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RECIP. NAME RECIPIENT AFFILIATION
KNIGHTON, G.W. Licensing Branch 3

SUBJECT: Provides addl documentation re control room design review
& safety parameter display sys per Suppl 1 to NUREG-0737

DISTRIBUTION CODE: A003S COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 9+21
TITLE: OR/Licensing Submittal: Suppl 1 to NUREG-0737 (Generic Ltr 82-33)

NOTES: J Hanchett 1cv PDR Documents. ELD Chandler 1cv. 05000361
J Hanchett 1cv PDR Documents. ELD Chandler 1cv. 05000362

RECIPIENT ID CODE/NAME	COPIES LTR ENCL	RECIPIENT ID CODE/NAME	COPIES LTR ENCL
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INTERNAL: IE/DEPER/EPB	3 3	NRR/DHFS/HFEB	5 5
NRR/DHFS/PSRB	1 1	NRR/DL/ORAB	1 1
NRR/DL/ORB5	5 5	NRR/DSI/CPB	1 1
NRR/DSI/ICSB	1 1	NRR/DSI/METB	1 1
NRR/DSI/RAB	1 1	NRR/DSI/RSB	1 1
ORB5 PAULSON, W	1 1	REG FILES	1 1
RGNS	1 1		
EXTERNAL: LPDR	1 1	NRC PDR	1 1
NSIC	1 1	NTIS	1 1
NOTES:	2 2		

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September 1, 1983

Director, Office of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, 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

- References: A. NRC Generic Letter 82-33 dated December 17, 1982
- B. SCE letter from K. P. Baskin to Mr. Darrell G. Eisenhut of the NRC dated May 13, 1983
- C. NRC letter from George W. Knighton to Messrs. Robert Dietch (SCE) and James C. Holcombe (SDG&E) dated July 8, 1983

Reference A provided all licensees with Supplement 1 to NUREG-0737 - Requirements for Emergency Response Capability. In addition, licensees were requested to furnish the NRC a proposed schedule for completing each of the basic requirements for the items identified in the enclosures to Reference A.

Reference B provided SCE's response to the NRC's request. Reference C provided SCE with the results of the NRC's review of Reference B as it relates to the requirements of Supplement 1 to NUREG-0737 for the Detailed Control Room Design Review (CRDR) and the Safety Parameter Display System (SPDS).

Reference C states that for licensees which have previously completed activities applicable to the CRDR and SPDS, it is not the NRC's intent that those activities be repeated. However, sufficient documentation must be submitted to allow the NRC staff to evaluate the adequacy of the licensee's program for performing the CRDR and SPDS reviews. Further, it was stated that if SCE believes that the requirements of Supplement 1 to NUREG-0737 have been fulfilled, then documentation to this effect must be provided. That is precisely the case with SONGS 2 and 3 and it is the purpose of this letter to provide additional documentation to describe the process followed by SCE with regard to the CRDR and SPDS reviews.

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First, with respect to the CRDR issue, SCE recognized the importance of this issue early as a result of the initial evaluations of the TMI incident and initiated an aggressive approach toward resolution of the CRDR issue. Even though the NRC had not yet issued new specific guidance relative to the CRDR, SCE commissioned a task force to evaluate the SONGS 2 and 3 Control Room in June, 1980. Enclosure I to this letter provides a summary CRDR description of SCE's activities which resulted in the existing configuration of the SONGS 2 and 3 Control Room. As indicated in the enclosure, SCE actively pursued NRC involvement in the CRDR effort to ensure that the aggressive SCE approach was consistent with the NRC's philosophy and that members of the NRC's Human Factors Engineering Branch were involved to assure that the findings from the NRC's audit of the Control Room's of other nuclear power facilities were factored into the SONGS 2 and 3 CRDR. This aggressive effort by SCE was undertaken to provide early resolution of a firm control room design to minimize the possibility of operator errors once the plant was licensed due to subsequent changes to the control room configuration that would require substantial retraining of operators.

Enclosure I summarizes activities from the establishment of the CRDR Working Group in June of 1980 to the final resolution of the NRC's concerns relative to the CRDR. Specifically, the enclosure discusses SCE's program for CRDR and the NRC's involvement, including the NRC Audit of the SONGS 2 and 3 Control Room and the resolution of corrective actions identified by the NRC. In addition, Enclosure I addresses the nine specific requirements of Paragraph 5.1.b of Supplement 1 to NUREG-0737. SCE will be pleased to meet with the current NRC staff and present this information in more detail to help facilitate a better understanding of this material and previous SCE/NRC interaction relative to the SONGS 2 and 3 CRDR.

