

U. S. NUCLEAR REGULATORY COMMISSION  
REGION V

Report No. 50-206/90-11  
Docket No. 50-206  
License No. DPR-13  
Licensee: Southern California Edison Company  
Facility Name: San Onofre Nuclear Generating Station Unit 1  
Inspection at: San Onofre Site, San Clemente, California  
Inspection Conducted: September 13, 1990 through September 28, 1990  
Inspectors: G. Johnston, Team Leader, Operator Licensing Examiner  
C. Townsend, Resident Inspector, San Onofre  
Accompanying  
Personnel: C. Meeker, COMEX Inc.  
M. McWilliams, SAIC Inc.

Approved By:

  
D. F. Kirsch, Chief  
Reactor Safety Branch

11/7/90  
Date Signed

Summary:

Inspection from September 13, 1990 through September 28, 1990 (Report No. 50-206/90-11)

Areas Inspected: A special team inspection of the licensee's Emergency Operating Procedures was conducted in accordance with Temporary Instruction TI 2515/92. This inspection was conducted to verify that the SONGS 1 Emergency Operating instructions (EOIs) were technically accurate; that the EOI specified actions could be meaningfully accomplished using existing equipment, controls, and instrumentation; and that the procedures were useable by the operator.

Results of Inspection:

The licensee's program for maintaining and upgrading the Emergency Operating Instructions was effective and conformed to accepted industry practice. However, SOI-14-46, Attachment 1, "Emergency Operating Instruction Writer's Guide" was not always consistent, and provided incomplete guidance to procedure writers. The licensee's Verification and Validation program appears to have not been effective at eliminating inconsistencies with the Writer's guide, and Control Room and plant labeling.

Areas of Strength Observed During the EOP Inspection:

The licensee had in place an effective program that upgraded the Emergency Operating Instructions, when appropriate.

Significant Issues:

The licensee had instituted a review of safety related instrumentation loop uncertainties. This review included an analysis of the effects of harsh environmental conditions on instrument inaccuracies. The licensee should ensure the inclusion of data generated from this review, pertaining to the setpoints utilized, in the Emergency Operating Instructions if instrument setpoints are recommended which are at variance with the current setpoints.

Summary of Violations:

No violations were identified.

Deviations:

No deviations were identified.

## REPORT DETAILS

### 1. NRC Inspectors

- \*G. Johnston, Team Leader, Licensing Examiner, RV
- \*C. Townsend, Resident Inspector, San Onofre
- \*C. Meeker, Reactor Systems Specialist, COMEX Inc.
- \*M. McWilliams, Human Factors Specialist, SAIC Inc.
- \*T. Sundsmo, Licensing Examiner, RV

### Persons Contacted

- \*H. E. Morgan, Vice President and Site Manager
- \*J. Reeder, Manager, Nuclear Training
- \*R. Krieger, Station Manager
- \*G. Gibson, Supervisor, Nuclear Licensing
- \*M. Short, Manager, Station Technical
- \*R. Plappert, Supervisor, Technical Support and Compliance
- \*J. Schramm, Unit 1 Plant Superintendent
- \*W. Norris, Licensing Engineer
- \*J. Jamerson, Licensing Engineer
- \*K. Johnson, Controls Engineer
- \*M. McKinley, STA Supervisor
- \*S. Prokopovich, Westinghouse Site Representative
- \*J. Reynolds, Operations Supervisor
- \*D. Towler, QA Engineer
- \*K. Weigand, QA Engineer
- \*J. Iyer, Shift Technical Advisor
- \*D. Werntz, Licensing Engineer
- K. Meyer, Industrial Engineering Supervisor

\*Denotes those present at Exit Meeting on September 28, 1990.

Members of operating crews, training personnel, and auxiliary operators were interviewed during the course of this inspection.

### 2. Procedure Reviews

A review of the San Onofre Nuclear Generating Station Unit 1 EOP's and EOP program documents was conducted, applying the criteria in Temporary Instruction TI 2515/92, Revision 1, "Emergency Operating Procedures Team Inspections," the requirements of Supplement 1 to NUREG-0737, "Requirement for Emergency Response Capability," the guidelines in NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures," and the findings of NUREG-1358, "Lessons Learned From the Special Inspection Program for Emergency Operating Procedures Conducted March-October 1988." The review consisted of a desktop review of the documents, as well as procedure walkdowns and interviews on site during the period September 13 to September 28, 1990.



The following Emergency Operating Instructions were examined during the inspection:

S01-1.0-10	Reactor Trip and Safety Injection
S01-1.0-11	Reactor Trip Response
S01-1.0-12	SI Termination
S01-1.0-23	Transfer to Cold Leg Recirculation
S01-1.0-30	Loss of Secondary Coolant
S01-1.0-32	Loss of RHR Due to Secondary Coolant in Containment
S01-1.0-40	Steam Generator Tube Rupture
S01-1.0-60	Loss of All AC Power
S01-1.0-61	Loss of All AC Power Recovery
S01-1.2-1	Response to Inadequate Core Cooling
S01-1.3-1	Response to Loss of Secondary Heat Sink
S01-1.3-3	Response to Steam Generator Low Level

The inspectors' review of the EOIs revealed no technical errors of significance when comparing the EOIs to the Westinghouse Owners Group Emergency Response Guidelines. The inspectors' review did determine the following:

- o The EOIs differ significantly from the Westinghouse Owners Group Emergency Response Guidelines (WOG ERGs). This is due to significant design variations between SONGS 1 and the Westinghouse reference plant design utilized in the WOG ERGs.
- o The variations between the EOIs and the WOG ERGs have been reviewed with the assistance of the vendor (Westinghouse). The inspectors determined that this review appeared to be comprehensive, and was documented in S01-14-48, "Unit 1 Emergency Operating Instruction Technical Guidelines" which contains the deviation documentation. Further, each EOI has a procedure bases document that describes the technical requirements for each step. The deviations were adequately supported in each case where there was a difference between the WOG ERGs and the facility EOIs.
- o The EOIs did vary significantly in the usage of the harsh environment methodology utilized in the WOG ERGs. The WOG ERGs use harsh environment factors to ensure that the setpoint acceptance values are optimal to the conditions present in the containment. The facility chose to incorporate harsh environment factors for some instrumentation, for example Steam Generator Water Level, in the procedural acceptance criteria rather than using the accepted practice in the ERGs of including harsh environment criteria within brackets alongside the normal values. The inspectors indicated to facility management that this was not in accordance with the principle of the WOG ERGs of utilizing optimum procedural steps whenever possible.



