GA-C16642

GENERAL ATOMIC

INTERIM REPORT

INDEPENDENT VERIFICATION OF SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2&3 SEISMIC DESIGN AND QUALITY ASSURANCE PROGRAM EFFECTIVENESS

PREPARED FOR

SCE Southern California Edison Company

GENERAL ATOMIC PROJECT 2408

JANUARY 25, 1982

TORREY PINES TECHNOLOGY

A DIVISION OF GENERAL ATOMIC COMPANY

CONTENTS

FIGURES

TABLES

1. EXECUTIVE SUMMARY

1.1. INTRODUCTION

General Atomic Company was engaged by Southern California Edison Company to conduct an independent review of the seismic design for its San Onofre Units 2 and 3, including an assessment of the effectiveness of the quality assurance program for design.

The program is structured to verify that the design process adequately converted the seismic design bases specified in the Final Safety Analysis Report (FSAR) into design documents that were transmitted to the constructor or the fabricator. The major tasks (A, B, and C) are designed to do this verification by first reviewing all the procedures used in the design process to determine that the basic process is adequate, then reviewing a sample of the points where the procedures should have been implemented to assure that they were in fact practiced, and finally reviewing technically the final design documents, which are the products of the design process. The entire plan taken together will provide a discerning basis on which the adequacy of the seismic design can be judged.

Two other tasks (D and G) review aspects of the construction process. Task D reviews the plan for field audits and Task G reviews the as-built configuration of a segment of pipe.

General Atomic Company, through its Torrey Pines Technology Division, is qualified to perform this evaluation for Southern California Edison. General Atomic Company has been in the nuclear power plant industry for over 20 years and has a large staff of capable, experienced, technically trained personnel. In addition, General Atomic operates under the first NRC-approved Quality Assurance Program and has significant expertise in quality assurance.

General Atomic Company and all its personnel on this program are independent of Southern California Edison and San Diego Gas & Electric Company, the major owners of San Onofre Units 2 and 3. Revenues from Southern California Edison (SCE) and San Diego Gas & Electric (SDGE) are not a significant portion of General Atomic's revenues. No person working on this program has a significant financial interest in SCE or SDGE nor does any person have any family member who is presently employed by SCE or SDGE or who is engaged directly or indirectly in the design or construction of San Onofre Units 2 and 3.

This interim report was planned in the overall program to indicate early results of the program. The report includes the interim results of the comprehensive review of the design control process and the technical review of one signficant safety system (one train of the low-pressure safety injection section of the Safety Injection System) and the walkdown (field examination at the plant site) of a pipe segment. In the technical review done to date, over 650 technical documents (specifications, drawings, calculation packages, etc.) have been reviewed. More than 45 man-months have been expended in the total program effort. The program is ongoing and is scheduled for completion on March 31, 1982.

The first section of this report is structured as an executive summary giving a synoptic overview of the program and the interim conclusions. The second section of the report is a more detailed discussion of the program and its status. The program schedule status is given in Section 3.

1.2. SCOPE

The overall purpose of this program is to conduct an independent review of the seismic design of San Onofre Units 2 and 3 from NRC-approved design bases to implementation by the constructor or fabricator. This effort also includes review of the effectiveness of the applicable portions of the quality assurance (QA) program.

The program is structured to verify that the design process adequately converted the seismic design bases specified in the FSAR into design documents that were transmitted to the constructor or fabricator. The program includes a review of the SCE and Bechtel Power Corporation (BPC) quality assurance audit plans and their implementation at the construction site and the fabricator's shop. The program does not review the design process performed by equipment fabricators other than Combustion Engineering Company (CE).

The program is structured to concentrate on Unit 2. It reviews Unit 3 insofar as there are significant unique features of Unit 3.

The program also includes a field walkdown of a specified segment of the piping system.

The program is scheduled for completion on March 31, 1982. A significant portion of the program, including the review of the design process used by BPC, SCE, and CE and the technical review of the majority of one system, has been completed. This interim report presents the work done to date and the conclusions that can be drawn from this work.

The program currently consists of seven tasks. These tasks are structured so that together they give overall assurance of the adequacy of the seismic design. The first task, Task A, Design Procedure Review, includes a comprehensive review of the procedures used in the design process. All applicable procedures at SCE, CE, and BPC were reviewed. The intent of this task was to provide an assessment of the adequacy of the design system used on the seismic design of San Onofre Units 2 and 3.

Task B, Design Procedure Implementation Review, will review a significant number of steps within the design process (over 200) where the procedures, identified in Task A, should have been implemented. The intent of this task is to give assurance that the design system identified in Task A was implemented during the design process.

Task C, Seismic Design Technical Review, involves a technical review of 22 features (plant structures, systems, segments of systems, components, and other equipment) in the plant. The intent of Task C is to provide assurance that in fact the design process that was identified in Task A and reviewed for implementation in Task B, did produce an adequate technical design.

Task D, Audit Plan Review, entails a review of the audit plans of BPC and SCE. The intent of this task is to assure that audits of the constructor and fabricators were in fact carried out and that these audits were designed to assure implementation of the design documents.

Task E, Processing of Findings, involved processing and evaluating Potential Finding Reports identified in Tasks A, B, C, D, and G and bringing them to final resolution. Potential Finding Reports basically define questions raised during the various reviews. In this task these Potential Findings are either determined to be Findings, Observations, or Invalid Findings (these terms are defined in Section 1.3.6).

Task F, Report Procedure, covers preparation of the program plan, the interim report, and the final report.

Task G, Pipe Segment Walkdown, is the comparison of a segment of pipe as installed in the field to the installation as envisioned by the piping analyst.

This entire program plan taken together will provide a discerning basis on which the adequacy of the seismic design can be judged.

1.3 STATUS

Sections 1.3.1 through 1.3.5 summarize the status of each review task. The status of all Potential Finding Reports is summarized in Section 1.3.6.

1.3.1. Design Procedure Review, Task A

Objective

The objective of Task A is to evaluate the SCE, BPC, and CE design control systems for compliance with the NRC-approved QA section of the Preliminary Safety Analysis Report (PSAR) and, in the case of CE, for compliance with the CE QA Topical Report, where that report is applied to the San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 design effort. This QA section of the PSAR and the CE QA Topical Report include descriptions of SCE, BPC, and CE QA programs for design control during the design and construction phase.

Work Completed

The relevant design control procedures that governed the seismic design work at each of the three organizations were reviewed to determine if these procedures satisfied the commitments made by each organization in the PSAR. In the case of CE, the review was also made for the commitments in its QA Topical Report for the period after 1977, since this Topical Report was the appropriate NRC-approved QA program for CE starting in 1977. This work is designed to determine if each of the design organizations had an effective system in place to control the design activities. The work is complete for SCE, BPC, and CE.

Conclusions

This review determined that BPC, SCE, and CE each had design control procedures in effect for the plant design period. In the case of BPC and SCE, these procedures were found to satisfy adequately the design control commitments made in the PSAR. In the case of CE, the review to date indicates that in general their procedures adequately satisfy the commitments; however, several commitments were not apparently addressed in the procedures reviewed, and therefore a final statement cannot be made until the resolution of these Potential Findings is complete.

Eight Potential Finding Reports have been issued on this task.

1.3.2. Design Procedure Implementation Review, Task B

Objective

The objective of Task B is to verify that SCE, BPC, and CE design control procedures, as identified in Task A, were implemented in seismic-related design work by these organizations. This review will determine, by examination of a selection of design documents, if the design system procedures of each organization were actually followed.

Work Completed

The preparatory work for this review has nearly been completed and the review itself has begun on BPC and SCE items. The preparatory work included development of a procedure to provide detailed working instructions to the reviewers, preparation of detailed checklists to be used in the review, and identifying and locating documents needed to start the review procedure. Over 200 points and steps have been identified for review. Each of these points and steps represents a document or documents (e.g., drawings, specifications, calculations) associated with a specific part of the seismic design chain for an item (e.g., valve, pump, piping system).

Conclusions

The review is in the early stage and no results are available at this time.

No Potential Finding Reports have been issued on this task.

1.3.3. Seismic Design Technical Review, Task C

Objective

The objective of this task is to review the seismic design of selected safety-related structures, components, and systems of San Onofre Units 2 and 3 for compliance with NRC-approved design basis and methodology specified in FSAR Sections 3.7 and 3.8.

Work Completed

- Seismic design chain networks (or seismic interface charts) for nine safety-related systems have been developed. These networks identify the seismic-related design process and flow-of-interface information and design organizations responsible for the design activity, including major subcontractors. These networks are used in conjunction with the Selection Plan for identifying the features to be reviewed.

- The Selection Plan for use in choosing the features to be reviewed has been completed. These features are plant structures, systems, segments of systems, components, and other equipment.

- Twenty-two features of San Onofre Units 2 and 3 have been identified in accordance the Selection Plan and seismic design chain networks as the subject of the seismic technical design review. Ten of these features are included in the Safety Injection System (SIS).

- The procedure for use in performing the detailed seismic design review has been prepared. This procedure is based on the design review approach for design verification as approved in ANSI N45. 2.11 - 1974, Section 6.3.1. Calculations are used only in a supplemental fashion. This approach allows a much broader and

more thorough review for a given resource used than do the other two approaches, namely alternate calculations and testing.

- The scope of the initial design review was limited to features in a segment of the SIS, the primary safety system selected as the focus of the initial review. Features reviewed include:

  - Refueling water storage tank.
  - Low pressure safety injection pump.
  - Safety injection tank.
  - Major piping.
  - Small bore piping.
  - Pipe supports and snubbers.
  - Valves.
  - Instruments, racks, and panels.
  - Switchgear and power panels.
  - Electrical and control cables.

Review of design documents relevant to the selected features within the scope of the interim report resulted in the issuing of 47 Potential Finding Reports (PFRs).

Conclusion

Based on the technical review completed to date, no inadequacies have been found in the seismic design of the selected features of San Onofre Units 2 and 3 that would significantly impact the seismic design adequacy.

1.3.4. Audit Plan Review, Task D

Objective

The objective of this task is to review and evaluate the QA audit plan(s) of SCE and BPC and to verify implementation of those plans. The

review and evaluation will be restricted to audit plans and audits covering implementation of seismic design output (i.e., drawings and specifications) at the construction site or the fabricator's shops.

Work Completed

A procedure was developed to provide detailed working instructions for this task. The regulatory requirements for audit planning and scheduling were identified, and the SCE and BPC procedural requirements in this area were identified and evaluated against those regulatory requirements.

Audit plans and schedules for SCE and BPC were reviewed for compliance with the procedural requirements identified above. Samples of BPC and SCE audits that covered supplier and site implementation of seismic design documents were identified and listed. A review of the reports for these audits will complete the work under this task.