Relative to the Remote Shutdown Panel (RSP) the RSP was evaluated to the CRDR review criteria and considered to be adequate during the CRDR. Subsequently, during startup testing, areas of potential improvements to the RSP to facilitate enhanced operation were identified. SCE is in the process of evaluating these items. Any changes implemented as a result of this evaluation will be made utilizing the criteria developed and applied to the SONGS 2 and 3 Control Room.

Second, with respect to the SPDS, Reference B discussed pertinent documents that have previously been sent to the NRC describing the SONGS 2 and 3 equipment additions that perform the SPDS function. In addition, information was also provided with respect to SCE's implementation schedule for the SONGS 2 and 3 display systems.

The SPDS for SONGS 2 and 3 provides a structure to display a minimum set of information which define the safety status of the plant. This information would be utilized by an operator to diagnose or respond to a plant transient or event to assist in maintaining plant safety. Enclosure 2 provides additional information to the NRC for the Critical Functions Monitoring System (CFMS) of the SONGS 2 and 3 Accident Monitoring System. This enclosure provides an analysis of the SPDS requirements as part of the CFMS.

September 1, 1983

The specific parameters monitored for each of the critical functions as described in Table 2 of the enclosure were selected as those that provide information important to the evolution and diagnosis of the design basis transients and accidents as addressed in Chapter 15 of the FSAR. When the SONGS 2 and 3 display systems hardware are fully implemented in accordance with previous commitments, the ranges for the selected parameters will be consistent with Regulatory Guide 1.97. Consequently, SCE considers an event specific safety analysis for the SPDS is not necessary.

Since the equipment comprising the SPDS for SONGS Units 2 and 3 is being made operational on a phased schedule as described in Reference B, an Implementation Plan has been developed for using the SPDS in conjunction with the operator's response to emergency or accident conditions. Although the basic display equipment for the SPDS (that is, the CFMS) is operational on both SONGS 2 and 3, the complete complement of inputs and the final software for processing all the inputs will not be completed until first refueling of both units. Consequently, the plan for Cycle 1 operation is to develop operator familiarization with the use of the CFMS and verify system performance. Existing operating instructions reference the use of CFMS information to cross check or supplement other indicators or strip chart recorders. In anticipation of completing the required input signals and software to the SPDS at first refueling, the implementation plan provides for the development of a strategy for SPDS use that can be incorporated into the upgraded Emergency Operating Instructions (EOI's) currently under development as a separate post-TMI commitment. This strategy will be based on input from Combustion Engineering, SCE operations and engineering and other utilities who have accepted the CFMS design for their SPDS. The specific methodology for integrating the SPDS information into the EOI's and subsequent operator actions has not yet been determined; it is expected that the approach to be used will be finalized in sufficient time to allow SPDS integration with procedure preparation and training accomplished consistent with the first refueling schedule for implementing the upgraded EOI's.

If you have any questions regarding this information, please call me.

Very truly yours,



M. O. Medford
Supervising Engineer
San Onofre Units 2 and 3 Licensing

Enclosures

cc: H. Rood (to be opened by addressee only)

CONTROL ROOM DESIGN REVIEW

When the initial evaluations of the 1979 TMI incident were completed, it became evident that human factors engineering deficiencies were significant contributory factors to the seriousness of the incident. Because SCE recognized the importance of this issue to the safe operation of San Onofre Units 2 and 3, SCE management commissioned a task force to perform a human factors review of the SONGS 2 and 3 control room. This action was taken even though the NRC had not yet proposed/issued new requirements as a result of the TMI investigation.

A Control Room Design Review (CRDR) Working Group was activated in June 1980 with the following guidelines:

1. To review the SONGS 2 and 3 control room from a human factors standpoint,
2. To identify all the man-machine interface areas where significant human factors enhancement could be accomplished, and
3. To propose recommendations for approval and implementation.

The CRDR Working Group was a multi-organizational group to assure objectivity and a proper blend of disciplines and experience. The group included representatives from SCE-Engineering and Operations, Combustion Engineering-NSSS, Bechtel Power Corporation-Engineering, and Whitson Associates-Human Factors Engineering. This group included a representative from SCE Operations with reactor operator experience. It should be noted that while most of the participants of the working group had knowledge of the plant, none were involved in the original design of the plant or control panels. This was done deliberately to minimize the problems associated with designer bias.