The inspectors concluded from the review of the EOIs that the procedures were technically correct and met the needs of the operators for use during significant operational events.

During the review of the EOIs, the inspectors examined the ongoing work associated with determining the effect of instrument loop uncertainties on setpoints for safety related instrumentation. This work currently is about one-third complete and has not yet resulted in significant changes to the EOIs. The licensee staff indicated that the majority of the work would be completed prior to SONGS 1 returning to service (Mode 3). The inspectors determined that the information generated by this evaluation could produce significant new issues related to the EOI setpoints. The inspectors indicated to licensee management that even though these issues may not be reportable under the requirements of 10 CFR 50.72 and 73, the possibility of changes to the procedures that could alter the strategy or introduce new concerns exists and, therefore, warrants NRC examination. The inspectors, therefore, solicited and received a commitment from the licensee to notify the Resident Inspectors if there was a determination that a significant change had to be made to an EOI as a result of the evaluation.

### 3. Control Room and Plant Walkdowns

Selected procedures were walked down in the Control Room and in the plant with licensed and nonlicensed operators who would normally perform the procedures. The objective of the walkdowns was to verify that all operator actions called for in the procedures could be performed in a timely manner with minimal potential for error. The results of these walkdowns are summarized below and examples of specific findings are provided in Attachment A.

During the walkdowns of the EOIs in the Control Room, the inspectors noted that numerous discrepancies existed between the EOIs and the Control Room instrumentation and controls. For example, in EOI S01-1.0-30 "LOSS OF SECONDARY COOLANT," Step 21c, the step states "Ensure exciter motor breaker 15211B02 - OPEN," but the switch buttons are labeled "START" and "STOP." In many instances, the name of the equipment in the EOI did not correspond with the label on the switch or indicator. For example, in EOI S01-1.0-30 "LOSS OF SECONDARY COOLANT," Step 9b(3), Response Not Obtained (RNO), the switch referred to in this step is labeled "NORMAL TEST" with no "/" between the words, as it is described in the procedure. Also, there is no "(OR/AND)" on the label. In addition, the layout of the switches in the Control Room was not always optimum, and the physical spacing of indicators and switches complicated the performance of some steps. For example, the instrumentation in the Control Room was found to be difficult to read for the following reasons:

- o The location of some meters caused parallax problems because the meters were above the heads of the operators.
- o The procedures asked for more precise values to be determined by the operator than was possible, because the graduations of the scales were too large. As an example, the operator was asked to "Check RCS pressure - LESS THAN 2185 PSIG" in step 5b of S01-1.0-30 "LOSS OF SECONDARY COOLANT," but the meter for RCS pressure is only marked in 20 PSIG increments.

- o The scales of the instruments were inappropriate for the parameter to be determined. As an example, the operator was asked to "Check at least two SI flow indicators - LESS THAN 1000 GPM" in step 23a of SOI-1.3-1 "RESPONSE TO LOSS OF SECONDARY HEAT SINK," but the first indication, which is at the bottom of the meter, is 1000 GPM, the result of the use of a non-linear scale.

The deficiency associated with the parallax problem was previously recognized by the licensee, and is an item to be corrected during future Control Room Design Review modifications. The inspectors concluded the items associated with instrumentation require attention by the licensee, but should not preclude the operators from accomplishing the tasks in the associated procedures. These items should have been identified during previous verification and validation exercises. This concern was conveyed to facility management. The management indicated they would examine the instrumentation, and determine what corrective action was needed.

The inspectors noted that only one copy of the EOIs in a bindered copy was readily available to the watchstanders in the Control Room, which limits the amount and quality of backup support that can be provided to the Control Room Supervisor during an emergency.

Some lighting problems were noted during the plant walkdowns, where there was no emergency lighting available to perform an EOI action. Two locations, in particular, where local lighting was a problem were for the local action Steps 30b and 31b for SOI-1.0-60 "LOSS OF ALL AC POWER" (see discussion in Attachment A.) Egress with lighting was available to all areas of the facility, and the operators were supplied with sufficient portable lights to accomplish most tasks. The licensee has conducted a lighting survey, and corrective actions were in progress to correct this weakness by either moving current emergency lighting or the procurement of new lights. The inspectors examined the survey, and determined that it was thorough and had addressed all areas in the plant where emergency lighting was required to perform local EOI actions.

The EOI procedure steps that involve a significant number of actions in various parts of the plant were sometimes not sequenced in the EOI to optimize rapid accomplishment. This was found in several procedures where local actions to align valves for flowpath changes involved a long list of valves that were numerically ordered, rather than ordered in the most convenient order of accomplishment. Also, the operators that would perform the actions did not have easy access to the parts of the EOIs that contained the steps that must be carried out. Several Senior Operators indicated different strategies for providing Plant Equipment Operators instructions. Those strategies included tearing pages out of the procedures and handing those pages to the Plant Equipment Operators (PEOs), or reading the steps over the plant radio system, and writing the steps out on blank pieces of paper. The licensee management was informed of this concern. The inspectors noted that this concern could be resolved by developing a standard method to instruct PEOs on local operating tasks of the EOIs.



The metal identification tags attached to the valves in the plant were very difficult to read, because they offered little visual contrast between the valve number and the tag. This, in turn, required the operator to handle the tag when he tried to read it, which increased the time it took to carry out the desired action.

The manual operation of valves CV737A and B in the Component Cooling Water system, proved to be very time-consuming, because of the requirement to remove the entire sheetmetal covering around the valve actuator, to gain access to a vent valve that must be operated prior to repositioning the valve. The operation could be made much simpler, if an access port was provided in the sheetmetal cover to gain access to this vent valve, similar to the access port now available for the valve operating wrench.

