

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-282/85015(DRS); 50-306/85012(DRS)

Docket Nos. 50-282; 50-306

License Nos. DPR-42; DPR-60

Licensee: Northern States Power Company  
414 Nicollet Mall  
Minneapolis, MN 55401

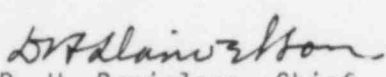
Facility Name: Prairie Island Nuclear Generating Plant, Units 1 & 2

Inspection At: Prairie Island Site, Red Wing, MN  
Fluor Engineers, Inc. (FEI)

Inspection Conducted: June 25-28 and August 28-30, 1985 at site  
July 2-3 and 24-26, 1985 at FEI

Inspector:  I. T. Yin

9/20/85  
Date

Approved By:  D. H. Danielson, Chief  
Materials and Processes Section

9/20/85  
Date

Inspection Summary

Inspection on June 25 through August 30, 1985 (Report Nos. 50-282/85015(DRS); 50-306/85012(DRS))

Areas Inspected: Routine, announced inspection of the requalification program for piping system snubbers and of the large capacity snubbers installed on the steam generators. The inspection involved a total of 70 inspector-hours onsite and at the A-E's office by one NRC inspector.

Results: Within the areas inspected, two violations were identified (failure to take adequate corrective action on identified steam generator snubber (SGS) deficiencies - Paragraphs 5 and 8; failure to submit LERs on SGS deficiencies, increased loading conditions and modifications - Paragraphs 5, 6 and 8).

## DETAILS

### 1. Persons Contacted

#### Northern States Power Company (NSP)

A. D. Smith, Consultant Schedule Engineer  
\*G. D. Gore, System Engineer  
\*D. Mendele, Plant Superintendent, Engineering and Radiation Protection  
\*G. L. Miller, Superintendent, Operations Engineer  
\*E. L. Watzl, Plant Manager  
A. A. Hunstad, Staff Engineer  
L. L. Anderson, Lead Production Engineer  
C. Baltos, Engineer Associates

#### Fluor Engineers, Inc. (FEI)

C. E. Agan, Project Manager  
J. K. Khanna, Structural Engineer  
W. P. Brennan, Project Engineering Manager  
A. V. Settler, General Manager, Engineering  
B. L. Dickerson, Project Piping Engineer  
G. H. Bartholomees, Project QA Engineer

#### New Hampshire Testing Laboratories (NHTL)

P. Ellis, Test Laboratory Manager

#### USNRC - Region III (RIII)

\*J. E. Hard, Senior Resident Inspector  
\*M. M. Moser, Resident Inspector

\*Denotes those attending the management exit meeting on August 30, 1985, at the site.

### 2. Action on Previous Inspection Findings

(Closed) Unresolved Item (306/78-16-01): Lack of requirements on: (a) recording snubber leak locations, and (b) measuring snubber cold and hot position settings. The inspector reviewed the following NSP procedures, which incorporated the above requirements, and had no adverse comments:

- Test No. 2171, "Technical Specification Shock Suppressor Check," Revision 5, dated January 7, 1983.
- D45.1, "Basic Engineers Snubber Maintenance Procedure," Revision 6, dated June 14, 1984.
- SP 2225, "Snubber Functional Tests," Revision 1, dated August 25, 1983.

(Closed) Unresolved Item (306/78-16-03): Inadequate Basic Engineer (BE) production QC and licensee vendor surveillance, audit, and receipt inspection. See Paragraph 3.

(Closed) Unresolved Item (306/78-16-04): Undesirable characteristics identified during some of the BE snubber tests, including: (a) no responses under dynamic loading, (b) excessive displacement under dynamic loading conditions, (c) improper sample representation. Lack of Anker Holth (AH) snubber design and test data. See Paragraph 3.

(Closed) Unresolved Item (306/78-16-05): Incorrect component creep velocity settings. Possible BE snubber load capacity reduction due to improper needle valve settings. See Paragraph 3.

(Closed) Unresolved Item (306/78-16-06): AH snubber lockup velocity (LV) could interfere with piping thermal movements. Lack of dynamic testing for AH snubbers. Lack of environmental testing to determine LV change due to higher temperature. See Paragraph 3.

