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

Report Nos.: 50-335/88-08 and 50-389/88-08

Licensee: Florida Power and Light Company (FP&L)
9250 West Flagler Street
Miami, Florida 33102

Docket Nos.: 50-335 and 50-389 License Nos.: DPR-67 and NPF-16

Facility Name: St. Lucie 1 and 2

Inspection Conducted: March 31 and April 11 - 19, 1988

Inspector: J. Stewart, Team Leader 8/3/88
Date Signed

Accompanying Personnel:
J. O'Brien, Reactor Inspector
S. Sun, NRR System Engineer
C. Tolbert, Human Factors Engineer
L. Defferding, License Examiner
H. Bibb, St. Lucie Resident Inspector

Approved By: E. Gagliardo, CE Program Manager 8/3/88
Date Signed

Inspection Summary

Inspection Conducted March 31 and April 11-19, 1988 (Report 50-335/88-08 and 50-389/88-08

Scope: This special, announced inspection was conducted in the area of Emergency Operating Procedures (EOPs) and included the implementation of the vendor Generic Technical Guidelines (GTG), the validation and verification program and the training conducted on the EOPs.

Results: No unsafe operational conditions were identified. One deviation from a licensee commitment was identified. Additional followup is warranted in specific EOP technical review items, and human factor element review items.

DETAILS

1. Persons Contacted

*G. Boissy, Plant Manager
*C. Burton, Operations Supervisor
K. Harris, Site Vice-President
G. Madden, Licensing Engineer
*L. McLaughlin, Technical Assistant
*M. Shepherd, Training Supervisor
*E. Weinkam, Licensing Engineer
*W. Windecker, Procedures Supervisor

Other licensee employees contacted included engineers, technicians, reactor operators, and plant equipment operators.

NRR Attendees

*J. Persensky, Section Chief, Human Factors Assessment
*E. Tourigny, Project Manager

NRC Region IV

*J. Gagliardo, Chief, Operational Programs Section

NRC Resident Inspector

*H. Bibb

*Attended exit interview on April 19, 1988.

2. Exit Interview

The inspection scope and findings were summarized on April 19, 1988, with those persons indicated in paragraph 1 above. The team leader described the areas inspected and discussed in detail the inspection findings listed below. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection.

NOTE: A list of abbreviations used in this report is contained in Appendix E.

Item Number	Status	Description/Reference Paragraph
IFI 389/88-08-01	Open	Correction of technical discrepancies contained in EOPs as noted in Appendix B, the NOD and paragraph 4.

IFI 389/88-08-02	Open	Correction of discrepancies noted during plant walkdowns as outlined in Appendix D.
IFI 389/88-08-03	Open	Correction of lesson plans and completion of EOP training when EOPs revised.
IFI 389/88-08-04	Open	Correction of human factors discrepancies contained in EOPs as outlined in Appendix C.

3. St. Lucie EOP/CEOG CEN-152 Procedure Comparison

A comparison of the plant's EOPs and the CEOG procedure guidelines was conducted to ensure that the licensee had generated procedures in accordance with the CEOG recommendations. The EOPs reviewed are listed in Part I, Appendix A, of this report. The comparison included a review of licensee letters issued to document changes made from the CEOG recommendations and interviews with personnel to determine the bases for the changes.

The inspectors determined, by review of the procedures listed in Appendix A and the St. Lucie PGP, that the licensee had failed to properly document and or, perform technical evaluations, and to provide justifications for several of the deviations from CEN-152 contained in the EOPs. The description of the deviations are discussed in Section 4 and Appendix B of this report. This deficiency is a deviation from licensee commitments concerning NUREG 0737, Supplement 1.

4. Independent Technical Adequacy Review of the EOPs

The inspectors reviewed the St. Lucie 2 (SL-2) EOPs listed in Part I of Appendix A. As a result of the review, the inspectors determined that, in general, the SL-2 EOPs were technically adequate and accurately incorporated the CEOG procedure guidelines of CEN-152 (Revision 2). The following is a summary of the inspector's observations and findings:

- SL-2 EOPs generally follow the CEN-152 step sequences.
- Entry/exit conditions to the SL-2 EOPs are clearly identified and can be followed by trained reactor operators.
- Notes and Cautions within the SL-2 EOPs are generally clear and are appropriately located in the EOPs.
- SL-2 EOPs appear to maintain the CEN-152 prioritization of the accident safety function mitigation hierarchy with the few exceptions noted in Appendix B.

However, during the review, the inspectors identified a number of technical deficiencies in SL-2 EOPs, and these are listed in Appendix B. The licensee acknowledged the technical deficiencies, which were identified by the inspectors, and agreed to correct them in the EOPs as required to be consistent with the next revision of CEN-152 and the PGP. The deficiencies in the EOPs were characterized in two categories: (a) omissions of major steps specified in the CEN-152 guidelines, and/or the lack of documentation for the technical basis to justify the omissions; (b) deviations from the suggested procedural steps listed in the CEOG CEN-152 without providing technical basis and/or justification for the alternative steps contained within the plant-specific EOPs.

The inspection team determined that the licensee had not developed adequate documentation of the technical evaluations required to justify its deviations and omissions from CEN-152. The following is an example of the lack of documentation for the technical evaluations and justifications: SL-2-EOP-06 requires the operator to trip all (four) RCPs for the total LOF event. On the other hand, CEN-152 provides a general guideline of trip two/leave two for the RCP trip strategy. The subsequent tripping of the final two operating RCPs is performed only after the subsequent efforts to restore feedwater have failed. For the LOF procedure, CEN-152 recommends, in addition to the trip two/leave two RCP guideline, that each plant develop its RCP pump trip strategy for the LOF event. The licensee chose to trip four RCPs to mitigate LOF. However, the licensee did not provide the technical basis or justification for its use of its own RCP pump trip strategy.