The tool lockers located in the plant were poorly organized in that there was no inventory control system to insure that the tools that were needed by the operators in an emergency would always be available.

The location of the EOIs within the Control Room was clearly defined and easily accessible with the latest revision available. Egress throughout the plant was good and access to the equipment needed to carry out the actions in the plant was not found to be a problem.

The inspectors concluded that the operators could perform the tasks of the EOIs in the Control Room and in the plant, although some information deficiencies were apparent in the procedures. The licensee management indicated they would review all of the identified discrepancies and would take corrective action to address each of them.

#### 4. Verification and Validation

Thorough verification and validation (V&V) of EOPs is critical to ensure the technical and format bases documents (that is the technical guidelines and the writer's guide) have been consistently applied to the EOIs; to ensure that the procedures' equipment nomenclature corresponds to the plant nomenclature and equipment; and to ensure that the procedures are usable and can be performed.

The inspection's walkdowns indicated that past EOI validation efforts have not been effective with regard to control room and in-plant labeling, as well as with ensuring consistency with the writer's guide. As part of the licensee's long term EOI upgrade program, however, revisions to the program were being introduced as described in SOI-14-46, Attachment 2, "EMERGENCY OPERATING INSTRUCTION VALIDATION PROGRAM." As this procedure only became effective on August 22, 1990, its effectiveness could not be determined. While this procedure appears to improve the V&V program, a number of weaknesses in it were also noted.

Requirements for Validation - Section 5.0 of Attachment 2 states that all revisions to EOIs must undergo all or a portion of the validation process; however, there was no criteria provided as to the extent of validation that would be required for a given type or level of revision.



Reviewer Independence - Section 2.2 of Attachment 2, which describes requirements for performing plant walkthroughs, allowed for reviews to be performed by the EOP/revision author. This practice does not ensure independence in the validation process. Although walkthroughs performed by the EOP author can provide valuable insights during the development/revision phase, such reviews do not provide the independent objective evaluation needed for formal validation.

Validation Criteria - Evaluation criteria to be used during the plant and control room walkthroughs were provided in Attachment 4. It was not clear, however, which criteria should be applied during plant walkthroughs and which should be applied during control room walkthroughs. Also, additional elements to be examined during plant walkthroughs were listed in the main body of the validation procedure (Section 2.2.2) that were not consistent with the criteria provided in the Attachment 4 checklist. The licensee stated that the next revision of SO1-14-46 would provide separate checklists for plant and control room walkthroughs, and that all criteria related to plant walkthroughs would be consolidated.

Responsibilities - Responsibilities for coordinating various validation tasks were not well defined in SO1-14-46. Important responsibilities that were not designated included: determining when the procedures are ready for validation, selecting the validation team members for each task, ensuring that validation tasks are completed, compiling and resolving validation findings, and documenting the validation process. The licensee stated that these tasks were typically the responsibility of the EOI custodian, but agreed that they should be more clearly defined.

Review vs. Validation - Section 2.5 describes the SONGS requirement to perform an "interdisciplinary review" (referred to as a 109 review) which involves routing the EOIs to a number of different site organizations for review and comment. This review was described as "an additional verification of technical adequacy, consistency, and administrative procedural compliance," although an option was provided to use this review to fulfill requirements for desk-top review (validation). This type of review, however, does not ensure the highly structured, focussed evaluation that the validation process was intended to provide. Validation should ensure that the specific criteria called out in Attachment 3 of the procedure are systematically addressed. Also, the review should be conducted by appropriately experienced individuals.

Multidisciplinary Team - There was no requirement to involve human factors expertise in the validation process other than the requirement to route the EOI through the Industrial Engineering organization as part of the "109" review. Although the licensee had recently begun using this group to provide human factors input as part of the desk top review process, they had not been involved in control room/plant walkthroughs or in simulator validations. Based on the team's findings which included a number of human factors related comments (see Paragraph 5), this has been a weakness in past validation efforts. The licensee stated that they intend to expand and formalize the role of the Industrial Engineering group in the EOI validation process.

Validation and Training - The latest validation program included a requirement that operators and STAs be trained on EOI revisions prior to assuming shift duties following revision implementation. It has been the licensee's practice, however, to provide this training on draft EOIs and to consider this training as part of the validation process. Often, final versions of the procedures will be issued immediately prior to restart (after refueling outage), which may not provide sufficient time to train operators on the final changes that are made as a result of validation.

The current EOIs were subjected to a verification and validation program that was effective in identifying significant human factors related problems. The inspectors concluded that the current revision of S01-14-46, with the noted weaknesses corrected, will provide an improved verification and validation program. The licensee anticipates extensive reviews of current EOIs, and indicated that those revisions that will occur are going to be subjected to the revised V&V program. The licensee was informed of these noted discrepancies during the course of the inspection and stated that all of the comments will be addressed in their corrective actions.

#### 5. Human Factors Review of EOIs

EOI Writer's Guide - In order to develop and maintain procedures that clearly and consistently present information to operators in a way that will minimize error, a complete and restrictive writer's guide is necessary. Writer's guides that do not address every aspect of the procedures, and precisely define methods and formats to be used, leave format decisions to the writer's judgement. Because individual writer's judgement will vary, the quality and consistency of procedures can deteriorate over time.

Guidance for the preparation and revision of EOIs at SONGS Unit 1 was provided in S01-14-46, Attachment 1, "Emergency Operating Instruction Writer's Guide." In general, the guidance provided in this document was consistent with accepted human factors principles and guidance provided in NUREG-0899, "Lessons Learned from Emergency Operating Procedures Team Inspections." There were a few areas, however, where guidance was incomplete or not sufficiently restrictive to ensure consistency in the EOIs. Many of the human factors related deficiencies noted in the EOIs reflected an incomplete writer's guide. These areas are identified below.