(Closed) Unresolved Item (306/78-16-07): Lack of AH snubber design and test data. Lack of BE snubber environmental test data. See Paragraph 3.

(Closed) Unresolved Item (306/78-16-08): Lack of filtering of fluid during snubber fill operation to prevent particle inclusion that could clog up the small needle valve orifices inside the BE snubbers. Inspection for suspended particles in the snubber fluid and removal of particles by filtering snubber fluid through 90 micron or finer filter before filling are required in NSP D45.1, "BE Snubbers Maintenance Procedures," dated June 14, 1984.

(Closed) Unresolved Item (282/79-12-01): Some of the concrete expansion type anchor bolts (CEAs) were installed on pipe restraint baseplates with less than 10 bolt diameter spacing. Some of the CEA installations were out of plumb. Approximately 420 supports with CEAs were modified. Approximately 1000 supports with CEAs were repaired. The work and associated evaluation are documented in Teledyne Engineering Services Technical Report TR-3607-1 "Final Summary Report Evaluation of Seismic Category 1 Pipe Support Expansion Anchors In Response to USNRC IE Bulletin 79-02," dated March 8, 1983.

The inspector reviewed the following specific supports documented in Unresolved Item No. 282/79-12-01, and had no adverse comments:

<u>Support Mark No.</u>	<u>Work Request Authorization</u>	<u>Work Completion Date</u>
MSH-62	C 4269	08/30/79
MSH-64	E 1174	02/10/81
MSH-65	F 4560	11/11/82
MSH-66	D 5800	09/26/80
MSH-67	F 4905	12/03/82
MSH-68	C 4001	07/16/79

### 3. Piping Snubber Requalification

A number of technical issues that resulted from BE and AH snubber testing were discussed with NSP during a site inspection conducted in November through December 1978 (RIII Inspection Report No. 50-306/78-24). Since then, all AH snubbers have been replaced by Paul-Munroe and BE hydraulic snubbers. For BE snubbers, an extensive requalification program was conducted by NSP at Wyle Laboratories, Huntsville, Alabama. The BE snubbers that were dynamic tested included sizes 3/4", 1½", 2½", and 3¼". Some of the snubbers were also tested under an adverse environmental condition by soaking them in saturated steam for 2 hours followed by a dynamic test at 175°F. The snubber components that required adjustments during dynamic tests included ribbed and non-ribbed poppet valves and needle valves. Changes were also made to the poppet valve springs. All the present safety-related snubbers had been overhauled and rebuilt in accordance with plant maintenance procedures. The inspector reviewed the following reports, and had no adverse comments:

- NSP, "Basic Engineers Snubber Evaluation Program from June 15, 1979 to September 1, 1979," dated October 17, 1979.
- Nutech Report NSP-32-003, "Basic Engineering Snubber Evaluation, Prairie Island Nuclear Generating Plant," dated December 15, 1978.
- Wyle Laboratories Test Report No. 44601-1, "Qualification Test Program on Basic Engineers Model BE 410 Hydraulic Snubbers for Northern States Power Company Prairie Island Nuclear Generating Plant," dated August 15, 1979.

No violations or deviations were identified.

### 4. Snubber Inservice Inspection

The inspector reviewed the NSP visual inspection and functional testing conducted on safety-related snubbers during the Unit 1 plant refueling outage from January to March 1985. Records reviewed included:

- NSP SP 1171, "Technical Specification Shock Suppressor Check," conducted on January 12 through 15, 1985, including Work Requests for fixing deficiencies identified during visual inspection.
- NSP SP 1225, "Snubber Functional Tests," conducted on March 29, 1985.

No violations or deviations were identified.

