

IMPLEMENTATION PLAN FOR SEISMIC UPGRADING OF
SAN ONOFRE UNIT 1

I. INTRODUCTION

This document describes the implementation plan for completion of the seismic upgrading of San Onofre Unit 1 to withstand a 0.67g Housner ground motion.

- a. Resolution of the site ground motion issue
- b. Resolution of in-situ soil conditions
- c. Reevaluation and modification of structures
- d. Reevaluation and modification of mechanical equipment and piping
- e. Reevaluation and modification of electrical raceways and conduits
- f. Resolution of anchorage of electrical equipment
- g. Resolution of issues on Seismic Backfit Project

This program will comprise (1) the completion of the above reevaluations, including resolution of NRC comments on the criteria and methodology used in the reevaluations, and (2) the completion of all structural modifications required as a result of these reevaluations.

Section II of this plan provides detailed descriptions of the various activities in the program, schedules for the completion of analyses and modifications, and the licensing milestones, including areas where NRC approvals are requested to support the upgrading activities. Tables 1 and 2 provide a summary of the target milestone schedule for completion of the implementation plan. As summarized in these tables, timely NRC approvals are

required throughout the program to support a return to power by November 28, 1982.

II. ACTIVITY DESCRIPTIONS

The following paragraphs provide a description of each of the activities in this program, an identification of milestones for each activity and a schedule for completion of each activity.

A. Site Ground Motion

By letters dated August 4, 1980, March 15, 1981, and April 24, 1981, the NRC indicated that we should continue our seismic reanalysis program using the 0.67g Housner ground response spectrum. Consistent with these letters, the seismic analyses are being conducted using the 0.67g Housner spectrum.

By letter dated April 5, 1982, the NRC indicated that the 0.67g Housner response spectrum is the appropriate free field motion for the reanalysis and seismic upgrading of San Onofre Unit 1 subject to the receipt of certain confirmatory information. This confirmatory information was provided by letter dated April 15, 1982. In subsequent telephone discussions with the NRC staff, additional information was requested to support preparation of the NRC's safety evaluation. This additional information will be provided by June 28, 1982. It is expected that this information will permit a final decision and preparation of a safety evaluation report by the NRC by July 16, 1982.

The NRC's April 5, 1982 letter also requested that we provide information pertaining to the seismic safety margins in structures, systems and components relative to a 10 percent exceedance of the Housner spectrum over a limited period range. This information will be provided by July 30, 1982. It is requested that NRC review and acceptance of this information be provided by August 13, 1982.

B. In-Situ Soil Conditions

The seismic analyses and conceptual design of modifications at San Onofre Unit 1 have been based on a 95% compaction for all fill material. In a letter dated April 30, 1982, SCE indicated that as a result of testing that was conducted during construction work during the current outage, it was discovered that relative densities less than this value did occur. In the local areas where this was encountered, remedies were implemented. In addition, SCE committed to investigate the potential for similar conditions in other areas of the site and to resolve the potential impact of such conditions on the seismic analyses.

The backfill at the site has been defined in areal extent and its density has been characterized based on review of construction records and photos together with observations made subsequent to original construction for plant modifications. Safety related structures, systems and components that could be impacted by the soil conditions have been identified.

The effect of low density backfill on structures was a reduction of the soil stiffness parameters due to a change in the embedment effects and an increase in lateral pressures. The impact of these changes on previously completed seismic analyses has been assessed. It has been demonstrated that, except for the fuel storage building, these changes do not change the conclusions reached or the modifications implemented and/or developed based on the previously completed seismic analyses. For the fuel storage building, the impact of these changes will be evaluated by additional analyses and/or modifications as indicated in Item II.C.7 below. For piping and components, the effects of low density backfill are also being evaluated.

