U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-304/87012(DRS)

Docket No. 50-304 License No. DPR-48

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

Facility Name: Zion Station, Unit 2

Inspection At: Zion Site, Zion, Illinois

Inspection Conducted: April 20-22, and August 18, 1987

Inspector: J. A. Tavula — Date: Sept. 1, 1987

Approved By: D. H. Danielson, Chief
Materials and Processes Section — Date: 9/1/87

Inspection Summary

Inspection on April 20-22, and August 18, 1987 (Report No. 50-304/87012(DRS))
Areas Inspected: Routine safety inspection of snubber surveillance and functional testing (70370) and training (41400).
Results: Two apparent violations were identified (inadequate test procedures - Paragraph 2.b and lack of procedures - Paragraph 2.c).

DETAILS

1. Persons Contacted

Commonwealth Edison Company (CECo)

+*G. Pliml, Station Manager
+*R. Cascarano, Technical Staff Supervisor
+*A. Padleckas, Technical Staff Engineer
+*R. Lane, Primary Group Leader
 *B. Majhi, Maintenance Staff
+*C. Schultz, Regulatory Assurance Supervisor
 *J. Bolek, Senior Financial Coordinator
+*D. Wozniak, Senior Engineer - SNED
  M. Madigan, ISI Coordinator
  J. Reiss, Senior Engineer - SNED
 +P. LeBlond, Nuclear Licensing
 +J. Ballard, Quality Control Supervisor
 +J. Rappeport, Quality Assurance Engineer

Sargent and Lundy (S&L)

R. Hameetman, Project Manager/Zion
R. Krawczyk, Project Engineer/Zion
P. Olson, Supervisor/EMD/Zion

Nuclear Regulatory Commission (NRC)

 J. Harrison, Chief, Engineering Branch
 D. Danielson, Section Chief
*N. Williamsen, Resident Inspector
+P. Eng, Resident Inspector

*Denotes those attending the interim exit interview on April 22, 1987.

+Denotes those attending the final exit interview on August 18, 1987.

2. Snubber Visual Inspection and Functional Testing

a. Background

Zion Unit 2 was approximately 581 hydraulic and 57 mechanical safety-related snubbers in Unit 2. The functional testing requirements for both groups are specified in the Technical Specification Section 4.22. The hydraulic snubber sample size is specified as ten total snubbers, whereas the mechanical snubber sample size is specified as ten percent of the total population.

b. Procedure and Documentation Review

The NRC inspector reviewed the following CECo procedures and had the following comments:

(1) TSS 15.5.48, "Hydraulic and Mechanical Snubbers Surveillance", Revision 12, October 10, 1986.

(a) Testing Prerequisites

No temperature range is specified for performing the functional tests on hydraulic snubbers although a temperature range is specified for mechanical snubbers. Since the activation velocities and bleed rates are dependent on the hydraulic fluid viscosity, the temperature of the hydraulic fluid is a critical parameter that must be controlled. The procedure is inadequate in this respect. This is an example of a violation of 10 CFR 50, Appendix B, Criterion XI, in that the test procedure did not include provisions for assuring that the test is performed under suitable environmental conditions. (304/87012-01A)

(b) Acceptance Criteria

1 Appendix A, Part II of the procedure specifies that the snubber should be stroked for the entire travel to verify free piston movement. This fulfills the Technical Specification (Tech Spec) requirement to verify "proper piston movement". The acceptance criteria listed in Table 3 of Appendix A states:

"Free piston movement = Piston is able to travel entire stroke without hanging up."

Although quantitative acceptance criteria were specified for the other attributes associated with hydraulic snubber operability, (i.e., locking velocity and bleed rate) no appropriate quantitative acceptance criteria was specified for "proper piston movement". This drag force can be a significant consideration in determining piping stresses due to thermal expansion.

