



# Commonwealth Edison Company

ONE FIRST NATIONAL PLAZA ★ CHICAGO, ILLINOIS

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June 24, 1971

Dr. Peter A. Morris, Director  
Division of Reactor Licensing  
U.S. Atomic Energy Commission  
Washington, D.C. 20545

Subject: Additional Information concerning the  
operation of Dresden Unit 2

Dear Dr. Morris:

*not in file*  
On April 24, 1971, we submitted to you Dresden Special Report Nos. 10 through 13. Report No. 13 of that series discussed the core spray water hammer problem. This report has been reviewed by members of your staff and additional information concerning the applied forces and fatigue life of the Emergency Core Cooling System piping was requested.

Attached hereto is a report entitled "Supplemental Information to Special Report #13 Core Spray Water Hammer Incident". We believe that this information answers the questions raised by members of your staff.

In addition to three signed originals, 19 copies of this additional information are also submitted.

Very truly yours,

*Byron Lee Jr.*

Byron Lee, Jr.  
Assistant to the President

*151 JYK/Staff 7/7/71*  
*JBA*  
*YCH*  
*RHC*  
SUBSCRIBED and SWORN to  
before me this 24th day  
of June, 1971.

*Patricia A. Nelson*  
Notary Public

SUPPLEMENTAL INFORMATION TO SPECIAL  
REPORT # 13

CORE SPRAY WATER HAMMER INCIDENT

There are two questions concerning the stress analysis included in Special Report No. 13, Dresden 2 Core Spray Water Hammer Incident, dated April 21, 1971 which are as follows:

- 1 - Each of the loading cases presented consists of a momentum force applied at a single location within the system. Would it not be more realistic to account for the overlap that would actually occur and therefore apply force at more than one location for each case?
- 2 - No mention is made in the report of how many stress cycles occurred nor is any assessment made of the cumulative fatigue damage that might have occurred due to the rather large stress of 115,078 psi calculated in run No. 5 at point 70. What is the calculated fatigue damage, and does enough fatigue life remain to provide for the operational loads the piping will be subsequently subjected to?

In answer to the above, the following information is presented:

Special Report No. 13 covered water hammer incidents for both the 2A and 2C core spray discharge lines, but only included stress calculations for the 2A line. The 2C analysis was not included because the calculations were not complete at the time the report was issued.

As stated in the report, the static loading analysis made for the 2A piping yields gross overestimates of piping stresses and deflections. For this reason a realistic fatigue damage could not be estimated from the results. Furthermore, an estimate of fatigue damage requires knowledge of the number of stress cycles applied. The static analysis does not provide information from which to estimate number of cycles. Had momentum forces been applied at

more than one location for each of the loading cases analyzed, the calculated deflections would have been even more exaggerated and inconsistent with the physical evidence. Clearly, the only useful purpose of the analysis was to establish areas of relative high stress so that those portions of the system could be more closely investigated by appropriate non-destructive examination techniques.

Since Report No. 13 was issued, the analysis of the 2C piping has been completed. The 2C analysis is more realistic in that a dynamic method was used; i.e., time varying momentum forces were applied at all points within the system. Calculated stresses and deflections were much smaller than the values obtained from the static method and calculated deflections were in better agreement with the physical evidence. The results of this more refined analysis supports our position that the 2A piping static analysis was very conservative.

Attached is a calculation showing the estimated fatigue damage due to calculated stresses in the 2C piping. The maximum calculated usage factor of 0.02 shows the fatigue life of the piping was only slightly degraded. Since the cyclic operating loads for the core piping discharge outside the drywell consists primarily of internal pressure, the remaining fatigue life of the piping is more than adequate to provide the intended design life.

No formal fatigue damage estimate has been made for the 2A discharge since we still have only a static loading analysis for that piping. However, because of physical similarities between the 2A and 2C piping, the 2C calculation can be considered as representative for both systems.

CALCS. FOR FATIGUE DAMAGE - 2C CORE SPRAY DISCHARGEA. ALTERNATING STRESSREFERENCE 1 GIVES THE MAX. COMBINED BENDING  
AND TORSIONAL STRESS AT POINT 70 AS:

$$S_{ALT} = 51,161 \text{ PSI}$$

B. NO. OF APPLIED CYCLES

1. PIPING FIRST PERIOD = .69 SEC

2. ASSUME MAX. STRESS IS APPLIED 1 FULL  
MINUTE. (THIS IS EXTREMELY CONSERVATIVE.)

3. NO CYCLES =  $\frac{1 \text{ CYCLES}}{.69 \text{ SEC}} \times 60 \text{ SEC} = 87 = m$

C. ALLOWABLE CYCLES

FROM FIG. 1-705.3.3(a), B31.7-1969:

$$N = 4000$$

D. USAGE FACTOR

$$U = \frac{m}{N} = \frac{87}{4000}$$

$$U = .02$$

REF. 1 - RESULTS OF WATER HAMMER ANALYSIS 2C ATTACHED  
TO GE LETTER CEM-DR2, LTR. #115-71, DATED  
MAY 21, 1971.