U.S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos. 50-361/88-13, 50-362/88-14

Docket Nos. 50-361, 50-362

License Nos. NPF-10, NPF-15

Licensee: Southern California Edison Company
P. O. Box 800
2244 Walnut Grove Avenue
Rosemead, California 92770

Facility Name: San Onofre Units 2 and 3

Inspection at: San Onofre, San Clemente, California

Inspection conducted: June 1, 1988 through June 14, 1988

Inspector: Robert J Pate for 9/8/88
Mr. Perry Stewart, Team Leader Date Signed
Region IV

Team Members: J. O'Brien, Senior Reactor Inspector, Region V
L. Defferding, Licensing Examiner
C. Tolbert, Human Factors Specialist
S. Sun, Reactor Systems Engineer
P. Bibb, Resident Inspector, St. Lucie
A. Hon, Resident Inspector, San Onofre

Approved By: Robert J Pate for 9/8/88
J. E. Gagliardo, EOP Manager Date Signed
Region IV

Inspection Summary

Inspection on June 1 through June 14, 1988 (Report Nos. 50-361/88-13 50-362/88-14)

Areas Inspected: Special team inspection of Units 2 and 3 Emergency Operating Instructions (EOI) including the following areas:

- o Basic EOI/CEN-152 comparison
- o Technical adequacy review of the EOIs
- o Control Room and plant walkdown
- o Simulator
- o EOI ongoing evaluation
- o Human factors related guidance

Results:

General Conclusions and Specific Findings: No unsafe operational conditions were identified.

Significant Safety Matters: None.

Summary of Violations: None.

Open Items Summary: During this inspection, three follow-up items were opened. Follow-up is warranted in: (1) incorporation of instrumentation safety margins into the emergency operating instructions, when the CEN-536 study identifies the appropriate margins needed; (2) revision of the Writer's Guide to provide a method for incorporating minor changes into the emergency operating instructions; and (3) review of operator attitude and training in the use of the new functional recovery instruction.

DETAILS

1. Persons Contacted

Southern California Edison (SCE) Company

*C. McCarthy, Vice President, Site Manager
H. Morgan, Station Manager
*R. Krieger, Operations Manager
V. Fisher, Assistant Operations Superintendent, Units 2/3
*M. Wharton, Assistant Technical Manager
*G. Gibson, Compliance Engineer
*M. Trillo, Unit 2/3 Operating Procedures Supervisor
*T. Vogt, Assistant Operations Superintendent, Units 2/3
*M. Hyman, Training Administrator
*G. Swift, Training Instructor
*D. Powers, Shift Technical Advisor
*G. Vaslos, Quality Assurance Engineer
T. James, Simulator Training Supervisor
R. Mette, Operations Training Supervisor
M. Kelley, Simulator Training Instructor
M. Jones, Operations Technical Assistant
K. Johnson, Engineering Supervisor
J. Tate, Operations Technical Assistant

*Denotes those attending the exit meeting on June 14, 1988.

The inspectors also contacted other licensee employees during the course of the inspection, including operations shift superintendents, control room supervisors and control room operators.

Also in attendance at the exit meeting on June 14, 1988, were the following NRC and NRC contracted staff personnel:

W. Regan, NRR Chief, Human Factors Branch
A. Chaffee, Region V Deputy Division Director
J. Gagliardo, Region IV Section Chief, CE EOP Manager
P. Stewart, Region IV CE EOP Team Leader
J. O'Brien, Region V Reactor Inspector
C. Tolbert, SAIC, Human Factors Engineer
L. Defferding, Battelle Northwest Labs, License Examiner
S. Sun, NRR Reactor Systems Engineer
A. Hon, San Onofre 1 Resident Inspector

2. SAN ONOFRE 2 AND 3 (SO23) EOI/CEOG CEN-152 Procedure Comparison

A comparison of the San Onofre 2 and 3 (SO23) Emergency Operating Instructions (EOIs) and the Combustion Engineering Owners Group (CEOG) Emergency Procedure Guidelines (EPG) CEN-152, Revision 2 was conducted to ensure that the licensee had implemented procedures in accordance with the CEOG recommendations. The EOIs reviewed are listed in Part I, Appendix A, of this report. The comparison included a review of the licensee's

documents and interviews of personnel to verify that deviations from CEN-152 were justified.

The inspectors determined that the licensee had adequately developed plant specific EOIs to implement CEN-152, Revision 2. The changes from the CEN-152 recommendations were reviewed with the bases established and documented by the licensee.

No violations or deviations were identified.

3. Independent Technical Adequacy Review of the EOIs

The S023 EOIs listed in Part I, Appendix A, were reviewed to ensure that the procedures were technically accurate and incorporated the guidelines of CEN-152 Revision 2. This review verified that the CEOG step sequence was followed, the exit/entry points were correct, transfer between procedures was well defined and appropriate for procedures performed concurrently, that minimum staffing was met, and that notes and cautions were used correctly. Each deviation from CEN-152 was reviewed to ensure that safety significant deviations were reported to the NRC as required, that safety evaluations were performed per 10 CFR 50.59 and that deviations warranted by specific plant design were incorporated, and prioritization of accident mitigating strategies were correct.

The team determined that, in general, the EOIs adequately incorporated the procedure guidelines of CEN-152. The summary of the findings and observations of the S023 EOIs is as follows:

- The S023 EOIs generally followed the CEN-152 Revision 2, step sequence with inclusion of plant specific actions and details, such as valve designations, or specific operation tasks required to accomplish the actions. The EOIs used floating steps (FSs) to include the non-sequence steps contained in CEN-152 (those steps designated with an asterisk). Specifically the FSs included instructions for re-startup of RCPs, throttling/stopping of safety injection (SI) flow, identification and elimination of voids, and termination of containment spray (CS) system, etc. Use of the FSs concept maintains the integrity of the sequential steps and prevents the operator from having to continuously go back through all procedure steps to locate and review a non-sequence step.

- Entry/exit points to the S023 EOIs were clearly stated and could be followed by trained reactor operators.

- Notes within the S023 EOIs were generally clear and appropriately located in the EOI.

- The CEN-152 prioritization of the accident safety function investigation hierarchy was maintained in the EOIs.

- The plant specific values for plant protection system setpoints (e.g., SIAS, CIAS, CSAS) were consistent with the plant design valves.

During the EOI review, the team identified a number of technical concerns in the EOIs, and they are listed along with the licensee's responses in Appendix B of this report. The identified concerns focused on three areas: (1) inadequate documentation of technical bases for the setpoints for the plant protection system or acceptance criteria of the safety function status checks; (2) omissions of major steps specified in the CEN-152 guidelines without technical justification for the omissions; and (3) deviation from the suggested procedural steps listed in CEN-152 without providing technical bases and/or justification for the use of alternative steps contained within the plant specific EOIs. During the inspection, the licensee either provided the clarification to the EOP deviations from CEN-152 or acknowledged the technical deficiencies, which were identified by the inspection team, and agreed to correct them in the EOIs as required to be consistent with CEN-152 in the next revision to the SO23 EOIs. The team determined that the licensee's resolutions were acceptable. The team also identified the following item regarding instrument errors in an adverse containment environment.

- The industry recognizes that instrument accuracy is affected significantly by adverse containment environments resulting from the steam line breaks, feedwater line break, and LOCAs inside the containment. The instruments effected include pressurizer level and pressure, steam generator pressure and level, and reactor coolant system temperature indicators. However, as stated in a letter from V. C. Hall (CE) to M. L. Merle (SCE), dated February 27, 1984, these errors have not been assessed for SO23. In general, only traditional (not including the effect of the adverse containment environment) instrument errors for instruments (including plant protection setpoints) were considered in the preparation of the EOIs. The team identified a concern regarding the effective use of EOIs for accidents resulting from breaks inside containment, since no consideration of instrument errors in these conditions was included in the EOIs in the area of setpoints for plant protection systems (i.e., SIAS, EFAS, CIAS, CSAS, etc.), nor in the acceptance criteria of safety function status checks. In response, the licensee stated that the study of instrument errors in a harsh containment environment, was currently underway with CEN Task 536. The licensee was awaiting the results of this project and will revise its EOIs accordingly. In order to satisfactorily close out this issue, the licensee is required to submit the results of the CEN Task 536 and its impact to the SO23 EOIs for NRC (NRR) review and approval. The licensee also committed to provide a schedule for submittal of these documents. This item will be followed up by the NRC resident inspector during a future inspection (Open Item 50-361/88-13-01).