References to External Procedures - When referencing the use of an external procedure from the EOIs, a complete reference should be provided which identifies the specific step or section to be performed. This ensures that the operator can quickly move to the appropriate location in the procedure and prevents any confusion as to which steps/sections are applicable. Complete references are typically not provided in the SONGS EOIs, and no direction is provided in the writer's guide for specifying the appropriate sections or steps when referencing a procedure outside the EOI set.



Transitions - When transitions are made to steps that are preceded by a caution statement, the EOIs sometimes provide a warning to observe the caution. This is not discussed in the writer's guide, however, and is not done consistently in the EOIs. Because it is more likely that cautions will be missed during a transition, this practice should be applied consistently and specified as a requirement.

Vocabulary - The EOIs contained a number of verbs that were poorly defined or had overlapping meanings with terminology that was used elsewhere in the procedures. For example, the instruction to "operate a breaker" does not provide clear indication as to the specific action required. In some cases instructions are provided to "secure" a piece of equipment, in lieu of a more restrictive statement to "stop" the equipment. To eliminate any ambiguity in the EOI steps, the list of "preferred" verbs in the writer's guide should be reviewed to ensure that all words are defined as having only one, explicit meaning. When verbs have overlapping meanings (such as secure/stop) the one with the most restrictive meaning should be selected. Also, instructions in the writer's guide should be more explicit in directing the writer to select verbs, abbreviations, and condition terms from the lists provided. Reference to an "approved" list, as opposed to "preferred" would provide more effective controls.

Although the terms check, verify, and ensure are defined in both the writer's guide and the user's guide, there were a number of instances where their use was not consistent with the intention of the step. Because this distinction was not being consistently maintained, the writer's guide should include an expanded discussion on the proper use of these terms.

Use of Logic Terms - The EOIs contain widespread inconsistencies in highlighting the logic terms AND, OR, and THEN. In many cases they are not highlighted when they should be, and in other cases they are inappropriately highlighted when used as simple conjunctions. OR is sometimes used inappropriately to specify operation of alternate train equipment, when in fact the alternatives presented are not equally acceptable options, but rather very dependent on which train is in use. There are, also, cases where the phrase AND/OR is used. This should be avoided in that the term OR by itself includes this condition.

Placekeeping Aids - The EOIs do not provide a mechanism for placekeeping within a procedure, such as check-off boxes. Although multi-colored ribbons are attached to the EOI binders in the Control Room for use in page keeping, this does not provide a means of tracking the performance of EOI steps.

Component Identification - The writer's guide states that equipment controls, and displays should be identified in operator language, and states that these should be the same as panel engraved names. As observed during control room walkthroughs, operator language and engraved panels were often different (see Paragraph 3). Until this problem is resolved, the writer's guide should recognize this discrepancy and provide guidance for component identification that will minimize the potential for



confusion. There were also inconsistencies in the EOIs as to when component identification numbers were used instead of, or in addition to, the common language name. In many cases, references to valves included only the valve number and not the descriptive name. Use of component identification numbers was not addressed in the writer's guide.

Step Structure - The SONGS EOIs follow the WOG guideline format in which actions are often written as abbreviated sentences, followed by an expected plant condition or response, which is set apart by a hyphen and appears in upper case font. An example would be "Verify Reactor Trip Breakers - OPEN." The writer's guide does discuss the format of these steps as "conditional statements" within the section on logic statements (section 4.4), but there is no discussion of when they should be used (versus full sentences) or of differences in sentence structure between the ACTION/EXPECTED RESPONSE (AER) and RESPONSE NOT OBTAINED (RNO) columns.

The inspectors concluded that the licensee's writer's guide had deficiencies consistent with previously identified generic deficiencies associated with the WOG Emergency Response Guideline writer's guide. The licensee indicated that the concerns identified by the inspectors would be addressed in their corrective action.

#### 6. Operator Training

The inspectors examined the current training, and past training schedules, for Requalification Training to determine the amount of training the operators have received for each of the EOIs. The inspector also examined several lesson plans for EOIs to determine if the training was comprehensive, both in terms of classroom time and in simulator time for the EOIs. The inspector concluded that the program provided sufficient time and a comprehensive training program for the EOIs. The inspector observed from interviews and observations during the facility walkthroughs that the operators appeared well trained. A future inspection that will encompass observations of a crew during training and performing a simulator exercise will be conducted at the Zion training facility.

#### 7. Exit Meeting

The inspectors met with the licensee staff denoted in Paragraph 1 on September 28, 1990 to discuss the findings of the inspection. The inspectors stated that the procedures were technically adequate, useable, and that the operators were well trained. The inspectors went on to describe the inspection, and provided some examples of the deficiencies observed.

The inspectors stated that the EOIs were generally acceptable based on the reviews and walkdowns the inspectors had conducted. The inspectors concluded that trained and experienced operators could respond to and mitigate emergencies utilizing the current procedures. However, the careful application of an improved writer's guide, and a thorough Verification and Validation program should be pursued by licensee management to correct numerous consistency and human factors concerns identified in the EOIs.

The Team Leader emphasized that the facility should not allow its procedures to vary significantly from the general principles outlined by the Westinghouse Owners Group Emergency Response Guidelines. As an example, the Team Leader pointed out that the variance in the use of the harsh environment setpoints by the procedure writers was clearly at odds with the optimal approach that the Westinghouse Owners Group presented to the NRC. The Team Leader stated that the NRC had endorsed a symptom based approach to emergency operating procedures, and had accepted the WOG ERG optimal format in lieu of the preferred symptom based approach.

The inspectors solicited the commitment discussed in Paragraph 2. The Team Leader emphasized that the notification request was to ensure that an issue not addressed by 10 CFR 50.72 or 50.73 was conveyed to the Resident Inspector as soon as it became apparent.

## Attachment A

Results of Emergency Operating Instruction  
Table Top Review and Plant WalkdownsS01-1.0-10 REACTOR TRIP OR SAFETY INJECTION

## Step 1.c:

The instruction to "verify rod bottom indicator lights - ON" is not consistent with the similar Step 4a in S01-1.0-11, which includes the qualifier "all lights - ON."

