CP&L

Carolina Power & Light Company

SERIAL: LAP-83-358

AUG 17 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324
LICENSE NOS. DPR-71 AND DPR-62
EMERGENCY OPERATING PROCEDURES UPGRADE
SUBMITTAL OF PROCEDURES GENERATION PACKAGE

Dear Mr. Denton:

In an April 15, 1983 response to NRC Generic Letter 82-33, Carolina Power & Light Company (CP&L) mentioned that upgraded Emergency Operating Procedures (EOPs) using the BWR Owners' Group technical guidelines and INPO's EOP Writing Guideline had been drafted and that a procedures generation package would be submitted in accordance with Supplement 1 to NUREG-0737. Carolina Power & Light Company is hereby submitting this procedures generation package, including plant-specific technical guidelines, a plant-specific writers guide, and a description of our program for verification and validation.

If you have questions concerning this submittal, please contact our staff.

Yours very truly,

S. R. Zimmerman
Manager
Licensing & Permits

SRZ/ccc (7579CEH)

Attachments

cc: Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-RII)
Mr. S. D. MacKay (NRC)
Mr. D. B. Vassallo (NRC)

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CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

Emergency Operating Procedures
Generation Package

ABSTRACT

The purpose of this document is to identify the elements used by Carolina Power & Light's Brunswick Steam Electric Plant to prepare and implement improved Symptom Oriented Emergency Operating Procedures (EOP's) for use by control room personnel to assist in mitigating the consequences of a broad range of accidents and multiple equipment failures. This document applies only to the EOP's so designated; it does not address emergency preparedness or emergency planning.

Table of Contents

APPENDIXES

A. INTRODUCTION

1. Purpose and Scope

This document identifies the elements used by Carolina Power & Light's Brunswick Steam Electric Plant to revise its Emergency Operating Procedures. The Brunswick EOP's have been restructured and reformatted to a symptom basis, i.e., converted to a function oriented procedure as opposed to the event oriented procedure. The revised EOP will provide the operator with improved directions to mitigate the consequences of a broad range of accidents and multiple equipment failures. The guidance provided in this document applies only to Brunswick's EOP's and not to other procedures, e.g., Plant Emergency Procedures (PEP's).

This document is based upon the NRC Guideline for Preparation of Emergency Operating Procedures, i.e., NUREG-0899, August 1982.

2. Background

Shortly after the accident at TMI, the NRC formed the Bulletins and Orders Task Force (B&OTF) within the Office of Nuclear Reactor Regulation. The Task Force was responsible for reviewing and directing the NRC activities associated with the Three Mile Island type accident for all operating plants, to assure their continued safe operation.

On the basis of NRC's review, it was concluded that the General Electric designed boiling water reactor plants were quite capable of coping with small break LOCA's and with feedwater transients with or without stuck open relief valves.

The NRC did, however, identify improvements in the systems, procedures and analysis, which will make the GE designed BWR's less susceptible to core damage during accidents and transients, coupled with system failures or operator errors. One of the recommendations from the B&OTF was to restructure and reformat the current EOP's from an event basis to a symptom basis. The Symptom Based Emergency Operating Procedures would be categorized according to general plant symptoms, such as loss of coolant inventory, as opposed to several separate existing associated procedures, i.e, LOCA Inside Containment, LOCA Outside Containment and Loss of Normal Feedwater.

The Loss of Coolant Inventory Procedure would include the essential features of those existing procedures associated with LOCA Inside Containment, LOCA Outside Containment and Loss of Normal Feedwater, but would make use of the fact that the initial operator response for the latter procedures are similar.

Shortly after the TMI accident, the Owners' Groups were formed to study and resolve problems associated with the operation of their plants. The GE Owners' Group concurred with the NRC and recommended that the Emergency Operating Procedures for nuclear plants be restructured and reformatted to a symptom basis, as opposed to the more event specific basis.

The Owners' Group developed a Generic Guideline to be used by the utilities to produce Symptom Based or Function Oriented Emergency Operating Procedures. This guideline, i.e., Emergency Procedure Guidelines, Revision 2, NEDO-24934, June 1982 was reviewed and approved by the Office of Nuclear Reactor Regulation and issued to all licensees on February 8, 1983 (Generic Letter 83-05).

B. BRUNSWICK STEAM ELECTRIC PLANT'S EMERGENCY OPERATING PROCEDURE UPGRADE PROGRAM

The Brunswick Emergency Instructions (EI's) were found to have several deficiencies. One of these deficiencies was that there were too many EI's. No clear guidance was provided to help the operator determine which EI to use during multiple failures.

Event based procedures are inadequate because they place a greater burden upon the reactor operator in that each event must be classified prior to being able to "pick up" the <u>right</u> procedure. The operator must then remember the Immediate Action to be performed. If more than one procedure is required, concurrently, which is usually the case, the operator must establish the priority of actions.

This type of Emergency Operating Procedure results in no systematic and consistent method established for handling emergency conditions.

Several of the Event Based Emergency Instructions were combined with the Plant Technical Guideline, which closely parallels the Generic Guideline, into more integrated type Symptomatic Emergency Operating Procedures that establish the order of priority of Operator Actions and minimize the confusion as to which procedure should be used for a given operating situation.

The principal advantages of the Brunswick Symptom Based Emergency Operating Procedures over the event based procedures are:

1. The EOP's, as a whole, are simplified significantly and, therefore, do not require the operator to make a detailed diagnosis of the plant conditions prior to consulting the EOP.

2. The total number of EOP's which the operator has to use, during an emergency, have been reduced significantly.

3. The Symptomatic Emergency Operating Procedures are a more integrated type procedure.

Flowcharts are used for the Immediate Operator Action Steps of the improved Brunswick EOP's. These flowcharts provide the operator with visible guidance, which will help get the plant into a safe condition quickly and consistently and eliminate the burden of memorizing the Immediate Operator Actions (see Figure 1).

The Generic Emergency Procedure Guidelines have been used throughout the Brunswick EOP's. However, the guidelines have not been simply converted into Brunswick Procedures.

Two of the major deficiencies of the old event type EOP's are operator confusion as when to enter the EOP's and in what order to execute the steps. This is confusing, especially if more than one procedure applies.

The Brunswick EOP's have been designed to minimize these deficiencies. This has been accomplished by selecting one common entry condition to the EOP, i.e., "ANY REACTOR SCRAM," which is an indication of a potential emergency. This gets the operator into the EOP quickly. Once the EOP is entered, the order of priority is established and the operator is directed to the appropriate portion of the procedure. The Immediate Action Steps can be executed within three to twenty minutes, depending upon plant conditions.

There is no need for the operator to attempt to memorize the Immediate Action Steps because they are visible, i.e., on the flowcharts, which are to be placed in the Control Room.

If no true emergency evolves, the operator will quickly exit the EOP and enter normal plant Operating Procedures.

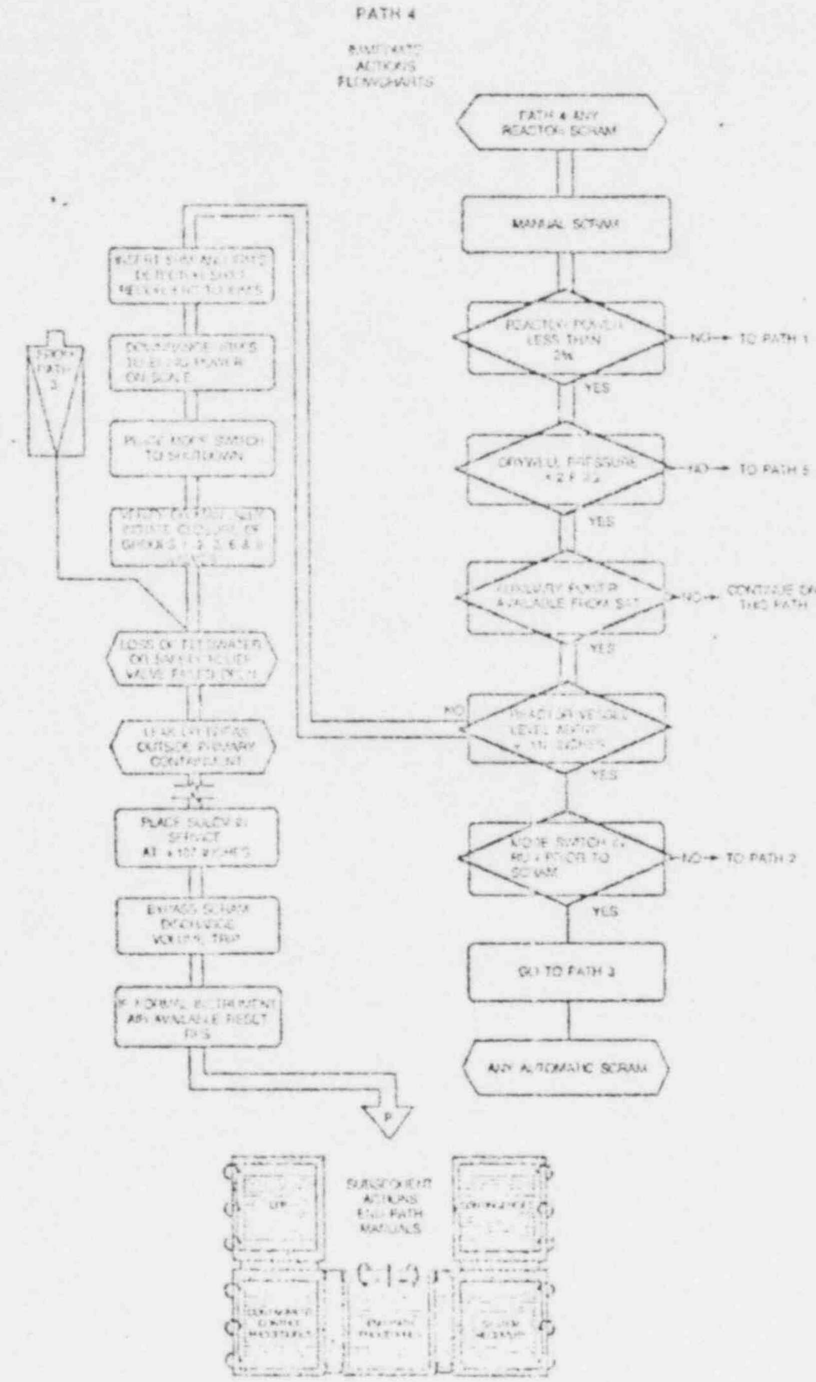

PATH 4
PATH 4 ANY REACTOR SCRAM
MANUAL SCRAM
NO → TO PATH 1
YES
NO → TO PATH 5
YES
NO → CONTINUE ON THIS PATH
YES
NO
YES
NO → TO PATH 2
YES
GO TO PATH 3
ANY AUTOMATIC SCRAM
PLACE MODE SWITCH TO SHUTDOWN
OUTSIDE PRIMARY CONTAINMENT
BYPASS SCRAM DISCHARGE VOLUME TRIP
P

Figure 1

Once the flowchart steps are completed, the operator enters the End Path Manual, i.e., Subsequent Actions. At this time, the plant is shut down and should be in, or headed for, a safe condition with the most important verifications and actions completed.

It is now appropriate to branch out into concurrent portions of the EOP, as necessary. The operator has taken early corrective actions which are required during the first few minutes, following the initiation of the reactor shutdown.

The plant transients should be changing more slowly, giving the operator time to branch out into more than one procedure as necessary to protect the Containment, recover degraded or failed systems and to deal with contingencies as required. The expected concurrent use of the Containment Control Procedures in the End Path Manuals, should not be beyond the operator's capability to respond, due to the slowly changing parameters of the Containment.

The Brunswick EOP Upgrade Program consisted of the following general outline (see Figure 2):

1. Converted some existing Emergency Instructions into Annunciator Procedures.

2. Converted some existing Emergency Instructions into Abnormal Operating Procedures.

3. Reworked remaining Emergency Instructions and the BWR Owners' Group Guidelines into Function Oriented Immediate Action Flowcharts and Subsequent Action End Path Manual Procedures.

The following list of Brunswick EOP improvements was accomplished as a result of the Upgrade Program:

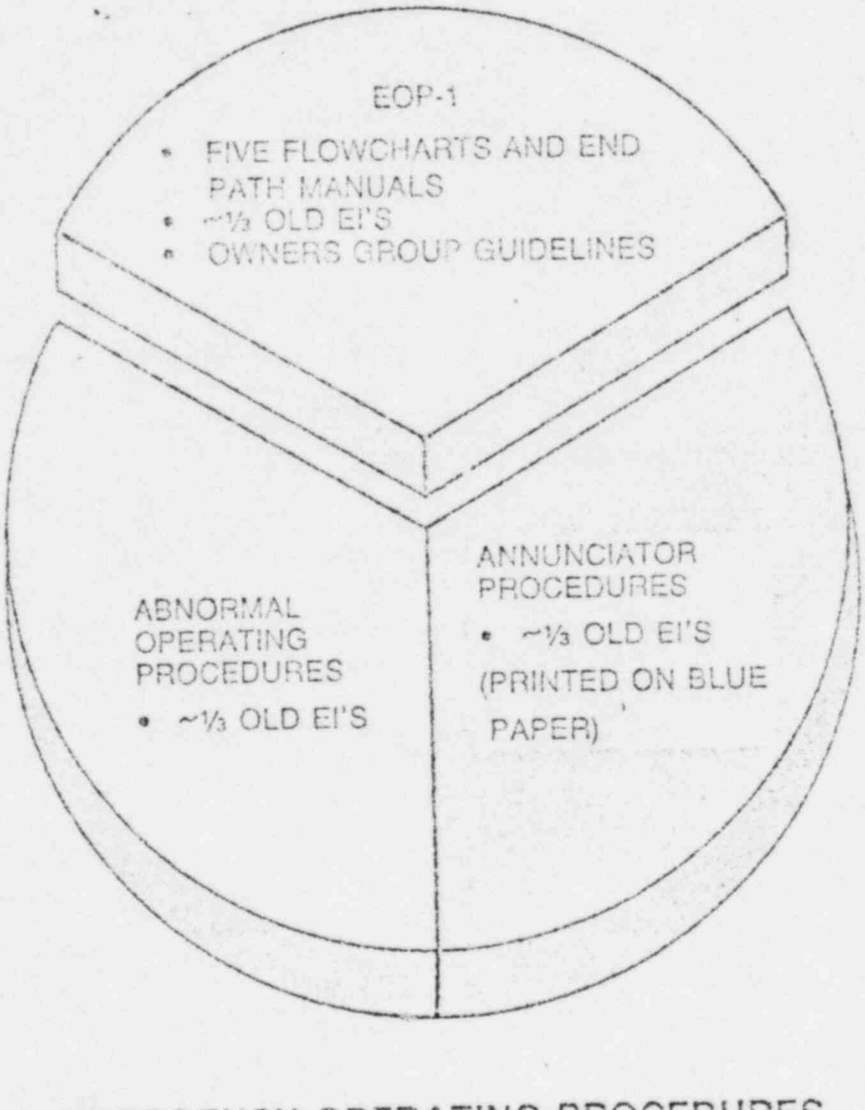
1. Made Immediate Operator Actions visible.

2. Reduced reliance on operator memory.

3. Guided operator to appropriate procedure.

4. Removed confusion as to which procedure applied.

5. Improved operator awareness of total plant conditions.



EMERGENCY OPERATING PROCEDURES RESTRUCTURE

Figure 2

6. Improved operator decision making process.

7. Improved operator training for emergency conditions.

8. Provided operator job performance improvement.

C. BRUNSWICK STEAM ELECTRIC PLANT
PLANT-SPECIFIC TECHNICAL GUIDELINE

The EOP Generic Guideline was used as a basis for the Brunswick Plant-Specific Technical Guideline. The format and arrangement of the Brunswick Guideline closely parallels the Generic Guideline and contains plant-specific information for Brunswick (see Appendix I).

Since the Brunswick Technical Guideline is based upon the Generic Guideline, which has been validated by the Owners' Group and approved by the NRC, there is no requirement to validate the Brunswick Plant-Specific Technical Guideline.

The Plant-Specific Technical Guideline was used throughout the Brunswick EOP's.

The EOP's differ from the guideline in that the steps from the various portions of the guideline, e.g., Level, Pressure and Power Control, have been rearranged in a logical sequence that establishes the order of priority of certain safety functions for the operator and reduces confusion as to which steps should be executed. This eliminates the awkwardness of attempting to execute more than one procedure concurrently during the initial, sometimes stressful, moments of a potential emergency condition.

These important safety functions, i.e., key parameters, establish the order of priority for the operator and provide guidance to the appropriate portion of the Brunswick EOP's.

The operators have been trained to continuously monitor the condition of the key parameters while executing the steps of the EOP's and to enter the appropriate portions of the procedure according to the status of these important functions.

D. BRUNSWICK STEAM ELECTRIC PLANT WRITERS' GUIDE FOR EMERGENCY OPERATING PROCEDURES

The Brunswick EOP Writers' Guide is based upon the requirements of Guidelines for the Preparation of Emergency Operating Procedures, NUREG-0899, August 1982, Section 5.0 - Plant-Specific Writers' Guide and the industry's Emergency Procedures Writing Guideline, INPO-82-017, July 1982.

The Brunswick EOP Writers' Guide contains all the necessary information and guidance for translating the technical information into Brunswick's EOP's (see Appendix II).

E. BRUNSWICK STEAM ELECTRIC PLANT VALIDATION/VERIFICATION PROGRAM FOR EMERGENCY OPERATING PROCEDURES

The Brunswick EOP's have undergone an extensive process of validation/verification to establish the accuracy of information provided and to determine that these procedures can be accurately and efficiently carried out.

The validation/verification process has addressed both technical and human engineering adequacy of the Brunswick EOP's.

All Brunswick licensed personnel, consisting of operators and engineers, have participated in extensive classroom (desk top reviews) and simulator exercises, using the upgraded EOP's during special courses and annual requalification training. Simulator exercises have been conducted at three simulators, i.e., Browns Ferry, Limerick and Hatch.

A pre-implementation training session, for all licensed personnel is scheduled for late 1983. The training is to be conducted on the Brunswick simulator.

The EOP's were revised many times during the EOP development phases as a result of licensed personnel comments and recommendations. This experience indicates, with a large degree of confidence, that the upgraded Brunswick EOP's are adequate to mitigate transients and accidents.

1. Objectives of the Brunswick Validation/Verification Process

Objective 1: The Brunswick EOP's are technically correct, i.e., they accurately reflect the Technical Guidelines.

Discussion: The GE Owners' Group has validated and the NRC has approved the Generic Emergency Operating Procedure Guidelines (Rev 2). The Generic Guideline was used to develop the BSEP Plant-Specific Technical Guideline and the Brunswick EOP's.

Objective 2: The Brunswick EOP's are written correctly, i.e., they accurately reflect the Writers' Guide.

Discussion: The Brunswick EOP Writers' Guide was used in the preparation of the EOP's (see Appendix II). The purpose of the Writers' Guide is to provide administrative and technical guidance on the preparation of EOP's to ensure they are complete, accurate, convenient, readable and acceptable to the BSEP control room personnel.

Objective 3: The Brunswick EOP's are usable, i.e., they can be understood and followed without confusion, delay or errors.

Discussion: Brunswick's licensed personnel experience in the use of the new EOP's during classroom and simulator exercises has demonstrated that the procedures can be accurately and efficiently carried out and that the EOP's are adequate to mitigate transients and accidents.

The General Physics Corporation conducted a Human Factors Review of the Brunswick Flowcharts.

Comments and recommendations from the licensed personnel at Brunswick and General Physics Corporation's (Human Factors) review were used to revise, i.e, improve the EOP's.

Objective 4: There is a correspondence between the EOP's and the Brunswick control room/plant hardware, i.e., control/equipment indications that are referenced, are available (inside and outside the Control Room), use the same designation, use the same units of measurement and operate as specified in the procedures.

Objective 5: The language and level of information presentation in the Brunswick EOP's is compatible with the minimum number, qualifications, training and experience of the plant operating staff.

Objective 6: There is a high level of assurance that the Brunswick EOP's work, i.e., the procedures guide the operator in the mitigation of transients and accidents.

Discussion: The licensed operator training sessions, Brunswick Control Room Walk-Through and a independent Human Factors Review adequately substantiates that objectives 4, 5 and 6 have been met.

2. Methods of Brunswick EOP Validation/Verification

The methods of Brunswick EOP validation/verification are listed as follows (see Appendix III):

a. Desk Top Reviews

b. Simulator Exercises

c. Control Room Walk-Throughs

d. Documentation of Technical Guidelines (see Attachments A, B and C of Appendix III)

e. Independent Human Factors Review (Summary)

F. BRUNSWICK STEAM ELECTRIC PLANT SYMPTOMATIC EMERGENCY OPERATING PROCEDURES TRAINING

All Brunswick licensed personnel, i.e., operators and engineers, have had extensive training in the use of the new EOP's (see Figure 3 and Appendix IV). During the training sessions comments and recommendations from the trainees were recorded. A response to each comment was made, by the EOP development group, and was sent to the Shift Operating Supervisor for each group of operators. This method of feedback encouraged operator input to the new EOP development process. The EOP's were greatly improved by this valuable input.