A complete report of these evaluations and conceptual remedies for in-situ soil conditions will be provided by July 23, 1982. This report will also include the response to comment number 1 in the NRC's letter dated January 19, 1982. It is requested that NRC acceptance of SCE's evaluation and proposed remedies be provided by August 6, 1982. A revised assessment for SEP Topic II-4.F, Settlement of Foundations and Buried Equipment, will be provided two weeks after NRC acceptance; the target date being August 20, 1982.

C. Structures

The criteria and methodology used for the seismic reevaluation of the majority of the structures at San Onofre Unit 1 was submitted to the NRC by letter dated February 17, 1981. For the fuel storage building, this was supplemented by section 2.4 of the report forwarded by letter dated April 30, 1982. For

masonry walls the criteria and methodology were forwarded in two reports submitted by letters dated January 11 and 15, 1982. A discussion of the analysis results, milestones and modification schedules is provided for each structure in the seismic reevaluation program in the following paragraphs.

1. Control and Administration Building

Results of the reevaluation of the control and administration building were provided by our letter dated February 9, 1982. No modifications are required to this structure.

In a meeting with the NRC on May 20, 1982, the NRC provided us with a set of comments on the reevaluation of the control and administration building. SCE will be prepared to respond to these comments in a meeting with the NRC during the week of July 19, 1982. It is requested that all issues be resolved either at this meeting or shortly thereafter such that NRC acceptance of the criteria, methodology and results can be provided by August 13, 1982.

2. Seawall

Results of the reevaluation of the seawall were provided by our letter dated December 8, 1981. No modifications are required to the seawall. There have been no comments by the NRC on the evaluation of the seawall; therefore, it is requested that NRC acceptance of the criteria, methodology and results be provided by August 13, 1982.

3. Reactor Auxiliary Building

Results of the reevaluation of the reactor auxiliary building were provided by our letter dated December 8, 1981. Modifications were required to several connections in this structure. These modifications have been completed.

In the May 20, 1982 meeting, the NRC provided comments on the reevaluation of the reactor auxiliary building. SCE will be prepared to respond to these comments in a meeting during the week of July 19, 1982. It is requested that NRC acceptance of the criteria, methodology and results be provided by August 13, 1982.

4. Ventilation Equipment Building

Results of the reevaluation of the ventilation equipment building were provided by our letter dated December 8, 1981. Modifications were required to several connections in this structure. These modifications have been completed.

In the May 20, 1982 meeting, the NRC provided comments on the reevaluation of the ventilation equipment building. SCE will be prepared to respond to these comments in a meeting during the week of July 19, 1982. It is requested that NRC acceptance of the criteria, methodology and results be provided by August 13, 1982.

5. Intake Structure

Results of the reevaluation of the circulating water system intake structure were provided by our letter dated December 8, 1981.

Modifications are required to the north, south and east pumpwell walls. These walls will be strengthened by stiffening the top edges of the walls. This will be done by providing a structural member along the periphery of the upper walls and integrally connecting it to the free standing edges of the walls. SCE will be prepared to discuss a preliminary design for these modifications in a meeting during the week of July 19, 1982. Construction of the modifications will be completed during the current outage.

At the May 20, 1982 meeting, the NRC provided comments on the reevaluation of the intake structure. SCE will be prepared to respond to these comments in a meeting during the week of July 19, 1982. It is requested that NRC acceptance of the criteria, methodology, results and preliminary design for modifications be provided by August 13, 1982.

6. Turbine Building

Results of the reevaluation of the turbine building were provided by letter dated April 30, 1982. Modifications are required to the north and south turbine extensions and the west and east heater platforms. All modifications required for the north turbine

extension and west heater platform have been completed. Similar modifications will be implemented for the south extension and east heater platform. SCE will be prepared to discuss these modifications in a meeting during the week of July 19, 1982. Construction of these modifications will be completed during the current outage.

At the May 20, 1982 meeting, the NRC provided comments on the reevaluation of the turbine building. SCE will be prepared to respond to these comments in a meeting during the week of July 19, 1982. It is requested that NRC acceptance of the criteria, methodology and results be provided by August 13, 1982.

