UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-261/94-07

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket No.: 50-261 License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: March 14-25, 1994

Inspector: Larry S. Mellen 3/31/94
Larry S. Mellen, Reactor Engineer Date Signed

Accompanying Personnel: C. Rapp, RII
L. King, RII
C. Moore, PSHA, Inc.
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Approved by: 3/31/94
Thomas A. Peebles, Acting Chief Date Signed
Operational Programs Section
Operations Branch
Division of Reactor Safety

SUMMARY

Scope:

This was a special, announced Emergency Operating Procedure (EOP) team inspection. Its purpose was to verify that the Robinson Unit 2 EOPs and EOP support procedures were technically accurate, that their specified actions could be meaningfully accomplished using existing equipment, controls, and instrumentation, and that the available procedures had the usability necessary to provide the operator with effective operating tools. The inspection evaluated the adequacy of the licensee's EOPs and EOP support procedures, conformance of these procedures to the Westinghouse Owners' Group Emergency Response Guidelines, and conformance to the approved writer's guides. The inspection included a comparison of the EOPs and the EOP support procedures to the licensee's generic technical guidelines, a technical adequacy review of the procedures, control room and in-plant walkthroughs, simulator evaluation of selected procedures, a review of on-going control of these procedures, and interviews of plant personnel who use the procedures.

Results:

The overall assessment was that the EOPs and EOP support procedures were generally adequate. The team identified a number of Technical and Human Factors deficiencies. Of greater concern was the lack of quality assurance involvement, procedural guidance that permits deviating from the approved mitigation strategy, lack of rigor during the verification and validation process, and failure to adequately resolve previously identified inspection findings in this area. There were four violations issued (1) for the failure of the Quality Assurance organization (Nuclear Assessment Department) to audit EOPs or EOP support procedures, (2) for procedures, instructions, and drawings errors, (3) document control deficiencies, and (4) corrective action deficiencies.

REPORT DETAILS

1. Persons contacted

Licensee employees

*S. Hinnant, Vice President - Robinson
G. Attarian, Chief Electrical Engineer
L. Baxley, Radiological Controls
J. Benjamin, RESS (NED)
H. Carter, Manager of Licensed Operator Retraining
*T. Cleary, Manager Technical Support
*J. Cox, Operations
*L. Dutton, Document Control Supervisor
C. Georgeson, Chief Engineering Section - I&C
D. Gudger, Licensing Engineer
M. Heath, Manager - I&C Maintenance
M. Herrell, Manager - Training
*K. Jury, Manager - Licensing/Regulatory Programs
*R. Krich, Manager - Regulatory Affairs
R. Moore, Manager - Operations
*C. Olexik, Manager - NAD
*M. Pearson, Plant General Manager
*D. Whitehead Manager Plant Support Services
A. Wingert, Operations
D. Winters, Operations Procedures Coordinator

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

NRC Resident Inspectors

*W. Orders, Senior Resident Inspector
*C. Ogle, Resident Inspector

*Attended exit interview on March 25, 1994.

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

2. Independent Technical Adequacy Review of the EOPs

The team reviewed the procedures listed in Appendix B, and found that generally,the vendor-recommended accident mitigation strategy and action sequence was followed. The main entry into the EOP network was via Path-1 on a reactor trip or safety injection. The only other EOPs that were entered directly were EPP-1, EPP-5, and EPP-21. The EOP entry and transition conditions closely followed the ERG. The SDD, with few exceptions, adequately defined the differences between the EOPs and the ERGs. However, several weaknesses were noted.

For example, setpoint values and justifications were contained in the EOP setpoint study. The team noted that setpoint values were generated by a vendor from information provided to them by the licensee in 1990, but were not reviewed by the licensee before being incorporated into the EOPs.

Cautions in the EOPs and support procedures frequently lacked a description of the potential hazard to equipment or personnel as required by the WGs. Both notes and cautions were written containing action steps or conditional steps, also contrary to the WG.

Some additional examples of technical concerns found in the EOPs and EOP support procedures are listed below.

AOP-17, Attachment 1 did not provide a complete listing of valves.

EPP-1, did not provide guidance on how long the AFW pump can operate without service water.

EPP-1, required the SDAFW pump supply switched from the CST to alternative supply at 10 percent CST level. The SBO Coping report stated that the supply must be switched to the alternate supply at 34 percent CST level to prevent rendering the SDAFW pump inoperable. OP-402 assumed the SDAFW pump was stopped before switching to alternate supply. This is identified as part of Violation 50-261/94-07-02, "Procedures, Instructions, and Drawings Errors."

Path-1, Column 3, second step under entry point C required opening Foldout B. Step 6, "AFW Supply Switchover Criteria," included an instruction to switch to alternative AFW water supply if CST level decreases to less than 10 percent.

AOP-14, Section A, Step 2.1, regarding control room indications, did not list the following control room alarms: APP-001 - B3, D3, E1, C2, and F3.