A daily quiz was given to each trainee during this training. The trainees participation and quiz grade were documented (see Figure 4). The trainees were also evaluated during the simulator training (see Figure 5).

In addition to the licensed personnel training course, all non-licensed operators, i.e., auxiliary operators, will be trained in the portions of the EOP for which they are responsible.

G. EMERGENCY OPERATING PROCEDURE ADMINISTRATIVE CONTROL

The Brunswick Administrative Procedures Manual, Volume I, Section 5.5.2 generally outlines how the EOP's are to be maintained.

When changes occur in the plant design, Technical Specifications, Technical Guidelines, Writers' Guide, other plant procedures or Control Room that will affect the EOP's, they shall be revised on a timely basis to reflect these changes. In addition, when operating and training experience, Simulator Exercises, Control Room Walk-Throughs or other information indicate that incorrect or incomplete information exists in the EOP's, they shall be revised on a timely basis.

Any revision to the EOP must be consistent with the following documents:

1. Brunswick EOP Writers' Guide

2. Brunswick EOP Technical Guideline

3. Brunswick EOP Calculation Procedures

4. General Electric Topical Report - NEDO-24934, Emergency Procedure Guidelines' latest revision.

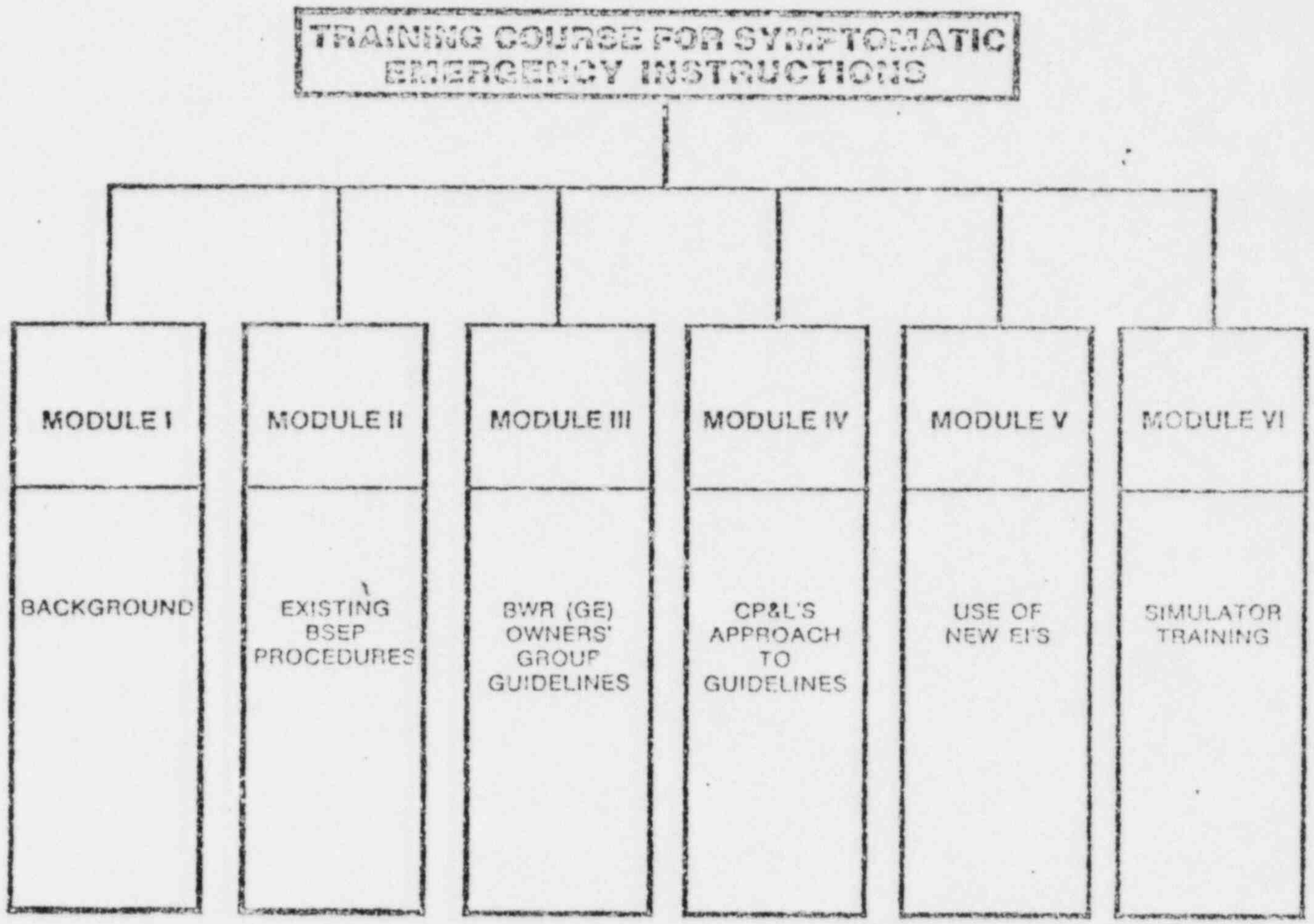

TRAINING COURSE FOR SYMPTOMATIC EMERGENCY INSTRUCTIONS
MODULE I
BACKGROUND
MODULE II
EXISTING BSEP PROCEDURES
MODULE III
BWR (GE) OWNERS' GROUP GUIDELINES
MODULE IV
CP&L'S APPROACH TO GUIDELINES
MODULE V
USE OF NEW EI'S
MODULE VI
SIMULATOR TRAINING

Figure 3

CLASSROOM TRAINING

SYMPTOMATIC EMERGENCY OPERATING INSTRUCTIONS

TRAINEE'S NAME: ______________________________

INSTRUCTOR'S NAME: ______________________________

DATES OF TRAINING: ______________________________

DATE	COURSE OR SUBJECT	QUIZ	CLASS PARTICIPATION		
			S	NI	U

S-SATISFACTORY
NI-NEEDS IMPROVEMENT
U-UNSATISFACTORY

NOTE: IF NI OR U EVALUATION IS MADE, THE INSTRUCTOR MUST EXPLAIN IN REMARKS SECTION.

REMARKS:

Figure 4

SIMULATOR TRAINING

SYMPTOMATIC EMERGENCY OPERATING INSTRUCTIONS

NAME ______________________________________ LICENSE ____________________

DATE	POS.	DESCRIPTION OF EXERCISE	A	B	C	D	E	F	G	H

*

A. USED PROPER PROCEDURE
B. USED PROCEDURE CORRECTLY
C. EXECUTED PATH CHANGES CORRECTLY
D. ENTRY TO AND USE OF END PATH PROCEDURE MANUALS
E. COMMUNICATION
F. ACTION TAKEN WHEN KEY PARAMETERS CHANGE
G. ACTION TAKEN WHEN PATH-SPECIFIC PARAMETERS CHANGE
H. SYSTEM MANIPULATION AND VERIFICATION

REMARKS: (MANDATORY IF ANYTHING OTHER THAN SATISFACTORY)

SAT.=S NEEDS IMP.=N
*OPERATOR ACTION TAKEN

____
INSTRUCTOR

Figure 5

Volume VI of the Plant Operating Manual consists of the following sections:

Section A - Description of how the EOP's are to be revised.

Section B - Brunswick Technical Guidelines, EOP Writers' Guide and Calculation Procedures.

Section C - Brunswick Flowcharts and End Path Manual Procedures, i.e., End Path Procedures, Containment Control Procedures, Local Emergency Procedures, System Recovery Procedures and Contingency Procedures.

Section D - Brunswick EOP Users' Guide

APPENDIX I

Plant-Specific Technical Guideline for Emergency Operating Procedures

CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

Plant-Specific Technical Guideline for Emergency Operating Procedures

INTRODUCTION

Based on the BWR system design, the following Symptomatic Emergency Procedure Guidelines have been developed:

- o RPV Control Guideline
- o Containment Control Guideline

The RPV Control Guideline restores and maintains RPV water level within a satisfactory range, shuts down the reactor, controls RPV pressure and cools down the RPV to cold shutdown conditions. This guideline is entered after low RPV water level, high drywell pressure, or an isolation has occurred or a condition which requires reactor scram exists and reactor power is above 3% or cannot be determined.

The Containment Control Guideline controls primary containment temperatures, pressure and level whenever suppression pool temperature, drywell temperature, drywell pressure, or suppression pool water level is above its normal operating limit or suppression pool water level is below its normal operating limit.

At various points throughout these guidelines, precautions are noted by the symbol [#]. The number within the box refers to a numbered "Caution" contained in the Operator Precautions section. These "Cautions" are brief and concise red flags for the operator.

At various points within these guidelines, limits are specified beyond which certain actions are required. While conservative, these limits are derived from engineering analyses utilizing best-estimate (as opposed to licensing) models. Consequently, these limits are not as conservative as the limits specified in a plant's Technical Specifications. This is not to imply that operation beyond the Technical Specifications is recommended in an emergency. Rather, such operation may be required under certain degraded conditions in order to safely mitigate the consequences of those degraded conditions. The limits specified in the guidelines establish the boundaries within which continued safe operation of the plant can be assured. Therefore, conformance with the guidelines does not ensure strict conformance with a plant's Technical Specifications or other licensing bases.

The entry conditions for these Emergency Procedure Guidelines are symptomatic of both emergencies and events which may degrade into emergencies. The guidelines specify actions appropriate for both. Therefore, entry into procedures developed from these guidelines is not conclusive that an emergency has occurred.

ABBREVIATIONS

ADS - Automatic Depressurization System

APRM - Average Power Range Monitor

CRD - Control Rod Drive

CS - Core Spray

ECCS - Emergency Core Cooling System

GP-01 - General Plant Operating Procedure

HCU - Hydraulic Control Unit

HPCI - High Pressure Coolant Injection

LCO - Limiting Condition for Operation

LOCA - Loss of Coolant Accident

LPCI - Low Pressure Coolant Injection

MSIV - Main Steam Line Isolation Valve

NDTT - Nil-Ductility Transition Temperature

NPSH - Net Positive Suction Head

RCIC - Reactor Core Isolation Cooling

RHR - Residual Heat Removal

RPS - Reactor Protection System

RPV - Reactor Pressure Vessel

RSCS - Rod Sequence Control System

RWCU - Reactor Water Cleanup

SBGT - Standby Gas Treatment

SLC - Standby Liquid Control

SORV - Stuck Open Relief Valve

SRV - Safety Relief Valve

OPERATOR PRECAUTIONS

****

CAUTION #1

Monitor the general state of the plant. If an entry condition for either the RPV Control Guideline or the Containment Control Guideline occurs, enter that procedure. When it is determined that an emergency no longer exists, enter the normal Operating Procedure.

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CAUTION #2

Monitor RPV water level and pressure and primary containment temperatures and pressure from multiple indications.

****

****

CAUTION #3

If a safety function initiates automatically, assume a true initiating event has occurred unless otherwise confirmed by at least two independent indications.

****

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CAUTION #4

Whenever RHR is in the LPCI mode, inject through the heat exchangers as soon as possible.

****

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CAUTION #5

Suppression pool temperature is determined by the average of computer points W108 and W117 or the average of points 14 and 21 on CAC-TR-1258. Drywell average temperature is determined by computer point C074 or PT-16.2.

****

****

CAUTION #6

Whenever temperature near the instrument reference leg vertical runs exceeds the temperature in the table and the instrument reads below the indicated level in the table, the actual RPV water level may be anywhere below the elevation of the lower instrument tap.

Temperature	Indicated Level	Instrument	
180°F	265 in.	Shutdown Range Level	150 to 550 in.
any	69 in.	Wide Range Level	0 to 210 in.
304°F	any in.	Narrow Range Level	150 to 210 in.

****

****

CAUTION #7

Heated reference leg instrument B21-N026A and B indicated levels are not reliable during rapid RPV depressurization below 500 psig. For these conditions, utilize cold reference leg instruments to monitor RPV water level.

****

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CAUTION #8

Observe net positive suction head (NPSH) requirements for pumps taking suction from the suppression pool (see Pages 6 and 7).

****

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CAUTION #9

If signals of high suppression pool water level -24 inches (high level suction interlock) or low condensate storage tank water level 3.0 feet (low level suction interlock) occur, confirm automatic transfer of or manually transfer HPCI and RCIC suction from the condensate storage tank to the suppression pool.

****

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CAUTION #10

Do not secure or place an ECCS in MANUAL mode unless, by at least two independent indications, (1) misoperation in AUTOMATIC mode is confirmed, or (2) adequate core cooling is assured. If an ECCS is placed in MANUAL mode, it will not initiate automatically. Make frequent checks of the initiating or controlling parameter. When manual operation is no longer required, restore the system to AUTOMATIC/STANDBY mode if possible.

****

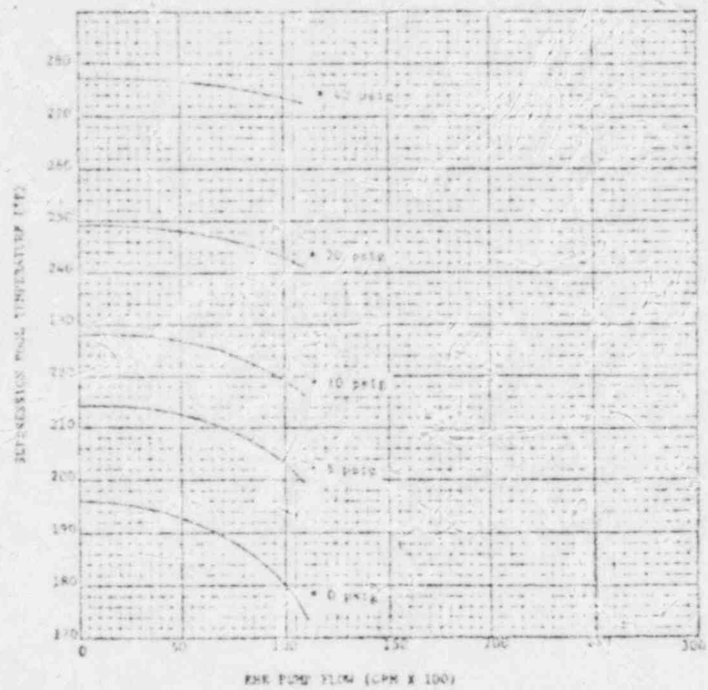
****

CAUTION #11

If a high drywell pressure ECCS initiation signal 2.0 psig (drywell pressure which initiates ECCS) occurs or exists while depressurizing, prevent injection from those core spray and RHR pumps not required to assure adequate core cooling prior to reaching their maximum injection pressures. When the high drywell pressure ECCS initiation signal clears, restore core spray and RHR to AUTOMATIC/STANDBY mode.

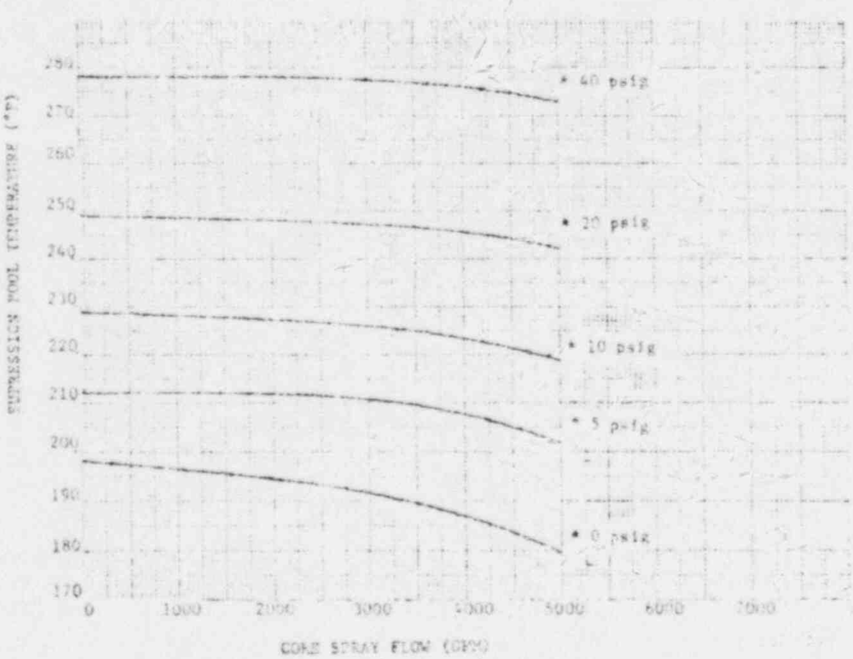
****

RHR NPSH LIMIT

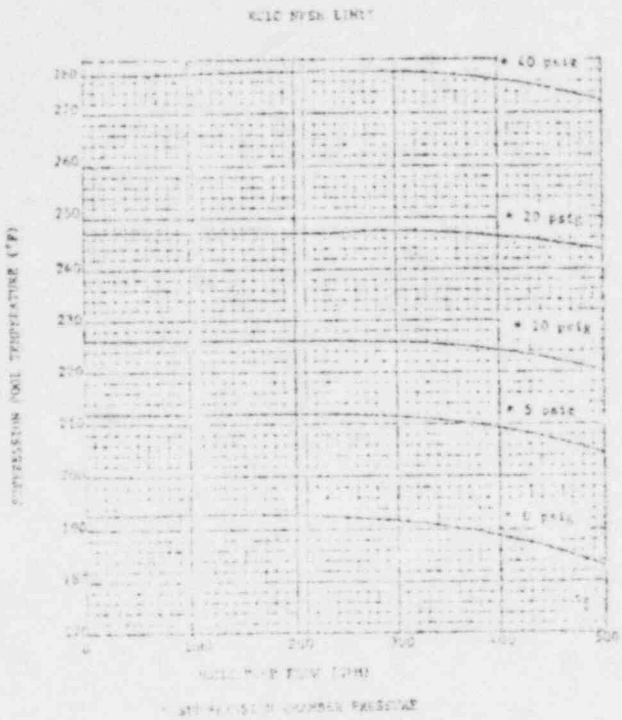


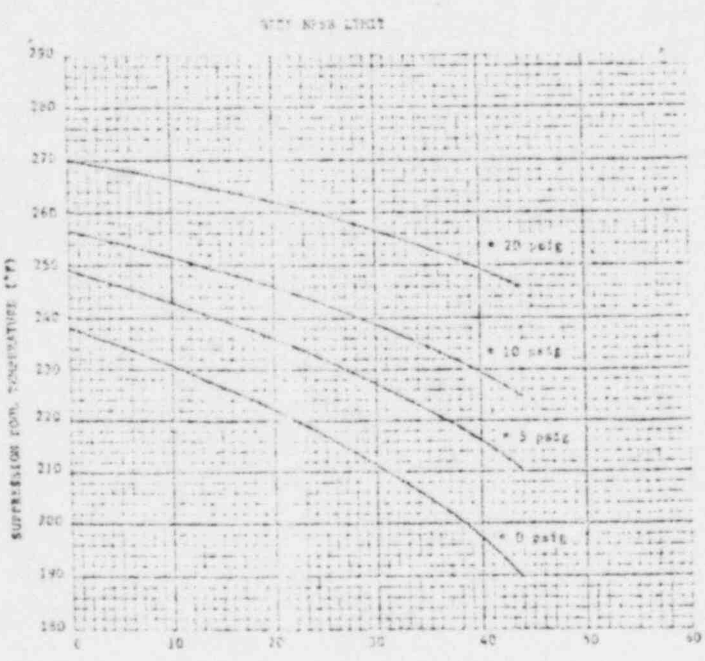
* SUPPRESSION CHAMBER PRESSURE

CORE SPRAY NPSH LIMIT



* SUPPRESSION CHAMBER PRESSURE


* 40 psig
* 20 psig
* 10 psig
* 5 psig
* 0 psig
0
500


SUPPRESSION POOL TEMPERATURE (°F)
290
280
270
260
250
240
230
220
210
200
190
180
* 20 psig
* 10 psig
* 5 psig
* 0 psig
0
10
20
30
40
50
60
HPCI PUMP FLOW (GPM X 100)
* SUPPRESSION CHAMBER PRESSURE

****

CAUTION #12

Do not throttle HPCI speed below 3000 rpm or RCIC speed below 2000 rpm (minimum turbine speed limit per turbine vendor manual).

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CAUTION #13

Cooldown rates above 100°F/hr (RPV cooldown rate LCO) may be required during periods of rapid RPV depressurization.

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CAUTION #14

Do not depressurize the RPV below 120 psig (HPCI low pressure isolation setpoint) unless motor driven pumps sufficient to maintain RPV water level are running and available for injection.

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CAUTION #15

Open SRV's in the following sequence if possible: A, E, J, B, F, D, G, C, H

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CAUTION #16

Bypassing RPV low water level ventilation system and MSIV isolation interlocks may be required to accomplish this step.

****

****

CAUTION #17

Cooldown rates above 100°F/hr (RPV cooldown rate LCO) may be required to conserve RPV water inventory, protect primary containment integrity, or limit radioactive release to the environment.

****

****

CAUTION #18

If continuous LPCI operation is required to assure adequate core cooling, do not divert all RHR pumps from LPCI mode.

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CAUTION #19

Manually trip SLC pumps at 0% level in the SLC tank.

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****

CAUTION #20

Defeating RSCS interlocks may be required to accomplish this step.

****

****

CAUTION #21

Elevated suppression chamber pressure may trip the RCIC turbine on high exhaust pressure.