5. Review of McDowell Wellman Engineering Company, Anker Holth Division (AH),  
SGS Test Data

a. SGS Leakage

A SGS with Serial No. 1 installed on steam generator (SG) No. 21 in Unit 2 was tested at NHTL on June 22, 1982, to determine lockup velocity (LV) and bleed rate (BR). Seal leakage was observed starting at 700 to 800 Kips tension loading. The leak was found to be caused by a slight deformation of the O-ring seal estimated to be 1/32". Residue on the cylinder walls, from phenolic bushing wear, was observed and the NHTL report dated July 2, 1982, stated that "Hydraulic fluid discoloration, a reddish tint, and traces of rust were evident inside cylinder" during overhaul. The one front static seal and the two small O-rings installed on control valve that are connected to the snubber cylinder were replaced. No NDE was performed to check if there was pitting on the inside of the snubber cylinder walls. Visual inspection was performed but was not documented. No chemical analysis was performed to check for water or loose particles in the fluid. Fluid inside the one snubber that was tested was replaced with new/clean fluid. The fluid in the other 15 snubbers installed in Units 1 & 2 was not replaced.

b. Possibility of Bolt Relaxation

In responding to NSP's question on the possible cause of the seal leak observed during tests, Bergen-Paterson (B-P) Pipe Support Corporation, the operator of NHTL, in a letter to NSP, dated July 2, 1985, stated that, "In our opinion the logical sources of leakage might have occurred due to bolt torque." B-P did not discuss the possibility of snubber bolt torque relaxation in 1982 with NSP, therefore, no bolt torque check was initiated for any of the 16 SGSs.

c. SGS Seepage After Seal Replacement

The NHTL Notice of Anomaly No. 11, dated June 24, 1982, stated that after snubber valve rebuild, seepage was observed at bolts. The B-P letter to NSP, dated July 10, 1985, "assumed" the seepage was "assembly oil" used to lubricate sealing surfaces. The assembly oil is regular SGS fluid. At the time of the SGS tests conducted in June 1982 there were no measures, such as further loading of the snubbers, to ensure that seepage will stop at some point in time. However, the licensee stated that the same snubber was pressurized to an equivalent of 810 Kips loading after control valve replacement in September 1984 and no seepage was observed.

The inspector determined that the NSP corrective action was inadequate, in that it failed to investigate (1) cause of seal leak (O-ring and bushing deterioration, bolt relaxation, etc.), (2) possible cylinder pitting, and (3) extent of fluid contamination. Since no additional tests were performed on the other 15 SGSs, the worst case conditions could

not be established. Consequently, no meaningful corrective action could be initiated. This is a violation of 10 CFR 50, Appendix B, Criterion XVI (282/85015-01A; 306/85012-01A).

The inspector further determined that the SGS deficiencies were significant and should have been reported by NSP through an LER. The failure of NSP to report these deficiencies is a violation of 10 CFR 50.73.a(1), (2)ii(A), and 2(ii)(B) requirements (282/85015-02A; 306/85012-02A).

#### 6. Replacement of SGS Control Valves

Since June 22, 1982, after snubber testing was performed at NHTL, NSP had sufficient information to recognize that the SGS control valve bleed orifice could be clogged by deteriorated bushing particles. In response to an NSP request, Westinghouse Electric Corporation (W) performed an evaluation and concluded that a zero BR was acceptable and documented their conclusion in a letter to NSP (NSP-82-531), dated July 9, 1982. However, due to a previous evaluation of a SG tube rupture where it was concluded that the resulting fast vessel cooling could exceed the SGS LV of  $0.2 \pm 0.05$ "/min and induce additional thermal stresses on the piping nozzles, NSP decided to replace all existing control valves to achieve a LV to approximately 1 in/min. The plant change order for the control valves was issued on July 22, 1982, and revised on October 26, 1982. The B-P valve block replacements were delivered onsite on August 29, 1983. Records showed that the original control valves were replaced with B-P units on the following dates:

##### Unit 1 SG No. 11 Snubbers

Work request G-6013-SN-Q was issued on November 8, 1983. Work was completed December 19, 1983.

##### Unit 1 SG No. 12 Snubbers

Work request H-7081-RC-Q was issued on December 10, 1984. Work was completed February 17, 1985.

##### Unit 2 SG No. 21 Snubbers

WR H-3475-SN-Q was issued on July 17, 1984. Work was completed on September 14, 1984.

##### Unit 2 SG No. 22 Snubbers

Work request H-3474-SN-Q was issued on July 17, 1984. Work was completed on September 14, 1984.

The replacement of the SGS control valves to alleviate a deficient condition that could affect system safe operation was not reported to the NRC. This is a violation of 10 CFR 50.73.a(1), (2)ii(A), and (2)ii(B) requirements (282/85015-02B; 306/85012-02B).