Part 3.0 of Section 2 of AOP-014 under Auto Actions, stated that FCV-626, "Therm. Bar. Flow Cont.," will close at 100 gpm flow through RCP thermal barriers. The procedure did not reference actions for leakage from RC thermal barrier to CCW system.

3. Review of the EOPs by In-plant and Control Room Walkthroughs

During the in-plant and control room walkthroughs, the team noted that the format of the AOPs continued to differ substantially from the EPPs. This discrepancy was noted by the 1989 NRC EOP inspection team, but had not been corrected. This is identified as part of violation 50-261/94-07-04, Corrective Action Deficiencies.

The team was concerned about the legibility of metal tags used to label equipment outside of the control room. For example, there were situations in which it might be necessary to hold onto a ladder with one hand, the valve tag with the other and simultaneously use a flashlight to read the valve tag.

Although the team identified numerous discrepancies between the nomenclature used on equipment labels and in procedures, in most cases the discrepancies were minor. However, instances of substantial discrepancies were identified. For example, EPP-19, Step 4 refers to components on a panel identified as "PZR PORV - Auxiliary Panel DG." The referenced components were found panel "GC" and no panel "DG" was found. The team determined that the more substantial discrepancies identified could lead to errors or delays in procedure performance. The high frequency of minor discrepancies observed raised questions about the adequacy of the process used to validate portions of the procedures that were performed outside of the control room.

The team believed that walkthroughs, in areas where recent efforts to improve labelling had been undertaken, demonstrated that substantial improvements had been made. For example, during walkthroughs of portions of DSP-002, very few nomenclature discrepancies were found, and no major discrepancies were identified. Further, several effective aids for locating and identifying equipment were provided in the area where the procedure steps were performed. For example, color coded markers were used to assist in quick identification of equipment, and some panels were indexed into rows and columns with the compartments identified.

Walkthroughs of the procedures identified numerous cases where manpower and tool requirements for performing actions outside of the control room were not specified. For example:

- In EPP-1, Step 12 directed the removal of fuses. The procedure did not indicate prior to this step that fuse pullers are needed to perform this task.

- In AOP-017, Step 10.1 directed taking local control of the charging pump speed by disconnecting the speed control linkage and manually positioning the fluid drive. The procedure did not specify this task required tools for removing a cotter pin and a clevis pin.

- AOP-004, Attachment 3, Step 4 directed manual throttling of the MDAFW Pump Discharge Valves to maintain steam levels between 65 and 85 percent WR as indicated on the Secondary Control Panel. These valves were not near the control panel, and were particularly difficult to access. To effectively perform this step, a second operator would be required to relay information.

- AOP-020, Attachments 1 and 2 contained actions that must be performed in the RHR Pump Pit (Step 15 directs operators to these attachments). However, radio communication was not possible from within the RHR Pump Pit. To effectively perform this step, a second operator would be required to relay information.

The team identified the following as situations where task-specific procedures would have been appropriate for locally performed actions:

- EPP-22 and EPP-25 includes a step that directs opening of five DS breakers. Although the breaker cabinets were clearly labeled by number, this location information was not provided in the procedures.

- EPP-1, Step 12 provided direction for removing breaker control power fuses. Between two and four breakers were associated with each component listed. Thus, performing the tasks required the breakers and their locations to be recalled from memory correctly.

The team was concerned that the level of detail in procedures was inadequate in some cases. For example, EPP-1, Step 4.b, did not indicate that the described action must be performed locally and EPP-1, Attachment 1, did not distinguish between Battery A and Battery B loads.

The team was concerned that some procedure steps required more precise readings from gauges and instrumentation than could be reliably obtained. For example, coolant level in the Spent Fuel Pit was required to be maintained less than 37 and 5/8 inches. However, the level markings on the side of the Spent Fuel Pit were obscured by boron residue and marked at 2-inch increments.

The team was concerned that cautions and notes were not used correctly or consistently. For example, OMM-040 indicates that notes in procedures should be used to provide supplemental information and that operators should be able to perform procedures correctly without referring to the notes. However, notes frequently contained both action instructions and cautionary information, as in the following examples.

- In EPP-1 the first note prior to Step 7 provides important information about the timing of particular tasks.

- In EPP-1 the second note prior to Step 7 alerts the operator of the need to execute other procedures within one hour if it becomes necessary to perform those procedures. Because failure to perform those procedures when required could result in substantial hazards, the team believed that a caution was warranted rather than a note. Further, because the information contained instructions of ongoing applicability, the team believed that a step of continuous applicability directing users to perform the referenced procedures was required.

Logic statements were frequently not used in accordance with the WG requirements for the presentation of decision criteria or were used in ways that could potentially lead to operator error.

- The Emergency Procedure Foldouts consisted almost entirely of conditional statements that were not formatted as logic statements.

- Long, complex, and embedded logic statements were especially common in the AOPs. For example, AOP-018, Section B, Step 5.4 contained logic statements within other logic statements and a note between the IF and THEN clauses of one of these.

