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AUTH.NAME AUTHOR AFFILIATION
BASKIN,K.P. Southern California Edison Co.
RECIP.NAME RECIPIENT AFFILIATION
MIRAGLIA,F. Licensing Branch 3

SUBJECT: Forwards revised response to NRC Sys Interaction Branch Question 510.1 re seismic & nonseismic Category 1 sys interaction.Response to be distributed w/Amend 24 per 791029 svc list.Affidavit to be forwarded within 10 days.

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Southern California Edison Company

P. O. BOX 800
2244 WALNUT GROVE AVENUE
ROSEMEAD, CALIFORNIA 91770

K. P. BASKIN
MANAGER OF NUCLEAR ENGINEERING, SAFETY, AND LICENSING

TELEPHONE
(213) 572-1401

March 9, 1981

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Frank Miraglia, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

Enclosed are sixty-three (63) copies of the revised response to NRC Systems Interaction Branch (SIB) Question 510.1. The revisions provide the additional information and commitment requested by the SIB auditors during their site audit on March 3, 4, and 5, 1980.

Direct distribution of this response will be made as part of the Amendment 24 distribution which will be in accordance with the service list provided by SCE's letter of October 29, 1979. An affidavit attesting to the fact that distribution has been completed will be provided within ten (10) days of docketing of Amendment 24.

If you have any questions or comments concerning this information, please contact me.

Very truly yours,

K P Baskin

Enclosures

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Question 510-1

Your response to Question 112.40 indicates that you have undertaken a program to ensure that non-seismic Category I systems will not interact with seismic Category I systems. In order for us to evaluate your program, additional information is required. This information should be provided in the form of a systems interaction program description which addresses the following matters:

(1) The objective of the program. The primary objective of the program as well as any secondary or corollary objectives, e.g., maintenance of the ability of safety-related systems to accommodate single failures, should be stated.

(2) The scope of the program. The equipment, i.e., structures, systems and components, to be protected against potentially adverse interactions as well as the types of interactions to be considered in the program, e.g., physical, functional, direct, indirect, should be discussed.

(3) The organization established to implement the program. The organization established to implement the program, including the elements of the organization, their responsibilities and their reporting relationships, should be described. The description should address the corporate management positions responsible for the implementation of the program, the team used to postulate the interactions, any independent audit or review organizations and any consultants used in the program.

(4) The methodology used in the program. The methodology used in the program should be described. The description should address the preparation of the criteria used to postulate the interactions, the preparation and maintenance of a documentation data base, the performance of the walkdowns by the interaction team, the evaluation of the findings and recommendations of the interaction team, the implementation of modifications, the means for ensuring that the modifications themselves will not contribute to adverse interactions and any provisions for independent audit or review of the program.

(5) The criteria used to postulate the interactions. The criteria used to postulate potentially adverse interactions and the bases for the criteria should be described, e.g., failure criteria for various types of non-safety systems.

Response

(1) Objective

A design basis of the San Onofre 2&3 Station is to protect safety-related equipment from seismic events by precluding interactions. This protection is provided to ensure the integrity of the reactor

coolant pressure boundary, to minimize the release of radioactivity, and to enable the plant to be placed in a safe condition, by preventing non-seismic items from interacting with safety-related items.

The seismic systems interaction program for San Onofre 2&3 assures that those portions of structures, systems, or components whose continued function is not required but whose structural failure could reduce the functioning of any safety-related plant feature (including redundancy for single failure protection) to an unacceptable level are designed and constructed so that the SSE will not cause a failure.

(2) Scope

The San Onofre 2&3 program scope provides for physical and functional protection of all safety-related components, systems, and structures to meet the objectives stated above. The program scope does not include seismic qualification of individual components (i.e., vents for valve operators) or control grade/protection grade instrumentation interactions. These items are covered under separate programs.

The conservative approach of seismically designing all significant mass non-safety-related components inherently precludes direct, and indirect system interactions due to the occurrence of an SSE. This approach is applied to all components of significant mass whose failure could adversely affect safety-related equipment located within all SCI buildings.

(3) Organization

The seismic systems interaction program is implemented by the A/E and has been accomplished within the Bechtel project engineering team. The project organization chart is shown in figure 510.1.-1.

An interdiscipline task force was established under the direction of the Project Engineer. The members were qualified engineers from all disciplines, (nuclear, control systems, mechanical, electrical, plant design, civil, and architectural) and were headed by the Nuclear Engineering Group Supervisor (EGS) and the Codes Group.

Potential interactions between source (non-seismically designed items) and target (safety-related) equipment were postulated by the task force using established project practices. The task force also recommended resolutions to the identified interactions. The decisions were reviewed by the Project Engineer and appropriate Assistant Project Engineer (APE).

Final closeout action by the responsible discipline is reviewed and documented by the task force. This also ensures that new interactions are not created.

Methods for seismic design of non-safety-related items, and the guidelines and criteria were established by the various EGS's and were approved by the appropriate discipline chief engineers. The guidelines and criteria are incorporated into applicable project design drawings and specifications. This includes details for field routed or located items such as small pipe. This ensures that field personnel have the proper guidelines and criteria.