7. Fuel Storage Building

Results of the reevaluation of the fuel storage building were provided by letter dated April 30, 1982. Two modifications were required to this structure: (1) Strengthening of the wall to roof diaphragm on the north and east walls of the new fuel room by the addition of approximately 20 new through bolts, and (2) addition of a structural steel braced frame to the east wall of the new fuel room. Construction of these modifications will be completed during the current outage.

In the May 20, 1982 meeting the NRC provided comments on the reevaluation of the fuel storage building. SCE will be prepared to respond to these comments in a meeting the week of July 19, 1982. It is requested that NRC acceptance of the criteria and methodology be provided by August 13, 1982.

Subsequent to the analysis of the fuel storage building, lower density backfill was discovered adjacent to the fuel pool during the construction of the north turbine building foundations. Due to the effect of the fill on the originally assumed soil parameters, the fuel storage building will be reevaluated for lower density backfill. If the structure is reanalyzed, the reanalysis will utilize real time histories which will be modified to provide a tighter envelope of the Housner spectrum than those utilized in the previous analysis of the fuel storage building. Alternatively, an evaluation of possible modifications will be undertaken. SCE will be prepared to discuss our proposed approach in a meeting the week of July 19, 1982. It is requested that NRC acceptance of our approach be provided by August 6, 1982. A report summarizing the results of these analyses and/or modifications will be provided by October 1, 1982. It is requested that NRC acceptance of the results be provided by October 15, 1982.

8. Masonry Walls

The masonry walls have been reevaluated using a nonlinear inelastic time-history analysis. This analysis showed that although many walls exhibit considerable inelastic response, all are within the limits set forth in the criteria. These analysis results and the associated methodology were submitted in three volumes by letters dated January 11 and 15, 1982. A fourth volume describing the results for the fuel storage building walls was submitted April 30, 1982. By letters dated February 17, 1982 and April 2, 1982, the NRC indicated that the methodology could not be accepted without additional confirmatory testing. In meetings on May 11 to 13, 1982 NRC comments on the masonry wall evaluation were discussed together with a proposed testing program. Responses to comments raised by the NRC at the May 11 to 13 meetings will be provided by July 9, 1982.

In view of the current program, SCE is reevaluating alternatives to performance of a test program. Specifically, implementation of modifications to eliminate the need for or reduce the scope of a test program are being investigated. The results of this evaluation will be provided to the NRC for approval by July 16, 1982. If it is determined that a test program will be performed, a description of the test program will be submitted for NRC approval by July 16, 1982. It is requested that NRC approval of our approach, including the test program if appropriate, be provided by July 30, 1982.

The current plans for the testing program if it is conducted would be to perform the testing from September 1982 through the end of the year. The testing of the first specimens would be completed in mid-October. The raw data from these tests would provide an indication of probable conclusions of the test program. Data reduction and evaluation would be performed in early 1983, with final results provided to the NRC by March 1, 1983.

9. In-Structure Response Spectra

In-structure response spectra have been generated where required for the structures discussed above. A report which provides these spectra and describes the methodology used in developing them will be submitted by July 9, 1982. It is requested that any NRC comments on the spectra be discussed at a meeting during the week of July 19, 1982 such that NRC acceptance of the methodology and results can be provided by August 13, 1982.

D. Mechanical Equipment and Piping

The criteria and methodology for the seismic reevaluation of balance of plant mechanical equipment and piping was submitted to the NRC by letter dated October 8, 1981. At the May 20, 1982 meeting with the NRC, a set of NRC consultant comments on the methodology and criteria was provided to us. SCE

will be prepared to respond to these comments at a meeting during the week of July 19, 1982. It is requested that NRC acceptance of the criteria and methodology be provided by July 30, 1982.

Results of the reevaluation of mechanical equipment and piping associated with the reactor coolant pressure boundary and safe shutdown systems were provided to the NRC by letter dated April 30, 1982. A number of piping and equipment support modifications were identified in this report. Before implementing these modifications, these analyses will be reviewed and where appropriate reanalyzed.

