

Structural Safety Margins of Containments

FY82 Program Plan

Submitted by

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FY82 Program Plan

Abstract

A concise statement of work to be accomplished during FY82, including its milestones and estimated costs, is provided in this program plan. This information is provided to allow a review and evaluation of Sandia's FY82 experimental program relative to the overall program objectives.

Introduction

The overall objectives of the Structural Safety Margins of Containments program are 1) the generation of the data base needed to assess methods for predicting the behavior of LWR containments under accident and severe environments beyond current design requirements; 2) the assessment of selected predictive numerical methods; and 3) the improvement of predictive numerical methods as necessary. The logic behind the establishment of these objectives is discussed in detail in the background study for the Structural Safety Margins of Containments Program submitted to the USNRC during FY81.

FY82 Program Description

The work to be accomplished in FY82 is

- experimental and analytical post-yield range investigation of prototypical models of steel containment structures subjected to internal static pressure;

- the design of prototypical reinforced concrete models for use in the FY83 and FY84 experimental program;
- the acquisition of prestressed concrete containment experimental data from foreign sources.

For the purposes of this program a prototypical structural model is defined as "A model which has the same structural characteristics as the prototype and which utilizes materials that are similar to those used in the prototype, but whose structural behavior is not directly related to the prototype by similitude relationships."

The steel containment sub-program is a multi-year effort which will continue through FY84. However, the experimental portion of this program will be conducted during FY82 and FY83. The evaluation of analytical methods will continue into FY84.

The principal FY82 activity is experimentation involving the examination of six prototypical models (SC-1 through SC-6) and the design of the large prototypical steel model (SC-7). This large steel model will be used in the FY83 experimental program. Fabricating models SC-1 through SC-6, procuring the experiment associated instrumentation, conducting experiments SC-1 through SC-6, and designing model SC-7 will require the expenditure of over one-half (56%) of the program's FY82 budget.

The second largest FY82 expenditure, about one-quarter (24%) of the FY82 budget, is also directed toward the understanding of the behavior of steel containment structures. This money

will be used for analytical support of experiments SC-1 through SC-6, the selection of analytical methods for assessment of predictive capabilities, and the comparison of the analytical predictions with the experimental results.

The remaining 20 percent of the FY82 budget is directed toward investigation of concrete containment behavior beyond the elastic limit of its steel reinforcement and of its steel prestressing tendons. The bulk of this money (15%) will be utilized for the design of reinforced concrete prototypical models (models RCC-1 through RCC-6) and supporting analytical investigations. Five percent of the FY82 budget is directed toward obtaining data from the Canadian experiment on a prototypical model of the CANDU containment and interfacing with the British on their proposed experiments on a model of the SNUPPs containment.

FY82 Program Particulars

Details of the FY82 program are included as Table 1 through Table 6.

- Table 1 - Proposed Experiments for Steel Containments
- Table 2 - Proposed Experiments for Reinforced Concrete Containments
- Table 3 - FY82 Milestones
- Table 4 - FY82 Budget
- Table 5 - FY82 - FY85 Milestone Summary
- Table 6 - FY82 - FY85 Budget Summary

TABLE I

PROPOSED EXPERIMENTS FOR STEEL CONTAINMENTS

<u>EXPERIMENT</u>	<u>SIZE</u>	<u>DESCRIPTION</u>
SC-1 & SC-1	1/32	CLEAN SHELL EXPERIMENT TO SERVE AS THE CONTROL AND TO PROVIDE DATA FOR BASIC 2-D POST-YIELD METHOD EVALUATION
SC-3 & SC-4	1/32	RING STIFFENED SHELL EXPERIMENT TO PROVIDE ADDITIONAL POST-YIELD METHOD EVALUATION DATA AND STRUCTURAL EFFECTS DATA
SC-5 & SC-6	1/32	RING STIFFENED SHELL WITH PRIMARY PENETRATIONS TO PROVIDE DATA FOR 3-D POST-YIELD METHOD EVALUATION
SC-7	1/10	RING STIFFENED SHELL WITH PENETRATIONS UTILIZING CONVENTIONAL CONSTRUCTION METHODS