The major omission listed in Appendix B, which may impair effectiveness of the safety function controls is described as follows:

- SL-2 EOPs, with few exceptions, do not include the RCP NPSH requirements, while CEN-152 specifies a RCP NPSH curve in a figure entitled "typical post-accident pressure-temperature limits," which was included in many sections of the guidelines. The safety significance of the omission of the NPSH requirement is that this omission may cause the operator to violate NPSH limits resulting in damage to RCPs and which may then result in degrading the post-accident RCS heat removal capability of the plant.

The minor omissions and deviations listed in Appendix B, which may impair effectiveness of the safety function controls are summarized as follows:

- CEN-152 does not clearly provide guidelines for hydrogen control; however, it recommends that the licensee develop its own guidelines for hydrogen control in the functional recovery procedures. SL-2-EOP-08 includes neither hydrogen monitoring nor hydrogen control actions. The licensee did not provide a technical basis to justify excluding the procedure for hydrogen control from the EOP.

- SL-2-EOP-08 does not include a procedural step to preclude damage to the HPSI pumps due to low HPSI flow (30 GPM per pump as noted in

CEN-152) during Recirculation Actuation System operation. Failure of the HPSI pumps may severely degrade the plant capability to control effectively RCS inventory, RCS pressure, and RCS and core heat removal.

- Step 7.a of the SL-2-EOP-01 implied that the normal containment pressure is less than 4 psig. The corresponding containment pressure in step 9.b of CEN-152 is less than 1.5 psig, or a value to be consistent with the plant-specific design. The licensee's use of 4 psig in step 7.a was inadequate, because when the value of containment pressure is in the range of 3.5 to 4 psig, the procedure step will fail to direct the operator to perform the contingency action of step 7.a, which requires that the operator verify that CIAS has been initiated, when the containment pressure increases to 3.5 psig. This deficiency was found by the inspectors during the table-top review meeting on March 31 and conveyed to the licensee on April 3, 1988. The licensee corrected this deficiency by changing the "normal" containment pressure from 4 psig to 2 psig in the SL-2-EOP-01, Revision 2, dated April 5, 1988.

- Diagnostic chart (Figure 1) of the SL-2-EOP-01 has a deficiency in that the entry condition to the LOF procedure SL-2-EOP-06 is a failure to maintain water level in either SG. The corresponding entry condition in CEN-152 is loss of water level to both SGs. This deficiency in the EOP would direct the operator to enter into the LOF EOP for an event with loss of water level to only one SG. There would be no safety significance to this occurrence unless the reactor operator would trip the RCPs before exiting the procedure.

The licensee's resolutions to the major omissions discussed above will include either the addition of required steps to the procedures to be consistent with CEN-152 in the next revision or to provide the technical basis to justify the deviations. The inspector noted that the licensee's proposed resolutions were adequate and acceptable. The revision of the EOPs and the documentation for the noted technical justifications will be followed up in a later inspection (Open - IFI 389/88-08-01).

The above deficiencies constitute a deviation from the licensee's commitments.

5. <u>Review of Validation Program and Independent Verification of the EOPs</u>

A control room and plant walkdown of the EOPs indicated in Part I, Appendix A was conducted to ensure that the procedures had been validated and verified by the licensee. During the walkdown the inspectors verified that instruments and controls were correctly labeled, indications referenced in the procedures were available to the operator, and values used were not overly specific for the indicators available. The walkdown also verified that the procedures can be performed by the normal shift compliment. Deficiencies identified in the walkdown are listed in

Appendix D. Related human factors weaknesses are also discussed in Section 8 and listed in Appendix C of this report.

Administrative procedures (listed in Part II of Appendix A) were reviewed to ensure that adequate controls exist to incorporate changes to the EOPs, the latest revision is available to the operators, and the EOPs are easily accessible. Documentation of the licensee's validation and verification program was reviewed to ensure that discrepancies noted were adequately addressed and corrected, comprehensive reviews were conducted, table top reviews were adequate, walkdowns were completed and documented, and human factors analyses were incorporated in the program.

During the walkdowns (control room, simulator, and in-plant) the inspectors identified the deficiencies listed in Appendix D. The licensee committed to make the appropriate procedure revisions as noted in Appendix D. The licensee's revision of the EOPs and associated documentation for the correction of the noted procedural deficiencies will be followed up in a later inspection (Open IFI - 389/88-08-02).

6. EOP Training

The inspectors assessed the adequacy of the EOP training by reviewing two areas. The first dealt with observing an unrehearsed operating crew performing the EOPs in the site-specific simulator with scenarios designed to exercise each of the EOPs. The second effort was to review the lesson plans and training records for the hot licensed and requalification operator training programs as they pertained to EOP training.

a. Simulator Scenarios

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

- The utility relies heavily upon the training and experience level of the operators. This reliance was characterized by expecting the operators to know to take exact steps based on very general or vague statements in the EOPs. As observed during the simulator scenarios, the operators generally used the steps of the EOPs as guidelines.

- In at least one instance (SL-2-EOP-6, LOF), the operators exhibited a knowledge of the CEN-152 guidance, and followed it rather than the actual EOP steps. See comments below in formal training discussion.

- Other observations of Human Factors weaknesses are addressed in Section 8 and Appendix C of this report.

b. Formal Training Programs

Because of the heavy reliance on operator training, the operators' understanding of the meaning of EOP steps, and their minimal experience (in the recently installed simulator) using the EOPs, the team opted to review the hot license and requalification operator training programs. Presently, the utility has just brought the site-specific simulator operational and is in the process of validation of this simulator as per NRC requirements. Concurrently, the licensee is developing the simulator scenarios to be used for future training, and the inspector reviewed these scenarios and the planned use of the simulator. As compared to what has been observed in other utilities' training programs, the licensee's proposed use of the simulator seems to be quite aggressive, and adequate coverage appears to be given to the performance of the EOPs.