For example, all of the small piping will be reanalyzed using computer methods as used for large piping as opposed to simplified design guide methods. In the case of the condensate storage tank, extensive rework would be required to upgrade this tank to withstand a 0.67g Housner ground motion. Presently, due to the lack of seismic anchorage of the tank, a temporary connection is provided to supply firewater to the auxiliary feedwater pumps as an alternate source of auxiliary feedwater. SCE will consider various alternative methods to provide a permanent seismically qualified source of auxiliary feedwater. Included in the alternatives will be:

- a. Upgrading the existing condensate storage tank and auxiliary feedwater suction piping to 0.67g Housner
- b. Providing a new seismically qualified tank dedicated to the auxiliary feedwater system.

- c. Providing an alternate seismically qualified supply of water to the auxiliary feedwater pumps

The reevaluation of the mechanical equipment and piping associated with the accident mitigating systems was not addressed in the April 30, 1982 report. This piping and equipment will be analyzed utilizing the same criteria and methodology which will be used for the reanalysis of the safe shutdown systems and the reactor coolant pressure boundary.

It is expected that all analyses of mechanical equipment and piping will be completed by October 1, 1982. Construction of required modifications will proceed in parallel with the analyses and will be completed during the current outage. A final report providing the results for mechanical equipment and piping will be provided by October 1, 1982. It is requested that NRC acceptance of the results be provided by October 15, 1982.

E. Electrical Raceways and Conduits

The criteria and methodology being utilized for the seismic reevaluation of electrical raceways and conduits will be submitted to the NRC by July 30, 1982. It is requested that NRC acceptance of the criteria and methodology be provided by August 13, 1982.

Based on this criteria and methodology modifications will be designed to seismically upgrade electrical raceway and conduit supports as required. It is anticipated that these modifications will consist mainly of unistrut members with the possible use of some tube sections where access is limited. In areas where masonry wall deflections were calculated to be large enough to affect attached electrical raceways and conduits, additional structural supports will be added to limit the deflections of the walls.

Construction of required modifications to electrical raceways and conduits will be completed during the current outage. A final report providing the results for electrical raceways and conduits will be provided by October 15, 1982. It is requested that NRC acceptance of the results be provided by October 29, 1982.

F. Anchorage of Electrical Equipment

The results of the investigation of the anchorage of safety-related electrical equipment were provided by letters dated March 25, 1981 and May 29, 1981. All modifications required as a result of these investigations have been implemented. The criteria and methodology used in these investigations were submitted by letter dated April 12, 1982.

Since these investigations were performed, actual floor response spectra for the control room have become available from the seismic reevaluation of this structure. We have reviewed our previous calculations and design margins, which were based on estimated floor spectra in the control room, and have

determined that the existing anchorages are adequate and no additional modifications are required as a result of considering the actual floor spectra. This will be documented by July 2, 1982. It is requested that NRC acceptance of the criteria, methodology and results be provided by July 30, 1982.

G. Seismic Backfit Project

The seismic reevaluation of the containment, reactor building and nuclear steam supply system (NSSS) main loop and components was completed in 1976. Modifications which were required to the supports of some components were installed during an outage from October 1976 to March 1977. A report documenting the criteria, methodology and results of these evaluations and backfits (referred to as the Seismic Backfit Project) was provided by letter dated May 18, 1977.

By letter dated April 26, 1982 the NRC provided comments by its consultant Lawrence Livermore National Laboratory on the reevaluation of the containment and reactor building. In the meeting on May 20, 1982, the NRC provided comments by its consultant EG&G on the reevaluation of the NSSS. SCE will be prepared to respond to these comments in a meeting during the week of July 19, 1982. A formal response to the April 26, 1982 letter documenting the discussions from that meeting will be provided by July 30, 1982. It is requested that NRC acceptance of the criteria, methodology and results of the Seismic Backfit Project be provided by August 13, 1982.

