

SAFETY EVALUATION REPORT REGARDING THE
PROCEDURES GENERATION PACKAGE FOR

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2

1. INTRODUCTION

Following the Three Mile Island (TMI) accident, the Office of Nuclear Reactor Regulation developed the "TMI Action Plan" (NUREG-0737) which required licensees of operating reactor to reanalyze transients and accidents and to upgrade emergency operating procedures (EOPs) (Item I.C.1). The plan also required the NRC staff to develop a long-term plan that integrated and expanded efforts in the writing, reviewing, and monitoring of plant procedures (Item I.C.9). NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures," describes the use of a "Procedures Generation Package" (PGP) to prepare EOPs. Submittal of the PGP was made a requirement by Generic Letter 82-33, "Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability." The generic letter requires each licensee to submit a PGP, which includes:

- (i) Plant-specific technical guidelines
- (ii) A writer's guide
- (iii) A description of the program to be used for the validation of EOPs
- (iv) A description of the training program for the upgraded EOPs.

This report is the review of the Carolina Power & Light Company (CP&L) response to the generic letter related to development and implementation of EOPs (Section 7 of Generic Letter 82-33) for H. B. Robinson Steam Electric Plant Unit No. 2 (HBR2).

Our review was conducted to determine the adequacy of the CP&L program preparing, implementing, and maintaining upgraded EOPs for HBR2. This review was based on NUREG-0800, (formerly NUREG-75/087), Subsection 13 "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." Section 2 of this report briefly discusses the CP&L submittal, the NRC staff review, and the acceptability of the submittal. Section 3 contains the conclusions of this review.

As indicated in the following sections, our review determined that the procedure generation program for HBR2 has several items that must be satisfactorily addressed before the PGP is acceptable. CP&L should address these items in a revision to the PGP or documented justification for why such revision is not necessary. This revision and/or justification need not be submitted, but should be retained for subsequent review by the NRC staff. The revision of the PGP, and subsequently of the EOPs, should not impact the schedule for the use of the EOPs. The revision should be made in accordance with the HBR2 administrative procedures and 10 CFR 50.59.

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2.0 EVALUATION AND FINDINGS

In a letter dated July 2, 1984 from A.B. Cutter (CP&L) to S.A. Varga (NRC), CP&L submitted its PGP for HBR2. The PGP contained an introduction and the following sections:

- Plant-Specific Technical Guidelines
- Writer's Guide
- EOP Verification and Validation Program
- EOP Training Program.

The NRC staff review of the HBR2 PGP is documented in the following subsections.

A. Plant-Specific Technical Guidelines (P-STG)

The P-STG program description was reviewed to determine if it described acceptable methods for accomplishing the objectives stated in NUREG-0899. CP&L described a process that will take the Westinghouse Owners Group (WOG) emergency response guidelines (ERGs) Low Pressure Version, Revision 1, that were developed for a Westinghouse standard four-loop plant design and, with appropriate changes, develop EOPs for HBR2. CP&L identified the following source documents for use in generating EOPs for HBR2.

- Writer's Guide for EOPs
- WOG generic guidelines and background documents (LP Revision 1)
- HBR2 Updated FSAR
- Plant System Descriptions
- HBR2 Technical Specifications
- HBR2 Piping and Instrument Drawings
- HBR2 current Emergency Instructions and Abnormal Instructions
- HBR2 Operating, General and Administrative Procedures
- Miscellaneous Technical Manuals, Plant Curves, etc. as necessary.

CP&L will use the source documents to produce Critical Safety Function Status Trees (CSFSTs), Functional Restoration Procedure, End Path Procedures, and Path Procedures (flowcharts). The Path Procedures will incorporate the action of E-0, "Reactor Trip or Safety Injection," E-1, "Loss of Reactor or Secondary Coolant," and E-3, "Steam Generator Tube Rupture." The cover letter to the PGP states that there are no differences between the HBR2 EOPs and the WOG ERGs which result in safety concerns. Our review of the HBR2 P-STG identified the following concerns:

