



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

APR 12 1979

MEMORANDUM FOR: R. J. Bosnak, Chief, Mechanical Engineering Branch, DSS  
FROM: S. N. Hou, Mechanical Engineering Branch, DSS  
SUBJECT: MEETING MINUTES - RESPONSE COMBINATION IN MARK-II PLANTS

On March 30, 1979, a meeting (Attachment A) with Mark-II Owner's Group was held in Bethesda to discuss staff comments (Attachment B) on their proposed Kennedy-Newmark Criteria (Attachment C) for combining dynamic responses using SRSS. Discussions include staff review status, Owner's response to staff comments (Attachment F) and presentations by the Brookhaven National Laboratory (Attachment G) regarding the progress in their on-going generic studies on response combination methodologies.

As mathematically indicated (Attachment D), the rules of SRSS are valid only for combining standard deviations when all functions to be combined are stationary, uncorrelated, and with zero-mean. Hence, any proposed SRSS application to combining the extreme peaks of response functions, which also may not be stationary, uncorrelated, and with zero-mean, certainly need careful investigation. The purpose is to ensure the validity of assumptions used; the adequacy of criteria to cover various nature of response functions; the limitation of criteria application; and the applicability of criteria to aid the engineering processes in design and analysis.

Currently, we have two technical assistant contracts with BNL for generic investigation on response combination methodologies and for evaluating the Owner's proposed criteria. The expected completion date for both contracts is September 30, 1979. Their findings may be helpful to complete our review on the proposed Kennedy-Newmark criteria.

In order to expedite the licensing process, Interim acceptance criteria (Attachment E) for using SRSS were developed since November, 1978 for lead Mark-II plants. With respect to combining dynamic responses of LOCA and SSE loads, the staff position as outlined in NUREG-0484 is that SRSS is acceptable for the reactor coolant pressure boundary systems, components and supports. In addition, the staff has accepted the SRSS method of combining responses resulting from LOCA and SSE for all other ASME Class 1 and 3 systems, components and supports in the plant.

8001080116

~~8001080~~

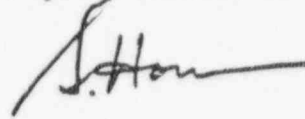
90011185

APR 12 1979

R. J. Bosnak

- 2 -

In summary, this meeting is helpful to achieve mutual understanding in views and to inform the progress of on-going efforts of all sides.



S. N. Hou  
Mechanical Engineering Branch  
Division of Systems Safety

Attachments:

- A. Meeting Agenda & Attendance List
- B. Staff Comments on the proposed criteria
- C. The Mark-II Owner's proposed Kennedy-Newmark Criteria
- D. Staff presentation: Background Information on Response Combinations
- E. NRC Interim Acceptance Criteria for using SRSS
- F. Dr. Kennedy's presentation: Response to Staff Comments on the Proposed Criteria
- G. BNL Presentation: Progress report on their generic studies.

cc w/att:

J. P. Knight, DSS  
F. Schauer, DSS  
K. Wichman, DOR  
H. L. Brammer, DSS  
F. Cherny, DSS  
J. Richardson, RES  
W. F. Anderson, SD  
E. G. Igne, ACRS  
H. Chau, Mark-II Owner's Group  
M. Reich, BNL

90011186

# ATTACHMENT A

Meeting Agenda On  
RESPONSE COMBINATION IN MARK-II PLANTS  
March 30, 1979

- I. Status report on staff review 10 min.
  - A. Describe review effort
  - B. Explain staff concern
  - C. Propose review schedule
- II. Mark-II Owner's response to staff  
comments on Kennedy-Newmark Criteria 50 min.
- Break 10 min.
- III. BNL Presentation:
  - A. Comments and planned reviews  
on Kennedy-Newmark Criteria 10 min.
  - B. Progress report on generic  
studies 50 min.
    - 1. Objective of studies
    - 2. Approaches used
    - 3. Findings up to present:
      - a. Identify major parameters
      - b. Summarize findings on  
sensitive studies
    - 4. Identify remaining work and  
completion date

