CT-1276

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July 29, 1980

Mr. M. Bender, Chairman,
ACRS Subcommittee on Combination of
Dynamic Loads,

NRC PROGRAMS ON COMBINATION OF DYNAMIC LOADS,
Discussions with Staff on June 19, 1980.

On June 19th the writer met with several NRC staff members in Washington, Silver Springs and Bethesda to discuss the status of work on combination of dynamic loads under thrir various programs. It was hoped that these meetings would provide a basis for planning an agenda for the next meeting of the Subcommittee. Following is a brief resume of the discussions.

Division of Reactor Safety Research
Mechanical Engineering Research Branch
James E. Richardson & John A. O'Brien

There are two principal parts to the program on dynamic load combination under the direction of the Mechanical Engineering Research Branch: 1) Establishing the probability of combined SSE and LOCA occurrence (decoupling), and 2) Demonstration of load factors as related to the probability of failure.

Methods have been developed for using component reliability to determine load factors for use in design of mechanical and structural components. The determination of load factors may include the effects of site, type of load, and type of component as well as other considerations.

Richardson and O'Brien hope to develop the load factor method to the point that it will be accepted by the ASME for combining these loads in applications subject to the ASME Boiler and Pressure Vessel Code. If that is successful it would result in a uniform and consistent approach to the mechanical and structural systems affecting the nuclear plants. They also anticipate revisions of Standard Review Plan Sections 3.8 and 3.9 and of Regulatory Guide 1.46 as a result of this work.

Dr. O'Brien presented a tentative agenda for a presentation of their program before the Subcommittee and suggested that the meeting be held about the third week of September instead of in August so that all of the people would be available. A suggested preliminary agenda in which his tentative proposal is incorporated is attached to this memo.

Division of Engineering
Mechanical Engineering Branch
S. N. Hou

Dr. Hou briefly reviewed the work sponsored by NRR on load combination methodology. He is concerned with obtaining short t m results, which will enable the Office of Nuclear Reactor Regulation to make decisions on current applications. The work consists of 1) response combination, 2) event combination, and 3) stress limits.

Under this program Brookhaven has reviewed the SRSS proposal as presented in General Electric Company Report No. NEDO-24010, and the basis for the two criteria for use of SRSS as given in Supplement 2 to NEDO-24010. Their results are reported in NUREG/CR-1330. Dr. Hou stated that the Brookhaven study shows that SRSS is not safe. 84% probability of nonexceedance gives a mean of approximately 50% probability of occurrence.

The study consisted of a generic study of response combination plus a study of non-exceedance probabilities.

Dr. Hou said that it would be desirable to show that it is not necessary to combine the SSE and LOCA events. He believes that if it can be established that the piping material is ductile then combination of SSE and LOCA loads should not be required.

The current interim position of Regulatory is that recommended in NUREG-0484.

Dr. R. Gamble

Dr. Gamble discussed a program on elastic-plastic fracture mechanics. The objective of this program is to establish "leak-before-break" properties for piping, which he believes would eliminate the necessity for combining SSEand LOCA loads on piping. This program is based on what is called a "deterministic" approach rather than the probabilistic approach being followed by the reaearch group. Dr. Gamble does not believe that probability factors can be reliably established for use in implementation of the load factor approach.

A presentation was made of this program at the Subcommittee meeting of August 1979, but it is felt that an up-date should be worth while at the next meeting. Dr. Gamble suggested that the presentation should include a summary of the data that is needed to make elastic-plastic analysis practical. He said that some work is being sponsored by the Mark II owners group, but some Mark II owners are not contributing, so they are not being permitted to use the data.

Summary

The program sponsored by the Nuclear Reactor Research Division is following a probabilistic load factor approach, which will probably be a long range program, especially if it requires changes in codes. However, it has the potential of providing consistency between the methodologies applied to the mechanical components and those applied to the structures by which they are supported.

The program of the Regulatory group is of shorter range and will relie on use of the absolute sum and SRSS methods primarily, until better methods are available. Decoupling of the SSE and LOCA may provide some relief if it can be safely established.

