NRC PDR

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NUCLEAR REGULATORY COMMISSION
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Generic Task A-7

MEMORANDUM FOR: D. Eisenhut, Acting Director, Division of Operating Reactors

THRU: G. Lainas, Chief, Plant Systems Branch, Division of Operating Reactors

V. Noonan, Chief, Engineering Branch, Division of Operating Reactors

FROM: C. Grimes, A-7 Task Manager

SUBJECT: PROPOSED POSITION FOR POOL SWELL LOAD DEFINITION AND LOAD COMBINATIONS FOR THE MARK I CONTAINMENT LONG TERM PROGRAM

On June 22, 1979, we met with representatives of the Mark I Owners Group to discuss the uncertainties associated with the definition of pool swell pressure loads and the relative significance of these uncertainties to the design of the structure. The Mark I Owners expressed the concern that, while individual margins in the loading functions appear inconsequential, the cumulative effect could result in substantial modifications. This point was evidenced by Enclosure 1, in which they quantified the cumulative effect of the pool swell upward load combinations. The staff noted that the local safety-relief valve (SRV) negative pressure peak is a more substantial contributor to the upward load combination than the margin for uncertainties being suggested by the staff. We concluded that it would be more sensible, technically, to reconsider the DBA (i.e., pool swell) + SRV event combination, than to deliberate about the uncertainties in the individual (e.g., upward pressure) loading contributors.

In the Short Term Program, the DBA + SRV event combination was excluded on the basis that the combination did not reflect a "most probable" load condition and would be reassessed in the Long Term Program (LTP). The rationale for this conclusion is discussed in Section III.D.9 of the Short Term Program Safety Evaluation Report, NUREG 0408.

The LTP reassessment of this event combination considered (1) the potential for a mechanistic actuation of the valves; and (2) the potential for spurious actuation of an SRV. GE has advised us that primary system analyses have been performed which demonstrate that SRV cannot mechanistically (i.e., pressure) actuate under DBA conditions; however, these analyses have not been submitted for staff review. In considering the potential for spurious actuation, we concluded that, although the probability of the event combination is low, the capability of the structure to withstand the event combination, without loss of function, should be demonstrated. These concerns were previously discussed with the Mark I Owners in September 1977 and a staff position, similar to the one presented here, was presented to them at that time. This approach is also consistent with our requirements for long-term application of drywell to wetwell differential pressure control ($\Delta P$) as a load mitigating feature, which were presented to the Mark I Owners in October 1977. The $\Delta P$ position similarly requires that the capability of the structure to withstand the loading conditions without differential pressure control and without loss of function be demonstrated, even though the loss of differential pressure control is an unlikely event.

We recognize that our proposed position for the definition of pool swell upward loads (i.e., mean load + 15% + $2\sigma$) provides a conservative load and we agree that unnecessarily compounded conservatisms should be avoided. In this particular case, the bulk of the conservatism arises from the postulated SRV discharge event; however, it cannot be completely neglected. Therefore, we propose that this problem be addressed by modifying the structural acceptance criteria for this particular event combination in recognition of the improbability of the superposition of the peak loads. This approach would require that GE submit the primary system analyses, supporting the non-mechanistic event coupling, for DSS to review as part of the Task A-39 generic SRV loading issue.

The modified structural acceptance criteria can be summarized as follows:

LOCA = Service Level A

LOCA + SRV = Service Level C

The Mark I Owners expressed an interest in pursuing this position. However, the representatives of the Owners Group indicated that their conclusions are presently based on generic structural studies, while the individual plant-unique analyses may identify other problems.

We believe that the proposed position will permit a reasonably conservative load definition without resulting in unnecessarily compounded conservatisms. Therefore, with your concurrence and that of the cognizant DOR Branch Chiefs, the A-39 Task Manager, and the Director of the Unresolved Safety Issues Program, we discussed this approach with representatives of the Owners Group in a meeting held on June 29, 1979. The structural acceptance criteria proposed by the Owners Group and agreed to by the staff are presented in Enclosure 2. Similar acceptance criteria will be developed for the attached piping and concrete containment design (i.e., Brunswick).