The team was concerned about the use of bulleted lists in procedures. For example, EPP-01, Step 5 directed checking that at least one steam supply to the SDAFW pump is open. The use of bullets in the RNO action implied that both valves would be opened when opening only one valve was required.

The team was concerned that requirements in procedures to transition to other procedures in accordance with explicit or implied cross references could severely hamper procedure use for mitigation of accidents. This is identified as part of Violation 50-261/94-07-02, "Instructions, Procedures, and Drawings Errors."

- Procedure steps frequently indicated or implied that other procedures needed to be used but did not specify the steps or section in those procedures to use. For example, AOP-013, Step 5.5 directed increasing the level of water in the Spent Fuel Pit ". . .in accordance with OP-019." The absence of a more specific location for the referenced information, require determining which portion of OP-019 would be used and what prerequisite information was applicable. The prerequisites in OP-019 also included additional implicit cross-references to other procedures (OP-603, OP-306, OP-920, and OP-906). The step apparently referenced in OP-019 (Step 8.1), included additional implicit references (to OP-913 and OP-915). Since these documents also included implicit cross-references either as prerequisites or within the (presumed) applicable sections, the chain of cross-references quickly cascaded to include (at least) nine OPs, three FMPs, and one GP.

- Cross-references were used when including the referenced information in the original procedure would have better supported operators. For example, FRP-H.1, Step 1.b, directed a transition to a single step in GP-007, which was also a cross-reference.

The Path procedures used in the simulator were reduced from the size specifications stated in OMM-041. The page size specified in OMM-041 was 37 by 25 inches and the page size of the procedures used in the simulator was approximately 24 by 18 inches.

The team believed that the graphics of the path procedures were unnecessarily complex. For example, flowlines often contained turns causing the paths to snake across the page. As specified in OMM-41, multiple paths ending in a single location were indicated with parallel flowlines rather than by merging the lines into a single line. Neither procedure users nor writers were aware of any advantage or reason for this approach.

The path procedures appeared to be an effective tool for both quickly diagnosing plant conditions and assisting in maintaining a "big picture" perspective of events. Operators described techniques they used when following these procedures in which they exploited the visual elements of the procedures to keep track of information, review status, and plan ahead.

The team believed that when these techniques were used, the Path procedures provided the operators with substantially more assistance for maintaining and using a "big picture" perspective than was provided in the text-format procedures.

4. Simulator Observation

The adequacy of the approved site-specific EOP network was evaluated in two simulator scenarios, a SGTR with a MSLB and a SBO, that were developed by the team. The minimum crew specified in TS of 2 ROs, 1 SRO, a Shift Foreman, and an STA, were used in the simulator control room. Two AOs were stationed in the actual plant to simulate the local actions during each of the scenarios. Based on these scenarios, the following observations were made.

- The mitigation strategy of the approved site-specific EOPs was not followed during the simulator scenarios observed. For example, during the SGTR with a MSLB, all the MSIVs were closed before entering the diagnostic portion of the EOPs. This resulted in loss of the primary heat removal system and potentially uncontrolled, unmonitored releases through the MSL PORVs. If the EOP mitigation strategy had been followed, closure of all MSIVs would not have been necessary. Also, during the SBO, the EDGs were allowed to run without adequate cooling for an extended period, even though both the high coolant temperature and the high lube oil alarms for EDG "B" were lit. If the mitigation strategy of EPP-1 had been followed, EDG "B" would have been shutdown sooner.

Departures from the EOP network step sequences was an accepted plant practice, was included in operator training, and was documented as allowable by OMM-022. Specifically, OMM-022 stated the EOPs are a "tool" for successful mitigation of an event. Therefore, performing EOP steps out of sequence was allowed. This practice was inconsistent with the ERG mitigation philosophy in that the ERG mitigation boundaries were not maintained. This could result in a plant configuration which would not permit diagnosis, mitigation, or recovery using the approved site-specific EOP network.

5. Verification and Validation

The licensee's program for V&V of the EOPs and EOP support procedures was inadequate to provide assurance that the EOPs were written in accordance with the applicable WGs, and could be performed, as written, under expected conditions of use. A number of programmatic deficiencies were found in this area. This is identified as part of Violation 50-261/94-07-04, "Corrective Action Deficiencies."

The team reviewed the procedure history files for a sample of EOPs to assess the V&V processes followed in procedure development. For each procedure, these files contained completed document change forms that maintained the signatures of those individuals involved in reviewing

procedure revisions, and various records of validation exercises and safety analyses of the revisions. However, the team was unable to verify the depth or completeness of the V&V reviews because the following information was unavailable:

- records of discrepancies identified and resolved during the check for written correctness against the applicable WGs
- records of the scenarios developed for simulator validation of the procedures, the number of scenarios run, or the composition of the crews involved in the exercises
- records of discrepancies identified and resolved during the simulator validation exercises and tabletop discussions of the procedures
- records of the results of walkthroughs of the procedures with the intended users to identify staffing, communications, equipment and lighting requirements for performing local actions, as well as to identify any procedure nomenclature or labeling changes required to support performance of the procedure
- records of specific user comments on the procedures that had been incorporated into the revision, and
- records of other procedures affected by the revision, contrary to AP-022.

