UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 0 0 1981

.Task Action Plan B-10

MEMORANDUM FOR: Walter R. Butler, Chief, Containment Systems Branch, Division of Systems Integration

THRU: John A. Kudrick, Section Leader, Containment Systems Branch, Division of Systems Integration

FROM: Mel B. Fields, Containment Systems Branch Division of Systems Integration

SUBJECT: MEETING WITH GENERAL ELECTRIC ON MARK III LOCA-RELATED POOL DYNAMIC LOAD CRITERIA (November 20, 1981)

Members of the Containment Systems Branch and its consultants met with General Electric personnel in Bethesda on November 20, 1981 to discuss the remaining unresolved issues dealing with the generic LOCA-related pool dynamic loads for the Mark III containments. Also present at the meeting were representatives from several utilities that are building Mark III plants, including the Mississipp Power and Light Company (Grand Gulf applicant). A summary of the meeting is presented below. Attachment 1 is the attendence list, and attachment 2 is a copy of the non-proprietary portion of the meeting handouts.

1) Pool Swell Velocity

The current specification proposed by GE for the maximum pool swell velocity is 40 ft/sec. The staff and its consultants have concluded that a 40 ft/sec velocity is not adequately supported by the available experimental data and scaling techniques. After examination of the available data and various scaling methods, we have determined that a maximum velocity of 50 ft/sec adequately bounds the pool velocity that can be expected in a Mark III plant during a LOCA. As part of this pool swell velocity specification, we will develop a relationship between velocity and height over the initial pool surface for the first 10 feet of pool swell to account for the acceleration of the water to its maximum velocity. GE was informed of this determination at this meeting after a brief discussion of the issues involved. It should be noted that the Grand Gulf facility was analyzed for a bounding pool velocity of 60 ft/sec so as not to impact the licensing schedule for this plant. The analysis provided by MP&L demonstrated that the current design of Grand Gulf structures would not be exceeded by 60 ft/sec pool swell loads.

2) Froth Impact Loads

The current specification proposed by GE for froth impact on the HCU floor is a triangular pulse with a 15 psid amplitude and a 100 msec width at the base. GE's justification for this load specification, presented by Steve Husik, is based on the PSTF roof pressure history readings from selected test runs. Dr. George Maise of the Brookhaven National Laboratory, an NRC consultant, pointed out that the potential scatter in the test data due to

water level probe placement in the GE Pressure Suppression Test Facility (PSTF) is too large to support the 15 psid amplitude as a conservative value. However, an alternative approach for resolving the froth impact amplitude issue was suggested by Dr. Maise during the meeting. This approach uses the measured impact data on targets located above the pool surface whose elevations correspond to the HCU floor elevation in a Standard Mark III plant, when the modified Froude scaling laws are assumed to hold true. This approach removes the substantial uncertainties that are associated with the method developed by GE. We understand GE agrees with the approach suggested by Dr. Maise and that they plan to use it in an upcoming submittal. A final evaluation of Dr. Maise's approach in resolving this issue will be made by the staff and its consultants and will be reported in the forthcoming NUREG report on Mark III LOCA-related pool dynamic loads.

The other issue in the froth impact specification is the pulse width. Recent information provided by MP&L (in a letter from L. F. Dale to H. Denton, dated October 9, 1981) indicates that the structural response of the HCU floor may be more sensitive to the pulse width than previously assumed. At the meeting GE agreed to review the PSTF test data and determine the range of possible pulse widths and provide this range to the staff. Members of the Structural Engineering Branch who were present for this portion of the meeting stated that the SEB would review the structural significance of the froth impact load and provide guidance on the selection of the pulse width(s) that should be used. Close coordination between the CSB and SEB will be maintained in order to successfully complete the parallel efforts undertaken by these branches.

3) Submerged Structure Loads

Dr. George Bienkowski, an NRC consultant, discussed the remaining concerns we have with GE's specification for chugging loads on submerged structures.

Our original concern was that the chug source strength selected for design purposes did not adequately bound the experimental data from the PSTF. GE's latest response stated tht the conservatisms inherent in the GESSAR methodology sufficiently compensated for the possible nonconservatisms in the chug source strength. Dr. Bienkowski pointed out that the hydrodynamic mass effect was not accounted for in GE's response. Including this effect will eliminate most or all of the conservatisms in the GESSAR method for submerged structures with diameters greater than one foot. We suggested that GE revise the chug source strength for large (> one foot in diameter) submerged structures and attempt to show that these revised loads are bound by other loads (e.g., LOCA air bubble loads).

