspector

Inspection at SWEC on December 1-2, 1981

CECo

*D. B. Wozniak, Principal Engineer

SWEC-NY

*P. Garfinkel, VP and Deputy Manager *E. J. Siskin, Engineering Manager *P. Dunlop, 'ssistant Engineering Manager *K. Y. Chu, Division Manager, EMD *D. S. Patel, Project Engineer *S. Liu, Assistant Project Engineer *J. Petruso, QA Program Administrator

Stone and Webster Corporation - Boston

*J. W. Kelly, QA Program Administrator *W. R. Curtis, Lead EA Engineer

USNRC-RIV

*D. D. Chamberlain, Contractor Inspector

*Denotes those attending the exit meeting on December 2, 1981.

Inspection at CECo on December 8, 1981

CECo

*D. B. Wozniak, Principal Engineer *F. G. Lentine, Nuclear Licensing Administrator *J. E. LaFontaine, Zion Staff Engineer, Maintenance

SWEC-NY

*P. Dunlop, Assistant Engineering Manager

Sargent and Lundy

*G. T. Kitz, Division Head, EMD *S. E. Azzazy, Supervisor, EMD *R. H. Jason, Project Manager

*Denotes those attending the management exit meeting on December 8, 1981.

Inspection at NRC-RIII Office on December 21, 1981

CECo

*L. D. Butterfield, Zion Project Engineer, SNED
*J. S. Abel, Station Nuclear Engineer
*F. G. Lentine, Nuclear Licensing Administrator
*D. B. Wozniak, Station Nuclear Engineer
*J. E. La Fontaine, Maintenance Engineer, Zion

Sargent and Lundy

*G. T. Kitz, Head, EMD *S. E. Azzazy, Supervisor, EMD *R. H. Jason, Project Manager

USNRC-RIII

*D. H. Danielson, Section Chief *J. Neisler, Project Inspector *I. T. Yin, Reactor Inspector

*Denotes those attending the management exit meeting on December 21, 1981.

Licensee Action on Previously Identified Items

(Closed) Unresolved Item (295/80-19-03; 304/80-19-03): In conjunction with NRC-RIV Report No. 99900507/79-03, dated October 12, 1979, paragraph 3.g(2), relative to the lack of shear lugs on pipe clamps to prevent slippage during an axial loading condition, the S&L engineers determined that torquing the pipe clamp bolts was required. A letter, dated October 30, 1979, was forwarded to CECo. This recommendation was not included in the site inspection procedure. Followup inspection was performed in December 1980 at SWEC, and the findings were recorded in RIII Report Nos. 50-295/80-24; 50-304/80-26. The inspector concluded this item to be a violation subsequent to the review of the subject matters during this inspection. See Paragraph 2 for details.

(Closed) Unresolved Item (295/80-19-05, 06, 07; 304/80-19-05, 06, 07; 295/80-24-01, 03; 304/80-26-01, 03): These items involve SWEC corporate control of project performance including personnel authorities and responsibilities, qualifications, and training. Detailed discussion of the subject areas was documented in a followup inspection conducted in December 1980 at SWEC in RIII Report Nos. 50-295/80-24; 50-304/80-26. These items are closed, see Paragraph 1 for details.

(Closed) Unresolved Item (295/80-19-09; 304/80-19-09): Although a system to verify every one of the IEB 79-14 calculation packages by the Engineering Assurance personnel was in place, there appeared to be a lack of comprehensive QA program implementation audit by the SWEC QA Department. Prior to the RIII inspection, CECo performed an audit on November 24-25, 1980, Audit Report 1-80-105, to followup the RIII findings. The lack of SWEC QA audit program was documented in Finding No. 2 of the CECo audit. The responsibility of followup of this item was transferred to the RIV Contractor Inspector. See RIV Vendor Inspection Branch Report No. 99900509/81-05 for resolution.

(Closed) Unresolved Item (295/80-19-12; 304/80-19-12): The acceptability of the slotted seismic restraints. A followup inspection was performed in December, 1980 at SWEC (RIII Report Nos. 50-295/80-24; 50-304/80-26). The inspector concluded this item to be a violation subsequent to the review of the subject matters. See Paragraph 3.b for details.