Conclusions

The SCE and BPC procedural requirements for audit planning and scheduling were found to be consistent with the regulatory requirements, except for the lack of an SCE procedural requirement in response to one part of the regulatory requirements. This item is identified as a Finding (see Section 1.4, Item 3).

The review of SCE and BPC audit plans and schedules determined that those plans and schedules were prepared as required by the SCE and BPC procedures, and that the schedules did include site and suppliers (fabricator shop) audits covering implementation of seismic design output.

One Potential Finding Report has been prepared on this task.

1.3.5. Pipe Segment Walkdown, Task G

Objective

The objective of this task is to verify, to the extent possible with nondestructive visual examinations, the proper installation of portions of a particular piping run that had been reviewed in Task C.

Work Completed

The walkdown included a portion (approximately 300 ft) of the safety-related piping for the Safety Injection System in San Onofre Unit 2. A field audit of four stress isometric drawings and 12 of 37 pipe support drawings was performed.

Conclusions

For the portion of piping examined, the piping was routed as defined on the stress isometrics. Also, the types of seismic restraints installed in the field agreed with the types shown on the stress isometrics. Several deviations were noted in pipe support locations and details.

Two Potential Finding Reports have been initiated on this task.

1.3.6. Potential Findings

As of January 24, 1982, 58 Potential Finding Reports (PFR) have been initiated. Classification of 20 of these PFRs has been completed and the remaining 38 are in various stages of review and processing. Fifteen of the completed PFRs have been classified as Invalid Findings and four have been classified as Observations. One has been classified as a Finding. These results are summarized in Table 1-1. Table 1-2 summarizes an "unofficial" categorization of the 38 potential findings that have not been completely processed.

TABLE 1-1
STATUS OF POTENTIAL FINDING REPORT
PROCESSING AS OF JANUARY 24, 1982
ASSOCIATED WITH INTERIM REPORT REVIEWS

	Task					
	A	B	C	D	G	Total
Initiated	8	--	47	1	2	58
Sent to ODO[a]	8	--	37	1	2	48
Returned by ODO[a]	--	--	30	1	2	33
Sent to FRC[b]	--	--	25	1	2	28
Returned by FRC for More Information	--	--	6	--	2	8
Recommended Classification to Project Manager	--	--	19	1	--	20
Processing Completed	--	--	19	1	--	20
Invalid Findings	--	--	15	--	--	15
Observations	--	--	4	--	--	4
Findings	--	--	--	1	--	1

[a]ODO is the Original Design Organization (e.g., SCE, BPC, CE).

[b]FRC is the Findings Review Committee. This committee reviews all Potential Findings for adequate definition, evaluates their validity, and then classifies them.

TABLE 1-2
CATEGORIES OF POTENTIAL FINDINGS THAT HAVE NOT COMPLETED THE PROCESSING CYCLE

	Technical	Design Definition	Traceability	Procedural
Task A	--	--	--	8
Task B	--	--	--	--
Task C	8	16	4	--
Task D	--	--	--	--
Task G	2	--	--	--
Total	10	16	4	8

DEFINITION OF POTENTIAL FINDING CATEGORIES

Technical	Includes use of incorrect calculational techniques, nonconservative assumptions, incorrect input values, numerical errors, invalid conclusions.
Design Definition	Includes inadequate, inconsistent, or imprecise definition of design requirements, incorrect references or inputs.
Traceability	Includes use of undocumented sources of input, unsubstantiated conclusions.
Procedural	Includes failing to have or follow adequate procedures.

Invalid Findings are the result of apparent deviations, uncovered in the course of the independent verification, that are resolved to the satisfaction of project personnel, usually during the Potential Finding review by the Original Design Organizations. Observations are actual deviations but because of their nature are judged not to have the potential for significant impact on the seismic design adequacy of San Onofre Units 2 and 3. Findings are actual deviations that could have potential for significant impact on the seismic design adequacy.

Observations and Findings are sent to the Executive Vice-President of SCE for resolution. In the case of Findings, a Corrective Action Plan (CAP) is prepared and returned for review. The review will determine if the CAP satisfies the concern expressed in the Finding.

1.4. INTERIM CONCLUSIONS

The following interim conclusions can be drawn.

1. The design process used by SCE, CE, and BPC is adequate and could reasonably be expected to produce an adequate design.

2. In the work completed to date there have been no deviations found in the design which have been judged to have significant impact on the seismic design adequacy of San Onofre Units 2 and 3.

3. The SCE and BPC procedures for planning and scheduling audits of the construction site and fabricator's shops were consistent with the regulatory requirements except that SCE procedures did not require planned and periodic audits to determine the effectiveness of the QA program as required in 10CFR50, Appendix B, Section XVIII.

4. The pipe segment walkdown indicated that, except for the two open PFRs, the implementation of the design in the field is adequate.

2. DISCUSSION

This section presents details of the work that has been completed to date for each of the review tasks (A, B, C, D, and G). It also includes, in Section 2.6, the details for processing the Potential Finding Reports (Task E) and a summary of their status. Task F covers preparation of program reports.

2.1. DESIGN PROCEDURE REVIEW, TASK A

This task is designed to determine if BPC, SCE, and CE each had design control procedures in place during the design phase, to determine if these procedures addressed commitments made in the NRC-approved QA programs, and to identify the specific procedures and manuals that applied to the design activities at each organization.

The first step in this task, Subtask A1, provided a detailed description of the structure of the design control procedures applicable to seismic design work performed at each of the three organizations. This subtask was accomplished by visits to each of the three organizations, interviews with cognizant staff members, and reading of relevant manuals and procedures to determine content for the subjects covered. This work is completed and documented in the form of lists of applicable manuals and procedures for each of the three organizations and in the form of descriptions of the content and scope of each manual.

The second step, Subtask A2, called for each relevant design control procedure to be obtained for review. This subtask is complete. The following design-control related documents for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 have been obtained.

SCE

- SONGS 2 and 3 QA Manual Part 1 (Chapter 3, all issues since 1977)
- SONGS 2 and 3 QA Manual, Part 1
- SONGS 2 and 3 QA Manual, Part 2
- QA Reference Procedures Manual (Engineering and Construction)
- QA Reference Procedures Manual (Corporation Documentation Services)
- QA Reference Procedures Manual (QA Sections N3.01, N3.03, N18.07, N18.08)

BPC

- Quality Program Manual
- QA Department Procedures Manual
- Project Quality Program Manual
- Project Internal Procedures Manual, Volumes 1 and 2
- Field Construction and QC Manual, Volumes 1, 2, 3, and 4
- Project Design Criteria Manual
- Project External Procedures Manual

CE

- QA Program: CE NSSS QA Program (CENPD-210-A)
- QA of Design Manual
- Preparation and Maintenance of MPIs, NPS-MPI-1
- Control of Engineering Drawing, NPS-MPI-2
- Specification Preparation and Revision, NPS-MPI-4
- Technical Change Request (TCR), NPS-MPI-7
- Deviation of Contract Requirements (DCR), NPS-MPI-8

- Purchase and Manufacturing Prerequisitions and Supplements, NPS-MPI-19
- Safety Analysis Report Preparation Procedure, NPS-MPI-19
- QA of Design, NPS-MPI-18
- Design QA Procedures - Reactor Design Dept. RD-1
- Design QA Procedures Applicable to Plant Engineering NSSS Safety Related Design Activities, PE-QA-001
- Group QA Manual
  - QAP 4.1
  - QAP 4.2
  - QAP 4.4
  - QAP 15.2
  - QAP 16.1
- Design Procedure, I&CE Procedure 100
- Design Development and Review, I&CE Procedure 13
- Quality Assurance of Design, I&CE Procedure 12
- Vendor Quality Control Program Specification, WQC 11.1
- Submittal Instructions for Technical Change Request (TCR), WQC 3.1

The review to determine if design control procedures adequately implement PSAR commitments, Subtask A3, was performed as follows. The review consisted of: (1) identifying and extracting the seismic design control commitments made by SCE, BPC, and CE in Appendix A of the PSAR (and also by CE in its Topical Report); (2) entering the commitments as checklist questions on a specially prepared checklist form; (3) examining the manuals in detail and recording on the form the specific section(s) in which each commitment was addressed; and (4) indicating on the form whether or not the commitment is adequately addressed. In those cases in which judgment had to be exercised as to adequacy (e.g., the manuals contained wording or phrasing similar to, but not exactly the same as, that used in the PSAR), comments

were added to justify the reviewer's decision as to adequacy. The documentation of the review is in the form of completed checklists and the procedure that describes the review process. The review is complete.

The review uncovered several instances in which a PSAR or topical report commitment made by CE was not addressed in the CE internal procedures reviewed. Eight PFRs have been written to cover these instances.

Subtask A4 called for a summary of the design control process for SCE, BPC, and CE. These summaries have been prepared and were issued. The summaries provide descriptions of the design control process within each organization, and are used to help train personnel working on the project under Task B. Using the background provided by these summaries, the Task B reviewers can perform their jobs more efficiently.

All procedure reviews described above were performed only for the current revisions of procedures. Subtask A5 calls for a review of design control procedure revisions in other time periods, for compliance to the applicable PSAR revision (and Topical Report in the case of CE). This work, which is completed, verified that the PSAR (and Topical Report) commitments were implemented in working procedures and manuals throughout the design activity period, except as noted in the PFRs described above.

2.2. DESIGN PROCEDURE IMPLEMENTATION REVIEW, TASK B

This task is designed to determine if the design control procedures in effect at CE, BPC, and SCE (as identified in Task A), were implemented in the design documents related to seismic design work.

The first step in this task, Subtask B1, was to identify points and steps in the design process that were to be checked for compliance with design control procedures. Each point and step represents a document or documents (e.g., drawings, specifications, or calculations) associated with a specific component, structure, or system.

The following selection criteria were used:

- All points and steps associated with the features reviewed in Task C were included.
- Additional safety-related points and steps were included to bring the total to about 200.
- SCE/BPC/CE interfaces were included.
- Work spanning the entire calendar period of the seismic design effort was included.
- Work in all phases of the project was included.
- All types of design documents were included.
- Work within BPC and CE was included.

The total number of points and steps actually identified is over 200.

Locating of documents, Subtask B2, will be a continuing process throughout the task, and the documents needed to start the review are currently available. Additional documents will be obtained as needed, either by request from the cognizant design organization or by visits to the design office.

Subtask B3 involves the actual review. The first step in this subtask was to develop a procedure for detailed working instructions for the review of design documents. Included in this procedure is the use of a checklist that provides a list of procedural requirements for each type of design document. It is used by the reviewer to ensure that a thorough review is made for each document and to provide a record of the review. The review evaluates the compliance of (seismic) design activities, processes, and

documents with the design control requirements in the various manuals, procedures, and instructions.

Completed work includes issuance of the above procedure, preparation of detailed checklist questions for the review (complete for SCE and BPC, in process for CE), and start of the actual review for Bechtel and SCE items. No item has been processed through a complete review, and no conclusions can be drawn at this time.