## Step 3:

The use of the conditional phrase AND/OR should be avoided, as the logic term OR performs the same function. (See also step 8a.)

## Step 8.b:

The Action/Expected Response (AER) instruction directs the operator to ensure that the VCT suction valves are closed. Further instructions to be followed in the event that local actions are necessary are provided in RNO instruction. Since use of the word "ensure" provides for taking any actions necessary (including local actions) to obtain desired condition, the operator would not need to refer to the RNO column the way the step is currently written, and would not read the applicable cautionary instructions.

## Step 9.d:

The instruction to verify "RWST level - NOT APPROACHING 20%" should be rewritten to eliminate negative wording.

## NOTE prior to Step 15, Step 16 RNO, and Step 17 RNO:

The inspector determined that this and other Steps, NOTES, and CAUTIONS related to 480 V bus 3 will have to be changed prior to restart because of design changes.

## Step 16 (RNO):

The logic term "and" is not highlighted as per writer's guide instructions.

## Step 17 (RNO):

The operator is directed to ensure that the in-service CCW heat exchanger outlet valves MOV 720 A or MOV 720 B open. The use of plural (valves) is inconsistent with the desired condition of only the valve associated with the in-service heat exchanger being open. This step also illustrates the need to provide a mechanism for designating alternate train equipment. The use of "or" indicates that either valve is equally acceptable to open, which is not the case.



## Step 20.a:

The step "Ensure both DGs - RUNNING" infers an extensive effort to get both Diesel Generators running if they are not. A RNO step should be added.

## Step 21:

The list of valves identified for local operation would be better presented as an attachment that could be given to the PEO, rather than having to remove a page from the procedure or communicate each valve position over the radio or telephone.

## Step 22.a:

The step seems to require a RNO response by inference. The step requires "Start control room air treatment fan A 33." There are no specifics as to what to do should the fans not start.

## Step 22.b (RNO):

The transition to step 23 should call to the operator's attention the caution statement that precedes this step, to ensure that it is not missed.

## Step 31.a (RNO):

The step directs the operator to "Maintain feed flow to that SG - LESS THAN 150 GPM." Because this limit should be followed even when the operator returns to the AER column, this limit would be more appropriately presented as a caution along with the rationale for this limit (i.e. prevention of water hammer).

S01-1.0-11 REACTOR TRIP RESPONSE

## Step 1.c (RNO):

The word AND is used incorrectly as a logic term. This step is actually made up of two substeps rather than a logical condition.

## Step 4:

Same comment as for S01-1.0-10, Step 31.

## Step 5.a RNO:

The step consists of the actions of S01-1.1-1, "Response to Nuclear Power Generation/ATWS." It appears appropriate to transition to that procedure, rather than taking the actions as described in an abbreviated form.

## Step 8.a (RNO):

The logic term "and" is not highlighted as per writer's guide instructions.

## Step 10.b (RNO):

The first use of "and" should be highlighted as a logic term and it is not. The second time it is used, it is incorrectly highlighted as a logic term, when its use is only to connect two substeps.

## Step 17.a:

This appears to be redundant to Step 17.b which requires the initiation of S0123-0-25, "Trip/Transient Review."

S01-1.0-12 SI TERMINATION

## Step 7.a RNO:

It is not clear what "Evaluate containment status" means in this case. The inference is that the operators would look for anomalous conditions to determine why pressure was not less than 1.4 psig.

S01-1.0-23 TRANSFER TO COLD LEG RECIRCULATION

## Step 1.b (RNO):

This step directs the operator to place the NORMAL/TEST switch (OR/AND) to the test position. The (OR/AND) qualifier does not help in identifying the switch as it is labeled NORMAL/TEST and should be deleted to avoid confusion.

## Step 3.a (RNO):

The transition to Step 4 should call to the operator's attention the caution statement that precedes this step, to ensure that it is not missed.

## Step 5.b:

The operator is instructed to ensure that the charging pump lockout switch is reset. The reset buttons in the control room have no labels which identify them.

## Step 6.b (RNO):

The transition to step 8 should call to the operator's attention the caution statement that precedes this step, to ensure that it is not missed.

## Step 7.a:

The operator is directed to check for RWST level approaching 12%. This wording is open to varying interpretations, and should be clarified by specifying an actual level or range of level at which actions should be performed.

## Step 8.a:

The order of Substeps 1 and 2 should be reversed, to eliminate the need for the operator to backtrack across the control room after checking the status of SI recirculation pumps.

## Step 8.e (RNO):

The operator is directed to locally open Component Cooling Water valves CV737A and B. These valves are housed in a steel cabinet that requires removal of 10 screws for access to operate. It does not appear that this step can be performed in an expeditious manner. (See also Step 8.f(RNO).)

## Step 8.g:

The operator is directed to "locally operate the respective valve breakers." The direction to operate the breaker is vague and should be clarified. The operator interpreted this as meaning to "make-up the contacts to open the valve." The operator, however was not sure which contacts these were, stating that it would be helpful if they were labeled. Also, rubber gloves were not available in the local electrical safety box.

## Step 9.a:

The operator is directed to depress the automatic makeup STOP pushbutton. This is labeled "Boric Acid Blend System" in the control room.

## Step 14.a:

This step is a "When/Then" conditional phrase, however it is not formatted as per the writer's guide.

SOI-1.0-30 LOSS OF SECONDARY COOLANT

## Step 2.b:

If the operator is unable to equalize AFW flow in the action step 2a, he proceeds to the RNO for Step 2a, which shifts AFW Trains. When Step 2a RNO is complete, the operator proceeds to Step 2b. Since there is no direction to equalize flow in either Step 2a RNO or Step 2b, the single fact that RCS loop delta-temperature indications are or are not equal will not provide a valid indication of a feed header rupture. This same concern applies to the Continuous Action Step "FEED LINE BREAK ISOLATION". The steps should have a statement added (Note or Caution) that indicates that the check of loop delta-temperature is only valid with equalized flows.



