



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report No.: 50-395/90-23

Licensee: South Carolina Electric & Gas Company
Columbia, SC 29218

Docket No.: 50-395

License No.: NPF-12

Facility Name: V. C. Summer

Inspection Conducted: August 20-24, 1990

Inspector:

Sheryl Lenzler
L. Lawyer, Team Leader

9/11/90
Date Signed

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9/11/90
Date Signed

SUMMARY

Scope:

This was a special, announced Emergency Operating Procedure (EOP) team inspection. Its purpose was to verify that corrective actions for previous findings in the area of emergency and abnormal operating procedures were adequate.

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Results:

The NRC team found that the licensee's resolution of comments in NRC Inspection Report 395/88-26 was technically accurate, timely, and thorough. The team found the EOPs adequate to mitigate the spectrum of accidents addressed in the WOG ERGs.

The team found that the accessibility of equipment necessary to EOP performance was excellent.

There are three areas which require improvement. These areas are technical content of procedures, AOP writer's guide and simulator fidelity. Technical inadequacies in the AOPs for refueling cavity water loss and control room evacuation and the EOPs for S/G depressurization, loss of ESF AC, natural circulation and natural circulation with a void are discussed in paragraph 2 and Appendix B. Writer's guide associated deficiencies in AOPs are discussed in paragraph 4 and Appendix C. Simulator limitations in fidelity are discussed in paragraph 3 and Appendix B.

REPORT DETAILS

1. Persons Contacted

Licensee employees

D. Bradham, Vice President, Nuclear Operations
*C. Fields, Shift Engineer
*M. Towlkes, Associate Manager, Shift Engineering
D. Haile, Nuclear Licensing Engineer
A. Horz, Auxiliary Operator
T. Howell, Training Instructor
*R. Karbach, Procedure Unit Supervisor
V. Keliy, Training Supervisor
S. Lathern, Reactor Operator
F. Lucas, Reactor Operator
H. Manos, Senior Reactor Operator
*J. Skolds, General Manager, Nuclear Plant Operations
R. Smith, Computer Engineer
*T. Wessner, Human Factors Engineer
*K. Woodward, Manager, Nuclear Operation Education and Training

Other licensee employees contacted included instructors, engineers, mechanics, technicians, operators, and office personnel.

NRC Representatives

*J. Hayes, Project Manager
*R. Haag, Senior Resident Inspector
*L. Modenos, Resident Inspector

*Attended Exit Interview

Procedures reviewed during this inspection are listed in Appendix A.

References to appendices are noted in parentheses. For example, (B IV 1) refers to Appendix B, item IV.1.

A listing of abbreviations used in this report is contained in Appendix D.

2. Review of Procedures by Inplant Walkthrough

The team reviewed an additional sample of EOPs and AOPs to assess the quality of the licensee's procedure upgrade process. These procedures were reviewed for human factors impact, adherence to the writer's guide, effectiveness of the V&V program and operator usability.

The team determined that the procedures were an improvement over those that had been used and that the procedures would adequately mitigate reactor accidents. Also, during the procedure walkthroughs, incidents of equipment inaccessibility were not encountered.

However, problems were noted with four EOPs as discussed below. The EOP for Loss of all ESF AC power did not adequately address protection of the RCP motor bearings or chemical sampling (B I 12a and d). The chemical sampling comment is generic to all EOPs with loss of BOP power (B I 12a). The attachment one valve listing for the EOP for S/G depressurization did not adequately identify certain block valves (B I 9a). The EOPs for natural circulation cooldown and natural circulation cooldown with a void in the head failed to provide a mitigation strategy in the event one or more generators were faulted (B I 4a).

The AOP for Control Room Evacuation did not adequately direct the operator to evaluate the status of the "A" RCP before tripping both the "B" and "C" RCPs. This could result in the unit going into natural circulation before a boration path is established (B II 9e). The other major AOP inadequacy was with the AOP for decreasing water level in the spent fuel pool or refueling cavity. The technical basis for this procedure was nonexistent and therefore appropriate constraints and actions had not been incorporated in the procedure (B II 5).

Specific instances where EOPs lacked sufficient detail or information are detailed in Appendix B. The deficiencies in EOPs and AOPs delineated in Appendix B are identified as part 1 of IFI 395/90-23-01.

There were no violations or deviations identified in this area.

3. Simulator Observations

The inspection team observed three simulator scenarios performed by the licensee in order to verify the adequacy of several of the EOPs and AOPs to mitigate their respective accidents. The scenarios performed were:

- a. Small break LOCA with a PZR spray valve failure
- b. Loss of secondary heat sink with steam dump failure, loss of main feedwater and loss of EFW
- c. SGTR

The inspection team concluded that the EOPs and AOPs utilized during each scenario were adequate to accomplish accident mitigation.

The team reviewed the capability of the V. C. Summer simulator to support EOP and AOP V&V and to train operators in EOP real time performance. The team found that about one-fourth of the EOPs cannot be validated on the simulator and nearly three-quarters have not been simulated with the operators for training (B VII 1). A review of the simulator fidelity limitations is identified as IFI 395/90-23-03. A table top method was used to validate those procedures which could not be validated on the simulator. Classroom training had been conducted for all EOPs.

There were no violations or deviations identified in this area.

4. Writer's and User's Guides

The team conducted a review of the WG to determine the adequacy of the program for preparing and implementing procedure upgrading. This review was based on NUREG-0899, Guidelines for the Preparation of Emergency Operating Procedures. The team concluded that the procedure generation program had addressed all relevant areas of procedure generation required by NUREG-0899; but that a number of deficiencies remain, primarily in the area of AOPs which interface with EOPs.