The CRDR plan of action was as follows:

1. Review all existing documentation - NUREG's, standards, specifications, NRC audits, etc.,
2. Review operating instructions as they pertain to control room activities.
3. Summarize major areas identified for human factors improvement or enhancement,
4. Develop criteria for application of human factors engineering to the specific areas identified, and
5. Evaluate the control room utilizing that criteria and summarize the results in a report to SCE management.

Since the NRC had not yet issued new specific guidance relative to the human factors engineering issue as a result of TMI, SCE requested a meeting with the NRC staff to discuss our approach and obtain NRC input towards early resolution of this issue for the SONGS 2 and 3 control room. SCE subsequently met with the NRC staff (including representatives of the NRC Human Factors Engineering Branch) on July 2, 1980 in Bethesda, Maryland. During the meeting SCE provided an overview of the ongoing SONGS 2 and 3 CRDR and discussed general topics and requirements for a subsequent NRC site audit of the control room. The NRC's audit was scheduled for August 4-8, 1980. The NRC's meeting announcement of this audit is provided as Attachment 1.

In the interim the CRDR Working Group utilized the following documents to help identify deficiencies and develop solutions:

- o NUREG-0585 - TMI-2 lessons learned Task Force Final Report 10/79
- o NUREG-0660 - NRC Action Plans developed as a result of the TMI-2 Accident 5/80
- o EPRI NP-1118 - Human Factors Methods for Nuclear Control Room Design Final Report 11/79 and 2/80
- o NRC Human Factor Review of:
 - VEPCO-North Anna Unit 2
 - TVA-Sequoyah Plant
 - PSE&G-Salem Unit 2
 - Duke Power-McGuire Unit 1
- o Human Factors Engineering Guidelines required for Control Room Design and Evaluation - Human Technologies, Inc.

The working group attacked the problem by reviewing the existing control room layout, control panel configuration, instrument arrangements, labeling, and annunciator systems. Mock-ups of the control room panels were made for the use of the group and for the use of the engineering design group to help in the implementation of the working group recommendations.

Review of the NRC's previous audits of other plants established certain repetitive deficiencies. Those that were determined to be pertinent to the SONGS 2 and 3 control room design were identified and were included in the starting point of the CRDR Working Group activities.

With this information as background, the CRDR continued by evaluating such things as the anthropometrics, labeling, original displays, control/display integration and work space design in varying degrees of detail.

In order to facilitate a better NRC understanding of the SONGS 2 and 3 control room design and SCE's program plan for this review, SCE provided the following information informally to members of the NRC audit team prior to the scheduled audit:

1. SCE's "Control Room Design Review Interim Report" dated July 25, 1980 (Attachment 2)

2. Draft Emergency Operating Instructions (LOCA, Steam Generator Tube Rupture, Steam Line Rupture & Loss of Feedwater or Steam Generator Level)

The "Control Room Design Review Interim Report" (Attachment 2) describes the CRDR working group review plan as described above and the status of the following items at that time:

1. Identification of potential and real problem areas in control room panel design.
2. Development of criteria to resolve problems identified.
3. Recommendations for solutions to certain identified problems.
4. Recommendations for on-going study of other problems.

During the August 4-8, 1980 NRC audit of the SONGS 2 and 3 control room the following items/activities were discussed/performed:

1. Scope and Objectives of SCE's CRDR including preliminary recommendations
2. NRC assessment of control operator and control room equipment interaction/interface during responses to several simulated emergency conditions.

Particular emphasis was placed by the NRC on the following aspects of the control room:

1. The adequacy of information presented to the operator to reflect plant status for normal operation, anticipated operational occurrences, and accident conditions;
2. The groupings of displays and the layout of panels;
3. Improvements in the safety monitoring and human-factors enhancement of controls and control displays;
4. The communications from the control room to points outside the control room, such as the onsite technical support center, remote shutdown panel, offsite telephone lines, and to other areas within the plant for normal and emergency operation.
5. The use of direct rather than derived signals for the presentation of process and safety information to the operator;
6. The operability of the plant from the control room with multiple failures of nonsafety-grade and nonseismic systems;

7. The adequacy of operating procedures and operator training with respect to limitations of instrumentation displays in the control room;
8. The categorization of alarms, with unique definition of safety alarms.
9. The physical location of the shift supervisor's office either adjacent to or within the control room complex.

On August 29, 1980 SCE was informally provided with a draft report delineating the NRC audit findings and conclusions. SCE subsequently met with the NRC staff on September 16, 1980 to discuss SCE's response to the NRC's audit findings. SCE's letter of October 29, 1980 (Attachment 3) documented the NRC's audit findings and corresponding SCE responses and commitments to those findings which were made during the September 16, 1980 meeting in order to satisfy the NRC's concerns. It should be noted that many of the NRC's findings were previously identified by SCE during the CRDR process and plans were already in progress to correct many of the findings.