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****

CAUTION #22

Defeating isolation interlocks may be required to accomplish this step.

****

****

CAUTION #23

Do not initiate drywell sprays unless suppression pool water level is below +9 inches (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water).

****

****

CAUTION #24

A rapid increase in injection into the RPV may induce a large power excursion and result in substantial core damage.

****

****

CAUTION #25

Large reactor power oscillations may be observed while executing this step.

****

RPV CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to:

- Restore and maintain RPV water level within a satsifactory range,
- Shut down the reactor, and
- Control RPV pressure and cool down the RPV to cold shutdown conditions (RPV water temperature below 212°F).

ENTRY CONDITION

A condition which requires or has initiated a reactor scram.

OPERATOR ACTIONS

RC-1 If reactor scram has not been initiated, initiate reactor scram.

> Irrespective of the entry condition, execute Steps RC/L, RC/P and RC/Q concurrently.

RC/L Monitor and control RPV water level.

RC/L-1 Confirm initiation of any of the following:

- o Isolation
- o ECCS
- o Emergency diesel generator

Initiate any of these which should have initiated but did not.

If while executing the following step: o Boron Injection is required, enter CONTINGENCY #7. o RPV water level cannot be determined, RPV FLOODING IS REQUIRED; enter CONTINGENCY #6. o RPV Flooding is required, enter CONTINGENCY #6.

RC/L-2 Restore and maintain RPV water level between +162.5 inches (low level scram setpoint and +208 inches (high level trip setpoint) with one or more of the following systems: #9 #10 #11

- o Condensate/feedwater system 1182 - 0 psig (RPV pressure range for system operation)
- o CRD system 1448 - 0 (RPV pressure range for system operation)
- o RCIC system 1210 - 62 psig (RPV pressure range for system operation) #12

- o HPCI system 1210 - 120 psig (RPV pressure range for system operation)
- o Core spray system 320 - 0 psig (RPV pressure range for system operation)
- o RHR system 237 - 0 psig (RPV pressure range for system operation)

If RPV water level cannot be restored and maintained above +162.5 inches (low level scram setpoint), maintain RPV water level above 0 inches (top of active fuel).

If RPV water level can be maintained above 0 inches (top of active fuel) and the ADS timer has initiated, prevent automatic RPV depressurization by resetting the ADS timer.

If RPV water level cannot be maintained above 0 inches (top of active fuel), enter CONTINGENCY #1.

If Alternate Shutdown Cooling is required, enter CONTINGENCY #5.

RC/L-3 Proceed to cold shutdown in accordance with GP-01.

RC/P Monitor and control RPV pressure.

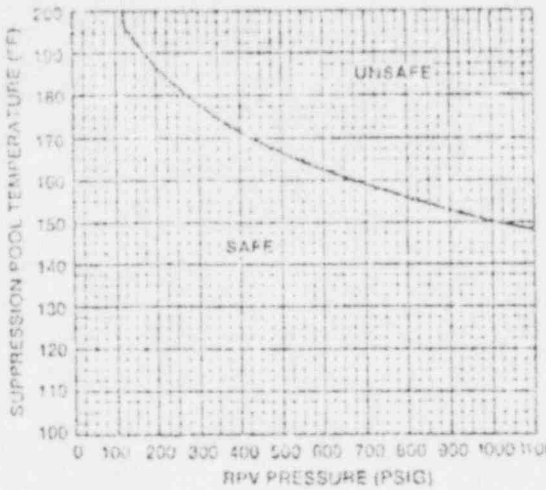
If while executing the following steps:

- o Emergency RPV Depressurization is anticipated, rapidly depressurize the RPV with the main turbine bypass valves. #13
- o Emergency RPV Depressurization or RPV Flooding is required and less than seven (number of SRV's dedicated to ADS) SRV's are open, enter CONTINGENCY #2.
- o RPV Flooding is required and at least seven (number of SRV's dedicated to ADS) SRV's are open, enter CONTINGENCY #6.

RC/P-1 If any SRV is cycling, manually open SRV's until RPV pressure drops to 950 psig (RPV pressure at which all turbine bypass valves are fully open).

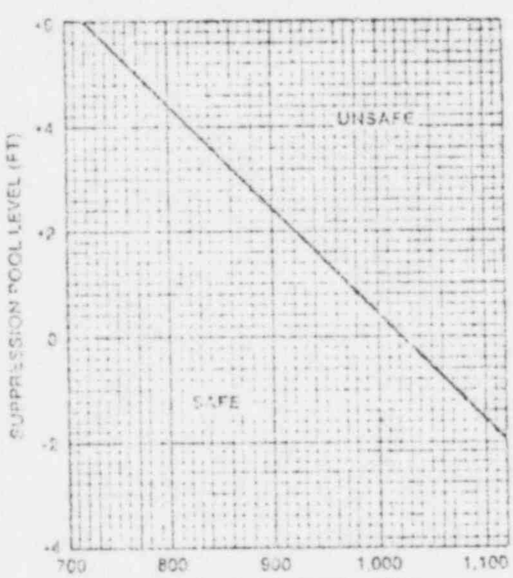
If while executing the following steps:

- o Suppression pool temperature cannot be maintained below the Heat Capacity Temperature Limit, maintain RPV pressure below the Limit. #8 #13 #14



Heat Capacity Temperature Limit

- o Suppression pool water level cannot be maintained below the Suppression Pool Load Limit, maintain RPV pressure below the Limit. #13 #14



Suppression Pool Load Limit

- o Steam Cooling is required, enter procedure developed from CONTINGENCY #3.

If while executing the following steps:

- o Boron Injection is required, and
- o The main condenser is available, and
- o There has been no indication of gross fuel failure or steam line break,

open MSIV's to reestablish the main condenser as a heat sink. #16

RC/P-2 Control RPV pressure below 1105 psig (lowest SRV lifting pressure) with the main turbine bypass valves. #14

RPV pressure control may be augmented by one or more of the following systems:

- o SRV's. If the continuous SRV pneumatic supply is or becomes unavailable, depressurize with sustained SRV opening. #15
- o HPCI #12
- o RCIC
- o RWCU (recirculation mode) if no boron has been injected into the RPV.
- o Main steam line drains

- RWCU (blowdown mode) if no boron has been injected into the RPV. Refer to sampling procedures prior to initiating blowdown.

If while executing the following steps the reactor is not shut down, return to Step RC/P-2.

RC/P-3 When RPV water level is stabilized and either:

- All control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), or
- 618 pounds (Cold Shutdown Boron Weight) of boron have been injected into the RPV, or
- The reactor is shut down and no boron has been injected into the RPV,

Depressurize the RPV and maintain cooldown rate below 100°F/hr (RPV cooldown rate LCO). #14, #17

RC/P-4 When the RHR shutdown cooling interlocks clear, initiate the shutdown cooling mode or RHR. #18

If the RHR shutdown cooling mode cannot be established and further cooldown is required, continue to cool down using one or more of the systems used for depressurization.

If RPV cooldown is required but cannot be accomplished and all control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), ALTERNATE SHUTDOWN COOLING IS REQUIRED; enter CONTINGENCY #5.

RC/P-5 Proceed to cold shutdown in accordance with GP-01.

RC/Q Monitor and control reactor power.

> If while executing the following steps:
>
> o All control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), terminate boron injection.
>
> o The reactor is shut down and no boron has been injected into the RPV, enter GP-01.

RC/Q-1 Confirm or place the reactor mode switch in SHUTDOWN.

RC/Q-2 If the main turbine generator is on line and the MSIV's are open, confirm or initiate recirculation flow runback to minimum.

RC/Q-3 If reactor power is above 3% (APRM downscale trip) or cannot be determined, trip the recirculation pumps.

> Execute Steps RC/Q-4 and RC/Q-5 concurrently.

RC/Q-4 If the reactor cannot be shut down before suppression pool temperature reaches 110°F (Boron Injection Initiation Temperature), BORON INJECTION IS REQUIRED; inject boron into the RPV with SLC and prevent automatic initiation of ADS. #19

RC/Q-4.1 If boron cannot be injected with SLC, inject boron into the RPV by one or more of the following methods:

- CRD
- RWCU
- Feedwater
- HPCI
- RCIC

RC/Q-4.2 If boron is not being injected into the RPV by RWCU, confirm automatic isolation of or manually isolate RWCU.

RC/Q-4.3 Continue to inject boron until 618 pounds (Cold Shutdown Boron Weight) of boron have been injected into the RPV.

RC/Q-4.4 Enter End Path Procedure for cooldown following boron injection.

RC/Q-5 Insert control rods as follows:

RC/Q-5.1 If any scram valve is not open:

- Remove:

  H12-P609 C71-F14A,C and F15A and F16A
  H12-P611 C71-F14B,D and F15B and F16B

  (fuses which deenergize RPS scram solenoids).

- Close C12-F095 (scram air header supply valve) and open drain valves for C12-PSL 3363 and 3364.

When control rods are not moving inward:

- o Replace:

  H12-P609 C71-F14A,C and F15A and F16A
  H12-P611 C71-F14B,D and F15B and F16B

  (fuses which deenergize RPS scram solenoids).

- o Close drain valves for C12-PSL 3363, 3364 and N012 (scram air header vent valves) and open C12-F095 (scram air header supply valve).

RC/Q-5.2 Reset the reactor scram.

If the reactor scram cannot be reset:

1. Start both CRD pumps.

   If no CRD pump can be started, continue in this procedure at Step RC/Q-5.6.1.

2. Close C12-F034 (HCU accumulator charging water header valve).

3. Rapidly insert control rods manually until the reactor scram can be reset. #20

4. Reset the reactor scram.

5. Open C12-F034 (HCU accumulator charging water header valve).

RC/Q-5.3 If the scram discharge volume vent and drain valves are open, initiate a manual reactor scram.

1. If control rods moved inward, return to Step RC/Q-5.2.

2. Reset the reactor scram.

   If the reactor scram cannot be reset, continue in this procedure at Step RC/Q-5.5.1.

3. Open the scram discharge volume vent and drain valves.

RC/Q-5.4 Individually open the scram test switches for control rods not inserted beyond postion 06 (maximum subcritical banked withdrawal position).

When a control rod is not moving inward, close its scram test switch.

RC/Q-5.5 Reset the reactor scram.

If the reactor scram cannot be reset:

1. Start both CRD pumps.

   If no CRD pump can be started, continue in this procedure at Step RC/Q-5.6.1.

2. Close C12-F034 (HCU accumulator charging water header valve).

RC/Q-5.6 Rapidly insert control rods manually until all control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position).

#20

If any control rod cannot be inserted beyond position 06 (maximum subcritical banked withdrawal position):

1. Individually direct the effluent from C12-F102 (CRD withdraw line vent valve) to a contained radwaste drain and open C12-F102 (CRD withdraw line vent valve) for each control rod not inserted beyond position 06 (maximum subcritical banked withdrawal position).

2. When a control rod is not moving inward, close its C12-F102 (CRD withdraw line vent valve).

CONTAINMENT CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to control primary containment temperatures, pressure and level.

ENTRY CONDITIONS

The entry conditions for this guideline are any of the following:

- o Suppression pool temperature above 95°F (most limiting suppression pool temperature LCO).
- o Drywell temperature above 135°F (drywell temperature LCO or maximum normal operating temperature, whichever is higher)
- o Drywell pressure above 2.0 psig (high drywell pressure scram setpoint)
- o Suppression pool water level above -27 inches (maximum suppression pool water level LCO)
- o Suppression pool water level below -31 inches (minimum suppression pool water level LCO).

OPERATOR ACTIONS

Irrespective of the entry condition, execute Steps SP/T, DW/T, PC/P and SP/L concurrently.

SP/T Monitor and control suppression pool temperature.

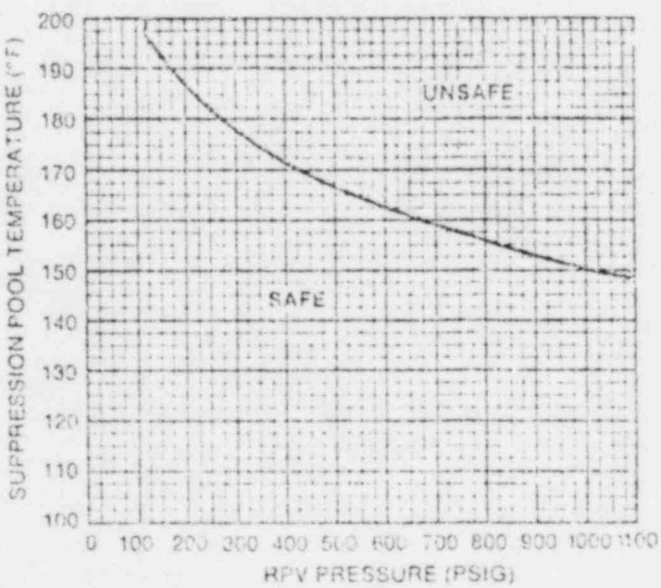
SP/T-1 Close all SORV's.

As soon as it is recognized that the valve will not close, scram the reactor.

SP/T-2 When pool temperature exceeds 95°F (most limiting suppression pool temperature LCO), operate available suppression pool cooling. #18

SP/T-3 Before suppression pool temperature reaches 110°F (Boron Injection Initiation Temperature), scram the reactor.

SP/T-4 If suppression pool temperature cannot be maintained below the Heat Capacity Temperature Limit, maintain RPV pressure below the Limit. #8 #13 #14



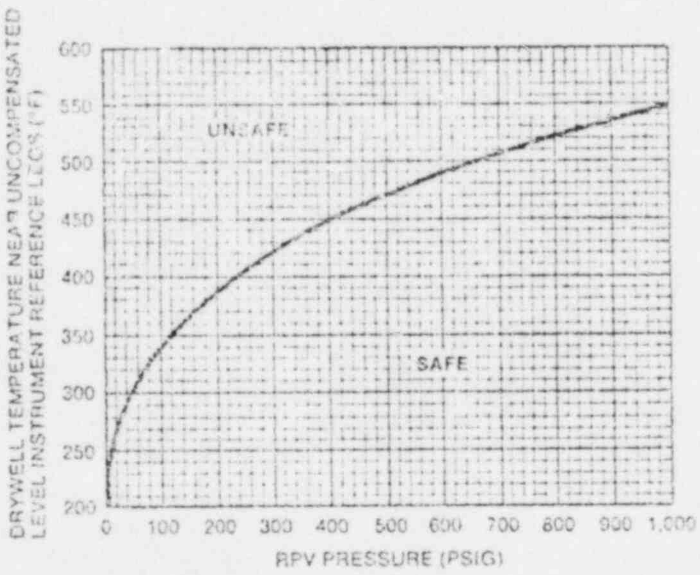
Heat Capacity Temperature Limit

If suppression pool temperature and RPV pressure cannot be restored and maintained below the Heat Capacity Temperature Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.

DW/T Monitor and control drywell temperature.

DW/T-1 When drywell temperature exceeds 135°F (drywell temperature LCO or maximum normal operating temperature, whichever is higher), operate available drywell cooling. #6

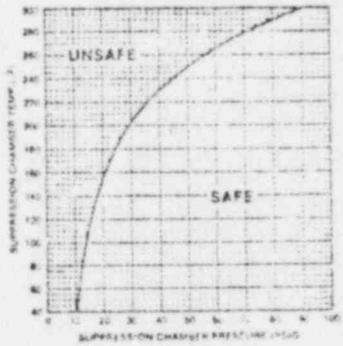
DW/T-2 If drywell temperature near the cold reference leg instrument vertical runs reaches the RPV Saturation Temperature, RPV FLOODING IS REQUIRED; enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.



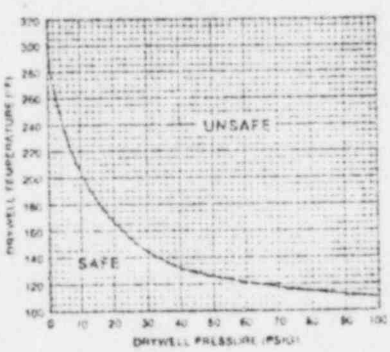
RPV Saturation Temperature

#18

DW/T-3 Before drywell temperature reaches 300°F (maximum drywell design temperature) but only if suppression chamber temperature and pressure are below the Drywell Spray Initiation Pressure Limit A and drywell temperature and pressure are below Drywell Spray Initiation Limit B, shut down recirculation pumps and drywell cooling fans and initiate drywell sprays.



Limit A



Limit B

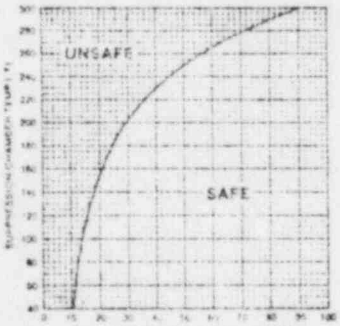
DW/T-4 If drywell temperature cannot be maintained below 300°F EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.

PC/P Monitor and control primary containment pressure.

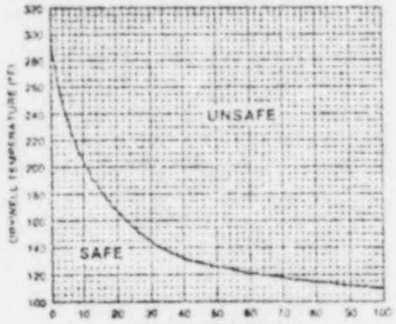
PC/P-1 Operate the SBGT and drywell purge as required, only when the temperature in the space being evacuated is below 212°F (Maximum Noncondensable Evacuation Temperature). Use SBGT and drywell purge operating procedures. #21

PC/P-2 Before suppression chamber pressure reaches 16.5 psig (Suppression Chamber Spray Initiation Pressure) initiate suppression pool sprays. #8, #18

PC/P-3 If suppression chamber pressure exceeds 16.5 psig (Suppression Chamber Spray Initiation Pressure) but only if suppression chamber temperature and pressure are below the Drywell Spray Initiation Pressure Limit A and drywell temperature and pressure are below the Drywell Spray Initiation Pressure Limit B, shut down recirculation pumps and drywell cooling fans and initiate drywell sprays. #18

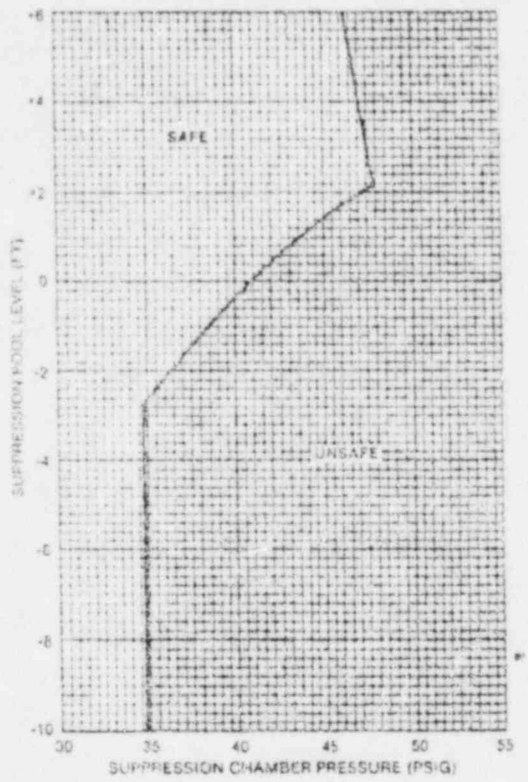


Limit A



Limit B

PC/P-4 If suppression chamber pressure cannot be maintained below the Pressure Suppression Pressure, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

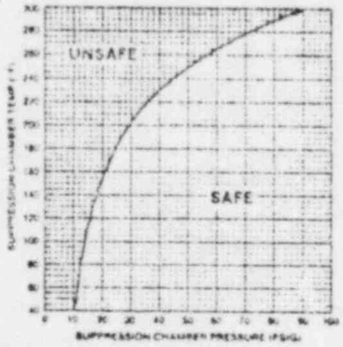


Pressure Suppression Pressure

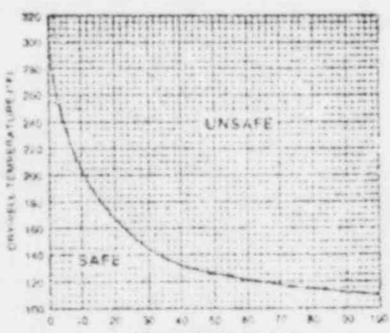
PC/P-5 If suppression chamber pressure cannot be maintained below 58 psig (the Primary Containment Design Pressure), RPV FLOODING IS REQUIRED.

PC/P-6 If suppression chamber pressure cannot be maintained below 88 psig (the Primary Containment Pressure Limit), then irrespective of whether adequate core cooling is assured:

- o Initiate suppression pool sprays.
- o If suppression chamber temperature and pressure are below the Drywell Spray Initiation Pressure Limit A and drywell temperature and pressure are below the Drywell Spray Initiation Pressure Limit B, shut down recirculation pumps and drywell cooling fans and initiate drywell sprays.



