Franklin Research Center
A Division of The Franklin Institute

BR
CT-1236

April 25, 1980

Mr. El Igne
Advisory Committee on
Reactor Safeguards
Washington, D.C. 20555

Reference: Report on ACRS Subcommittee Meeting on Concrete Structures

Dear El:

This meeting was called to review NRC research programs in structural engineering branch.

The overall goal of the research is to develop and/or sharpen the NRC tools for evaluation of safety-related structures. The main purpose of this meeting was to review the research (in progress and as planned) and to make recommendations related to the FY 82 budget.

All of the Structural Engineering programs relate to one of the three major areas: 1) load definition, 2) structural response, and 3) structural performance.

In general, research programs appear to be well defined and properly directed and will eventually provide the NRC with better capability to evaluate safety related NPP structures.

For some of the programs, such as SSMRP, the anticipated product may not be as originally requested by the NRR. Original request called for predominantly structural efforts, current program proceeds along research lines with no substantial near term deliverables. It appears that the major emphasis is on SEISIM computer program development, rather than delivery of intermediate modules, such as SSI analysis capability (SMACS).

I suggest that efforts should be made to extract an SSI module from the SSMRP and use it in the Engineering Characterization of Seismic Inputs Program.

This latter program is an undertaking to improve the Reg. Guide 1.60 spectra in two ways: 1) make inputs at foundation level, and 2) generate site specific spectra. As indicated during discussion, the information required for this program can be generated by the SSI method of the SSMRP.

CCS-1
X. Z. ZUDANS

The Benjamin Franklin Parkway, Philadelphia, Pa. 19103 (215) 448-1000 TWX-710 670 1889

Furthermore, it is recommended that the staff consider a greater departure from the proposed characterization of seismic input and consider accepting site specific free field input as the basis. The reason for this suggestion is that in order to produce response spectra at the foundation, extensive SSI analysis will have to be performed by the staff. It appears far more sensible to let the industry do the SSI analysis. NRC then should concentrate its efforts on review of computer programs offered for SSI analysis, preferably eliminating the use of deconvolution type of programs (in favor of continuum type of computer program such as CLASSI). It is also noted that SSMRP project must have completed (or nearly completed) the review and assessment of SSI computer programs by now. If this approach is followed, Reg. Guide 1.60 need not be changed extensively except for site specific response spectra modification.

Another area needing some comment is the Steel Containment Buckling Criteria program. This program is needed since the ASME Code does not provide adequate guidance. However, the manner in which it proposes to accomplish the objective is subject to criticism. The initial effort on this program (by Weingarten, et al.) did not come up with the results responsive to the original scope of work (calling for simplified method to evaluate buckling load for steel containment). The difficulty lay in the lack of experimental evidence on the value of the so-called "knock down factor" (ratio of actual buckling load to that computed by the state-of-the-art analysis method). Recommendation was made that a 2-dimensional finite element analysis methodology be developed to perform such an analysis. Since there is no practical way to describe the structural imperfections, even the most advanced 2-D analysis will still fail to produce the real buckling load. Accordingly, experimental means are needed to assess the knockdown factors for containment like structures. The proposed program in this area calls for a comprehensive 2-D analysis of two actual containments followed by parametric studies and assessment of the quality of 1-D methods. It is not clear to me what good can come out of the 2-D analysis of two real containments unless the same two containments are also analyzed with 1-D methods (with the capability of representing asymmetric prebuckling loads). If that were done, at least a qualitative evaluation of 1-D vs. 2-D could be accomplished. However, as indicated before industry could perform such analysis if it wishes to justify its 1-D code. It was indicated that STAGS computer code would be used to do this work. This is a well developed code in the aerospace industry and the proposed program is just another number exercise, not a research.

As far as the buckling criteria development is concerned this 2-D analysis is not required. What is required are some tests and subsequent analysis of <u>the tested</u> structure, not necessarily a model of the real containment.

Safety Margins for Containments program (concrete containments) is well defined and may provide some feedback to steel containment buckling criteria program.

Dynamic testing and damage assessment program requires modification. It was pointed out that damage assessment by dynamic testing would require predamage dynamic signatures of the structures for comparison. As I recall, ORNL is working on such a program for mechanical components and there does not seem to be any reason why the same methods (instrumentation, computer programs) could not be used for structures.*

Effectiveness of QA procedures also requires redirecting to identify areas where improved QA/QC procedures would give high benefits and then provide the industry (and I&E) with a set of guidelines for preparation of improved QA/QC procedures.

Very truly yours,

Zenon Zudans
Sr. Vice President - Engineering

---

*Dr. Bill Sides at ORNL reported during 17 Jan 1980, IEEE & NRC meeting on Response Patter Recognition as a tool to detect incipient failures - DAS (Disturbance Analysis System). The process requires storage of original signatures and comparison of noise signatures at a later time. Complete information about the overall dynamic response of the system is also required. There is a learning period during which statistical information is collected and recorded for reference as a normal operation band of various spectra. The system is ready for collection of baseline data.

cc: Dr. Chester P. Siess
Dept of Civil Engineering
University of Illinois