

SUPPLEMENTAL SAFETY EVALUATION REPORT  
PROCEDURES GENERATION PACKAGE  
HOPE CREEK GENERATING STATION

1. INTRODUCTION

Following the Three Mile Island (TMI) accident, the Office of Nuclear Reactor Regulation developed the TMI "Action Plan" (NUREG-0660 and NUREG-0737), which required licensees of operating reactors and applicants for an operating license to reanalyze transients and accidents and upgrade emergency operating procedures (EOPs) (TMI item I.C.1). The plan also required the NRC staff to develop a long-term plan that would integrate and expand efforts in writing, reviewing, and monitoring plant procedures (Item I.C.9). NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures," represents the staff's long-term program for upgrading EOPs, and 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 to the NRC a PGP, to include:

- (i) Plant-specific technical guideline
- (ii) 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.

In a Safety Evaluation Report (SER) dated October 1984, the staff reviewed Public Service Electric & Gas Company's (PSE&G) plan for developing and implementing operating and maintenance procedures for Hope Creek Generating Station. From that review, it was determined that PSE&G must submit a PGP for Hope Creek to be in compliance with Supplement 1 to NUREG-0737. The PGP was scheduled for submittal to the staff in January 1985.

This Supplemental Safety Evaluation Report (SSER) describes the review of PSE&G's response to Generic Letter 82-33 related to development and implementation of EOPs and to the October 1984 SER. Our review was conducted to determine the adequacy of the applicant's program for preparing and implementing EOPs. At the time of the initial review, criteria were not included in the Standard Review Plan (SRP). This review was, therefore, based on NUREG-0899, the reference document for the EOP upgrade portion of Generic Letter 82-33. Review criteria based on this guidance have since been incorporated into the SRP Section 13.5.2, "Operating and Maintenance Procedures," Revision 1 (July 1985). Section 2 of this SSER briefly discusses the four parts of the applicant's submittal, the staff review methods, and the acceptability of the submittal. There are some items in Section 2 (Supplemental Items) that the staff believes would further enhance the applicant's EOPs. These issues were identified in the staff review of the applicant's response to a Request for Additional Information (RAI) dated May 14, 1985. In the context of the overall excellence of the program developed by the applicant, these issues are of minor significance. We are, therefore, identifying these issues for information only, and recommend that the applicant consider addressing the items in the next revision to the EOPs, and modify the PGP accordingly.

## 2. EVALUATION AND FINDINGS

In a letter dated January 28, 1985, from R. L. Mittl (PSE&G) to A. Schwencer (NRC), PSE&G submitted its PGP for Hope Creek Generating Station. The PGP for Hope Creek contained sections covering the Plant-Specific Writer's Guide (P-SWG), a description of the Verification/Validation programs, and a description of the Training program for EOPs. The Plant-Specific Technical Guidelines (P-STG) were submitted to the NRC later in a letter from R. L. Mittl to A. Schwencer, dated April 10, 1985. The staff conducted a review of the Hope Creek PGP (including the P-STG)

and identified its findings in a RAI which was forwarded to PSE&G in a letter from W. R. Butler to R. L. Mittl, dated May 14, 1985. PSE&G responded to the RAI in a letter from R. L. Mittl to W. R. Butler, dated July 29, 1985, and included Revision 1 to the PGP. This SSER is based on the staff's review of the applicant's response to the RAI and their revised PGP.

## 2.1 Plant-Specific Technical Guidelines

The P-STG was reviewed to determine if it provided acceptable methods to meet the objectives of NUREG-0899. The applicant briefly described the methods used to develop their EOPs from the generic Emergency Procedure Guidelines (EPGs), identified deviations from the guidelines, and provided the technical bases for the deviations.

The Hope Creek Generating Station EOPs are based on the BWR Owners Group EPGs which are contained in NEDO-24934, Revision 3. The staff safety evaluation of the EPGs, dated February 4, 1983 (Generic Letter 83-05) identified two areas of the guidelines as requiring further revision. Specifically, the overly conservative limits in the determination of drywell spray flow rate needed to be reduced and the criterion for defining emergency venting pressure needed to be determined. These generic issues as well as several plant-specific questions were included in the May 14, 1985 RAI. The applicant addressed these items in their July 29, 1985 response.

### Drywell Spray Initiation Pressure Limit

The drywell spray initiation pressure limit for Hope Creek is defined by a figure which combines the parameters Suppression Chamber Temperature and Suppression Chamber Pressure. This figure identifies a safe area for the operator to initiate the drywell sprays. The safe area is that for

which actuation of the drywell spray will not result in a primary-to-secondary containment pressure decrease in excess of the negative pressure capability. The applicant has provided a plant-unique calculation based on a BWR Owners Group generic calculational procedure to determine the appropriate limits for the curve and to justify the use of a drywell spray flow rate at full rated flow from one train. The procedure calculates the initial conditions such that after the sprays cool the entire containment to the spray temperature, the containment negative design differential pressure of 3 psi is not exceeded. The calculational procedure assumes that the suppression chamber is filled with air at maximum relative humidity and the drywell is full of steam. A spectrum of suppression chamber conditions was considered which establishes the limits on the curve in the Hope Creek Technical Guidelines.