## Step 5.b:

This step directs the operator to check RCS pressure - LESS THAN 2185 PSIG. That is difficult to do, because the gage is graduated in 20 PSI increments.

## Step 9.b(1) Response Not Obtained (RNO):

The switch referred to in this step is labeled "NORMAL TEST" with no "/" between the words as described in the step. The term "(OR/AND)" appears to be a typographical error. The step also states "(expect some circuit delay)". The Background Document states that the time delay is approximately 13 seconds. Operators are not familiar with this value, and including the information would be beneficial to the operators and consistent with the practice noted in other EOs.

## Step 9.b(3) RNO:

The last sentence should specify that the "TEST" switch should be used to reset SI at the sequencer to eliminate confusion with the Normal Test switch referred to in RNO Step 9b(1) above.

## Step 12 RNO:

The reset buttons for the charging pumps are not labeled.

## Step 14 Caution:

The caution directs action when RWST level approached 12%, but the Continuous Action Step "TRANSFER TO COLD LEG RECIRCULATION" directs action when RWST level is equal to or less than 20%. It is unclear when the caution would apply, since the Continuous Action Step directs actions at a higher RWST level. It might be more appropriate to include this action as an additional step in the Continuous Action Step.

## Step 16.a:

The operator is directed to position the RHR heat exchanger temperature controller to "MANUAL, SET AT 30% OPEN:". The manual indicator on the controller has a range of 0 to 100, with 0 being full open and 100 being full close. All the operators initially would have placed the valve at 30% on the manual indicator, which would have positioned the valve at 70% open. The wording of this step needs to be corrected to eliminate this confusion.

## Step 16.e RNO:

This step does not address the conflict between the action in the RNO and the action contained in the Continuous Action Step "SI REINITIATION CRITERIA". Both steps contain the same plant parameter, which is pressurizer level less than 10% [20%]. In the RNO, the operator is sent to a step involving AFW flow until pressurizer level is restored, but in the Continuous Action Step the operator is directed to Initiate Safety

Injection. The operator should not have conflicting guidance between the Continuous Action Steps and the procedure steps.

Step 21.b RNO:

The step directs the operator to implement SOI-1.0-61, LOSS OF ALL AC POWER RECOVERY, step 24, but the step does not prompt the operator to observe the Caution and Note preceding the step. This prompt is especially important in this instance, because the caution and note are located on the previous page of the EOI and will be missed by an operator directed to the step from another EOI.

Step 21.c:

The step states "Ensure exciter motor breaker 15211B02 - OPEN", but the switch buttons are labeled "START" and "STOP".

SOI-1.0-32 LOSS OF RHR DUE TO SECONDARY COOLANT IN CONTAINMENT

Step 1.a(2) RNO:

The step directs the operator to limit charging flow to 220 GPM, but the available charging pump flow meter only reads a maximum flow of 110 GPM.

Step 2.e and 2.f:

The local operations in these two steps are not sequenced in an efficient manner to expedite accomplishment.

Step 3.a:

The reset switches discussed in this step have been modified in the current outage period. The step needs to be rewritten to incorporate the modification.

Step 8.d(1) RNO:

The format of this step is not consistent with the identical actions in Step 1a(2) RNO.

Step 9.a:

The step directs local operations and states that RWST level be maintained at approximately 12%. The only RWST level indication that is available to the operator is indicated in feet not percentage. An appropriate RWST level in feet is needed.

SOI-1.0-40 STEAM GENERATOR TUBE RUPTURE

## Step 1:

The step deleted the actions in the ERG that were associated with High Radiation from the steam lines, but it was not justified in the deviation document. The steam lines currently do not have radiation monitors on the individual steam lines. Rather, there are monitors on the steam headers, but these will not allow determining which steam generator has ruptured.

## Step 2.b:

The word "or" should be highlighted as a logic term as it defines the condition that must be satisfied to continue in the AER column. Likewise, "or" in the RNO column should be highlighted.

## Step 2.e:

The step states "Start all lift oil pumps", but the labels call the pumps lube oil pumps. The procedure and labels should use the same terminology.

## Step 4:

The high level step directs the operator to start one RCP. However Substeps a through c provide steps for preparation prior to startup. By including these steps under the instruction to start a pump, they might be missed by an overly anxious RO.

## Step 4.b(1):

The permissive lights for the RCP oil lift pressure are unmarked white lights.

## Step 4.b(4):

The step states "RCP seal injection differential pressure", but the label on the meter reads "SHAFT SEAL DIFF PRESSURE". The procedure and label should use the same terminology. The step states the meter should read "APPROXIMATELY 20 INCHES W.C.", but the meter does not indicate the value of the increments and the abbreviation "W.C." is not defined in the Writer's Guide.

## Step 4.c (RNO):

The use of and/or should be avoided as the inclusive "or" provides the same meaning.



## Step 5.b (RNO):

The transition to step 6 should call attention to the caution preceding the step.

## Step 9.c.1:

This step directs the operator to maintain manageable primary - secondary differential pressure. The term "manageable" is vague and open to varying interpretations.

## Step 10.a:

The step directs operator to verify that the ruptured SG level is not increasing uncontrollably. This negative wording increases the likelihood for operator miscommunication.

## Step 11.b RNO:

The operator is provided no guidance or direction about what to do once he has executed the first IF/THEN action of stopping depressurization when pressurizer level is greater than 70%. Since depressurization to saturation is the goal of this step, the operator is not expected to proceed on to the next step (#12) in the procedure if pressurizer level exceeds 70% and the RCS is still pressurized. Without any additional guidance, that is what the User's Guide requires. More direction is needed in this step.

## Step 12.b:

The combination of logic terms AND and OR in the same statement make the condition ambiguous.

## Step 14 Caution:

The operators are unclear of the meaning of the term "Faulted" in this caution and it is not defined in the User's Guide.

## Step 14.a (RNO):

Same comment as SOI-1.0-20, step 31.a (RNO).

## Step 15.c:

The wording of this step is inconsistent with the wording of the identical step in SOI-1.0-61, LOSS OF ALL AC POWER RECOVERY Step 20c.