During subsequent discussions, it was CECo's position that the determination of the drag force is not typically required for hydraulic snubbers. The basic design of the snubbers would cause the high drag problem to manifest itself in a more obvious manner, such as hydraulic fluid leakage. Documentation

supporting this view is supposed to be available from the snubber manufacturer (Grinnell). Pending the receipt and review of this documentation this is considered an Unresolved Item. (304/87012-02)

2 Appendix A, Table 3, lists the acceptance criterion for hydraulic snubber locking velocity as one inch per minute (IPM) to 100 IPM. This is in contrast to the factory set locking velocity of six IPM to ten IPM. In addition, the maximum testing velocity documented by Grinnell was 40 IPM. Previously the technical justification for increasing the locking velocity from 40 IPM up to 100 IPM was reviewed in NRC Inspection Report No. 50-304/81-24, Item 2.b. At that time the approach used to justify the use of 100 IPM was based on the calculated piping response. Utilizing a conservative approach with several typical piping configurations, the peak velocity of the snubber attachment point was shown to exceed the 100 IPM criterion. On that basis it was concluded that if the locking velocity of the snubber was found to be less than 100 IPM, the snubber would lock up and perform its intended function.

In reviewing this matter further, however, the NRC inspector found that there was no documentation available from Grinnell to verify that the snubber could function properly at the 100 IPM velocity.

Grinnell's Technical Report PHD 7579-S-1, dated October 1977, "A Parametric Study of the Effect of Locking Velocity and Bleed Rate Setting on the Dynamic Performance of ITT GRINNELL FIG. 200 and FIG. 201 Hydraulic Snubbers", draws the following conclusions:

"2. The maximum pip-to-pin displacement . . . at an LV and BR setting within the ranges stated below,
Locking Velocity: 1.0 in/min. to 40 in/min.
Bleed Rate: 0.1 in/min. to 25 in/min.
is not significantly different from the average pin-to-pin displacement at the factory settings given to Table I.

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4. Based on the parameters considered in this study the dynamic performance of the ITT GRINNELL hydraulic snubber is not altered significantly if the locking velocity and bleed rate are found to be different from the settings of Table I, as long as they are within the ranges stated in (2) above, for input frequencies between 3 to 33 HZ."

During the inspection, CECo stated that Grinnell would have to perform additional testing before they could verify that the 100 IPM locking velocity would be acceptable. By the conclusion of the inspection, it was not yet decided whether to proceed with this additional testing or not. However, until such testing confirms the acceptable performance of the snubbers, the locking velocity acceptance criteria will be reduced and will be based on a maximum velocity of 40 IPM.

During a supplementary discussion after the exit meeting, CECo stated that GRINNELL had previously sent a letter allowing them to establish their own acceptance limits. However, since that time, GRINNELL appears to have changed their position on the subject in that they now will not concur with the 100 IPM velocity without additional testing.

Ultimately, it should be determined whether there was an adequate design basis for establishing the 100 IPM acceptance criteria for the hydraulic snubbers. Pending review of the previously mentioned letters, this is considered an Unresolved Item. (304/87012-03)

3 Given the fact that the piping will exceed the 100 IPM velocity during a seismic event, additional consideration must be given to the operating environment of the snubber when performing the functional test. In some cases, the snubber is located in an area where the snubber's ambient operating temperature exceeds the test temperature by a significant amount. This temperature difference and its effect on the activation velocity of the snubber is currently not accounted for in establishing the acceptance criteria. If the activation velocity of the snubber is determined to be 99 IPM at 75°F, it will be well above this value if the snubber's operating environment is 120°F. On this basis, the snubber may not lock up during a seismic event since the existing analysis only verified that the piping velocities would exceed 100 IPM.

This is another example of a violation of 10 CFR 50, Appendix B, Criterion XI in that the test procedure did not incorporate acceptance limits contained in applicable design document. (304/87012-01B)

(c) Snubber Listings

Attachment D, "Master List for Safety-Related Snubbers", lists all the safety-related hydraulic and mechanical snubbers for Units 1 and 2. Currently ten percent to 15% of the listed snubbers do not have the snubber's size given in the procedure. Without this information, a representative sample of snubbers consisting of various sizes, as required by the Tech Spec, cannot be easily determined.