C. Grimes
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Plant Systems Branch
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Enclosures:
As stated

cc: S. Hanauer
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ENCLOSURE 1

POOL SWELL UPWARD LOAD COMBINATION

| LOAD CASE | LOADING COMBINATION | TENSION STRESS (kips) |
|---|---|---|
| (A) NOMINAL | $PS + EQ - DL$ | 75 |
| (B) RANDOM MARGIN | $(PS + 2\sigma) + EQ - DL$ | 90 |
| (C) "15%" MARGIN | $(1.15\ PS + 2\sigma) + EQ - DL$ | 125 |
| (D) SRV - TEST LOAD | $(1.15\ PS + 2\sigma) + EQ + SRV_{test} - DL$ | 185 |
| (E) SRV - LDR | $(1.15\ PS + 2\sigma) + EQ + SRV_{LDR} - DL$ | 235 |
| (F) HEADER IMPACT - SRSS | $(1.15\ PS + 2\sigma) + EQ + (SRV^2_{LDR} + HDR^2)^{1/2} - DL$ | 242 |
| (G) HEADER IMPACT - ABS | $(1.15\ PS + 2\sigma) + EQ + SRV_{LDR} + HDR - DL$ | 275 |

PS = Pool Swell Pressure Load
EQ = Earthquake Load
DL = Deadweight Load
SRV = Safety-Relief Valve Discharge Load
HDR = Header Impact Reaction Load

# MARK I LOAD COMBINATIONS & STRUCTURAL ACCEPTANCE CRITERIA

| EVENT COMBINATIONS | | SRV | SRV + EQ | | SBA IBA | | SBA + EQ IBA + EQ | | | | SBA + SRV IBA + SRV | | SBA + SRV + EQ IBA + SRV + EQ | | | | DBA | | DBA + EQ | | | | DBA + SRV | | DBA + EQ + SRV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | CO, CH | | | CO,CH | | | CO, CH | | | CO,CH | | PS (1) | CO, CH | PS | | CO,CH | | PS (1) | CO, CH | PS | | CO,CH | |
| TYPE OF EARTHQUAKE | | | O | S | | | O | S | O | S | | | O | S | O | S | | | O | S | O | S | | | O | S | O | S |
| COMBINATION NUMBER | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| LOADS<br>Normal (2) | N | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Earthquake | EQ | | X | X | | | X | X | X | X | | | X | X | X | X | | | X | X | X | X | | | X | X | X | X |
| SRV Discharge | SRV | X | X | X | | | | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X |
| LOCA Thermal | $T_A$ | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| LOCA Reactions | $R_A$ | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| LOCA Quasi-Static Pressure | $P_A$ | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| LOCA Pool Swell | $P_{PS}$ | | | | | | | | | | | | | | | | X | | X | X | | | X | | X | X | | |
| LOCA Condensation Oscillation | $P_{CO}$ | | | | | X | | | X | X | | X | | | X | X | | X | | | X | X | | X | | | X | X |
| LOCA Chugging | $P_{CH}$ | | | | | X | | | X | X | | X | | | X | X | | X | | | X | X | | X | | | X | X |
| STRUCTURAL ELEMENT | ROW | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| External Class MC<br>Torus, External Vent Pipe, Bellows, Drywell (at Vent), Attachment Welds, Torus Supports, Seismic Restraints | 1 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A (3,6) | A | B (3,6) | C | B | C | C | C | C | C | C | C |
| Internal Vent Pipe<br>General and Attachment Welds | 2 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A (3,5) | A | B (3,5) | C | B | C | C | C | C | C | C | C |
| At Penetrations (e.g., Header) | 3 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A (3) | A | B (3) | C | B | C | C | C | C | C | C | C |
| Vent Header<br>General and Attachment Welds | 4 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A (3,5) | A | B (3,5) | C | B | C | C | C | C | C | C | C |
| At Penetrations (e.g., Downcomers) | 5 | A | B | C | A | A (4) | B | C | B (4) | C | A | A (4) | B | C | B (4) | C | A(3, 4,5) | A (4) | B(3, 4,5) | C | B (4) | C | C | C | C | C | C | C |
| Downcomers<br>General and Attachment Welds | 6 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A (3, 5) | A | B (3, 5) | C | B | C | C | C | C | C | C | C |
| Internal Supports | 7 | A | B | C | A | A | B | C | B | C | A | A | B | C | B | C | A | A | B | C | D | C | C | C | C | C | C | C |
| Internal Structures<br>General | 8 | A | B | C | A | A | C | D | C | D | C | C | D | E | D | E | E | E | E | E | E | E | E | E | E | E | E | E |
| Vent Deflector | 9 | A | B | C | A | A | C | D | C | D | C | C | D | D | D | D | D | D | D | D | D | D | D | D | D | D | D | D |