It is also noted that the EPGs contain a restriction on drywell spray flow rate of approximately 10 percent of full flow capability. The staff SER on the EPGs stated that this limit is very conservative and that a more realistic flow rate should be determined. The Hope Creek plant-unique calculation satisfies this staff requirement and is acceptable.

#### Primary Containment Pressure Limit

With regard to emergency venting of the primary containment, the staff SER on the EPGs recognized that it may not be appropriate to determine the primary containment pressure limit generically. The staff established an interim limit of twice the design pressure for venting, subject to a plant-unique analysis to demonstrate containment integrity. The applicant's July 29 submittal included a proposed primary containment pressure limit of 185 psig which is three times the design pressure of 62 psig and well in excess of the estimated ultimate capacity of

100 psig. We have informed the applicant that additional discussion of the basis for this limit should be provided. We require that the applicant provide additional background information in the following areas:

- (1) Since the use of the identified vent paths in the EOP is an action far beyond design basis events, the applicant should perform a best-estimate evaluation of the vent path valve operability (capability to open and reclose).
- (2) A rapid depressurization from venting may result in suppression pool flashing and hydrodynamic loads; the applicant should perform analyses to determine if the resulting hydrodynamic loads exceed the design capability of the suppression pool and submit the results to NRC.
- (3) The applicant should consider the prioritization of the selected emergency vent paths to minimize radioactive release rates.
- (4) The applicant should consider other flow paths, such as the drywell and suppression pool spray headers.
- (5) The applicant should consider the effect of containment venting on ductwork failure (if used as a pathway), and the resulting consequence of subjecting equipment near the failed duct to the steam/radiation environment.
- (6) The applicant should consider ADS operability at the elevated containment pressure.

Staff review of this item must be completed prior to operation above 5 percent power.

### Function and Task Analysis

Supplement 1 of NUREG-0737 specifically calls for the identification of "information and control requirements" as a part of the reanalysis of transients and accidents. The need for such analysis is to ensure that the parameters as well as instrumentation and controls called out in the EOPs, and available in the control room for emergency operations, are based on operator information and control requirements (derived from the functions and systems as defined by the EPGs), rather than on what is already available. On May 4, 1984, a meeting was held with the BWR Owners Group to discuss the task analysis requirements of Supplement 1 to NUREG-0737. This meeting determined that because the EPGs do not explicitly identify the plant-specific information and control needs, plant-specific analysis is required. Such an analysis may be described in either the PGP or the Detailed Control Room Design Review (DCRDR) Summary Report, with appropriate cross referencing. To satisfy this requirement, Hope Creek has elected to reference the "system function and task analysis" as described in their DCRDR Summary Report and Supplementary Report. With staff approval of these reports, this item will be closed out for the PGP.

With adequate resolution of the above open items, the applicant's P-STG should meet the objectives of NUREG-0899 and should provide adequate guidance for translating the generic guidelines into EOPs. The staff will confirm that the applicant adequately addresses these items and will report its review in a subsequent safety evaluation report.

### 2.2 Plant-Specific Writer's Guide

The writer's guide was reviewed to determine if it provided acceptable methods for meeting the objectives of NUREG-0899. Unlike most plants, however, the Hope Creek EOPs were implemented using a flowchart format,



with the exception of "EOP Support Procedures (Series 300 procedures)". Furthermore, the EOP support procedures were presented in a narrative format and were developed using guidance contained in plant administrative procedures. In reviewing the writer's guide, it appeared to the staff that the use of flowcharts, the mix with narrative procedures and the lack of existing guidance for developing flowchart procedures resulted in a writer's guide with significant problems; the staff identified a number of items needing clarification or expansion. These items were documented in the May 14, 1985 RAI. The applicant responded to these items in its July 29, 1985 submittal which included a revision to the PGP (Revision 1). Staff review of this submittal indicated that substantial improvements were made to the applicant's PGP, although several concerns remained or were newly identified. These are as follows:

- (1) Hope Creek Series 100 and 200 procedures, as flowchart procedures, are specifically covered by the P-SWG. However, Series 300 procedures, while being classified as EOPs, are not covered by a writer's guide that is included as a part of the PGP. Based on the applicant's description and the example of the Series 300 procedures provided in the PGP, these procedures are not typically found under the category of EOPs. Since this is the case, we have determined that a review of the writer's guide associated with these procedures is not appropriate. While the applicable administrative procedure should be referenced in the PGP, the procedure itself should not be included as a part of the PGP or as an attachment to the PGP.
- (2) The PGP should indicate that the procedures are located so that they do not obstruct controls or displays during storage or use, that they are easily accessible and are convenient to use (e.g., not difficult to handle).