TABLE 2

EXPERIMENTS FOR REINFORCED CONCRETE CONTAINMENTSWITH STEEL LINERS

<u>EXPERIMENT</u>	<u>SIZE</u>	<u>DESCRIPTION</u>
RCC-1 & RCC-2	1/10	PROTOTYPICAL MODEL, NO SEISMIC STEEL, NO PENETRATIONS. THESE EXPERIMENTS WILL SERVE AS THE CONTROL AND WILL PROVIDE DATA FOR BASIC 2-D POST-YIELD METHOD EVALUATION.
RCC-3 & RCC-4	1/10	PROTOTYPICAL MODEL WITH SEISMIC STEEL, BUT NO PENETRATIONS. THESE EXPERIMENTS WILL PROVIDE ADDITIONAL 2-D DATA AND STRUCTURAL EFFECTS DATA.
RCC-5 & RCC-6	1/10	PROTOTYPICAL MODEL WITH SEISMIC STEEL AND PRIMARY PENETRATIONS. THESE EXPERIMENTS WILL PROVIDE DATA FOR 3-D METHOD EVALUATION.

FY82 Milestones

[illegible]

FY82 BudgetAnalysis

465

Analysis - Steel Containments

350

Axisymmetric - 2D

75

Axisymmetric - 2D (Penetrations)

65

Penetrations - 3D

180

Dynamic Response

30

Analysis - Concrete Containments

115

Reinforced Concrete - 2D and 3D (Preliminary)

115

Experiments

1015

Experiments - Small Prototypical Steel Models
(SC-1 through SC-6)

745

Model Design, Fabrication and Inspection

140

Material Properties Determination and NDT of Welds

45

Preparation of Experimental Plan

30

Preparation of Experimental Facilities

280

Conduct of Experiments

250

Experiments - Large Prototypical Steel Model (SC-7)

95

Sandia Tech Support for Design Contract

20

A-E Design Contract for Drawings & Specifications

45

Preparation of Experimental Plan

30

Experiments - Prototypical Reinforced Concrete
Models (RCC-1 through RCC-6)

105

Design Review of Reinforced Concrete Containments

35

Sandia Tech Support for Design Contract

20

A-E Design Contract for Drawings & Specifications

50

Experiments - Prestressed Concrete Containments

70

Interface with Foreign Experimental Programs

70

TOTAL FY82 Budget

\$1480K

TABLE 5

FY82-FY85 MILESTONES SUMMARY
(STATIC PRESSURE LOADING ONLY)

COMPLETION OF	<u>CONTAINMENT CONSTRUCTION TYPE</u>		
	STEEL	PRESTRESSED CONCRETE	REINFORCED CONCRETE
EXPERIMENTAL PROGRAM	FY83	FY83*	FY84
EVALUATION OF NUMERICAL METHODS	FY84	FY84	FY85

* DATA FROM FOREIGN EXPERIMENTAL PROGRAMS

TABLE 6

FY82-FY85 BUDGET SUMMARY

(STATIC PRESSURE LOADING ONLY)

<u>BUDGET ITEM</u>	<u>FY82</u>	<u>FY83</u>	<u>FY84*</u>	<u>FY85*</u>
EXPERIMENTAL FACILITY PREPARATION	280	75	50	--
STEEL CONTAINMENTS				
ANALYSIS	350	200	170	--
EXPERIMENTS	560	350	--	--
REINFORCED CONCRETE CONTAINMENTS				
ANALYSIS	115	240	340	300
EXPERIMENTS	105	1000	1000	--
PRESTRESSED CONCRETE CONTAINMENTS				
ANALYSIS	--	135	275	--
ESTABLISH INTERFACES WITH FOREIGN PROGRAMS	70	--	--	--
	1480	2000	1835	300

*Planning for the Dynamic Pressure Experiments is expected to begin in FY84. The experiments will begin in FY85. Estimated costs of this sub-program are not included in this table.