The governing administrative documents, AP-022 and OMM-043, do not require that these records be maintained.

The team observed a simulator and tabletop validation of a revision to EPP-9. This procedure describes a set of time-critical actions that must be performed when RWST level decreases to less than 27 percent. The goal of the procedure is to transfer the SI and CS systems to the recirculation mode. The validation process observed was deficient in many areas. For example, none of the steps in the RNO column were performed, although revisions to these steps had been made. Further examples of weaknesses in the procedure that were not identified by the validation process can be found in Appendix D.

The team identified a good practice during the validation, in that an AO was included on the validation team to provide comments on actions that would be performed by AOs out of the control room. However, the team was told in interviews that this is not a common practice.

Disciplines other than licensed operators who must perform steps in the EOPs, such as chemistry and health physics personnel, are not typically involved in reviewing and validating the procedures. In a talk-through with a chemistry specialist of FRP-J.2, it was identified that Step 2 of

this procedure, which states "Sample CV Sump Water for Activity," cannot be performed. Chemistry would only be able to sample CV sump water from the RHR system. Records reviewed in the procedure history file for this procedure confirmed that chemistry had not been required to review it.

Procedure reviewers are not trained to perform the reviews required in OMM-043. Guidance for performing the reviews is contained in AP-022 and OMM-043, and checklists for the reviews are provided. Although the guidance suggests that reviewers walk through the procedures, walkthroughs are not required to consider such issues as available lighting, step-sequencing, manpower requirements, correspondence between procedural information and information on labels and tags, availability of necessary tools and equipment, and communications requirements. As a result, the technical and usability deficiencies described in Section 3.0 of this report were identified during the team's walkthroughs of the procedures, but had not been identified through the licensee's V&V program. Further examples of procedural deficiencies that were found by the team but had not been identified by the licensee can also be found in Appendix D.

6. Management Control of EOPs

The team reviewed the procedures that provided the management controls for the EOPs and the EOP procedural network. These included the controls for programs such as: procedure maintenance, setpoint control, training, and audits. The team identified some weaknesses in each of the program areas reviewed.

a. Setpoint Control

The team reviewed the EOP setpoints that were contained in "Emergency Operating Procedures Setpoints Document Final Report," dated January 27, 1993. The information the setpoints were based upon was circa 1990 information, much of which is out of date. The setpoints have not been verified by the licensee, and there were no administrative controls to ensure that modifications to instrument loops were reviewed for setpoint implications.

b. Procedure Maintenance

The team reviewed the EOP procedure maintenance program. The team found there were no administrative controls to ensure that operator comments from LORP on EOPs, AOPs, or support procedures were reviewed for procedural inclusion. There were also inconsistent administrative controls to feed comment resolution back to the comment originator. The team witnessed the informal program that gathered and reviewed the LORP comments. The team concluded that the licensee had not devoted sufficient resources to effectively administer the program.

c. Training

The team observed that AO training did not encompass complete procedures in the EOP network. Training appeared to focus on the performance of specific in-plant steps in the EOPs and support procedures, rather than on developing an understanding of the overall mitigation strategy and the role of the in-plant actions in accomplishing EOP goals.

d. Audits

The 1989 NRC EOP inspection identified inadequate QA involvement in EOP development prior to implementation. To determine if QA involvement had increased since that time, the team requested the results of audits performed by the QA organization since the 1989 NRC EOP inspection. The team was informed that the QA group had been replaced by NAD in 1991, and there were no records of any audits by either of the groups during the period.

The team was provided with one technical comment sheet, dated March 22, 1993, which was based on an independent review of EOP setpoints. The independent review, while documented only as a comment, identified problems with EOP setpoints. These included math errors in the subcooling monitor setpoints, multiple errors in the PZR Level setpoint and incorrect data supplied to the vendor that performed the setpoint calculations. On March 26, 1993, a meeting was held between NED and Operations on the setpoint issues. The decision was made to extend NED's review deadline and look at all of the calculations. The budget was later cut and the deadline was extended again. The items have still not been corrected, and by procedure, the NAD comments have been purged from the computer records.

While there are multiple causes for the setpoints not being corrected in a prompt manner, the root cause is a breakdown in the program controls for the NAD organization. The NAD program manual requires that comments either be elevated to findings status, or purged after one year. Although this was the only time in five years that the EOP program had any portion reviewed, there were known problems with the EOP program, and this NAD independent review identified problems with EOP setpoints which could have operational impact, the comments were deemed not significant enough to be elevated to a finding. Without being elevated to a finding, there were no required corrective actions, no formal or documented NAD follow up, no timely review of other potentially impacted setpoints, and the records were purged after 12 months.