- (3) The PGP should indicate how the flowcharts will actually be implemented in the control room, i.e., will the shift supervisor use the charts and call out the steps? Will each operator have their own flowchart? With the relatively large number of flowcharts, each differing in size from the next, it is not clear how they will be used by the operators.
- (4) The PGP should indicate how access to the needed flowchart(s) will be facilitated through placement, layout, format, etc. From the information provided it is not clear whether the operators will have to "thumb through" a pile of flowcharts to get to the correct one or whether the flowcharts will be ordered, color coded, tabbed, etc., allowing them to be easily distinguished/selected.

With adequate resolution of the above items, the applicant's writer's guide should meet the objectives of NUREG-0899 and should provide adequate guidance for translating the P-STG into EOPs that will be useable, accurate, complete, readable, convenient to use and acceptable to control room operators. The staff will confirm that the applicant adequately addresses these items and will report on its review in a subsequent safety evaluation report.

### 2.3 EOP Verification/Validation

The verification and validation programs were reviewed to determine if adequate methods were described for meeting the objectives of NUREG-0899. The applicant states that its programs for verification and validation are modeled after the guidelines provided by the Institute for Nuclear Power Operations (INPO 83-006). Although the INPO guidelines have not been formally reviewed and approved by the NRC, the guidance contained therein appears to go beyond the objectives stated in NUREG-0899 and therefore should provide a sound basis for developing a verification and



validation program. The applicant's verification and validation workplan includes the following activities: (1) Technical Verification, (2) Editorial Verification, (3) Validation, and (4) Assessment and Resolution.

Our review of the applicant's program for verification and validation as provided in the January 28, 1985 PGP submittal found it unacceptable. Specific comments were provided in the May 14, 1985 RAI. Although review of the applicant's July 29, 1985 response to the RAI indicated that all outstanding issues had been addressed, the following concern was identified:

- (1) The intent of exercising the EOPs on a simulator is to demonstrate that the procedures are, in fact, useable by the operating crew and that they are capable of mitigating the consequences of a broad range of accidents (including multiple and consequential failures). The adequacy of these exercises depends on both the choice of scenarios and the manner in which the exercises are carried out (e.g., without prior operator knowledge of the particular scenario being exercised). From the information provided in the PGP, it appears that the choice of scenarios is based on the desire to exercise specific procedures or flow paths rather than to combat specific events. While it is important to exercise the procedures to the fullest extent possible, the manner in which the procedures are actually implemented is in response to events. The staff is concerned that the approach the applicant is taking may not adequately challenge the procedure set and thus not be sensitive to certain technical and/or human factors problems. The fact that these procedures are written using a relatively new and untested approach demands that the applicant be as rigorous as possible in its validation. The applicant should explain how its approach to

exercising the EOPs will adequately challenge them to ensure that the EOPs are fully tested, or describe how it will modify its approach to meet this objective.

With adequate resolution of the above item, the applicant's verification and validation program should provide acceptable methods for meeting the objectives of NUREG-0899 and should provide assurance that the EOPs adequately incorporate the guidance of the writer's guide and the technical guidelines, and will guide the operator in mitigating emergency conditions. The staff will confirm that the applicant adequately addresses this item and will report its review in a subsequent safety evaluation report.

#### 2.4 EOP Training Program

The applicant's description of the program for training operators on the EOPs was reviewed to determine if adequate methods are employed to meet the objectives of NUREG-0899. Review of the January 28, 1985 submittal identified several deficiencies with the training program. These deficiencies were detailed in the May 14, 1985 RAI. The applicant's response to these deficiencies were included in the July 29, 1985 submittal. As described in the revised PGP, the training program consists of a combination of classroom instruction, simulator exercises and training on revisions to the EOPs. Review of the revised training program was found acceptable with one minor exception. Item 34 stated that "all" operators should have the opportunity to work with the full complement of EOPs. In response to this item, the applicant references Enclosure 1, Section 7.4.1, of the July 29, 1985 submittal. Although this portion of the submittal is responsive to the item, the word "all" was not included in the response. The response should read "... to provide all operators with instruction ..."

## 2.5 Supplemental Items

In evaluating the sample flowchart provided with the July 29, 1985 submittal, the staff determined that there were several characteristics of the flowchart which were not consistent with good human factors practice. These characteristics are identified in the following items which are provided for information only. Although they are relatively minor, these items should be considered for inclusion in the next revision to the EOPs and PGP.

- (1) The direction of branches (yes/no) should be consistent throughout the flowcharts. For example, all "yes" branches should move to the right, while all "no" branches should move to the left.
- (2) The directional arrows should be made more distinct by enlarging them.
- (3) The numerical designator of a caution (with the circle around it) should be duplicated next to the caution itself and be further highlighted by placing it to the left of the caution itself (as it currently is), and moving the title (OPERATOR CAUTIONS) over the caution.
- (4) A border should be placed around the flowchart so that if a copy is made in which part of the chart has been cut off, it will be readily apparent.

## 3. CONCLUSIONS

Based on our review, with the exceptions noted in Section 2 of this SSER, we conclude that the PS&G PGP for Hope Creek Generating Station meets the requirements of Supplement 1 to NUREG-0737 and provides acceptable

methods for accomplishing the objectives of NUREG-0899. The PGP should be revised to address the items described in Section 2 and be resubmitted to the NRC.