2.3. SEISMIC DESIGN TECHNICAL REVIEW, TASK C

The objective of this task is to review the seismic design of selected safety-related structures, components, and systems of San Onofre Units 2 and 3 for compliance with the NRC-approved design basis and methodology specified in FSAR Sections 3.7 and 3.8.

The scope of this task includes the following:

- Preparation of the seismic design chain networks for major safety systems of San Onofre Units 2 and 3 (Subtask C1).
- Preparation of the selection plan for use in choosing the features to be reviewed (Subtask C2).
- Selection of the features to be reviewed (Subtask C3).
- Preparation of the procedure to be used for performing the technical review (Subtask C4).
- Performance of the detailed technical design review of the selected features to be accomplished in two phases: input to the interim report (January 25, 1982) and final report (March 31, 1982) (Subtask C5).

Work completed to date is summarized below.

2.3.1. Seismic Design Chain Networks, Subtask C1

The seismic design chain networks (or the equivalent of the seismic interface chart described in Appendix B of ANSI N45.2.11-1974) illustrate the seismic-related design process associated with structures, components, and systems for San Onofre Units 2 and 3. The networks include the flow (input/output) of interface information between distinct design activities. The networks also identify the principal design organizations involved (SCE, BPC, and CE), including identification of design groups within these principal organizations at the design activity level. Major engineering service subcontractors involved are also identified.

For this program, seismic design chain networks were generated for nine safety-related systems as follows:

1. Safety injection system.
2. Reactor coolant system and reactor internals.
3. Shutdown cooling system.
4. Component cooling water system.
5. Ultimate heat sink.
6. Containment spray system.
7. Chemical and volume control systems.
8. Reactor protection system.
9. On-site electric power systems.

The network titled "Site Seismicity and Soil-Structure Interaction" (Fig. 2-1) is the common starting point for all safety system networks. The seismic design chain network for the Safety Injection System is shown in Fig. 2-2.

2.3.2. Selection Plan for Plant Features, Subtask C2

The selection plan has been prepared for use in choosing the features (i.e., plant structures, systems, segments of systems, components, and other

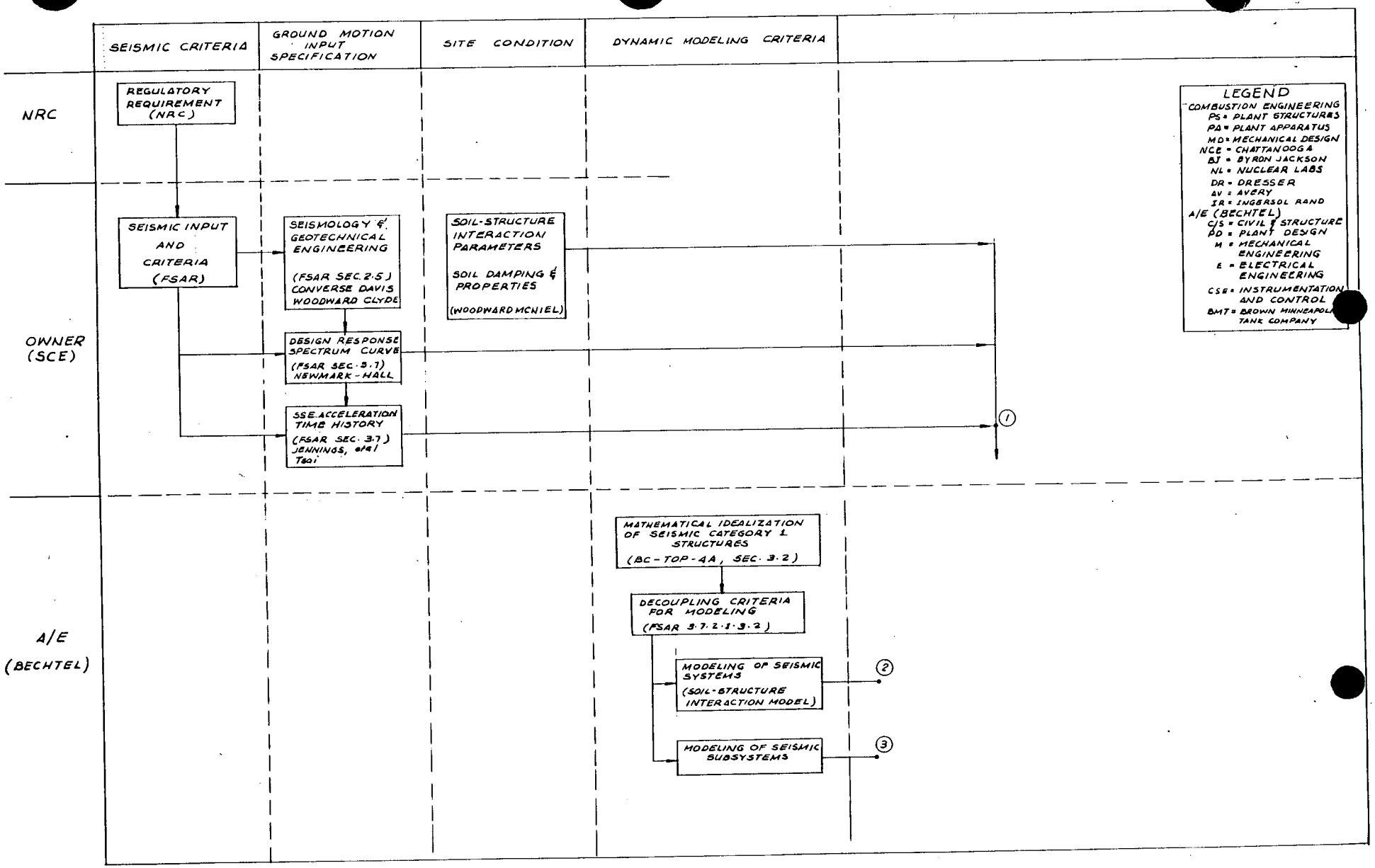


Fig. 2-1. Seismic design chain of SONGS Units 2 and 3 - site seismicity and soil structure interaction

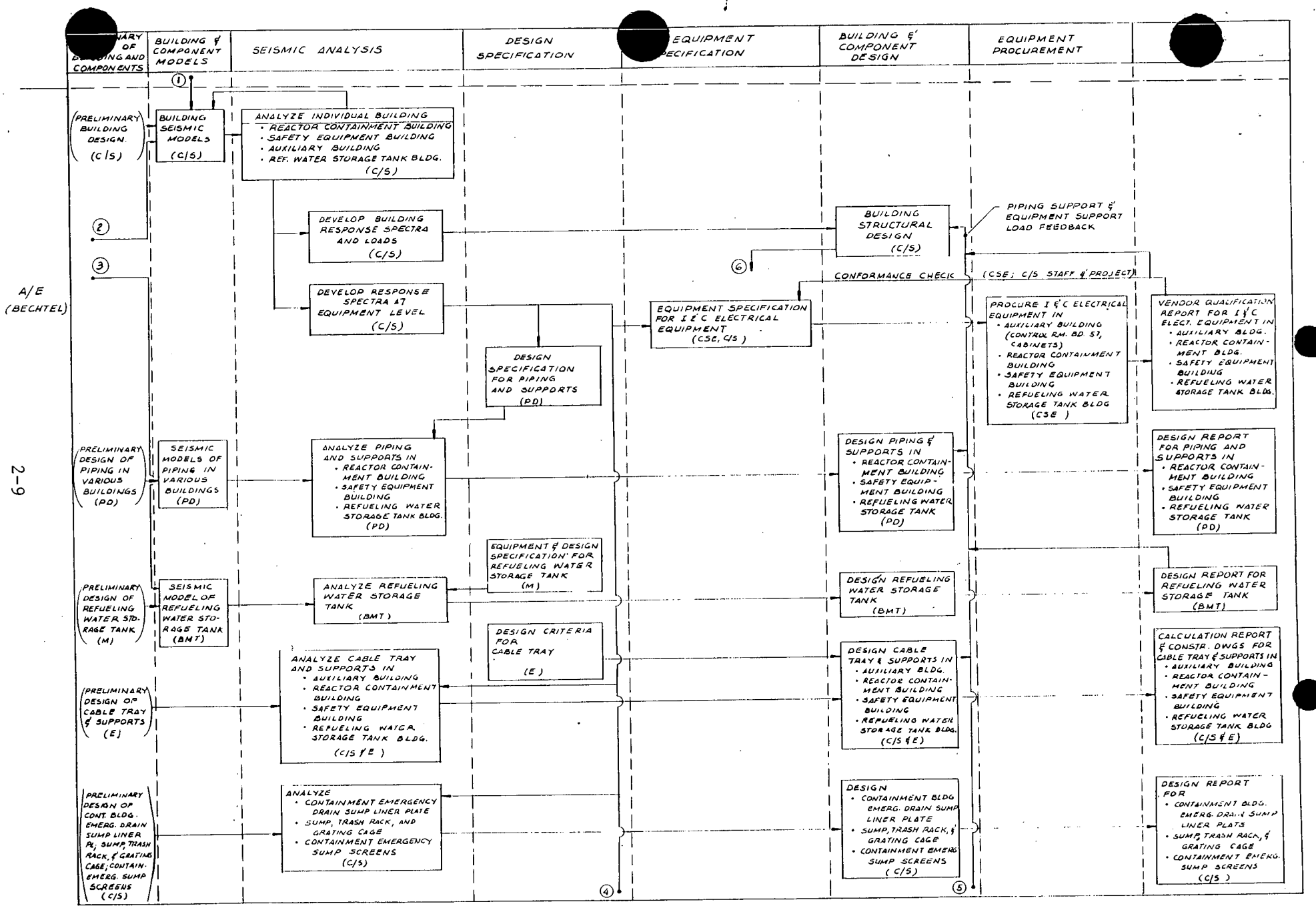


Fig. 2-2. Seismic design chain of SONGS Units 2 and 3 - Safety Injection Systems (sheet 1 of 2)