Table 1

Target Milestone Schedule for Completion
of the Seismic Upgrading of San Onofre Unit 1

A.	Site Ground Motion	
1.	Confirmatory Information	4/15/82
2.	Provide Additional Information to NRC	6/28/82
3.	NRC Final Decision and SER	7/16/82
4.	Provide Information Relative to 10 Percent Exceedance of Housner Spectra	7/30/82
5.	NRC Acceptance of Information in Item 4	8/13/82
B.	In-Situ Soil Conditions	
1.	Report with Evaluation and Proposed Remedies	7/23/82
2.	NRC Acceptance of Evaluation and Remedies	8/6/82
3.	Revised SEP Topic II-4.F	8/20/82
C.	Structures	
1.	Control and Administration Building	
a.	Criteria and Methodology	2/17/81
b.	Results of Reevaluation	2/9/82
c.	Meeting to Resolve NRC Comments	7/23/82
d.	NRC Acceptance of Criteria, Methodology and Results	8/13/82
2.	Seawall	
a.	Criteria and Methodology	2/17/81
b.	Results of Reevaluation	12/8/81
c.	NRC Acceptance of Criteria, Methodology and Results	8/13/82

3. Reactor Auxiliary Building
 - a. Criteria and Methodology 2/17/81
 - b. Results of Reevaluation 12/8/81
 - c. Meeting to Resolve NRC Comments 7/23/82
 - d. NRC Acceptance of Criteria, Methodology and Results 8/13/82
4. Ventilation Equipment Building
 - a. Criteria and Methodology 2/17/81
 - b. Results of Reevaluation 12/8/81
 - c. Meeting to Resolve NRC Comments 7/23/82
 - d. NRC Acceptance of Criteria, Methodology and Results 8/13/82
5. Intake Structure
 - a. Criteria and Methodology 2/17/81
 - b. Results of Reevaluation 12/8/81
 - c. Preliminary Design of Modifications 7/23/82
 - d. Meeting to Resolve NRC Comments 7/23/82
 - e. NRC Acceptance of Criteria, Methodology, Results and Preliminary Design 8/13/82
 - d. Completion of Modifications and Return to Power 11/28/82
6. Turbine Building
 - a. Criteria and Methodology 2/17/81
 - b. Results of Reevaluation 4/30/82
 - c. Meeting to Resolve NRC Comments 7/23/82
 - d. Meeting to Discuss Design of Modifications 7/23/82
 - e. NRC Acceptance of Criteria, Methodology and Results 8/13/82
 - f. Completion of Modifications and Return to Power 11/28/82

7. Fuel Storage Building
 - a. Criteria and Methodology 4/30/82
 - b. Results of Reevaluation 4/30/82
 - c. Meeting to Resolve NRC Comments 7/23/82
 - d. Define Approach 7/23/82
 - e. NRC Acceptance of Approach 8/6/82
 - f. NRC Acceptance of Criteria and Methodology 8/13/82
 - g. Provide Report with Additional Reevaluation Results 10/1/82
 - h. NRC Acceptance of Additional Reevaluation Results 10/15/82
 - i. Completion of Modifications and Return to Power 11/28/82
8. Masonry Walls
 - a. Criteria and Methodology 1/15/82
 - b. Results of Reevaluation 1/11/82
 - c. Respond to NRC Comments 7/9/82
 - d. Provide Decision as to Approach 7/16/82
 - e. Provide Description of Test Program 7/16/82
 - f. NRC Acceptance of Approach and/or Test Program 7/30/82
 - g. Provide Results of Test Program 3/1/83
9. In-Structure Response Spectra
 - a. Provide Spectra and Methodology 7/9/82
 - b. NRC Acceptance of Methodology and Spectra 8/13/82
- D. Mechanical Equipment and Piping
 1. Criteria and Methodology 10/8/81
 2. Partial Results of Reevaluation 4/30/82
 3. Meeting to Resolve NRC Comments 7/23/82