To date, the licensee's EOP training program has consisted of the initial training prior to EOP implementation (December 1985), or subsequently as part of the hot licensed operator training for Reactor Operators and Senior Reactor Operators. All the operators having this training have maintained their proficiency with EOPs by performing the following:

- a required reading program covering all the EOPs (over a one-year cycle).

- approximately four lecture hours on that year's "target EOP."

- a portion of the one week simulator training at the CE simulator in Windsor, Connecticut.

- completing the annual requalification exam.

- by completing the required reading program which communicated the new information to the operators as revisions were made to the EOPs.

The above training program meets the minimum requirements as committed to by the licensee, and is comparable to training programs for other utilities (who do not have a site specific simulator).

Additionally, the inspectors reviewed the existing training lesson plans and materials listed in Part III of Appendix A, that were used for both the lecture and required reading programs. These lesson plans adequately covered the technical basis behind the procedures as well as the structure and format of the EOPs. Unfortunately, the technical basis presented in the lesson plan supported the steps of CEN-152, and occasionally disagreed with the steps in the St. Lucie EOPs and the technical bases as presented verbally during the inspection by the plant staff. Based on this information and the observed performance of the operators which deviated from the EOPs, (as noted in paragraph 6.a), the inspectors questioned whether the lesson plans were properly developed. The inspectors questioned if the deviations had been addressed, and what was the method used for development of the lesson plans. The inspectors also noted that operator performance in the simulator and the technical bases described in the lesson plans were consistent with the CEN-152 basis, and not the St. Lucie EOPs. Documenting these deviations is necessary.

As the St. Lucie staff develops the technical basis for the differences between the St. Lucie EOPs and CEN-152, the lesson plans can then be revised and appropriate training can be provided to the operators.

The individual discrepancies are addressed in the Independent Technical Adequacy Review Section (Section 4) and Appendix B of this report. The revision of the lesson plans and performance of appropriate training on these revisions will be followed up in a later inspection. (Open - IFI 389/88-08-03).

No violations or deviations were identified.

7. <u>On-Going Evaluation of EOPs</u>

Administrative controls (procedures listed in Part II of Appendix A) were reviewed to ensure the licensee had a program in place for the continued evaluation of EOPs. This program included controls to revise procedures based on changes to the plant equipment, and operator feedback for procedure improvement. The program required the EOPs to be reviewed in detail periodically per Section 6 of the plant technical specifications.

No violations or deviations were identified.

8. Human Factors Analysis of EOPs

The human factors review included an analysis of the procedures, observations of the instruments both outside of and in the control room required to implement the EOPs, and environmental factors. The data were obtained by the following methods:

- Table-top review of the EOPs.
- Table-top review of the Writer's Guide.
- Walkthroughs of the Unit 1 and 2 control rooms.
- Walkthroughs of the Unit 2 plant.
- Observation of simulator scenarios.
- Interviews with operators.

The problems identified are described in the following paragraphs with details in Appendix C.

Regarding format of the EOPs, page identification, headings, and margins were consistently presented. Operators indicated that the newer function-based EOPs were easier to use than the older, event-based EOPs. However, several concerns were identified and are discussed below.

(1) There were inconsistencies between the EOPs and the Writer's Guide. These inconsistencies were with the dual column format, logic terms, numbering system and spacing, vocabulary and figures.

(2) The following additional concerns were identified with figures:

a) The optical resolution required for certain EOP steps was not adequate in the corresponding figure;

b) Figures did not contain all information needed by the operator. For example, figures did not identify which regions represented acceptable and unacceptable plant conditions; and NPSH curves were not provided where needed.

(3) The inspection team noted that some steps which were included in other EOPs were not included in EOP-8. Operators also noted dissatisfaction with this procedure. The licensee committed to modify this procedure and insert the omitted steps.

b. Control Room Instrumentation

Regarding use of EOPs in the control room, the following concerns were identified:

(1) In the St. Lucie 2 control room the inspection team noted that most of the gauges were color-coded and the main panel was reasonably well laid out. However, various concerns with recorders and gauges were noted relative to the execution of EOPs, and were supported via observations made by the inspection team and comments made by operators during interviews. They are listed in Appendix C.

(2) Labeling concerns identified in the control room included pencil and pen markings on instrument lables, primarily on the HVAC panel, and inconsistency of ranges on containment sump level meters (one has 0-7', the other has 25' to 0). The licensee stated that a CRDR was completed last year and all labeling problems were scheduled to be corrected this year.

(3) Inconsistencies were noted between layout and the sequence of use of the components listed in the EOPs.

(4) The following concerns were identified with the control room environment:

a) Seven of the eleven operators who were interviewed expressed dissatisfaction regarding noise levels in the control room. Under normal operating conditions, noise from the RPS fans is too loud and interferes with daily activities. Further, if a reactor trip occurs, a large number of people enter the control room, thereby creating more noise and confusion.

b) The team observed distraction in the control room environment by the constant illumination of some annunciators. If operators grow accustomed to lit annunciators, their perception of alarmed annunciators may be decreased.