Limit A



Limit B

PC/P-7 If suppression chamber pressure exceeds 88 psig (the Primary Containment Pressure Limit), vent the primary containment in accordance with the procedure for containment venting to reduce and maintain pressure below the Primary Containment Pressure Limit. #22

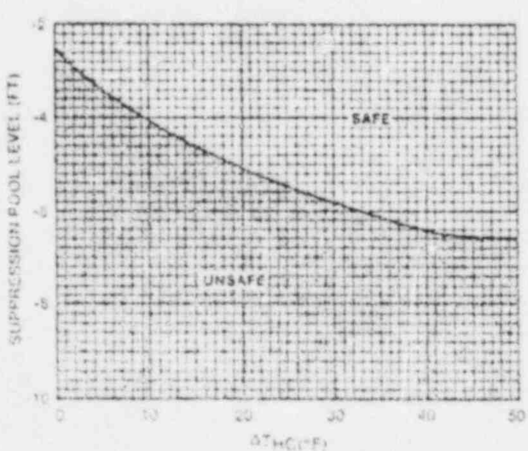
SP/L Monitor and control suppression pool water level.

SP/L-1 Maintain suppression pool water level between -27 inches (maximum suppression pool water level LCO) and -31 inches (minimum suppression pool water level LCO). Refer to the sampling procedure prior to discharging water.

#8, #9

SP/L-2 If suppression pool water level cannot be maintained above the Heat Capacity Level Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.

REACTOR PRESSURE	SUPPRESSION POOL TEMPERATURE LIMIT	MINUS	ACTUAL SUPPRESSION POOL TEMPERATURE	EQUALS	ΔT_{HC} (°F)
1000 TO 1100 psig	148°F	-		=	
900 TO 1000 psig	150°F	-		=	
800 TO 900 psig	152°F	-		=	
700 TO 800 psig	152°F	-		=	
600 TO 700 psig	155°F	-		=	
500 TO 600 psig	162°F	-		=	
400 TO 500 psig	168°F	-		=	
300 TO 400 psig	171°F	-		=	
200 TO 300 psig	177°F	-		=	
150 TO 200 psig	188°F	-		=	
LESS THAN 150 psig	(°F) ΔT_{HC} > 50°F				50°F

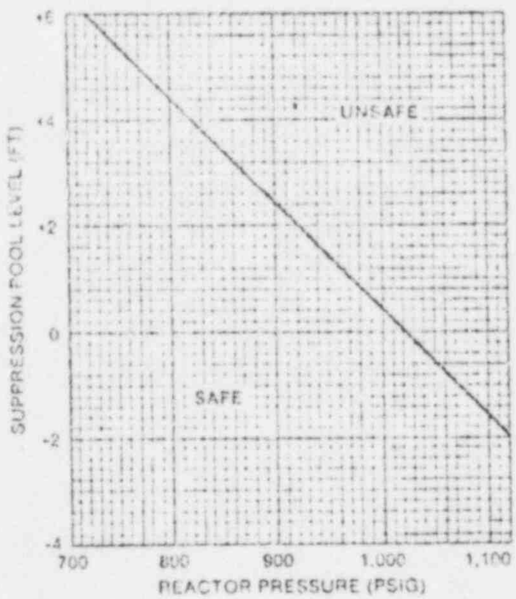


Heat Capacity Level Limit

SP/L-3 If suppression pool water level cannot be maintained below -27 inches (maximum suppression pool water level LCO):

SP/L-3.1 If adequate core cooling is assured, terminate injection into the RPV from sources external to the primary containment.

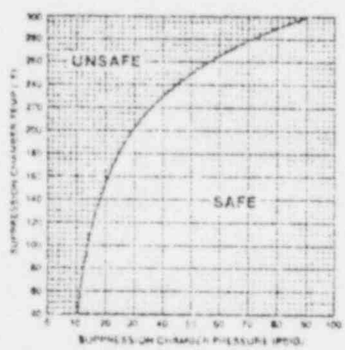
SP/L-3.2 If suppression pool water level cannot be maintained below the Suppression Pool Load Limit, maintain RPV pressure below the Limit. #13 #14



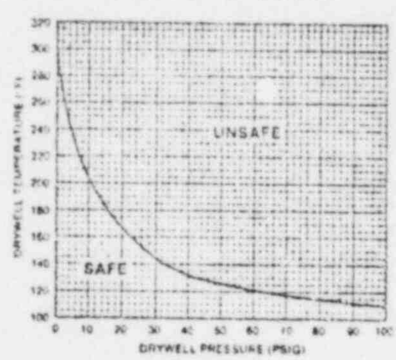
Suppression Pool Load Limit

If suppression pool water level and RPV pressure cannot be restored and maintained below the Suppression Pool Load Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.

SP/L-3.3 Before suppression pool water level reaches +9 inches (elevation of bottom of Mark I internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water) but only if suppression chamber temperature and pressure are below the Drywell Spray Initiation Pressure Limit A and drywell temperature and pressure are below the Drywell Spray Initiation Pressure Limit B, shut down recirculation pumps and drywell cooling fans and initiate drywell sprays. #18



Limit A



Limit B

SP/L-3.4 If suppression pool water level exceeds +9 inches (elevation of bottom of Mark I internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water) continue to operate drywell sprays.

#23

CONTINGENCY #1

LEVEL RESTORATION

If while executing the following steps:

- o Boron Injection is required, enter CONTINGENCY #7.
- o RPV water level cannot be determined, RPV FLOODING IS REQUIRED; enter CONTINCENCY #6.
- o RPV Flooding is required, enter CONTINGENCY #6.

C1-1 Line up for injection and start pumps in two or more of the following injection subsystems:

- o Condensate
- o RHR-A
- o RHR-B
- o RHR-C
- o RHR-D
- o Core Spray-A
- o Core Spray-B

If less than two of the injection subsystems can be lined up, commence lining up as many of the following alternate injection subsystems as possible:

- o Fire system
- o ECCS keep fill systems
- o Condensate Transfer System
- o SLC (test tank)
- o SLC (boron tank)
- o RHR service water cross-tie

C1-2 Monitor RPV pressure and water level. Continue in this procedure at the step indicated in the following table.

RPV PRESSURE REGION

(350 psig)[1] (120 psig)[2]

	HIGH	INTERMEDIATE	LOW
INCREASING	C1-3	C1-4	C1-5
DECREASING	C1-6		C1-7

1 (RPV pressure at which core spray shutoff head is reached)
2 (HPCI low pressure isolation setpoint)

> If while executing the following steps:
>
> o The RPV water level trend reverses or RPV pressure changes region, return to Step C1-3.
>
> o RPV water level drops below +45 inches (ADS initiation setpoint), prevent automatic initiation of ADS.

C1-3 RPV WATER LEVEL INCREASING, RPV PRESSURE HIGH

Enter the RPV Control Guideline at Step RC/L.

C1-4 RPV WATER LEVEL INCREASING, RPV PRESSURE INTERMEDIATE

IF HPCI and RCIC are not available and RPV pressure is increasing, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED. When RPV pressure is decreasing, enter the RPV Control Guideline at Step RC/L.

If HPCI and RCIC are not available and RPV pressure is not increasing, enter the RPV Control Guideline at Step RC/L.

If HPCI and RCIC are available, when RPV water level reaches +162.5 inches (low level scram setpoint), enter the RPV Control Guideline at Step RC/L.

C1-5 RPV WATER LEVEL INCREASING, RPV PRESSURE LOW

If RPV pressure is increasing, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED. When RPV pressure is decreasing, enter the RPV Control Guideline at Step RC/L.

Otherwise, enter the RPV Control Guideline at Step RC/L.

C1-6 RPV WATER LEVEL DECREASING, RPV PRESSURE HIGH OR INTERMEDIATE

If HPCI and RCIC are not operating, restart whichever is not operating.

If no CRD pump is operating and no injection subsystem is lined up for injection with at least one pump running, start pumps in alternate injection subsystems which are lined up for injection.

When RPV water level drops to 0 inches (top of active fuel):

- o If no system, injection subsystem or alternate injection subsystem is lined up with at least one pump running, STEAM COOLING IS REQUIRED. When any system, injection subsystem or alternate injection subsystem is lined up with at least one pump running, return to Step C1-3.
- o If any RPV injection exists, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED. When RPV water level is increasing or RPV pressure drops below 120 psig (HPCI low pressure isolation setpoint) return to Step C1-3.

C1-7 RPV WATER LEVEL DECREASING, RPV PRESSURE LOW

If no core spray subsystem is operating, start pumps in alternate injection subsystems which are lined up for injection.

If RPV pressure is increasing, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

When RPV water level drops to 0 inches (top of active fuel), enter CONTINGENCY #4.

CONTINGENCY #2

EMERGENCY RPV DEPRESSURIZATION

C2-1 When either: #13,#14

- Boron Injection is required and all injection into the RPV except from boron injection systems and CRD has been terminated and prevented, or
- Boron Injection is not required,

C2-1.1 Open all ADS valves.

If any ADS valve cannot be opened, open other SRV's until seven (number of SRV's dedicated in ADS) valves are open.

C2-1.2 If less than three (Minimum Number of SRV's Required for Emergency Depressurization) SRV's are open and RPV pressure is at least 50 psig (Minimum SRV Reopening Pressure) above suppression chamber pressure, rapidly depressurize the RPV using one or more of the following systems (use in order which will minimize radioactive release to the environment): #22

- Main condenser
- RHR (steam condensing mode)
- Main steam line drains
- HPCI steam line
- RCIC steam line
- Head vent

If RPV Flooding is required, enter CONTINGENCY #6.

C2-2 Enter the RPV Control Guideline at Step RC/P-4.

CONTINGENCY #3

STEAM COOLING

C3-1

If while executing the following steps Emergency RPV Depressurization is required or any system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter CONTINGENCY #2.

When RPV water level drops to -100 inches (Minimum Zero-Injection RPV Water Level) or if RPV water level cannot be determined, open one SRV.

When RPV pressure drops below 700 psig (Minimum Single SRV Steam Cooling Pressure), enter CONTINGENCY #2.

CONTINGENCY #4

CORE COOLING WITHOUT LEVEL RESTORATION (SPRAY COOLING)

C4-1 Open all ADS valves. | #13 |

If any ADS valve cannot be opened, open other SRV's until seven (number of SRV's dedicated to ADS) valves are open.

C4-2 Operate core spray subsystems with suction from the suppression pool.

When at least one core spray subsystem is operating with suction from the suppression pool and RPV pressure is below 290 psig (RPV pressure for rated core spray flow), terminate injection into the RPV from sources external to the primary containment.

C4-3 When RPV water level is restored to 0 inches (top of active fuel), enter the RPV Control Guideline at Step RC/L.

CONTINGENCY #5

ALTERNATE SHUTDOWN COOLING

C5-1 Initiate suppression pool cooling.

C5-2 Close the RPV head vents, MSIV's, main steam line drain valves, and HPCI and RCIC isolation valves.

C5-3 Place the control switch for one (Minimum Number of SRV's Required for Alternate Shutdown Cooling) SRV in the OPEN position.

C5-4 Slowly raise the RPV water level to establish a flow path through the open SRV back to the suppression pool.

C5-5 Start one core spray or RHR pump with suction from the suppression pool.

C5-6 Slowly increase core spray or RHR injection into the RPV to the maximum.

C5-6.1 If RPV pressure does not stabilize at least 94 psig (Minimum Alternate Shutdown Cooling RPV Pressure) above suppression chamber pressure, start another core spray or RHR pump.

C5-6.2 If RPV pressure does not stabilize below 220 psig (Maximum Alternate Shutdown Cooling RPV Pressure), open another SRV.

C5-6.3 If the cooldown rate exceeds 100°F/hr (maximum RPV cooldown rate LCO), reduce core spray or RHR injection into the RPV until the cooldown rate decreases below 100°F/hr (maximum RPV cooldown rate LCO) or RPV pressure decreases to within 50 psig (Minimum SRV Reopening Pressure) of suppression chamber pressure, whichever occurs first.

C5-7 Control suppression pool temperature to maintain RPV water temperature above 70°F (head tensioning limit).

C5-8 Proceed to cold shutdown in accordance with GP-01.

CONTINGENCY #6

RPV FLOODING

C6-1 If at least three (Minimum Number of SRV's Required for Emergency Depressurization) SRV's can be opened, close the MSIV's main steam line drain valves, HPCI, RCIC and RHR steam condensing isolation valves.

C6-2 If any control rod is not inserted beyond position 06 (maximum subcritical banked withdrawal position):

C6-2.1 Terminate and prevent all injection into the RPV except from boron injection systems and CRD.

> If while executing the following step, RPV water level can be determined and RPV Flooding is not required, enter CONTINGENCY #7 and the RPV Control Guideline at Step RC/P-4 and execute these procedures concurrently.

C6-2.2 When RPV pressure is below the Minimum Alternate RPV Flooding Pressure, commence and slowly increase injection into the RPV with the following systems to maintain RPV pressure above the Minimum Alternate RPV Flooding Pressure: #24

Number of open SRV's	Minimum Alternate RPV Flooding Pressure (psig)
7	100
6	120
5	145
4	190
3	250
2	380
1	770

- o Condensate pumps
- o CRD
- o RHR

If RPV pressure cannot be maintained above the Minimum Alternate RPV Flooding Pressure, commence and slowly increase injection into the RPV with the following systems to maintain RPV pressure above the Minimum Alternate RPV Flooding Pressure:

- o Core spray
- o Fire system
- o ECCS keep fill systems
- o Condensate transfer system
- o RHR service water cross-tie

C6-2.3 When:

- o All control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), or
- o The reactor is shut down and no boron has been injected into the RPV,

continue in this procedure.

C6-3 If RPV water level cannot be determined:

C6-3.1 Commence and increase injection into the RPV with the following systems until at least three (Minimum Number of SRV's Required for Emergency Depressurization) SRV's are open and RPV pressure is not decreasing and is at least 100 psig (Minimum RPV Flooding Pressure) above suppression chamber pressure.

- o Core spray
- o RHR
- o Condensate pumps
- o CRD

- Fire system
- ECCS keep fill systems
- SLC (test tank)
- SLC (boron tank)
- RHR service water cross-tie

C6-3.2 Maintain RPV pressure at least 100 psig (Minimum RPV Flooding Pressure) above suppression chamber pressure by throttling injection.

C6-4 If RPV water level can be determined, commence and increase injection into the RPV with the following systems until RPV water level is increasing:

- Core spray
- RHR
- Condensate pumps
- CRD
- Fire system
- ECCS keep fill systems
- Condensate transfer system
- SLC (test tank)
- SLC (boron tank)
- RHR service water cross-tie

C6-5 If RPV water level cannot be determined:

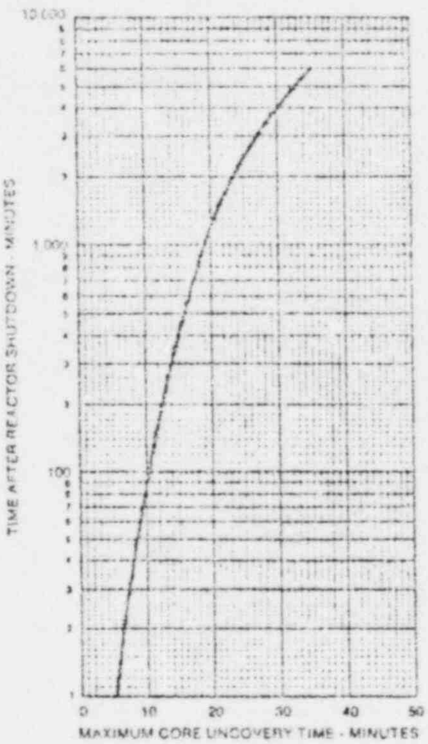
C6-5.1 Fill all RPV level instrumentation reference columns.

C6-5.2 Continue injecting water into the RPV until temperature near the cold reference leg instrument vertical runs is below 212°F and RPV water level instrumentation is available.

If while executing the following steps, RPV water level can be determined, continue in this procedure at Step C6-6.

C6-5.3 If it can be determined that the RPV is filled or if RPV pressure is at least 85 psig (Minimum RPV Flooding Pressure) above suppression chamber pressure, terminate all injection into the RPV and reduce RPV water level.

C6-5.4 If RPV water level indication is not restored within the Maximum Core Uncovery Time Limit after commencing termination of injection into the RPV, return to Step C6-3.



Maximum Core Uncovery Time

C6-6 When suppression chamber pressure can be maintained below 88 psig (the Primary Containment Pressure Limit), enter RPV Control Guideline at Steps RC/L and RC/P-4 and execute these steps concurrently.

CONTINGENCY #7

LEVEL/POWER CONTROL

> If while executing the following steps RPV Flooding is required or RPV water level cannot be determined, control injection into the RPV to maintain reactor power above 8% (Reactor Flow Stagnation Power) but as low as practicable.
>
> However, if reactor power cannot be determined or maintained above 8% (Reactor Flow Stagnation Power), RPV FLOODING IS REQUIRED; enter CONTINGENCY #6.

C7-1 If:

- o Reactor power is above 3% (APRM downscale trip) or cannot be determined, and
- o Suppression pool temperature is above 110°F (Boron Injection Initiation Temperature), and
- o Either an SRV is open or opens or drywell pressure is above 2.0 psig (high drywell pressure scram setpoint).

lower RPV water level by terminating and preventing all injection into the RPV except from boron injection systems and CRD until either: #25

- o Reactor power drops below 3% (APRM downscale trip), or
- o RPV water level reaches 0 inches (top of active fuel), or
- o All SRV's remain closed and drywell pressure remains below 2.0 psig (high drywell pressure scram setpoint).

If while executing the following steps Emergency RPV Depressurization is required, continue in this procedure at Step C7-2.1.

If while executing the following step:

- o Reactor power is above 3% (APRM downscale trip) or cannot be determined, and
- o RPV water level is above 0 inches (top of active fuel), and
- o Suppression pool temperature is above 110°F (Boron Injection Initiation Temperature), and
- o Either an SRV is open or opens or drywell pressure is above 2.0 psig (high drywell pressure scram setpoint),

Return to Step C7-1.

C7-2 Maintain RPV water level either: | #9, #10, #11, #24

- o If RPV water level was deliberately lowered in Step C7-1, at the level to which it was lowered, or
- o If RPV water level was not deliberately lowered in Step C7-1, between +162.5 inches (low level scram setpoint) and +208 inches (high level trip setpoint),

with the following systems:

- o Condensate/feedwater system 1182 - 0 psig (RPV pressure range for system operation)
- o CRD system 1448 - 0 psig (RPV pressure range for system operation)

- RCIC system 1210 - 62 psig (RPV pressure range for system operation) #12

- HPCI system 1210 - 120 psig (RPV pressure range for system operation)

- RHR system 237 - 0 psig (RPV pressure range for system operation)

If RPV water level cannot be so maintained, maintain RPV water level above 0 inches (top of active fuel).

If RPV water level cannot be maintained above 0 inches (top of active fuel), EMERGENCY RPV DEPRESSURIZATION IS REQUIRED:

C7-2.1 Terminate and prevent all injection into the RPV except from boron injection systems and CRD.

C7-2.2 When RPV pressure is below the Minimum Alternate RPV Flooding Pressure, commence and slowly increase injection into the RPV with the following systems to restore and maintain RPV water level above 0 inches (top of active fuel): #24

Number of open SRV's	Minimum Alternate RPV Flooding Pressure (psig)
7	100
6	120
5	145
4	190
3	250
2	380
1	770

- o Condensate/feedwater system
- o CRD
- o RCIC
- o HPCI
- o RHR

If RPV water level cannot be restored and maintained above 0 inches (top of active fuel), commence and slowly increase injection into the RPV with the following systems to restore and maintain RPV water level above 0 inches (top of active fuel):

- o Core spray
- o Fire system
- o ECCS keep fill systems
- o Condensate transfer system
- o RHR service water cross-tie

If while executing the following step reactor power commences and continues to increase, return to Step C7-1.

C7-3 When 319 pounds (Hot Shutdown Boron Weight) of boron have been injected or all control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), restore and maintain RPV water level between +162.5 inches (low level scram setpoint) and +208 inches (high level trip setpoint).

If RPV water level cannot be restored and maintained above +162.5 inches (low level scram setpoint), maintain RPV water level above 0 inches (top of active fuel).

If RPV water level cannot be maintained above 0 inches (top of active fuel), EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; return to Step C7-2.1).

If Alternate Shutdown Cooling is required, enter CONTINGENCY #5.

C7-4 Proceed to cold shutdown in accordance with End Path Manual 1.