Elastic-plastic fracture mechanics must wait for the collection of supporting data. However it may provide a basis for decoupling the SSE - LOCA events.

The Regulatory group's program at Brookhaven was thoroughly reviewed at the last meeting of the Subcommittee. It should only be necessary to report the final results of the program at the next meeting. Also the work on elastic-plastic fracture mechanics was covered previously and only an up-dating should be desired now. The work sponsored byRichardson and O'Brien should be included as they recommend, and that will require about six hours to complete. It may be desirable to hold a two-day meeting, so that the Subcommittee will have time for discussion. A possible agenda for a two-day meeting is attached. Please change it any way that is suitable.

W. R. Gall, P.E.
A.C.R.S. Consultant.

POSSIBLE AGENDA
ACRS SUBCOMMITTEE ON COMBINATION OF DYNAMIC LOADS
WASHINGTON, D. C.
November __, 1980

	Approximate Time
I. EXECUTIVE SESSION	8:30 A.M.
II. Office of Nuclear Reactor Research, Program on Combination of Dynamic Loads.	
A. Introduction (J. O'Brien)	9:00A.M.
B. Load Combination Problem Overview. (Dr. C. K. Chou)	9:15 A.M.
C. Event Decoupling:	
1. Description - Large LOCA-SSE Decoupling Activities. (Dr. S. C. Lu)	9:40 A.M.
2. Technical Details and Results:	
2.1 Probabilistic Approach. (Dr. L. L. George)	9:55 A. M.
2.2 LOCA Directly Induced by Earthquakes; Loads and Stresses, (Dr. R. A. Larder)	10:25 A.M.
********** BREAK **********	10:40 - 11:10 A.M.
Pipe Crack Growth Analysis. (Dr. R. D. Strait/ Dr. D. Harris)	11:10 A.M.
2.3 LOCA Indirectly Induced by Earthquakes. (Mr. F. M. Gilman)	12:00
2.4 Safety Margins and Cost Assessment. (Dr, S. C. Lu/Dr. J. D. Stevenson)	12:15 P.M.
3. Summary and Recommendations. (Dr. S. C. Lu)	12:30 P.M.
********** LUNCH **********	12:45 - 1:45 P.M.
D. Load Combination Methodology Development:	
1. Selection of Load Combinations. (Dr. M. W. Schwartz)	1:50 P.M.
2. Demonstration of the Load Combination Methodology. (Dr. M. K. Ravindra)	2:10 P.M.
3. Derivation of Target Reliabilities for Subsystems and Components Based on System Analysis. (Dr. J. D. Collins)	3:00 P.M.
4. Commentary by Prof. C. A. Cornell	3:20 P.M.
5. Commentary by Dr. R. F. Kennedy	3:40 P.M.
E. Phase II Planning. (Dr. C. K. Chou)	4:00 P.M.
F. Commentary by Peer Review Panel	4:15 - 5:00 P.M.

Approximate Time

Peer Review Panel:
Prof. G. Apostolakis
Prof. G. Irwin
Dr. E. C. Rodabaugh
Prof. M. Shinozuka
Dr. C. Stoddart

********** OVERNIGHT RECESS **********

III. BNL/NRC Evaluation of SRSS. (NRC Staff) 9:00 A.M.

BNL Report on Methodology. (NRC Staff/BNL Staff) 9:30 A.M.

IV. Fracture Mechanics Analysis for LWR Piping - Progress Report. Mechanistic Pipe Break, Deterministic Analysis, Decoupling. (NRC Staff) 10:00 A.M.

V. Progress Reports Requested at Meeting of 8/22/79
1. Secondary Piping System - Dynamic Load Combination Methods. (NRC Staff)
2. Effects of Snubber Malfunctions. (NRC Staff)
3. Unification of Structural and Process Systems. (NRC Staff)

VI. Comments by The Subcommittee

VII. Caucus

Viii. Adjournment.