The final phase of the San Onofre Seismic interaction program was a field walkthrough of the safety-related areas by a team of supervisory Bechtel office engineers (process assistant project engineer, deputy nuclear engineering groups supervisor and the lead responsible nuclear engineer). The team's findings were reported to the Project Engineer and the interactions task force. A special team including the responsible discipline is formed and resolves the interaction. Closeout action is the same as described above.

The entire program was subject to the normal project practices implemented by the Project Internal Procedures Manual as well as the Project Quality Procedures Manual. Design and design control are carried out in the same manner as that for safety-related items. This includes the performance of appropriate design reviews.

Field work is performed under the direction of experienced field construction superintendents and is inspected by the staff of field engineers stationed at the site. The field engineers are responsible for verifying that construction is performed in accordance with the design drawings and specifications and with applicable standard codes and specifications (see subsection 3A.1.29).

SCE employed an independent consultant (Robert Cloud Associates) to review the seismic interaction program and its results (through 5-80). The consultant reported directly to SCE management.

(4) Methodology

For the San Onofre 2&3 Station a conservative design approach was taken to eliminate the numerous seismic interaction situations that otherwise could occur by:

a. Arrangement of the plant layout was originally based on maximizing the physical separation of redundant or diverse safety-related components and systems from each other and from non safety-related items. Items which are not associated with or do not support the main safety-related components within each area are generally restricted from those areas.

b. Several classes of components located within safety-related structures were seismically designed and constructed for

structural integrity, even though they were non safety-related. Typical items include:

- o Conduit and cable tray
- o Fire protection sprinkler systems
- o Permanent and temporary maintenance cranes
- o HVAC equipment (within the containment only)
- o HVAC ductwork
- o Control room panels
- o Instrumentation supports
- o Control room ceiling lighting
- o Miscellaneous steel such as grating, handrails, staircases and platforms.

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c. The turbine building and large mass components within it, that could interact with safety-related structures were seismically designed and constructed. The reactor protection system loss of load input signals which are generated in the turbine building are protected as discussed in question response 032.10.

As a result of the above design philosophy, the activities of the task force could be effectively focused on the limited number of seismic interaction situations that remained. The review identified the remaining items that required seismic upgrading. The majority of the items evaluated were large and small piping, large mass equipment, and lighting.

The final phase of this program consists of a field walkthrough of safety-related areas. The purpose of this phase is to determine that the project objectives to seismically upgrade non safety-related items in safety-related areas have been implemented.

The seismic interaction program is an ongoing program which will consider current and future modifications to the plant. The above three phases will be followed. The nature of the situation may result in an emphasise on the field review of the changes.

Seismic design of upgraded non safety-related components is based on the installation of adequate supports. Upgraded supports for non safety-related items were seismically designed to similar criteria and specifications (less material documentation) as their safety-related counterparts. For example, piping support design loads are

based on SSE g loading using the applicable floor response spectrum. All piping supports are designed per AISC requirement, with a few exceptions in which under SSE conditions up to 1.5 times the AISC allowable is used. Table 510.1-1 presents the loading combination used for the piping and piping support design. 1.5 times the AISC allowable still provides an elastic solution. 24

Items that are seismically designed on a generic basis or that are uniquely identified, are so indicated on appropriate design drawings and specifications. These documents are subject to all of the review and approvals specified in the Project Internal Procedures Manual. The design drawings serve to document the upgrading of non safety-related items to withstand seismic loads. Decisions and actions resulting from the program are documented by conference notes, letters, design criteria manuals, action items, etc., in accordance with the Project Internal Procedure Manual.

(5) Criteria used for Interaction accessment.

A conservatively simplistic approach was taken, which assumed that any non-safety-related item of significant mass, that is not seismically upgraded, and is located in the vicinity (in the same room) of a safety-related item, will non-mechanistically cause the loss of function or pressure boundary. The item must be relocated or upgraded to preclude the interaction. Engineering judgement is used to ascertain that the small mass items are not a problem based on conservative standard project bolting details.

Because a seismic event affects the entire plant, the redundant or diverse system would be similarly affected; therefore all such situations must be corrected to assure the safety of the plant assuming the loss of offsite power and a single failure (i.e., the evaluation does not take credit for redundancy).

As a result of the NRC field Audit the applicant has committed to evaluating the effect of an SSE on lighting fixtures, and will take corrective action as necessary to prevent adverse interactions. 24

Reference

See response to Questions 112.40 and 032.10, and FSAR subsection 3A.1.29.