## Step 18.c:

The words "the associated" should be used instead of the word "one" prior to condensate pump, because only the pump whose discharge valve is closed in the previous substep should be started.

## Step 19 Caution:

The caution states "Radiological conditions should be considered while performing operations outside the Control Room". The caution should appear prior to step 18 not step 19, because step 18 is the first action in this procedure that is done outside the Control Room.

## Step 19:

The local operations in this step are not sequenced in an efficient manner to expedite accomplishment. Since an operator will need to refer to this two page list of equipment while in the plant, the step, excluding steps 19j & k which are Control Room actions, should be located on a form that the plant operator will be able to take with him into the plant when the step is to be performed.

The format of listing valve numbers within the main body of the step is inconsistent with the format usually used which is to list the valve numbers in columnar form following the action. Also, the wording "position valves-CLOSED" is not consistent with the typical direction to "close valves."

## Step 19.h&amp;i:

The directions to locally limit operation of valves and pump usage are vague and need clarification as to the specific actions required.

## Step 19.i:

The step directs the operator to "Locally limit reheater sump pump usage." This is difficult to perform, because there is no local indication to monitor the sump level and the pump controllers are not labeled.

## Step 19.j:

The step states "Verify condenser vacuum - GREATER THAN 26" Hg", but the indications on the two adjacent meters read in pressures of 0 to 10" HG and 0 to 5 PSIA. The verification step should refer to the parameters of the indicators that the operator will use.

## Step 19.k:

The step states "Stop both vacuum pumps", but the pumps are labeled "COND. VAC PUMP."

## Step 21.b:

Inconsistency between direction to open valves (plural) and qualifying phrase CCW 459 or 461, indicating that only one is required to be closed.

## Step 21.g&amp;h:

These steps appear to be out of order or at least appear to require combining. Step 21.h requires a minimum flow rate to be verified, after the action of Step 21.g to establish a cooldown. These would appear to be potentially conflicting actions. Also, Step 21.h does not specify a cooldown rate, and it also does not indicate whether the Residual Heat Removal flow control valve is to be opened or throttled "Slowly."

## Step 22.d:

The step directs the operator to verify automatic turbine turning gear engagement, but doesn't include a step to check that the turning gear engaged light is on, which is required in addition to the actions already listed in the step.

## Step 23.c:

These substeps use three, different methods of wording IF/THEN conditional statements (not described in the writer's guide).

## Step 23.d:

The step directs the operator to stop any operating RCPs. This wording is ambiguous and could be interpreted as meaning stop all RCPs, or to stop any that the operator chooses to stop.

## Step 23.e:

The operator is directed to maintain pressurizer level high in the indicating range. This step is unclear as to what actions should be taken to maintain level, and needs clarification of the phrase "high in the indicating range."

SOI-1.0-60 LOSS OF ALL AC POWER

## Step 7:

The ACTION/EXPECTED RESPONSE in this step is difficult to understand due to the multiple criteria that are used to define the conditions. The conditions need to be organized and defined in a simpler format to assist the operator in reaching the correct conclusion. This is one of the few steps in the EOIs that specifies a two out of three channel correlation when arriving at a decision and it complicates the step wording as a result.

## Step 9d:

The step states "Verify SISLOP - NOT ACTUATED", but the operators were not sure how to make this determination. Some specific indications of how to arrive at this conclusion are needed to assist the operator in reaching the correct answer.



## Step 14:

This step will become unnecessary with the valve repairs in progress during this maintenance period and the step, along with the associated actions in the Continuous Action Step "LOSS OF OFFSITE POWER AND DIESEL GENERATORS", should be deleted from this instruction.

## Step 15 RNO:

The step can apply to either step 15a or 15b, depending on the circumstances, but as presently written it can only be used if the action in step 15a is not successful. The step needs to be rewritten to allow both options.

## Step 17.b:

The step directs the operator to "Ensure RCP seal supply valves - CLOSED:". but it does not list the Alternate Controller Selector switches or the Alternate Control switches which should be checked in order to ensure that the valves are closed.

## Step 21.c:

The step states "Ensure generator DC emergency seal oil pump - RUNNING." This step cannot be performed as written, because there are no indications for this pump in the Control Room. The step must be performed locally. The name of this pump does not agree with the local label for this pump, which is "AIRSIDE SEAL OIL BACKUP PUMP."

## Step 27:

The breaker number is 42-1417 vice 42-1317, which is the number that presently appears in the EOI.

## Step 29:

The operator had difficulty locating the valves listed in this step. The step does not indicate that these are locally operated valves and does not include the area where they are located, which is the chemical feed area.

## Step 30.b:

The step does not indicate that the valve is locally operated. Also, there is no emergency light in the area to assist the operator in locating the valve.

## Step 31.b:

The emergency light that is in the area to assist in locating and operating the breakers in this step, is redirected away from the DC breaker panel. It only illuminates the top of the emergency light itself.

S01-1.0-61 LOSS OF ALL AC POWER RECOVERY

Step 8:

At the completion of this step, the Critical Safety Function Status Trees can be implemented in accordance with the note at the beginning of the procedure. A step to prompt the operators of this fact after step 8 would be useful.

Step 12.a:

It is not clear why only the radiation monitor R1212 is verified prior to establishing Containment Ventilation. Also, the Containment Sphere Particulate monitor R1211 also provides indication of potential radioactivity release from containment if ventilation is restored, and should also be verified.

Step 13.f:

Same as comment on Step 16a of S01-1.0-30 Loss of Secondary Coolant.

Step 15.b:

The step states "Energize at least one pressurizer heater control and backup group. "The operators are not sure if the step requires them to energize one control group and one backup group or just one control group or one backup group. The step should be rewritten to clarify the desired action.

Step 24 Note:

The note tells the operator to reset the 186-3 relays at No. 1 DG ACB 152-11C14 and No. 2 DG ACB 152-12C15 prior to opening the diesel generator breakers. The operator was confused by the wording of this note, because the 186-3 relays are actually located on the Auxiliary Cubicles 11C15 and 12C16. The only relays located on the breaker panels 11C14 and 12C15 are 186-2 relays. The note should contain the correct relay locations.