(Closed) Noncompliance Item (295/80-24-02; 304/80-26-02): Failure of licensee audit to identify that SWEC management was exempting required personnel training without written justification. The responsibility of followup of this item was transferred to the RIV Contractor Inspector. See RIV Vendor Inspection Branch Report No. 99900509/81-05 for closeout details.

1. Meeting Held at RIII with CECo and SWEC Personnel

Questions relative to SWEC-NY office personnel job descriptions, personnel qualifications, and training were raised during RIII inspections at SWEC-NY on August 27-28, 1980 (RIII Inspection Report Nos. 50-295/80-19; 50-304/80-19) and December 10-11, 1980 (RIII Inspection Report Nos. 50-295/80-24; 50-304/80-26). RIII request

for position on NRC requirements on personnel qualification and training was forwarded to IE:HQ on February 10, 1981. IE:HQ letter, dated April 16, 1981, to RIII confirmed the positions stated in RIII inspection reports. CECo letter, dated May 6, 1981, was sent to IE:HQ stating the licensee's position on the subject issues. Per SWEC's request, a meeting was held at IE:HQ on July 8, 1981 to discuss the SWEC program. Matters discussed during the meeting were documented in a IE:HQ memorandum, dated July 23, 1981, to RIV Vendor Inspection Branch. A followup meeting on specific program areas that were applicable to Zion IEB 79-14 evaluation work was held at RIII at the CECo's request on July 31, 1981. Presentation on SWEC personnel selections, improvements in overall trainings provided for all levels of staff members, and job descriptions that had incorporated into specific work implementation procedures were made by the SWEC CA and Engineering management. The RIII management stated that further review of SWEC program will be conducted at SWEC-NY office during a future followup inspection. During the December 1-2, 1981 inspection at the SWEC-NY, the responsibility of review of the subject matters was transferred to the RIV Contractor Inspector. Inspection findings will be documented in RIV Vendor Inspection Branch Inspection Report No. 99900509/81-05.

2. Bolt Torque Requirements on Pipe Clamps

a. Relative to the lack of shear lugs to prevent pipe clamp slippage for those cases in which an axial force exists, the requirement of torque application to the pipe clamp bolts was addressed in the SWEC procedure. SWEC-NY Procedure ZPP-1, "Pipe Stress and Support Evaluation", Revision 8, dated Ju'y 27, 1981, where Paragraph 4.2.2.3, stated, in part, that "In accordance with construction specification, clamp bolts for skewed snubbers have to be tightened with a specific torque so that a sufficient force is developed to assure no slippage between the clamp and the pipe."

S&L in discussion with ITT-Grinnell, the manufacturer of the clamp assemblies, concluded in a letter to CECo, dated October 30, 1979, Subject: IE Bulletin No. 79-14 Pipe Clamp Torquing Requirements, the following:

Therefore, please incorporate into the 79-14 inspection program the following torque checking requirements for those hydraulic shock and sway suppressors and rigid strut assemblies that are not oriented perpendicular to the pipe:

Top Bolt Torque (Bolt No. 1, attached sketch) 5 - 25 Ft-Lbs

Bottom Bolt Torque (Bolt No. 2, attached sketch)

| Bolt Diameter | Torque Ft-Lbs |
|---------------|---------------|
| 3/4" | 25 - 50 |
| 1" | 60 - 100 |
| 1-1/4" | 100 - 150 |
| 1-1/2" | 100 - 150 |
| 1-3/4" | 100 - 150 |

In review of Zion Nuclear Station Supplementary Procedure for "IE Bulletin 79-14 Pipe Clamp Torquing Requirements", approved on February 19, 1981 where it stated, in part, that, "Check torque on pipe clamp bolts top and bottom to ensure minimum value of 10 ft-lbs. If as found torque value is 10 ft-lbs. or above, no further check is necessary. If the bolts are less than 10 ft-lbs., adjust them to 10 ft-lbs."

The field inspection procedure that differed with the design consideration was considered to be an item of violation. (295/81-28-01; 30./81-26-01).