1. Section II.C of the PGP states that existing Emergency Instructions which are not superseded by the ERGs may be retained in the new HBR2 EOP network. Attachment 1 of the PGP lists three procedures (EPP-21, Reenergizing Pressurizer Heaters from Emergency Buses; EPP-22, Post Accident Containment Venting; and EPP-24 SGTR Isolation) which will be part of the EOP network that are not developed from the ERGs. For each of these two procedure, CP&L should provide technical justification for why its inclusion in the EOP network is necessary, and describe how it will be interfaced into the EOP network without disrupting the ERG-based methodology. This justification should be retained as part of the HBR2 PGP.
2. Section II.D(3) of the PGP and Section 5.1(4), page 5, of the writer's guide states that Path procedures relieve the operator of the burden of memorization of immediate actions. The ERG Background Document for E-0 states that immediate actions "are those actions which the operator should be able to perform before opening and reading his emergency procedures." Whether the procedure is in a two-column or flow chart format is immaterial. The PGP should clarified regarding the memorization of immediate operator actions. If memorization is not required, this deviation should be technically justified.
3. Section II.E of the PGP states that an ERG/EOP transition document will consist of list of ERG/HBR2 differences, step deviation forms, and derivations of instrument values. This section should be revised to state that this document will also include a description of the basis for plant-specific information used to satisfy the ERG bracketed items (discussed in Section II.C(3) of the PGP).

With adequate resolution of the above, the HBR2 plant-specific technical guidelines program should meet the objectives stated in NUREG-0899 and should provide adequate guidance for translating the ERGs into the HBR2 EOPs.

B. Writer's Guide

The writer's guide was reviewed to determine if it described acceptable methods for accomplishing the objectives stated in NUREG-0899. The purpose of the writer's guide is to provide administrative and technical guidance on the preparation of EOPs and their revisions. Our review of the HBR2 writer's guide identified the following concerns:

1. Cautions and notes provide operators with important supplemental information concerning specific steps or sequences of steps in the EOPs. The writer's guide should be expanded with regard to the following:

- a. Section 5.2.6, page 7, indicates that in flowcharts the same symbol is to be used for notes, cautions, and information statements. Because caution statements provide information used to prevent actions by control room operators that could injure personnel, damage equipment, or endanger public health and safety, it is important they be distinguished from notes or information statements, which contain less critical information. This section should be revised to require different symbols for information statements versus caution statements, and to include sufficient emphasis for cautions when they appear on flowcharts.
 - b. Section 5.3.11, page 12, discusses the content and format of note statements. While the information provided in notes is not critical it is important to the execution of the procedures. Thus, emphasis is required to prevent the operator from overlooking this supplemental information. This section should be revised to indicate that notes presented in the textual EOPs be highlighted in some manner (e.g., be surrounded by lines) to differentiate them from cautions while drawing attention to their content.
 - c. The writer's guide should state that each caution and note will be wholly contained on a single page to ensure that the flow of information from procedures to operators is uninterrupted.
 - d. Section 5.3.11, states that notes will not contain action steps. The note statement in Attachment 6.4 should be corrected, because it contains an operator action in the form of a transition.
2. Conditional and logic statements are used in the EOPs to describe a set of conditions or a sequence of actions. These statements can be confusing, so it is important to provide explicit guidance for their use. The writer's guide should be revised with regard to the following:
 - a. Section 5.4.7, page 16, indicates that the use of AND and OR within the same statement are to be avoided. There are occasions, however, when it is necessary to use AND and OR in the same statement. This section should provide guidance and examples of acceptable usage in those situations. See NUREG-0899, Appendix B, for additional information.

- b. Examples of the correct use of AND, the inclusive OR, IF NOT, IF...THEN, IF...WHEN, the list format to be used when joining three or more conditions, and examples of sequences to avoid should be included in the writer's guide because of their importance and complexity.
 - c. Section 5.4.7, includes NOT as a separate logic term. Other than with IF, it is not clear how NOT is to be used as a logic term in EOPs. Specific directions for and examples of the use of NOT as a logic term should be included in the writer's guide.
 - d. The writer's guide does not provide any information on the use of logic terms within Path Procedures. The writer's guide should be expanded to address this issue or, alternatively, the guidance provided in Section 5.4.7, could be noted as applicable to all types of EOPs.
3. Path Procedures and Critical Safety Function Status Trees will be presented in flowchart format. Flowcharts can be a valuable means of presenting information; however, procedure writers must be provided with sufficient information to produce properly and consistently formatted flowcharts. In addition to the overall deficiencies noted in other comments, guidance for the preparation of Path Procedures and Critical Safety Function Status Trees should be expanded to address the following issues:
- a. Section 5.2, page 6-7, refers to Attachment 6.2 and 6.3 for examples of designation and numbering, symbols, and lines use in the flowcharts. In addition to referencing these attachments, criteria for pitch size and type style should be included within the text of the writer's guide.
 - b. Section 5.2.1, page 6, indicates that Path Procedures and CSFSTs will be identified by a unique identifier, but does not discuss Path Procedure Titles. Procedure Titles are an important source of information to operators. The writer's guide should state that Path Procedures and CSFSTs will be titled.
 - c. Section 5.2.1 should state that the facility and unit designator will appear on Path Procedures and CSFSTs.
 - d. The writer's guide should either state that each Path Procedure and CSFSTs will be contained on a single board or should describe a system of board numbering or pagination.
 - e. The writer's guide does not specify the size of the boards on which the Path Procedures or CSFSTs will be printed.

