

## UNITED STATES NUCLEAR REGULATCRY COMMISSION ADVISORY COMMITTEE ON REACTOR SAFEGUARDS WASHINGTON, D. C. 20555

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September 11, 1979

## M. Bender

QUESTIONS CONCERNING SIGNIFICANCE OF RECENT SNUBBER FAILURES

This is in response to questions in your August 31, 1979 letter (attached) about my August 16, 1979 report, "Significance of Recent Snubber Failures at Operating Nuclear Power Plants."

#### Question 1

Did the PG&E study address all sizes of snubbers? If not, did they treat the large mechanical snubbers being used in some applications? Also, what did they assume to determine the likelihood of pipe failure due to lockup?

#### Response 1

The PG&E study was based on snubber failure data reported in ORNL/NUREC/ TM-53, dated October, 1976. The data covered all sizes of snubbers reported to the NRC as having failed. However, the data do not distinguish among sizes of snubbers which failed, they only list the quantity of different types of failure.

The large mechanical snubbers were not discussed in the PG&E study. Furthermore, the mechanical snubbers of all sizes were considered by the PG&E study as having little failure data and, "Because of the lack of information, failure probabilities calculated for hydraulic snubbers will be assumed for mechanical snubbers." Therefore, PG&E did not have sufficient data to specifically address a particular size or type of snubber.

The assumptions used in determining the likelihood of pipe failure due to lockup were:

- Failure could only occur due to thermal stresses since seismic stress calculations are based on a locked-up snubber.
- It was assumed that failure resulted from low cycle fatigue since, "Piping stresses induced by thermal movement are self relieving and rarely cause pipe failure except by fatigue."
- The thermal cycles assumed for the piping systems analyzed by PG&E were 20 cycles/year. Failure was assumed if the calculated number of cycles for failure (i.e., a through-wall pipe crack) due to a snubber failure was less than 20 cycles.



## Question 2

Is there any relationship between snubber size and snubber failure?

#### Response 2

My literature search did not reveal any comprehensive study of snubber size versus failure rate. Furthermore, the LER for a snubber problem generally does not include information on the snubber size, thus making a comparative study difficult. However, in NUREG-0467, dated June, 1978, "Operating Experience with Snubbers," a study done by Georgia Power Company at Edwin I. Hatch Unit No. 1 revealed a size versus failure relationship. The data represented approximately 32 months of operation for a total of 270 hydraulic snubbers. Although the results are not generic they do represent an interesting size versus failure rate relationship for one power plant. The results are shown graphically in Figure 1.



# Question 3

Is there anything to indicate pipe failure sensitivity as a function of snubber location, e.g., would a locked-up snubber on a large feedwater line be likely to induce failure due to thermal cycling induced fatigue?

### Response 3

The PG&E study addressed the fact that not all snubber failures would result in overstressing the pipe. They analyzed the following Diablo Canyon piping systems:

- 1. Component Cooling Water
- 2. Residual Heat Removal
- 3. Steam Supply to the Auxiliary Feedwater Turbine
- 4. Accumulator Injection Line
- 5. Pressurizer Relief Valve Header

A total of thirty snubbers were represented in these piping systems. The systems were thermally and seismically analyzed assuming the failure of each snubber, one at a time. The result was that, given a single snubber failure, 91% of all lines analyzed would remain within seismic <u>allowable</u> stresses and 82% of all lines would remain within thermal <u>allowable</u> stresses. The actual failure stresses were even less likely to occur for the systems analyzed by PG&E.

It is interesting to note that the PG&E study did not consider the main feedwater or main steam piping systems which have relatively large thermal movements.

The lockup of a snubber on such a piping system could potentially result in more damage than for the PG&E analyzed piping systems.

No sensitivity study for snubber failures as a function of location was found.

I will continue to study the snubber related problems at nuclear power plants and report my findings. Please contact me if you have additional comments or questions about this work.

Darry D. Young

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Attachment: Bender to Young ltr. dtd. 8/31/79

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