No violations or deviations were identified.

4. Review of Validation Program and Independent Verification of the EOIs (25592)

As a result of the TMI-2 accident, NUREG-0899 was issued in August 1982 to establish the guidelines for the development and implementation of EOIs which would provide the operators with directions to mitigate the consequences of a broad range of accidents and equipment failures.

Paragraph 3.3.5 of this NUREG required that, after development, the EOIs were to undergo a process of verification/validation to determine that the procedures were technically adequate, address both technical and human factors issues, and could be accurately and efficiently carried out.

The licensee's procedure, OP-SO23-O-39, Emergency Operating Instruction Authors Guide, outlined the validation program and provided detailed instructions and forms for desk top reviews and simulator exercises.

The licensee provided documentation to show that the simulator portion of their validation program met the following purposes:

- Determine that the simulator equipment uses the designations, units of measure and operation that is used in the EOIs.
- Determine that the EOIs could be understood and followed without confusion, delays, or errors.
- Determine that the EOIs are assured to guide the licensed operator in mitigating transients and accidents.

A review of procedure records showed that the procedures had been reviewed and comments submitted, but documentation was not provided to verify that desk top reviews had been done or documented according to the Writer's Guide. The desk top reviews were expected to ensure that:

- The EOIs accurately reflect the CEOG Guidelines.
- The EOIs accurately reflect the Writer's Guide.
- The EOIs use language and level of information that was compatible with the qualifications, training, experience, and the minimum number of licensed operators on shift.
- The EOIs reference controls, equipment, and hardware that are available.

The inspection team conducted control room, simulator and plant walkdowns of the EOIs listed in Part I of Appendix A of this report to ensure that the procedures were validated and verified by the licensee.

During the walkdown, instruments and controls were verified to be correctly labeled, indications referenced in the procedures were available to the operator and values were not too specific for the indicators available (except for those deficiencies indicated below and in Appendix D). Administrative procedures were reviewed to ensure adequate controls existed to incorporate changes to the EOIs, and that the latest revision was available to the operators, and that they were easily accessible. Documentation of the licensee's validation program was reviewed to ensure that discrepancies noted were adequately addressed and corrected, and comprehensive reviews were conducted.

The team noted that when modifications were made in the plant or the control room that the applicable EOIs had not been changed to reflect the

modifications. The team noted that several EOI deficiencies, which had been identified, had existed for nine months in some cases. The root cause of the accumulation of several minor deficiencies in the EOIs was that the Writer's Guide did not provide a mechanism for making minor corrections to the EOIs. The licensee committed to correct this deficiency by changing the Writer's Guide, which will permit temporary changes to the EOIs. The team determined that the licensee's proposed corrective action appeared adequate.

During one of the simulator scenarios, the plant reached a condition where a safety function could not be met in procedure S023-12-2, Reactor Trip Recovery, Attachment 1, safety function status check, reactivity control C 1 or 2 and the crew returned to the Functional Recovery EOI. The success path RC-1, Attachment 1, Chart 1, page 15 of 55, only required reactor power to be less than 10^{-4}%, which was being met. This would have sent the operators back to trip recovery procedure again. The licensee agreed to review this procedure and correct any inconsistencies in the next revision.

The licensee committed to make the appropriate procedure revisions to the deficiencies identified as noted in Appendix D. The licensee's correction of the noted EOI procedural deficiencies will be followed up in a later inspection (Open Item 50-361/88-13-02).

No violations or deviations were identified in this area.

5. EOI Training (25592)

The inspectors assessed the adequacy of the EOI training by reviewing three areas. The first dealt with observing an unrehearsed operating crew performing the EOIs in the site-specific simulator with scenarios designed to exercise each of the EOIs. The second effort was to review the lesson plans and training records for the hot licensed and requalification operator training programs as it pertained to EOI training. Finally, interviews were conducted of a selected sample of the Operations Staff.

a. Simulator Scenarios

The team's licensed operator examiner and reactor inspector developed scenarios similar to those used for licensed operator exams and EOI training. During the performance of these scenarios with the unrehearsed operating crew, the entire NRC EOI inspection team had the opportunity to: observe the operator's performance to validate or dismiss any concerns that may have been raised during the table-top reviews of the EOIs; assess the licensee's operating philosophy (possibly it differs from CEOG guidance in CEN-152); assess the human factors elements (place keeping, assignment of duties, physical interference, etc.) associated with the performance in a "real time" atmosphere; and observe how the operators diagnosed accident conditions, and transition from one EOI to another. The team made the following observations:

- The operators exhibited adequate knowledge of the EOIs and the CEN-152 guidance.

- o The operators seemed reluctant to use the Functional Recovery Procedure (FRP). See comments in paragraph c below and in Section 7 of this report.

- o Control room manning for a single unit implementing the EOIs was adequate; however, staffing would be slightly strained if both units were involved in the EOIs. See comments in paragraph c below.

- o Other Human Factors type observations are addressed in Section 7 and Appendix C of this report.

b. Formal Training Programs

Lesson plans and simulator scenarios used for EOI training were reviewed to determine whether the training covered the technical basis for the procedure. The lesson plans and material reviewed are listed in Part III of Appendix A. This review included a review of attendance sheets for randomly selected lesson plans, and examined how the licensee handled makeup training for those who miss the normally scheduled training. The team made the following observations:

- o The hot license training programs adequately covered the technical basis and operating philosophy of the EOIs; however, the requalification program failed to emphasize these areas. The requalification program involved approximately three hours of lecture and three hours in the simulator for each EOI. No additional time was spent on the FRPs.

- o The requalification program relied heavily on the operations "priority" reading program for EOI changes, and only had computer based "plato" exams to ensure that the operators were current with the EOIs.

The training program met the minimum requirements as committed to by the licensee and was comparable to training programs at other similar facilities.

c. Operator Interviews

Operators were interviewed to determine their understanding of the EOIs and their responsibilities and required actions, both individually and as a team. Additionally, operators were interviewed to determine if they felt that actions were duplicated by other operators, that they were knowledgeable of the requirements for transitioning from one procedure to another, and that training was conducted on revised EOIs before they were implemented.

The operators made the following comments indicating their concerns:

(1) Difficulty in the use of the FRPs.

"Entry conditions for the FRP were vague; you only enter the FRP when you don't know what to do." "The FRP is a last resort effort." "If you enter the FRP from one of the event based procedures you waste too much time confirming what you already verified in the event based procedure." "Exit conditions from the FRP are confusing." "Training on selection of proper success paths was weak."

(2) EOI procedures and training lacked guidance when both units were simultaneously implementing EOIs.

"The procedure provided adequate reminders of equipment and resources available from the other unit, but failed to address what would happen if the casualty affected both units." They also had no recollection of any training done to address this area.

These observations and the weaknesses in the requalification programs (paragraph b) were presented to the licensee at the exit meeting, and they noted that the improvements will be incorporated in the Revision 3 training this August 1988, and in the Revision 3 to the EOIs to be implemented by October 1988.

No violations or deviations were identified.

6. On-going Evaluations of EOIs (25592)

Administrative procedures listed in Part II of Appendix A were reviewed to ensure that the licensee has an effective program in place to maintain the EOIs up to date and provide feedback from operator experience, simulator exercises, actual post-trip reviews, control room/plant walkthroughs, and plant design changes. These administrative procedures were found to contain sufficient direction to ensure positive feedback of information to effect changes in the EOIs. In some instances, the procedure contained a form for the user to complete, describing the proposed change, identifying the change by a specific number, and providing justification for the change. Several of these completed forms were reviewed by the team and found to be satisfactory.

The team noted that EOIs were treated differently than other site procedures, in that temporary changes were not permitted to be made to EOIs. This fact was noted in Operating Procedure SO123-0-20, Revision 0, paragraphs 6.4.3.2 and 6.7.1.1. Changes to EOIs could only be made in the more rigid permanent revision manner with formal review and approval. This observation is discussed in Section 4 of this report.

No violations or deviations were identified in this area.