The program that allowed a deficiency to be handled in this manner and required the records of this inappropriately handled finding to be destroyed after 12 months, does not meet the requirements of 10 CFR 50, Appendix B, Criterion XVII, "Quality Assurance Records" which requires in part, "Sufficient records shall be maintained to furnish objective

evidence of activities affecting quality and that the records shall include audits, and the records shall be identifiable and retrievable." The program also is inconsistent with TS 6.10.2.k which requires, in part, records of the independent reviews by NAD be maintained for the duration of the operating license. The program is also inconsistent with PLP-026 which requires in part that conditions adverse to quality be identified and promptly corrected. Additionally, the program is inconsistent with 10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions Deficiencies." The team felt that the programmatic aspects of the QA/NAD were ineffectual and that this represented a violation of the basic QA program guidelines. This is identified as Violation 50-261/94-07-01, "Quality Assurance Program Deficiencies"

e. Configuration Control

In the review of EOP setpoints the team identified a RPS power supply configuration error. This power supply was used for RPS pressurizer level instrument loops and consequently affects the EOPs through the EOP setpoint calculations. The power supply on the controlled drawings was a Hagan Model 121 Loop Power Supply. This was a 45-volt power supply. The power supply that was actually installed was a Lambda Model 122-137. This was a 40-volt power supply. After further NRC investigation it was determined that there were a total of twenty power supplies installed that were of a different type and of a lower voltage rating than the power supply depicted on the drawings, and that the discrepancy had apparently existed for more than 25 years. The licensee issued an ACR to investigate this problem after the 20 power supplies were identified as deficient by the inspectors. The specific transmitters and Hagan Wiring Diagrams are listed in Appendix C. This is identified as part of Violation 50-261/94-07-02, "Instructions, Procedures, and Drawings Errors."

AOP-017 did not identify CVC-353 as a locked closed valve. P&ID 5379-685, Sheet 2 indicated the valve was locked closed. The team inspected the valve and determined the P&ID, rather than the procedure, was correct.

f. Document Control

The team identified that the controlled copies of AOP-004 in the EOF and the technical library were incorrect in that 13 of 21 pages were missing. The copies were replaced. The team ensured the copies in the control room were correct. The licensee did write an ACR or investigate the deficient condition. The team selected a sample of procedure revisions to determine if the problem was isolated to a single occurrence. It was not. The team identified problems with the controlled copies of PEP-104, APP-048, OST-010, and OST-551. These copies included the Emergency On-site Facility copies. The condition

of the copies made the procedures unusable. Following the team's findings, the licensee issued an ACR and identified several additional controlled drawing deficiencies. The team identified this as Violation 50-261/94-07-03, "Document Control Deficiencies."

g. Corrective Actions

The team found that many of the weaknesses identified in NRC Inspection Report No. 50-261/89-16 have not yet been resolved. These weaknesses include (1) needed equipment for some required actions is not prestaged, mentioned in the procedures, or always easily available, (2) the plant verification and validation process continues to be inadequate, (3) no process has been established to ensure that changes to equipment or other procedures that affect the EOPs and EOP support procedures are identified and result in the necessary procedure revisions, (4) no requirement for in-plant walkthroughs of procedures has been incorporated into the governing EOP program documents, (5) staffing for all disciplines who must perform actions in the EOPs and support procedures (e.g., Instrument and Controls, chemistry) is not provided round the clock, and (6) independent job performance aids for Auxiliary Operators who must perform multiple local actions have not been developed for actions other than a few in the dedicated shutdown procedures. The failure to adequately address these weaknesses is identified as part of violation 50-261/94-07-04, Corrective Action Deficiencies.

7. Exit Interview

The inspection scope and findings were summarized on March 25, 1994, with those persons indicated in paragraph 1. The NRC described the areas inspected and discussed in detail the inspection findings listed below. No proprietary material is contained in this report. No dissenting comments were received from the licensee.

Item Number	Status	Description/Reference Paragraph
50-261/94-07-01	Open	VIO - Quality Assurance Program Deficiencies (paragraph 6.b)
50-261/94-07-02	Open	VIO - Instructions, Procedures, and Drawings Errors (paragraphs 2, 3 6.e)
50-261/94-07-03	Open	VIO - Document Control Deficiencies (paragraph 6.f)
50-261/94-07-04	Open	VIO - Corrective Action Deficiencies (paragraph 4, 5, 6.g)