## 7. SGS Manifold Functionability

The ability of a bank of snubbers to function as a unit depends largely on the LVs of the snubbers. A W letter to NSP dated October 18, 1982, specifies if the snubbers can be adjusted to 6-10 in/min LV, the design requirement would be met. However, if the LVs can only be adjusted to 0.6-10 in/min all snubbers in a bank must lockup at the same velocity.

The present SGS LVs could only be set at 0.6 to 10 in/min, with preference given to 1 in/min (NSP letter to B-P, dated November 4, 1982). To achieve 6-10 in/min LV, the existing ports inside the snubber cylinder body would have to be enlarged.

NSP believes that even if three of the SGS orifices are clogged, the snubber loading on all the SGSs would still be equal based on the assumption that the spring positioned check valves within the manifold hydraulic circuit would remain open. This assumption results in a worst case loading condition when all orifices are clogged. The W analysis was documented in a letter to NSP, dated July 9, 1982, and was based on the above assumption. The inspector noted that since the functionability of the manifold was not yet proven, the worst case design condition could be a combination of (1) clogged orifices, (2) unclogged orifices, and (3) fluid leak due to seal material property changes or bolt torque relaxation.

The FEI report, "Evaluation of the 900 K McDowell Wellman Hydraulic Suppressors for Prairie Island Nuclear Generating Plant," dated July 1985 stated that, "The snubbers themselves will not lock until the last control valve closes thereby ensuring that all snubbers in a bank lock at the same time." The present inclusion of particles in the snubber fluid, due to piston bushing deterioration, could prevent seating of the control valve poppets. This could mean if any one of the four snubbers in a bank failed to lockup, the entire assembly could become inoperable. Failure of the poppet valves to seat properly depends on particle size and amount of particles in the fluid. Data regarding particles in the fluid was not available.

To resolve the manifold operation principle issue NSP plans to develop and complete a testing program prior to May 1986. This is an unresolved item (282/85015-03; 306/85012-03).

## 8. SGS Design Load Increase

The W letter to NSP (PT-PDQ-1825), dated October 18, 1982, states that the SGS main steam pipe rupture load would be 4469 Kips, an increase of 35% when compared with 3312 Kips loading that resulted from the original FEI calculation. W, in a recent letter NSP (NSP-85-619), dated July 3, 1985, reduced the SGS design load to 3885 Kips (an increase of 17% from the FEI load). During the inspection, FEI stated that the existing SGSs were acceptable because of an extra built-in safety margin.

When NSP became aware of the large SGS design load increase, NSP met with W at FEI on November 12, 1982, to discuss the issue. A W letter to NSP (NSP-82-585), dated December 21, 1982, forwarded the design bases and assumptions from which the large SGS design load increase was calculated. NSP did not request FEI to evaluate the difference between the W and FEI design criteria. No documentation exists that would justify accepting the 35% SGS design load increase. The NSP corrective action to resolve the apparent discrepancy was inadequate. This is a violation of 10 CFR 50, Appendix B, Criterion XVI (282/85015-01B; 306/85012-01B).

NSP did not perform a Safety Evaluation to determine whether or not the above issue was reportable to NRC. This is a violation of 10 CFR 50.73.a(1), (2)ii(A), and (2)ii(B) requirements (282/85015-02C; 306/85012-02C).

#### 9. SGS Dynamic Analysis

In view of the possible clogging of the SGS orifices and the resulting undesirable LV, W recommended (W letter to NSP, dated July 12, 1982) additional dynamic analyses be performed in 2 phases (Phases I and II). The W analyses were completed. The results were forwarded to NSP in the following letters:

W letter (NSP-82-531), dated July 9, 1982.

W letter (NSP-82-564), dated October 18, 1982.

W letter (NSP-82-585), dated December 21, 1982.

The inspector reviewed the above W letters and could not correlate their content with the recommended Phases I and II analytical recommendations. The backup calculations and system dynamic analyses were not reviewed by NSP or FEI. These calculations are proprietary and are available for review at the W office. This is an unresolved item (282/85015-04; 306/85012-04).