7. Human Factors Analysis of EOIs (25592)

An integral part of the EOI inspection effort was to identify human factors considerations in the implementation of SO23 EOIs. The human factors review covered a number of domains including analysis of the procedures, observations of instruments in the control room, outside the

control room, and environmental factors, to name a few. The data were obtained via several methods:

- o Table-top review of the EOIs and the Writer's Guide.
- o Walkthroughs of the Unit 2/3 control rooms and plants.
- o Observation of simulator scenarios.
- o Interviews with operators.

Specific examples of deficiencies discussed in this section are provided in Appendix C.

a. Functional Recovery Instruction Procedure

The EOI inspection team observed that operators were reluctant to enter the FRP. The inspection team determined that based on the observations during the simulator exercises and the interviews with the operators, that the operating philosophy of most of the operators included all or some of the following attitudes and perceptions of the FRP:

(1) Do not enter the FRP, unless operators had no idea what was happening in the plant and that no other recourse (e.g., EOI) was available.

(2) A negative attitude toward the FRP; the operators did not think that the FRP would actually work in some cases. In two cases, the FRP sent the operator to another EOI, which then in turn sent the operator back to the FRP, because the acceptance criteria were different in the two procedures involving the safety function being mitigated.

(3) The FRP was too cumbersome to use efficiently, based on the method of entry into the FRP. The FRP contained all steps necessary to satisfy the safety functions and stabilize the plant. However, if the operators were transferred to the FRP from an event based EOI, they were required to start at the beginning of the FRP, which may take several minutes to get to the desired step, while repeating the same steps which had previously been completed in the event based EOI (i.e., safety function checklist).

(4) The FRP was hard to follow. The FRP included a basic text, figures, attachments, floating steps, safety functions checklist, and success paths for each of the safety functions. In addition, no tabs or page numbers were given when a different section of the FRP was referenced in a procedure step. As a result, placekeeping, which was difficult in the event based EOIs, was even more difficult in the FRP.

The deficiency described in item (2) above occurred because the FRP acceptance criteria were designed to be less stringent than those in

the other EOIs. For example, in comparing the acceptance criteria on page 8 of the Reactor Trip Recovery procedure with those on page 25 of the FRP, two different acceptance criteria were found. This type of deficiency forced the operators to choose between one of two EOIs. When asked what they would do in such a situation, operators gave varying responses.

The team also determined that some of the above noted deficiencies were repeated in the EOI training program, thereby reenforcing the operators' attitudes noted above. As discussed in the training section (Section 5), operators have observed FRP failures to work, thus, decreasing operators' confidence in the procedure. These deficiencies present a fundamental inadequacy in the implementation of the FRP during emergency conditions. The inspectors determined that since the FRP was supposed to be the procedure that will work regardless of ongoing events, that collectively the identified FRP program inadequacies were significant. The licensee committed to correct the above noted deficiencies, and their root causes (also addressed in this report) in the next revision of the FRP. This item will be followed up in a future inspection (Open Item 50-361/88-13-03).

b. Procedure Placekeeping

The inspection team noted concerns with placekeeping methods. During the scenario, the CRS was observed holding several pages in the EOIs with his fingers, and more than one procedure opened on his desk. No checkoff spaces are provided in the EOIs. Additionally, no method for recording time and associated parameter values in the procedure was provided. The licensee committed to make improvements with placekeeping methods.

c. Procedure Organization

No method is provided to aid operators in easily locating sets of steps, for example, floating steps, in the EOIs. Based on the complexity of the EOIs,some method, such as tabs, for subdividing the EOIs is needed in order to aid in the organization of the EOIs. The licensee stated that tabs would be included in the next revision of the EOIs.

d. Casualties Requiring EOI Performance on Both Units.

During an emergency in one unit, the Shift Supervisor (SS) and Shift Technical Advisor (STA), who were shared by both units, would proceed to the affected unit. Although this meets 10 CFR 50.52 if the unaffected unit were to simultaneous develop an emergency, it was not clear exactly how immediate supervision would be allocated to each unit.

As noted in Section 5, EOI training did not include dual-unit events occurring simultaneously on both Units 2 and 3. The team noted that training could be improved in this area for the SS, STA, and CRS.

e. Floating Steps (FSs)

The inspection team noted that operators had differing opinions regarding the implementation of the FSs. The difference in understanding was felt to be indicative of inadequate training and lack of guidance in the Writer's Guide in differentiating between recurrent and continuous steps when defining verbs, such as "monitor" and "initiate".

Overall the inspection team felt that the use of the FSs were an improvement over the guidance given in CEN-152, and that providing additional operator training and guidance in the use of the FSs would improve the implementation of the EOIs.

f. Emergency Operating Instruction Documentation

The EOIs were generally well-written and well-formatted, however, several human factors concerns were noted. These concerns included the following:

1. Handwritten notes were found in the Unit 2 control room EOIs. The licensee promptly removed the marked-up copies from the control room.

2. Some EOIs contained steps that were not sufficiently specific. The lack of specificity is inconsistent with the guidance in the Writer's Guide to present clear and unambiguous information (p. B-19).

3. Figures in the EOIs are generally acceptable, although the xerox copies of some were found to be illegible, and identification of "acceptable/unacceptable" regions were needed.

4. Although specified by the Writer's Guide (p. B-5), ending an instruction with a colon if nothing follows it is misleading. Several examples were found throughout the EOIs and it was recommended that they be changed to periods. The Writer's Guide should selectively state that colons be used when substeps follow.

5. The logical flow and organization of some EOI steps was awkward or mismatched. In some steps, the logic appeared to be reversed because the AE/R column described a contingency.

g. Control Room

The EOI inspection team concluded that in general, the control room panels were reasonably well displayed and organized. However, the team identified several human factors concerns associated with execution of the EOIs. These deficiencies are described in Appendix C of this report.

h. Local Control Stations

The following concerns were noted during walkdowns of local control stations:

1. Components needed to complete EOI tasks are inoperable.

2. In EOI 12-12, p. 16 of 41, HR-2, RNO 1, operators are required to "Use fire hoses...." However, there are no fittings near the diesel driven fire pump.

3. The accessibility of valves required in EOI 12-7 (LOFC) is limited.

4. Several concerns were noted with the manipulation of the Inverter via the Manual Transfer Switch required in EOI-12-16, p. 6 of 7 VA-2b. and e. These concerns included missing information, location of the fuses, and installation.

8. Exit Meeting (30703)

On June 14, 1988, an exit meeting was conducted with the licensee representatives identified in Section 1. The inspectors summarized the inspection scope and findings as described in the Results section of this report.

The licensee acknowledged the inspection findings and noted that appropriate corrective actions would be implemented where warranted. The licensee did not identify as proprietary any of the information provided to or reviewed by the inspectors during this inspection.

APPENDIX A

I. San Onofre 2 and 3 (SO23) EOIs Reviewed

1. SO23-12-1 (Revision 1): Standard Post Trip Actions
2. SO23-12-2 (Revision 2): Reactor Trip Recovery Guidelines
3. SO23-12-3 (Revision 1): Loss of Coolant Accident Recovery Guidelines
4. SO23-12-4 (Revision 2): Steam Generator Tube Rupture Recovery Guidelines
5. SO23-12-5 (Revision 2): Steam Line Break Recovery Guideline
6. SO23-12-5 (Revision 2): Loss of Feedwater Recovery Guideline
7. SO23-12-7 (Revision 2): Loss of Forced Circulation Recovery
8. SO23-12-8 (Revision 2): Functional Recovery Guideline
9. SO23-12-9 (Revision 1): Reactivity-Priority 1
10. SO23-12-10 (Revision 1): RCS Inventory 3
11. SO12-12-11 (Revision 1): RCS Pressure-Priority 4
12. SO23-12-12 (Revision 1): Heat Removal-Priority 5
13. SO23-12-13 (Revision 1): Containment Isolation-Priority 6
14. SO23-12-14 (Revision 1): Containment Temperatures and Pressure
15. SO23-12-16 (Revision 1): Vital Auxiliary-Priority 2

II. Procedures Revised Which Were Referenced In EOIs

1. SO23-3-2.6 Shutdown Cooling System Operation
2. SO23-5-1.5 Plant Shutdown from Hot Standby to Cold Shutdown
3. SO23-3.2.22 SFAS Operation
4. SO23-3-2.28 Containment Combustible Gas Control System