APPENDIX II

Writers' Guide
for
Emergency Operating Procedures

CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

WRITERS' GUIDE FOR EMERGENCY OPERATING PROCEDURES

Table of Contents

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ABBREVIATIONS

ADS - Automatic Depressurization System

ANS - American Nuclear Society

ANSI - American National Standards Institute

AOP - Abnormal Operating Procedure

APRM - Average Power Range Monitor

ASDC - Alternate Shutdown Cooling

ATWS - Anticipated Transient Without Scram

BOP - Balance of Plant

CAC - Containment Atmospheric Control

CAD - Containment Atmospheric Dilution

CCP - Containment Control Procedure

COND - Condensate

CONV - Conventional

CRD - Control Rod Drive

CST - Condensate Storage Tank

DW/T - Drywell Temperature

EBOP - Emergency Bearing Oil Pump

ECCS - Emergency Core Cooling System

EI - Emergency Instruction

EOP - Emergency Operating Procedure

EPP - End Path Procedure

E&RC - Environmental Radiation Control

ESOP - Emergency Seal Oil Pump

EXCH - Exchanger

FW - Feedwater

GM - General Manager

HCLL - Heat Capacity Level Limit

HCTL - Heat Capacity Temperature Limit

HCU - Hydraulic Control Unit

HDR - Header

HI - High

HPCI - High Pressure Coolant Injection

HX - Heat Exchanger

IA - Instrument Air

IAN - Instrument Air Non-Interruptible

IRM - Intermediate Range Monitor

KV - Kilo Volt

LEP - Local Emergency Procedure

LPCI - Low Pressure Coolant Injection

LPCS - Low Pressure Core Spray

MCC - Motor Control Center

MG - Motor Generator

MSIV - Main Steam Line Isolation Valves

MSL - Main Steam Line

NDTT - Nil-Ductility Transition Temperature

NPSH - Net Positive Suction Head

NUC - Nuclear

PC/P - Primary Containment Pressure

PEP - Plant Emergency Plan

RAD - Radiation

RBCCW - Reactor Building Closed Cooling Water

RCIC - Reactor Core Isolation Cooling

RC/L - Reactor Control Level

RC/P - Reactor Control Pressure

RC/Q - Reactor Control Power

RECIRC - Recirculation

RHR - Residual Heat Removal

RPS - Reactor Protection System

RPV - Reactor Pressure Vessel

RSCS - Rod Sequence Control System

RTGB - Reactor Turbine Gauge Board

RWCU - Reactor Water Cleanup

RWM - Rod Worth Minimizer

RX - Reactor

SA - Service Air

SAT - Startup Auxiliary Transformer

SBGT - Standby Gas Treatment

SJAE - Steam Jet Air Ejector

SLC - Standby Liquid Control

SRM - Source Range Monitor

SORV - Stuck Open Relief Valve

SOS - Shift Operating Supervisor

SP/L - Suppression Pool Level

SP/T - Suppression Pool Temperature

SRP - System Recovery Procedure

SRV - Safety Relief Valve

SULCV - Startup Level Control Valve

TBCCW - Turbine Building Closed Cooling Water

TIP - Transversing In-Core Probe

Figures and Tables

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide administrative and technical guidance on the preparation of Emergency Operating Procedures (EOP's) to ensure that they are complete, accurate, convenient, readable and acceptable to the BSEP Control Room personnel.

1.2 SCOPE

This Writers' Guide applies to the writing of BSEP EOP's i.e., flowcharts and the associated written instructions which are in the End Path Manuals.

2.0 ORGANIZATION OF EMERGENCY OPERATING PROCEDURES

The EOP's shall consist of symptomatic or function oriented procedures which are in flowchart format and End Path Manuals, which are in written format.

3.0 ORGANIZATION OF BSEP FLOWCHARTS

The BSEP Flowcharts shall consist of function oriented paths.

The EOP Users' Guide outlines the Brunswick EOP's and describes how these procedures are to be used by the Control Room personnel to handle emergency and potential emergency situations.

3.1 DESIGNATION AND NUMBERING

The flowcharts are the procedures that govern the plant operation during emergency conditions and specify immediate operator actions to be taken to bound the problem and to return the plant to a stable condition.

Each flowchart shall be uniquely identified (see Figure 1). This identification permits easy administration of the process of procedure preparation, review, revision, distribution and operator use.

The identification shall be located at the upper left of each flowchart (see Figure 1).

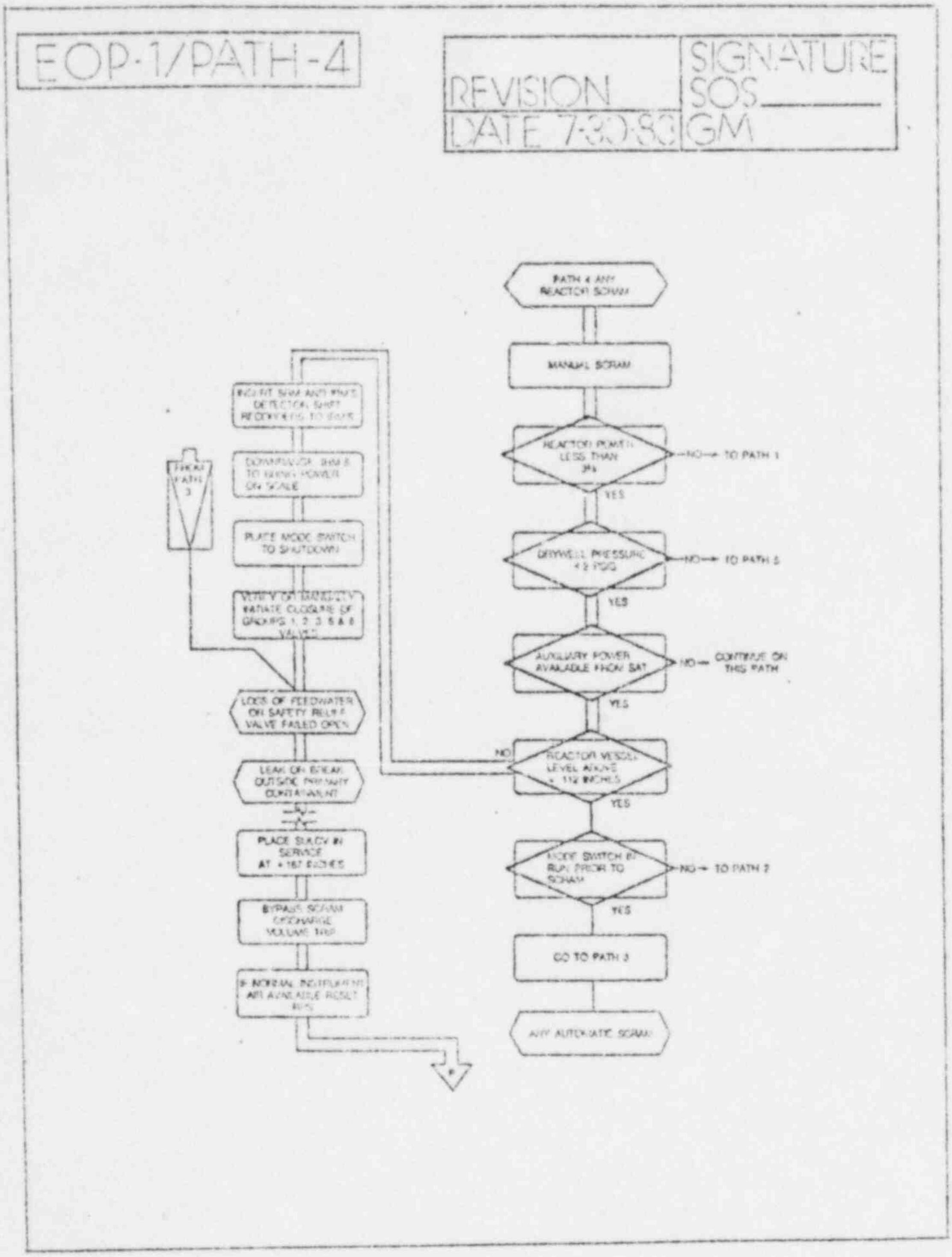


Figure 1 Flowchart Identification

The flowcharts shall not have other identifying titles. The philosophy is for the operator to immediately enter <u>any</u> flowchart when the EOP entry condition occurs. Once the operator enters the flowchart, it will lead to the proper procedural steps.

3.2 REVISION AND AUTHORIZATION

Each flowchart shall include information which identifies the current revision designation and authorized signatures. This information shall be located at the upper right of each flowchart (see Figure 1).

3.3 UNIT IDENTIFICATION FOR FLOWCHARTS

There shall be no unit identification for the flowcharts.

3.4 PAGE IDENTIFICATION

There shall be no page identification on the flowcharts. The Immediate Action Steps for each flowchart shall be included on one page.

3.5 FORMAT

The flowcharts shall utilize standard logic symbols (see Figure 2).

These symbols shall be arranged in a decision tree type flowchart consisting of Information/Caution, Decision and Action Steps that provide the operator with guidance intended to bound the problem and get the plant into a safe condition quickly, systematically and consistently (see Figure 1).

3.6 DECISION SYMBOL

This symbol shall contain a question which the operator is to answer YES or NO. The question shall pertain to a plant parameter, setpoint, switch position, or system condition.

If the particular step is designated as a key or path specific parameter, it should have an action symbol superimposed over the standard decision symbol. These important steps are further highlighted by making the decision symbol lines heavier than normal (see Figure 2). The operator may be required to return to these steps.

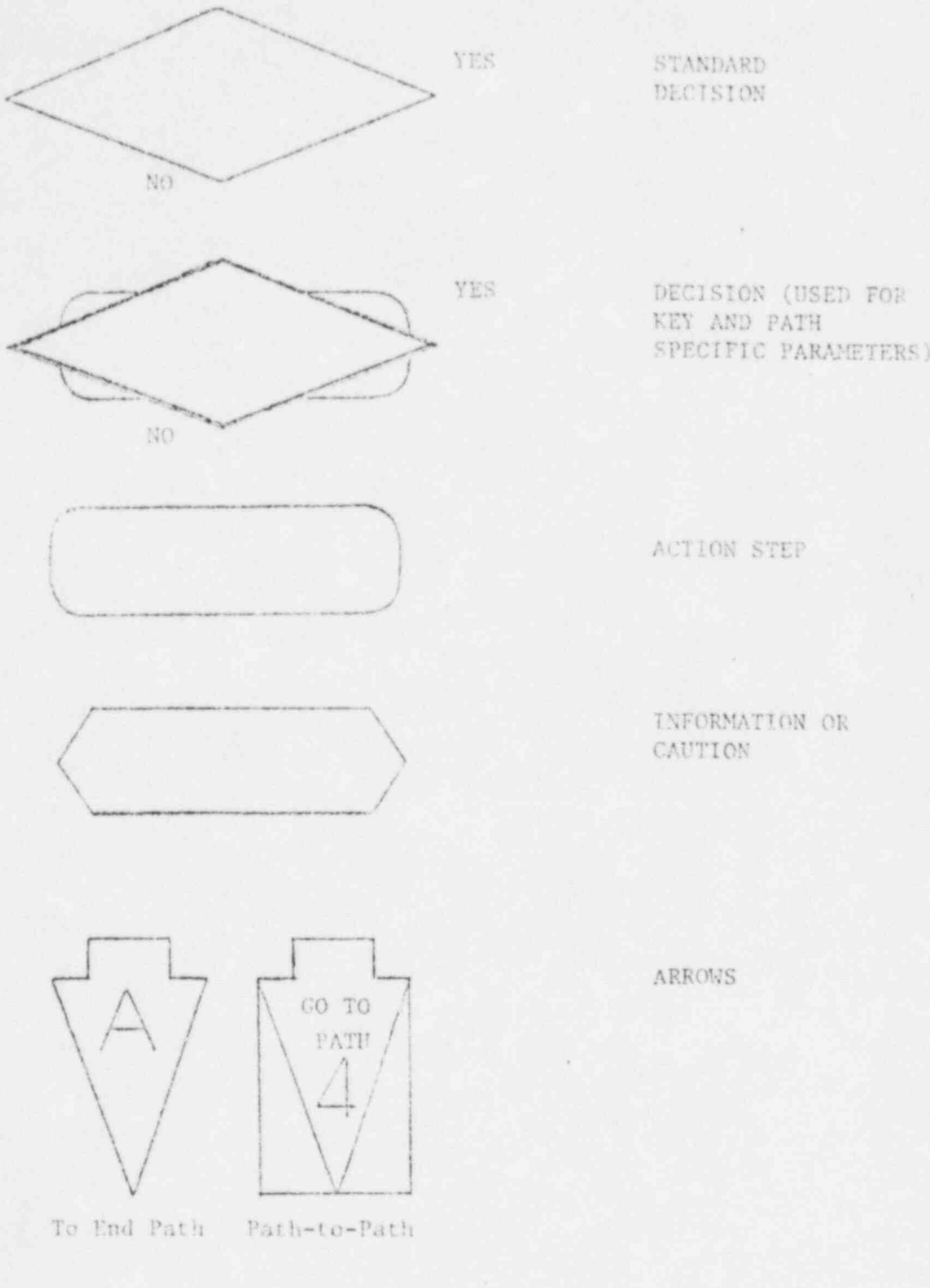


Figure 2 Standard Logic Symbols

3.7 ACTION SYMBOL

This symbol shall contain a specific action, command or verification which the operator should perform.

3.8 INFORMATION SYMBOL

This symbol shall contain information which may be useful to assist the operator in diagnosing plant conditions. The symbol is also used to provide operator cautions.

3.9 ARROW SYMBOLS

There shall be two basic types of arrow symbols used on the flowcharts (see Figure 2).

The path-to-path arrows guide the operator from one flowchart to another. The path-to-end-path arrow guides the operator from the Immediate Action Steps (flowcharts) to the appropriate Subsequent Action Steps (End Path Procedures).

3.10 CONNECTING LINES

There shall be two basic line widths used to guide the operator through the flowchart. The operator should follow these lines always entering the symbols at the top and exiting the symbols at the sides or bottom.

The wide line, Yellow Brick Road, represents the expected plant response for each flowchart.

The narrow lines are equally important. They represent possible response of the plant for many situations on each flowchart.

No lines shall cross or intersect on the flowcharts, except where two or more enter the same symbol.

3.11 ENTRY CONDITION FOR FLOWCHARTS

The entry conditions shall be, "Any Reactor Scram."

The entry condition for each flowchart is identical (see Figure 1).

3.12 KEY PARAMETERS

Each flowchart shall have identical initial formats, i.e., the entry conditions followed by the key parameters (see Figure 1).

The key parameters are very important. They establish the priority of actions and guide the operator to the appropriate procedure.

3.13 PATH SPECIFIC PARAMETERS

The path specific parameters are located on the Yellow Brick Road of the flowcharts. These steps are emphasized by the used of heavy decision symbols and superimposed action symbols.

3.14 AUTOMATIC ACTIONS

Important safety system automatic initiation verifications shall be included in the flowcharts. The following statement enclosed within an action symbol is an example of operator verification of automatic actions: "Verify Auto or Manually Start HPCI, RCIC and SBGT."

3.15 IMMEDIATE OPERATOR ACTIONS

The steps on the flowcharts are the Immediate Operator Action Steps. These operator actions are taken to stop further degradation of existing conditions and to mitigate their consequences or to bound the problem.

The immediate operator actions shall be visible to the operator, therefore, no need or requirement exists to memorize these actions.

3.16 OPERATOR CAUTIONS

Operator cautions shall be included on the flowcharts where appropriate. The cautions are enclosed in information symbols.

3.17 PLACE KEEPING AIDS

The flowcharts shall be mounted on a lightweight surface such as styrofoam and covered with a thin transparent layer of plastic, which can be marked on with a felt-tip pen or grease pencil. The operator shall check off the steps of the flowchart as they are performed. Felt-tip pen ink and grease pencil are easily erased.

3.18 WRITING STYLE FOR FLOWCHARTS

The flowchart steps shall be written in a style that presents the information in a simple, familiar, specific and unambiguous manner.

The flowchart steps should be brief and exact. The following guidelines should be used for flowchart development:

a. Decision and Action Steps shall deal with only one idea.

b. Complex evolutions should be prescribed in a series of steps, if possible.

c. Operator actions should be specifically stated.

d. Identification of components should be in everyday terms, i.e., operator language.

e. Expected results of routine tasks need not be stated.

f. Words and meanings shall be consistent throughout the flowcharts.

g. Use only accepted abbreviations that are familiar to the operator, i.e., the ones listed in this Writers' Guide.

h. Avoid the use of time dependent operator actions.

i. Use units of measure that are familiar to the operator. The operator should be able to relate the units to those referenced on the plant instrumentation without conversion, translation or mental manipulation.

j. Generally, notes and tables should not be used on flowcharts. However, it is permissible to use them if this simplifies the procedure.

k. Word order should be selected to require a minimum of punctuation on the flowcharts.

3.19 VOCABULARY

Words used in the steps of the flowcharts should convey precise understanding to the trained operator. The following rules are to be used:

a. Use simple words. Simple words are usually short words of few syllables. Simple words are generally common words.

b. Use common usage if it makes the procedure easier to understand.

c. Use words that are concrete, rather than vague, specific rather than general, familiar rather than formal, precise rather than blanket.

d. Verbs with specific meaning should be used. Some examples of suitable verbs are listed in Table 1.

e. Equipment status shall be denoted as operable, available or running, depending upon the specific condition of the equipment.

   Operable and available mean that the system, component or device is capable of performing its intended function(s) in the intended manner.

   Running denotes that the system, component or device is performing its intended function(s).

3.20 SEQUENCING

Tasks and Action Steps shall be sequenced according to technical necessity, which should be the overriding consideration. Additionally, the physical layout and organization of the Control Room is an important consideration in sequencing tasks for optimal staff movement and monitoring when performing a sequence of tasks and actions.

Table 1. Examples of Action Verbs

Verb	Application
ADJUST	To regulate or bring to a more satisfactory state, for example, "ADJUST CAD Tank pressure to 100 psig"
ALIGN	To place a system in proper or desired configuration for an intended purpose, for example, "ALIGN CAD Vaporizer to Reactor Building"
ALLOW	To permit a stated condition to be achieved prior to proceeding, for example, "ALLOW discharge pressure to stabilize"
CHECK	To perform a comparision with a procedural requirement, for example, "CHECK Reactor Building Area Radiation and Vent Radiation Monitors"
CLOSE	To change the physical position of a mechanical device so that it prevents physical access or flow or permits passage of electrical current, for example, "CLOSE Valve FW-V177"
COMPLETE	To accomplish specific procedural requirements, for example, "COMPLETE data report QA-1, "COMPLETE Steps 7 through 9 of Section III"
ESTABLISH	To make arrangements for a stated condition, for example, "ESTABLISH communication with the Control Room"
INSPECT	To measure, observe, or evaluate a feature or characteristic for comparison with specific limits; method of inspection should be included, for example, "visually INSPECT for leaks"
ISOLATE	To close one or more valves in a system for the purpose of separating or setting apart a complete system or a portion of the system from the rest, for example "ISOLATE Interruptible Instrument Air Header using RTGB Controls"
MAINTAIN	To keep in a existing state, for example, MAINTAIN the reactor vessel water level between +162 and +208 inches, with one or more of the following systems . . ."

Table 1. Examples of Action Verbs (Continued)

Verb	Application
OPEN	To change the physical position of a mechanical device, such as valve or door to the unobstructed position that permits access or flow, or prevents passage of electrical current, for example, "OPEN Valve FW-V177"
PLACE	To put in a particular position, for example, "PLACE mode switch to 'SHUTDOWN'"
RECORD	To document specified condition or characteristic, for example, "RECORD discharge pressure"
REDUCE	To cause a parameter to decrease in value, for example, "REDUCE reactor pressure with Bypass Valve Manual Jack"
SET	To physically adjust to a specified value an adjustable feature, for example, "SET HPCI Speed Controller to maintain RPV water level near normal"
START	To originate motion of an electric or mechanical device directly or by remote control, for example, "START RHR and Core Spray Pumps"
STOP	Opposite of start, for example, "STOP the Condensate Pumps"
SYNCHRONIZE	To make synchronous in operation, for example, "SYNCHRONIZE the Diesel Generator to the (E) Bus"
THROTTLE	To operate a valve in an intermediate position to obtain a certain flow rate, for example, "THROTTLE Valve E11-F017A to . . ."
TRIP	To manually activate a semi-automatic feature, for example, "TRIP incoming Feeder Breakers to 4KV Emergency (E) Busses"
VENT	To permit a gas or liquid confined under pressure to escape at a vent, for example, "VENT CRD Scram Air Headers"
VERIFY	To observe the expected condition or characteristic, for example, "VERIFY on <u>OR</u> START both CRD Pumps"

3.21 VERIFICATION STEPS

Verification Steps are used to determine whether the objective of a task or a sequence of actions has been achieved. This is easily accomplished on the flowchart, e.g., "Manually start HPCI" followed by "HPCI Start Successful?" In this example the operator would check off the Command Step, enter the Verification Step, check it off then continue, following the appropriate route.

This arrangement ensures that equipment response and operator actions have occurred and are correct for given situations.

If an Action Step cannot be accomplished, the operators are trained to so indicate, i.e., circle the step, and continue on through the procedure.

3.22 LOCATION INFORMATION

The flowchart steps shall provide necessary 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. Additional location information should be provided in the End Path Manuals, Operator Training and at remote locations.

3.23 NUMERICAL VALUES

The use of numerical values shall be consistent with the following rules:

a. Arabic numerals shall be used.

b. For numbers less than unity, the decimal point shall be preceded by a zero, for example 0.1.

c. The number of significant digits shall be equal to the number of significant digits available from the display and reading precision of the operator.

d. Acceptance values should be specified in such a way that addition and subtraction by the user is avoided, if possible. This can generally be done by stating acceptance values as limits. Examples are as follows: +170 inches minimum, +200 inches maximum, +170 inches to +200 inches.

A statement of midpoint and the upper and lower limits may be used when appropriate, for example 10 milliamperes (9.5 to 10.5). Avoid using ±.

e. Engineering units should always be specified for numerical values of process variables. They should be the same as those used on the Control Room displays, for example, psig instead of psi.