APPENDIX A

ACRONYMS

AB	Auxiliary Building
AFW	Auxiliary Feedwater
AO	Auxiliary Operator
AOP	Abnormal Operating Procedure
AP	Administrative Procedure
APP	Annunciator Panel Procedure
CCW	Component Cooling Water
CSFST	Critical Safety Function Status Tree
CST	Condensate Storage Tank
CV	Containment Vessel
DG	Diesel Generator
DS	Dedicated Shutdown
DSDG	Dedicated Shutdown Diesel Generator
DSP	Dedicated Shutdown Procedure
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
EOF	Emergency Operations Facility
EPP	End Path Procedure
ERG	Emergency Response Guideline
FCV	Flow Control Valve
FRP	Functional Recovery Procedure
GP	General Procedure
gpm	gallons per minute
HVAC	Heating Ventilation and Air Conditioning
LORP	Licensed Operator Requalification Program
MDAFW	Motor Driven Auxiliary Feedwater
MSIV	Main Steamline Isolation Valve
MSL	Main Steamline
MSLB	Main Steamline Break
NAD	Nuclear Assessment Department
NED	Nuclear Engineering Department
OMM	Operations Management Manual
OP	Operating Procedure
POG	Plant Operations Guideline
PORV	Power Operated Relief Valve
PSTG	Plant Specific Technical Guidelines
PZR	Pressurizer
QA	Quality Assurance
RC	Reactor Coolant
RCP	Reactor Coolant Pump
RHR	Residual Heat Removal
RNO	Response Not Obtained
RO	Reactor Operator
RTGB	Reactor Turbine Generator Board
RVLIS	Reactor Vessel Level Information System
RWST	Reactor Water Storage Tank
S/G	Steam Generator
SGTR	Steam Generator Tube Rupture
SI	Safety Injection

SBO	Station Blackout
SDAFW	Steam Driven Auxiliary Feedwater
SDD	Step Deviation Document
SRO	Senior Reactor Operator
STA	Shift Technical Advisor
TB	Turbine Building
V&V	Verification and Validation
WG	Writer's Guide
WR	Wide Range
WOG	Westinghouse Owners' Group

APPENDIX B

PROCEDURES REVIEWED

Procedure	Title	Revision
AOP-001	Malfunction of Reactor Control System	5
AOP-002	Emergency Boration	4
AOP-004	Control Room Inaccessibility	5
AOP-005	Radiation Monitoring System	10
AOP-006	Turbine Eccentricity/Vibration	5
AOP-007	Turbine Trip Without Reactor Trip Below P-7	2
AOP-008	Accidental Release of Liquid Waste	2
AOP-009	Accidental Gas Release from a WGDT	3
AOP-010	Inadequate Feedwater Flow	7
AOP-011	Loss of Circulating Water Pump	2
AOP-012	Partial Loss of Condenser Vacuum	7
AOP-013	Fuel Handling Accident	5
AOP-014	Loss of Component Cooling Water	4
AOP-015	Secondary Load Rejection or Turbine Runback	3
AOP-016	Excessive Primay Plant Leakage	7
AOP-017	Loss of Instrument Air	10
AOP-018	Reactor Coolant Pump Abnormal Conditions	5
AOP-019	Malfunction of RCS Pressure Control	3
AOP-020	Loss of Residual Heat Removal (Shutdown Cooling)	13
AOP-021	Seismic Disturbances	6
AOP-022	Loss of Service Water	10
AOP-023	Loss of Containment Integrity	6
AOP-024	Loss of Instrument Bus	5
AOP-026	Low Frequency Operation	3
AOP-027	Operation with Degraded System Voltage	6

Procedure	Title	Revision
AOP-028	ISFSI Abnormal Events	2
AOP-029	Loss of DC Bus "A"	2
AOP-030	Loss of DC Bus "B"	2
AOP-031	Operation with High Switchyard Voltage	1
AOP-032	Accidental Release of Water from the Fire Protection System	1
EPP-1	Loss of All AC Power	11
EPP-2	Loss of All AC Power Recovery without SI Required	9
EPP-3	Loss of All AC Power Recovery with SI Required	7
EPP-4	Reactor Trip Response	8
EPP-5	Natural Circulation Cooldown	6
EPP-6	Natural Circulation Cooldown with Steam Void in Vessel	4
EPP-7	SI Termination	11
EPP-8	Post LOCA Cooldown and Depressurization	6
EPP-9	Transfer to Cold Leg Recirculation	13
EPP-10	Transfer to Long Term Recirculation	7
EPP-11	Faulted Steam Generator Isolation	3
EPP-12	Post SGTR Cooldown Using Backfill	5
EPP-13	Post SGTR Cooldown Using Blowdown	5
EPP-14	Post SGTR Cooldown Using Steam Dump	5
EPP-15	Loss of Emergency Coolant Recirculation	7
EPP-16	Uncontrolled Depressurization of All Steam Generators	7
EPP-17	SGTR with Loss of Reactor Coolant: Subcooled Recovery	7
EPP-18	SGTR with Loss of Reactor Coolant: Saturated Recovery	6
EPP-19	SGTR without Pressurizer Pressure Control	5

