NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
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January 21, 1993

Docket No. 50-423
B14354

Re: 10CFR50.90
10CFR50.91

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

Millstone Nuclear Power Station, Unit No. 3
Proposed Revision to Technical Specifications
Snubber Functional Test - Request for Additional Information

By letter dated January 15, 1993,(1) Northeast Nuclear Energy Company (NNECO) proposed to amend its Operating License, NPF-49, by incorporating changes into the Technical Specifications of Millstone Unit No. 3. Specifically, the proposed amendment would revise the surveillance requirement frequency for functional tests of snubbers by allowing a one-time extension to the current 18-month surveillance interval, plus the additional 25 percent allowed by Technical Specification 4.0.2. NNECO requested that the NRC Staff process this amendment on an emergency basis pursuant to 10CFR50.91(a)(5), in that failure to act on this proposed amendment would result in a plant shutdown.

On January 19, 1993, the NRC Staff requested further information in the form of seven questions. The purpose of this submittal is to respond to those questions. The questions and responses are contained in the attachment to this letter.

We believe the attached information, coupled with the information provided in our submittal dated January 15, 1993, provides a complete basis for approval of the requested amendment. Of course, should the Staff have any additional questions, NNECO remains available to respond promptly to them.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

J. F. Opeka

J. F. Opeka
Executive Vice President

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cc: See Page 2

(1) J. F. Opeka letter to the U.S. Nuclear Regulatory Commission, "Millstone Nuclear Power Station, Unit No. 3, Proposed Revision to Technical Specifications, Snubber Functional Testing," dated January 15, 1993.

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cc: T. T. Martin, Region I Administrator
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3
P. D. Swetland, Senior Resident Inspector, Millstone Unit Nos. 1, 2, and 3

Mr. Kevin McCarthy, Director
Radiation Control Unit
Department of Environmental Protection
Hartford, CT 06116

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Attachment 1

Millstone Nuclear Power Station, Unit No. 3

Snubber Functional Test

January 1993

Millstone Nuclear Power Station, Unit No. 3

Snubber Functional Test

Question: 1. Please provide a quantitative breakdown of each "Type" of snubber, by size, inspected during the previous inspection.

Response: At Millstone Unit No. 3, per Technical Specification Section 4.7.10.e, at least once per 18 months during plant shutdown (usually during the refueling outage), a representative sample of each type of safety-related snubber is functionally tested. There are four types of snubbers that are installed at Millstone Unit No. 3. Type 'A', 'B', 'C', and 'D' signify small mechanical, medium mechanical, large mechanical, and large hydraulic snubbers, respectively. The mechanical snubbers are of Pacific Scientific manufacture, while the large hydraulic snubbers were manufactured by Paul-Munroe. During Millstone Unit No. 3's third refueling (last) outage, functional tests of snubbers were completed as follows:

Type of Snubber	Total Quantity	Number of Snubbers Tested	Method Used per Tech. Spec. 4.7.10.e
A (PSA-1/4, 1/2)	231	231 (plus 37 spares)	4.7.10.e.1
B (PSA-1, 3, 10)	543	43 (plus 8 spares)	4.7.10.e.2
C (PSA-35, 100)	117	12 (plus 2 spares)	4.7.10.e.1
D (Hydraulic)	44	5	4.7.10.e.1

Question: 2. Of the 19 failures reported for small mechanical snubbers, identify whether these are "Type A" only, or whether they include other "types."

Response: During the last refueling outage, snubbers were functionally tested in accordance with the Millstone Unit No. 3 Technical Specification requirement (see response to Question 1). During that testing, a total of 19 functional test failures were initially identified. All of the above failures occurred on Type 'A' (small mechanical snubbers, Pacific Scientific PSA-¼s and PSA-½s); no other functional failures were identified for other types (i.e., Type 'B', 'C', or 'D') of snubbers.

Question: 3: The licensee stated that a majority of failures were due to "external loadings." Please quantify all of the failure mode groups, and provide a discussion of the root cause findings of and evaluation for each of the failure categories, as well as corrective actions. A generalization describing the likely cause of excessive external loadings is unacceptably weak.