(5) Two concerns were noted with material resources. They were:

a) Only one copy of the EOPs exists in the Control Room yet both the NPS (or ANPS) and desk operator need copies.

b) The set of curves located directly above the delta T recorder is difficult to read.

c. <u>Local Control Stations</u>

(1) In general, local components and needed information were easily accessible. The following exceptions were noted:

a) In order to reach components in the AFW Pump area, the operator must climb over a 3-foot wall and squeeze around components and seismic restraints.

b) In the implementation of EOP-4, page 6, step 11, a series of valves along the steam tressel must be closed. To close the AFW isolation valves, the operator must lean over the railing, stretch to reach each valve, and use both hands to close it. The operation places the operator in a physically precarious position.

c) Operators stated that the solenoid valves that close the steam supply to the 2C AFW Pump from the affected SG are relatively inaccessible because they are located in the overhead close to the ceiling, and at times no ladder is available to reach them, thus making it difficult to perform these tasks in a timely manner.

d) Information needed to perform local actions is not always readily accessible. Operators may be required to xerox copies of the pages needed to perform an EOP from the control room copy.

(2) Labels for components throughout the plant were difficult to read due to engraved labels and small letter and number size. The engraving has the potential to become filled with dirt or erode. Additionally, some labels were positioned on an adjacent component, posing a potential for operator error.

(3) Several environmental concerns were noted at local control stations. These included:

a) Communications between the control room and a local operator were often impaired due to ambient noise levels. Page announcements may not be heard and radio communication may not be audible. One operator stated that this problem was chronic and limited his accessibility to local operators.

b) At some local sites, lighting was not adequate, thus forcing operators to carry and use flashlights. An example of this was the AFW Pump area, which must be accessed in EOP-6. Another example was the Surge Tank CCW flowmeter, which, although located adjacent to a light, was too dark to read.

c) A third environmental concern noted was that in a few instances loose items, such as wire coils, rags, and equipment found in or near the traffic patterns in some areas of the plant raises the potential for the operator to trip on the items and/or be impeded by them.

d. <u>Additional Interview Comments</u>

Additional operator comments were made regarding EOP task/role assignments and EOP development and implementation.

Three out of the eleven operators interviewed stated that the assignment of tasks/roles was not always clear during EOP implementation. This comment was also supported by the inspection team's observations during simulator scenarios. In addition, three operators expressed concern with the requirement that one operator be assigned to complete the Safety Function Status Check Sheets which monopolizes an operator when he may be needed elsewhere.

Operators who helped write the EOPs stated that the EOPs were well formulated and logical. One operator, however, suggested that too many EOP revisions result in extra confusion by placing an added responsibility on the operators to be trained on the latest EOP revision. Two operators said that the final revisions take too long to become permanent changes.

Three operators stated that so many tabs exist in the EOPs that they over lap with each other, blocking those underneath. They asserted that the multiple tabs made it difficult to quickly locate an EOP. In contrast, one operator stated that separators were needed in EOP-8. Two operators stated that the weight of the EOP document was too heavy.

In summary, almost all operators expressed confidence that the EOPs would work in an actual emergency. One operator expressed an interest in the addition of more EOP training during requalification. These comments are consistent with observations made by the inspection team members.

Appendix A

List of Procedures Reviewed

I. Procedures Reviewed on Table Top

1. 2-EOP-01: Standard Post Trip Actions
2. 2-EOP-02: Reactor Trip Recovery
3. 2-EOP-03: Loss of Coolant Accident
4. 2-EOP-04: Steam Generator Tube Rupture
5. 2-EOP-05: Excess Steam Demand
6. 2-EOP-06: Total Loss of Feedwater
7. 2-EOP-07: Loss of Forced Circulation
8. 2-EOP-08: Functional Recovery

II. PGP Administrative and Validation and Verification Procedures

1. QI3-PR/PSL-1 Design Control (After Fuel Loading)
2. QI5-PR/PSL-1 Preparation, Revision, Review/Approval of Procedures
3. QI5-PR/PSL-2 Writer's Guide for EOPs
4. QI5-PR/PSL-3 Verification Guide for EOPs
5. QI5-PR/PSL-4 Validation Guide for EOPs
6. QI5-PR/PSL-6 Requirements for Development and Revision of Emergency Operating Procedures (PGP)
7. Administrative Procedure No. 0010120 Duties and Responsibilities of Operators on Shift.

III. EOP Training Material and Lesson Plans Reviewed

1.	LP 09-02801	Reactor Trip Event, Standard Post Trip Actions and Trip Recovery
2.	LP 822	Reactor Trip Event and Procedure
3.	LP 09-02803/LP 824	LOCA Event/Procedure
4.	LP 09-02804/LP 825	SGTR Event and Procedure
5.	LP 09-2805/LP 826	ESD Event and Procedure
6.	LP 09-2806/LP 07-02827	LOF Event and Procedure
7.	LP 09-02807/LP 823	Loss of Forced Circulation: Natural Circulation/Cooldown
8.	LP 09-10808/LP 07-11828	Functional Recovery
9.	LP 07-02821	EOP Overview

Appendix B

Technical Review Comments

The following are inspector comments as a result of reviews of the St. Lucie 2 (SL-2) EOPs. The licensee committed to correct these deficiencies. Section 4 of this report provides further discussions regarding these items.

1. SL-2-EOP-01: Standard Post Trip Actions (Revisions 1 and 2)

   a. Step 2.d did not identify which DC bus was required to be energized. The licensee committed to specify the proper DC bus which was required to be energized, and to also include the DC breaker designations for the DC buses to be reenergized in the contingency action statement in the next revision to the EOP.

   b. Step 7.a of the SL-2 procedure (Rev. 1) had a contingency action performed by the operator to ensure CIAS at a containment pressure of greater than 4 psig. The corresponding containment pressure as specified in CEN-152, step 9.b, is 1.5 psig or an alternative value to be consistent with the plant specific design. The licensee plant specific containment pressure of 4 psig in this step was inadequate, since this deviation from CEN-152 would not have directed the operator to perform the required contingency action in Step 7.a until containment pressure had reached 4 psig. The contingency action in Step 7.a required that the operator verify that CIAS had been initiated when the containment pressure had increased to 3.5 psig. This deficiency was noted during the table-top review meeting on March 31, 1988. This deficiency was conveyed to the licensee on April 3, 1988. The licensee corrected the deficiency by changing the containment pressure value from 4 psig to 2 psig in SL-2-EOP-1, Revision 2, dated April 5, 1988.

