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RPS

MEMORANDUM FOR: E. G. Case, Acting Director
Office of Nuclear Reactor Regulation

R. B. Minogue, Director
Office of Standards Development

FROM: Saul Levine, Director
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER - 12, MODIFICATIONS TO
PRESSURE VESSEL FAILURE PROBABILITY PREDICTION

This memorandum transmits the results of the modifications incorporated
in the OCTAVIA computer code (Research Information Letter dated February
25, 1977) as discussed in meetings between RES and NRR and as referenced
in the letter (Case to Levine, dated March 24, 1977). The modifications involve:

1. The capability to handle residual stresses. Coding
was incorporated in OCTAVIA to handle residual stresses
which can be a constant or can vary with flaw size.

2. An upper limit to be imposed on the toughness. Coding
was incorporated to allow the user to impose an upper
bound on the toughness.

and

3. The capability to handle uncertainties in the toughness.
The OCTAVIA code was modified to calculate the 95% and
5% confidence bounds on the toughness as derived from
the basic HSST data (ORNL-TM-4914). The best fit to the
data was also updated based on regression analyses.
The user also has the option of inputting his own
confidence bounds or best fit.

The draft reports which are enclosed describe the above modifications
and sensitivity studies which have been made on the effects of these
modifications. The Surry 1 vessel has been re-evaluated with the
modified versions of OCTAVIA and the median pressure vessel failure
probabilities are shown in Tables 1 and 2. Table 1 is for a copper content
of 0.25% which was used as the present copper content in Surry 1; Table 2
is for a reduced copper content of 0.1%. Figure 1 is a plot associated
with Table 1.

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From Table 1, the median failure probability is 5×10^{-7} per vessel years for an operating temperature of $110°$ and the current age of Surry taken to be approximately 2.5 years; the failure probability increases to 3×10^{-5} per vessel year after 40 years. These numbers compare with 6×10^{-7} per vessel year for 2.5 years and 3×10^{-5} per vessel year after 40 years reported in the previous OCTAVIA Research Information Letter. Table 2 shows the 1 to 2 order of magnitude reduction in failure probability due to reduced copper content. The effect of copper content is similar to that in the previous OCTAVIA calculation. For the input data used, the modified OCTAVIA results generally agreed within a factor of 2 with the previous results from OCTAVIA.

Original Signed by
Saul Levine

Saul Levine, Director
Office of Nuclear Regulatory
Research

Enclosures:
1. Calculation of Pressure Vessel
   Failure Probabilities for
   Surry 1
2. Sensitivity Studies on Residual
   Stress and Toughness Limits
3. The OCTAVIA Computer Code: PWR
   Reactor Pressure Vessel
   Failure Probabilities Due
   to Operationally Caused
   Pressure Transients

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Refers to RES MC#1277.

RECORD NOTE: *See previous yellow for concurrence. 2nd page retyped in Dir. Off.

office ►	RES:PAB	RES:PAB	RES:TA:D	RES:SA:D	RES:D	
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