The writer's guide should be expanded to specify the size of the boards.

- f. Section 5.2.10, page 7, indicates that Path Procedures and CSFSTs "may be appropriately mounted." The PGP should state that the boards will be displayed so that they are easily accessible by operators and do not obscure instruments and displays.
- g. The writer's guide should specifically address the level of detail to be included in the Path Procedures and CSFSTs. This level of detail should be adequate for a trained operator to use the flowcharts, but not so great that the flowcharts become cluttered and unusable.
- h. In Attachment 6.2, all text in the flowchart is capitalized. If all words are capitalized, then capitalization cannot be used for emphasis. Furthermore, text written in all capitals is more difficult to read than mixed case. Capitalization in Path Procedures and CSFSTs should conform to the rules established for written procedures.
- i. The writer's guide does not specify line spacing for Path Procedures and CSFSTs. The writer's guide should be revised to provide line-spacing requirements. Because flowcharts can be read more easily when double-spaced, the writer's guide should specify that text in flowcharts be double spaced.
- j. Several flowpaths in Attachment 6.2 move from bottom-to-top. Flowcharts may be read more easily by operators when the logical movement is either from left-to-right or from top-to-bottom. The writer's guide should contain instructions to avoid upward movement in flowcharts.
- k. The writer's guide should be revised to indicate a means by which operators will be able to differentiate between flowpath lines, e.g., sufficient spacing between the lines, distinctive line patterns, or color-coding. If several flowpath lines run parallel to each other, operators may have difficulty following the correct line.
- l. The writer's guide should be revised to specify a means of indicating the initial entry point into Path Procedures and CSFSTs. The initial entry point into a flowchart should be clearly identified so that operators enter the flowpath at the correct point.

- m. Attachment 6.2 contains instructions to "open Foldout C." It is not clear how foldouts will be used in conjunction with flowcharts. The writer's guide should be revised to indicate how foldouts will be used in this situation.
- n. The path-to-endpath arrows used in Attachment 6.2 differ from the examples given in Attachment 6.3. To reduce the possibility of operator confusion, consistent symbols should be used throughout the flowchart format. The writer's guide should be revised so that all symbols used in examples are consistent with the guidance provided.
- o. Attachment 6.2 contains Path Entry Point Arrows K and L. This suggests that there are at least a dozen path-to-path transitions in Path-1 alone. The construction of Path-1 should be examined to evaluate whether its apparent complexity can be minimized.
- p. Attachment 6.2 contains two action boxes and a path-to-endpath arrow (upper left of example procedure) which cannot be accessed. The example should be clarified.

Further guidance regarding flowchart-format EOPs is provided in NUREG/CR-5228.

- 4. Transitions or references to other procedures or sections of procedures can be disruptive and cause unnecessary delays. In addition to the directions provided in Section 5.3.13, pages 12-13, the writer's guide should be expanded with regard to the following:
 - a. Because of the confusion and delays which can result when references to other procedures or parts of procedures are required, the writer's guide should discuss the criteria to be used when deciding if the necessary information should be included in the text of the procedure or if a reference should be used.
 - b. The writer's guide should describe the format for references in EOPs. Attachment 6.5, page 27, includes the verb "complete," and gives as an example "complete steps 7 through 9 of Section III." If "complete" is to be used to denote a reference, the writer's guide should be modified accordingly.
 - c. Some method for easily identifying sections or subsections in the EOP, such as tabbing, should be specified to facilitate rapid movement from one part of the EOPs to another.
 - d. The words GO TO should be capitalized or otherwise emphasized to sufficiently differentiate GO TO statements from surrounding text.