This drawback of the procedure was previously recognized by the station and is currently being upgraded. The next revision to the procedure should contain the new information.

(d) Sample Selection

The current procedure revision does not provide guidance for the selection of the snubber functional sample. The requirements from the Tech Spec are listed, but the determination of a "representative sample" is not given. Based on the lack of attention given to snubber sample selection, additional guidance is necessary.

It was noted that two of the ten snubbers tested during the functional tests this outage had been rebuilt and tested during the last Unit 2 outage. One of the two snubbers had even been included in the sample for the functional testing done last outage. On this basis the NRC inspector did not agree with CECo personnel regarding what constitutes a representative sample.

Based on additional discussions with the plant personnel, CECo has agreed to add a statement in the procedure relating to the selection of recently rebuilt and tested snubbers.

(e) Service Life Monitoring

The procedure currently requires that the installation and the maintenance records for each snubber be maintained. Additionally, every 18 months these records shall be reviewed to verify that the "indicated service life", will

not be exceeded prior to the next service life review. Currently the service life for the hydraulic snubbers is based solely on the snubber manufacturer's recommendation regarding seal life expectancy. It is the NRC inspector's understanding that the snubber service life is currently not being reevaluated based on each snubber's maintenance record. This appears to be contrary to the bases given in the Tech Spec for snubbers.

The basis for this concern stems from the fact that at least one snubber (VCRS-2073) was rebuilt four times in the last five outages. At least ten other snubbers were rebuilt three times out of the last five outages due to some type of deficiency. It was not determined by the NRC inspector whether seal failure was the cause of these problems. However, there did not appear to be any system in place to identify "problem" snubbers and to determine the cause of the problem. The result of the above review may mean the reduction of service life for certain snubbers located in extreme environments in the plant.

Based on additional discussions with the plant engineers, CECo has agreed to add a more rigorous trending analysis to the procedure, in order to identify problem snubbers.

(2) P/M 017-2N, Revision 1, March 31, 1987, "Pacific Scientific Mechanical Snubbers Removal and Reinstallation".

The recent revision added a checklist for proper snubber installation and an Attachment No. 1 with a list of snubbers required for Modes 5 and 6 operation.

For the portions of the procedure reviewed, no adverse comments were made by the NRC inspector.

(3) P/M 017-3N, Temporary Change dated March 30, 1987, "Hydraulic Snubber Removal and Reinstallation Procedure".

The recent revision added a checklist to insure that spacers and cotter pins are properly installed. Also Attachment No. 2 was added with a list snubbers required for Modes 5 and 6 operation.

For the portions of the procedure reviewed, no adverse comments were made by the NRC inspector.

c. Test Results

The following ten hydraulic snubbers were functionally tested during this outage.

Snubber No.	Rebuilt*
2RHRS-2133	Sp. '83, F. '85
2SIRS-2309	F. '81
2VCRS-2067	F. '81
2RCFR-213	Sp. '83
2MSRS-211	Sp. '84
2MSRS-150-15	Sp. '83, F. '85
2MSRS-150-17	Sp. '84
2FWRS-2039	Sp. '83
2DTRS-2077	F. '81
2CCRS-2147	F. '81

*Sp. and F. denote Spring and Fall outages.

The functional test for 2RHRS-2133 was witnessed by the NRC inspector. All snubbers met the current functional acceptance criteria. No adverse comments were made.

The following mechanical snubbers were functionally tested this outage.

First Sample	Second Sample
2VC192-RS1	2VC192-RS2
2RC146-SR1	2VC109-RS2
2SIRS-2219A	2RCRS-2120
2SIRS-2061	2RC146-FR1
2RC151-RV1	2RCRS-2119
2MS004-RS2	2CCRS-2334A

From the initial sample, snubber SIRS-2061 failed all the functional test acceptance criteria and therefore, required the second sample to be taken. All snubbers from the second sample met the current functional acceptance criteria.