IV. Discussion

V. Closing

A-1

90011187

ATTENDANCE LIST

March 30, 1979 MK-II Meeting

<u>Name</u>	<u>Organization</u>
R. Bosnak	NRC/DSS/MEB
H. L. Brammer	NRC/DSS/MEB
Pei-Ying Chen	NRC/DSS/MEB
Lingagoud Memula	Bechtel
Louis C S Nieh	Stone & Webster
Jo S. Abel	Commonwealth Edison
A. K. Singh	Sargent & Lundy
R. P. Kennedy	Engineering Decision Analysis Co.
C. V. Subramanian	General Electric Co.
G. H. Weidenhamer	NRC/SCSD
R. K. Mattu	NRC/DSS/MEB
K. N. Jabbour	NRC/DOR/SEP8
C. P. C. Wang	BNL
M. Reich	BNL
J. Curreri	BNL
Kulin D. Desai	NRC/DSS/MEB
M. Hartzman	NRC/DSS/MEB
A. W. Chan	S&W
K. Wichman	NRC/DOR/EB
J. B. Mahoney	Burns & Roe
C. K. Chau	Lawrence Livermore Lab.
J. F. Costello	NRC/RES
K. G. Hazifotis	General Electric
John O'Brien	NRC/RES
David D. Reiff	NRC/RES
C. P. Tan	NRC/DSS/SEB
R. M. Stephens	NRC/DSS/MEB
S. N. Hou	NRC/DSS/MEB

90011188

# ATTACHMENT B

## MECHANICAL ENGINEERING BRANCH

### COMMENTS ON

#### NEDO-24010 SUPPLEMENT 2

##### A. For Criterion #1:

1. The proposed criterion represents a fresh approach by utilizing characteristics of time functions, instead of attempting generic conclusions from a few case studies as done by others. Generally speaking, the criterion is simple, easy to apply, and may be able to achieve a high non-exceedance probability in most cases. However, the criterion appears to be based on engineering judgement without the needed data basis to verify the claimed goal of achieving 84% non-exceedance probability.

2. We are not certain the parameters used, such as number and level of high peaks, durations, etc., are sufficiently adequate to ensure a justifiable SRSS combination in all cases meeting the criterion.

For instance, one important condition to warrant the use of SRSS is that both time functions shall be rapidly varying. Since "rapid varying" is a relative term, a comparison of frequency contents in time function may be necessary.

A search of parameters which control the characteristics of time functions in conjunction with sensitivity studies of those parameters may be helpful to verify the adequacy of the criterion.

90011189

As an alternative, numerical examples associated with non-exceedance probability evaluation (i.e., use CDF) may be conducted to develop the data base for verifying the assurance level of the proposed criteria.

3. The proposed criterion indicated that the use of SRSS can be based on the characteristics of either the loading time functions, or the response time functions. We feel that combination of responses should be solely based on the characteristics of the response time functions.

Since the characteristics of the responses are effected by the structural dynamic properties, such as natural frequencies, damping values, etc. even the same loading can produce responses of various nature. Thus a loading time function meeting the criteria may not necessarily mean that the response time functions will also meet the criteria. We would require justification for the use of loading functions.

4. It is rather difficult to determine whether two time functions are strongly correlated, or weakly correlated just by observation alone. Furthermore, judgement by opinion may vary from person to person. We have adequate confidence that the level of correlation among earthquake ground motion components is weak. However, to determine the level of correlation among response time functions other than earthquake event may present a problem.

90011190

Additional work of calculating the coefficient of correlation may be needed. The work will be compounded when an increased number of time functions are needed to be combined at one time.

5. Many response time functions may not have a zero mean. No guidance is provided on how such cases would be handled.

B. For Criterion #2:

1. It was stated in the preamble of the report that the intent of the proposed criteria for response combinations is to achieve a non-exceedance probability of 84% (+). We feel that proposed criterion #2 may not achieve that goal if it uses SRSS based on a 50% (+) non-exceedance probability, since it appears to be inconsistent with the stated intent. Furthermore, the purpose and the basis in adding an additional requirement of 85% (+) non-exceedance probability at 1.2 SRSS is not clear, since the proposed value to be used is SRSS, not the 1.2 SRSS.

One of the many possible reasons for people to promote SRSS is because the method is simple and convenient. If we go to the trouble of generating a CDF curve at the 84% non-exceedance probability then that value may be more justifiable than the SRSS value. Why bother to have two SRSS related values?

90011191

2. Since a CDF curve is used in the criterion, guidance to ensure the validity of the curve may be necessary.

Notice that CDF curve may not be unique due to following circumstances:

- a. Response time function is not unique.
- b. Durations of the strong motion portions taken for response combinations are arbitrary.
- c. The probability density function assumed for defining phasing relationships among response functions is arbitrary.

Thus, how a bounding CDF curve is defined to ensure adequate coverage of all mentioned uncertainties is essential to the application of the proposed criterion #2.

90011192