The PGP did not address the need to provide consistency between EOPs and AOPs at their interface. As a result, the AOPs which interfaced with EOPs did not follow the same guidelines as the EOPs. The AOPs did not specify when local operations were required, nor the location of locally operated components such as valves and breakers. Also, the AOPs were not in a two column format and did not use constrained verbs (C I 1b). EOP and AOP formatting, nomenclature, labeling, and information presentation were not the same. Details of these and other deficiencies are presented in Appendix C and are identified as IFI 395/90-23-02.

In addition, the team reviewed the EOP user's guide. The team concluded that this document provided useful and positive guidance on the general rules of EOP usage and control room activities associated with EOP implementation. Specific comments concerning the EOP user's guide are presented in Appendix B.

There were no violations or deviations identified in this area.

5. Review of NRC Inspection Report 395/88-26 Concerns and IFIs

The team reviewed concerns documented in IR 395/88-26 and the SER dated June 29, 1987. The team conducted reviews of deviation documents, procedure verification and validation guidelines, management control, setpoints and drawings; and performed simulator observations, procedure reviews and walkthroughs.

a. Deviation Documents

Paragraph 11.a of IR 395/88-26 identified that the licensee was in the process of developing an EOP plant differences document to identify and provide justification for deviations and additions to the generic WOG. The team determined that this development effort had led to the licensee issuing OAG-103.3 to document the specific plant differences between their plant and the reference plant. The licensee also issued deviation documents for each of their EOPs. These documents are a part of the licensee's PSTG.

b. Verification and Validation

The team reviewed concerns from IR 395/88-26 regarding licensee programs for verification and validation of EOPs and found them to be adequately resolved. Verification and validation concerns identified during this inspection are detailed in Appendix B. Followup on these concerns is identified as part 2 of IFI 395/90-23-01.

c. Procedure Review and Walkthroughs

The team conducted walkthroughs of those EOPs noted in IR 395/88-26 as having deficiencies. With the exception of the minor comments delineated in Appendix B, all previously identified comments had been resolved.

d. Simulator Observations

IR 395/88-26 documented several operating deficiencies identified during the observation of simulator scenarios. No deficiencies were noted in the scenarios observed during this inspection.

e. Management Control

The licensee's corrective actions to IR 395/88-26 included an audit by an independent outside organization to ensure the intent of the ERGs and NUREG-0899 were met.

During this inspection, the team determined from a review of the licensee's rewrite of EOPs that the licensee utilized a multidisciplinary team. The procedure rewrite reflected the licensee's positive attitude towards achieving effective user friendly emergency procedures. The licensee's team included independent outside organizations to provide human factors input as well as technical evaluations. Additionally, a V&V was conducted by SROs, training department instructors, QA and other qualified operations personnel. Further review indicated that the licensee conducted a review of each EOP to determine if additional weaknesses existed within the EOPs previously reviewed by the NRC team as well as EOPs not reviewed.

The QA group actively participated in the development and review of EOPs, conducted a training audit and surveillances of classroom instructions and simulator sessions. The team reviewed QA's findings and determined that the findings were adequately dispositioned by the licensee.

Station administrative procedure SAP-207A provides adequate guidance for the development, V&V, training, implementation and maintenance of the EOPs. Additionally, the procedure provides a formal operator feedback form replacing the informal methods previously employed.

The team found that management had been prompt in their response to identified weaknesses and thorough in their additional procedure reviews.

f. Setpoints

The team reviewed OAG-103.2 which was used as a reference source for the various setpoints in the EOPs. The only deficiency the team noted was that the licensee did not have a formal mechanism to ensure that replaced instrumentation that was used in the calculation of EOP setpoints was properly evaluated to determine if an EOP setpoint should have been changed.

The team followed up on previous concerns identified in IR 395/88-26.

- 1) IR 395/90-23 indicated that the licensee had not generated an EOP setpoint document to provide technical justification for process variables and trigger setpoints used in the EOPs. The team reviewed OAG-103.2 and the referenced calculations and found that the calculations reviewed included the appropriate error calculations in the determination of EOP setpoints.
- 2) IR 395/90-23 indicated that setpoints were not supported by a setpoint document that included allowances for potential cable degradation losses (I.R. loss). The team reviewed a selected sample of EOP setpoint calculations and found that I.R. losses had been included, as required.

g. Drawings

The team reviewed both interim and permanent plant drawings. Several of the drawings identified in IR 395/88-26 as illegible were reviewed and found to be legible. Other drawings reviewed were also found to be legible. For those interim drawings reviewed, only one was issued prior to 1988. That interim drawing had an issue date in 1983.

There were no violations or deviations identified in this area.

6. Review of the SER Comments on the PGP

The team reviewed the SER comments on the PGP as discussed below and found that the comments can be closed upon resolution of the deficiencies noted in this report.

a. Comparison of EOPs to ERGs

Paragraph 1.A of the SER on the licensee's PGP identified that there were safety significant differences between the ERGs and the licensee's EOPs, and that the licensee's justification for these differences was not included in the PSTG. In order to correct this item the licensee issued OAG-103.3 to document the specific plant differences between the Summer plant and the reference plant. The licensee also issued deviation documents for each of their EOPs. These documents are a part of the licensee's PSTG.

Paragraph 2.A of the SER also identified that the licensee had not developed an EOP for transfer to hot leg recirculation (ES-1.4 of the ERG). The licensee developed EOP 2.3 which corrected this problem.

b. Writer's Guide

The team reviewed the comments documented in the June 29, 1987 SER relating to the writer's guide. The team conducted a comparison of the current writer's guide with the comments in the SER. The team concluded that the licensee had been responsive to the SER and had resolved the comments documented therein.

c. Verification & Validation

The team reviewed the SER comments for V&V of EOPs. All except two SER comments were adequately resolved. The two unresolved comments are V&V personnel qualifications (B IV 2a) and simulator validation (B IV 2a).

d. Training Program

The description of the operator training program on EOPs was reviewed to determine if previously omitted NUREG-0899 objectives had been incorporated into existing plant documents. SAP-207A administratively controls the licensee's training program. A review of SAP-207A indicated that concerns previously identified had been corrected. The team also reviewed lesson plans and verified that objectives were included when applicable.