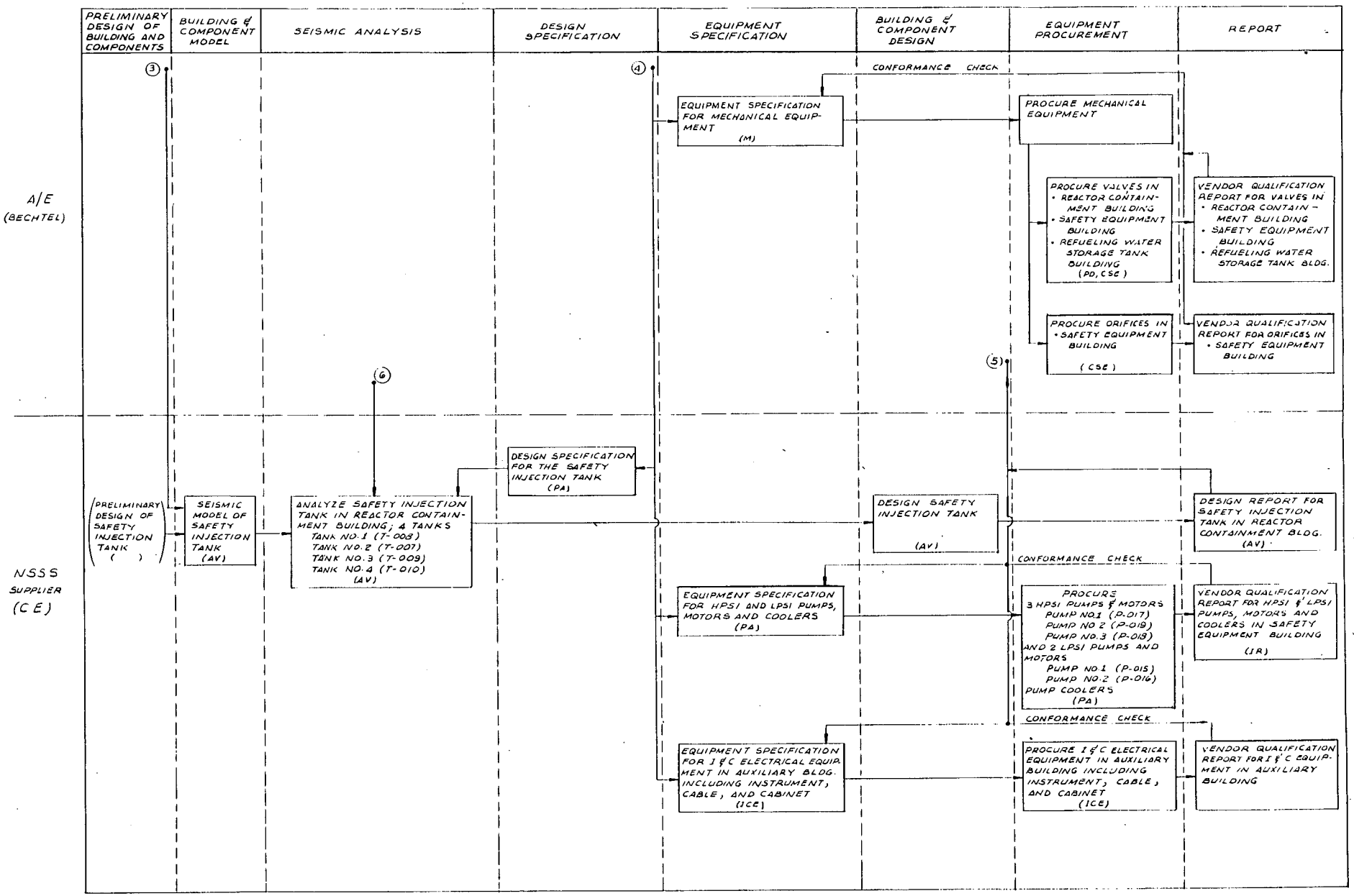


Fig. 2-2. Seismic design chain of SONGS Units 2 and 3 - Safety Injection Systems (sheet 2 of 2)

equipment) of San Onofre Units 2 and 3 to be subjected to a detailed seismic review. The selection plan satisfies the criteria for selecting representative features as shown in Table 2-1. In addition to these criteria, other factors were considered in developing the selection plan.

The first factor was to consider previous seismic reviews of other nuclear power plants, such as the PWR plants included in NRC's systematic evaluation program (SEP).* The reassessment of seismic design under the SEP was based on review of selected structures, components, and systems of the nuclear plants. The basis for, and selection of, features reviewed provides background data for use in this selection plan.

The second factor was to consider the margin designed into the features to assure continued functioning during a seismic event. The results of preliminary determination of failure modes associated with a seismic event for safety-related structures and components of the reference plant (Zion 1) for NRC's seismic safety margins research program (SSMRP) have been reported by Campbell and Wesley.** The selection of features for the San Onofre seismic design review will utilize this report as guidance, especially in focusing on the seismic-sensitive areas of the selected feature to be subjected to a detailed structural evaluation.

The third factor was to consider results of previous audits conducted on San Onofre by SCE. Some features that have been audited previously were selected for review with emphasis on open seismic design issues, if any.

Conformance of the selection plan with established criteria is demonstrated in Table 2-2, where elements of the plan are cross-referenced against relevant selection criteria.

---

*Nelson, T. A., R. C. Murray, D. A. Wesley, and J. D. Stevenson, "Seismic Review of the Palisades Nuclear Power Plant Unit 1 as Part of the Systematic Evaluation Program," NUREG/Cr-1833 UCRL-53015, January 1981.

**Campbell, R. D., and D. A. Wesley, "Preliminary Failure Mode Predictions for the SMRP Reference Plant (Zion 1)," NUREG/CR-017303, UCRL-15042, January 1981.

TABLE 2-1
CRITERIA FOR SELECTING FEATURES FOR SEISMIC DESIGN REVIEW

1. Most of the features selected shall be important to safe shutdown and cooldown of the reactor in the event of a safe shutdown earthquake [or the equivalent, the design basis earthquake (DBE)].

2. Features selected shall be representative of safety-related portions of the plant, including:

   a. At least one safety-related structure.
   b. At least one major NSSS component.

3. Components selected shall be at different elevations.

4. The majority of components selected shall be in the selected safety-related structure(s).

5. The complete range of sophistication in seismic design methods shall be covered.

6. Features with design interfaces between SCE, BPC, and CE shall be included. Other subcontractors will be included, if significant.

7. The system(s) selected shall include safety-related mechanical components, controls, electrical, piping, and cabling.

TABLE 2-2
SELECTION PLAN FOR IDENTIFYING FEATURES FOR SEISMIC DESIGN REVIEW

	Element	Relevant Criteria (Table 2-1)
1.	Review dynamic analysis and structural design of seismic-sensitive areas of two major structures. The selected structures must contain portions of the selected systems in Items 2 and 3.	2,5
2.	Review seismic design of a well defined segment of a major safety system. Include:	1,3,4,5, 6,7
	a. Large- and small-bore piping at low and high elevations covering various ASME piping classes.	3,4,5,7
	b. At least 10 pipe supports and snubbers.	3,4,5
	c. At least one major piece or component supplied by BPC; one supplied by CE and installed by BPC. Components to be considered are tanks, pumps, and valves.	6
	d. Instruments and electric-equipment-associated cabling, panels, racks, and supports at low and high elevations. Choose at least 2 instruments supplied by CE and installed by BPC.	3,5,6
	e. Electrical raceways and at least 10 raceway supports at low and high elevations.	3,5
	f. At least 5 seismic-sensitive items.	(a)
3.	Review features within other systems, primarily the reactor coolant system, in CE's scope of supply with BPC design interfaces. Include:	1,2,4,5, 6,7
	a. Reactor vessel, internals, and supports.	1,2,5,6
	b. At least one major mechanical component e.g., primary coolant pump.	1,2
	c. Class 1 piping supplied by CE.	1,4
	d. Items with design interface between BPC and CE.	6
	e. At least 5 seismic-sensitive items.	(a)
4.	If the seismic design of a major safety-related feature other than equipment (e.g., piping, structures) was subcontracted by BPC, CE or SCE, review at least one feature to represent each chain.	1,6
5.	Review at least one feature which had been previously audited by SCE and left open or recommended for further review.	(a)
6.	If significant differences in the design of Seismic Category 1 features are found between San Onofre Units 2 and 3, review at least one feature representative of the differences.	1,6

(a) Additional factors.

2.3.3. Selected Features for Review, Subtask C3

Twenty-two features have been selected for the detailed seismic design review in accordance with the selection plan (Section 2.3.2) and in conjunction with the seismic design chain networks (Section 2.3.1). Table 2-3 lists the selected features and shows how they comply with the elements of the selection plan.

The major structures selected for detailed review were the reactor containment building and the auxiliary intake structure (features 1 and 2 in Table 2-3). The review includes all dynamic analyses necessary to show reasonableness of in-structure response spectra used for seismic design of components and systems located in the reactor containment building. Stress analyses of seismic-sensitive areas of the reactor containment building and auxiliary intake structure will be reviewed to verify that the structure includes adequate resistance to DBE loads. Structural design of several component and equipment supports will also be reviewed to verify that imposed loadings and responses are correctly reflected in the structural design. Of primary interest is the steel framing that supports major pieces of equipment in the reactor containment building.

The major safety system selected for detailed review is the Safety Injection System (SIS). The segment of the SIS to be reviewed (features 3 through 12 in Table 2-3) includes the refueling water storage tank T006 (which is part of the Fuel Pool Cooling System) located in the yard, extends through the low-pressure safety injection pump P-016 in the safety equipment building, past the safety injection tank T008, to the nozzle in the cold leg of the NSSS piping. The items reviewed include the two tanks and one pump identified above, 28 valves, major piping, small-bore piping, instrumentation, tubing, electrical cables, switchgear, and power panels related to this segment of the SIS. Seismic design of representative pipe supports, snubbers, and equipment supports are also being reviewed.

TABLE 2-3
FEATURES SELECTED FOR SEISMIC DESIGN TECHNICAL REVIEW

Review Feature	Selection Plan Element (Table 2-2)
Major Structures	1
1. Reactor containment building	1
2. Auxiliary intake structure	1,4
Segment of the Safety Injection System	2
3. Refueling water storage tank	2c, 2f
4. Low pressure spray injection pump	2c, 2f
5. Safety injection tank	2c, 2f
6. Major piping	2a, 5
7. Small bore piping	2a
8. Pipe supports and snubbers	2b
9. Valves	2d
10. Instruments, racks, and panels	2d, 2f
11. Switchgear and power panels	2d, 2f
12. Electrical and control cables	2d
Features Within Other Systems	3
13. Dynamic analysis of reactor coolant system	3a, 3d
14. Reactor coolant pump and supports	3b, 3d, 3e
15. Reactor vessel support	3a, 3d, 3e
16. Fuel element grid spacers	3a, 3e
17. Reactor coolant system cold leg (piping)	3c, 3d, 3e
18. Diesel generator oil storage tank	3c
19. Two locally mounted instruments	2d
Other Structures, Components, or Features	
20. Cable raceways	2e, 2f
21. Control panel CR57	4
22. Segment of reactor containment building internal structure and supported equipment[a]	5, 6[a]

[a]One selected piece of equipment to represent the difference between Units 2 and 3.