Step 24:

The step consists of a matrix table, but it is not clear in the upper left hand square how Bus 1C and Bus 2C relate to the matrix. A dividing line between the two busses appears to be missing.

S01-1.2-1 RESPONSE TO INADEQUATE CORE COOLING

Step 1:

The operator is directed to check any two hot leg Resistance Temperature Detectors (RTDs). During the walkdown, the operator was not sure if they could be from the same loop or not. This should be clarified in the procedure.

## Step 2.a.2 (RNO):

The operator is directed to ensure that the safety injection (SI) and feed pumps are tripped. The feed pumps should be listed first, as tripping SI pumps first could cause cavitation in the feed pumps.

## Step 3:

Under the high level step to verify SI system valve alignment, substep "a" directs the operator to ensure both SI trains initiated. This is not properly part of verifying valve alignment, and would be more appropriately presented as a separate high level step or a step which encompasses verification of valve alignment and SI pumps running. Also, because this substep is not specific in stating the desired action (that is, verifying SI actuation lights on), the operator interpreted it to require him to verify SI pumps were running, which is a separate step on the next page.

## Step 6.b (RNO):

Same comment as S01-1.0-23, step 1.b (RNO).

## Step 8.a:

The step calls for verification of RCS charging flow greater than 80 GPM. There is no indication of units (GPM) on the flow meter.

## Step 8.b:

The step calls for checking RCS pressure less than 1170 PSIG. The meter is not labeled as "RCS Pressure," only as "Wide Range Pressure." Also, the meter is marked in 50 PSIG increments so reading less than 1170 PSIG is difficult.

## Step 10.a:

There are no descriptive labels identifying each of the RCP seal supply controllers. There are only labels with the instrument numbers for each controller. Also, the instrument numbers identify them as FC 1115 A, B, and C while in actuality each controller controls two valves (that is, A&D, B&E, and C&F).

## Step 10.b:

The step directs the operator to open the "cold leg injection valves." The control room labels do not match this descriptive name.

## Step 12.a:

The operator is directed to verify core exit thermocouples (TCs) indicated on the nixi tube read out. The specification of using the nixi tube read out is not mentioned in previous step to verify TCs (step 1.a). The TCs could also be read out at the chart recorder.



## Step 14.a:

The reference to "PORV block valve" does not match the control room label of "Power Relief Isolation Valve."

## Step 14.c:

The inside/outside arrangement of controls for PORVs and associate block valves in control room is confusing and is not well marked. This arrangement has four control switches aligned horizontally this way: Block Valve A - Block Valve B - PORV B - PORV A. The operator has to remember the arrangement or closely read the labels to ensure the proper alignment of the valves.

## Step 15.a (RNO):

Same comment as S01-1.10, step 31.a (RNO).

## Step 16.a:

The reference to mode position on the selector switch (PRESSURE CONTROL, CONDENSER) does not match actual position label on the switch (CONDENSER).

## Step 18.a:

The step directs the operator to implement S01-4-3 RCP Operation "to the extent possible." This wording leaves it unclear as to what start-up criteria can be waived in this situation. In procedure S01-1.0-4, Step 4, the criteria are spelled out in the procedural step.

## Step 19.h (RNO):

This step is intended to accomplish the same function as Step 11.c, yet is worded quite differently. The operator stated that the wording in previous step is correct.

## Step 20:

The operator is directed to check the containment water level. There was no descriptive label for the indicator on the panel.

## Step 21.g (RNO):

Same comment as S01-1.0-23, step 8.e (RNO).

## Step 21.h (RNO):

Same comment as S01-1.0-23, step 8.g (RNO).

## Step 21.i (RNO):

Same comment as step 19.h (RNO).

SOI-1.3-1 RESPONSE TO LOSS OF SECONDARY HEAT SINK

Step 6:

The deviation document refers to Steam Generator (SG) pressure, but this step addresses Reactor Coolant System (RCS) pressure not SG pressure.

Step 12.a:

The step initiates feed flow to the SGs, but contains no directions to the operator concerning feed rates or SG level considerations. The following substeps in this step contain no guidance in this respect either.

Step 13.a(2):

The step wording is inconsistent with the same step in the Continuous Action Step "RCS". The step only states "RCS hot leg temperature and pressure - INCREASING", but the Continuous Action Step states "RCS pressure AND hot leg temperature - STEADILY INCREASING". The steps conveying the same meaning should be worded the same to eliminate operator confusion. The other two substeps are also worded slightly differently than the Continuous Action Step.

Step 13.a(3):

The step uses the term "WIDE RANGE" when referring to a SG level in INCHES. As a convention to differentiate these SG levels from the more normal percent levels, it appears effective. However, this convention is not delineated in the writer's guide and therefore would not be used consistently throughout the EOIs. A consistent practice should be established.

Step 16.b:

The step states "Verify at least one charging pump - RUNNING." In the RNO of Step 15c, the operator is directed to start the test pump if neither charging pump is running. If the test pump is not considered to fill the requirement of this step (Step 16b), the step should be reworded to make that fact clear to the operator.

Step 23.a:

The step states "Check at least two SI flow indicator - LESS THAN 1000 GPM:". This is a difficult task for the operators to perform, because the meters that the operator must use have their first indicated flow rate marked as 1000 GPM, and the mark is located at the bottom of the meter face.

SOI-1.3-3 RESPONSE TO STEAM GENERATOR LOW LEVEL

The bottom of the first page of this EOI contains a statement concerning Adverse Containment Conditions, but this provision is not utilized in this EOI. Therefore the provision serves no useful purpose.

## Step 5.a RNO:

This RNO step uses multiple IF/THEN conditions, but the conditions do not conform to the rules for using the IF/THEN convention as specified in the User's Guide, paragraph 2. 3.3. The second IF/THEN option in this step is actually functioning as an RNO for the first IF/THEN option. This is not allowed in the User's Guide.