Table 510.1-1
SEISMIC UPGRADING OF PIPING

There are two types of piping to be upgraded:

1. Piping up to the first anchour past a SC-I and SC-II or III interface.

   Part of the pipe is seismic category I and part is not as discussed in section 3A.1.29.4. A dynamic analysis is done for the whole line out to the first anchor in the non-seismic category I portion, and the following condition is met:

   $$\sigma_{LP} + \sigma_{DW} + \sigma_{OBE} \leq 1.2S_h$$

2. Seismic Category II and III Piping routed in Safety-related areas.

   a. Small bore (2-inch diameter and less) was analyzed the same as seismic category I, hence meeting the following equation:

      $$\sigma_{PO} + \sigma_{DW} + \sigma_{OBE} \leq 1.2S_h$$

   b. Except as noted in 2.c. below large bore piping was designed the same as seismic category I, hence meeting the equation given in 2.a. above.

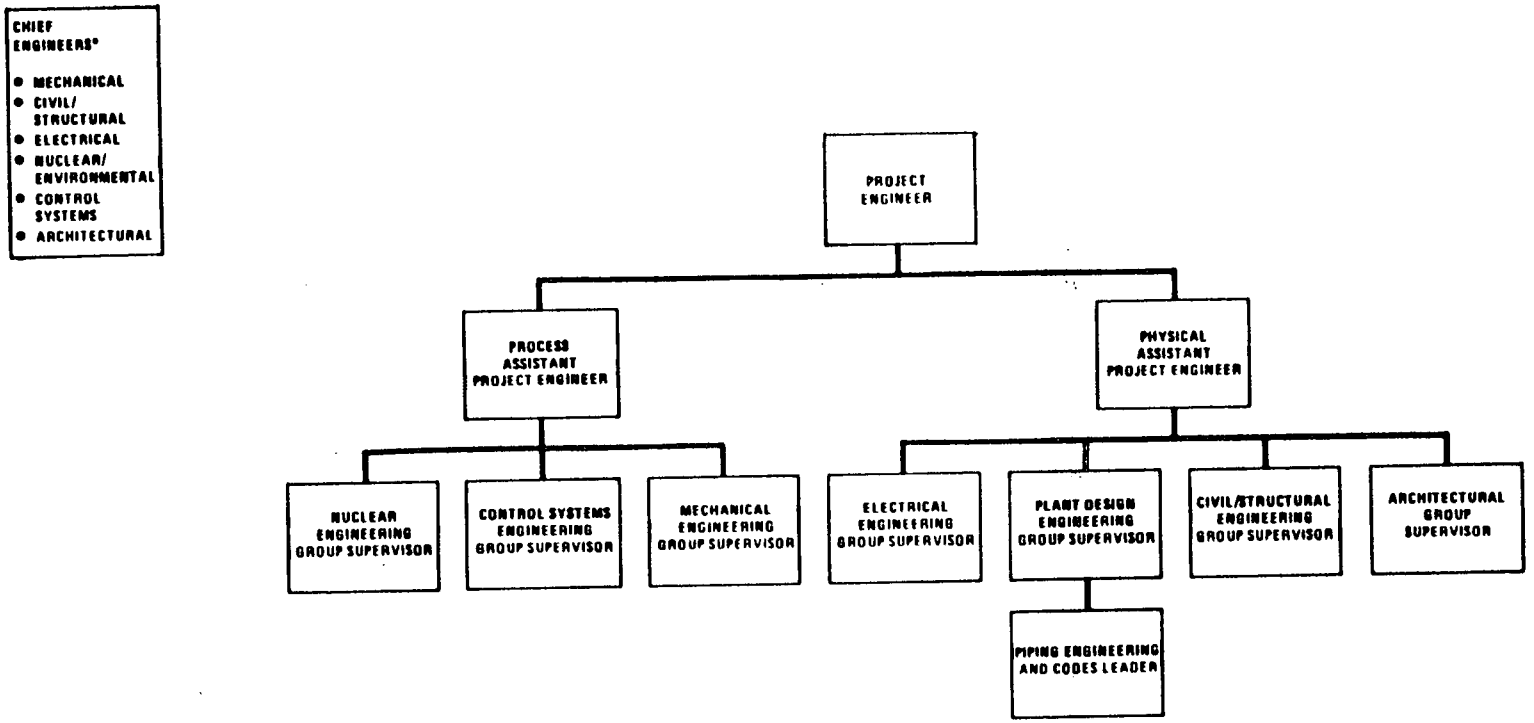
   c. For certain large bore piping runs the support spacing must be increased to accommodate other interferances. For these situations (less than 5 percent of the cases) the following equation is met for the piping using a static analysis and UBC seismic levels.

      $$\sigma_{PO} + \sigma_{DW} + \sigma_{UBC} \leq 1.2S_h.$$

      The pipe supports are designed for a load derived by using a static seismic analysis to the maximum span to estimate the seismic load during the SSE.

      The static seismic analysis is very conservative. A dynamic seismic analysis would show that the seismic category I requirements are met as follows:

      $$\sigma_{PO} + \sigma_{DW} + \sigma_{OBE} \leq 1.2S_h.$$



*CHIEF ENGINEERS PROVIDE OFF-PROJECT TECHNICAL DIRECTION

SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3

SIMPLIFIED BECHTEL PROJECT ENGINEERING ORGANIZATION CHART

Figure 510.1-1