ATTACHMENT

SNUBBER ELIMINATION AT MCGUIRE NUCLEAR STATION USING LIMIT STOPS

INTERIM REPORT

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MCGUIRE SNUBBER ELIMINATION PROGRAM

1.0 INTRODUCTION

Duke Power Company (DPC) has initiated a program that is intended to lead to a substantial reduction in the number of snubbers in use at the McGuire Nuclear Power Plant. This reduction in the number of snubbers will be accomplished by replacing snubbers with Limit Stops manufactured by Grinnell, Inc., under license to Robert L. Cloud & Associates (RLCA), the original developers. The Electric Power Research Institute (EPRI) contributed partial financial support to the development.

The purpose of this submittal is to present a description of the plan developed by DPC to show the McGuire piping systems remain qualified with Limit Stop pipe supports and to describe the engineering program being conducted in support of the plan. A second submittal will be made at a later time when the engineering program is complete. If the program is successful, the second submittal will contain engineering results that will serve as a basis for changing out snubbers for Limit Stops at McGuire.

This submittal is consistent with verbal information presented by DPC and RLCA to the NRC in a meeting in the White Flint building on June 18, 1992, and fulfills the verbal commitment made at that time to present a written submittal that describes the program.

2.0 PROGRAM DESCRIPTION

2.1 Objectives

The specific objective of the Duke plan is to replace each snubber in the McGuire Plant with a Limit Stop. This objective was formulated after review of dynamic tests on full-scale piping systems that showed the dynamic performance of piping systems under dynamic loads supported by Limi Stops was equivalent or superior to that of piping supported by snubbers [Ref 1,2,3].

In addition, actual experience of piping systems with primitive limit stop seismic supports protected installed power piping in quite severe actual earthquakes.

To support this objective, analytical studies are presently underway to show specifically that the licensing basis for the McGuire Plant is not compromised by the change-out of snubbers for Limit Stops. In the event that a clear and comprehensive proof of this hypothesis fails to emerge from the analytical studies, a secondary objective has been formulated. The secondary objective is to establish the limitations that exist to the realization of the primary goal, and to formulate criteria that delineate those snubbers that can be changed out for Limit Stops, those snubbers that should be changed for struts, and those snubbers that should remain. The basis for such criteria, if required, will be the ASME Code and other licensing basis limitations.

In summary, the present program has as a goal the development of analytical support for a complete change-out of snubbers for Limit Stops, or secondarily, the establishment of the limitations of such an approach and development of rules or criteria for a partial change out.

2.2 Rationale & Benefits

DPC expects to realize significant benefits in each of the following areas by changing out snubbers for Limit Stops.

- Safety
- Reliability
- ALARA
- Cost

As regards safety, the Limit Stops are passive devices. There are no active mechanisms to lock up or otherwise fail and expose the piping to unanticipated loads. Similarly, corrosion, galling, and other materials-related problems are not anticipated because the Limit Stops are designed with large clearances to be tolerant of hostile environments and are made from austenitic stainless steel.

Concerning reliability, the passive tolerant nature of the Limit Stops are expected to lead to complete reliability for the devices themselves and concomitantly improved reliability for the systems they are installed on.

The passive nature, together with the readily visible settings and internal parts of the Limit Stops, makes them easily inspectable from a remote distance and also eliminates the need for dismounting and testing. Elimination of this function will result in a significant dose reduction.

In the same vein, the cost of operation with Limit Stops will be reduced because the greater reliability eliminates the need for expensive testing as well as the potential for snubber-related pipe failure evaluations and the consequences associated with radiation exposure. The Limit Stops require no special inspection beyond normal nuclear safety-related pipe support inspection.