4. NRC Acceptance of Methodology and Criteria 7/30/82
 5. Provide Report with Reevaluation Results 10/1/82
 6. NRC Acceptance of Results 10/15/82
 7. Completion of Modifications and Return to Power 11/28/82
- E. Electrical Raceways and Conduits
1. Provide Criteria and Methodology 7/30/82
 2. NRC Acceptance of Criteria and Methodology 8/13/82
 3. Provide Report with Reevaluation Results 10/15/82
 4. NRC Acceptance of Results 10/29/82
 5. Completion of Modifications and Return to Power 11/28/82
- F. Anchorage of Electrical Equipment
1. Criteria and Methodology 4/12/82
 2. Results of Reevaluation 5/29/81
 3. Document Results of Control Room Review with Actual Floor Response Spectra 7/2/82
 4. NRC Acceptance of Criteria, Methodology and Results 7/30/82
- G. Seismic Backfit Project
1. Criteria and Methodology 4/18/75
 2. Results of Reevaluation 5/18/77
 3. Meeting to Resolve NRC Comments 7/23/82
 4. Respond to NRC April 26, 1982 Letter 7/30/82
 5. NRC Acceptance of Criteria, Methodology and Results 8/13/82

Table 2

Target Milestone Schedule for Completion
of the Seismic Upgrading of San Onofre Unit 1