Features associated with the reactor coolant system (RCS), which are generally in CE's scope of supply with BPC interfaces, selected for review include the following:

		Table 2-3 Feature No.
1.	Dynamic analysis of the RCS major components (reactor vessel, steam generators, primary coolant pumps, and pressurizer).	13
2.	Seismic-sensitive areas of the reactor vessel (vessel-support).	15
3.	Fuel assembly clip grid spacers.	16
4.	Reactor coolant pump and support.	14
5.	RCS cold leg piping.	17

Additional selected features having aspects satisfying other requirements of the Selection Plan are:

		Table 2-3 Feature No.
1.	Diesel generator oil storage tank (underground).	18
2.	Control room panel design subcontracted by BPC.	21
3.	Segment of reactor containment building internal structure and supported equipment (representing difference between Units 2 and 3).	22
4.	Cable raceways	20
5.	Two locally mounted instruments.	19

In the course of the review, additional features will be selected if deemed prudent in covering the totality of desired features to be reviewed in accordance with the selection plan.

2.3.4. Review Procedures, Subtask C4

The purpose of the review procedure is to establish a uniform and comprehensive method to perform the seismic design technical review of selected safety-related structures, components, and systems of San Onofre Units 2 and 3. The objective of the review is to ascertain that the seismic design of the selected features is consistent with the NRC-approved design basis and methodology specified in FSAR Sections 3.7 and 3.8. As a guideline in the development of these procedures the following questions, as they relate to seismic design, from Section 6.3.1 of ANSI Standard N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants," were used:

- Were the inputs correctly selected and incorporated into design?
- Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent reverifications when the detailed design activities are completed?
- Are the appropriate quality and quality assurance requirements specified?
- Are the applicable codes, standards, and regulatory requirements including issue and addenda properly identified and are their design requirements met?
- Have the design interface requirements been satisfied?
- Was an appropriate design method used?
- Is the output reasonable compared to inputs?

- Are the specified parts, equipment, and processes suitable for the required application?

- Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?

The technical review is performed following the steps shown in the flow diagram in Fig. 2-3. The reviewer addresses the ANSI N.45.2.11, Section 6.3.1, questions as they apply to each step of the review. These questions are augmented by a list of factors considered important in a technical review of a seismic design. There are lists of factors for structures, piping and support, cable raceway and supports, components, equipment, and cables.

The reviewer is required to document each item reviewed by a Review Evaluation Report, whether or not Potential Findings are recorded.

2.3.5. Detailed Technical Design Review, Subtask C5

For this Interim Report, the design review scope was limited to features associated with the major safety system selected, i.e., the segment of the SIS (Features 3 through 12 on Table 2-3). For completeness, the status of the technical design review of all selected features listed on Table 2-3 is summarized below.

Major Structures

1. Reactor Containment Building

   Review of the dynamic analysis of the reactor containment building performed by BPC is in progress. Approximately 20 documents have been fully or partially reviewed. Three PFRs have been issued pertaining to some noted discrepancies in computer input data.

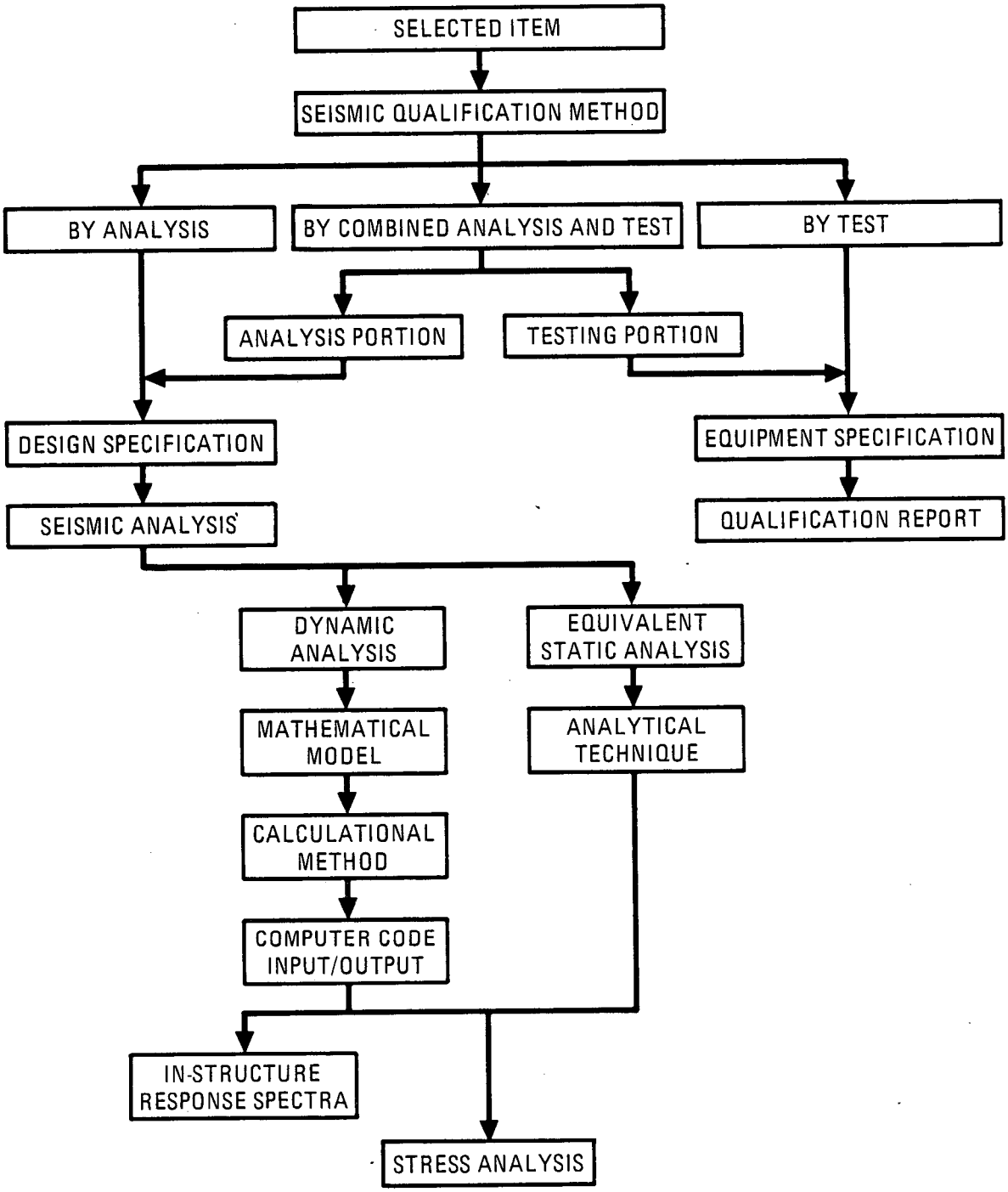


Fig. 2-3. Flow diagram for the seismic design technical review

2. Auxiliary Intake Structure

Review has not yet started. The design of the auxiliary intake structure was performed by SCE. Design documents have been obtained from SCE.

Segment of the SIS

3. Refueling Water Storage Tank (T-006)

Review of BPC's Specification for tank T-006 is complete. The tank is installed on a concrete slab at grade elevation. BPC subcontracted the design and fabrication of the tank to Brown-Minneapolis Tank (BMT) Company. Seismic requirements (including in-structure response spectra) contained in the tank specification prepared by BPC were reviewed. Interface loads between the tank nozzle (BMT scope) and piping (BPC scope) were checked. The review resulted in one Potential Finding Report (PFR) due to a difference in interface loads specified for the tank nozzle and those used in the piping analysis. The seismic requirements in the specification were found adequate. Review of BMT's tank analysis and design may be required subject to the resolution of the PFR.

4. Low-Pressure Safety Injection (LPSI) Pump (P-016)

Review of LPSI pump (P-016) is complete. The pump is located in the Safety Equipment Building. CE procured the pump from Ingersoll-Rand (with an electric motor from Westinghouse). Approximately ten documents were reviewed, including three pump and electric motor specifications prepared by CE. Interfaces (seismic-induced loads and movements) between the pump and its support (BPC scope) and between the pump and interconnecting piping (BPC scope) were also reviewed. Two PFRs have been issued

relating to the in-structure response spectra specified in the pump specification and the mounting bolt support design . An open item pertaining to resonance of the pump suction system to the DBE and the potential for periodic cavitation due to pressure-wave reduction of such head at the pump is being evaluated.

5. Safety Injection Tank (T-008)

Review of the safety injection tank (T-008) is complete. Tank T-008 is located in the reactor containment building (elevation 45 ft). Tank T-008 was designed by CE; P. F. Avery, a division of CE, fabricated the tank. Aproximately 15 documents were reviewed, which included specifications, dynamic analysis and structural analysis reports, drawings, and interface information on tank support and nozzle-pipe connections (BPC scope). The dynamic analysis of the tank accounted for the effect of slosh. Two PFRs have been issued. Except for discrepancies noted in the PFRs, the overall seismic design of tank T-008 is concluded to be adequate.

6. Major Piping

The review of major piping (typically 8 in. or greater diameter) associated with the segment of the SIS consisted of six piping analysis packages prepared by BPC. The packages are labeled PSG No. 56, 57, 74, 78, 82, and 117. PSG No. 78 is ASME III, Class 1; the others are ASME III, Class 2 or 3. Review of PSG No. 78 and 82 is complete; review of the remaining piping analysis packages is approximately 75% complete.

Design documents reviewed for a typical piping analysis package consist of design specifications, isometric drawings, calculations, piping area drawings, valve data sheets, computer code (including input/output data), and codes/standards used.

Thus far the review of major piping has resulted in the issuing of 14 PFRs. The PFRs filed pertain to apparent geometrical discrepancies in the modeling of piping branches, minor errors in isometric drawings, and simplifying assumptions not documented in the calculations. BPC's method of combining seismic inertia and seismic anchor movement (SAM) loads is still under review. BPC's technical approach to seismic analysis of piping is considered adequate.

7. Small Bore Piping

A review of small-bore piping (typically 2 in. or less in diameter) associated with the segment of the SIS consisted of two piping analysis packages prepared by BPC. The packages are labeled PSG No. 245 and calculation file 1295. PSG No. 245 is ASME III, Class 1 piping; No. 1295 is ASME III, Class 2. Review of PSG No. 245 is complete. Design documents for calculation file No. 1295 have been obtained from BPC and the review has started. Design documents reviewed for small-bore piping are essentially similar to those reviewed for major piping (see Feature No. 6 above).

Review of small-bore piping thus far has resulted in issuing of one PFR related to a Stress Intensity Factor (SIF) input in the computer analysis. Overall, review comments made on major piping (Feature No. 6) apply to small-bore piping as well.

8. Pipe Supports and Snubbers

Twelve pipe supports (hangers, snubbers, and springs) were selected from piping analysis packages PSG No. 78, 82, and 245 to be the subject of detailed design review. BPC is responsible for the design of pipe supports. Design documents reviewed for a typical support design include design specifications, hand

calculations, and drawings. Review included verifying consistency of seismic loads used in the design against output loads from the piping analysis package.

