50-237

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May 24, 1983

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Mr. James G. Keppler, Regional Administrator
Directorate of Inspection and
Enforcement - Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Dresden Station Unit 2
Main Steam Line Snubber Failure
NRC Docket No. 50-237

Reference (a): B. Rybak letter to J. G. Keppler
dated May 13, 1983.

Dear Mr. Keppler:

As delineated in our May 13, 1983 response (Reference (a)) concerning the Dresden Station Unit 2 Snubber Action Plan the following items were to be sent to you on May 20, 1983:

1) Correlation of test data with analysis,
2) Determine why there was a mismatch and why it was not identified,
3) Provide MSIV analysis results,
4) Compare SRV test results to MSIV analyzed loads.
5) Plan for performing interference checks on the MSIV line snubber pipe clamps during the 62 day technical specification snubber inspection.

Response to items 1) and 3) is in the form of attachments to this letter which were provided by Sargent and Lundy. As stated in their test correlation report, here is an ongoing effort to determine potential reasons for the discrepancy between expected values and actual test values of the line thermal movements. It should be pointed out, however, that the growth even though different than expected do not present a safety concern. This was addressed in detail in our May 13, 1983 submittal. We will provide an update of the further investigation to resolve the thermal growth discrepancies with our May 27, 1983 submittal.

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The results of the MSIV closure analysis indicate that the loads generated during that event are on the same order of magnitude as those measured during the SRV discharge event. Considering, then, that piping analyses are conservative and that the analyzed MSIV closure loads are on the same order of magnitude as the measured SRV loads, which were in themselves very low, we still feel that the MSIV closure event is not the cause of the snubber failure. The information which could be gained by actually performing a MSIV isolation does not justify the challenge to the plant safety systems.

In response to item 2 the Dresden Quality Control Department performed an investigation of the type of pipe clamps that were installed with the MSIV snubbers. As stated in our May 13 response it appears that all the pipe clamps are NPS clamps, and not the required Pacific Scientific clamps. These clamps were purchased and installed by Phillips Getschow Co.

In a documentation review, it was discovered that Phillips Getschow had ordered Pacific Scientific clamps from NPS Industries. In addition, they required a "Certificate of Conformance" as Quality Assurance documentation. Their receiving documents include a Certificate of Compliance to a material specification. They had received the clamps with the assumption that they were Pacific Scientific clamps. We acquired photographs of the installed clamps that were taken by NUTECH. The pictures showed that the clamps were not Pacific Scientific. At that time, a telephone call to NPS was made to try to determine which type of clamp was shipped. NPS confirmed they had shipped NPS clamps and not the Pacific Scientific clamps that were ordered. Furthermore, they said it was a common practice of theirs to make this type of substitution.

In our opinion, there were three problems with the purchasing and receiving of these clamps. First, NPS should not have made a substitution without informing Phillips Getschow. Second, Phillips Getschow's purchase order should have required a Certificate of Conformance to a Pacific Scientific part number. Third, while receiving the clamps it should have been noted that the Certificate of Compliance did not certify that the clamps were Pacific Scientific. It only certified the material type of the clamps.

Again, as stated in our May 13 response this does not present an immediate safety concern. Non-conformance reports, however, are being written by both the contractor and our Station Construction Departments to address corrective for the specific problem and to prevent recurrence.

Finally, we committed to have a plan for checking for clamp interference during the Dresden Unit 2 62 day snubber inspection. We would like to defer this submittal until June 3 to enable us to review the results of the binding study which is due May 27 and incorporate the binding study will provide valuable information for defining the specific areas for inspection depending on the of binding postulated.

If there are any questions on the above, please contact this office. Per the action plan the next transmittal will be May 27, 1983.

Very truly yours,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

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cc: NRC Senior Resident Inspector - Dresden w/o Att.
R. Gilbert - NRR w/Att.

Attachments

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ATTACHMENT A

A forced vibration time history analysis was performed to determine the effects on the main steam header C and the associated SRV piping resulting from dynamic loads acting on the main steam piping due to Main Steam Isolation Valve (MSIV) closure. Based on the information contained in the FSAR, the steam flow rate through the valve was taken as 2.45×10^6 lb/hr at a pressure of 965 psia. The valve closure from 100% to 0% flow was taken as a linear function of time and the closure time was taken as 1.8 sec (provided by Commonwealth Edison Company). The force time history was generated using in-house computer program 'HYTRAN'. The resulting piping support loads caused by the MSIV closure event are given in the attached table. From the table, it is seen that the MSIV closure loads are bounded by the SRV discharge loads. It should be noted that the SRV discharge loads given in the attached table were obtained with a relatively slow valve opening time of 280 mSec. With a faster opening time of 60 mSec for the SRV, the MSIV closure loads will become insignificant relative to the SRV transient loads.