3.24 ABBREVIATIONS, LETTER SYMBOLS AND ACRONYMS

The use of unfamiliar abbreviations should be avoided because they may be confusing to those who are to use the procedures. Abbreviations may be used where necessary to save time and space, and when their meaning is unquestionably clear to the operator. Consistency should be maintained throughout the flowcharts (see Abbreviation List in this document).

Capitalization of abbreviations should be uniform. The period should be omitted in abbreviations, except in cases where the omission would result in confusion.

Abbreviations, symbols and acronyms should not be overused. Their use should be for the benefit of the reader. They can be beneficial by saving reading time and ensuring clarity when space is limited.

3.25 TYPING FLOWCHART STEPS

Gothic elite, pitch 12, typewriter element shall be used.

The flowchart steps should be typed on Standpat Applique System pressure sensitive sheets. The words of each step should be arranged, i.e., centered to best utilize the available space. Avoid typed information touching the symbol borders.

3.26 PREPARING AND MOUNTING FLOWCHARTS

The flowcharts' layout, i.e., symbols and connecting lines, are prepared on sheets of 3 mil matte polyester drafting film (mylar), using standard drafting instruments, i.e., a special template and filmograph drawing leads such as Berol No. 6375 El.

The typed steps are then transfered to the drawing film.

The completed flowcharts shall be reduced by 50% and mounted on lightweight boards such as styrofoam.

Each board shall then be laminated with a thin, transparent plastic material. Each flowchart board may be framed with lightweight aluminum for additional strength.

3.27 REPRODUCTION OF FLOWCHARTS

Reproduction of the flowcharts may be done on a standard blueprint copier. Reduced flowcharts on film (mylar) should be used for the original.

3.28 REVISIONS TO FLOWCHARTS

The current revision of each flowchart shall be maintained on film (mylar) both full size and half size, and be kept in the plant vault, along with paper reproductions of prior revisions.

When changes occur in the plant design, Technical Specifications, Technical Guidelines, Writers' Guide, other plant procedures or Control Room that will affect the flowcharts, the flowcharts should be revised on a timely basis to reflect these changes. In addition, when operating and training experience, simulator exercises, control room walk-throughs or other information indicate that incorrect or incomplete information exists in the flowcharts the flowcharts should be revised on a timely basis. These changes should be reviewed to ensure consistency with the Technical Guidelines and the Writers' Guide. Operators should be encouraged to suggest improvements to the flowcharts.

4.0 ORGANIZATION OF BSEP END PATH MANUALS

The Brunswick End Path Manuals consist of the following written procedures:

a. End Path Procedures (EPP)

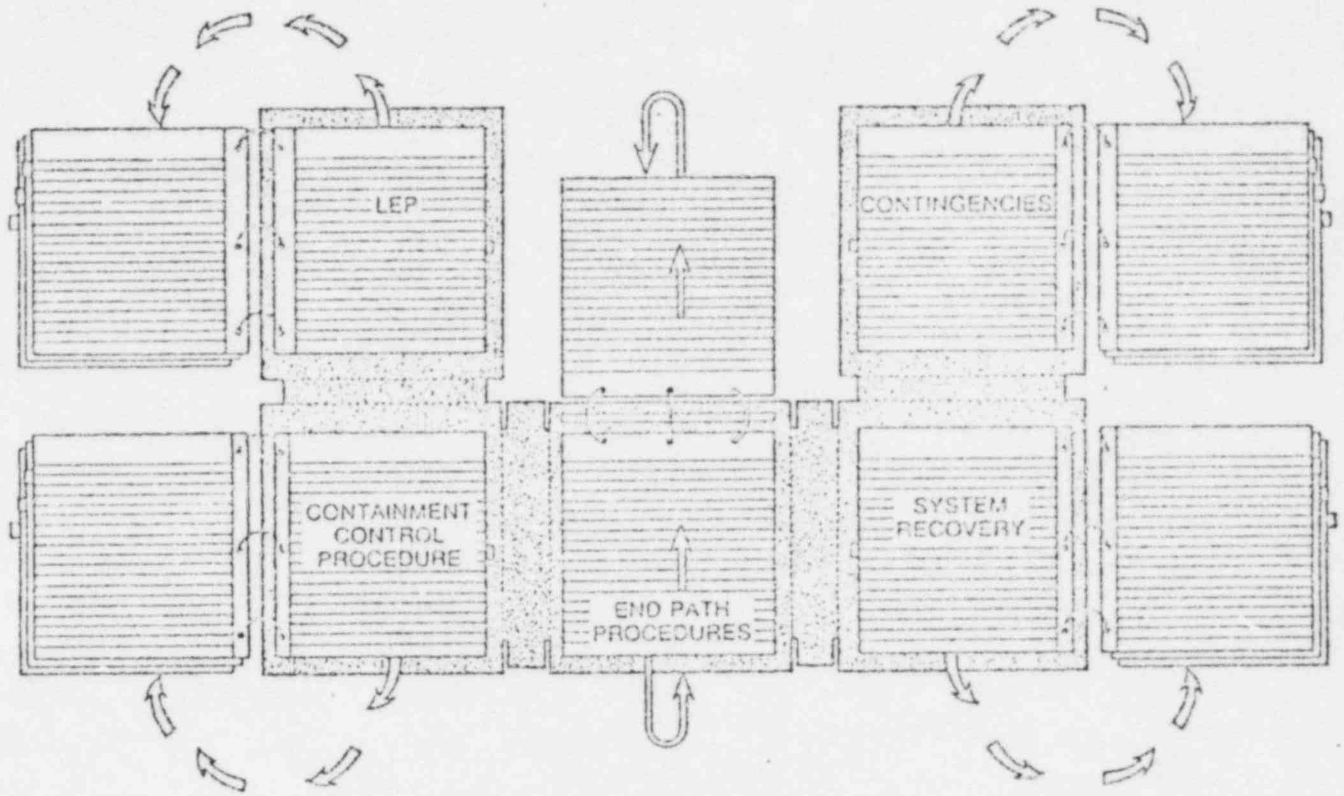
b. Containment Control Procedures (CCP)

c. System Recovery Procedures (SRP)

d. Local Emergency Procedures (LEP)

e. Contingency Procedures (CP)

The above procedures shall be in identical format. The End Path Manuals shall be arranged as indicated by Figure 3.



BSEP END PATH PROCEDURE MANUAL

Figure 3 End Path Arrangement

4.1 DESIGNATION AND NUMBERING

The End Path Manuals contain the instructions that govern the plant operation during emergency conditions and specify the subsequent operator actions to be taken to return the plant to a stable condition.

Each procedure shall be uniquely identified. This identification permits easy administration of the process of procedure preparation, review, revision, distribution, and operator use (see Section 4.0).

4.2 COVER SHEET

Every End Path Manual Procedure shall have a cover sheet (see Figure 4). The purposes of this cover sheet are: (1) to identify the procedure and (2) to indicate the approval status. A descriptive title is to be used that identifies the procedure.

4.3 REVISION SHEET

Every procedure shall have a revision sheet (see Figure 5). The revision sheet will be the second page of each procedure.

4.4 PROCEDURE DESIGNATION AND NUMBERING

The identifying number and designation for all procedures in the End Path Manuals shall include the information contained in the following example:

Example: BSEP/VOL VI/EOP-01/EPP-2A

- EPP-2A — Specific Identification End Path Procedure 2A
- EOP-01 — Procedure Designation
- VOL VI — Plant Operating Manual Volume
- BSEP — Plant Designation

4.5 REVISION NUMBERING AND DESIGNATION

The latest revision shall be indicated on the cover sheet for each procedure (see Figure 4).

CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

UNIT 0

EMERGENCY OPERATING PROCEDURE-01

END PATH PROCEDURE: 2A

VOLUME VI

REV 01

Reviewed By: ______________________________ Date: __________
Manager - Operations

Approved By: ______________________________ Date: __________
General Manager

Page 1 of 7

Figure 4 Cover Sheet

LIST OF EFFECTIVE PAGES
EOP-01

END PATH PROCEDURE: 2A

PAGE(S) . REVISION

BSEP/VOL VI/EOP-01/EPP-2A Page 2 of 7 REV 01

Figure 5 List of Effective Pages

The second sheet of each procedure shall be the revision sheet (see Figure 5). This sheet contains a list of effective pages and revision numbers.

At the lower right hand corner of each page of the procedure, with the exception of the cover page, the abbreviation "REV" will be used, followed by digits denoting the current revision for each page.

To identify revisions to the text of the procedure a change bar, located in the right margin alongside the text change, will be used to indicate a change in the text (see Figure 6).

4.6 PAGE IDENTIFICATION AND NUMBERING

Each page of the procedure shall be identified by: (1) the procedure designator and number (located on lower left of sheet), (2) the page number specified as "Page __ of __" (this information shall be centered at the bottom of each page, as shown in Figure 6) and a revision number on the lower right of each sheet, i.e., REV 01.

4.7 FORMAT

The format for each procedure shall be consistent in the End Path Manuals.

4.7.1 Page Format

A sentence format shall be used for all End Path Manual Procedures. A sample page format is presented in Figure 6.

4.7.2 Procedure Organization

The following section headings shall be used for all End Path Manual Procedures:

a. TITLE--The title shall be stated for operator association with the entry conditions.

   The example title (Figure 6) represents a title for an End Path Procedure. Other examples of End Path Manual Procedures follow:

A. TITLE - End Path Procedure: 2A

B. PLANT CONDITIONS

A reactor scram has been initiated from the "STARTUP" mode. The immediate actions of Path 2 have been completed.

C. OPERATOR ACTIONS

****

CAUTION

DO NOT SECURE OR PLACE an ECCS or RCIC in "MANUAL" mode UNLESS by at least two independent indications:

1. Misoperation in the "AUTOMATIC" mode is confirmed, OR

2. Adequate core cooling is assured.

IF an ECCS or RCIC is placed in the "MANUAL" mode, it will NOT initiate automatically. MAKE frequent checks of the initiating or controlling parameter. WHEN manual operation is no longer required, RESTORE the system to "AUTOMATIC/STANDBY" mode if possible.

****

__ 1. RESTORE AND MAINTAIN reactor vessel level between +170 and +200 inches with one or more of the following systems; USE in order that will minimize high conductivity feed to the Reactor.

__ a. Condensate/Feedwater - - - - - - - - - - - - - - 1182 - 0 psig

__ b. CRD - 1448 - 0 psig

__ c. RCIC - 1210 - 62 psig

__ d. HPCI - 1210 - 120 psig

__ e. RHR - 237 - 0 psig

__ f. Core Spray - - - - - - - - - - - - - - - - - - 320 - 0 psig

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Figure 6 Example Procedure

Example A: Drywell Temperature Control

Example B: System Recovery Procedure for TBCCW

b. PLANT CONDITION OR ENTRY CONDITION--The entry conditions for the End Path Procedures are the plant conditions which exist at the exit point from the flowchart. Figure 6 is an example of an End Path Procedure for which the plant condition (entry condition) is exit point A on Flowchart 2.

Another example of an entry condition is as follows:

Example: Drywell temperature above 135°F

The entry conditions should include alarms, indications, operating conditions, automatic system actions, or other unique symptoms that the operator is to use. These conditions guide the operator whether or not to execute the procedure.

c. OPERATOR ACTIONS--The operator actions will be short, concise, identifiable instructions that give appropriate directions to the user.

4.7.3 Section and Step Numbering

Instructional steps will be numbered and indented as follows:

C. OPERATOR ACTIONS

__ 1. VERIFY . . .

__ a. CHECK . . .

__ (1) POSITION . . .

Operator place keeping aids are indicated by a horizontal line as shown above.

4.8 WRITING INSTRUCTIONAL STEPS

Writing instructional steps shall be consistent in the End Path Manuals.

4.8.1 Instructional Step Length and Content

Instructional steps will be concise and precise. Conciseness denotes brevity; preciseness means exactly defined. Thus, instructions should be short and exact. General rules to be used in meeting these objectives are as follows:

a. Instructional steps should deal with only one idea.

b. Short, simple sentences should be used in preference to long, compound, or complex sentences.

c. Complex evolutions should be prescribed in a series of steps, with each step made as simple as practicable.

d. Objectives of operator actions should be specifically stated. This includes identification of exactly what is to be done and to what.

e. For instructional steps that involve an action verb relating to three or more objects, the objects will be listed with space provided for operator checkoff.

f. Limits should be expressed quantitatively whenever possible (refer to Subsection 3.23).

g. Mandatory sequence of steps is assumed unless otherwise stated.

h. Identification of components and parts should be complete. Equipment and system names should be highlighted by initial capitalization.

i. Instruction content should be written to communicate to the user.

j. Expected results of routine tasks need not be stated.

k. When actions are required based upon receipt of an annunciated alarm, list the setpoint of the alarm for ease of verification.

l. When requiring resetting or restoration of an alarm or trip, list the expected results immediately, following the resetting or restoration, if it would be beneficial to the operator.

m. When considered beneficial to the user for proper understanding and performance, describe the system response time associated with performance of the instruction.

n. When system response dictates a time frame within which the instruction must be accomplished, prescribe such time frame. If possible, however, avoid using time to initiate operator actions. Operator actions should be related to plant parameters.

o. When additional confirmation of system response is considered necessary, prescribe the backup readings to be made.

4.8.2 Use of Logic Terms

The logic terms AND, OR, NOT, IF NOT, WHEN, THEN, UNLESS and UNTIL, are often necessary to describe precisely a set of conditions or sequence of actions. When logic statements are used, logic terms will be highlighted so that all the conditions are clear to the operator. Emphasis will be achieved by using capitalization and underlining. All letters of the logic terms shall be capitalized and the words will be underlined.

Use other logic terms as follows:

a. When attention should be called to combinations of conditions, the word AND shall be placed between the description of each condition. The word AND shall not be used to join more than three conditions. If four or more conditions need to be joined, a list format shall be used.

b. The word OR shall be used when calling attention to alternate combinations of conditions. The use of the word OR shall be in the inclusive sense. The use of OR in the exclusive sense will be avoided whenever possible. To specify the exclusive "OR", the following may be used: "either A OR B but not both."

c. When Action Steps are contingent upon certain conditions or combinations of conditions, the step shall begin with the words IF or WHEN followed by a description of the condition or conditions (the antecedent), a comma, the word THEN, followed by the action to be taken (the consequent). WHEN is used for an expected condition. IF is used for an unexpected but possible condition.

d. Use of IF NOT should be limited to those cases in which the operator must respond to the second of two possible conditions. IF should be used to specify the first condition.

e. THEN shall not be used at the end of an Action Step to instruct the operator to perform the next step because it runs actions together.

f. DO NOT, CANNOT and BEFORE shall be used for emphasis in Action Steps.

4.8.3 Cautions

End Path Manual cautions shall be included in the written procedure in a format that makes them stand out from the steps of a procedure.

The cautions shall be placed immediately before the procedural steps to which they apply.

The cautions should have a row of asterisks before and after them.

Cautions shall extend across the entire page and shall be highlighted as shown in Figure 6. This placement of cautions helps ensure that the procedure user observes the caution before performing the step. It should be used to denote a potential hazard to equipment or personnel associated with or consequent to the subsequent instructional step. A caution statement should not include an action.

Example Caution:

****

CAUTION

Large reactor power oscillations may be observed while executing this step.

****

4.8.4 Notes

If additional information other than cautions is necessary to support an action instruction, a note should be used. A note should present information only, not instructions. The note should be centered and indented approximately eight spaces from the margin.

Example Note:

NOTE

The reactor head flange and head temperatures should be maintained greater than 70°F when head bolts are tensioned.

4.8.5 Calculations

Mathematical calculations should be minimized in the EOP's. If a value has to be determined in order to perform a procedural step, a chart or graph should be used whenever possible.

4.8.6 Use of Underlining

Underlining will be used for emphasis of logic terms, cautions, notes, miscellaneous emphasis and conditional statements.

4.8.7 Referencing and Branching to Other Procedures or Steps

a. Referencing

Referencing implies that an additional procedure or additional steps will be used as a supplement to the procedure presently in use. Referencing other steps within the procedure being used, either future steps or completed steps, should be minimized. When only a few steps are involved in the referencing, the steps should be stated in the procedure wherever they are needed.

b. Branching

Example of concurrent procedure use: IF while executing this procedure, any of the following primary containment parameters are exceeded, THEN ENTER the associated procedure in the Containment Control Section of this End Path Manual and EXECUTE it concurrently with this procedure.

Example of branching from one procedure to another: IF reactor vessel level CANNOT be maintained above 0 inches, THEN EXIT this End Path Procedure and ENTER the "Level Restoration Procedure" in the Contingency Section of this End Path Manual.

Use quotation marks to emphasize the title of the referenced or branched procedure, for example, THEN EXIT this procedure and ENTER the "Steam Cooling Procedure" in the Contingency Section of this End Path Manual.

4.8.8 Component Identification

With respect to identification of components, the following rules are to be followed:

a. Equipment, controls, and displays will be identified in operator language (common usage) terms. These terms may not always match engraved names on panels but will be complete.

b. When the engraved names and numbers of panel placards and alarm windows are specifically the item of concern in the procedure, the engraving should be quoted verbatim and emphasized by using all capitals.

c. The names of plant system titles are emphasized by initial capitalization.

d. If the component is seldom used or it is felt that the component would be difficult to find, location information should be given in parentheses following the identification.

4.8.9 Level of Detail

Too much detail in EOP's should be avoided in the interest of being able to effectively execute the instructions in a timely manner. The level of detail required is the detail that a newly trained and licensed operator would desire during an emergency condition.

To assist in identifying the appropriate level of detail, the following examples of verb use may be used:

a. For power-driven rotating equipment, use START, STOP.

b. For valves, use OPEN, CLOSE, THROTTLE open, THROTTLE close, THROTTLE.

c. For power distribution breakers, use SYNCHRONIZE, CLOSE and TRIP.

d. For control switches with a position placement that establishes a condition, the verb "PLACE" should be used, along with the engraved name of the desired position, i.e., PLACE the Mode Switch to "SHUTDOWN."

e. Standard practices for observing abnormal results need not be prescribed within procedural steps. For example, observation of noise, vibration, erratic flow, or discharge pressure need not be specified by steps that start pumps.

4.8.10 Printed Operator Aids

When information is presented using graphs, charts, tables, and figures, these aids must be self-explanatory, legible, and readable under the expected conditions of use and within the reading precision of the operator.

a. Units of Measure

Units of measure on figures, tables and attachments should be given for numerical values that represent observed measurement data, or calculated results. A virgule (slant line) should be used instead of "per."

Examples: ft/sec, lbs/hr

b. Titles and Headings

Capitalization should be used for references to tables and figures within text material, and column headings with a table.

Examples: Refer to Figure 201 for . . . .
. . . as shown in Table 201, Equipment Power Supplies, the . . . .

c. Figure, Table and Attachment Numbering

Sequential arabic numbers should be assigned to figures, tables, and attachments in separate series. The sequence should correspond with the order of their reference in the text. The symbol "#" and abbreviation "No." are unnecessary and should not be used. The number alone suffices.

Examples: Figure 1, Figure 2, etc.
Table 1, Table 2, etc.
Attachment 1, Attachment 2, etc.

Page identification for attachments should consist of a block of information that identifies (1) procedure number, (2) attachment number, (3) page number, and (4) revision number. Page numbering of attachments should meet the requirements of Subsection 4.6.

Section numbering for attachments should be in accordance with Subsection 4.7.3.

4.8.11 Revision To Procedures

When changes occur in the plant design, Technical Specifications, Technical Guidelines, Writers' Guide, other plant procedures or Control Room that will affect the procedures, the procedures should be revised on a timely basis to reflect these changes. In addition, when operating and training experience, simulator exercises, control room walk-throughs or other information indicate that incorrect or incomplete information exists in the procedures, the procedures should be revised on a timely basis. These changes should be reviewed to ensure consistency with the Technical Guidelines and the Writers' Guide. Operators should be encouraged to suggest improvements to the procedures.

5.0 MECHANICS OF STYLE

5.1 SPELLING

Spelling should be consistent with modern usage. When a choice of spelling is offered by a dictionary, the first spelling should be used.

5.2 HYPHENATION

Hyphens are used between elements of a compound word when usage calls for it. The following rules should be followed for hyphenation:

a. When doubt exists, the compound word should be restructured to avoid hyphenation.

b. Hyphens should be used in the following circumstances:

- o In compound numerals from twenty-one to ninety-nine; for example: one hundred thirty-four

- o In fractions; examples: one-half, two-thirds.

- o In compounds with "self"; examples: self-contained, self-lubricated.

- o When the last letter of the first word is the same vowel as the first letter of the second word--as an alternative, two words may be used; example: fire-escape or fire escape.

- o When misleading or awkward consonants would result by joining the words; example: bell-like.

- o To avoid confusion with another word; examples: re-cover to prevent confusion with recover, pre-position to avoid confusion with preposition.

- o When a letter is linked with a noun; examples: X-ray, O-ring, U-bolt, I-beam.

- o To separate chemical elements and their atomic weight; examples: Uranium-235, U-235.