III. EOP Training Material and Lesson Plans Reviewed

1. Classroom and Lecture Presentations:

Lesson Plan	Lesson Title
2E0701	Introduction to Emergency Operating Instructions
2E0702	Standard Post Trip Actions (Classroom)
2E0703	Loss of Coolant Accident EOI (Classroom)
2E0704	Steam Generator Tube Rupture EOI (Classroom)
2E0705	Excessive Steam Demand EOI (Classroom)
2E0706	Loss of Forced Circulation EOI (Classroom)
2E0707	Loss of Feedwater EOI (Classroom)
2E0708	Functional Recovery Actions (Classroom)
2E0709	Reactor Trip Recovery (Classroom)
2E0712	Standard Post Trip Actions (Simulator)

2E0713	Loss of Coolant Accident (Simulator)
2E0714	Steam Generator Tube Rupture (Simulator)
2E0715	Excessive Steam Demand (Simulator)
2E0716	Loss of Forced Circulation (Simulator)
2E0717	Loss of Feedwater (Simulator)
2E0718	Functional Recovery Actions (Simulator)
2E0719	Reactor Trip Recovery (Simulator)

2. Simulator Scenarios and Lesson Plans:

Lesson Plan	Lesson Title
2RS719	Reactor Trip (SPTA)
2RS719	Emergency Boration
2RS719	ATWS
2RS719	Functional Recovery
2RS720	Turbine or Generator Trip
2RS720	SBCS Auto Control Malfunction
2RS721	MFWP Trip/Recovery
2RS722	Loss of Offsite Power
2RS722	Operation during System Disturbance
2RS723	Reactor Trip (SPTA)
2RS723	Loss of RPS Channel
2RS723	CEAC Failures
2RS724	Boration/Dilution at Power
2RS724	Salt Leak
2RS724	Loss of FFCPD
2RS724	Loss/Failure of Normal Feedwater
2RS725	Fire Inside Containment
2RS726	RCP Seal Failure
2RS726	Loss of Offsite Power
2RS726	Natural Circulation Cooldown
2RS726	Loss of Shutdown Cooling System
2RS726	Decay Heat Removal
2RS727	Loss of CCW System
2RS727	Loss of CCW to RCP
2RS727	Loss of Instrument Air
2RS727	Loss of RPS Channel
2RS728	Fuel Failure/High RCS Activity
2RS728	Plant Shutdown
2RS728	Small Break LOCA Inside Containment
2RS728	RCS Leak
2RS729	Loss of Shutdown Cooling System
2RS729	Loss of Vital Bus
2RS729	Large LOCA Outside Cuntainment
2RS730	Loss of Non-IE Instrument Bus
2RS730	Main Steam Line Break
2RS731	Loss of All Feedwater
2RS731	Loss/Failure of Normal Feedwater
2RS731	Loss of Vital DC Bus
2RS731	Reactor Trip Recovery
2RS731	Inadvertent CIAS
2RS732	Loss of Condenser Vacuum

2RS732	Loss of Saltwater Cooling
2RS733	Earthquake
2RS733	Saturated RCS Response
2RS733	Large LOCA Inside Containment
2RS734	S/G Tube Leak/Rupture
2RS734	Loss of Load
2RS734	Operation During System Disturbance
2RS735	Small Break LOCA Outside Containment
2RS735	Contaminated Injured Man
2RS735	RCS Leak

APPENDIX B

Technical Review Questions and Answers

The following are inspection team questions as a result of reviews of the SO23 EOIs. In the following responses, the licensee either provided clarification for the deviations from CEN-152, or acknowledged the deficiencies identified by the inspection team and agreed to correct them in the next revision to the EOIs. Section 5 of the report provides further discussions regarding these items.

I. EOI-SO23-12-1 (Revision 1): Standard Post Trip Actions

Q1: Step 3 - start of emergency boration: no procedure is included or referred for initiation and termination of emergency boration while CEN-152 requires boration to be consistent with Technical Specification values. Provide justification for the omission.

R1: Emergency boration is an evolution covered frequently by operators as part of their training and in simulator scenarios. Unit ACO Task 222BGB0968, "Emergency Borate the Reactor Coolant System," is taught in the CVCS classroom lesson 2XA206 (Objective 3.10: List the controls used and describe how they are manipulated to achieve...Emergency Boration). This task is also taught and reinforced in the Emergency Boration AOI Lesson 2A0711. Lesson 2E0712, SPTA Simulator, contains a scenario that requires Emergency Boration, and states that the "students should carry out the following (E.B.) steps from memory." In addition, this event (ATWS) will send the Operator to the Functional Recovery instruction (SO23-12-9) where detailed instructions exist (in RC-2) for verifying emergency boration is properly established. Regarding termination criteria, the Safety Function Status Check of SO23-12-8 (Functional Recovery) requires "Reactor power $<10^{-4}$ AND not rising." It must be noted that the bases of the Reactivity Control Safety Function is NOT to restore the Tech Spec Shutdown Margin (SDM) but simply to ensure the reactor is and remains shutdown. This is consistent with CEN-152 which states that "Since (normal) procedures require boration prior to cooldown, these criteria are adequate to ensure shutdown." Upon achieving $<10^{-4}$ the operator would return to the RTR procedure (SO23-12-2) and if the boron concentration was also greater than 1750 ppm exit then he would exit EOI's, and confirm that SDM requirements were met (by performing SO23-3-3.29 "Calculation of SDM"), and then secure emergency boration. (Also, see Response to Question 2 of EOI SO23-12-2 for acceptance criteria of boration.)

Q2: Step 5.6 - "verify RCS saturated margin >20°F." The inspector has the following concerns:

a. Whether RCS saturated margin is used in this procedure while the core exit saturated margin is used in all the other EOIs?

b. Whether the instrumentation error due to the adverse containment environment was included in the acceptance criteria or not?

c. Indicate instrument uncertainties as identified in a letter from Hall (CE) to Merlo (SCE), dated February 27, 1984. Also address SCE's position on the other five issues indicated in the same letter.

R2: a. To be consistent with the other EOIs, the RCS saturation margin will be changed to specify core exit saturation margin.

b. The instrument error is included in 20°F based on the SCE's calculation. The inspector determined that the method in CEN-268 was used and that the instrument error in the harsh containment environment contributed about 13°F to the 20°F saturated margin. The calculation was based on the assumptions of the containment environments with initiation of the RCS pipe breaks inside containment for a few minutes, therefore further analysis is needed to assess the long term effect of the harsh containment environment on the acceptance criteria of the saturation margin (see response c.6 of this question).

c. Response to Enclosure Items 1 - 6 from Letter to M. L. Merlo from V. C. Hall dated February 27, 1987, Subject Upgraded SONGS Units 2 and 3 Emergency Procedure Technical Guidelines (EPTGs).

(1) Pressurizer Fill and Drain as a Method of Plant Depressurization

The Loss of Forced Circulation (LOFC) EOI directs the operator to use the fill and drain method of cooling the Pressurizer (PZR). During the LOFC emergency, assuming a loss of offsite power, as part of the Response Not Obtained (RNO) for step 14 g, the operator alternately fills and drains the PZR. The concern raised by the use of this method is the possibility of inadequate mixing, and therefore cooling of the PZR resulting, rather in an increase in saturation temperature and pressure.

(2) Hot and Cold Leg Injection Procedure and Boron Precipitation

The LOCA EOI uses the guidance provided by the EPTG with regard to hot and cold leg injection. This injection method is used between two and four hours following the LOCA. The procedure steps involved do not address charging pumps. Charging pumps are maintained running until such time as the SI throttle and flow criteria are satisfied as specified in FS-3.

(3) Reactor Coolant Gas Vent System

The EOIs reference use of the gas vent system in the FS. The step request evaluation by the Emergency Coordinator for its use in dealing with void elimination. The licensee agreed with the recommendation provided by CE that use of

the gas vent system should not be part of the "normal" strategy used in developing steps for void elimination. The licensee indicated, however, its use should be considered under the close evaluation of the technical staff as a potential use of non-condensible gas elimination in order to avoid the possibility of further core degradation.