TABLE

COMPARISON BETWEEN SRV DISCHARGE AND MSIV CLOSURE LOADS

(MS-C SUBSYSTEM)

Snubber ID	SRV Discharge Load (Valve Opening Time = 280 mSec) (lbs)	MSIV Closure Load Closing Time = 1.8 Sec (lbs)
#50 2-3001C-S1 (M-564G-1) NP 27 (X-Skew)	1560	785
#51 2-3001C-S2 (M-564G-2) NP 28 (X-Skew)	1822	1514
#44 2-3001C-S3 (M-564G-3) NP 55B (X-Glob)	1617	719
#54 2-3019C-S2 (M-564G-9) NP 119 (X-Skew)	1141	149
#55 2-3019C-S1 (M-564G-8) NP 120 (Z-Skew)	632	83

ATTACHMENT B

DRESDEN - 2

MAIN STEAM MONITORING TEST

TEST-ANALYSIS CORRELATION

May 19, 1983
EMD-043781

1.0 Introduction

The results of the Dresden-2 main steam monitoring procedure (SP 83-4-54, Rev. 0) revealed no measured response that could be considered a source of the failure of the five main steam snubbers. However, some discrepancies between measured and analytically predicted piping responses were observed for the SRV discharge loadings and for the piping thermal expansion movements. Analyses were performed to assess the effects of these discrepancies. These analyses demonstrated that the piping stresses remained within code allowables for all the monitored events. The "Dresden-2 Main Steam Monitoring Procedure Seven-Day Evaluation" (Sargent & Lundy Calc. No. EMD-043449, Rev. 0) documents the results of these evaluations.

The purpose of this writeup is to offer explanations for the discrepancies between the analytically predicted and measured piping responses.

2.0 Thermal Movements

2.1 Walkdown Readings

The recorded thermal movements for the constant and spring supports on Main Steam lines are within the design values with some minor deviations. The maximum deviation was found to be within 1/2" for the spring supports and 5/8" for snubbers. These deviations likely result from the factor described below.

2.1.1 RPV Nozzle Thermal Movements

In general, the spring supports movements are either smaller or bounded by the design values. The measured upward vertical movements were less than the analytically predicted movements. This smaller than predicted upward movement was most prevalent on the hanger nearest to the RPV nozzle. This discrepancy between predicted and measured movements likely results from the use of conservative (larger than actual) RPV movements in the piping thermal expansion analysis.

A comparison was made between Dresden and LaSalle RPV thermal movements to identify the source of the discrepancies. The Dresden RPV nozzle movements were calculated by assuming linear expansion and a uniform temperature over the vessel length. Using GE's formulae (Spec. 22A3828, Rev. 1, MPL No. A42-3670), which were provided for the LaSalle Station RPV, the nozzle thermal movements were found to be very close to the originally calculated values. However, GE stated that "the application of these formulae should result in conservatively high values for the vessel growth." Therefore, with less conservative RPV nozzle movements, the actual support movements would be very close to the design values. Note that during the plants previous operation, piping shakedown to elastic behavior and material creep could also result in smaller than predicted movements.

2.1.2 <u>Support Spring Resistance (Variability) Effect</u>

A variable (spring or constant) support would require applied load in order for the spring to move up or down. This applied load with respect to the dead weight is called variability, which would differ from one support to another and would depend on the support design and its condition. A sensitivity analysis was performed for Main Steam C line, based on 10% variability, to assess the effect of the piping resistance to thermal movements. As a result, the piping thermal movements at some locations changed by 3/16". With a higher variability ratio (could reach 20%) the deviation in piping thermal movements are expected to be even greater than 3/16".

2.1.3 Thermal Movements Measurement Accuracy

The thermal movements were visually recorded during cold as well as hot (460°F) conditions. The smallest division on a typical snubber is 1/2" and on a constant spring support is either 3/32" or 1/4" depending on the total travel distance of the support. A typical support or snubber reading would require a combination of judgement and approximation. A ± 1/4" reading tolerance is considered reasonable for both cold and hot conditions. This could result in a combined tolerance of ± 1/2" on the thermal movement. This measurement tolerance is consistent with the hanger manufacture (Bergen-Paterson) recommendation.

Taking into account the above factors, thermal deviations within 1/2" are viewed as acceptable, as long as the spring supports and snubbers are positioned within their working ranges. Therefore, the walkdown thermal readings are considered within the design values and no significant deviation has been identified.

2.2 LVDT Measurements

The piping vertical movements as recorded by the LVDT's were consistent with the movements indicated by the hanger readings. The LVDT readings also indicated that the piping upward movement was somewhat less than analytically predicted. The probable reasons for these discrepancies were discussed in Section 2.1.