Mel B. Fields

Mel B. Fields
Containment Systems Branch
Division of Systems Integration

Enclosure:
As stated
cc: (See page 3)

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ATTACHMENT 1

MARK III MEETING

ATTENDENCE

11/20/81

NAME	ORGANIZATION
Mel Fields	CSB/DSI/NRC
W. Butler	CSB/DSI/NRC
D. Houston	NRR/DL/LB#2
M. J. Shab	Stone & Webster, Cherry Hill
T. P. Speis	NRR/RS
J. A. Kudrick	CSB/DSI/NRC
Ain Sonin	MIT (for BNL/NRC)
George Maise	BNL
H. C. Pfefferlen	GE
C. A. Vath	Gilbert Association Inc.
J. P. McGaughy	Mississippi Power & Light Co.
P. J. Kochis	Bechtel Power Corporation
R. L. Beck	Bechtel Power Corporation
H. E. Townsend	GE
E. J. McNamara	GE
S. A. Hucik	GE
W. M. Davis	GE
C. Economos	BNL

Non-Proprietary

ATTACHMENT 2

MARK III POOL SWELL

- VELOCITY

- HCU FLOOR FROTH IMPACT

SA HUCIK, MANAGER
CONTAINMENT DYNAMIC LOADS

NOVEMBER 20, 1981

POOL SWELL VELOCITY

o 40 FT/SEC IS AN ADEQUATE PEAK POOL SWELL DESIGN VELOCITY

BASIS

- o PSTF FULL SCALE AIR TEST
  - V = 38 FT/SEC
- o PSTF 1/3 AREA SCALE DATA
  - V = 33 FT/SEC
- o PSTF $1/\sqrt{3}$ LINEAR SCALE MODIFIED FROUDE DATA
  - V = 44 FT/SEC
- o 2D MAC ANALYTICAL MODEL
  - V = 39 FT/SEC

POOL SWELL VELOCITY

SUMMARY

- SEVERAL APPROACHES ALL GIVE VELOCITY IN RANGE OF 38 FT/SEC TO 44 FT/SEC
- ADDITIONAL CONSERVATISMS IN THE ANALYSIS NOT CONSIDERED IN BASIS
  - CONSERVATIVE DRYWELL PRESSURE
  - NO CONDENSATION IN DRYWELL
  - INSTANTANEOUS DOUBLE ENDED GUILLOTINE BREAK
- 40 FT/SEC IS AN ADEQUATE POOL SWELL DESIGN VELOCITY

SAH-3

11-20-81

FROTH IMPACT

- o 15 PSID IS A CONSERVATIVE FROTH IMPACT LOAD AT THE HCU FLOOR

- o ALL APPLICABLE PSTF ROOF IMPACT DATA, WHEN SCALED TO V = 60 FT/SEC, SHOW $P_{LIFT\ MAX} < 10$ PSID

  - WILL SHOW WHY NON-PROTOTYPICAL DATA NOT USED

  - WILL JUSTIFY IMPACT PRESSURES SCALE AS VELOCITY

  - WILL SHOW HOW LIFT PRESSURES WERE OBTAINED

FROTH IMPACT

- o ALL 5 AND 6 FOOT SUBMERGENCE, AIR AND STEAM BLOWDOWN TESTS WITH BREAK AREAS < 200% DBA WHICH HAD BREAK-THROUGH SEVERAL FEET FROM THE ROOF WERE USED IN THIS STUDY

- o JUSTIFICATION FOR NOT USING NON-PROTOTYPICAL DATA IS:

  - 5801-12 WAS A 7.5' SUBMERGENCE TEST

    - o NON-PROTOTYPICAL CEILING LIQUID IMPACT DUE TO LOW PSTF ROOF

  - 5806-5, 7, 10 HAD BLOWDOWN ORIFICE SIZES > 200% DBA BREAK AREA

    - o LARGER SLUG → HIGHER ρ_{IMPACT} → HIGHER P_{LIFT}
    - o $\rho_{IMPACT} \propto$ % DBA BREAK AREA
    - o $P_{LIFT} \propto$ % DBA BREAK AREA

  - 5802-1, 2 HAD BREAKTHROUGH CLOSER TO ROOF THAN PROTOTYPICAL

    - o 5802-2 HAD BREAKTHROUGH AT ROOF
    - o 5802-1 HAD SIMILAR IMPACT PRESSURE AND DENSITY

    ∴ BOTH HAD BREAKTHROUGH VERY CLOSE TO ROOF

SAH-5
11-20-81

FROTH IMPACT

o VELOCITY SCALING OF FROTH IMPACT DATA

- P ∝ IMPULSE/DURATION

- IMPULSE DURATION DOES NOT CORRELATE WITH VELOCITY

- P ∝ VELOCITY

- TO SCALE, $P = P_{\text{NET LIFT MAX}} \times 60 \text{ FT/SEC} \div V_{\text{TEST MAX}}$

SAH-8

11-20-81

FROTH IMPACT

- o PROCEDURE FOR CALCULATING SCALED LIFT PRESSURES
  - ROOF PRESSURE READINGS AT 1', 2', 3' AND 4' FROM THE DRYWELL WALL WERE AVERAGED TO OBTAIN P_{LIFT} (TIME)
  - $P_{LIFT\ MAX}$ WAS THEN FOUND
  - $P_{BACKGROUND}$ WAS SUBTRACTED TO OBTAIN THE MAXIMUM NET LIFT PRESSURE
  - $P_{NET\ LIFT\ MAX}$ WAS THEN LINEARLY SCALED TO V = 60 FT/SEC
  - SCALED PEAK NET LIFT PRESSURES FOR AIR AND STEAM TESTS WERE PLOTTED VERSUS REPORTED DISTANCE BETWEEN THE PSTF ROOF AND THE BREAKTHROUGH LOCATION

- o MAXIMUM NET LIFT IMPACT PRESSURE WHEN SCALED TO 60 FT/SEC IS 8.6 PSID, SHOWING 15 PSID IS CONSERVATIVE