

50 - 237

Regulatory

Edison Co.

# Commonwealth Edison Company

ONE FIRST NATIONAL PLAZA ★ CHICAGO, ILLINOIS

Address Reply to:

POST OFFICE BOX 767 ★ CHICAGO, ILLINOIS 60690

December 13, 1971

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



Subject: Dresden Unit 2 Sensitized Stainless Steel Safe Ends

Dear Dr. Morris:

This is in response to your letter of June 7, 1971 in which you requested additional information concerning the sensitized stainless steel safe ends for Dresden Unit 2. Attached is a report which provides our evaluation of the Dresden Unit 2 sensitized stainless steel safe ends.

Our evaluation indicates that although the fatigue strength of sensitized stainless steel is somewhat less than that of unsensitized stainless steel, there is still a margin of over 500% in the usage factors of the material. Our report concludes that an accelerated inspection of Dresden Unit 2 safe ends is not warranted by the information we have to date.

Should you have any further questions regarding this matter, please let us know. In addition to three signed originals, 19 copies of this report are also submitted.

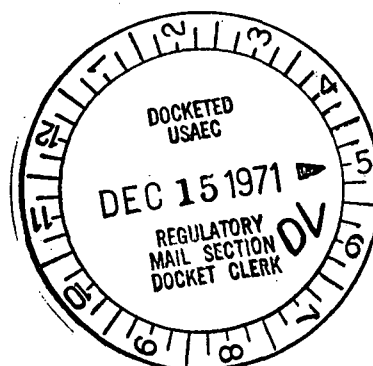
Very truly yours,

*Wayne L. Stiede*

Wayne L. Stiede  
Nuclear Licensing Administrator

SUBSCRIBED and SWORN to  
before me this 13<sup>th</sup> day  
of December, 1971.

*Patricia A. Nelson*  
Notary Public



5418

237-288.1  
LB

SENSITIZED STAINLESS STEEL SAFE ENDS  
Dresden Unit 2

A review of the design fatigue strength of the sensitized stainless steel safe ends for Dresden Unit 2 has been performed. The sensitized stainless steel usage factors, based on design cyclic loads and the ASME Fatigue Design Curve of ASME Boiler and Pressure Vessel Code Section III, have been calculated and are reported in the Babcock & Wilcox Certified Stress Report for the Dresden Unit 2 pressure vessel. The results of this analysis are as follows:

<u>Nozzle</u>	<u>Sa (psi)</u>	<u>Design Cycles (n)</u>	<u>Allowable Cycles (N)</u>	<u>Usage Factor (U)</u>
Recirculation Inlet	73,000	130	4,100	.032
Core Spray	55,000	255	14,000	.018
CRD Hydraulic Return	41,500	370	55,000	.007
Recirculation Outlet	49,000	345	25,000	.014

The method of calculation of the usage factors is quite conservative. Stresses were calculated for each design condition and the stress ranges and stress amplitudes were evaluated considering all design conditions. All of the different design cycles were assumed equal to the maximum stress amplitudes instead of using the cumulative usage factor as defined in the ASME Boiler and Pressure Vessel Code Section III, paragraph N 415.2(e). The usage factor was then calculated based on the total number of design cycles at the maximum stress amplitude.

The results of this stress analysis were compared with the "worst case" sensitized stainless steel fatigue failure data reported in GEAP-10207-23. The usage factors for the Dresden 2 furnace sensitized stainless steel safe ends show a minimum margin of 500% over the usage factor calculated from the "worst case" data.

It is the consensus that furnace sensitized type 304 stainless steel is susceptible to stress corrosion cracking in high purity oxygenated water at sustained primary stresses at or above the 550°F yield strength. The existing substantial amount of data indicates that no failures of sensitized 304 stainless steel material have occurred in the normal BWR environment (0.2-0.4 ppm O<sub>2</sub> high purity water) or in accelerated tests in 100 ppm O<sub>2</sub> high purity water at sustained primary tensile stresses below the 550°F yield strength. Because the design of the Dresden Unit 2 pressure vessel is in accordance with the ASME Code, the primary general membrane stresses, S<sub>m</sub>, were limited to 2/3 yield strength at room temperature and 0.9 yield strength at 546°F. Also, special inspections and measurements (Startup Test Procedure #12) were made during Dresden Unit 2 pressure vessel startup to verify that piping expansion was according to design and that no sustained unusual loadings were transmitted to the safe ends. To date no failure of the sensitized stainless steel safe ends on the Dresden Unit 1 pressure vessel have been detected. There have been cracks in the

highly sensitized heat affected weld zones of some piping in Dresden Unit 1; the General Electric Company has documented information regarding the cracks. Based on this information, it can be seen that the factors contributing to the cracks on Dresden Unit 1 are not applicable to Dresden Unit 2.\*

Battelle-Columbus is conducting studies of stress corrosion cracking of sensitized stainless steel; these studies began before the operation of Dresden Unit 2 and therefore provide "leading data". Also, 100% of the Dresden Unit 2 sensitized stainless steel safe ends have been examined twice within a twelve month period, and no cracks or failures were detected. It has been shown that sensitized stainless steel cracks do not result in catastrophic pipe failures. Therefore, it is our plan to conduct Dresden Unit 2 safe end inspections per the requirements of ASME Boiling and Pressure Vessel Code Section XI, 1971 Edison (not on an accelerated basis).

- \* (A) Verbal Report to the Commission by Messrs. Diederich and Holyoak of Commonwealth Edison Company on or about May 2, 1967.
- (B) Letter to Dr. P. A. Morris from H. K. Hoyt, Superintendent, Dresden Station, dated December 17, 1970.
- (C) Letter to Dr. P. A. Morris from H. K. Hoyt, Superintendent, Dresden Station, dated March 5, 1970.