The inspector reviewed the site data obtained after checking of the 57 pipe clamps, dated March 10, 1981. For pipe sizes o" to 16" diameter, the following information was stated in the summary:

| Restraint No. | Pipe Size | Break-a Torque | Break-away Torque (Ft-lbs) | | Re-Torquing (FtLbs.) | |
|---------------|-----------|-------------------|-------------------------------|--------|----------------------|--|
| | | Bolt #1 | Bolt #2 | Bolt # | 1 Bolt #2 | |
| SWRS-2133 | 8" | 80 | 50 | 20 | 50 | |
| SIRS-1227 | 8" | 90 | 45 | 20 | 50 | |
| CCRS-1208 | 12" | 30 | 50 | 25 | 50 | |
| CCRS-1199 | 12" | 60 | 80 | 20 | 50 | |
| CCRS-1200 | 12" | 50 | 70 | 20 | 50 | |
| CCRS-1197 | 12" | 150 | 120 | 25 | 50 | |
| CCRS-1213 | 12" | 20 | 70 | 20 | 50 | |
| CCRS-1214 | 12" | 50 | 180 | 20 | 50 | |
| CCRS-1221 | 12" | 100 | 40 | 20 | 50 | |
| CCRS-1171 | 16" | 100 | 120 | 20 | 50 | |
| CCRS-1232 | 16" | 150 | 120 | 25 | 50 | |
| CCRS-1116A | 6" | 40 | 50 | 20 | 50 | |
| CSRS-1101 | 14" | 140 | 50 | 20 | 50 | |
| CSRS-1112 | 6" | 155 | 60 | 20 | 50 | |
| CSRS-1106 | 6" | 90 | 120 | 20 | 50 | |
| CSRS-1104 | 14" | 80 | 80 | 20 | 50 | |
| CSRS-1124A | 6" | 70 | 100 | 20 | 50 | |
| CSRS-1124 | 6" | 130 | 60 | 20 | 50 | |
| CSRS-1126 | 10" | 80 | 90 | 20 | 50 | |
| CSRS-1127 | 10" | 80 | 100 | 20 | 50 | |
| CSRS-1119 | 6" | 60 | 110 | 20 | 50 | |
| CSRS-1109 | 14" | 50 | 70 | 20 | 50 | |

| Restraint No. | Pipe Size | Break-away Torque (Ft-1bs) | | Re-Torquing (FtLbs.) | |
|---|--|--------------------------------------|--------------------------------|-----------------------------|-------------------------|
| | | Bolt #1 | Bolt #2 | Bolt # | 1 Bolt #2 |
| CSRS-1122A | 10" | 60 | 50 | 20 | 50 |
| CSRS-1122 | 10" | 50 | 20 | 20 | 50 |
| CCRS-1336 | 6" | 5 | 50 | 25 | 50 |
| RHRS-1125E | 24" | 5 | 50 | 20 | 50 |
| CCRS-1159 | 8" | 5 | 15 | 5 | 40 |
| CSRS-1125 | 10" | 70 | 120 | 20 | 50 |
| CSRS-1110 | 14" | 60 | 30 | 20 | 50 |
| CSRS-1118A | 6" | 20 | 30 | 20 | 20 |
| CCRS-1193 | 16" | 150 | 75 | 20 | 50 |
| CCRS-1220 | 12" | 30 | 100 | 20 | 50 |
| CCRS-1217 | 12" | 70 | 100 | 20 | 50 |
| CCRS-1216 | 12" | 80 | 105 | 20 | 50 |
| CCRS-1204 | 12" | 40 | 15 | 20 | 50 |
| Subsequent to t (1) In view of values obt | he review, th the unpredic ained and the | e inspecto table natu improper | or comment or of the torque | nted: he brea load pr | kaway torq oportions |

(2) It was not clear whether or not lubrication was required for implementation of the S&L bolt torque values listed above. The re-torquing of the bolts inspected was without application of bolt lubrication. This is an unresolved item. (295/81-28-03; 304/81-26-03)

above data were unknown. This is an unresolved item.

(295/81-28-02; 304/81-26-02).