The NRC August 4-8, 1980 audit findings were additionally documented by the NRC in Item 1.D.1 of Supplement No. 1 to the Safety Evaluation Report for SONGS 2 and 3, dated February, 1981 (Attachment 4). The NRC concluded in the SER that in general,

"....the control room was designed to promote effective and efficient operator actions. The controls and displays are, in most cases, functionally grouped and generally well integrated. Alarm displays have good visibility and are easily readable from the main control area. Alarm displays are located over appropriate system controls and displays. The physical design of the vertical boards and the control console reflects consideration of human anthropometry. Alarm panels are tilted down for normal visual access and all controls on bench boards are accessible to operators. In many cases the deficiencies identified by the staff had been previously identified by SCE during their control-room review, and plans are in process to rectify many of these deficiencies."

The SER specified a schedule for correcting the deficiencies identified. The information presented in the SER was consistent with the agreements SCE had reached with the NRC during the September 16, 1980 meeting as documented by SCE's October 29, 1980 letter to the NRC.

Furthermore, many of the deficiencies identified in the SER were included by the NRC in License Condition 2.C(19)f of the SONGS 2 Operating License (Attachment 5). Also, License Condition 2.C(17)c of the SONGS 3 Operating License (Attachment 6) requires implementation of the corrective actions specified in the SER. SCE's letter of August 19, 1982 informed the NRC that all activity associated with the seventeen corrective actions specified in the SONGS 2 license condition had been satisfied. As a result of SCE's review of the corrective actions specified in the SER, it is concluded that all corrective actions required for the SONGS 2 and 3 Control Room have been completed.

In addition to the above, details associated with SCE's CRDR were presented to the NRC Advisory Committee on Reactor Safeguards (ACRS) in early 1981. No additional actions resulted from those meetings. Excerpts from the ACRS transcripts are provided as Attachments 7 and 8 for your information.

It should be noted that the modifications to the control room were not limited to the items identified by the NRC in the SER or SONGS License Conditions. The modifications made by SCE incorporated all of the NRC's requirements into a well configured/engineered scheme which included the following:

- o The panels and all instrument bezels were repainted to provide system demarcation.
- o All labels were changed and relocated to satisfy the hierarchical CRDR labeling criteria.
- o Pushbutton and status light lenses were changed to provide revised legends and glare free lenses.
- o The annunciator system was prioritized by color coding windows, the ringback feature added, the location mimic added to the panel, and the acknowledge and reset capability modified.
- o The operating and emergency instructions were revised.
- o The communication system was modified.

Based on operating experience with the control room modifications identified in License Conditions 2.C(19)f and 2.C(17)c for SONGS 2 and 3, respectively, SCE may identify the need to further change these modifications. If that situation does arise, SCE will so inform the NRC. As additions or modifications are made to SONGS 2 and 3 necessitating control room changes, the criteria developed during the CRDR will be utilized to the extent applicable.

Attachments 9 and 10 provide photographs of an artist's rendition of a typical control panel before, with line demarcation added, and after (respectively) the CRDR modifications were implemented. It is quite clear from these photographs that the modification resulted in substantial changes which enhance the operators' capability for successful incident evaluation responses during stressful incidents and would minimize the possibility of human factors induced errors.

In summary, SCE believes that the information provided in this Enclosure and the Attachments thereto adequately address the NRC's nine specific requirements of Paragraph 5.1.b of Supplement 1 to NUREG-0737.

DLC:8957

ENCLOSURE 1
ATTACHMENT 1



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 31 1980

Docket Nos.: 50-361/362

MEMORANDUM FOR: A. Schwencer, Acting Chief, Licensing Branch No. 3,
Division of Licensing

FROM: H. Rood, Project Manager, Licensing Branch No. 3,
Division of Licensing

SUBJECT: FORTHCOMING MEETING WITH SOUTHERN CALIFORNIA EDISON
COMPANY

DATE & TIME: August 4-8, 1980
9:30 A.M. - 4:00 P.M.

LOCATION: San Onofre Nuclear Generating Station
Unit 1 Administration Building
San Diego County, California

PURPOSE: To conduct on-site review of San Onofre 2 and 3 control
room design and operation.

PARTICIPANTS: SCE
F. Nandy, et al
NRC
D. Scaletti
R. Froelich

H. Rood

H. Rood, Project Manager
Licensing Branch No. 3
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cc: See next page

3pp.

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ENCLOSURE 1
ATTACHMENT 2