There were no violations or deviations identified in this area.

7. Actions on Previous Inspection Findings (92701, 92702)

(Closed) IFI 395/88-26-06: Correct EOP discrepancies identified in Appendix 7 of IR 395/88-26. The team reviewed the discrepancies and verified that all had been corrected except for those items identified in paragraph III of Appendix B to this report. This item is closed.

(Closed) IFI 395/88-26-07: Correct EOP discrepancies identified in paragraph 11.c of IR 395/88-26. The team verified that the items in paragraph 11.c were appropriately dispositioned. This item is closed.

(Closed) VIO 395/89-14-01: Corrective action on licensee identified operator-at-the-controls problems. The team reviewed the licensee's response to this violation and concluded that it provided adequate corrective action for the identified deficiency. The team also verified implementation of those corrective actions. This item is closed.

(Closed) Safety Information Management System (SIMS) Items I.C.1.2.A (B VI 1), I.C.1.3.A (B VI 1), I.C.1.2.B (B VI 2), I.C.1.3.B (B VI 2), II.B.4.2.A (B VI 3), and II.B.4.2.B (B VI 3) are closed as detailed in Appendix B.

8. Exit Interview (30703)

The inspection scope and findings were summarized on August 23 and 24, 1990, with those persons indicated in paragraph 1. The NRC described the areas inspected and discussed in detail the inspection results listed below. No proprietary material is contained in this report. No dissenting comments were received from the licensee.

<u>Item Number</u>	<u>Description, Paragraph No.</u>
IFI 395/90-23-01	Technically inadequate procedures and V&V comments, paragraphs 2 and 5.b and Appendix B
IFI 395/90-23-02	Writer's and user's guide discrepancies, paragraph 4 and Appendix C
IFI 395/90-23-03	Simulator fidelity limitations, paragraph 3 and Appendix B

APPENDIX A

PROCEDURES REVIEWED

EOP-1.0	Reactor Trip/Safety Injection Actuation	Rev 5
EOP-1.1	Reactor Trip Recovery	Rev 4
EOP-1.2	Safety Injection Termination	Rev 4
EOP-1.3	Natural Circulation Cooldown	Rev 4
EOP-1.4	Natural Circulation Cooldown with Steam Void in Vessel	Rev 3
EOP-2.0	Loss of Reactor or Secondary Coolant	Rev 6
EOP-2.1	POST-LOCA Cooldown and Depressurization	Rev 4
EOP-2.3	Transfer to Hot Leg Recirculation	Rev 5
EOP-2.4	Loss of Emergency Coolant Recirculation	Rev 4
EOP-3.0	Faulted Steam Generator Isolation	Rev 4
EOP-3.1	Uncontrolled Depressurization of All Steam Generators	Rev 4
EOP-4.0	Steam Generator Tube Rupture	Rev 7
EOP-4.2	SGTR With Loss of Reactor Coolant: Subcooled Recovery Desired	Rev 4
EOP-6.0	Loss of All ESF AC Power	Rev 4
EOP-6.2	Loss of All ESF AC Power Recovery With SI Required	Rev 3
EOP-9.0	High Radiation Outside Containment	Rev 3
EOP-12.0	Monitoring of Critical Safety Functions	Rev 6
EOP-13.0	Response to Abnormal Nuclear Power Generation	Rev 4
EOP-14.2	Response to Saturated Core Cooling Conditions	Rev 3
EOP-15.0	Response to Loss of Secondary Heat Sink	Rev 4
EOP-15.3	Response to Loss of Normal Steam Release Capabilities	Rev 3
EOP-15.4	Response to Steam Generator Low Level	Rev 3
EOP-17.1	Response to Reactor Building Flooding	Rev 3
EOP-18.2	Response to Voids in Reactor Vessel	Rev 3
AOP-106.1	Emergency Boration	Rev 0
AOP-112.2	Steam Generator Tube Leak Not Requiring SI	Rev 0
AOP-115.5	Loss of Residual Heat Removal System While at Mid-Loop Conditions	Rev 0
AOP-117.1	Total Loss of Service Water	Rev 1
AOP-123.1	Decreasing Water Level in the Spent Fuel Pool or Refueling Cavity	Rev 0
AOP-123.2	Decreasing Boron Concentration in the Spent Fuel Pool or Refueling Cavity During Refueling	Rev 0
AOP-123.3	Potential Fuel Assembly Damage During Refueling	Rev 0
AOP-206.1	Loss of Condenser Vacuum	Rev 2

AOP-403.3	Continuous Control Rod Motion	Rev 0
AOP-403.6	Dropped Control Rod	Rev C
AOP-600.1	Control Room Evacuation	Rev 0
DAG-103.2	Emergency Operating Procedure Setpoint Document	Rev -
DAG-103.3	EOP Plant Differences Document	Rev 0
SAP-207A	Development of Emergency Operating Procedures	Rev 1

APPENDIX B

TECHNICAL AND HUMAN FACTORS COMMENTS

This appendix contains technical and human factors comments and observations. Unless specifically stated, these comments are not regulatory requirements. However, the licensee acknowledged that the factual content of each of these comments was correct as stated. The licensee further agreed to evaluate each comment, to take appropriate action and to document that action. These items will be reviewed during a future NRC inspection.