5.3 PUNCTUATION

Punctuation should be used only as necessary to aid reading and prevent misunderstanding. Word order should be selected to require a minimum of punctuation. When extensive punctuation is necessary for clarity, the sentence should be rewritten and possibly made into several sentences. Punctuation should be in accordance with the following rules:

5.3.1 Brackets

Do not use brackets.

5.3.2 Colon

Use a colon to indicate that a list of items is to follow for example, RESTORE cooling flow as follows:

5.3.3 Comma

Use of many commas is a sign the instruction is too complex and needs to be rewritten. Therefore, evaluate the number of commas to ensure the instruction is not too complex.

Use a comma after conditional phrases for clarity and ease of reading. Example: WHEN level decreases to 60 inches, THEN START pump . . . .

5.3.4 Parentheses

Parentheses shall be used to indicate alternative items in a procedure, instruction, or equipment numbers.

5.3.5 Period

Use a period at the end of complete sentences and for indicating the decimal place in numbers.

5.4 VOCABULARY

Words used in procedures should convey precise understanding to the trained person. The following rules apply:

a. Use simple words. Simple words are usually short words of few syllables. Simple words are generally common words.

b. Use common usage if it makes the procedure easier to understand.

c. Use words that are concrete rather than vague, specific rather than general, familiar rather than formal, precise rather than blanket.

d. Define key words that may be understood in more than one sense.

e. Verbs with specific meaning should be used. Examples are listed in Table 1.

f. Equipment status should be denoted as follows:

- o Available or operable--These words mean that a system, subsystem, train, component, or device is capable of performing its specified function(s) in the intended manner. Implicit in this definition is the assumption that all necessary attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment required for the system, subsystem, train component, or device to perform its function(s) are also capable of performing related support function(s).

5.5 NUMERICAL VALUES

The use of numerical values should remain consistent with those rules mentioned in Subsection 3.23.

5.6 ABBREVIATIONS, LETTER SYMBOLS AND ACRONYMS

The use of abbreviations, letter symbols and acronyms should remain consistent with those rules mentioned in Subsection 3.24.

6.0 TYPING FORMAT

6.1 GENERAL TYPING FORMAT

For the End Path Manual Procedures, the following general requirements shall be followed:

a. Paper size should be 8-1/2 x 11 inches.

b. White bond paper should be used.

c. Procedures may be typed on an electric typewriter or word processor.

d. Elite, pitch 12 typewriter element may be used.

6.2 PAGE ARRANGEMENT

a. Page margins are one inch from the left edge of paper and one inch from the right edge of paper.

b. Page identification information will be centered and one inch from the bottom of the page.

c. The text will begin 1-1/4 inches from the top of the paper and end at least three line spaces above the page information. Tables and figures shall be readable with the page so arranged. Rotation of printed matter should be minimized for Emergency Instructions.

6.3 HEADING AND TEXT ARRANGEMENT

Block style, as illustrated in Figure 6 is to be used. Section headings shall be in full capitals, with an underscore.

a. Section numbers shall begin one inch from the left edge of page.

b. Two line spaces shall be allowed between headings and respective text.

c. Two line spaces shall be allowed between paragraphs.

d. Text will be typed using one line spacing.

6.4 BREAKING OF WORDS

Breaking of words shall be avoided to facilitate operator reading.

6.5 ROTATION OF PAGES

If pages need to be rotated, these rules shall be followed:

a. The top of the page with rotated print is the normal left-hand edge.

b. The page margins do not rotate.

c. Page identification and numbering will not be rotated.

6.6 PRINTED OPERATOR AIDS

6.6.1 Figures

Figures include graphs, drawings, diagrams and illustrations. The following rules are established:

a. The figure number and its title are placed three line spaces below the figure field.

b. The figure number and title should be of elite type, pitch 12.

c. The figure field must not violate specified page margins.

d. The figure field should be of sufficient size to offer good readability.

e. The essential message should be clear; simple presentations are preferred.

f. Grid lines of graphs should be at least 1/8-inch apart; numbered grid lines should be bolder than unnumbered grid lines.

g. Labeling of items within the figure should be accompanied by arrows pointing to the item.

h. The items within the figure should be oriented naturally insofar as possible. For example, height on a graph should be along the vertical axis.

i. In general, items within the figure should be labeled. Typed labels should use elite type, pitch 12. Handwritten labels should be printed, using all capitals, with letters and numbers at least 1/8-inch high.

j. All lines in figures should be reproducible.

6.6.2 Tables

Tables should be typed using the following rules:

a. Type style and size should be the same as that for the rest of the procedure when possible.

b. The table number and title should be located above the table field and three line spaces below preceding text.

c. A heading should be entered for each column and centered within the column; the first letter of words in the column headings should be capitalized.

d. Horizontal lines should be placed above and below the column headings; vertical lines, while desirable, are not necessary or required.

e. Tabular headings should be aligned as follows:

   o Horizontally by related entries.

   o Vertically by decimal point for numerical entries.

   o Vertically by first letter for word entries; however, run-over lines should be indented three spaces.

f. Double spacing between horizontal entries suffices to segregate such entries, although horizontal lines may also be used if desired. If used, double horizontal lines should be used above and below the column headings.

g. There should not be a vacant cell in the table. If no entry is necessary, "NA" should be entered to indicate not applicable.

6.7 CAUTIONS AND NOTES

All notes and cautions should be distinguishable from the rest of the text by using the following format (see Subsection 4.8.3).

a. The applicable heading <u>"NOTE"</u> and <u>"CAUTION"</u> should be capitalized, centered.

b. The text of the note or caution should be block format, single spaced.

c. Cautions shall be further highlighted by asterisks two line spaces above the heading and two spaces below the last line of the text.

d. Cautions should be extended across the entire page.

e. Notes should be centered and indented eight spaces from the margin (see Subsection 4.8.4).

6.8 USE OF FOLDOUT PAGES

When used, a foldout page is treated as a single page. It should follow the same format as standard page except the width is different. The page should be folded so that a small margin exists between the fold and the right-hand edge of standard pages. This will reduce wear of the fold.

6.9 USE OF OVERSIZED PAGES IN END PATH MANUALS

Oversized pages should not be used. They should be reorganized or reduced to a standard page. If this cannot be done, a foldout page should be used.

6.10 USE OF REDUCED PAGES

Reduced pages should be avoided whenever possible. Final size of reduced pages should be standard page size. Reduced pages should be readable.

7.0 REPRODUCTION

Reproduction will be done on a standard copier.

APPENDIX III

Brunswick Steam Electric Plant
Validation/Verification Program
for Emergency Operating Procedures

TABLE OF CONTENTS

A. DESK TOP REVIEW

The Desk Top Review of the Brunswick EOP's consisted of the classroom training sessions conducted at the plant training facility.

During these sessions trainees were encouraged to ask questions and make comments concerning the new EOP's. These comments were of both technical and human engineering nature.

All important comments and recommendations were recorded by the instructor and used to revise the EOP's when desirable or appropriate.

Some examples of licensed personnel comments and the EOP development group's response is included as follows:

1. Is it necessary to manually scram the Reactor as the first action on the flowcharts?

   Response:

   Yes - This is a conservative action as a backup to the automatic scram.

2. Some old EI's require the operator to execute a manual scram. Where is this guidance to be located in the new procedures?

   Response:

   This guidance will be contained in Annunciator Procedures or Abnormal Operating Procedures.

3. The mode switch step appears too soon on the flowcharts. This could result in a Group 1 isolation on Unit 2 due to high steam line flow.

   Response:

   This step will be relocated on the next revision to the flowcharts.

4. Should a reference be made, on the flowcharts, to Operating or "other" procedures?

   Response:

   If the actions on the flowcharts do not reference Operating Procedures and the operator feels it necessary, these procedures may be used.

5. The Reactor should not be suddenly depressurized (Manual ADS) unless it is absolutely necessary.

Response:

The flowcharts will be revised to prevent unnecessary Manual ADS.

6. Why is the service water supply to the Vital Header not checked on the flowcharts?

Resonse:

The flowcharts will be revised to include steps concerning the Vital Header.

7. The flowcharts should contain earlier guidance for reactor water level control.

Response:

Revisions will be made on the flowcharts to provide guidance for earlier level control.

8. When placing the RHR System in suppression pool cooling, it is unclear which loop to use and exactly what the lineup should be.

Response:

Loop selection will be left to the operator's discretion. Specifying a certain loop would unnecessarily restrict the operator's ability to recognize plant conditions.

9. Is it necessary to monitor the diesel load when starting small motors such as Drywell Cooling Fan?

Response:

Yes - The diesels could be heavily loaded at the time the fan motors are started.

10. After a loss of off-site power and automatic diesel generator start, the RPS MG Sets should be started locally, to allow resetting of RPS and group isolations.

Response:

This step has been added on the flowcharts.

11. Should there be guidance provided to the operator which would prevent the second opening of a SRV shortly after it has been opened?

This would minimize the hazard of the SRV opening when the tail pipe contains an above normal amount of water.

The SRV opening sequence is specified on the flowcharts and will be posted in the Control Room. This, in conjunction with the SRV memory lights, should be sufficient guidance.

12. Color code, or change, the path-to-path arrow symbols to geometric symbols, e.g., circle, square, triangle, etc.

Response:

The path-to-path arrows will be color coded on the flowcharts that are used in the Control Room.

13. The path specific parameters should be highlighted.

Response:

These parameters have been highlighted by using heavy lines for the decision symbol.

14. At the exit points from the flowcharts the word "Procedure" is confusing; it is suggested that the words "End Path Manual" be used.

Example: GO TO END PATH
MANUAL 5 SECTION MM

Response:

This has been revised on the new flowcharts.

15. The connecting lines at the lower right portion of Flowchart 3 are too close.

Response:

This situation has been corrected on the latest revision of Flowchart 3.

B. SIMULATOR EXERCISES

During the early stages of the Brunswick EOP development process, the Browns Ferry simulator was used several times for conducting simulated emergency exercises, using both the old Event Oriented Emergency Instructions and the new Symptomatic or Function Oriented EOP's.

The following multiple failure exercises (problems) are examples of the scenarios used for simulator validation of the new EOP's:

Problem 1

Initial Conditions:	100% Power
Equipment Failures:	Loss of Off-Site Power Failure of Two Diesels Loss of HPCI Break in the Drywell

Problem 2

Initial Conditions:	100% Power
Equipment Failures:	Loss of RBCCW Loss of Drywell Coolers

Problem 3

Initial Conditions:	100% Power
Equipment Failures:	Loss of Off-Site Power Failure of Two Diesels Loss of HPCI

Problem 4

Initial Conditions:	100% Power
Equipment Failures:	Large Condenser Tube Leak Loss of RCIC Loss of HPCI

The conclusions following these initial simulator exercises indicated that the Brunswick approach, i.e., flowcharts for Immediate Action Steps, to Symptom Based EOP's was a viable solution to the EOP problem and that the operators quickly adapted to the new format.

The Limerick simulator was used in 1982 for training all licensed personnel in the use of the new EOP's. A list of simulator exercises was developed which provided adequate exposure to all portions of the Brunswick Flowcharts.

The 1983 simulator training was conducted at the Hatch simulator. The new EOP's were again used for this training.

The simulator exercises used were chosen from the following list:

Exercise No	Description
1	Loss of Instrument Air -- Manual Scram
2	Loss of CRD Pumps - Manual Scram
3	IRM Failure - Automatic Reactor Scram
4	Loss of Feedwater - Startup Mode
5	Loss of Feedwater - Run Mode
6	EHC Failure - Bypass Valves Fail Closed
7	EHC Failure - Bypass Valves Fail Open Loss of HPCI Loss of RCIC
8	EHC Failure - Bypass Valves Fail Closed Loss of Off-Site Power
9	LOCA - Small
10	Loss of Feedwater LOCA
11	Loss of Off-Site Power Loss of HPCI Loss of RCIC
12	Stuck Open SRV - Manual Scram
13	Turbine Trip Bypass Valves Fail Closed
14	Turbine Trip Stuck Open Bypass Valve LOCA - Small

Exercise No	Description
15	Turbine Trip - High Power
16	Fuel Cladding Failure
17	Loss of Coolant - Small
18	EHC System Malfunction - Pressure Regulator Oscillation
19	Loss of Feedwater
20	Steam Leak Outside Containment
21	Loss of Coolant Accident
22	Loss of Vacuum
23	Loss of Feedwater Loss of HPCI Loss of RCIC
24	Condenser Tube Leak Loss of HPCI Loss of RCIC LOCA
25	Turbine Trip Stuck Open Relief Valve (SORV)
26	Turbine Trip Turbine Bypass Valves (BPV) - Failed Closed Loss of HPCI
27	Turbine Trip Feedwater Regulator Failure
28	Steam Line Break Loss of HPCI Loss of RCIC
29	Loss of Feedwater LOCA

Exercise No	Description
30	High Conductivity - Manual Scram
31	MSIV Closure LOCA
32	EHC Failure - Pressure Regulator Failure - Low EHC Pressure Regulator Fails - High
33	Turbine Trip LOCA
34	Recirculation Pump Trip

An example of a simulator exercise is included (see Figure 1).

SIMULATOR EXERCISE

EXERCISE: EHC Failure - Bypass Valves Fail Open
Loss of HPCI
Loss of RCIC

FILE NO. 7-3F6.7

OBJECTIVES: Upon completion of this exercise the student will be able to:

Enter the EOP's (flowcharts) upon reactor scram and return the plant to a safe shutdown condition by correct execution of the EOP steps.

REFERENCES - RELATED LER's:

References: BSEP Symptomatic EOP Training Course
Related LER's: None

INITIAL CONDITIONS:

Power: 8%
Turbine on turning gear.
Mode switch in startup.

INSTRUCTOR GUIDE:

Direct the trainees to continue the startup.
Activate BPV failure.
Activate the other malfunctions after reactor scram.

SHIFT TURNOVER INFORMATION:

None

MALFUNCTIONS	OVERRIDES	REMOTE OPS.
Turbine Bypass Valves Fail Open		
HPCI Trip		
RCIC Trip		

SUPPLEMENTAL INFORMATION:

Fail HPCI and RCIC after the reactor scram has occurred.

EXPECTED RESPONSE: AS PER SERIAL RELATED CHECKOFF

Enter Path 2.

SUCCESSFUL COMPLETION OF THIS EXERCISE FULFILLS THE FOLLOWING NRC AND INPO REQUIREMENTS:

Harold Denton letter (NRC), March 28, 1980 - Enclosure 4, Items 16, 23 & 25.

Figure 1

C. CONTROL ROOM WALK-THROUGH

1. Introduction

The NRC Guideline for preparation of Emergency Operating Procedures, i.e, NUREG-0899, recommends that the licensee conduct Control Room Walk-Throughs as one method of the Validation/Verification of the Plant-Specific Emergency Operating Procedures.

2. Purpose

The purpose of the Control Room Walk-Through is to establish the accuracy of information and instructions contained in the Brunswick EOP's to determine that the procedure can be accurately and efficiently carried out, and to demonstrate that the procedures are adequate to mitigate transients and accidents. Both technical and human engineering adequacy have been addressed during this walk-through.

3. Brunswick Control Room Walk-Through

The Control Room Walk-Through shall be conducted by licensed operators. The team approach while using the flowcharts and End Path Manuals shall be stressed. Emphasis will be placed on information flow and interactions of the operators in the Control Room.

3.1 Objectives

The objectives of this walk-through are as follows:

a. Ensure the Brunswick EOP's are usable, i.e, they can be understood and followed without confusion, delays, errors, etc.

b. Ensure there is correspondence between the procedures and the control room/hardware, i.e., control/equipment/indications that are referenced, are available (inside and outside of the Control Room), use the same designations, use the same units of measurement, and operate, as specified in the procedures.

c. Ensure the language and level of information presentation in the EOP's is compatible with the minimum number, qualifications, training and experience of the operating staff.

3.2 Walk-Through Exercises

The following exercises shall be walked through in the Brunswick Control Room:

a. Manual Scram At Low Power (Startup Mode) Due To Loss Of Instrument Air

b. Turbine Trip At 100% Power

c. Loss of Feedwater At Low Power (Startup Mode)

d. Loss Of Feedwater At 100% Power

e. Fuel Cladding Failure At 100% Power

f. Steam Leak Inside Containment (Small Leak Assumed)

g. Loss of Coolant Accident Inside Drywell

h. Main Steam Line Rupture

i. EHC System Failure At 100% Power (Turbine Control And Bypass Valves Fail Open)

j. EHC System Failure At Low Power (Turbine Bypass Valves Fail Closed While Turbine Is On Turning Gear)

k. Loss Of Condenser Vacuum

l. Anticipated Transient Without Scram At 100% Power

m. Manual Scram Due To High Conductivity

n. Loss Of Feedwater
Loss Of HPCI
Loss of RCIC

o. Turbine Trip
   Stuck Open SRV

p. Turbine Trip
   Turbine Bypass Valves Fail Closed
   Loss Of HPCI

q. Loss Of Off-Site Power
   Loss Of HPCI
   Loss Of RCIC

An example of the Control Room Walk-Through Exercise is included (see Figure 2).

CONTROL ROOM EOP WALK-THROUGH EXERCISE - E.

1. Assumed initial conditions, i.e., power level, general state of the plant, etc: 100% POWER

2. Assumed malfunctions: LOSS OF COOLANT ACCIDENT - RECIRCULATION PUMP SUCTION PIPING RUPTURE

3. Procedures used, i.e., flowcharts and End Path Manual Procedures:

4. Exercise checkoffs:

	Yes	No
a. Easily Read	___	___
b. Read Rapidly Without Interruption	___	___
c. Precisely Understood	___	___
d. Understood Without Aid Of Additional Material	___	___
e. Reader Accepts Information Presented	___	___
f. Technically Correct	___	___
g. Nomenclature Consistent	___	___
h. Units Of Measurement Consistent	___	___
i. Physical Conflicts Between Staff Avoided	___	___
j. Duplication Of Tasks Avoided	___	___
k. Supervisor Able To Keep Up With Staff Actions	___	___

5. Remarks:

6. Exercise performed by:

SRO ______________________________

RO ______________________________

RO ______________________________

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Figure 2

D. GENERAL PHYSICS HUMAN FACTORS EVALUATION OF BRUNSWICK EMERGENCY INSTRUCTION FLOWCHARTS

General Physics Corporation has conducted a Human Factors Evaluation of the Brunswick EOP Flowcharts. The technical approach used was to conduct a literature review to develop a set of human factor guidelines for evaluating the format and implementation of EOP Flowcharts.

The guidelines were divided into eight areas: identification information, content, symbol coding, nomenclature/punctuation, functional flow and branching, readability, ease of use, and accommodation of revisions/multi-unit concerns.

The guidelines generated from the literature review were then compared to the latest revisions of the EOP Flowcharts.

Control Room Operators who had simulator experience and training in flowchart use were also interviewed.

As a result of the Human Factors Study, several changes have been made to the format and style of the flowcharts. These changes, such as highlighting key areas, have enhanced the usability of the flowcharts. All areas of concern identified by the Human Factors Study have been satisfactorily resolved.