Upon investigating the above snubber failure, it was disclosed that a limited "evaluation" had been performed by the plant personnel in response to the snubber failure. Zion's Tech Spec Paragraph 4.22.1.A.3 requires that for any snubber found inoperable, an engineering evaluation shall be performed on the components supported by the snubber. "The purpose of this engineering evaluation shall be to determine if the components supported by the snubber(s) were adversely affected by the inoperability of the snubber(s) in order to ensure that the supported component remains capable of meeting the designed service."

It is the NRC inspector's understanding that the evaluation performed by the plant was limited to a visual inspection of the piping and pipe supports in the immediate vicinity of the failed snubber. Based on the lack of obvious physical deformation, it was concluded that the piping was cable of meeting its designed service. The piping system was declared operable on this basis.

The extent of the above evaluation does not consider several critical technical aspects. First, it is not evident how the current evaluation considered the overall thermal response of the system. Since the snubber exceeded the drag criteria, the predicted thermal expansion of the system was no longer accurate. Depending on the exact piping configuration, snubber orientation, drag load, and thermal displacements, the piping system could be significantly overstressed in locations remote from the failed snubber. Without looking into the specific analytical aspects of each snubber failure, the area of greatest potential damage may not be obvious. Also, the fact that the system associated with the snubber is a "cold" system and would not itself have any large thermal expansion, does not necessarily mean that the overall thermal displacements are small. Relatively large thermal displacements can result in "cold" systems that are attached to high temperature systems.

Secondly, the fact that there is no gross physical damage done to the pipe or pipe supports does not preclude that cumulative damage has not been done to the system. Piping stresses or support loads that have exceeded their design limits should be evaluated to the extent necessary to ensure that they can still meet their designed service. If these loads and stresses have not been quantified, it would appear impossible to justify that the fatigue life of the component has not been significantly reduced.

During discussions with the plant personnel, it was disclosed that in the past a quantitative engineering evaluation has usually been performed as a result of any snubber failure. However, in the recent past this normal practice had been changed. The NRC inspector realizes that in some cases, a minimal evaluation may be sufficient to address certain types of snubber failures. However, in this situation a more rigorous analysis is required. Currently, there are no procedures to determine when and what type of evaluation is required for which type of snubber failures. The failure to have a procedure, appropriate to the circumstances, to control the above activities is an example of a violation of 10 CFR 50, Appendix B, Criterion V. (304/87012-04)

Other than noted above, no violations or deviations were identified during the inspection.

d. Visual Inspections

As required by the Tech Spec, all snubbers were visually inspected during this outage. Of the 638 total snubbers inspected, 249 or 39% had some type of recordable indication. Of these 249 snubbers, six were determined to be inoperable. As a result of the "failures" the intervals for visual inspection of the accessible and inaccessible hydraulic snubbers are 12 months and six months respectively.

A breakdown of the recordable indication is as follows:

Low Fluid	66
Leaking	60
Spacing Washers Missing	117
Other Hardware Missing	22
Insufficient thread Engagement	22
Miscellaneous	78

As a result of the recent revisions to Procedures P/M 017-3N and P/M 017-2N, the deficiencies associated with various hardware should be greatly reduced.

No violations or deviations were identified during the inspection.

e. Training

The certification and training records were reviewed for the engineer performing the snubber functional tests. Mr. A. Padleckas was certified to perform the Tech Spec Surveillance Procedure

No. ISS 15.5.48 on December 29, 1986. Observations made during the functional tests indicated he was familiar with the test apparatus and applicable testing procedures.

No violations or deviations were identified during the inspection.

3. Unresolved Items

An unresolved item is a matter about which more information is required in order to ascertain whether it is an acceptable item, a deviation or a violation. Two unresolved items were disclosed during this inspection and are discussed in Paragraphs 2.b.1 and 2.b.2.

4. Exit Interview

The Region III inspector met with the licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on August 18, 1987. The inspector summarized the purpose and findings of the inspection. The licensee representatives acknowledged this information. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed during the inspection. The licensee representatives did not identify any such documents/processes as proprietary.