I. EOP Comments

1. EOP 1.0 Reactor trip/safety injection actuation

- a. General comment: A walkthrough of the control board disclosed that most of the scales for the various recorders were obliterated by black ink from marking pens. The licensee had previously issued and completed work orders to correct this condition, however, discussion with several operators led the team to conclude that a permanent solution has not been found.
- b. Various steps: This procedure was inconsistent when referring to components. In some cases the generic name was used, in some cases the generic name followed by the valve number was used and in no case did the EOP nomenclature match the control board label for the following components; MS isolation, relief, dump and bypass valves, pressurizer spray, PORVs and block valves.
- c. Reference page: One of the RCP trip criteria was RCS wide range pressure less than 1380 psig. This was not supported by the Westinghouse calculation for this set point which specified the set point as 1381 psia (1366 psig) (reference Westinghouse letter CGE-83-822, dated September 22, 1983, equation 7). The licensee incorrectly used psig instead of psia when transferring the number from the setpoint calculation to the EOP. This setpoint is required to be established at a value between the RCS pressure for RCP trip considering small break LOCAs (1366 psig) and the RCS pressure for RCP trip in the event of a GTR and other transients (1421 psig) according to the generic issues section of the WDG ERG executive volume. Despite this error the setpoint fell between these limits.
- d. Step 6a: For the valves listed in this step, the EOP nomenclature did not match the label in the control room.
- e. Step 7b2 RNO: The action statement did not recognize that there were train A and train B switches for valve PVG-2030.

- f. Step 14b: For the valves listed in this step, the EOP nomenclature did not match the label in the control room.
 - g. Step 15a: The numbers on the paper in this chart recorder represented wide range pressures. The readability of this indication would be improved if the scale represented narrow range values.
 - h. Step 15a1 RNO: The intent of this action statement was to verify phase B and RB spray bistables had tripped. The action statement did not clearly require this action. The walkthrough operator could not distinguish action required by this step from the action required by step 15a2 RNO.
 - i. Step 17 RNO: This step did not list the valves that must be closed if required.
 - j. Step 21: The valves listed in the first two bullets were prefixed with IFV. They were shown as FCVs on the control board.
 - k. Step 23b RNO: This step did not recognize that the controllers for the listed valves must be placed in manual prior to closing the valves.
 - l. Step 27c: The EOP nomenclature for RM-G7 did not match the label on the control board.
 - m. Step 33a: The EOP nomenclature for RM-A11 did not match the label on the control board.
- 2. EOP-1.1 Reactor trip recovery
 - a. Step 7b1 RNO: This step referred to PORV block valves. The label on the panel used the terminology "isolation" valve.
 - 3. EOP-1.2 Safety injection termination
 - a. No comment
 - 4. EOP-1.3 Natural circulation cooldown
 - a. Step 20b: This step directed the operator to continue dumping steam from all S/Gs to facilitate cooldown of the reactor vessel head and S/Gs. This same step appears in both EOP-1.4, step 13b and ERG ES-0.3, Natural circulation cooldown with steam void in vessel. These action steps do not consider the possibility that one or more S/Gs may be faulted, thus alternate actions (RNOs) are not provided to the operators if all S/Gs are not available.

5. EOP-1.4 Natural circulation cooldown with steam void in vessel
 - a. General: This procedure had not been validated since the simulator was not capable of simulating natural circulation with a steam void in the vessel head.
 - b. Step 2 Note: The Note specified that "Saturated conditions in the PZR should be established before decreasing PZR level". It did not specify the method for determining PZR saturation.
6. EOP-2.3 Transfer to hot leg recirculation
 - a. General comment: This procedure required the operator to establish the switch from cold leg recirculation 11 hours after a LOCA and reverse the path every 18 hours after this transfer. There was no established method for reminding the operator to perform these evolutions at the required time.
7. EOP-2.4 Loss of emergency coolant recirculation
 - a. Step 7: This step provided instructions to initiate RCS cooldown to cold shutdown. Under alternative action B it may be necessary to use the TD EFW Pump or S/G blowdown to dump steam if the steamline power relief valves are not available. Procedure numbers were not provided for the two procedures the alternate methods identified.
8. EOP-3.0 Faulted steam generator isolation
 - a. No comment
9. EOP-3.1 Uncontrolled depressurization of all steam generators
 - a. Step 1a RNO fourth bullet: This step required the operator to locally close the Main FW Isolation valves (PVG-1611A(B)(C)) or block valves for all S/Gs. The operator on the walkthrough indicated that maintenance would be called to close these valves. This was not indicated in the procedure. Also the procedure did not indicate if block valves existed for these valves. The fifth and sixth bullets were valves which provided the same isolation function as the Main FW Isolation valves but this was not indicated by the procedure.
 - b. Step 1a RNO seventh bullet: The S/G back flush valve (PVT-1678C) did not have a local label tag.
 - c. Step 1a RNO tenth bullet: For the S/G sample isolation valves (SVX-9398A(B)(C)) the RNO stated "IF valves can NOT be closed, THEN locally close valves or block valves one loop at a time. REFER TO Attachment 1 for valve location information".

The S/G sample isolation valves are solenoid valves that cannot be operated locally and this was not indicated in the procedure.