(4) AFS and Emergency Feed Actuation Signal (EFAS)

The EOIs incorporate steps which direct the operator to reset EFAS when SG levels are above 30% (NR) (This is the reset value of the actuation signal.). It then further directs the operator to maintain levels between 40% to 80% NR which requires manual operation of the AFW system. No automatic level control system is provided for maintaining SG levels using the AFW system.

(5) Post Accident Sampling System (PASS)

The PASS is not addressed in the EOIs. This is consistent with CEN-152.

(6) Instrument Inaccuracies

The issue of instrument error in the harsh containment environments is an on-going project (CEN Task 536). The licensee is currently actively participating in the project. In order to resolve the issue of instrument error in the harsh containment environment satisfactorily, the licensee is required to commit itself to perform analysis for instrument errors and provide the schedule for submittal of the results of instrument error analysis and its applications to the EOIs for NRC review and approval. (This is identified as an open issue and will be followed up and closed out by the NRC on-site inspector. See Section 5 for further discussion.)

Q3: Pages 2-3 and 2-6 of EPTG relate to Step 12, which states do not operate RCPs when pressurizer pressure ≤1430 psia. The licensee had a difference between the EOI and EPTG since the EOI directs the operator to trip two RCPs and leave two RCPs running. Clarify the inconsistence in EOI vs. EPTG.

R3: The EPTG provided plant specific information and was issued by Combustion Engineering (CE) to SCE for the purpose of drafting the EOIs. EPTG Revision 1 included revised RCP operating strategy which specifies "tripping two RCPs (one in each loop) if the RCS depressurizes in a rapid and uncontrolled fashion below the pressurize pressure of 1430 psia." This is reflected in the current revision of the EOIs. The inspector determined the above explanation is included in the revised EPTG, which clarifies the apparent discrepancy between the EOI and the technical basis.

Q4: Step 6 - EOI does not include 5a, 5b, 5e of CEN-152. What is justification for omission?

R4: The EOIs use the verb ENSURE, which is defined in the Emergency Operating Instruction Authors Guide SO23-0-39 Table 3-1 page 30 as "to verify a specified condition exists, and if it does not, to manually take the necessary steps to establish the condition." Operators response to this term encompasses the requirements of CEN 152 step 5a, 5b, and 5e.

Q5: Step 7.4 - Step contingency action 6.C of CEN-152 is not included. What is justification for omission?

R5: EPTG Step 6 Contingency Action verifies RCS Subcooling greater than or equal to 20°F is not, in itself, indication of natural circulation conditions. Verification that T cold and T hot are not rising is considered a positive indication of natural circulation and thus a preferred method of verifying satisfactory Core Heat Removal. However, in the next revision of the EOIs, the RNO step addresses taking action to restore subcooling if indication of single phase natural circulations is lost.

Q6: Step 8.B.1 & 2 : 3 values (40%, 25%, 80% of narrow range) are given to initiate action - What is the technical bases for these values? (Refer to Question 6.C for instrument error also.)

R6: 25% NR is the ESFAS setpoint for EFAS. Instrument uncertainty is already included in the development of the ESFAS setpoints independent of the EOI. 40% NR to 80% NR is consistent with the CE EPTG prepared for SO23.

Q7: Step 10.2 specifies "containment spray header >50%." Does the instrument read in GPM or in %? What is the 50% flow rate in GPM (CEN-152 specifies the containment spray flow to be greater than 1500 GPM or plant specific value).

R7: The spray flow instrument reads in % flow. >50% flow corresponds to >1750 gpm. This is in accordance with startup testing performed at SONGS (ref PE-226-01).

Q8: Step 11.A - Hydrogen concentration is 0.5% Why do you use 0.5% and does it include instrument uncertainty?

R8: Specification of 0.5% Hydrogen will be removed from the next revision to the EOIs. This is consistent with CEN-152 Revision 3.

CEN-152 Revision 3 deletes the requirement to monitor H2 because no H2 is expected following an uncomplicated reactor trip. Revision 3 specifies maintaining containment temperature and pressure as a means of controlling the H2 (ref. p. 2-19 and 2-20). H2 recombiners are addressed in the LOCA EOI which places the H2 recombiners in service as specified in the EPTG App. A, page A-39 step 5.123.

Q9: Step 14.A.1 Regarding recovery diagnostic - the recovery diagnostic diagram is different from CEN-152. How are you going to effectively use the Table, since CEN diagram has flow arrow?

R9: Objective 5 of Lesson 2E0702, SPTA Classroom, is "use the Recovery Diagnostic to identify the recovery instructions to be implemented." The suggested strategy for the instructor to teach this lesson is to fill out the worksheets on the overhead while the students do the same in their individual copies of the EOI. One of the lesson's review questions gives the students a practical exercise in using the Recovery Diagnostic, and the lesson's closing statement says that the Recovery Diagnostic must be utilized even if the event's diagnosis is obvious.

The correct use of the Recovery Diagnostic is reinforced through all EOI training since the operators must go through the Standard Post Trip Actions (SPTA) and diagnose the event to get into the Reactor Trip Recovery (RTR), any other Optimum Recovery Instruction (ORI), and/or the Functional Recovery (FR). The next revision to the EOIs however, will be using a flow diagram similar to the one used in CEN-152 Revision 3.

II. EOI-S023-12-2 (Revision 2), Reactor Trip Recovery (RTR)

Q1: Entry conditions - In CEN-152, states that "standard post-trip actions have been performed"; the EOI does not include this statement.

R1: The implications of this Entry Condition step is for the operator to take an action verifying "standard post-trip actions have been performed." It is therefore an action step and not a condition for entry to the RTR. Also this Entry Condition step is the same as step 1 of the Operator Actions CEN-152 and is therefore redundant and not required.

Q2: Step C.2 of attachment 1 - What is the technical basis for boration to 1750 ppm?

R2: This boron concentration was chosen for simplicity as it matched the required boron concentration in the Refueling Water Storage tanks and was also the basis for the Shutdown Margin requirement of 5.15% which assumes a EOL MSLB accident and ensures the Reactor remains subcritical during this event, assuming all CEAs were inserted except the worst rod stuck out. However, the only time this number is used is during ATWS events, in which case the normal plant procedures would ensure emergency boration continued until the required SDM was restored. It is not intended that emergency boration be stopped upon achieving 1750 ppm until confirmation of required 5.15% SDM is assured. If an ATWS event occurs concurrent with a LOCA/MSLB/SGTR those EOIs ensure that prior to initiating cooldown that the "Emergency Coordinator evaluate RCS boron requirements for cold shutdown," and then the required concentrations are established. It is planned to replace this number with the criteria that "power is $<10^{-4}$% AND Emergency Boration is in progress, 5.15% SDM has been

achieved" in the next revision to clarify that once the RTR procedure has been achieved, emergency boration will continue until the Technical Specifications required SDM is restored.

III. EOI-SO23-12-3 (Revision 1): Loss of Coolant Accident

Q1: Step 4-E, the EOI does not include steps 3 and 9 of CEN-152 after step 4. Provide justification for omission.

R1: With input from Steam Generator Blowdown, Air Ejector, and Main Steam Line radiation monitors, there is adequate information to determine the presence of a SGTR. Because of the time involved in drawing and analyzing Su samples it is not considered the most expedient method for aiding the operator in LOCA diagnosis. Therefore, this direction was not incorporated in the LOCA EOI. SIAS initiation is recorded in step 1, and therefore, step 4 is not needed.

Q2: Step 17.A - provide the technical basis for 40 R/hr to activate CSAS to remove iodine.

R2: 40 R/r is based on maintaining the cumulative thyroid dose at the Exclusion Area Boundary less than 170 mrem/hr, which is below the level at which a protective action guide of sheltering would be recommended. Ref: Letter P. J. Knapp to H. E. Morgan, "Loss of Coolant Accident Emergency Operating Instruction", March 28, 1984.

Q3: Step 7 - the concept of a "floating step" is not used in CEN-152. Justify the use the of the FS and how it is consistent with "PGP Writer's Guidelines."

R3: CEN-152 refers to non-sequential steps as those performed strategically any time the specified condition(s) exist and are designated with an asterisk, i.e. *Steps Performed Continuously. The EOI Writers Guide, which was part of the PGP, in section 3.2.2 explains and justifies the concept of "floating steps". The FS concept differentiates between sequential and non-sequential steps by concentrating the latter. This maintains the integrity of the sequential steps preventing the operator from having to continuously go back through the procedure to review a step.

