ELECTRIC POWER
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TO: Recipients of EPRI NP-6041-SLR1

FROM: EPRI Publishing

SUBJECT: EPRI Technical Report, *A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)*

A typographical error was found in Equation H-27 on page H-17.

The denominator in the second bracketed term should read $1.12+S_1^{1.5}$. That is, the value of S_1 should be raised to the 1.5 power NOT multiplied by 1.5.

The error has been corrected.

An electronic version of the corrected report can be downloaded at:
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=NP-6041-SLR1

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accurately (no intentional conservatism) estimated by (12 to 14):

$$\sigma_p = \frac{0.6\ E_s}{(R/t_s)}\left[1 - \left(\frac{P\ R}{\sigma_{ye}\ t_s}\right)^2\right]\left[1 - \frac{1}{1.12 + S_1^{1.5}}\right]\left[\frac{S_1 + (\sigma_{ye}/36\text{ ksi})}{S_1 + 1}\right] \qquad \text{(H-27)}$$

where $S_1 = (R/t_s/400)$ and t_s is the sidewall thickness near the shell base, P is the tank internal pressure near its base, and σ_{ye} is the effective yield stress of the tank shell material. For HCLPF capacity computations it is suggested that a slight conservatism be introduced by specifying C_B in terms of $0.9\sigma_p$. Thus:

$$C_B = 0.9\ \sigma_p t_s \qquad \text{(H-28)}$$

Furthermore, P should be set equal to P_{C+} which represents the maximum combined pressure against the tank wall at the time of maximum moment. Lastly, for a tank shell material such as SA 240-Type 304 stainless steel with no specific yield point, it is uncertain what stress to use for σ_{ye}. This material shows no flat yield plateau and continues to show increasing stress with increased strain until its minimum ultimate stress capacity of 75 ksi is reached. For a CDFM capacity evaluation it seems reasonable to set σ_{ye} at the ASME Code (15) seismic design limit for primary local membrane plus primary bending which is $2.4S_m$ or 45 ksi for this material. The potential uncertainty range for σ_{ye} is estimated to be from 30 ksi to 60 ksi, with it likely to exceed 45 ksi.

For the example tank, $P = P_{C+} = 21.5$ psi, $t_s = 0.375$ inch, $E = 27.7 \times 10^3$ ksi, $(R/t_s) = 640$, $S_1 = 1.6$, $(P/\sigma_{ye}) = 0.48 \times 10^{-3}$, and $(\sigma_{ye}/36\text{ ksi}) = 1.25$. Thus, from Eq. H-27, $\sigma_p = 17.6$ ksi. When one considers the potential range on σ_{ye} of 30 to 60 ksi, then the resultant range on σ_p is 13.1 ksi to 21.1 ksi. The influence of this uncertainty range on the SME capacity will be subsequently assessed.

Using Eq. H-28, the compressive capacity of the shell is:

$$C_B = 0.9\ (17.6\text{ ksi})(0.375\text{ in}) = 5.92\text{ Kip/in} \qquad \text{(H-29)}$$

Although unlikely to govern for overall seismic response of fluid containing tanks, one should also check the buckling capacity of supported cylindrical shells under combined axial bending and internal pressure. The axial bending induced buckling stress, σ_{CB}, for such a case can be conservatively (essentially lower bound) estimated from (16):