- d. Attachment 1: This attachment included the S/G A,B and C blowdown sample cooler inlet valves but the procedure did not clearly indicate these as functioning as block valves for the S/G sample isolation valves and the operator on the walkthrough did not readily recognize them as such. Due to this lack of procedural information the operator on the walkthrough spent time looking at drawings to locate the S/G sample isolation valves and did not realize they could not be operated locally until arriving at the valve locations and still did not readily associate the S/G blowdown sample cooler inlet valves listed in Attachment 1 as functioning as block valves for the S/G sample isolation valves. Also the S/G sample cooler isolation valves are located in the primary sample sink in a contamination area and would probably be operated by chemistry rather than an AO. This was not indicated by the procedure.
10. EOP-4.0 Steam generator tube rupture
 - a. Attachment 1: The valves listed in the operator action section of this attachment required local actions; however, they were not identified as such.
 11. EOP-4.2 SGTR with loss of reactor coolant: subcooled recovery
 - a. No comment
 12. EOP-6.0, Loss of all ESF AC power
 - a. General comment: In this procedure and in all procedures that had both loss of BOP AC power as a caution and requirements for chemistry to take samples, the chemistry group's ability to perform analyses was limited due to the fact that the sample laboratory did not have AC or DC power available to perform the analyses. This problem affected analyses such as boron concentration, isotopic activity, and pH.
 - b. Reference page: The reference page was not attached to the controlled copy of this procedure in the main control room. The team requested the licensee to review the remaining controlled copies of other EOPs to determine if there were other EOPs that were missing the reference page. The results of this review were that all controlled copies of EOP-6.0 were missing the attached reference page. All other EOPs had all required reference pages. The licensee immediately corrected all copies of EOP-6.0.
 - c. Reference page item 2: This item was not applicable for the first 5 procedural steps.

- d. Step 5 caution: This caution required the RCPs to be stopped if AC power was not restored to at least one ESF bus within ten minutes. This caution was required in order to prevent the RCP bearing oil from exceeding 195 degrees and potentially damaging the bearings. There were no procedural steps for accomplishing this task. The RCP seals were not isolated until more than ten minutes into the event. There was no established method for reminding the operator to accomplish this task.
 - e. Step 13: This step required access through a security door. The health physics technicians that would perform this step did not have the required key.
 - f. Step 13b RNO: This step required the operator to stand on the main steam line to locally close XVGO2808A, XVGO2808B, and XVGO2808C. It may not be possible to stand on this piping for the time required to close these valves without sustaining severe burns.
 - g. Attachment 4 general comment: With the current alignment, the valve between the auxiliary boiler and the demineralized storage tank could have been opened and that would have provided demineralized water for primary makeup rather than filtered water.
 - h. Attachment 5 step 4d: This step required the operator to start the diesel driven alternate fire pump. This was an evolution that was not routinely performed and specific instructions for starting the pump were not given. Two ACs interviewed stated that instructions for this evolution would have been necessary for them to perform this step.
- 13. EOP-6.2 Loss of all AC power recovery with SI required
 - a. No comment
 - 14. EOP-12.0 Monitoring of critical safety functions
 - a. No Comment
 - 15. EOP-14.2 Response to saturated core cooling
 - a. No comment
 - 16. EOP-15.3 Response to loss of normal steam release capabilities
 - a. No comment
 - 17. EOP-15.4 Response to steam generator low level

- a. No comment

II. AOP comments

1. AOP-106.1 Emergency boration

- a. Step 4.1c1 and 4.1c2: These steps directed the opening of specific valves to initiate gravity draining the boric acid tank to the charging pump suction. The specified valves are not frequently operated valves and notation is not provided to guide the operator to the location of these valves. This occurred in other steps requiring local operations. Those steps are not flagged as requiring local operation nor do they specify the location of valves and breakers.
- b. Step 4.3: This step required a sample of the RCS for boron concentration but did not direct the operator to notify the Chemistry department of the need to take a sample.
- c. Step 4.5: This step directed the operator to use pressurizer heaters to promote mixing of boron between the reactor coolant system and the pressurizer. Caution tags were attached to both BU GRP 1 and BU GRP 2 switches. The caution tags referenced SO 89-10 which was issued to provide instructions governing modifications to the operations of both of these switches. These caution tags were in error; SO 89-10 had been replaced by SO 90-04. This error was pointed out to the licensee and the tags were corrected to reflect the current SO.
- d. Step 4.6: Same as step 4.3 above.

2. AOP-112.2 Steam generator tube leak not requiring SI

- a. No comment

3. AOP-115.5 Loss of residual heat removal system while at mid-loop conditions

- a. WOG ARG-1 step 3: This step required the operator to determine the time to boiling in order to make a decision on whether to establish containment integrity. The AOP established containment integrity without calculating time to boiling. As a result, the operator was deprived of valuable information concerning the severity of the event.
- b. Step 4.10c2: This step referred to MVG-8701(B) as the RCS loop B to pump B valve. The control board label designated the valve as the RCS loop C to pump B valve.
- c. Step 4.10c3: This step referred to MVG-8702(B) as the RCS loop B to pump B valve. The control board labeled this valve as the RCS loop C to pump B valve.

- d. Step 4.10c4: This step referred to HCV-605A(B). The control board was labeled FCV-605A(B).
 - e. Step 4.10c6: This step referred to HCV-605A(B). The control board was labeled FCV-605A(B).
 - f. Steps 4.13e, f, and 4.16a through i: These steps required local actions be taken concerning the referenced pumps and valves. The AOP did not state that these valves were local and did not specify the component location.
 - g. Steps 4.13e, 4.13f, 4.16c, 4.16d, 4.16e and 4.16g: The valve numbers referenced in these steps were not suffixed with the system letters as shown on the component label plate, e.g., XVG-6661 vice XVG-6661-SF.
4. AOP-117.1 Total loss of service water
- a. No comment
5. AOP-123.1 Decreasing water level in the spent fuel pool or refueling cavity
- a. General comment: The technical basis for this procedure is not adequately reflected in the procedure content. For example:
 - 1) the magnitude of the maximum leak is not disclosed to the user
 - 2) important information such as radiation levels as a function of water level are not readily available
 - 3) this procedure gives the operator no guidance in the event of loss of AC
 - 4) accidents other than cavity pool leak, have not been adequately reviewed and included
 - 5) the contribution to exposure rate on the refueling bridge due to the upper internals package may not be adequately reflected in the procedure.
6. AOP-206.1 Loss of condenser vacuum
- a. Local operations and locations are not specified for valve operations.
7. AOP-403.3 Continuous control rod motion
- a. No comment
8. AOP-403.6 Dropped control rod
- a. No comment