LVDT's also were used to measure lateral movement at snubber locations. As reported in the Seven-Day Evaluation there was a discrepancy between the LVDT measured movements and the walkdown measured movements. However, in all but one case the discrepancy was less than 1/2 inch, which is within the measurement tolerance of the walkdown. At snubber 51 the discrepancy is close to one inch. In the opinion of Wyle Labs, this discrepancy could be caused by a bad connection in the butt splicer or a bad connection internal to the LVDT. The change in containment ambient temperature, which reached ≈ 150°F, could then result in an errant LVDT reading.

The MS header lateral movements as measured by the LVDT's are greater than the predicted values by approximately one inch. An analysis for these discrepant movements was performed and the pipe stresses were shown to remain within Code allowables (RE: Seven-Day Data Evaluation). The explanation of the discrepant movements is currently being investigated.

3.0 SRV Transient Loads

The design basis analysis indicated that the SRV transient loads on the MS header piping were not significant. The test results confirm that these loads are not significant.

For example, snubber number 52 had the largest measured SRV load. For snubber 52 the addition (via SRSS) of the design basis SRV loads to the SSE loads increased the snubber design load by less than one percent. Adding a conservative interpretation of the measured SRV load (4300 lbs compression) to the SSE loads increases the snubber design load by less than eight percent (less than 650 lbs.).

The measured loadings did, however, differ from the analytically predicted loads. For six out of nine of the measured cases the measured loads were less than predicted, and for three cases the measured loads slightly exceeded their predicted values. This section provides probable sources of the discrepancy between measured and predicted loads.

3.1 Analytical Assumptions

In the design basis analysis various assumptions are made to account for unknown parameters and to arrive at a feasible analytical approach. These assumptions are made to approximate the actual system behavior. Deviations between the actual and assumed behavior will result in discrepancies between the predicted and actual response.

The analysis for SRV discharge loadings is performed in two steps; first the loadings are generated and then these loadings are input into a structural analysis. The primary assumptions made in both steps are described below.

3.1.1 Forcing Function

The primary assumptions used in the generation of the forcing function involve the behavior of the SRV valve. Assumptions are made concerning the valve opening; e.g. the rate of area opening, the time of opening, and the flow rate. Variance between these assumptions and actual valve behavior result in variance in the predicted and actual forcing functions.

In addition, small loadings in the header piping are generated by the depressurization wave that is created in the header when the SRV valve opens.

These depressurization loadings were not considered in the design basis analysis. These loadings were calculated to be small.

3.1.2 Structural Analysis

The primary assumption made in the structural analysis involve the piping and support behavior. A linear piping structural analysis is performed with an assumed damping value. The snubbers are assumed to be infinity rigid struts without gaps. The effect of spring and constant hanger supports is not considered. The actual system behavior is somewhat different than these assumptions, and some discrepancy between predicted and measured responses is therefore expected.

For example, snubbers do not behave as rigid struts. A snubber, per design, limits the piping acceleration to a value less than 0.02g. If the acceleration is less than this, the snubber will see no load. If a particular snubber allows the piping to move, then some of the loading will be absorbed in the piping and some of the loading will be redistributed to other snubbers or supports.

Actual snubber behavior alone, especially at low loading values, will account for a good deal of variance between predicted and measured responses. Loads will be distributed differently between snubbers and some loading will be absorbed in the piping.

3.2 Snubber Load Measurements

The snubber calibrations and the setup of the test equipment was designed for the measurement of large loads, of a magnitude that could fail a snubber. Specifically, there were no calibration data points for loads less than 5,000 lbs. and the oscillograph recorders were set on a scale of 10,000 lbs. per inch. The measured responses were typically well below these values. However, to get a rough idea of the system response, attempts were made to read the low level signals. Note that the variance in accuracy, as a percent of reading, increases as the signal level decreases.

Tabulated below are the estimated accuracies of the measured values for the three snubbers that experienced the largest loadings. The combined accuracy of the signal conditioning and strain gauge is 3.78% of reading (per Wyle Lab. document "Field Data Acquisition Accuracies").

This does not include the accuracy of the calibration curves, which is not defined, but would increase this percentage. The table includes, in terms of the measured parameter, the value of 1/2 the width of the noise band. The recorded measured loadings are felt to be conservative (especially in the case of compression) estimates of the actual response.

Snubber No.	Measured SRV Transient Loads (lbs)		Accuracies lbs				Notes
			Tension		Compression		
	Tension	Compression	3.78% Reading	1/2 Noise Band	3.78% Reading	1/2 Noise Band	
46	+ 1500	- 3700	± 57	244	± 140	615	According to subsequent calibrations, the compressio[n] readings could be conservativ[e] by an additional 14 to 36%
50	+ 1700	- 800	± 64	260	± 30	320	
52	+ 2000	- 4300	± 76	452	± 163	1778	