Q4: Steps 8.6, 11.6 and 12.e - no minimum feedwater flow, as required by CEN-152, is included in the steps. Provide the technical justification for the omission.

R4: Above 40% NR level there is no minimum feed flow requirement. Steps 8.b, 11.b and 12.e in combination with 12.h provide adequate direction for maintaining SG levels.

Q5: Pages 42 and 49 - the figures appear difficult to read. Enlarge figure for increased legibility.

R5: SCE will enlarge figure to allow for increase legibility.

Q6: Safety Injection Flow (SIF) figure page 35 - consider whether this curve needs a note "This curve is for conditions when a charging pump is running." If note is not needed, do the EOIs ensure that the charging pumps are running?

R6: The SIF figure shows the minimum acceptable SIS flow at the cold leg injection point which will ensure adequate heat removal capabilities during cold leg injection mode and recirculation mode. The figure is provided as a tool for the operator to verify SI flow using specifically installed instruments which do not including charging pump flow rates. As such, a note of this nature would not be technically accurate. The exclusion of this information from the figure does not by itself violate the provisions of the accident analysis. Rather, compliance with the requirements of the Technical Specifications and adherence to the EPG and EPTG for the EOI ensure the provisions of the accident analysis are satisfied.

Step 5a of the EOI ensures all available pumps are running to establish maximum SI flow. FS-2Ba checks to ensure flow is adequate per SIF curve and if not, the RNO step specifically addresses ensuring all available charging and SI pumps are running. The next revision to the EOI will specify the charging pumps as part of the initial SI flow verification.

IV. EOI-SO23-12-4 (Revision 2): Steam Generator Tube Rupture

Q1: Step 6.B.3 - the 200 degree F (which is a Technical Specifications limit) appears to have no margin, i.e., if operation exceeds it, the Technical Specifications are violated.

R1: Exceeding 200 degrees per hour (for a short period of time, i.e., less than one hour) is not a Technical Specifications violation although it is very undesirable to enter the action statement. The maximum anticipated operator initiated cooldown rate would come when lowering the PZR pressure from 2250 psia to 1000 psia during the SGTR. With both spray valves fully open this 108 degree change could occur over about 14 minutes. When averaged over any one hour period, this would still be less than 200 degrees per hour. In actual practice however, normally only one spray valve is used and it is not opened fully.

Q2: Step 14.e - after resetting EFAS - Do you still have AFW operating? If so, is it necessary to add step e "AFW"?

R2: In the absence of a MSIS, when the EFAS is reset, any AFW flow that existed prior to the reset of the EFAS will be maintained. It should be noted that MFW could still be providing water to the intact SG, and thus it is not recommended that we change Feedwater to AFW. SCE will make a further evaluation to ensure subsets e and h are consistent.

Q3: Step 16.A - refers to when a termination criteria is achieved - reference needed to FS 5 (page 33 of 56)?

R3: The next revision to SGTR references the appropriate FS.

Q4: Step 17.C - substeps 1, 2, 3, and 4 appear to be steps (not substeps).

R4: Substeps 1 thru 4 all have to do with establishing one train of CCW non-critical loop supply and return to the containment, and therefore are not stand alone steps. SCE will review and restructure these steps.

Q5: Step 19 - step A - Establish T hot >385 degrees; step B - Establish pressurizer pressure - This appears to be a logic loop - suggest adding the words "if not go to step 19A and lower temperature" to step B.

R5: This will be corrected in the next revision to the EOIs.

V. EOI-2023-12-6 (Revision 2): Loss of Feedwater

Q1: Step 1.c - why is this step here? - The step is for checking that a diesel generator is loaded while the contingency action is to verify availability of offsite power and then unload the diesels.

R1: Step 1a of the EOI requires completion of the SPTA which includes verification of the availability of offsite power. This verification is implied in the use of the word "unloaded." A reliable source of offsite power is important to establish as an action step for 1.C and more evaluation is important prior to stopping an unloaded diesel.

Q2: Step 9.d - Why are condensate pumps not considered as a feedwater source to be consistent with CEN-152?

R2: Next revision to the EOI will address this option. The present draft still provides for using the condensate pumps in the functional recovery. During the simulator validation of the revised EOIs use of the condensate pumps will be reviewed to determine its feasibility.

Q3: Step 1.6 - Recording SIAS time does not appear necessary for a loss of feedwater.

R3: The next revision to the EOI does not reference SIAS. CEN-152 Revision 3 removes the requirement. However, containment temperature and pressure are monitored and SI throttle criteria are included in the FS in the event SI was initiated.

VI. EOI-SO23-12-8 (Revision 2): Functional Recovery

Q1: Subprocedure PC-1 of chart (page 33 of 55) - CEN-152 has VCT included. Provide the justification for omission.

R1: The normal post SIAS actuation borated water supply to the charging pumps is the RWST and/or the Boric Acid Makeup Tanks. The VCT outlet valve to the charging pump suction, LV 0227B, closes on a SIAS

actuation and has no override capabilities from the control room and, therefore, is not used as a suction path to the charging pumps.

Q2: Step 2.a (page 2 of 55) says stop 4 RCPs while FS 1.a (page 7 of 55) says to check at least 1 pump per loops stopped. Provide the technical justification for the inconsistency.

R2: The next revision to the EOI corrects this inconsistency so that all RCPs will be tripped in both steps.

VII. EOI-SO23-12-14 (Revision 1): Containment Temperature and Pressure

Q1: CTP-3, page 5 of 9, step 4 - Why not check containment spray (CS) pump for cavitation also?

R1: The NPSH requirements for the HPSI pump is more restrictive than that of the CS pump (12.5' and 11.5' respectively). Therefore a problem with the HPSI pump cavitation would also indicate a similar problem with the CS pump. The RNO for step 4 a. is the throttling of the CS pump discharge valves which would reduce the cavitation of both pumps.

APPENDIX C

EXAMPLES OF HUMAN FACTORS DEFICIENCIES

1. Absence of Specific Information

   a. EOI 12-4, step 10, RNO 1. The RNO states, "Open ADV to control RCS T_H." The operator took several minutes to determine which atmospheric dump valve to open. The specific ADV should be explicitly indicated in the EOI. The licensee agreed to correct this in the next EOI revision.

   b. EOI 12-6, RNO step 5.c.1. "Evaluate Stopping Pumps." The specific pump should be cited, especially since the A/ER refers to just one main feed pump, and the preceding step identified three different pumps.

   c. EOI 12-16, VA-1, RNO c. "Attempt to re-energize Bus from:" In this case, the corresponding A/ER is in plural form, which makes the RNO reference to a bus confusing. The appropriate bus should be identified, e.g., energized or unenergized.

   d. EOI 12-14, CPT - 3.d.3. "Check containment emergency sump cooling." Since there is no specific sump cooling system, the required action must be more specific. The operator could not determine what actions were required to complete this step

2. References

   a. EOI 12-4, step 16.a. "Check SI termination criteria." Since these criteria are only found in the FSs, the exact location should be specified, i.e., "refer to FS 5 (p. 33 of 56)".

   b. EOI 12-3, FS-2D.e. Reference should be made to where the "Figure PT limits" can be found, e.g., a page number or figure number.

   c. EOI 12-7, RNO step 13.f. Go to substep a." The step number associated with the substep letter should be included, e.g., "Go to substep (13)a."

   d. EOI 12-4, RNO step 17.c.3. "Go to substep d." the step number associated with the substep letter should be included.

   e. EOI 12-3, p. 22 of 65, end of FS-2C. No reference is provided to tell the operators where to go next, especially since the subsequent two pages are figures rather than FS-2D or FS-3.

   f. EO 12-4, step 12.j. "Initiate Applicable Unit Cooldown Attachment 3 or 4." Reference should be made to indicate that Attachment 3 is for Unit 2 cooldown and Attachment 4 is for Unit 3 cooldown.

   g. EOI 12-4, pages 13 and 15 of 56. Indication should be made at the bottom of the page that the EOI continues (e.g., "cont.") onto the

subsequent page. On page 15, also, more blank space is needed between "Action/Expected Response" heading and step 13. As presently formatted, step 13 is not readily visible as it could be.

h. EOI 12-8, p. 8 of 55. An indication that this FS (FS-2B) continues after the subsequent page, which is a figure, is necessary.