   c. The contingency action of Step 8.b did not include the minimum required containment spray flow. This deviates from the contingency action of step 9.b in CEN-152, which specifies 1500 GPM for the minimum containment spray flow, and provides an option for each licensee to use a value to be consistent with the plant-specific design. The licensee committed to add the minimum required containment spray flow in the next revision of the EOP.

   d. The contingency action of Step 8.b required operator action to ensure initiation of CSAS when containment pressure increases to greater than 5.4 psig. Note 9 (page 5) of the licensee's Step Verification Documentation dated March 28, 1988, for SL-2, indicated a CSAS setpoint of 10 psig. In response to the inspector's comments (April 3, 1988), the licensee noted that the CSAS setpoint was 5.4 psig for SL-2, and corrected this error in the April 4, 1988 revision to the step verification documentation.

   e. The contingency action of Step 7.a of the SL-2 procedure indicated that the CIAS setpoint was equal to 3.5 psig. The note 8 (page 5) of

the Step Verification Document dated March 28, 1988, indicated a setpoint for CIAS of 5.0 psig. The licensee committed to clarify and correct the error in the next revision to the EOP and Step Verification Document.

f. Step 6.a instruction did not specify the minimum required feedwater flow, while the corresponding step 7.a.ii of CEN-152 specifies the minimum required feedwater flow of 150 GPM and suggests a plant-specific value as an alternative step. During the inspection, the licensee reviewed with the inspector their Power Plant Engineering Document EOP-84-2239 to justify the technical basis for the deviation. The licensee will include this technical justification in its Step Validation Document.

g. Deficiencies in Figure 1 (diagnostic chart):

(1) Entry condition for entering EOP-06 LOF was failure to restore water level in both SG. The corresponding criteria stated in CEN-152 is that failure to restore water level in at least one SG is the basis for satisfying the entry condition for LOF.

(2) Containment pressure was listed as 4 psig, which is in error. The correct pressure should be 2 psig (Unit 2 only) as listed in step 7.a of EOP-01.

(3) SG Pressure was listed as 750 psig, which is different than the 800 psig listed in step 6.c of EOP-01.

2. SL-2-EOP-2: Reactor Trip Recovery (Revisions 1 and 2)

a. Figure 1 and the related steps of SL-2 procedures did not include the NPSH requirements for restart or securing of RCPs while Figure 4.1 of CEN-152 includes the RCP NPSH curve. This deviation from CEN-152 will leave the operator with no NPSH criteria to restart or secure RCPs and may cause RCP failure, if the operator restarts or fails to secure RCPs, when RCP NPSH requirements are not satisfied. The licensee committed to include the RCP NPSH requirements contained in OP-0120023 (which contains NPSH curves for various combinations of RCPs running) in the EOPs. This comment is applicable to all EOPs that may require stopping or restart of RCPs (included in EOP-02, EOP-03, EOP-04, and EOP-08).

3. SL-2-EOP-03 LOCA (Revisions 1 and 2)

a. Figure 2 of this procedure contained HPSI curves. There was no acceptance criteria for the minimum required HPSI flow as a function of pressure in this figure. This comment is applicable to all EOPs that require reference to the HPSI flow curve. The licensee agreed to specify the acceptance criteria for the HPSI flow in the next revision of figure 2.

4. SL-2-EOP-4: SGTR (Revisions 1 and 2)

   a. Step 9 of the procedure was not adequate. This step specified an instruction to cooldown and depressurize the RCS by using the SBCS and main or auxiliary feedwater system. However, there was no contingency action specified if SBCS was not available. The licensee committed to add a contingency action to cooldown the RCS by using atmospheric dump valves, if SBCS is not available in the next revision.

   b. The caution on page 7 of the procedure was inadequate. The caution regarding RCP pressure requirements (OP-0120023) was an instruction and should be separated as a procedural step. The licensee agreed to include the NPSH requirements for the RCP restart criteria, and separate this caution as an instruction referring to OP-0120023 in the next revision in all EOPs where appropriate.

   c. Step 20 was inadequate. This step specified the method to control level in the isolated SG by draining via the SG blowdown piping. There was no stated maximum allowable SG blowdown rate. In addition, there was no contingency action as noted in the related step CEN-152 Rev. 3, if SG blowdown is not available for SG level control. The licensee agreed to specify the maximum allowable blowdown rate and add a contingency action to be consistent with CEN-152 (Rev. 3).

5. SL-2-EOP-05 ESD (Revisions 1 and 2)

   a. Step 8 of the procedure was inadequate. In step 5 of EOP-05 one RCP may have been previously tripped. In performing step 8 "tripping one RCP in each loop," after having tripped a RCP in step 5, only one RCP would remain operating, which is not in compliance with "the trip two, leave two" RCP trip strategy as noted in CEN-152. The licensee needs to clarify step 8 to be consistent with the RCP trip strategy of CEN-152.

   b. Steps 17 and 18 are instructions related to the hydrogen concern for the containment integrity safety function. Steps 19 - 24 are instructions related to containment temperature control and RCS heat removal. The sequences of the steps place higher priority to hydrogen control than to RCS heat removal. These step sequences are not in compliance with the hierarchy of the safety function controls as specified in CEN-152. The licensee agreed to change the priority for the safety function controls to be consistent with that of CEN-152 in the next revision of EOP-05.