Procedure	Title	Revision
EPP-20	LOCA Outside Containment	3
EPP-21	Energizing Pressurizer Heaters From Emergency Busses	5
EPP-22	Energizing Plant Equipment Using Dedicated Shutdown Diesel Generator	7
EPP-23	Restoration of Cooling Water Flow to Reactor Coolant Pumps	1
EPP-24	Isolation of Leakage in the RHR Pump Pit	3
EPP-25	Energizing Supplemental Plant Equipment Using the DSDG.	0
EPP-Supplements	Supplements	10
EPP-Foldouts	Foldouts	13
FRP-S.1	Response to Nuclear Power Generation/ATWS	6
FRP-S.2	Response to Loss of Core Shutdown	3
FRP-C.1	Response to Inadequate Core Cooling	6
FRP-C.2	Response to Degraded Core Cooling	5
FRP-C.3	Response to Saturated Core Cooling	3
FRP-H.1	Response to Loss of Secondary Heat Sink	7
FRP-H.2	Response to Steam Generator Overpressure	3
FRP-H.3	Response to Steam Generator High Level	5
FRP-H.4	(MISSING - SDD but no procedure)	
FRP-H.5	Response to Steam Generator Low Level	3
FRP-P.1	Response to Imminent Pressurized Thermal Shock	7
FRP-P.2	Response to Anticipate Pressurized Thermal Shock	4
FRP-I.1	Response to High Pressurizer Level	3
FRP-I.2	Response to Low Pressurizer Level	3
FRP-I.3	Response to Voids in Reactor Vessel	6
FRP-J.1	Response to High Containment Pressure	3

Procedure	Title	Revision
FRP-J.2	Response to Containment Flooding	2
FRP-J.3	Response to High Containment Radiation Level	3
OMM-022	Emergency Operating Procedures Users Guide	4
OMM-040	Writers Standard for Operations Procedures	3
OMM-041	Writer's Guide for the Development and Revision of Flowpath and Two Column Format Procedures	1
OMM-042	Writer's Guide for the Development and Revision of Single Column Format Procedures	3
OMM-043	Verification and Validation	2
AP-022	Document Change Procedure	15
POG-044	Operations Procedure Review	1
DSP-002	Hot Shutdown Using The Dedicated/Alternate Shutdown System	11
OP-101	Reactor Coolant System And Reactor Coolant Pump Startup And Operation	27

APPENDIX C

REACTOR PROTECTION SYSTEM DRAWING ERRORS

	TRANSMITTER #	HAGAN WIRING DRAWING #
1	PT-444	5379-3532
2	PT-445	5379-3532
3	PT-455	5379-3531
4	PT-456	5379-3531
5	PT-457	5379-3483
6	LT-459	5379-3482
7	LT-460	5379-3530
8	LT-461	5379-3501
9	LT-474	5379-3518
10	LT-475	5379-3513
11	LT-476	5379-3513
12	LT-477	5379-3518
13	LT-484	5379-3516
14	LT-485	5379-3514
15	LT-486	5379-3514
16	LT-487	5379-3516
17	LT-494	5379-3517
18	LT-495	5379-3513
19	LT-496	5379-3515
20	LT-497	5379-3517
21	FT-932	5379-3508
22	FT-933	5379-3508

APPENDIX D

VALIDATION AND VERIFICATION DEFICIENCIES

The following examples of weaknesses in the licensee's validation process were identified during the simulator validation of EPP-9:

- Cross-references, including entry conditions, to and from the procedure were not performed, so that potential effects of the revisions on the procedures were not evaluated.

- A full shift complement was not used in the exercise to validate that the actions can be coordinated among crew members without physical interference.

- The process failed to note that the SRO did not read aloud about half of the procedure steps verbatim, but rather paraphrased the content of the step, and failed to recognize the additional mental workload associated with having to translate steps in this fashion.

- The process failed to note that Step 1, which states, "Perform Steps 1 Through 18 Without Delay," is supplementary/descriptive information rather than an action step and that "without delay" is vague.

- The process failed to note that Step 2 is a caution, rather than an action step.

- The process failed to note that the licensee practice of RO repeat-backs of procedure steps could not be implemented for Steps 3 and 45 because they are too long and complex. The team observed that the RO did not attempt to repeat back these steps.

- The process failed to note that the RO required clarification from the SRO regarding the intent of the first bullet in Step 7.a because it is stated negatively rather than positively.

- The process failed to note that the third bullet in Step 7.a refers to stopping ALL RHR pumps, implying there are several, rather than to stop BOTH RHR pumps, as there are only two. The RO repeated this step back as "both," but validators failed to notice the discrepancy between the language in the procedure and common operator usage.

- The process failed to note that the SRO had to ask the RO, in Step 7.b, which CV spray pump was stopped and that the procedure did not include an instruction to the RO to report back this information.

- The process failed to note that Step 7.c is missing an OR between the two bullets. As formatted, this step implies that both sets of valves should be closed, but that the order of closing them is at the operator's discretion.

- The process failed to note that Step 10 includes conditional information but is presented as an action step.

- The process failed to note that Step 11 does not indicate that an RO must obtain keys and perform the action at a back cabinet.