Response: A total of 291 snubbers (not including spares) of all types were functionally tested during the third refueling outage. The 60 snubbers of Type 'B', 'C', and 'D' experienced no failures. After full sample expansion, a total of 231 Type 'A' snubbers were tested. Small mechanical snubbers are identified as Pacific Scientific PSA-1/4s and PSA-1/2s. During the refueling, as testing progressed, a total of 19 snubbers were classified as functional failures leading to testing of 100 percent of the small snubber population. Subsequent to a review of the test data, 3 of the 19 failures were determined to have been the result of damage during testing. As such, a total of 16 snubbers were classified as actual functional test failures. Our initial submittal conservatively represented that the functional failure total was 19 snubbers in order to be consistent with the reported total during the refueling outage.

Table 1 is a listing of the failed snubbers, along with a summary of the test vendor's (Qualtech Testing Services, Inc.) functional test results and inspection reports.

As previously stated, 3 of the 19 reported failures were determined not to have been reportable as technical specification functional test failures. The details of these failures are provided in Table 2, and the discussion provided below.

Our review of snubber test data toward the end of the third refueling outage identified the fact that activation testing was performed at levels well in excess of those recommended by Pacific Scientific (the snubber vendor). They recommend that their snubbers be tested at 10 percent to 30 percent of rated load fo approximately 0.50 inches of snubber stroke. Pacific Scientific does say that activation testing can be performed at levels as high as 100 percent of rated load, provided extreme caution is used when testing on servo-hydraulically controlled test machines in order to avoid overloading. The test vendor, utilizing a STADAS 4120 test machine which is servo-hydraulically controlled, performed activation testing at levels ranging from approximately 60 percent to 100 percent of snubber rated loading. It is NNECO's determination that these three snubbers (3RCS-1-PSSP-0113, CP-408053-H003, and 3BDG-1-PSSP-0433) were damaged as a result of the test methodology. This determination is evidenced by the fact that the test vendor identified the machine as causing "an overload condition" on CP-408053-H003, while for 3BDG-1-PSSP-0433, the functional test results were acceptable until the final drag test.

Based upon these test results and the corresponding disassembly reports, NNECO contracted Stone & Webster Engineering Corporation (SWEC) to determine the root cause(s) of the PSA-1/4 and PSA-1/2 failures which occurred during the last refueling outage, and to provide recommendations for a program to eliminate or reduce the failure rate. The 16 snubbers listed in Table 2 were the subject of SWEC's report entitled, "Evaluation of Snubber Failures at Millstone Unit No. 3 on RFO 3 Surveillance Testing," prepared for NNECO and dated October 15, 1992.

SWEC classified the 16 snubbers into 7 groups and listed the "most likely" and "alternate" failure causes for each group. The following section is excerpted from SWEC's report:

"The first group is notable because it involves four snubbers, RCS-1-PSSP-0914, -0978, -1019, and -1023 located on lines connected to the reactor coolant loop drain branch connections. The snubbers are all located on similar lines in similar locations. The lines have few rigid vertical supports in the area of the damaged snubbers. When disassembled by QualTec, the snubbers exhibited signs of overloading. SWEC examination of two of them noted twisted guide rods, a sign of torsional loading. All were tested as having high drag, or in one case, being locked up. One of the snubbers, PSSP-0914, had failed previously when tested in the 1986 surveillance testing."

"The second group of two snubbers, RCS-1-PSSP-1068 and SIH-1-PSSP-1109 are both located on safety injection line branch connections to the reactor coolant loop cold legs of two separate loops. The two snubber locations are at corresponding locations on the piping, and there is little intervening

flexibility between the snubbers and the loop. Both have moderately long W dimensions (21" and 29"). The overhaul report by QualTex for PSSP-1109 stated the snubber rods appeared to be "twisted" due to "improper installation techniques."