Eight PFRs have been issued based on the review to date. The PFRs are attributable to apparent deficiencies in documentation (e.g., basis for simplifying assumptions or conservative approaches not noted in calculations) or lack of thoroughness in the checking process (mislabeled node numbers) employed with these calculations. BPC's general approach to seismic design of pipe supports is considered conservative.

9. Valves

There are 28 valves associated with the segment of the SIS under review. Responsibility for the valves is shared by BPC (24) and CE (4). Review is in progress with respect to seismic requirements given in five general specifications (three prepared by BPC and two by CE) pertaining to manually operated valves and electric-motor-operated and solenoid-operated valves. One PFR has been issued to date.

Further review work is in progress on additional valve specifications obtained from BPC and CE, including review of interfaces between the valves and the associated piping analysis packages.

10. Instruments, Racks, and Panels

Instruments currently under review are CE-supplied process instruments and BPC-supplied limit switches, hand switches, and position-indicating lights associated with the segment of the SIS. The review was directed at Seismic Class 1 and B-train*

*Redundant systems have two trains of identical components, labeled "A" and "B."

instruments. Since the limit switches were qualified as an integral part of the valve actuators, their review was accomplished by review of the valve-actuator seismic requirements.

The qualification acceleration-levels specified for devices were verified to be higher than those allowed for the cabinetry in which they were mounted. This condition was also true for the two particular pipe-mounted instruments considered in this review. This portion of the instrument seismic review will be completed when clarification of the BPC and CE procedure for accepting equipment qualified to IEEE-344-1975, as opposed to the design basis IEEE-344-1971, is received.

Review of CE's specification for the Engineered Safety Features System (ESFAS) Auxiliary Relay Cabinet, 2L-34, has been completed. This cabinet contains Train A relays that actuate ESFAS DC solenoid valves and ac motor controllers for motor-operated valves, pumps, fans, and dampers. The specification was reviewed to determine whether or not the requirements specified are adequate to ensure seismic qualification of the cabinet.

The status of the review of the specification for Control Panel 2CR57 is reported under Feature No. 21. Review of one locally mounted instrument is reported in Feature No. 19.

Four PFRs, were issued as a result of this review. They are generally concerned with the apparent absence of required response spectra and requirements to the supplier to simulate the base anchorage support supplied by BPC. Also apparently absent from the specification were requirements for functional testing of the in-cabinet equipment and requirements for acceptable contact chatter during a DBE.

Information required to identify all Seismic Class I, B-train subtier components associated with the instruments under review has been obtained from BPC. Typical components are switches, relays, motor control centers, power supplies, and the panels (total of seven required) and local supports (total of two required) to which they are mounted. Review of additional selected items will be completed in February.

11. Switchgear and Power Panels (Motor Control Centers)

The switchgear units provide 4160V electrical power for the Engineered Safety Features Systems, which include the SIS. The switchgear units under review are mounted in the control room building (elevation 50 ft).

The switchgear units were procured by BPC. Review of BPC's procurement specification (with 10 addenda) is essentially complete. Two PFRs have been issued. The PFRs range from apparent discrepancies to insufficient information. In particular, several discrepancies were noted when references to the in-structure response spectra were incorporated in BPC's seismic specification.

Additional documents are being reviewed that will allow identification of specific switchgear units associated with the SIS electrical supply system. The final review of the switchgear specification will then be completed.

The motor control centers (MCC) provide and control 480V electrical power for the engineered safety features systems, which include the SIS. The MCC panels are in the control building (elevation 50 ft).

The MCCs were procured by BPC. Review of BPC's procurement specification (with eight addenda) is essentially complete. Two

PFRs have been issued. The PFRs range from apparent missing information and the use of preliminary information to concerns about the maximum allowable loads at the equipment mounting points during a design basis earthquake.

Additional documents are being reviewed that will allow identification of each individual MCC associated with the SIS electrical supply system. The final review of the MCC specification will then be completed.

12. Electrical and Control Cables

The objective of the review of this particular feature was to verify that safety-related cables associated with instruments and controls (Feature No. 10) in the segment of the SIS are routed in Seismic Category I raceways. Review of BPC's design criteria for Seismic Category I cable tray supports and design criteria for Seismic Category I electrical conduit supports has been completed as part of Feature No. 20. In these design criteria, BPC specifies that all tray and conduit supports in Seismic Category I buildings designed as Category I supports irrespective of electric cable classification or tray type. The cables for the instruments and controls of the SIS are located in the safety equipment building, reactor containment building, and electrical tunnels, which are Seismic Category I structures. According to BPC's design criteria, all cable tray/conduit supports in these buildings are Seismic Category I items; this then assures that electrical cables in these buildings are located in Seismic Category I trays and conduits.

Features Within Other Systems

13. Dynamic Analysis of Reactor Coolant System (RCS)

Documents required to initiate review of the dynamic analysis of the RCS have been requested from CE. The analysis was performed by CE.

14. Reactor Coolant Pump and Support

Specification and installation drawings for the reactor coolant pump and design documents for the supports have been obtained from CE. The supports were designed by CE and the pump was sub-contracted to Byron Jackson.

15. Reactor Vessel Support

Specifications and drawings for the reactor vessel support have been obtained from CE. The stress report has been requested.

16. Fuel Element Grid Spacers

Review of CE's design of the fuel element grid spacers is scheduled to start in mid-February.

17. Reactor Coolant System Cold Leg (Piping)

Specifications and drawings for the RCS cold leg piping have been obtained from CE. The stress report has been requested.

18. Diesel Generator Oil Storage Tank

Design documents (specifications, calculations, and drawings) for the diesel generator oil storage tank have been requested from BPC.

19. Two Locally Mounted Instruments

For this interim report, the field mounting design for the level transmitter (2LT-0312) located on the safety injection tank T-008 was reviewed. This instrument is supplied by CE and field mounted by BPC. BPC's specifications CS-J3, CS-J5, and CS-J8 were reviewed for seismic requirements. BPC's calculations for Seismic Category I field mounting support were reviewed for structural adequacy. An equivalent static analysis was conducted after the fundamental natural frequency of the support structure was calculated and the equivalent acceleration loadings for the horizontal and vertical directions were specified.

Three PFRs have been issued. The PFRs pertain to concerns that the sources of input seismic acceleration levels are not traceable nor cited in the calculation file and that references or data sheets on structural properties are not included in the calculation file made available to allow confirmation of values used. However, it appears that the design of the instrument mount is adequate.

One additional design of a locally mounted instrument will be reviewed in February.

Other Structures, Components, or Features

20. Cable Raceways

BPC's design criteria for Seismic Category I cable tray and electrical conduit supports have been reviewed. Additionally, 15 cable tray supports and one conduit support have been selected for detailed design review. These supports are associated with cable raceways containing safety-related cables for instruments and controls in the segment of the SIS under review. Review of eight

support designs has been completed; the remainder are approximately 50% complete.

Seismic requirements specified in BPC's design criteria are considered adequate for seismic design of cable tray and conduit supports. One PFR has been issued. Discrepancies noted are attributed to less-than-thorough checking or lack of documentation of simplifying assumptions and conservatisms used in the design calculation. Use of allowable loads such as insert pull-out loads from manufacturer's catalogs (e.g., Globe Strut) in design calculations is an open item requiring confirmation that BPC has validated manufacturer's qualification reports. Overall, BPC's technical approach provides sufficient conservatism in the design of cable tray and conduit supports.

21. Control Panel 2CR57

Review of BPC's specification applicable to Control Panel 2CR57 has been completed. Panel 2CR57 is the Engineered Safety Features System panel. Panel 2CR57 is 1 of 17 sections forming a double horseshoe arrangement in the main control room (elevation 30 ft). Panel 2CR57 is one of the end panels of the arrangement. BPC subcontracted the design and fabrication of the panels to Circle AW Products, which, in turn, subcontracted the dynamic analysis and testing to Wyle Labs. Review of Panel 2CR57 is scheduled in two phases: the first phase, review of the BPC specification, is complete; the second phase, review of the design by Circle AW Products/Wyle Labs, is scheduled for completion in March.

Three PFRs were issued as a result of the review of the BPC specification. The PFRs resulted from a concern that the specification supplied to date does not contain complete seismic requirements.

22. Segment of Reactor Containment Building Internal Structure and Supported Equipment

Review is scheduled to start first week in February. This feature is intended to cover representative differences between San Onofre Units 2 and 3.

2.4. AUDIT PLAN REVIEW, TASK D

This task is designed to determine if SCE and BPC performed audits at the site and at fabricator's shops in the area of implementation of seismic design documents, and to evaluate the effectiveness and results of such audits.

The first step completed in this task was the preparation of procedures to provide detailed working instruction.

The first subtask (D1) calls for identification of SCE and BPC procedural requirements for audit planning and scheduling, and for evaluation of those requirements against the applicable regulatory requirements. This work was carried out by visits to the SCE and BPC offices, interviews with cognizant personnel, and review of relevant procedures and regulatory requirements. The following procedures, relevant to scheduling of audits, were obtained for review:

SCE

- QA Reference Procedures Manual N18.04 - Rev. 1-18.

BPC

- SONGS 2 and 3 Project Quality Program Manual Procedure No. 18 - "Project Quality Audit," Rev. 0 (October 1974) to Rev. (June 10, 1975).

- LAPD Quality Program Manual, Procedure No. 18.1, "QA Audits," Rev. 5.

- LAPD QA Department Procedures, No. 5.1, "Project QA Audits," Rev. 15 (November 16, 1981).

- Procedure Supplier Quality Manual, 6th Edition, Rev. 0 (April 1, 1980), 5th Edition, Rev. 0-2 (October 1977-April 1978).

- Procurement Inspection Department Manual, 4th Edition, Section 3.1.2, "Audit Scheduling," Rev. 0 (May 1973) to Rev. 3 (February 1976); 3rd Edition, Section 5.3.2.18, "Audits," Rev. 3 (March 2, 1970).

- QA Standard, Section 3.0, Rev. 3 (December 1973) and Rev. 4 (April 1974).

The review has been completed and is documented in the form of completed checklists. The review showed that SCE and BPC procedures for audit planning and scheduling were consistent with regulatory requirements with the possible exception of one regulatory requirement that was not addressed in the SCE procedures. These procedures did not require planned periodic audits to determine the effectiveness of the QA program as required in 10CFR50, Appendix B, Section XVIII. One PFR was issued on this item.

Subtask D2 calls for a review of BPC and SCE audit plans and schedules to determine if those plans and schedules were prepared as required by BPC and SCE procedures, respectively. This review is complete and confirms that audit plans and schedules were available and prepared in accordance with the requirements. This work is documented by completed checklists, identifying the plans and schedules checked.

The identification of audits of site and fabricator's shops for work related to implementation of seismic design documents was required by

Subtask D3. Such audits have been identified and this work is documented by a listing of specific audits performed at suppliers and at the site in the area(s) of interest. This work confirmed that the area of interest (implementation of seismic design documents) was adequately covered by BPC and SCE audits.