(3) Where documented in ITT-G standard catalog No. MPH-73 for fig. 295 double belt pipe clamp, the following technical data was specified:

| Pipe Size | Bolt | Max. Load (Lbs.) | | |
|-----------|----------|------------------|-------|--|
| | Diameter | 650 F | 750 F | |
| 6" | 7/8" | 2865 | 2555 | |
| 8" | 7/8" | 2865 | 2555 | |
| 10" | 1" | 3240 | 2890 | |
| 12" | 1" | 3240 | 2890 | |
| 14" | 1 1/4" | 4300 | 3835 | |
| 16" | 1 1/4" | 4300 | 3835 | |

In discussion with the licensee representatives, the inspector was informed that all bolts found for above pipe sizes were 3/4". Whether or not the reduction of bolt sizes will compromise the component design load rating will be reviewed further. This is an unresolved item. (295/81-28-04; 304/81-26-04)

3. Review of SWEC-NY IEB 79-14 Stress Analyses

The inspector reviewed the following calculations:

Unit 1 Calculation No. 13430-CC-20, "Component Cooling From M. B. Anchor PS-34 to Reactor Coolant Pump 1D", approved on March 17, 1981.

- Unit 1 Calculation No. 13430-RC-14, "Reactor Coolant System From Hot Leg Loop 2 to Cold Leg Loop 2", approved on June 2, 1981.
- Unit 1 Calculation No. 13430-SI-11, "Safety Injection System from M. B. Anchor PS-108 to Cold Leg Loop No. 3", approved on May 8, 1981.
 - Unit 2 Calculation No. 2RC-02, "Pressurizer Spray Line -Pressurizer Relief Discharge Into the Relief Tank" including the first computer run of the as-found system conditions, NUPIPE R2542-L58, dated August 11, 1981, where stresses exceeding the operability criteria were identified. Computer re-run with additional snubbers, NUPIPE R2542-L55, was performed on August 12, 1981. The adverse condition was reported to the licensee on September 15, 1981. The four additional snubbers were installed on October 21 to November 5, 1981.

Unit 2 Calculation No. 2CC-09, "Component Cooling System", including first computer run, NUPWW3Z, dated August 13, 1981 where stresses exceeding the operability criteria were found, and computer re-run with additional restraints, NUPWW2G, dated August 18, 1981. The adverse conditions were reported to the licensee on September 29, 1981. The one required vertical rigid restraint and the one horizontal snubber were installed at the site on October 8, 1981 and October 1, 1981 respectively.

The inspection areas included checking of the computer input coordinates, snubber pin-to-pin settings and the hot and cold snubber position settings, modeled valve weights that were based on the manufacturer's drawing information, response spectra of the specific floor elevations were being inputed into the computer calculations, adjustment of the computer calculation outputs based on the stress intensification factors established in the ANSI B31.1-1967 Power Piping Code, and handling of mechanical loss of motion effects at the slotted seismic snubber assemblies and rigid restraints. The findings were as follows:

a. Checking of Snubber Settings

The present SWEC-NY procedure ZPP-1, "Pipe Stress and Support Evaluation", Revision 8, dated July 27, 1981, where Paragraph

4.2.2.1 stated, "Provide pin to pin dimension for both cold and hot position setting". During the review of the calculations, it was noted that the calculation of subject settings based on ITT-G formula was included in the component verification packages. However, the handling of the results from the calculations was not apparent at the time of the inspection. During the meeting held at S&L on December 8, 1981, the SWEC-NY Assistant Engineering Manager stated that ZPP-1 will be revised to provide verification of the existing snubber piston settings to be in compliance with the computed values. Setting deviation tolerances for different snubber sizes and strokes will also be developed.

This is considered to be an unresolved item. (295/81-28-05; 304/81-26-05)

b. Inadequate Evaluation of the Slotted Restraints

Subject problem areas were first identified during a joint NRC RIII and RIV inspection at the S&L office on September 24-26, 1979, see RIV Inspection Report No. 99900507/79-03. A subsequent RIV inspection performed on September 15-19, 1980 at S&L closed this issue and also, the concern relative to the lack of shear lugs on the piping systems subjected to axial loadings during adve se conditions as discussed in Paragraph 2 of this report based on the fact that the evaluation responsibility of these two issues were not assigned to S&L by the licensee. Refer to RIV Inspection Report No. 99900507/80-02 for details.