6. SL-2-EOP-06 LOF (Revisions 1 and 2)

   a. Step 3 was an instruction to regain feedwater operation. For clarification "feedwater" should be changed to "AFW". Step 3.b instruction was actually a contingency action that should be "if the inventory of the Unit 2 CST is not sufficient, then

utilize the Unit 1 CST per GNOP 2-0700030," which was stated in the licensee's partial loss of feedwater procedure. Step 3.b was also found to be similar to the concern for adequate condensate water addressed in step 17. The licensee agreed to change "feedwater" to "AFW" in step 3, and to delete 3.b to avoid repetition with step 17 in the next revision.

b. Step 7 was an instruction to trip all RCPs for the total LOF event. This instruction deviated from the RCP trip strategy in CEN-152, which provides a general guideline to" trip two and leave two RCPs" for total LOF event. CEN-152 also suggests that each plant develop its own pump trip strategy for the total LOF as appropriate. The licensee used its own trip RCP strategy, but did not provide the technical basis to justify the appropriateness of its strategy. The licensee agreed to provide a technical justification for its RCP trip philosophy used in LOF.

7. SL-2-EOP-08 Functional Recovery (Revisions 1 and 2)

a. Identified as being in deviation from CEN-152, this procedure does not include instructions for monitoring hydrogen. The licensee agreed to add hydrogen monitoring to the Functional Recovery EOP in the next revision.

b. Step "a" in success path 2 of Appendix I directs the operator to operate at least one recombiner when hydrogen concentrations are greater than 0.5 percent. The step appeared to be inadequate in that it did not specifying a hydrogen concentration when operation of the second hydrogen recombiner is recommended. The licensee agreed to add a hydrogen concentration for initiating the operation of the second hydrogen recombiner in the next revision of the EOP.

c. Success path 1 of Appendix D did not include instructions for RCS voiding identification and elimination. This is a deviation from CEN-152. The licensee agreed to incorporate the instructions for voiding identification and elimination to be consistent with the CEN-152 guidelines. This will be accomplished in success path 1 of Appendix D in the next revision.

d. There was no instruction step to prevent HPSI pumps from being damaged due to a low HPSI flow rate (30 GPM per pump as noted in CEN-152) prior to success path 3 of Appendix D. This is a deviation from CEN-152. The licensee agreed to include the step for HPSI pump protection due to low HPSI flow rate to be consistent with CEN-152 in the next revision of the EOP.

Appendix C

Human Factors Discrepancies

A. Procedures

1. Dual-Column Format

The definitions of, and distinction between, "Instructions" (I.) and "Contingency Actions" (C.A.) provided in the Writer's Guide (pages 11 and 18) is unclear. As a result, the procedure writer has inadvertently combined, interchanged, or omitted steps belonging to each column.

a. EOP-3, page 9, C.A.31. This does not appear to be a contingency for the corresponding instruction. Instead, it should be the subsequent instruction.

b. EOP-4, page 5, I.9. No contingency is provided if SBCS is not available. The licensee agreed to include it in next revision.

c. EOP-4, page 7, Caution. The caution is really an instruction and should be separated as an instruction. The licensee agreed to make this change in the next EOP revision.

d. EOP-4, page 7, Note. The note is a contingency action for Instruction step 14.c, and should be located adjacent to it, as a Contingency Action.

e. EOP-4, page 8, I.16. No contingency action is provided in case maximum safety injection flow requirements are not met.

f. EOP-6, page 4, I. and C.A.6. The instruction and contingency action for step 6 are reversed. The licensee agreed to revise them accordingly in the next revision.

2. Logic Terms

a. EOP-1, page 8, I.6.b - c. An "AND" is needed between b. and c. The licensee agreed to this revision.

b. EOP-4, page 8, I.17. It was not clear whether all criteria (a - d) are required. The licensee agreed to include "all" in the leading sentence.

c. All Safety Function Status Check Sheets. Logic terms are not distinguishable from surrounding text. The logic terms should be highlighted.

3. Numbering System and Spacing

a. EOP-4, pages 2-3. The numbering system problem is especially clear on page 3, where Section 5, Operator Actions, is not separated as a higher-order heading, and is thus confused with instruction step numbers. The licensee agreed to add "Section" to all higher-order headings. This page also illustrates a spacing deficiency; more space should have been inserted between Notes and between steps. A result of this error is that step 4, at the bottom, is virtually invisible. The licensee agreed to move it to the subsequent page.

b. EOP-3, pages 2-3. All comments stated for EOP-4, pages 2-3 above apply here as well (with the exception of the last comment regarding step 4).

c. EOP-3, page 4; EOP-5, Pages 2-3; and EOP-6, pages 2-3. These are examples where spacing out the text, toward the bottom of the page, would have resulted in less crowding between the Caution and subsequent step.

4. Figures

a. EOP-3 page 26. This figure (Figure 2) is referred to in in step 6 of EOP-3. Three problems were identified with using Figure 2 while performing step 6: 1) the figure does not have the optical resolution required by step 6; 2) a HPSI curve (for one or two pumps) is needed for confirmation; and 3) the step does not include a contingency for conditions when the HPSI pumps are on but the criteria of Figure 2 are not satisfied.

b. EOP-2, page 10. The existing figure does not provide the operator with useful information, namely, NPSH requirements. The licensee agreed to add these to the next revision.

c. EOP-3, page 25. NPSH information is omitted. The licensee agreed to add it to the next revision.

d. EOP-8. Operators are never instructed to turn on the Hydrogen Monitor in EOP-8. They should be so instructed in the Instruction step 4H or Success Path 1. The licensee agreed to add this in the next revision.

e. EOP-8, page 38. In Success Path 1 (after step 6), operators are not instructed on voiding identification. The licensee agreed to add this information in the next revision.

f. EOP-8, pages 5 and 55. Incorrect logic and technical guidance provided. Steps 4F i, ii, iii, and iv (page 5) and A, B, C, and D (page 55) are normal containment parameters, not containment isolation parameters. This reverse logic could mislead an operator. The licensee agreed to change all affected sections to "verify normal containment."

g. EOP-8, 4H, Success Path 1, normal operation. An "AND" should be inserted between "containment pressure <2 psig" and "ensure fan coolers operating." The licensee agreed to make this change in the next revision.

h. The Writer's Guide (page 12 of 38) presents ambiguous information concerning the location of figures. The Writer's Guide first suggests that they be placed following all text, then later states that "operator aids" be "located immediately after the "instructional steps" (page 12 of 38).