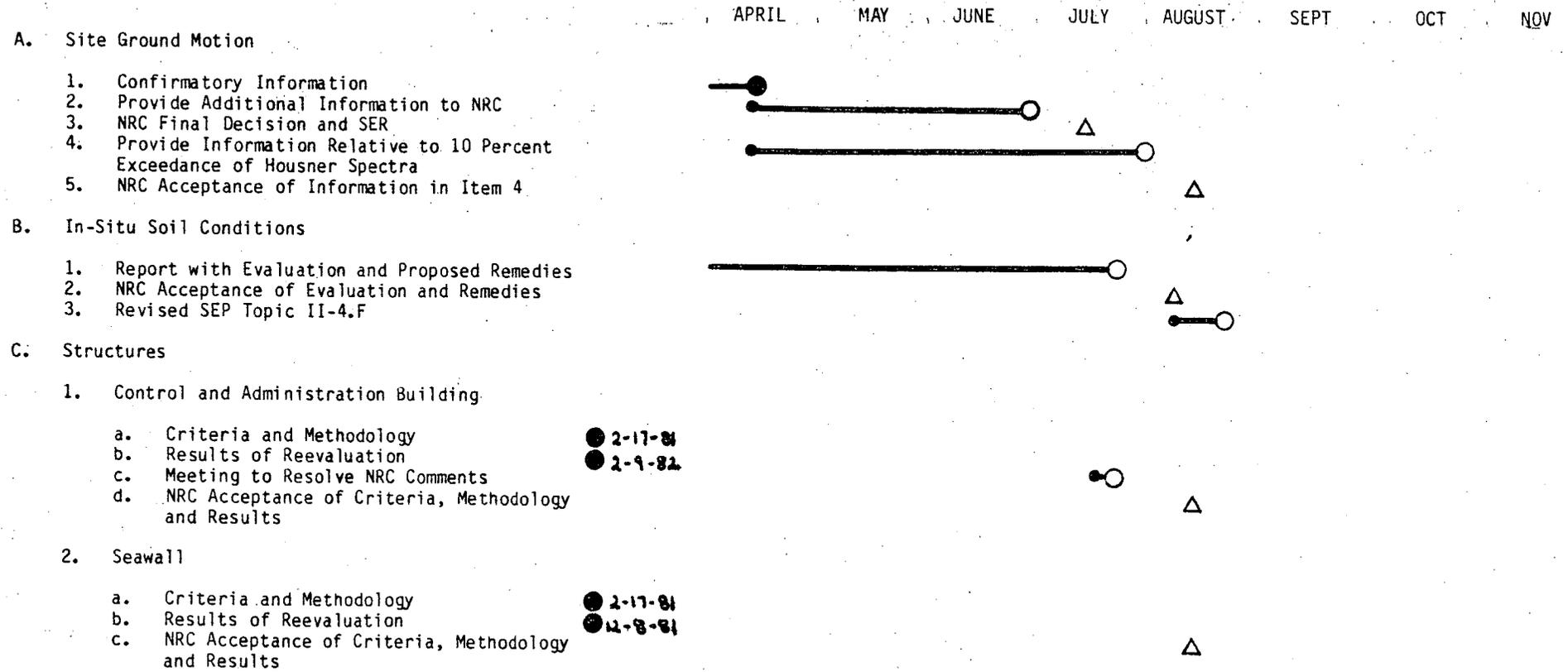


Table 2 (Contd.)