"The third group consists of three snubbers, SIH-1-PSSP-1029, -1030, and -1032, all located in the same loop cubicle and all on the same piping stress problem on the same run of pipe. The system has a 6" branch off a 12" RHS line connecting to the reactor coolant cold leg, reducing down to a 2" line on which the failed snubbers are located. There are no rigid vertical supports in the area of the snubbers. SWEC examination of SIH-1-PSSP-1030 noted severe shear deformation of the shaft at the torque carrier end, indicative of possible lateral impact. One of the snubbers, PSSP-1032, had failed previously in the RF02 surveillance testing. Further, two other snubbers which were located within a few feet of the three current failures, had failed the RF02 testing and were subsequently deleted from the piping."

"Group four is two snubbers, SIL-1-PSSP-0414 and -0459 on 6" SIL lines attached to the reactor coolant loop. The snubber locations are stress problem 7003B node 187 and problem 7001B, node 187. The locations are exactly corresponding to each other for the two reactor coolant loop connections."

"The fifth group includes a single snubber, [illegible]3051-H001, on a steam generator secondary side drain line. Its QualTec overhaul report suggested a possible cause of its bent rods and "displaced shear key" was mishandling or improper manufacture. SWEC examination noted the rods were twisted as if torsional loading had been applied."

"All five failure groups mentioned thus far plus snubber CHS-1-PSSP-0728 also comprise a larger grouping of snubbers, all of which are located in steam generator cubicles on lines attached to the generators or reactor coolant loops. Almost all snubbers in this category were considered by the testing organization to have exhibited signs of overloading."

"A sixth group consists of two snubbers located on the reactor head vent line near the Pressurizer Relief Tank, snubbers CP-409005-H012 and -H015. The snubbers act to prevent axial motion of the line below. The piping is subject to and analyzed for water hammer loadings from head vent line actuation and discharge into the PRT. The snubbers are located just downstream of valves HCV-442A and HCV-442B. Downstream, the line connects to the 12" pressurizer relief discharge line

leading to the PRT. The disassembly report of one snubber indicates evidence of vibration."

"The one remaining failed snubber not mentioned so far, CP-379707-H025, is located on a drain line to one of the recirculation spray heat exchangers. Its inspection report noted for the presence of excessive corrosion and its failure is not attributed to overloading. In Table 2 and 3 describing the failed snubbers CHS-1-PSSP-0728 is listed in this miscellaneous group because it has no other apparent grouping corollaries."

The failure groupings are listed as follows:

Group 1

Most Likely Failure Cause:	Damage due to external loading.
Alternate Failure Cause:	Water hammer from drain valve or vibration initiated by reactor coolant loop.

Group 2

Most Likely Failure Cause:	Damage due to external loading.
Alternate Failure Cause:	Vibration initiated by reactor coolant loop.

Group 3

Most Likely Failure Cause:	Vibration initiated by residual heat removal system vibration.
Alternate Failure Cause:	Damage due to external loading.

Group 4

Most Likely Failure Cause:	Vibration initiated by reactor coolant loop vibration aggravated by large mass of pipe.
Alternate Failure Cause:	Damage due to external loading.

Group 5

Most Likely Failure Cause:	Faulty installation.
Alternate Failure Cause:	Improper manufacture.

Group 6

Most Likely Failure Cause: Water hammer, either by valve actuation or pressurizer safety relief valve discharge.
Alternate Failure Cause: Vibration (cause unknown).

Group 7

Most likely Failure Cause: Excessive corrosion due to harsh environment.

SWEC concluded that, based upon their analysis of the 16 snubber testing failures, the main characteristics putting snubbers at risk for failure are location in the steam generator cubicles and placement on small bore piping or a nearby branch from large bore piping. They went on to note that a small number of failures could also be attributed to overloading due to fluid transients and corrosion due to a harsh environment.

As we had stated previously, small Pacific Scientific mechanical snubbers (PSA-1/4s and PSA-1/2s) are particularly susceptible to damage from unanticipated loadings, such as external torsion, side loadings, and impacts caused by mishandling. On the other hand, larger Pacific Scientific snubbers (PSA-1s and larger) are designed differently and are inherently more rugged. This fact is evidenced by the lower overall failure rate in those types of snubbers, even though those types of snubbers are located in some of the same areas and on some of the same lines which experienced small snubber failures.