3. Figures

a. EOI 12-3, pages 42 and 49 of 65. The central part of the figure, containing the actual curves, should be enlarged to increase the figure's readability. In addition, the quality of the reproduced copies found in the control room of these figures was also poor.

b. EOI 12-4, pages 18 and 19 of 56. Feedwater is measured in gallons or kilo gallons on the figures. However, the feedwater instrument is measured in percent (%). Therefore the operator must make a conversion. The units of measurement on the figures should be consistent with those on the required instrument(s).

c. EOI 12-3, p. 19 of 65, and other EOIs that use this SI Flow figure. The figure does not identify how many injection points are acceptable (3 or 4?). In addition, the figure does not identify acceptable and unacceptable regions, which is of significant aid to the operator. The table that is embedded within the figure formats has units of measurement different from the figure's units of measurement. The table reads "LB/In.^{2}a" and "GAL/MIN"; whereas the figure reads "PSIA" and "GPM." The table units should be changed to be consistent with the figures.

d. EO 12-3, p. 63 of 65. The figure contains a box in the lower left-hand corner which contains illegibly printed information. Also, the last line of text on the page is very light due to poor xerox quality. All printed information should be checked for readability following document reproduction.

e. EOI 12-8, p. 15 of 55, and all other EOIs that include this Pressure/Temperature Limits figure. The figure does not identify acceptable and unacceptable regions. Due to the high number of curves that are included, a designation of what is and is not acceptable would help the operators read the figure more quickly. This information could be provided with two different colors, and thus would not further visually clutter the figure. The xerox quality of this figure is marginal, and some of the print is blurred together.

4. Organization and Clarity

a. EOI 12-3, p. 34 of 65. The logical organization on this page is cumbersome and not immediately obvious. The OR between steps a and b is not very apparent, so the operator may not see it until the operator has read through most of the steps. A method for grouping all steps in a vs. those in b would help this problem, e.g., boxing each set of steps separated by or. Once the distribution between a

and b is highlighted, the remaining logic can more easily be addressed. It is not clear why ANDs were inserted between each step under a. This is a conflict with the Writer's Guide, which suggests a list format for a series of inclusive steps.

b. EOI 12-4, step 7.a. This step could be rewritten as an If - Then statement because step 1 is only to be performed if "a" is available. Operators could inadvertently perform step 1. without first examining a. and understanding the contingency.

c. EOI 12-4, step 8.b. The logic between the A/ER and RNO is mismatched, i.e., the RNO does not follow directly from the A/ER. The logic of this step should be reorganized.

d. EOI 12-4, step 13. Substeps 1. and 2. of this step should actually be b. and c. because they are not substeps beneath a., but instead of equal level with a. The licensee has agreed to correct this on the next EOI revision.

e. EOI 12-4, step 17.c. Substeps 2-4 are actually part of 1), and therefore should be a-c underneath 1). As presently formatted, substeps 2-4 appear independent of 1, when in fact they are the actions required to accomplish 1). The RNOs associated with this step are not aligned with that of the respective A/ERs. This adds difficulty to interpreting this step.

f. EOI 12-6, step 9.b. and 9.c. No RNOs are provided to tell the operator if the A/ER's cannot be met, i.e., if saturation margin is not between 80 - 160^{o}F.

g. EOI 12-13, attachment 1. A few of the ESF train and location designations listed in the Attachment are not compatible with the present control room panels, and should be updated.

h. EOI 12-16, VA-1, k and l. The logic of these two steps is difficult to follow; the operator took a few minutes to interpret it. It is not clear what operators should do.

i. EOI 12-7, step 13.a. The word "Project" is not immediately obvious as a verb. It should be capitalized or underlined, as appropriate, to illustrate that it is a verb.

k. EOI 12-7, step 11.b. "Stop unloaded Diesel Generator:" Either a specific reference to the diesel generator should follow this step or the colon should be a period. Otherwise, operators may infer that some information was omitted from the EOI.

l. EOI 12-3, step 4. "Notify Emergency Coordinator of initiation of LOCA procedure:" Again, if no information is required after the colon, it should be changed to a period.

m. EOI 12-8, pages 4 and 5 of 55. The logic presented on these two pages to initiate the Functional Recovery is difficult to follow. It is not clear if "optimal" is really intended as such, and whether it

is used consistently. The steps need to be condensed and explained in a more direct manner. The EOI inspection team understood that these pages have recently been revised in the latest EOI revision. The team did not have the opportunity to review the latest revision in detail.

n. EOI 12-7, RNO step g.2. "Allow corrected PZR level to lower to - 30%." Although the format of this step is consistent with the format to present plant conditions, this step could be misread as - 30% (minus 30%), i.e., to decrease by 30%. When numerical plant conditions are to be identified, they should be introduced by punctuation other than a short dash.

o. The EOI inspection team examined the bound EOIs in the Unit 2 control room and found handwritten notes in the margins, e.g., parameter values. The handwritten information could distract the next CRS who needs to use the EOIs. The licensee promptly removed the marked-up copies of the EOIs from the control room.

p. EOI 12-16, p. 2 of 7, VA-1 RNO c, the instruction is to "attempt to re-energize Bus from. . . ." Since the A/ER instruction referred to two buses, it is not clear in the cited instruction which bus is being referenced. The step should identify the specific bus. The absence of specific and unambiguous information could cause the operator to misinterpret the step.

5. Floating Steps

The variance in operators understanding of FS implementation was felt to be indicative of inadequate FS training and of vague definitions provided in the Writer's Guide.

The Writer's Guide (p. B-11) does not differentiate between "recurrent" and "continuous" steps. In fact, only "recurrent" step are addressed, and they implicitly assume "continuous" steps. "Monitor" is defined as a "recurrent" step and not necessarily continuous. When an EOI directs an operator to "monitor floating steps" it is not clear how frequently the steps are to be monitored.

When asked to interpret "initiate FS-5", virtually all operators stated that the current procedure steps were to be continued concurrently with initiating FS-5, thus requiring parallel actions. However, the Writer's Guide does not define "initiate"; it recommends that the verb "implement" be used to designate concurrent steps (p. B-11).

6. Control Room Panel Deficiencies

A few instrument scales were not labeled with measurement units. Also, both the Letdown Heat Exchanger Outlet Temperature Regulator and the Letdown Flow Pressurizer Level Regulator did not have measurement units. These instruments are required to perform EOI 12-3 (LOCA), page 34 of 65, step a.2. Another gauge which does not display measurement units is the Instrument Air Header Pressure gauge, required for EOI 12-16, VA-1, RNO g.1. The gauge has two adjacent scales which are identical, each of

which measures a different parameter; one measures air header pressure, the other, Nitrogen header pressure. But no differentiating label is provided to identify each scale. Consequently, the operator must rely on memory. (NUKEG 800, 5.6.6, 5.6.8)

In EOI 12-6 (LOFW), step 6.d requires operators to establish flow between 60 & 75 x 10^3 lbm/hr. On the Main Feedwater Recorder, however, this difference is less than one scale graduation and thus is almost imperceptible. The LOCA EOI, 12-3, p. 38, step a.b, also requires operators to check the Main Feedwater Recorder and make an equally indiscriminative judgment. (NUREG 800, 5.6.8)

A discrepancy between a QSPDS value and an EOI value was identified. In EOI 12-3 (LOCA), p. 39 of 65, the operator must determine whether "containment average temperature" is less than 215°F to satisfy the safety function. However the corresponding QSPDS display alarms at 120°F; therefore, the operator is alerted for no apparent reason. This is a potential source of confusion for the operator and should be evaluated and changed if necessary. In addition, other QSPDS parameter setpoints and values should be checked to ensure that there are no additional discrepancies. (NUREG 899, 5.4.6, 5.4.7)

The control panels were identified as having a couple of deficiencies that pertained directly to the EOIs. The problem with the broadest scope was found on the Electrical Systems panel. Verification of components on this panel are required when performing EOI 12-16 (Vital Auxiliaries), steps VA-1, a-e. The panel contains a mimic of the system which, although quite useful, does not differentiate between mimic labels and mimicked buses. Specifically, the buses are represented by long, thin, three-dimensional rectangles, which are connected to appropriate "components." The label that identifies the bus, however, is a mimic almost identical to the bus itself, except it is wider (i.e., more solvent) and is located approximately six inches away from the bus itself. The actual label, e.g., 2A02, is on one end of the "label mimic" so that it looks like the bus itself. Therefore, operators might erroneously conclude that two buses exist, or experience difficulty in determining which mimic actually represents the bus. To further complicate the panel, the voltage indicators are not physically connected to their corresponding buses. Thus, it is not obvious which meter belongs to which bus. Also, the nomenclature found in the EOI is not consistent with the mimic labels. The EOI (12-16, step VA-1.b & c) refers to the "IE 4 kV" buses, whereas the mimic is labeled as "Bus 2A04" and "Bus 2A06." If operators think in terms of IE 4 kV buses, then the mimic labels should reflect that (e.g., A-1E 4 kV vs. B-1E 4 kV).