9. AOP-600.1 Control room evacuation

- a. Steps 3.2a and 3.2b: These steps contained actions which could be accomplished from outside the control room, if required. There were no guidelines for accomplishing these steps from outside the control room.
- b. Steps 3.3d1 and 3.3d2: These steps required the turbine to be tripped prior to the manual reactor trip. Tripping the turbine first had not been evaluated. This sequence of steps could exacerbate the casualty in the event that an ATWS pre-existed. These steps were placed in this order to facilitate the path the operator took to the CREP, rather than because they were the best mitigation strategy.
- d. Step 3.4a: This step required the operator to verify that AC power was available to ESF buses. No guidelines were provided for contingencies if one or both ESF buses were not available.
- e. Step 3.4b note: This note referred to attachment I. If the "A" RCP was not running, this step would trip the remaining RCPs and place the unit in natural circulation prior to establishing the appropriate boration path.
- f. Steps 4.5 and 4.8: These steps required the operators to maintain a parameter at a single value. The operators can only control parameters within a finite band. No band was specified.
- g. Step 4.7: This step directed the operator to verify that the VCT level was "normal" rather than specifying the exact level or range for VCT level.
- h. Step 4.11a and 4.11b: These steps required the operator to determine subcooling and a saturation temperature, but failed to direct them to use steam tables.
- i. Attachment I Steps 2c and 3d: Step 2c directed the BOP operator to check whether condensate pump A is running. Several actions later, step 3d required the operator to recall whether the pump was running and, if it was, to trip the other two condensate pumps. Because the operator did not have to record the information in step 2c and because of the potential stress accompanying this event, there is the potential for the operator to incorrectly remember and thus trip all three condensate pumps.

III. EOPs Previously Reviewed

1. EOP-2.0 Loss of reactor or secondary coolant

- a. IR 395/88-26 attachment 7 comment 1a: This comment had not been resolved by the licensee. There was an unresolved design issue associated with this comment.
 - b. IR 395/88-26 attachment 7 comment 1b: The part of the comment concerning the EOP step had been resolved by the licensee. The part of the comment concerning the green band on the indicator had not been resolved. Modification Request Form 21632 had been issued to correct the green band problem.
 - c. IR 395/88-26 attachment 7 comment 1c: This comment had been resolved by the licensee.
2. EOP-2.1 Post-LOCA cooldown and depressurization
 - a. Note 15: This note was deleted in revision 3 of the procedure.
 - b. Step 35: Information was incorporated into the procedure in revision 3. The hot leg temperatures are less than 350 degrees F and RCS pressure is less than 425 psig.
 3. EOP-2.4 Loss of residual heat removal system
 - a. This procedure no longer exists as an EOP. It has been changed to an AOP (AOP 115.5).
 - b. Deficiencies noted in IR 395/88-26 were adequately addressed.
 4. EOP-3.0 Faulted steam generator isolation
 - a. Deficiencies noted in IR 395/88-26 were adequately addressed.
 5. EOP-4.0 Steam generator tube rupture
 - a. Two previously identified deficiencies noted in IR 395/88-26 had not been resolved. Both items concerned feed flow rates to hot dry generators. These items were being addressed by engineering.
 6. EOP-4.2 SGTR with loss of reactor coolant: subcooled recovery
 - a. Deficiencies noted in IR 395/88-26 were adequately addressed.
 7. EOP-6.0 Loss of all ESF AC power
 - a. Deficiencies noted in IR 395/88-25 were adequately addressed.
 8. EOP-6.2 Loss of all AC power recovery with SI required
 - a. Deficiencies noted in IR 395/88-26 were adequately addressed.

9. EOP-7.0 Refueling emergency

- a. Deficiencies noted in IR 395/88-26 were adequately addressed.
- b. General comment: This procedure was replaced by three AOPs: AOP-123.1, Decreasing Water Level in The Spent Fuel Pool or Refueling Cavity, Rev. 0; AOP-123.2, Decreasing Boron Concentration in The Spent Fuel Pool or Refueling Cavity During Refueling, Rev. 0; and, AOP-123.3, Potential Fuel Assembly Damage During Refueling, Rev. 0.
- c. The AOP-123 series did not follow the EOP two column format. The alternate actions were integrated within the action/expected response steps. Transitions from EOPs to AOPs required operators to adjust to format changes in methodologies of mitigating accidents. This situation creates a potential for exacerbating an already stressful operator environment during an emergency.

10. EOP-13.0 Response to abnormal nuclear power generation

- a. Deficiencies noted in IR 395/88-26 were adequately addressed.

11. EOP-15.0 Loss of heat sink

- a. Deficiencies noted in IR 395/88-26 were adequately addressed.

12. EOP-18.2 Response to voids in reactor vessel

- a. Deficiencies noted in IR 395/88-26 were adequately addressed.

IV. Details of Review of Verification and Validation

1. Current V&V review

- a. Review by the team indicated complete simulator validations have been performed for only 13 of the 43 EOPs. Team review disclosed that limitations in simulator modeling restricted the available scenarios for validation exercises.