Audit reports for the audits identified above will be examined (Subtask D4) to determine if the audit plan was carried out as required, to identify any deficiencies uncovered in the area of implementation of seismic design documents, and to evaluate the resolution of any such deficiencies to determine if they were satisfactorily resolved or corrected.

2.5. PIPE SEGMENT WALKDOWN, TASK G

A field audit of four stress isometric drawings and a representative number of supports was performed on a portion of the safety-related piping and supports for the SIS in San Onofre Unit 2. Approximately 300 ft of piping were examined.

An audit was performed on the isometric drawings. Two PFRs were issued.

A general audit which examined the attachment to the pipe and the attachment to the building structure was performed on 12 of 37 pipe support drawings and their referenced isometric drawings. A complete audit was performed on one of those support drawings.

The following is a summary of the results of this field audit:

1. The piping was routed as defined on the stress isometric drawings.

2. The types of seismic restraints installed in the field agreed with the types shown on the stress isometric drawings.

3. Two seismic supports were not located as shown on the stress isometric drawings.

4. One weight support was not located as shown on the stress isometric drawings.

5. Discrepancies were noted in dimensions, material sizes and shapes, and configuration between pipe suppport analysis drawings and the data acquired from the walkdown.

Based on the review to date of items 3, 4, and 5 and the overall results of the walkdown, it appears that the pipe design, implemented in the field, is adequate.

2.6. POTENTIAL FINDINGS

2.6.1. Processing of Findings, Task E

The first step in this task (Subtask E1) was to establish a Findings Review Committee. The committee consists of:

S. L. Koutz (Chairman), Chief Engineer, Engineering Technology
T. R. Colandrea, Director, Quality Assurance
C. Fisher, Manager of Licensing
A. M. Harris, Technical Advisor
A. J. Neylan, Manager of HTGR Technology Programs

The committee collectively has over 100 years of experience in the nuclear power field.

In the next step, Subtask E2, the criteria for classification of Potential Findings was defined. Then the procedure for the evaluation and classification of Potential Findings was developed in Subtask E3. The main features of the procedure for processing Findings are shown in Fig. 2-4.

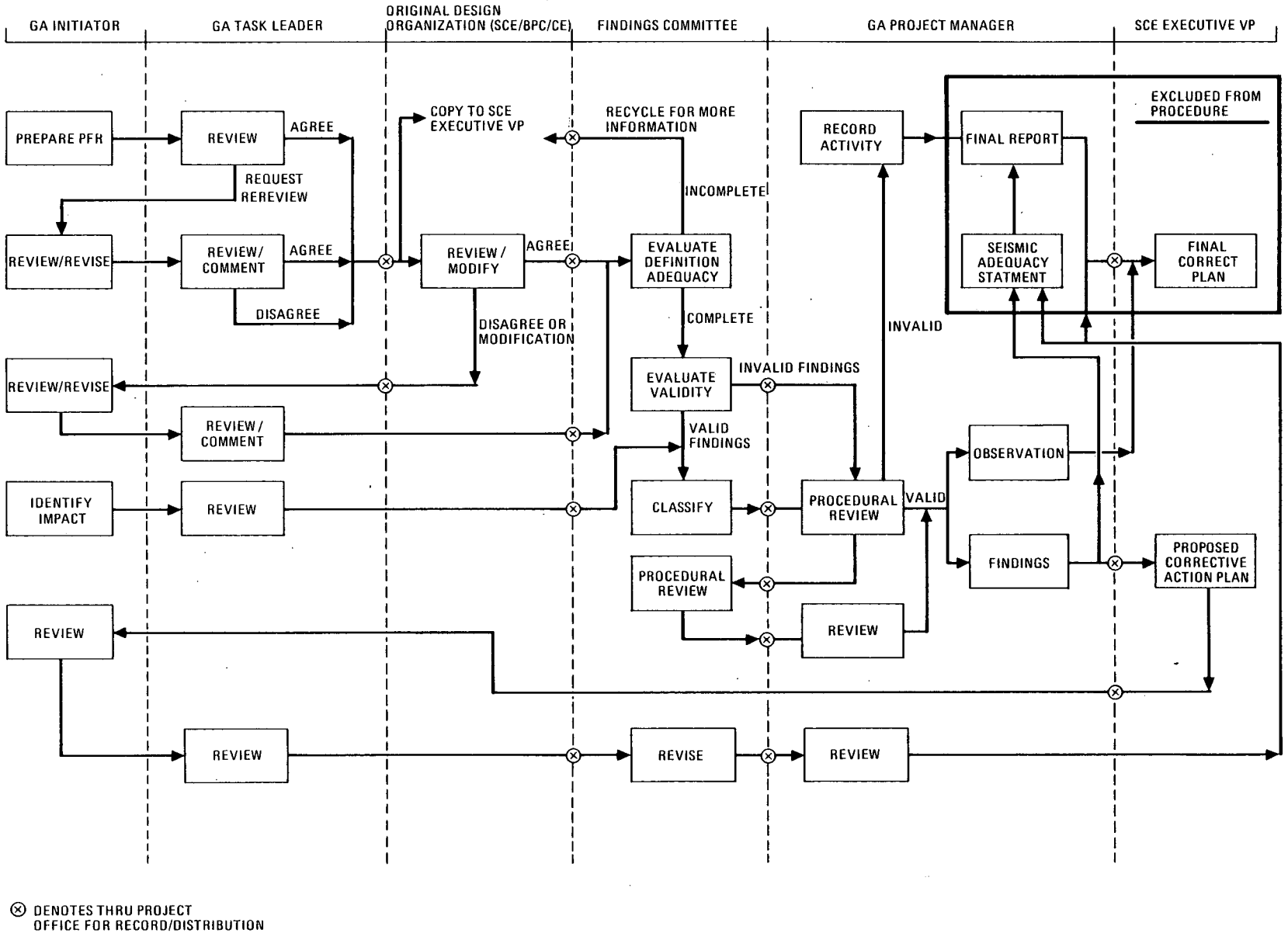


Fig. 2-4. Procedure for processing Findings

Personnel who are carrying out tasks A, B, C, D, or G are instructed to fill out a Potential Finding Report when they believe they have encountered a deviation which meets the definition of a Potential Finding contained in their task procedures. All Potential Finding Reports are maintained as permanent records. The Potential Finding Report is then reviewed by the task leader and the original design organization (SCE, BPC, or CE) to determine if the PFR is valid (i.e., if it is accurate, well defined, and traceable to the requirement). Independence of the initiator is maintained by giving the initiator the sole right to reject or incorporate comments by either the task leader or the original design organization (ODO). Records of each revision to a PFR are maintained and all comments, whether incorporated or rejected, are documented.

After being reviewed by the task leader and the ODO, the Potential Finding Report together with an impact assessment prepared by the initiator are sent to the Potential Finding Committee for evaluation and classification. The impact assessment is the initiator's appraisal of the seriousness of the Potential Finding.

A Potential Finding is classified as invalid if after the above review all parties, that is, the initiator, the task leader, and the ODO agree that the Potential Finding is inaccurate. In addition, Potential Findings may be classified as invalid if two out of three of the above parties conclude that the Potential Finding is invalid and the Potential Finding Committee is also convinced of its lack of validity.

Criteria are contained in the procedure for classifying a valid Potential Finding as either a Finding or an Observation. Basically, if a Potential Finding is a deviation that could result in a substantial safety hazard, or if there is an indication that there is a repetitive or generic deviation that could create substantial safety hazard, the Potential Finding is classified as a Finding. Potential Findings that are valid, but that do not satisfy the above criteria for a Finding, are classified as Observations.

The classification of the Potential Finding is reviewed by the project manager to determine if the correct procedures have been followed. Subsequently, the Observations and Findings are sent to the Executive Vice-President of SCE for resolution. In the case of Findings, a Corrective Action Plan (CAP) is prepared and returned for review. The review will determine if the CAP satisfies the concern expressed in the Finding.