Another panel deficiency was identified in the walkthrough of EOI 12-13 (Containment Isolation), on page 12 of 22, step g.1. The EOI lists four valves - two on Train A and two on Train B. The Train A valve names are listed directly under "Train A", and the Train B Valve names are listed directly under "Train B", thus unambiguously separating the two trains and associated valves. However, valve HV 9379, which is listed in the EOI under "Train B", is located in the Train A section of the control board. To minimize operator error and time, the valve control should be moved to the Train B section of the control board. (NUREG 899, 5.7.11)

Also identified during a walkthrough by the EOI inspection team was an incorrectly referenced annunciator. EOI 12-6 (LOFW), step 5.b.2, referenced the 60A33 annunciator window, but the correct window was 60A43. This discrepancy most likely arose from a plant modification that took place approximately two years ago. The EOI needs to be updated to be consistent with the modifications. (NUREG 699, 5.7.11)

Another control room human factors concern identified by the inspection team pertained to instrument error during emergency conditions. The accuracy of the instrumentation readings in the control room (e.g., pressurizer pressure, temperature, and level) has not been exactly determined at this time. Additional discussion of this problem is in Section 3 of this report. (NUREG 700, 6.1.1.1a)

7. Local Control Stations

   a. In EOI 12-14, Containment Temperature and Pressure, on page 4 of 9, the operator is to ensure that CSAS has activated by checking the position of valves and pumps listed in a table. However, some of these components are associated with the Sodium Hydroxide addition system which is no longer in service. These components have been abandoned in place. The licensee had previously identified this deficiency, however, it has been in existence for over a year on one unit and six months on the other. This concern with the EOI program is addressed in Section 6 of this report.

   b. During a walkdown of Step 6.c of EOI 12-6 (LOFW) operators were provided with the option to locally operate the main feed control valves. This local manipulation is not possible on Unit 2 because the valve handwheels were removed.

   c. In EOI 12-12, p. 16 of 41, HR-2, RNO 1, operators are told to "Use fire hoses...." However, there are no fittings near the diesel driven fire pump. The only available option is to hook up to the fire main supplied by the diesel driven fire pump. If operators are supposed to do the latter, then the EOI should explicitly say so to avoid time delays and operator misunderstanding. If the fire hoses are supposed to be connected to fittings, then these should be available, accessible and operable.

   d. The accessibility of valves required EOI 12-7 (LOFC) is limited. On page 14 of 50, RNO step 13.b, operators must access locked aux spray valves S21208MU130, 191 and 084, however, operators do not normally carry these keys with them. Instead, operators must return to the control room to get the keys. In addition, this room ("jailhouse") is entirely under Health Physics control. If an operator had to access the area immediately, e.g., in a Loss of Power, then he or she would be delayed waiting for the key. The licensee asserted that operators would have adequate time to get the keys or wait for HP.

   e. Another source of difficulty for operators is the manipulation of the Inverter via the Manual Transfer Switch, required in EOI 12-16, p. 6 of 7, VA-2b. and e. The switch is located about seven feet above the floor on a panel, is very large and because it is so high, obstructs

the position labels, i.e., "Inv." and "Line". A red light that indicated which position the switch is in is too dim to be readily detected. The switch is also very heavy, requiring two hands and a substantial effort to manipulate it.

f. Several problems were observed in the execution of EOI 12-5 (SLB), pgs. 45 and 52 of 54, step 4.c (for both pages). Operators are instructed to install SIT vent valve fuses in 2/3 L-071, located directly outside the control room. The fuses are listed in the EOI step, but the fuse amperage is not. The operator must first locate the fuses (which could not be located during the EOI walkthrough), however, once obtained, he/she may not know what amperage is required. Inserting the fuses is difficult. The operator requires a flashlight to see and must kneel on the floor. Additionally, the fuse labels are difficult to find because they are small, in the dark, and hidden behind many wires.

APPENDIX D

Verification/Validation Review Comments

Specific comments on the control room walkdowns and the review of the validation programs are provided below. The licensee committed to correct these weaknesses or review specific steps for potential changes. Section 4 of this report provides further discussions regarding verification and validation.

1. General

   a. The EPGs require the ability to measure feedwater flow greater than 150 gpm as part of the standard post trip and recovery actions. This flow is less than the smallest increment on the flow recorder scale. The licensee stated that they will initiate a Station Problem Report (SPR) requesting Station Technical to provide operations a means of measuring flows at low ranges of 150 gpm and greater.

   b. The QSPDS alarms at 120°F containment temperature which appears to be auctioneered from one of several temperature indications rather than an average temperature of 215°F. The licensee stated that an SPR is being prepared to address this problem. The SPR will request that the setpoint be raised to a value of 215°F in order to allow unnecessary alarms which may otherwise distract the operator.

   c. The manual auxiliary spray valves 521208MU130, 191 and 084 require keys which operators don't normally carry. The licensee stated that the use of manual auxiliary spray would only be used during a cooldown. The decision to cooldown is expected to take sufficient time so any required keys can easily be made available to the operator.

2. E01 S023-12-4 SGTR

   a. Step 10 RNO substep 1. should specify which ADV is to be opened to control T_H. The licensee stated this would be corrected in the next revision to the EOIs.

3. S023-12-6 LOFW

   a. Step 5.6.2. The annunciator referenced in the procedure should be changed from 60A33 to 60A43. The licensee stated that this will be corrected in the next revision.

   b. Step 6.C. The mainfeed regulation valves on Unit 2 cannot be operated locally because the handwheels have been moved to Unit 3. The licensee stated that a SPR report was prepared addressing this problem.

4. Functional Recovery

   a. S023-12-13 Containment Isolation

      (1) CI-2 step g.1) Train A valve HV9379 is listed under Train B.

(2) Attachment I - some valve controls or control indications are listed under the wrong train and other valve control locations are listed on the wrong panel.

The licensee agreed to review the valve lists and make corrections in the next revision.

b. S023-12-14 Containment Temperature and Pressure

(1) CTP-3 page 4 of 9, the table in step "a" contains pumps and valve designations that are no longer in use. (The sodium hydroxide system is not used.)

(2) CTP-3 page 409, the table in step "a" should include valves 2HV6501 in Train A and 2 HV6500 in Train B.

The licensee stated that this table will be revised to remove the equipment designations that are not in use and to include the two additional valves.

(3) CTP-3 page 6 of 9 step d.3 this step requests the operator to check if containment emergency sump cooling is required. Since there is no specific sump cooling system the operator was unsure what he was expected to check.

The licensee stated that after a RAS, the CS system in conjunction with the HPSI pumps, is the cooling medium used via the Shutdown Cooling heat exchangers to maintain core cooling. Prior to terminating the CS pumps an evaluation is required to determine if alternate means are available for core cooling. The next revision to the EOI will clarify this by requesting an evaluation by the SS to determine whether an alternate means of core cooling is being provided prior to resetting CSAS.

c. S023-12-15 Containment-Combustible Gas.

(1) C 6-1 page 2 of 6 step C should include step 6.2.7 of procedure S023-3-2.28 to be consistent with that procedure.

(2) CG-1 page 2 of 6 step C should be consistent with the labels on the equipment.

The licensee stated that the next revision to the EOI will be verified to be consistent with label indications on equipment and the referenced procedure.