Question: 4. The licensee stated that "nearly all" of the failed snubbers were located in the steam generator cubicles. Please identify the location of all of the failures. Discuss any definitive correlation between failure and location, rather than conjectural correlation as was provided for the steam generator cubicles.

Response: Of the 16 failed snubbers, 13 were located in the steam generator cubicles. Table 3 lists all those snubbers, their location, (line designation), and service. This fact was noted in the SWEC report (identified previously in the response to Question 3) which was performed under contract to NNECO. It also identified a majority of failures as being due to "external loadings" or "mishandling." These types of failure causes, when reviewed in conjunction with the extent of maintenance work which was performed in the cubicles in 1987. are suggestive of a meaningful correlation between the failures and locations. Other types of snubbers (PSA-1s and larger) in these areas, which are inherently more rugged and less susceptible to unintentional excessive loadings, did not experience similar types of failures or failure rates.

Question: 5. The licensee stated that "the entire population of small mechanical snubbers was tested." Please verify the "Types" of these snubbers and provide the quantity that was functionally tested. Identify all failures, and discuss their failure modes, root causes, and corrective actions.

Response: Refer to the response to Questions 1 and 3 above.

Question: 6. The submittal discusses visual examination results for small snubbers inspected during November 1991 and May 1992. Provide the visual examination results for all other snubbers visually inspected during the same inspection periods. Break down by "type."

Response: Only Type 'A' snubbers (small mechanical) were visually inspected in accordance with technical specification requirements, during the November 1991 and May 1992 plant outages. No visual inspection failures were identified during either of those inspections. In addition, numerous snubbers of other types were visually examined for any obvious signs of functional impairment. Also, the reservoirs of the large hydraulic snubbers (Type 'D') were examined for obvious leaks. No apparent failures or leaks were observed during those examinations.

Question: 7. The submittal makes reference to ASME O&M-4 (1990) regarding the operability testing requirements being keyed to refueling outages, and that the increase in the test interval provided acceptable levels of confidence in the reliability of snubber populations.

Increases in the test interval will provide acceptable levels of confidence, provided the sample size is proportionally adjusted so that 100 percent of the population is tested during the 10-year period. In light of the licensee's increase in this testing interval (to September 1993) and its previous practice of defining the interval as being upon change of modes, discuss how the sampling size will need to be revised to ensure that at least 100 percent of the population will be tested during the 10-year period.

Response: To provide assurance of snubber functional reliability, one of three functional methods are acceptable, per the Millstone Unit No. 3 Technical Specification Section 4.7.10.e. These are:

1) Functionally test 10 percent of a type of snubber with an additional 5 percent tested for each functional testing failure, or

2) Functionally test a sample size, in accordance with what is commonly referred to as the "37 plan," and determine sample acceptance or continue testing per Technical Specification Figure 4.7-1 or,

3) Functionally test a representative sample size, commonly referred to as the "55 plan," and determine sample acceptance or rejection using the stated equation.

ASME O&M-4 (1990) specifies functional testing of snubbers using the following methods:

1) Functionally test 10 percent of a type of snubber with an additional 5 percent tested for each functional testing failure, or

2) Functionally test a sample size (the "37 plan") and determine sample acceptance or corrective testing per Figure ISTD 7.12.1-1.

For Millstone Unit No. 3, since initial startup (January 1986) through the third refueling outage, the following functional testing of snubbers has been performed.

Type	Total No. of Snubbers	Total Tested
A	231	231
B	543	315
C	117	42
D	44	15

NNECO is in the process of finalizing plans for functional testing of snubbers during the next (fourth) refueling outage. NNECO plans to functionally test approximately 20 percent of Type 'A' (this includes failed snubbers in the last outage) and approximately 10 percent of Types 'B', 'C', and 'D' in accordance with the Technical Specification Section 4.7.10.e.