- e. Section 5.4.6.4, page 15, indicates that "as a general rule" most transitions to other procedures will occur from the right-hand column. The writer's guide should specifically discuss the situations in which transitions will occur from the left-hand column.
5. Several considerations need to be met to ensure that the vocabulary and syntax used in the EOPs are readily understood by both the procedure preparers and operators:
 - a. Attachment 6.5, page 27-29, should be expanded from a sample action verb list to an inclusive list of action verbs.
 - b. The writer's guide lists several words to avoid in Section 5.5.4, page 19, but should be expanded to address other types of words which should be avoided, such as those dealing with frequency (e.g., often, frequently) or amount (e.g., high, low, several).
 - c. Section 5.3 should include information on sentence structure; e.g., that steps will be written as short, complete sentences in the imperative mode, and will include only one action per step.
 - d. Section 5.4.3, page 14, addresses abbreviations and acronyms. In order to achieve consistency among procedures and between procedures and the control room displays and controls, a list of acceptable abbreviations and acronyms should be included in the writer's guide.
 6. Instructions should be written for various types of action steps that an operator may take to cope with different plant situations. As currently written, the writer's guide refers to several types of steps; however, this guidance should be expanded to address the following concerns:
 - a. Both high level and instructional steps are terms that are used but not defined in the writer's guide. The writer's guide should be revised to include definitions of these terms, instructions on how these steps should be written, and examples of their use.
 - b. Sections 5.1(2) and 5.1(4), page 5, discuss immediate operator actions. It is assumed that immediate operator actions are included in the EOPs so that their execution can be verified. These sections should be revised to indicate that immediate operator actions will be delineated, and the writer's guide should be revised to specify the method of delineation. See NUREG-0899, Section 5.4.6 for additional information.

- c. The writer's guide should include examples of, and address the definitions and formats for, the following types of action steps: (1) steps that verify accomplishment of objectives, (2) steps performed at intervals throughout a procedure, (3) steps for which several alternatives are equally correct, (4) steps which must be repeatedly performed, and (5) steps performed concurrently with other steps.
7. Information should be presented so that interruption in the flow of information from procedures to operators is minimal. The writer's guide should be expanded to address the following:
 - a. Action steps should be presented completely on one page and each procedure or section of a procedure should begin on a new page. For those conditions where a step cannot be contained on a single page, the writer's guide should specify the format used to denote a step continuation and should state that the entire step number will be used on the subsequent page.
 - b. Sections 5.6.1, 5.6.3, and 5.6.4, pages 19-20, should be revised to indicate that page rotation and breaking of words are unacceptable at all times.
 - c. The writer's guide should specify some type of placekeeping aid.
8. Sections 5.4.8 and 5.4.9, pages 16-17, provide guidance for formatting figures and tables. However, to help procedure writers prepare consistently formatted tables and figures, examples should be provided.
9. Section 5.4.2, page 14, indicates that information on the location of equipment, controls, or displays that are infrequently used, are in out-of-the-way places, or are otherwise difficult to find may be included, if required. This section should be revised to include formatting instructions for the presentation of location information.
10. Regarding EOP action steps, the following concerns should be addressed in the writer's guide:
 - a. Action steps should be structured so that they can be executed by the minimum shift staffing required by Technical Specifications.
 - b. Action steps should be structured to be consistent with the roles and responsibilities of operators.

- c. Action steps should be structured so as to minimize the movement of personnel around the control room while carrying out procedural steps (when the technical guidelines permit).
- d. Action steps should be structured to avoid unintentional duplication of tasks.
- e. Action steps should be structured to enable the control room supervisor to follow staff actions and monitor plant status.

See NUREG-0899, Section 5.8, for additional information.

- 11. Writers should be given sufficient information in the writer's guide to produce procedures that are consistently formatted. In order to assure consistency throughout the EOPs, instructions and examples in the writer's guide should be revised as follows:
 - a. Section 5.6, pages 19-20, should be expanded to explicitly specify the type style and pitch size to be used in the EOPs.
 - b. Section 5.4.11, page 17, states that equipment, controls and displays will be identified in operator language terms. To ensure that an operator is able to easily recognize the identity of equipment and controls, terms used in EOPs should match panel engravings, or an approach should be adopted that allows common terms to be associated directly with the panel engravings (e.g., using common terms with the label information in parenthesis).
- 12. The PGP should address the accessibility of EOPs and techniques to distinguish them from other plant procedures as they will be used in stressful conditions and under time constraints.
- 13. The quality of the reproduced copies of the EOPs should be addressed in the PGP since all copies of the EOPs should be clearly legible.