5. Clarity of EOPs

Other examples illustrating clarity deficiencies in the EOPs are as follows:

a. EOP-3, page 7, I.20. This instruction is lengthy and embeds multiple substeps, including a conditional statement. In addition, "cooldown" is used as both a noun and verb; beginning with a verb, then noun, noun, and verb. The confusion enters after the third "cooldown," which was a noun. The next sentence is initially unclear because cooldown reads as noun at first. This paragraph, at least the last sentence, needs to be modified.

b. EOP-3, page 5, C.A. 10.a. This step does not indicate exactly how SG are used to remove RCS heat. Its vagueness detracts from its impact as an instruction to do something.

c. EOP-4, page 6, I. 11.f. This step identifies local valves that must be operated, and so should be identified as "local" to be consistent with usage throughout the EOPs. The licensee agreed to add this in the next revision.

d. EOP-4, page 7, Caution. RCS pressure requirements should be listed to avoid having to flip through pages or go to another document. The licensee agreed to list them in the next EOP revision.

e. Vocabulary concerns found by the team consisted of words or phrases which could be interpreted in more than one way. For example, the use of the terms "verify," "check," and "establish" are not completely clear. While these three terms (and others) were defined in the EOP Writer's Guide (page 30 of 38), their definitions were not sufficiently precise to avoid misinterpretation.

f. Use of the verb "consider" was vague and corresponded to no particular behavior. Unless training specified exactly what was meant and what actions(s) were to be performed, the NPS, ANPS, or operator may be confused. For example, in the case of the LOF procedure, operators should have been directed unequivocally to "go to" EOP-6 (see technical discussion in Section 4).

B. Control Room

1. Panel Layout

The following two concerns were noted regarding the layout of instrument panels:

a. An inconsistency between panel layout and the EOP was noted in EOP-3, page 36. EOP-3 directs the operator to move from left to right on the HVAC panel to complete a CIAS checklist. However, the panel instruments, as listed in the EOP, were not laid out from left to right. The licensee agreed to correct this mismatch in the next EOP revision.

b. Operators pointed out that the PORVs, and safety valves discharge line temperature indicators and annunciators are on the main front panel; whereas the PORV and safety valve position indicators (flow indicators) are located on the back side of the panel. Therefore, to look at both instruments, an operator must either run around the entire panel, or ask a second operator to read it and call out its reading. In order to aid the operator in easily locating instruments, when two instruments must be viewed simultaneously, they should be co-located.

2. Instruments and Gauges

a) The measurement scale for the T_h, T_c (delta T) recorder is not sufficiently narrow (in temperature band) to allow the operator to make fine distinctions. In EOP-01, (page 7 of 12, step 5), operators are required to verify that delta T is less than 10°F. A 10° difference is almost imperceptible using the T_h and T_c recorder, thereby increasing the likelihood for operator error.

b) The width of the delta T recorder paper visible to the operator is too narrow to easily see the trends over short periods of time.

c) Recorders were hard to read, primarily because pen lines were too fine.

d) Gauges had scales for which units of measurement were not identified.

e) The increments in some scales, and the markings, made reading the scale difficult, especially when the operator was required to quickly estimate a reading between scale marks.

f) The measurement scales for the four RCP gauges were not consistent with each other.

g) The rounded, protruding shape of the gauges permits them to be viewed from many angles. Depending on the operator's height, proximity, and viewing angle, each operator may make a different reading.

Appendix D

Verification/Validation Review Comments

Specific comments on the control room walkdowns and the review of the verification and validation programs are provided below. The licensee committed to correct these weaknesses. Section 5 of this report provides further discussions regarding verification and validation.

1. SL-2-EOP-03 LOCA

   a. Step 23 requires clarification to identify which containment sump level instrumentation should be used by the operator to verify Figure 5. The licensee agreed to specify the correct instrument in the EOP.

   b. Step 27 was determined to need clarification based on interviews with Health Physics Technicians and a walkdown of the procedure with a ANPS (Senior Reactor Operator). When the ANPS called the health physics office, the technician, who the operator talked with was not familiar with the Health Physics Emergency Procedures associated with a LOCA. The licensee agreed to change the step to require the ANPS/NPS to communicate directly with the on-shift health physics supervisor during performance of EOP.

   c. Step 30 contingency action requires maintaining SIT level greater than 48 percent to prevent a violation of Technical Specifications. Based on a review of page 3/4 5-1 in the Technical Specifications, and OP 2-0410021, Revision 8, SIT minimum tank level was required to be 49 percent for the RCS pressure noted. The licensee agreed to change the required SIT level to be greater than 49 percent in this and other steps in the EOPs, so as to prevent an inadvertent violation of the Technical Specification.

   d. Step 36 instruction requires additional clarification as the realignment of the charging pump suction, by the operators, from the BAM tank to the RWT requires an equipment operator to rack out a breaker to a valve motor, while the control room operator holds a hand switch in the open position. This activity is not described in step 36. The licensee agreed to add guidance to provide adequate instructions to the operators.

   e. Appendix B, step 1, needs clarification to direct the operator to page 2 of the appendix for starting the hydrogen recombiners. The licensee agreed to include the referral to page 2 in the next revision of the EOP.

   f. Appendix C, "caution," step needs clarification of the instrument used to determine the flow rate. The licensee agreed to specify instrument FR-25-2 in the next revision to the EOP.

g. The Table 2 checkoff equipment list was not ordered from left to right on the HVAC panel in the control room as was noted in the table. The licensee will compare the Table against the HVAC panel and delete the note or reorder the table as applicable.