TABLE 1

Snubber No.	Summary of Vendor Testing and Inspections
3RCS-1-PSSP-0914	PSA-1/4 Drag Load: [illegible] lbs. The snubber was not disassembled due to the relatively low drag loading.
3RCS-1-PSSP-0978	PSA-1/4 Drag Load: Locked The rods of the rod and bearing assembly were bent. This condition is similar to conditions caused by overload.
3RCS-1-PSSP-1019	PSA-1/4 Drag Load: 180 lbs. The rods of the rod and bearing assembly were bent and the screw shaft of the torque carrier and shaft assembly was bent. These conditions are similar to conditions caused by overload.
3RCS-1-PSSP-1023	PSA-1/4 Drag Load: 115 lbs. The rods of the rod and bearing assembly were bent and the snubber was found to contain fluid (assumed to be water), accounting for internal corrosion. The condition in the rods is similar to conditions caused by overload, while the fluid and corrosion were caused by a harsh environment.
3RCS-1-PSSP-1068	PSA-1/4 Drag Load: 35 lbs. The rods of the rod and bearing assembly were bent. This condition is similar to the conditions caused by overload.

Snubber No.	Summary of Vendor Testing and Inspections
3SIH-1-PSSP-1109	PSA-1/4 Drag Load: Locked The rods of the rod and bearing assembly are bent and twisted. These conditions are similar to conditions caused by overload. However, the twist in the guide rods is similar to conditions caused by improper installation techniques.
3SIH-1-PSSP-1029	PSA-1/2 Drag Load: 36 lbs. The snubber was not disassembled due to the relatively low draw loading.
3SIH-1-PSSP-1030	PSA-1/2 Drag Load: 72 lbs. The screw shaft on the torque carrier end of the torque carrier and shaft assembly is bent and the bearing sockets on both ends of the torque carrier and shaft assembly are damaged. Both conditions are similar to those conditions by overload; the bearing socket damage was aggravated by testing.
3SIH-1-PSSP-1032	PSA 1/4 Drag Load: 57 lbs. The rods of the rod and bearing assembly were bent and the screw shaft on the torque carrier end of the torque carrier and shaft assembly was bent. These conditions are similar to conditions caused by overload. Also, the capstan spring and torque carrier showed signs of slight brinnelling. This condition is similar to conditions caused by vibration.

Snubber No.	Summary of Vendor Testing and Inspections
3SIL-1-PSSP-0414	PSA-1/2 Drag Load: 124 lbs. The screw shaft of the torque carrier and shaft assembly was bent and the bearing sockets on both ends of the torque carrier and shaft assembly were damaged. These conditions are similar to conditions caused by overload.
3-SIL-1-PSSP-0459	PSA-1/2 Drag Load: Locked The screw shaft of the torque carrier and shaft assembly is bent. This condition is similar to conditions caused by overload. The bearing sockets on both ends of the torque carrier and shaft assembly are damaged and the bearing socket in the housing is damaged. These conditions are similar to conditions caused by overload and vibration.
CP-408051-H001	PSA-1/4 Drag Load: 221 lbs. The snubber was delivered to the test trailer with the antirotation key displaced. This condition is similar to conditions caused by mishandling or manufacturing error. The rods of the rod and bearing assembly were bent and the bearing socket on the torque carrier end of the torque carrier and shaft assembly was damaged. These conditions are similar to conditions caused by overload.

Snubber No.	Summary of Vendor Testing and Inspections
CP-409005-H012	PSA-1/4 Drag Load: Locked The rods of the rod and bearing assembly were bent, the screw shaft of the torque carrier and shaft assembly was bent, and the bearing socket on the torque carrier end of the torque carrier and shaft assembly was damaged. These conditions are similar to conditions caused by overload.
CP-409005-H015	PSA-1/4 Drag Load: 262 lbs. The rods of the rod and bearing assembly were bent, the screw shaft on the torque carrier end of the torque carrier and shaft assembly was bent, and the bearing sockets on both ends of the torque carrier and shaft assembly are damaged. These conditions are similar to conditions caused by overload. The capstan spring and torque carrier showed signs of slight brinnelling. This condition is similar to conditions caused by vibration.
CHS-1-PSSP-0728	PSA-1/4 Drag Load: 19 lbs. The snubber was not disassembled due to the relatively low drag loading.
CP-379707-H025	PSA-1/2 Drag Load: 55 lbs. The snubber contained excessive amounts of corrosion on the inner tube, torque carrier and shaft assembly, capstan spring, and guide plate. This condition is similar to conditions caused by harsh environments. The high drag is believed to be attributable to rust dislodged during testing.