2.3 Technical Description

The primary objective of the present program is to provide evidence that the snubbers at McGuire can be changed-out on a one for one basis with Limit Stops with no unacceptable compromises in the licensing basis. The method to be employed is to perform an in depth analysis of a comprehensive sample of the McGuire piping with both snubbers and Limit Stops. Based on the in-depth analysis of the sample piping systems, and on previous NRC approval of the GAPPIPE computer program [Ref. 4,5,6],

snubbers in the sample piping systems will be replaced with Limit Stops pursuant to 10CFR50.59 criteria. Barring some unusual dynamic characteristics of the sample systems, it is anticipated that the results of the analysis and the in-situ performance of the installed Limit Stops will show the licensing basis for the plant remains uncompromised.

2.3.1 Sample Piping

The piping systems chosen to serve as the sample for analysis are listed in Table 1. Four systems have been chosen in order to have a fully comprehensive sample that contains a good representation of all the attributes of the McGuire piping. In particular as can be seen from the table, the primary attributes are addressed by the sample as follows:

Attribute	Sample Representation
ASME Class	1, 2, 3, and non-safety
Pipe Size	3/4" to 24"
Pipe Material	Stainless steel and carbon steel
Location	Reactor and Auxiliary Building
Problem Size	65 to 500 Mathematical Nodes
Flexibility	1st Mode frequency from 3.4 to 10.9 Hz
Design Temp	110°F to 650°F

As can be seen the sample will represent the diversity of the piping in the McGuire plant. All significant attributes and parameters are included. Although not noted in the table, Problem number 3 which is an ASME class 1 system incudes thermal transient loading as well. The program presently underway is based on the logic that inferences and conclusions which can be drawn from engineering analyses and actual hardware performance of the sample problems will be applicable to the plant as a whole.

2.3.2 Engineering Analyses

Analytical models of the sample piping problems will be created suitable for analysis with the GAPPIPE [Ref. 4] computer program. The GAPPIPE program permits dynamic analyses of piping

systems with all common types of nuclear plant dynamic loading. GAPPIPE has been well correlated with full scale tests and approved by the NRC [Ref. 5 & 6] after in depth review and independent verification by the NRC contractor, Brookhaven National Laboratory.

As a first step in this work, it is planned that the sample problems in the original design configuration will be re-analyzed with GAPPIPE to provide as benchmarks to the design analysis. The original design analysis was performed with the SUPERPIPE program.

The next step is to perform sufficient analysis to be able to support the overall DPC objective, which is to be able to substitute Limit Stops for snubbers on a one for one basis.

The original piping qualification at McGuire was done using seismic spectra based upon Reg. Guide 1.61 damping. However, McGuire is a modern plant where ASME Code Case N-411 pipe damping is applicable. It follows that it would be straightforward and permissible to re-analyze the piping using N-411 with an optimized number of seismic support where Limit Stops replace the existing snubbers.

Support optimization is not our objective because this would result in fewer seismic supports in the optimized configuration. Thus the piping system ends up with less support. Although this is currently an acceptable practice, the overall objective is to enhance or at the very least maintain current design margin.

It is DPC's preference not to implement a support optimization program at McGuire, but to substitute Limit Stops for snubbers at each snubber location and perform no new analysis. In this manner the robustness of the support system will be maintained. It is known from the results of several full scale tests that with this approach the safety of the pipe system will not be compromised [Ref. 1,2,3]. Analyses to support this thesis will be performed on the four sample problems described in Section 2.3.1 herein.

As a minimum, the system with all Limit Stop supports will be analyzed. This will be done with both Reg. Guide 1.61 and variable N-411

damping. The results will be compared to the design analysis. Other analyses will be performed as necessary.

In this submittal which is only intended to formally advise the NRC that this work is underway and why, it has not been deemed advisable to layout a rigid and prescribed menu of analyses. It is recognized that as the dynamic characteristics of the piping systems change with the changes in support systems, the changes in response will not necessarily be uniform and proportional. Nevertheless the first goal is to show the one-for-one snubber - Limit Stops change out results in acceptable response.