2. SL-2-EOP-04 SGTR

a. Step 11.f needs to identify that the listed valves are to be checked closed or closed locally as applicable. These valves are beside a main steam line which during a SGTR will have a radiation level higher than background, depending on RCS activity. The licensee agreed to add a caution, note or step to check the radiation level at the main steam lines prior to sending an equipment operator to close these valves.

b. Step 32

(1) In step 32, the operator is directed to exit this procedure and initiate SDC if the RCS is less than 325° and 275 psig using an applicable approved procedure. No procedure is listed. The licensee stated the procedure may vary depending on the RCS conditions when you arrive at this step. The licensee preference was to have the TSC provide guidance to the operator at this point and will add the guidance to the step. The inspector determined that the licensee's planned actions appear to be adequate.

(2) In step 32, you exit the procedure if the RCS is less than 325°F and 275 psig. The inspector noted that if you exited this procedure at step 32, you would not isolate the SIT tanks at 250 psig in step 33, because the operator would have been transferred to another procedure. The licensee indicated that isolating the SIT tanks is covered in the SDC procedures. The inspector determined that the step appeared to be adequate with the addition of the guidance referred to in (1) above.

c. During the simulator exercise, it was observed that Appendix B (2-EOP-04 SGTR) used for restoration of CCW to the RCPs was unable to be completed due to the loss of valve position indication for each of the return valves to the RCP seal coolers. The licensee staff identified this as a simulator problem; as each of the units have performed a design modification to have these valves fail open on loss of power. The licensee also has had the DC control power changed by a design change and indication power transferred to an essential electrical bus. The inspectors reviewed the design change package documentation during the plant walkthrough, and verified that the DC control power is supplied by essential electrical power. The inspectors also verified the licensee has included these modifications for updating the simulator.

3. SL-2-EOP-06 LOF

The contingency action step 5.3.a of 2-EOP-06 outlined the procedure for resetting and starting the 2C steam driven AFW pump. During the plant walkthrough the inspectors reviewed the safety significance of this added step. The inspector witnessed the control room portion in the simulator and walked through the procedure locally at the Unit 2 - 2C AFW pump. Since the manual operation of the AFW system procedure is not clearly addressed in any other procedure, the inspector agreed it was appropriate to retain it in this EOP.

4. EOP-7 Loss of Forced Circulation

Step 12 refers to ONP-2-0120039, Natural Circulation Cooldown Procedure. During the inplant walkdown of ONP-2-0120039, one valve in the table for isolating the SITS and the associated breaker was noted as being wrong. Valve 3646 should have been listed as valve 3644, and the breaker 2-42043 should have been 42048. This valve and breaker were correctly designated in EOPs 3 and 4. The licensee made a temporary change to the procedures on both Units 1 and 2.

5. SL-2-EOP-08 Functional Recovery EOP

a. Entrance into this functional recovery procedure from SL-2-EOP-01 will occur when more than one event has been identified. In recovery step 4.h and Appendix I, success Path 1, the operator is directed to check the hydrogen concentration level in this step, however, the operator was not previously directed to turn on the hydrogen monitor.

   Instructions to place the hydrogen analyzer in service are currently in EOP 08 in Step 8. The licensee has agreed to make the necessary changes in EOP-08 to ensure the hydrogen monitor is turned on and to support monitoring the hydrogen concentration.

b. In recovery action Appendix I, Success Path 2, the operator is instructed to have at least one recombiner in operation if the hydrogen concentration is greater than 0.5 percent. There should be a maximum concentration of hydrogen also for starting the second recombiner. The licensee agreed to evaluate this concern and revise EOP-08 as required.

c. Step 4.f and Appendix G Success Path 1. In step 4.F.i,ii, iii and iv on page 5 and Appendix G steps a, b, c, and d on page 55, the parameters are normal containment parameters, not methods to verify containment isolation. If these conditions are not met, then containment isolation is required. Also on page 55, the inspector noted that the wording in the diamond under success path 1 should read "are normal containment parameters normal?" The licensee agreed to change the wording, to properly address the inspector's concerns.

Appendix E

List of Abbreviations

AFW	Auxiliary Feedwater
ANPS	Assistant Nuclear Plant Supervisor
BAM	Boric Acid Makeup
CCW	Component Cooling Water
CEN-152	Combustion Engineering Emergency Procedure Guidelines
CEOG	Combustion Engineering Owner's Group
CIAS	Containment Isolation Actuation System
CRDR	Control Room Design Review
CSAS	Containment Spray Actuation System
EOP	Emergency Operating Procedure
EPG	Emergency Procedure Guidelines
ESD	Excess Steam Demand
HPSI	High Pressure Safety Injection
HVAC	Heating, Ventilation and Air Conditioning
LOCA	Loss of Coolant Accident
LOF	Loss of Feedwater
LP	Lesson Plan
NEO	Nuclear Equipment Operator
NPS	Nuclear Plant Supervisor
NPSH	Net Positive Suction Head
OJT	On-the-Job Training
OP	Operating Procedure
PGP	Procedure Generation Package
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RO	Reactor Operator
RWT	Refueling Water Tank
SBCS	Steam Bypass Control System
SG	Steam Generator
SGTR	Steam Generator Tube Rupture
SIT	Safety Injection Tank
SL-2	St. Lucie 2
STA	Shift Technical Advisor
TSC	Technical Support Center