#### 10. SGS Design Requirements

The FEI, Technical Specification (TS) No. 287, "Technical Specification for Fabrication and Delivery Hydraulic Shock Suppressors for Steam Generator Upper Lateral Supports," dated February 1, 1971, did not specify essential snubber performance and test acceptance criteria. This includes (1) operating and design bases earthquake dynamic loading, (2) LVs for seismic and loss of reactor coolant accident conditions, (3) frequency range wherein the snubber is required to react, and (4) spring stiffness of the entire assembly. Prior to the conclusion of the NRC inspection NSP initiated corrective action by issuing Purchase Order D81529MQ on July 17, 1985. This PO was subsequently amended with additional requirements on August 12, 1985, requesting W to evaluate the main steam line break loads and to compare FEI TS No. 287 with the present W generic E-Specification. RIII followup action is planned. This is an unresolved item (282/85015-05; 306/85012-05).

## 11. NSP Corrective Action Plans

### a. ITT-Grinnell (ITT-G) SGSs

The Unit 2 plant refueling outage is scheduled to begin in September 1985. During the Unit 2 refueling outage, NSP plans to replace four of the AK SGSs with four new ITT-G SGSs. The new SGSs were delivered to the site on February 18, 1985. Site QA release for use was dated June 13, 1985. The inspector reviewed:

- NSP Purchase Order (PO) D09078MQ, dated June 1, 1983. The PO requested delivery of four 1000 Kip capacity SGSs, manufactured and tested in accordance with FEI TS No. 287 requirements with the exception that the LV was specified to be 8 in/min  $\pm$  5%.
- ITT-G letter to NSP, dated February 15, 1985, provided certificate of compliance.
- Chicago Fluid Power Corporation letter to ITT-G, dated November 23, 1983, provided SGS cylinder manufacturing certification.

Subsequent to the review, the inspector had the following comments:

- (1) The breakaway and drag force tests were performed in dry nitrogen. These tests should have been performed in the condition where the SGSs were filled with GE SF 1154 silicone fluid.
- (2) Seal material certification did not state that all seals have met TS No. 287 Code requirements.
- (3) Seal life expectancies were not stated.
- (4) Design engineer review and approval of SGS seal design and selection in accordance with TS No. 287 was not apparent.
- (5) ITT-G test procedures including instrument calibration data were not available for review.
- (6) Evaluation and resolution of the cracking of the spherical bushing that occurred during qualification tests were not included in the test report package.

Followup review of the above items during the Unit 2 refueling outage is planned. This is an unresolved item (282/85015-06; 306/85012-06).

b. Actions Planned for Unit 2 SGSs

During the inspection conducted at the site on August 28-30, 1985, the inspector discussed the NSP corrective actions for the Unit 2 SGSs during the scheduled refueling outage. Actions committed to by NSP included:

- (1) NSP will remove all eight existing AH SGSs and conduct as-found tests to obtain performance data, including:  
(a) drag force, (b) LV, (c) BR at the 900 Kips compression and the 450 Kips tension loading conditions, and (d) seal leakage during BR tests at each load step increase.
- (2) After the as-found snubber tests, seal replacement will be performed for four of the eight AH SGSs. Material certifications including useful seal life expectancy backed by environmental tests will be provided for all seals installed in these SGSs.
- (3) After seal replacement in the four AH SGSs, functional tests will be conducted in accordance with the as-found snubber test procedures prior to re-installation. The test results will be reviewed and concurred with by the responsible engineering organization.
- (4) Procedures for as-found snubber tests will be submitted to RIII for review prior to their implementation. NSP will provide RIII sufficient notification to provide RIII an opportunity to observe the tests. Test results, procedures, technical data, documentation of corrective action, and engineering evaluations will be available for RIII review prior to plant startup.

Followup of NSP actions for the Unit 2 SGSs is planned. This is an unresolved item (282/85015-07; 306/85012-07).

The extent and schedule for Unit 1 SGS corrective action is dependent on the Unit 2 SGS refurbishment program tests and findings.

12. Unresolved Items

An unresolved item is a matter about which more information is required in order to ascertain whether it is an acceptable item, an open item, a deviation, or a violation. Unresolved items disclosed during this inspection are discussed in Paragraphs 7, 9, 10, 11.a, and 11.b.

13. Exit Interview

The Region III inspector met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on August 30, 1985. 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 by the inspector during the inspection. The licensee representatives did not identify any such documents/processes as proprietary.