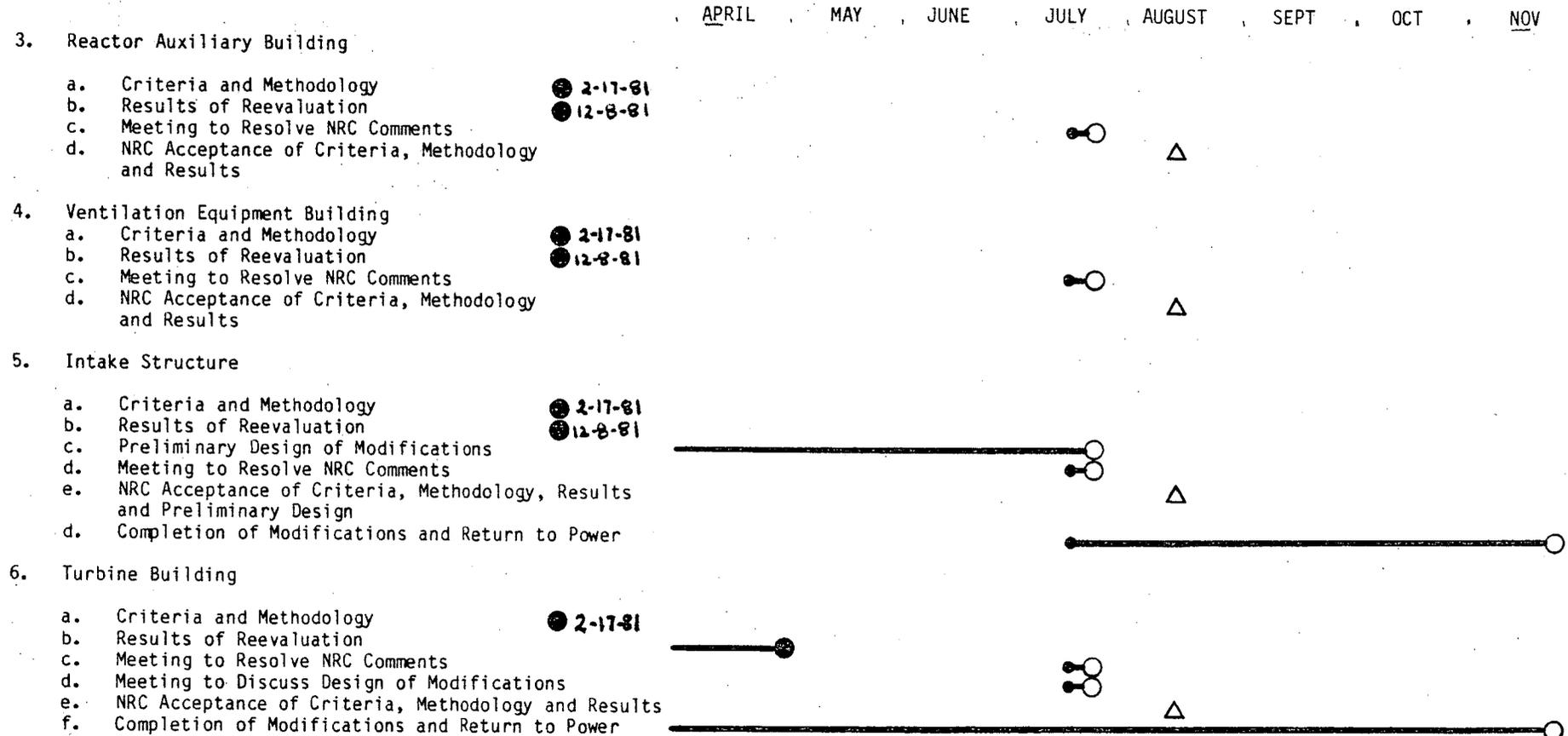


Table 2 (Contd.)

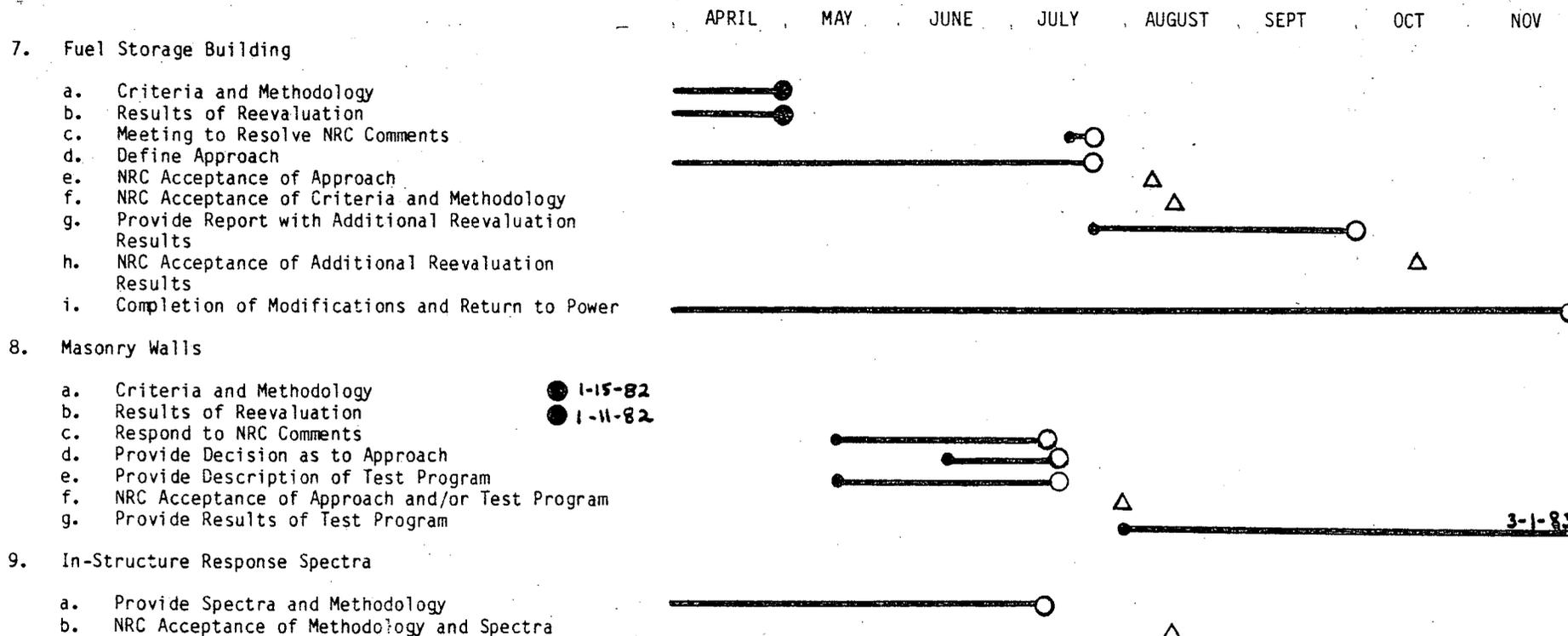


Table 2 (Contd.)