2. SER V&V items

- a. All SER V&V items had been adequately resolved with the exception of the following two:
 - 1) SER section C item 2 refers to specification of roles, responsibilities and selection criteria for personnel involved in V&V including human factors experts. Detailed specifications for human factors experts were not included in the licensee's SAP-207A.

- 2) SER section C item 3a referred to simulator validation as the primary evaluation method. SAP-207A merely designated simulator validations as the "preferred method". This does not adequately emphasize the role of the simulator in procedure validation.

V. SIMS Closeout Details

1. Items I.C.1.2.a and I.C.1.2.b - Inadequate core cooling: The team found that the licensee's procedures to assist the plant operating staff to:
 - a) recognize and prevent impending core uncovering and
 - b) recover from a condition in which the core has experienced inadequate core cooling were based on WOG analyses and were adequate.
2. Items I.C.1.3.a and I.C.1.3.b - Revise procedures: The team found that emergency procedures had been upgraded consistent with the WOG guidelines in response to NUREG-0737.
3. Items II.B.4.2.a and II.B.4.2.b - Training on mitigation of core damage: The team found that the licensee had developed and implemented a training program on mitigating core damage.

VI. Simulator Details

1. The licensee has a total of forty-three EOPs presently in use. Thirty-two of the EOPs have been at least partially validated on the simulator. The remaining eleven have not been validated on the simulator due to simulator modeling limitations. A table top method was used to validate the remaining eleven EOPs. Licensed personnel have been trained on thirteen EOPs in the simulator and all forty-three in the class room.

APPENDIX C

WRITER'S AND USER'S GUIDES COMMENTS

This appendix contains writer's and user's guides comments and observations. Unless specifically stated, these comments were not regulatory requirements. However, the licensee acknowledged the factual content of each of these comments as stated. The licensee agreed to evaluate each comment, to take the appropriate action, and to document that action. These items will be reviewed during a future NRC inspection.

I. IR 395/88-26 Writer's Guide Comments

1. General: The writer's guide did not provide enough examples to illustrate many of the principles of procedure writing. Examples were not provided that illustrated the implementation of some sections of guidance contained in the writer's guide.
2. General: The requirements for preparation of AOPs were not addressed in this or another writer's guide. The writer's guide failed to require that AOPs which interface with EOPs be written to the same requirements as the EOPs.
 - a. Important AOPs that interface with EOPs are not in two column format and they do not use constrained verbs.
 - b. Local operations, when required, are not specified in the procedure as "local"; locations of infrequently used components were not specified.
3. Section 3.10a: This section stated that "Instructions for the use of an attachment will always be provided in the body of the procedure", but did not state that such instructions would also be included in the attachment for easy reference.
4. Section 3.13b: This section provided guidance for splitting steps or substeps between pages and indicated that step splitting should be done at least at the end of a first level substep. However, it did not prohibit the splitting of time critical or dependent steps.
5. Section 3.14b: An example was not provided to clarify the step numbering exception noted when the RNO did not correspond to the substep in the corresponding action column.
6. Section 3.14c: This section stated that steps should not exceed two pages in length. However, it placed no restrictions on the number of actions or number of items being manipulated and did not state the requirement to limit a step to one concept only.
7. Section 3.16: This section indicated that operator actions with multiple contingencies may best be illustrated using a table, but provided no examples of good or bad table usage.

8. Section 3.18: This section stated that when it is imperative that a step be completed before proceeding to the next step, the procedure should clearly so state, generally by use of a note. This section lacked a description of all methods used for denoting time-dependent actions so that if a note was not used, the procedure writer would know what other convention to use.
9. Section 4.1: This section did not address the proper tense to use in sentence construction. If it were included, it would ensure consistency in syntax.
10. Section 4.1d2: This section stated that high level steps should only address one concept per step. Examples of proper and implementation of this guidance were lacking.
11. Section 4.4: It was not made clear that the primary labeling issues was that equipment labels in the EOPs the exact same way the equipment is labeled in the control the plant. Sections 4.4a through 4.4d provided examples of equipment labels varied for different systems and was used in illustrating the importance of the rule. However, the rule was not stated directly. In addition, this section did not indicate that since the equipment labels in the procedures were meant to match the labels of equipment exactly as they appear in the plant that there would be a possibility for some acronyms, abbreviations, or constrained language to be used differently than as prescribed in Attachments VI and VII of the writer's guide.
12. Section 4.5b1: This section stated that "The specific equipment tag number and exact control board nomenclature may be used in the [action] statement if necessary." Section 4.4 prescribed the usage of the exact equipment nomenclature for all systems described, and did not imply that there would be times when this information would be unnecessary. Thus, section 4.5b1 was not consistent with section 4.4. Additionally, this section stated that for valves operated locally all information should be included but did not specify what that was. It lacked a reference to the appropriate section in which this information could be found.
13. Section 4.6a: This section instructed the procedure writer to avoid abbreviating words, etc., unless the system or component was commonly referred to in an abbreviated form. The guidance failed to indicate that only the approved abbreviations, acronyms, and symbols found in the appropriate attachments of the writer's guide could be used.
14. Section 4.6b: This section warned the writer that if an abbreviation could represent two different words, to spell it out. The guidance failed to indicate that only those approved abbreviations found in the appropriate attachment of the writer's guide could be used.