Snubber No.	Summary of Vendor Testing and Inspections
CP-379707-H025 (cont'd.)	The bearing socket on both ends of the torque carrier and shaft assembly were damaged. This condition is similar to conditicns caused by vibration.

TABLE 2

Snubber No.	Summary of Vendor Testing and Inspection
3RCS-1-PSSP-0113	PSA-1/2 Subsequent to drag load testing and during the course of the activation testing, the snubber was pulled apart and testing was stopped. Upon disassembly and inspection, it was discovered that the guide rods were pulled from the bearing assembly. The bearing assembly was inspected and the stake marks where the rods are staked to the bearing appeared to be normal. The test vendor identified the cause of this type of failure to be attributable to conditions caused by high loads, although the maximum force recorded by the test machine was 365 lbs. They identified this condition as being unique in their five years of experience in failure analysis.
CP-408053-H003	PSA-1/4 Initial drag tests were successfully performed on this snubber. During the activation testing, the test vendor identified the snubber as being subject to an overload condition due to the way the snubber accepted load and the response time of the overload protection programmed into the test machine. Disassembly of the snubber showed the screw shaft of the torque carrier and shaft assembly to be bent, due to an overload.
3BDG-1-PSSP-0433	PSA-1/2 This snubber successfully completed its initial drag and activation tests, but recorded a high drag loading (33 lbs.) during its 'final' drag test. The final drag test is not considered part of the Technical Specification functional test; it is only a safety measure to determine whether or not the snubber has sustained any damage during load (activation) testing.

TABLE 3

No.	Snubber Identification	Line Designation	Service
1.	3SIH-1-PSSP-1109(¼)	3SIH-150-141	SIH to CL A
2.	3RCS-1-PSSP-1068(¼)	3RCS-150-223	SIH to CL D
3.	3RCS-1-PSSP-0914(¼)	3RCS-002-176	RCS drain C
4.	3RCS-1-PSSP-0978(¼)	3RCS-002-172	RCS drain A
5.	3RCS-1-PSSP-1019(¼)	3RCS-002-174	RCS drain B
6.	3RCS-1-PSSP-1023(¼)	3RCS-002-175	RCS drain B
7.	[1]CP-409005-H012(¼)	3RCS-001-231	PRT inlet
8.	[1]CP-409005-H015(¼)	3RCS-001-231	PRT inlet
9.	3SIL-1-PSSP-0414(¼)	3SIL-006-165	SIL to ACC C
10.	3SIL-1-PSSP-0459(¼)	3SIL-006-163	SIL to ACC A
11.	[1]CP-379707-H025(¼)	3RSS-750-127	RSS*E1B vent
12.	3SIH-1-PSSP-1029(¼)	3SIH-002-145	SIH to HL A
13.	3SIH-1-PSSP-1030(¼)	3SIH-002-145	SIH to HL A
14.	3SIH-1-PSSP-1032(¼)	3SIH-002-145	SIH to HLA
15.	CP-408051-H001(¼)	3BDG-001-002	A SG drain
16.	3CHS-1-PSSP-0728(¼)	3CHS-002-242	CHS to CL D

Key:

Systems
- SIH — Safety Injection High Head
- SIL — Safety Injection Low Head
- CL — Cold Leg
- HL — Hot Leg
- PRT — Pressurizer Relief Tank
- RSS — Recirculation Spray System
- ACC — Accumulator
- CHS — Charging

Line Size
- 750 - 3/4"
- 150 - 1½"
- 001 - 1"
- 002 - 2"
- 006 - 6"

(1) These three snubbers are not located in the steam generator cubicles.