With adequate resolution of the above items, the HBR2 writer's guide should accomplish the objectives stated in NUREG-0899 and should provide adequate guidance for translating the technical guidelines into EOPs that will be usable, accurate, complete, readable, convenient to use and acceptable to control room operators.

C. Verification and Validation Program

The description of the verification and validation program was reviewed to determine if adequate methods are described for

accomplishing the objectives stated in NUREG-0899. The verification and validation program described in the PGP identifies the following six objectives:

- that the EOPs are technically correct
- that the EOPs are written correctly
- that the EOPs are usable
- that there is a correspondence between the procedures and the control/plant hardware
- that the language and level of information presented in the EOPs is compatible with the minimum number, qualification, training, and experience level of the operating staff
- that there is high level of assurance that the procedures will work.

The verification and validation program will include simulator exercises, table-top reviews, and control room walk-throughs. Our review of the HBR2 verification and validation program description identified the following concerns:

1. The types of personnel involved in the verification and validation process (e.g., engineers, procedure writers, operations personnel, and human factors experts), and the roles and responsibilities of these individuals should be specified.
2. The EOPs will require a certain number of operators to carry out the various activities and steps as specified. The validation program description should indicate that the EOPs will be exercised, during the simulator exercises or control room walk-throughs, with the minimum control room staff size required by the facility Technical Specifications.
3. To assure verification and validation of all EOPs, the program description should include an indication that the full complement of EOPs will be exercised.
4. The validation program should be expanded to include a description of the criteria that will be used to select the scenarios to be run during the validation process. The criteria should be developed to validate all procedures and should ensure that single, sequential, and concurrent failures are included. A review of the capabilities and the limitations of the simulator will then identify what can be validated on the simulator. For the parts of the EOPs that cannot be validated on the simulator, the criteria for selecting any additional validation that may be needed and the methods to be

used, such as a control room walk-through or a mock-up walk-through, should be described. If the CP&L simulator is not specific to HBR2, then the validation program should include a commitment to revalidate the procedures when a plant-reference simulator is available.

5. Section IV.D.3, page 9, discusses resolution of comments generated during the verification and validation program. This section should include the criteria or methods that will be used for determining the need to reverify and revalidate any resultant change in the EOPs.
6. The discussion of verification and validation of future changes should be extracted from the writer's guide (Section 5.8) and should be incorporated into the verification and validation program discussion.

With adequate resolution of the above items, the HBR2 verification and validation program should accomplish the objectives stated in NUREG-0899 and should provide assurance that the EOPs adequately incorporate the guidance of the writer's guide and the technical guidelines.

D. Training Program

The description of the operator training program on the HBR2 upgraded EOPs was reviewed to determine if it described acceptable methods for accomplishing the objectives stated in NUREG-0899. The training program described in the PGP consists of the following parts:

- ° Phase 1--new EOP development process (classroom)
- ° Phase 2--HBR2 specific EOPs (classroom)
- ° Phase 3--simulator training

Our review of the HBR2 training program description for EOPs identified the following concerns:

1. It is crucial that all operators be trained on all aspects of each EOP so that all operators are prepared to execute each EOP to its fullest extent. The training program should include a commitment to train all operators on all EOPs.
2. The PGP states that the CP&L simulator will be used. The training program description should indicate the use of a wide variety of scenarios, including multiple (simultaneous and sequential) failures, to fully exercise (to the extent possible) the EOPs on the simulator and thus expose the operators to a wide variety of EOP uses. If the CP&L simulator is not specific to HBR2, then the training program should include a commitment to retrain the operators when a plant reference simulator is available.

3. The training program description should be expanded to include a discussion of the method to be used to train operators in areas where the simulator does not react like the plant and in parts of the EOPs that cannot be run on the simulator.

With adequate resolution of the above items, the HBR2 training program should accomplish the objectives stated in NUREG-0899 and should result in appropriate training for the HBR2 operators on the upgraded EOPs.

3. CONCLUSION

The staff concludes that, the PGP submitted by Carolina Power & Light Company for H.B. Robinson Steam Electric Plant, Unit No. 2 in a letter to NRC, dated July 2, 1984 should be reviewed to address the programmatic improvements outlined in Section 2 of this report. A PGP revision should not be submitted to the NRC. For items the licensee deems inappropriate or no longer applicable for inclusion in its PGP, it should develop and maintain documented justification in an auditable form. All revisions to the PGP should be reflected in plant EOPs within a reasonable period of time, e.g. the next planned revision of the EOPs.