During the inspection conducted on September 24-26, 1979, slots of 1/4" to 1/2" on pipe restraint attachment lugs were identified on the following restraints installed on the 16" component cooling pump discharge system. Most of the slots were in the horizontal direction.

CCRS-1230, 1229, 1226, 1227, 1228, 1220, 1221, 1222, 1223, 1230, 1231, 1232, 1217, 1216, 1218 and 1219.

The slots were designed to allow unrestricted thermal pipe movement. With this inherent freedom it is doubtful that pipe movement during an earthquake event can be effectively restrained. The non-linear characteristic of these slots was not considered in the S&L seismic analysis. Furthermore, the possibility of slots exceeding 1/2" could exist due to the lack of QC records of actual installed slot dimensions and the lack of a slot dimension verification during the IEB 79-14 field inspection. The problem could be further compounded by the fact that the older response spectrum used in piping seismic analyses peaked at a very narrow natural frequency (fn) bandwidth. Any small shifting of fn could move the system into the peak response region and cause a large increase in piping primary stresses. The S&L responsible engineers further stated that such conditions also exist in Dresdon 2 & 3, and Quad-Cities 1 & 2, CECo nuclear power plants of the same vintage, and that the ITT-G frame type rigid seismic restraints also had large spacings in between restraint structures and the piping.

A followup inspection was performed by the inspector at the S&L office on September 16-18, 1980. S&L, in representation of the licensee, provided three ASME technical papers for the inspector's review for justification of the design of the slotted restraints. The matters were documented in RIII Inspection Report Nos. 50-295/80-19; 50-304/80-19. The inspector reviewed the analytical data contained in these papers for the 0.03", 0.06" and 0.12" gaps existing in the mechanical snubbers and the combined system restraint assemblies, and stated that the data obtained can not justify slot size of 1/4" to 1 1/4" as observed during past and present inspections. Slot spacing up to 1 1/4" was found in the following restraints:

| Restraint No. | Horizontal Slot Length (in.) |
|---------------|--------------------------------|
| | Not including circular spacing |
| S1RS-1125 | 11/16 |
| S1RS-1126 | 13/16 |
| S1RS-1127 | 1/4 |
| S1RS-1128 | 1/4 |
| S1RS-1129 | 7/8 |
| S1RS-1130 | 7/8 |
| RCFR-226 | 3/4 |
| RCFR-227 | 1 |
| RCFR-228 | 3/4 |
| RCFR-230 | 1/2 |
| RCFR-231 | 3/8 |
| RCFR-232 | 3/4 |
| RCFR-233 | 1/4 |
| RCFR-234 | 1 |
| RCFR-237 | 1/2 |
| CCRS-1196 | 3/8 |

In conclusion, the inspector determined that the licensee design control relative to the subject matters was inadequate based on the following findings:

- The original slot restraint design was without technical justification and was not discussed in the FSAR.
- (2) The ASME technical publications reviewed by the inspector were far from conclusive in comparison with the response spectrum analysis and non-linear analysis as to the effects of the mechanical loss of motion effects during system vibratory conditions. The gap spacings discussed in these papers were much less than what were actually observed at Zion.

(3) The intent of the IEB 79-14 was to bring the previous construction or design nonconformances back to the Code allowable stress levels committed in the FSAR. Contrary to this, critical piping suspension systems provided for subsystems such as Pressurizer Relief, 2RC-02, which still consisted of three anchors, 14 slotted restraints, 13 snubbers, and four newly added snubbers. The effects of such a large amount of non-linear seismic restraining characteristics within the very complex piping system were not evaluated by SWEC-NY. The decision not to review the subject nonconformance was made by the licensee.

This is an item of violation. (295/81-28-06; 304/81-26-06)

Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. Four unresolved items disclosed during the inspection are discussed in Paragraphs 2.b.(1), 2.b.(2), 2.b.(3), and 3.a.

Exit Interview

The inspector met with licensee representatives at the conclusion of the inspection on December 2, and 8, 1981. The inspector summarized the scope and findings of the inspection. The licensee acknowledged the findings reported herein. Subsequent to the inspections, an inspection meeting was held in NRC-RIII office on December 21, 1981, to further review and discuss the findings. The licensee presentation did not reverse any of the noncompliance findings discussed in this report.