15. Section 4.10: This section did not indicate that tolerances must always employ the same units of measurements which are displayed on the instrumentation in the control room. This section also failed to indicate that the range must parallel the instrument readouts in the control room (e.g., did not allow a range of 212 to 248 if the control device provides only increments of 10).
16. Section 4.12b and 4.12c: These sections indicated that the units of measurement and increments for the grids of axes should have been either familiar or conveniently chosen. They failed to state that the criteria for choosing the units of measurement for the grids of axes must be based on the units of measurement used in the control room.
17. Section 4.12e: This section indicated that significant digits should not exceed three. This section failed to state that the number of significant digits must be based on the significant digits to which the control room indicators will be read.
18. Section 4.12f: No guidance was provided on text sizing to make labels and numerals readable.
19. Section 4.12g: This section lacked an example to demonstrate usage and implementation of its guidance.
20. Section 4.12i: This section did not indicate that hand drawn graphs were prohibited. In addition, this section failed to identify requirements for quality standards of graphic aids.
21. Section 4.13b: The guidance in this section stated, "Size the table according to the amount of data displayed", but provided no other guidance. It lacked examples of how to implement the guidance.
22. Section 4.14: This section did not provide guidance on how to construct figures other than their titling and labeling.
23. Section 4.15a5): The example of a caution did not employ the correct format. The box was not 6.25" wide per instructions in the writer's guide for formatting Cautions.
24. Section 4.15b3): This section states: "The need for additional information may point the procedure writer to using an attachment or reference page rather than a note." The job task analysis conducted as part of the training program should have provided the procedure writer with the information requirements of the operator for each step. This guidance lacked clear instructions and examples of what information should have been presented in a note, an attachment, a reference page and when to use each.
25. Section 4.16d: The writer's guide provided an example of the usage of the term "REFER TO" in capital letters but failed to mention a requirement for capitalizing this term.

26. Section 4.16f1): The writer's guide provided an example of using the term Complete as capitalized and bolded, but did not mention the emphasis requirements.
27. Section 4.16f3): The writer's guide stated that "Continue is often used as CONTINUE WITH in capital letters and bolded." If it is to be used differently, the writer's guide did not address how and when or otherwise state that it was to be always used in only one way. In the event it was intended to be used in more than one way, the writer's guide failed to present examples.
28. Section 4.19a: This section failed to provide an example of presenting concurrent steps in the body of a procedure.

II. Closeout of SER Comments on the Writer's Guide

The team reviewed the concerns documented in the June 29, 1987 SER relating to the writer's guide. A comparison was conducted to determine whether the licensee's implementation of corrective actions in response to the SER were adequate and met the requirements of guidelines addressed in the SER. All items were adequately resolved except the following:

1. Sections 3.6 and 3.7 used the terms "symptoms" and "conditions" to describe methods of entering EOPs. However, due to the similarity between the two terms a definition for each was needed but not provided.
2. Section 3.10: The writer's guide did not indicate that operator actions and entry conditions would be excluded from attachments.

III. EOP/WG Comparison

The following EOPs were evaluated for compliance with the writer's guide. Examples of deviations from the writer's guide are provided in this section.

1. EOP-1.4 Natural circulation cooldown with steam void in vessel
 - a. NOTE 3, page 2: This note implied an action to be taken if conditions for starting an RCP could be established during the procedure. The writer's guide stated that notes, cautions, and warnings would not include operator actions.
 - b. Step 1d: This step directed the operator to "GO TO the applicable portion of the appropriate GOP." The writer's guide stated that the appropriate use of GO TO was "GO TO (Procedure Title) (Step Number)".
 - c. Step 2 Note: This note provided an implied operator action to establish saturated conditions in the pressurizer before decreasing pressurizer level. The writer's guide stated that notes, cautions, and warnings would not include operator actions.

2. EOP-15.4 Response to steam generator low level

- a. Note 2, Page 2: This note contained an implied action to evaluate conditions for implementing emergency plan procedures. The writer's guide stated that notes, cautions, and warnings would not include operator actions.
- b. Step 3 caution: This caution included the term "unless" in its determination of whether feedwater flow should be established to any faulted steam generator, contrary to the writer's guide.

VI. User's Guide

The team reviewed the EOP user's guide. Comments from the review are presented below.

1. The UG did not emphasize the page numbering system which was implemented to ensure that any lost pages could be identified and to facilitate placekeeping.
2. The terms "symptoms" and "conditions" were not clearly defined in the UG.
3. The WG addressed a category of terms with special meaning. Even though these words were used infrequently throughout the EOPs, they were not introduced in the UG to familiarize the user with their usage and meaning.

APPENDIX D

AA	Alternative Action
AER	Action/Expected Response
AO	Auxiliary Operator
AOP	Abnormal Operating Procedure
ARP	Alarm Response Procedure
ARG	Abnormal Response Guidelines
CHAMPS	Computer History and Maintenance Schedule
CREP	Control Room Evacuation Panel
DBD	Design Basis Document
EOP	Emergency Operating Procedure
EPG	Emergency Procedure Guidelines
EQ	Environmental Qualification
ERG	Emergency Response Guidelines
GOP	General Operating Procedure
I&C	Instrument and Control
IEN	NRC Information Notice
ISEG	Independent Safety Engineering Group
LCO	Limiting Condition for Operation
LER	Licensee Event Report
MRF	Modification Request Form
MWR	Maintenance Work Request
NI	Nuclear Instrumentation
NLO	Non-licensed Operator
ONO	Off Normal Occurrence
PGP	Procedure Generation Package
PMTS	Preventive Maintenance Task Sheet
PRSC	Plant Safety Review Committee
RO	Reactor Operator
RNO	Response Not Obtained
R&R	Restoration and Removal
SBI/OCA	Small Break Loss of Coolant Accident
SER	Safety Evaluation Report
SI	Safety Injection
SIMS	Safety Information Management System
SOER	Significant Operating Event Report
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
SS	Shift Supervisor
STA	Shift Technical Advisor
STP	Surveillance Test Procedure
TS	Technical Specifications
UG	EOP User's Guide
WG	EOP Writer's Guide
WOG	Westinghouse Women's Group