- The process failed to note that Step 12 states that keys must be obtained before performing the actions, and so is inconsistent with Step 11.

- The process failed to note the implications of the time-critical nature of this procedure in Step 12. This step requires four actions to be performed at physically separated locations, but the step directs that only one operator be dispatched to perform them. Further, validators failed to note that the three AOs typically available on shift, may be unavailable to perform this step because they were dispatched to perform the Attachments in Step 10 and would be unlikely to have finished those actions before Step 12 must be performed.

- The process failed to note that the SRO did not wait for confirmation that Step 12 was completed before performing Step 13.

- At Steps 23-26, the RWST level fell to 6.87 percent before actions dependent upon it being less than 9 percent were performed. Although RWST level was shown on the SPDS, the RO used a small-faced mechanical gauge to obtain level information and may not have been able to see when level fell below 9 percent.

- The process failed to identify that, at Step 24, the operators were put in a "do loop" when they reached this step because the level was not below 9 percent but was at 11 percent. If he returned to Step 21, the question arose as to whether another RHR pump should be started. The SI pump was not secured until less than 9 percent in the RWST was obtained, which brings up the question of the adequacy of the NPSH at levels below 9 percent.

- The process failed to note that Step 34 is formatted as an action step, when in fact it is a critical caution that protects against potential damage to the fuel.

- The process failed to note that the first sentence in Step 45 is a note, rather than an action step.

- The process failed to identify that Step 1 in Attachments 1 and 2 are cautions rather than action steps.

- The process failed to note that Steps 2.a-d in Attachment 1, Steps 2.a, b,d and 3 in Attachment 2, and Steps 1.a, b, d and e in Attachment 3 are conditional steps but are not formatted as such.

- The process failed to note that Step 3 of Attachment 3 is a conditional step formatted as a logic statement.

- Written comments from the validation team were not encouraged to be maintained in the procedure history file as a record of the basis for the design of the procedure.

The following are examples of procedural deficiencies identified by the team were not found through the licensee's V&V process prior to approval and implementation:

- Substeps 13a, b, and c of EPP-1 must be performed inside the EDG room. Because of potential signal interference, portable radios could not be used to communicate while in the EDG room, and the PA system would be inoperable at this point in the procedure. No emergency lighting was provided at the EDG control panel, and the EDG room was behind a heavy fire door that is to remain closed during these activities. If an EDG could not be started, the operator must leave the EDG room to open the starting air solenoid valves, return to check if an EDG has started, then leave again to close the starting air solenoid breakers.

- The Caution tags on the root isolation valves for PX-1619A and B on the SW outlet from the CCW heat exchangers, which were required to be opened in Step 34.a.2 in the RNO column of EPP-1, were broken, melted and could not be read. The cautionary information contained on the tags was not provided in the procedure.

- Substep sequencing for Step 37 in EPP-1 was organized by system rather than by the location at which the actions must be performed. Consequently, if a single operator was required to perform these steps in order, for Substep 37.a, he would be required to perform two actions in the AB and two in the TB. For Substep 37.b, he would have to perform one action in the AB and another in the TB. For Substep 37.c, again he would perform one action in each building. Substep 37.d would be performed in the AB, and then Substep 37.e would be performed in the TB. Because manpower requirements were not addressed in the header for this step, control room personnel might assign one individual to perform all of these steps, rather than assign them to the "inside" AO (stationed in the AB) or the "outside" AO (stationed in the TB), as appropriate, potentially resulting in unnecessary delays in completing the step.

- A key was required to operate the pressurizer heater breaker arm switch in Step 11.b of EPP-21. However, the procedure did not provide direction to obtain the key until Step 7, on the second page of the procedure, following local actions in Steps 5 and 6. The key must be obtained in the control room.

- In EPP-22 at Step 2, the operator was required to locally open five Dedicated Shutdown Bus Breakers. Although the cabinets in which the breakers were contained had cabinet numbers on them in large, easily visible labels, this location information was not used in the procedure. Consequently, an operator would be required to search a bank of breaker cabinets to identify the correct cabinet for each action and to read small, visually busy cabinet labels that did not agree with the breaker titles

provided in the procedure. Further, although these actions could be performed in any order from a technical perspective, they were not presented in the procedure in any systematic sequence (e.g., left-to-right, top-to-bottom) that could reduce an operator's search time. This same step was also used in Step 3 of EPP-25.

- Although plant procedures required that only a diesel-qualified operator perform the local actions in EPP-22, there was no administrative process for ensuring that a diesel-qualified AO was always available on-shift.

- Step 1 of Attachment 1 to EPP-22 directed the operator to verify that Battery Charger A and A-1 breakers were "OPEN," whereas the indication on the breaker panels read "OFF." These same steps were used in Attachment 1 to EPP-25.

- Procedures referenced in DSP-002 were maintained at the Secondary Control Panel in a notebook. However, no laydown space was available for the procedures, making it difficult to follow them while performing actions or especially to track concurrent performance in multiple procedures.