In the event local anomalies arise and it is found necessary to retain some snubbers, sufficient investigations will be performed to establish criteria for choosing those snubbers to retain. Since the original design analysis was based upon certain simplifying assumptions (the state-of-the-art of 1980) it may for example prove useful to perform approximately realistic or exact analyses that simulate test results. In this manner comparisons between the response of different configurations can be made that are free of the potentially confusing effects of simplifying assumptions.

2.3.3 Hardware Demonstration

Once the sample piping problems are analyzed and the proposed support design changes are identified, the next step of the engineering program is to implement the actual hardware replacement of the existing snubbers with Limit Stops in accordance with 10CFR50.59 criteria. DPC plans to begin installing the new Limit Stops during the upcoming Unit 1 refueling outage (March, 1993), and will complete the installation during the upcoming Unit 2 refueling outage (July, 1993).

It is DPC's intention that these Limit Stops will be monitored and inspected during and after the planned outage. The intent is to determine as well as to demonstrate the actual in-situ performance of the Limit Stops during normal plant operation. Results of the inspection will serve as supporting evidence that the licensing basis remains uncompromised.

2.3.4 Conclusion

Ultimately a set of engineering results will be developed, supporting DPC snubber elimination objectives as described above.

3.0 FINAL REPORT

A final report on the work described herein together with overall DPC plans will be compiled and submitted to the NRC. A verbal presentation with opportunity for discussion is also planned. The overall intent is to keep the NRC advised of the results and findings of the pilot program

4.0 CONCLUSION

This report has presented in a general manner the approach DPC plans to take to eliminate snubbers at McGuire. The engineering program which is presently underway to support the DPC plan has been discussed. Finally, the categories of information to be furnished and method of presentation to the NRC that is planned prior to program implementation has been discussed.

5.0 REFERENCES

1. M.S. Yang, et.al., "Shaking Table Testing of a Piping System Supported by Seismic Stops," Vol. K2, pp 769-774, 10th SMIRT Conference, Anaheim, CA, August 14-18, 1989.

2. C.A. Kot, et.al., "SHAM: High-Level Seismic Tests of Piping at the HDR," Proceedings of the U.S. NRC 16th Water Reactor Safety Information Meeting, NUREG/CP-0097, Vol. 3, pp 339-362, NBS - Gaithersburg, MD, October 24-27, 1988.

3. C.A. Kot, et.al., "High Level Seismic/Vibrational Tests at the KDR - An Overview," Proceedings of the U.S. NRC 19th Water Reactor Safety Information Meeting, NUREG/CP-0119, Vol. 3, pp 59-90, NBS - Gaithersburgh, MD, October 28-30, 1991.

4. GAPPIPE/GAPPOST Computer Program Version 2.3 Users Manual, RLCA/P94/04-92/004, March 1992.

5. USNRC Safety Evaluation Report, "Implementation of Seismic Stops at Byron Unit No. 2," May 21, 1990.

6. Letter, Anthony H. Hsia, NRC, to Thomas J. Kovach, CECo, dated February 7, 1992, Docket No. STN50-455.

TABLE 1. CHARACTERISTICS OF SAMPLE PIPING PROBLEM

Sample Piping No.	Pipe Class	Pipe Size	Pipe Matl.	Bldg.	Problem Size Snubbers	Problem Size Nodes	1st Mode Frequency (CPS)	Design Temp. °F
1. CA152 Aux. Feedwater	3, NS*	8	CS	AUX	3	135	10.9	160
2. FW350 Refueling Water & Residual Heat Removal	2	6, 8, 12, 14, 18, 24	SS	AUX	18	500	3.4	110, 190, 250, 350
3. NC203 Pressurized Spray	1, 2	.75, 2, 4, 6	SS	R.B.**	19	250	8.3	650
4. SA5 Aux. Steam Drain	2, NS	1, 2	CS	R.B.	4	65	3.5	567

*NON SAFETY **REACTOR BUILDING