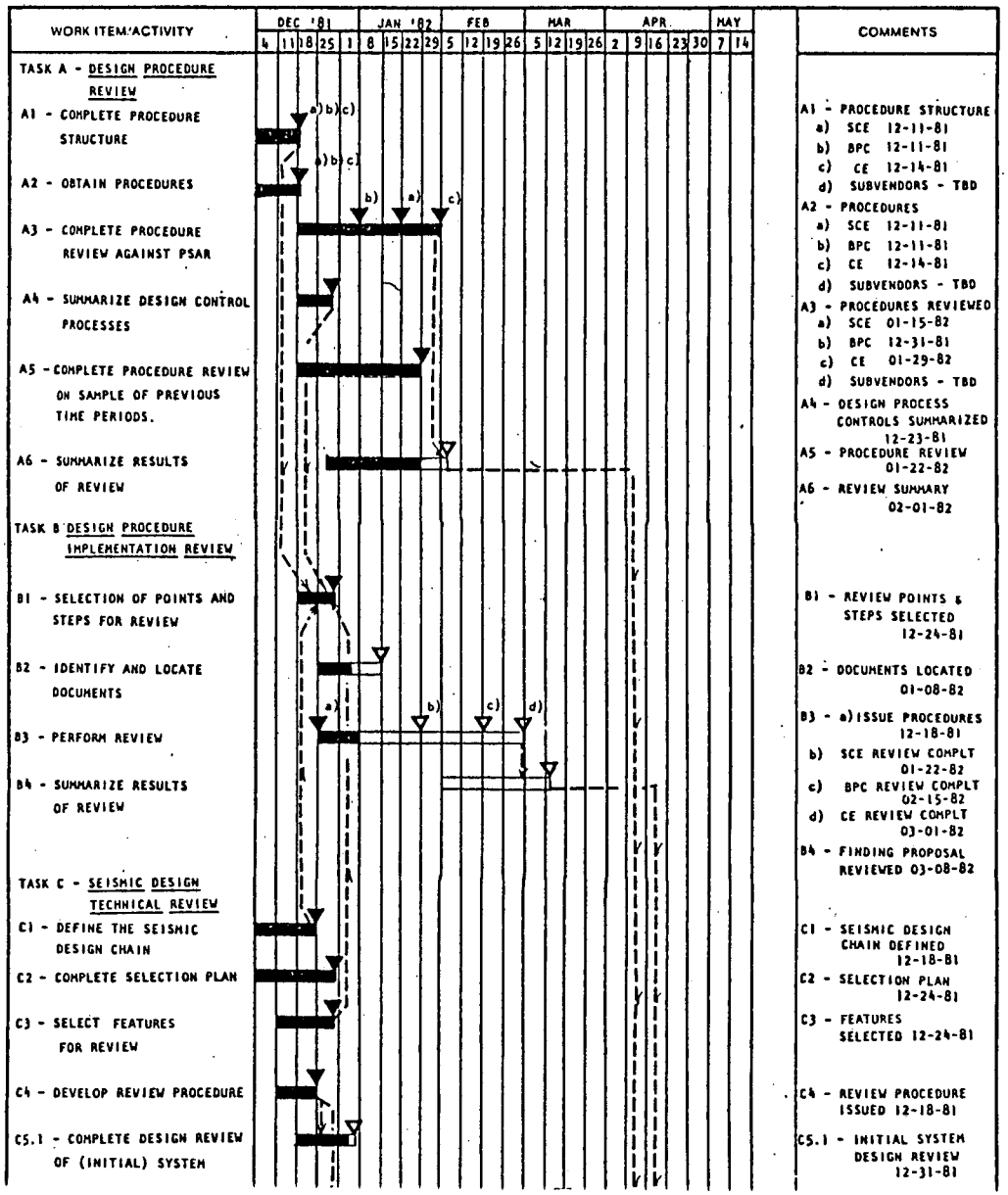
2.6.2. Review of Potential Findings

The status of the preparation and processing of potential findings is shown in Table 1-1. As of January 24, 1982, 58 Potential Finding Reports have been initiated, 48 have been sent to the original design organization (ODO) for review and comment and 33 have been returned from the ODO. Twenty-eight of the PFRs returned from the ODO have been sent to the Findings Review Committee (FRC) for review and classification; the remainder of the returned PFRs are in the process of being reviewed or revised by the project engineers. Of the 28 PFRs sent to the FRC, 8 have been returned for additional information and 20 have been forwarded to the Project Manager with a recommended classification. The Project Manager has concurred with all of the recommended classifications. Fifteen of the completed PFRs have been classified as Invalid Findings and four have been classified as Observations. One has been classified as a Finding. The Project Manager has forwarded the Observations and the Finding to the SCE Executive Vice-President.

3. PROGRAM SCHEDULE AND PROGRESS

The schedule for this program is shown in Fig. 3-1. All completed work is indicated by the shaded portions of the bars and triangles.

PROJECT TITLE INDEPENDENT VERIFICATION OF SONGS 2 & 3 SEISMIC DESIGN PROJECT MANAGER G. WESSMAN



COMMENTS

A1 - PROCEDURE STRUCTURE
a) SCE 12-11-81
b) BPC 12-11-81
c) CE 12-14-81
d) SUBVENDORS - TBD

A2 - PROCEDURES
a) SCE 12-11-81
b) BPC 12-11-81
c) CE 12-14-81
d) SUBVENDORS - TBD

A3 - PROCEDURES REVIEWED
a) SCE 01-15-82
b) BPC 12-31-81
c) CE 01-29-82
d) SUBVENDORS - TBD

A4 - DESIGN PROCESS CONTROLS SUMMARIZED 12-23-81

A5 - PROCEDURE REVIEW 01-22-82

A6 - REVIEW SUMMARY 02-01-82

B1 - REVIEW POINTS & STEPS SELECTED 12-24-81

B2 - DOCUMENTS LOCATED 01-08-82

B3 - a) ISSUE PROCEDURES 12-18-81
b) SCE REVIEW COMPLT 01-22-82
c) BPC REVIEW COMPLT 02-15-82
d) CE REVIEW COMPLT 03-01-82

B4 - FINDING PROPOSAL REVIEWED 03-08-82

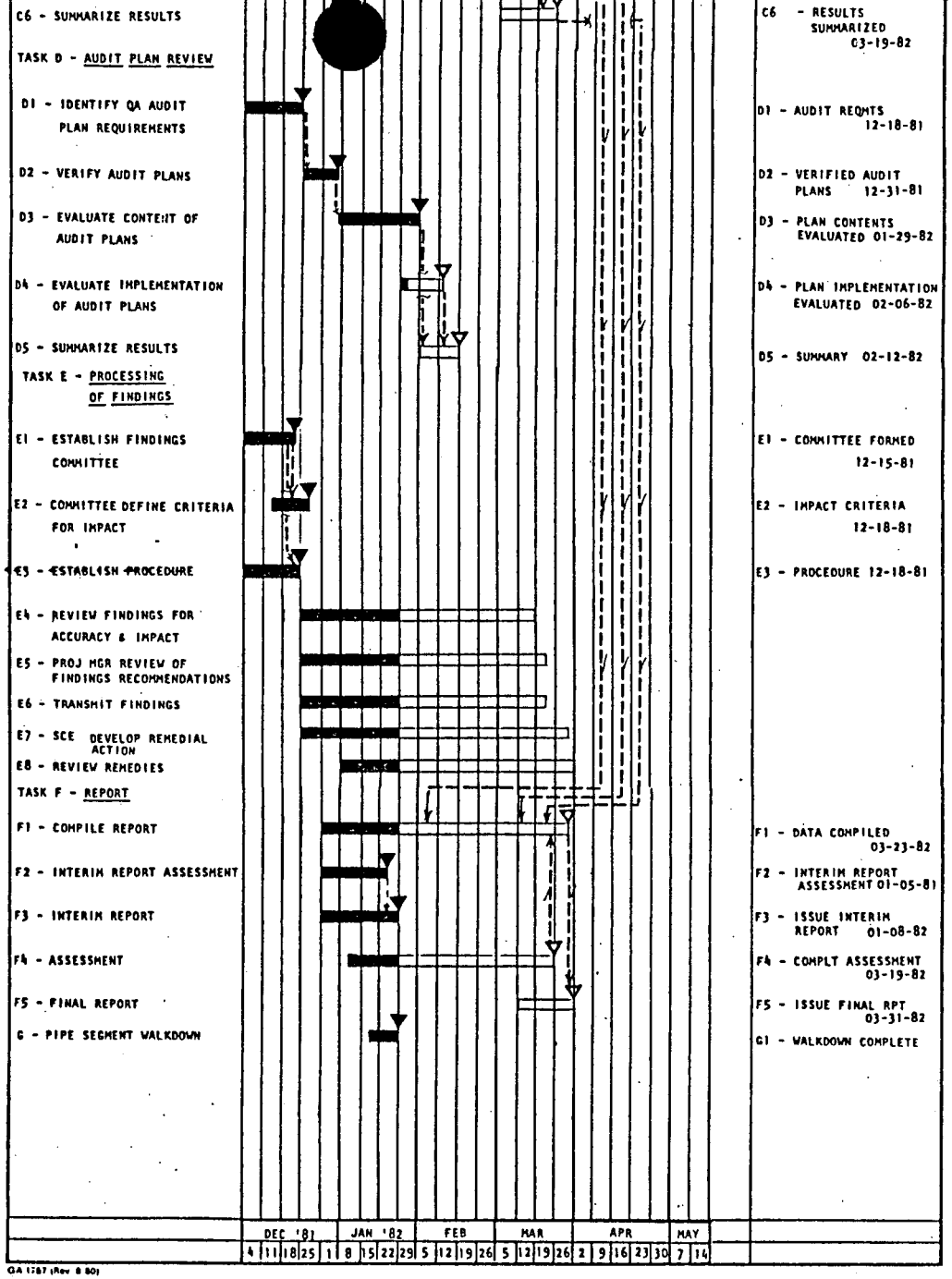
C1 - SEISMIC DESIGN CHAIN DEFINED 12-18-81

C2 - SELECTION PLAN 12-24-81

C3 - FEATURES SELECTED 12-24-81

C4 - REVIEW PROCEDURE ISSUED 12-18-81

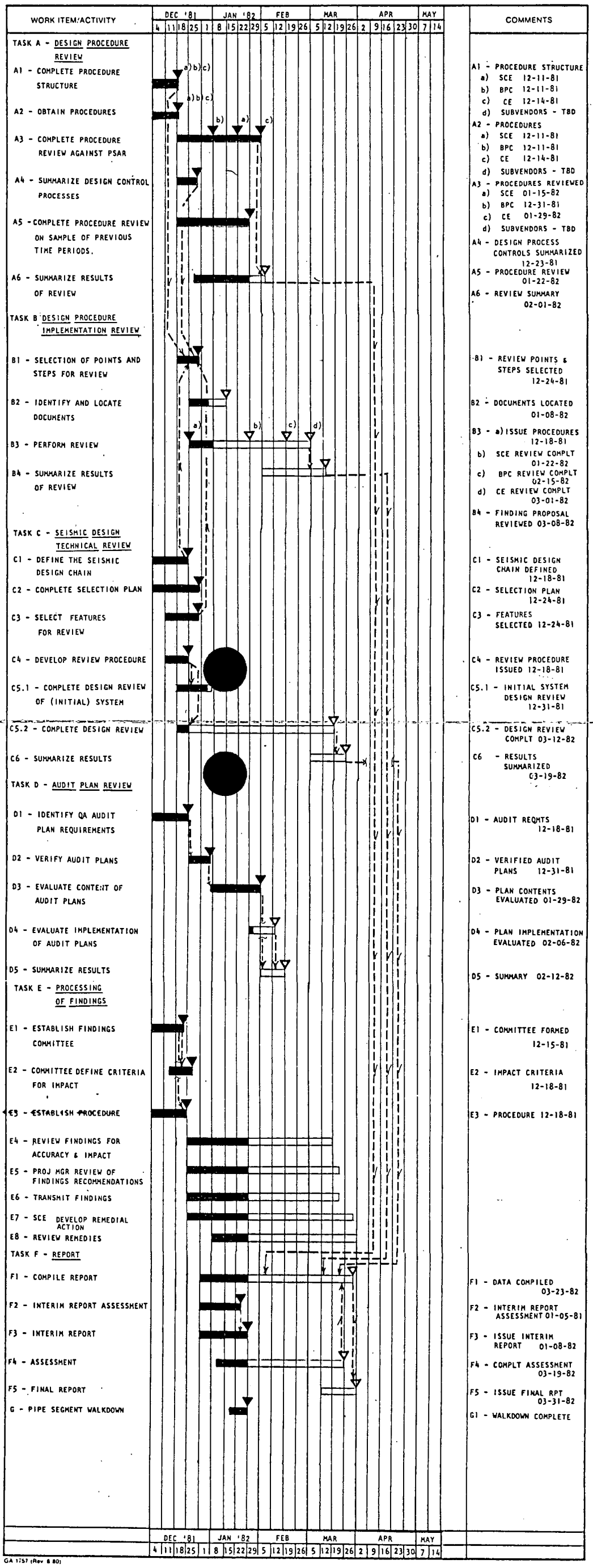
C5.1 - INITIAL SYSTEM DESIGN REVIEW 12-31-81



GA 1787 (Rev. 8 80)

Fig. 3-1. Program schedule

PROJECT TITLE INDEPENDENT VERIFICATION OF SONGS 2 & 3 SEISMIC DESIGN PROJECT MANAGER G. WESSMAN



GA 1757 (Rev 6 80)

Fig. 3-1. Program schedule