ATTACHMENT A
APPENDIX III

ATTACHMENT A
Appendix III

Source of Parameters Used in
Brunswick's Technical Guideline

A. <u>CAUTIONS</u>

1. Caution #6

Parameter/Value: Temperature and indicated levels

Source: Calculation Procedure for Guidelines (Appendix C), Section 2, Page C2-9

2. Caution #8

Parameter/Value: Net positive suction head curves

Source:

Core Spray - Calculation Procedure for Guidelines (Appendix C), Section 26

HPCI - Calculation Procedure for Guidelines (Appendix C), Section 26

RCIC - Calculation Procedure for Guidelines (Appendix C), Section 26

RHR - Calculation Procedure for Guidelines (Appendix C), Section 26

3. Caution #9

Parameter/Value: Suppression pool high level suction interlocks

Source: Brunswick Technical Specifications
Table 3.3.3-2, Page 3/4 3-35

Parameter/Value: CST low level suction interlock

Source: Brunswick System Description-32.1
Page 15

4. Caution #11

Parameter/Value: Drywell pressure which initiates ECCS

Source: Brunswick Technical Specifications
Table 3.3.3-2, 2.a., Page 3/4 3-34

5. Caution #12

Parameter/Value: HPCI and RCIC minimum speed

Source: Brunswick Operating Procedures
HPCI - OP-19, Section 2.6, Page 1
RCIC - OP-16, Section 2.6, Page 1

6. Caution #13

Parameter/Value: Reactor cooldown rate

Source: Brunswick Technical Specification
Limiting Condition for Operation
3.4.6.1, Page 3/4 4-13

7. Caution #14

Parameter/Value: HPCI low pressure isolation setpoint

Source: Brunswick Technical Specifications
Table 3.3.2-2, 4.a.2, Page 3/4 3-19

8. Caution #15

Parameter/Value: SRV opening sequence

Source: Brunswick Drawing - 9527-D-2793
Brunswick Drawing - 9527-F-1131

9. Caution #17

Parameter/Value: Reactor cooldown rate

Source: Brunswick Technical Specification Limiting Condition for Operation 3.4.6.1, Page 3/4 4-13

10. Caution #23

Parameter/Value: Elevation of bottom of Internal Suppression Chamber to Drywell Vacuum Breakers

Source: Brunswick Drawing - 9527-F-2813

B. RPV CONTROL GUIDELINE

Purpose

Parameter/Value: Cold shutdown condition

Source: Brunswick Technical Specifications Table 1.2, Page 1-8

1. Reactor Control/Level

RC/L - 2

Parameter/Value: Reactor scram - low water level

Source: Brunswick Technical Specifications Table 2.2.1-1, Page 2-4

Parameter/Value: Turbine trip - high reactor water level

Source: Brunswick System Description-19 Table 2.4, Page 22

Parameter/Value: Condensate/Feedwater System

Source: Brunswick System Description-32 Section 3.2.7, Page 64

Parameter/Value: CRD System

Source: Brunswick System Description-08 Section 3, Page 21

Parameter/Value:	RCIC System
Source:	Brunswick System Description-16 Low: Table 2.4, Page 35 High: Section 3.1, Page 44
Parameter/Value:	HPCI System
Source:	Brunswick System Description-19 Low: Table 2.4, Page 22 High: Section 3.2, Page 37 and Section 3.3, Page 38
Parameter/Value:	Core Spray System
Source:	Brunswick System Description-18 Section 3.2.1, Page 15
Parameter/Value:	RHR System
Source:	Brunswick System Description-17 Section 3.2.1, Page 42

2. Reactor Control/Pressure

RC/P-1

Parameter/Value:	RPV pressure at which all Turbine Bypass Valves are fully open
Source:	Brunswick General Plant Operating Procedure-01, Section B.4.5.19

RC/P-2

Parameter/Value:	Lowest SRV lifting pressure
Source:	Brunswick System Description-20 Section 3.1, Page 23

RC/P-3

Parameter/Value:	Cold shutdown weight of boron
Source:	Calculation Procedure for Guidelines (Appendix C), Section 5, Page C5-4
Parameter/Value:	RPV cooldown rate LCO
Source:	Brunswick Technical Specification 3/4.4.6, Page 3/4 4-13

3. Reactor Control/Power

RC/Q-3

Parameter/Value: APRM downscale trip

Source: Brunswick System Description-09, Section 2.4, Page 2-5

RC/Q-4

Parameter/Value: Boron injection initiation temperature

Source: Calculation Procedure for Guidelines (Appendix C), Section 6, Page C6-12

RC/Q-4.3

Parameter/Value: Cold shutdown weight of boron

Source: Calculation Procedure for Guidelines (Appendix C), Section 5, Page C5-4

RC/Q-5.1

Parameter/Value: Fuses which deenergize RPS scram solenoids

Source: U-1 - Brunswick Drawing - FP-50015
U-2 - Brunswick Drawing - FP-55046

Parameter/Value: Scram Air Header Supply Valve

Source: U-1 - Brunswick Drawing - 9527-D-2517
Source: U-2 - Brunswick Drawing - 9527-D-25017

RC/Q-5.2

Parameter/Value: HCU Accumulator Charging Water Header Valve

Source: U-1 - Brunswick Drawing - 9527-D-2516
U-2 - Brunswick Drawing - 9527-D-25016

RC/Q-5.6

Parameter/Value: CRD withdrawal line vent

Source: U-1 - Brunswick Drawing - 9527-D-2517
U-2 - Brunswick Drawing - 9527-D-25017

C. CONTAINMENT CONTROL GUIDELINE

1. Entry conditions

Parameter/Value:	Most limiting suppression pool temperature LCO
Source:	Brunswick Technical Specification 3.6.2.1, Page 3/4 6-9
Parameter/Value:	Drywell temperature LCO
Source:	Brunswick Technical Specification 3.6.1.1, Page 3/4 6-8
Parameter/Value:	High drywell pressure scram setpoint
Source:	Brunswick Technical Specifications Table 2.2.1-1, Page 2-5
Parameter/Value:	Maximum suppression pool water level LCO
Source:	Brunswick Technical Specification 3.6.2.1 Page 3/4 6-9
Parameter/Value:	Minimum suppression pool water level LCO
Source:	Brunswick Technical Specification 3.6.2.1, Page 3/4 6-9

2. Suppression Pool Temperature

SP/T-2

Parameter/Value:	Most limiting suppression pool temperature LCO
Source:	Brunswick Technical Specification 3.6.2.1, Page 3/4 6-9

SP/T-3

Parameter/Value:	Boron injection initiation temperature
Source:	Calculation Procedure for Guidelines (Appendix C), Section 6, Page C6-12

SP/T-4

Parameter/Value: Heat capacity temperature limit curve

Source: Calculation Procedure for Guidelines (Appendix C), Section 3.0, Page C3-29

3. Drywell Temperature

DW/T-1

Parameter/Value: Drywell temperature LCO

Source: Brunswick Technical Specification 3.6.1.1, Page 3/4 6-8

DW/T-2

Parameter/Value: Drywell temperature near cold reference leg vertical runs

Source: Elevation and azimuth of Condensing Chamber and vertical runs - Brunswick Drawing - 9527-LL-70080, Sheets 6, 6A and 15

Elevation and azimuth of Drywell Temperature Detectors

Brunswick Drawing 9525-F-35036

DW/T-3

Parameter/Value: Maximum drywell design temperature

Source: Final Safety Analysis Report Page 6.2.1-4

Parameter/Value: Drywell spray initiation pressure - Limits A and B

Source: Calculation Procedure for Guidelines (Appendix C), Section 9, Page C9-21 and C9-22.

4. Primary Containment Pressure

PC/P-2

Parameter/Value:	Suppression chamber spray initiation pressure
Source:	Calculation Procedure for Guidelines (Appendix C), Section 11, Page C11-8

PC/P-3

Parameter/Value:	Suppression chamber spray initiation pressure
Source:	Calculation Procedure for Guidelines (Appendix C), Section 11, Page C11-8
Parameter/Value:	Drywell spray initiation pressure - Limits A and B
Source:	Calculation Procedure for Guidelines (Appendix C), Section 9, Page C9-21 and C9-22

PC/P-4

Parameter/Value:	Pressure suppression pressure
Source:	Calculation Procedure for Guidelines (Appendix C), Section 12, Page C12-20

PC/P-5

Parameter/Value:	Primary containment design pressure
Source:	Calculation Procedure for Guidelines (Appendix C), Section 13, Page C13-7

The operating margin gained through the use of a curve for this parameter does not warrant the additional complications imposed by a two-dimensional limit. Therefore, the curve has not been used and RPV flooding is required at the most limiting suppression chamber pressure.

PC/P-6

Parameter/Value: Primary containment pressure limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 14, Page C14-6

The operating margin gained through the use of a curve for this parameter does not warrant the additional complications imposed by a two-dimensional limit. Therefore, the curve has not been used and spraying of the Primary Containment is required at the most limiting suppression chamber pressure.

Parameter/Value: Drywell spray initiation pressure - Limits A and B

Source: Calculation Procedure for Guidelines (Appendix C), Section 9, Page C9-21 and C9-22

PC/P-7

Parameter/Value: Primary Containment pressure limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 14, Page C14-6

The operating margin gained through the use of a curve for this parameter does not warrant the additional complications imposed by a two-dimensional limit. Therefore, the curve has not been used and venting of the Primary Containment is required at the most limiting suppression chamber pressure.

5. Suppression Pool Level

SP/L-1

Parameter/Value: Maximum suppression pool water level LCO

Source: Brunswick Technical Specification 3.6.2.1 Page 3/4 6-9

Parameter/Value: Minimum suppression pool water level LCO

Source: Brunswick Technical Specification 3.6.2.1 Page 3/4 6-9

SP/L-2

Parameter/Value: Heat capacity level limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 15, Page C15-13

SP/L-3

Parameter/Value: Maximum suppression pool water level LCO

Source: Brunswick Technical Specification 3.6.2.1 Page 3/4 6-9

SP/L-3.2

Parameter/Value: Suppression pool load limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 4, Page C4-12

SP/L-3.3

Parameter/Value: Elevation of bottom of Mark I Internal Suppression Chamber to Drywell Vacuum Breakers

Source: Brunswick Drawing - 9527-F-2813

Parameter/Value: Drywell spray initiation pressure - Limits A and B

Source: Calculation Procedure for Guidelines (Appendix C), Section 9, Page C9-21 and C9-22

SP/L-3.4

Parameter/Value: Elevation of bottom of Mark I Internal Suppression Chamber to Drywell Vacuum Breakers

Source: Brunswick Drawing - 9527-F-2813

D. CONTINGENCIES

1. Level Restoration

C1-2

Parameter/Val e: RPV pressure at which core spray shutoff head is reached

Source: Brunswick System Description-18 Section 3.2.1, Page 15

Parameter/Value: HPCI low pressure isolation setpoint

Source: Brunswick System Description-19 Table 2.4, Page 22

Parameter/Value: ADS initiation setpoint

Source: Brunswick System Description-01 Table 2.4.1, Page 40

C1-4

Parameter/Value: Low level scram setpoint

Source: Brunswick Technical Specifications Table 2.2.1-1, Page 2-4

C1-6

Parameter/Value: HPCI low pressure isolation setpoint

Source: Brunswick Technical Specifications Table 3.3.3-2, 2a., Page 3/4 3-34

2. Emergency RPV Depressurization

C2-1.2

Parameter/Value:	Minimum number of SRV's required for emergency depressurization
Source:	Calculation Procedure for Guidelines (Appendix C), Section 17, Page C17-4
Parameter/Value:	SRV reopening pressure
Source:	Calculation Procedure for Guidelines (Appendix C), Section 18, Page C18-4

3. Steam Cooling

C3-1

Parameter/Value:	Minimum zero-injection RPV water level
Source:	Calculation Procedure for Guidelines (Appendix C), Section 19, Page C19-6 The lower range of BSEP RPV level instrumentation is -100 inches
Parameter/Value:	Minimun single SRV steam cooling pressure
Source:	Through a bounding calculation applicable to all plants, the RPV pressure producing steam flow through one SRV sufficient to limit peak cladding temperature to 2200°F has been determined to be 700 psig. This number is supplied by GE.

4. Core Cooling Without Level Restoration (Spray Cooling)

C4-2

Parameter/Value: RPV pressure for rated core spray flow

Source: Core Spray Pump Technical Manual (FP-5700)

5. Alternate Shutdown Cooling

C5-3

Parameter/Value: Minimum number of SRV's required for shutdown cooling

Source: Calculation Procedure for Guidelines (Appendix C), Section 20, Page C20-10

C5-6.1

Parameter/Value: Minimum alternate shutdown cooling RPV pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 20, Page C20-11

C5-6.2

Parameter/Value: Maximum alternate shutdown cooling RPV pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 20, Page C20-10

C5-6.3

Parameter/Value: Maximum RPV cooldown rate LCO

Source: Brunswick Technical Specification 3.4.6.1, Page 3/4 4-13

Parameter/Value: Minimum SRV reopening pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 18, C18-4

C5-7

Parameter/Value: Head tensioning limit

Source: Brunswick General Plant Operating Procedure-01, Section E.4.28

6. RPV Flooding

C6-1

Parameter/Value: Minimum number of SRV's required for emergency depressurization

Source: Calculation Procedure for Guidelines (Appendix C), Section 17, Page C17-4

C6-2.2

Parameter/Value: Minimum alternate RPV flooding pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 21, Page C21-7

C6-3.1

Parameter/Value: Minimum number of SRV's required for emergency depressurization

Source: Calculation Procedure for Guidelines (Appendix C), Section 17, Page C17-4

Parameter/Value: Minimum RPV flooding pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 22, Page C22-9

C6-3.2

Parameter/Value: Minimum RPV flooding pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 22, Page C22-9

C6-5.3

Parameter/Value: Minimum RPV flooding pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 22, Page C22-9

C6-5.4

Parameter/Value: Maximum core uncovery time limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 23, Page 23-5

C6-6

Parameter/Value: Primary containment pressure limit

Source: Calculation Procedure for Guidelines (Appendix C), Section 14, Page C14-6

The operating margin gained through the use of a curve for this parameter does not warrant the additional complication imposed by a two-dimensional limit. Therefore, the curve has not been used and RPV flooding is required at the most limiting suppression chamber pressure.

7. Level/Power Control

C7-1

Parameter/Value: APRM downscale trip

Source: Brunswick System Description-09 Section 2.4, Page 2-5

Parameter/Value: Boron injection initiation temperature

Source: Calculation Procedure for Guidelines (Appendix C), Section 6, Page C6-12

Parameter/Value: High drywell pressure scram setpoint

Source: Brunswick Technical Specifications Table 2.2.1-1, Page 2-4

C7-2

Parameter/Value: RPV pressure range for system operation

Source: See "Reactor Control/Level" Step B.1, Page 3 of 16

C7-2.2

Parameter/Value: Minimum alternate RPV flooding pressure

Source: Calculation Procedure for Guidelines (Appendix C), Section 21, Page C21-7

C7-3

Parameter/Value: Hot shutdown boron weight

Source: Calculation Procedure for Guidelines (Appendix C), Section 24, Page C24-5

Parameter/Value: Low level scram setpoint

Source: Brunswick Technical Specifications Table 2.2.1-1.4

Parameter/Value: High level trip setpoint

Source: Brunswick System Description-19 Table 2.4, Page 22

ATTACHMENT B
APPENDIX III

ATTACHMENT B
Appendix III

Use of Brunswick's Technical Guideline
in Emergency Operating Procedures

A. INTRODUCTION

The Technical Guideline was used throughout the Brunswick EOP's. However, the guideline was used as a guide only, not a procedure.

The Brunswick EOP's are very conservative, i.e., they are designed to bound a wide spectrum of emergency conditions, operational problems and potential emergency conditions by anticipating plant response to a vast number of failures.

The flowcharts have been designed to eliminate operator confusion associated with when to enter the EOP, and exactly what actions should be taken during the initial few minutes following the onset of the potential emergency condition.

The flowchart steps are usually completed within approximately 10 minutes, at which time the operator is directed to a Subsequent Actions Procedure Book, i.e., the End Path Manual. This manual has been designed from a human engineering standpoint to provide all required guidance for the operator to take the plant to a safe condition. The unique arrangement of this manual presents several procedures to the operator for concurrent use, which eliminates fumbling through several operating manuals at once.

The Brunswick EOP's consist of five flowcharts and End Path Manuals.

B. ENTRY CONDITIONS

The entry condition to the Brunswick EOP's is any condition which requires or initiates a reactor scram.

C. OPERATOR ACTIONS

1.	RC-1 If reactor scram has not been initiated, initiate reactor scram.

The first action on each Brunswick Flowchart directs the operator to manually scram the Reactor.

2.	Irrespective of the entry condition, execute Steps RC/L, RC/P and RC/Q concurrently.

RPV Water Level, Pressure and Power Steps or actions are executed throughout the Brunswick Flowcharts.

The flowchart steps are prioritized for the operator, which reduces the confusion created by concurrent use of procedures during the initial, usually fast moving, transient conditions of a potential emergency.

D. RC/L - REACTOR VESSEL LEVEL CONTROL

1.	RC/L Monitor and control RPV water level.

The Brunswick Operators are trained to constantly monitor and control RPV level.

2. RC/L-1 Confirm initiation of any of the following:

- o Isolation
- o ECCS
- o Emergency Diesel Generator

Initiate any of these which should have initiated but did not.

The flowchart directs the operator to verify Automatic Actions as required, e.g., on Path-4. The first Action Step past the key parameters directs the operator to verify automatic start or to manually start HPCI, RCIC and SBGT. Three steps later the operator is directed to verify closure of Groups 1, 2, 3, 6 and 8 Isolation Valves. If auxiliary power is not available (on any flowchart), the operator is directed to verify on or to manually start the Diesel Generators. The operator is also directed to start the Diesel Generators, RHR and Core Spray Pumps if the RPV water level decreases to +45 inches. This guidance is on the Yellow Brick Road, i.e., the wide dark line, shortly after the key parameters.

3. If while executing the following step:

- o Boron injection is required, enter CONTINGENCY #7.
- o RPV water level cannot be determined, RPV FLOODING IS REQUIRED; enter CONTINGENCY #6.
- o RPV flooding is required, enter CONTINGENCY #6.

If the Reactor does not scram, i.e., all control rods do not insert past position 06, or the power is above 3%, following the initiation of a scram signal, the operator is directed to Path 1. If boron injection is then required while on Path 1, the operator is directed to execute the Boron Injection Steps of Contingency #7.

If the RPV water level cannot be determined while on the flowchart, the operators are trained to answer all water level questions as if the level is low and/or decreasing. This will lead through the required steps to line up all high pressure and low pressure ECCS prior to exiting the flowchart. The End Path Procedure provides the following guidance: "IF while executing this procedure, reactor vessel level CANNOT be determined OR reactor vessel flooding is required, THEN EXIT this End Path Procedure and ENTER the "Flooding Procedure" in the Contingency section of this End Path Manual.

RPV flooding is required for two severe containment problems, i.e., when the primary containment temperature increases to the RPV saturation point and when the primary containment pressure reaches the design pressure.

The Brunswick Containment Control Procedures, primary containment temperature and primary containment pressure control direct the operator to the Flooding Procedure for each problem.

4. RC/L-2 Restore and maintain RPV water level between +162.5 inches (low level scram setpoint) and +208 inches (high level trip setpoint) with one or more of the following systems: #9 #10 #11

- o Condensate/Feedwater System 1182 - 0 psig RPV pressure range for system operation)
- o CRD System 1448 - 0 (RPV pressure range for system operation)
- o RCIC System 1210 - 62 psig (RPV pressure range for system operation) #12
- o HPCI System 1210 - 120 psig (RPV pressure range for system cperation)
- o Core Spray System 320 - 0 psig (RPV pressure range for system operation)
- o RHR System 237 - 0 psig (RPV pressure range for system operation)

Rather than merely listing systems to maintain vessel level, the Brunswick Flowcharts prioritize the use of systems by defining plant conditions through fault tree logic, e.g., on Path 4 the vessel level has decreased below +112 inches which automatically closes or directs the operator to close the MSIV's. The procedure then directs the operator to use HPCI, RCIC and CRD to maintain level, since the Feedwater System is now unavailable. If the operator is unable to maintain RPV level with high pressure systems, the Reactor is depressurized and low pressure systems are used to restore level.

On Paths 2 and 3, if the MSIV's are open or pressure is below 350 psig, the Condensate/Feedwater System is used to maintain RPV level. If the operator is unable to maintain level with Condensate/Feedwater, HPCI and/or RCIC are used. If level still cannot be maintained, the operator will be directed to Path 4 in preparation for LPCI or Core Spray use.

Paths 1 and 5 follow the same pattern; the most desirable system that is available is used to maintain level. Each flowchart specifies level to be maintained between +170 and +200 inches.

Instructions to restore and maintain level between +170 and +200 inches and a list of systems and pressure ranges are included as one of the first steps in each End Path Procedure.

5. If RPV water level cannot be restored and maintained above +162 inches (low level scram setpoint), maintain RPV water level above 0 inches (top of active fuel).

Each flowchart directs operators to continue increasing injection flow to the Reactor until level is either increasing, stable or above the high level trip setpoint. Each End Path Procedure provides guidance to maintain level between +170 and +200 inches. If this level cannot be maintained, the alternate band (above 0 inches) is specified.

6. If RPV water level can be maintained above 0 inches (top of active fuel) and the ADS Timer has initiated, prevent automatic RPV depressurization by resetting the ADS Timer.

Flowcharts 2, 3 and 4 do not contain this step since a high drywell pressure signal is necessary to initiate the ADS Timer. Flowcharts 1 and 5 contain this step.

If level control problems are encountered while in the End Path Manuals, operators will be directed to the Level Restoration Contingency, which contains the guidance to prevent automatic initiation of ADS, if RPV level can be maintained above 0 inches.

7. If RPV water level cannot be maintained above 0 inches (top of active fuel), enter CONTINGENCY #1.

If, while using the flowcharts, the RPV water level cannot be maintained in the normal range, the operator is directed to the level restoration actions (Contingency #1).

All End Path Procedures direct operators to Contingency #1 if level cannot be maintained above 0 inches.

8. If alternate shutdown cooling is required, enter CONTINGENCY #5.

End Path Procedures direct operators to GP-01 for the purpose of taking the Reactor to cold shutdown. If normal shutdown cooling cannot be established, Abnormal Operating Procedure-15 would be entered. AOP-15 prioritizes which method of alternate shutdown cooling is appropriate.

9. RC/L-3 Proceed to cold shutdown in accordance with GP-01.

When the emergency conditions no longer exist, i.e., the RPV level, pressure and power are under control (normal) and no containment problems exist, the operator exits the EOP and enters the General Operating Procedure to take the plant to the desired mode, e.g., hot standby or cold shutdown.

10. Cautions associated with Step RC/L.

a. Caution #9 is to be covered in training and indicated on the RTGB.

b. Caution #10 is placed in each End Path Manual prior to the first Operator Action Step.

c. Caution #11 is to be covered in training and included in the Users' Guide.

d. Caution #12 is to be placed on the RTGB near the HPCI and RCIC Speed Controllers.

E. REACTOR CONTROL/PRESSURE

1. RC/P Monitor and control RPV pressure.

The Brunswick Operators are trained to constantly monitor and control RPV pressure while executing the steps of the EOP.

2. If while executing the following steps:

- o Emergency RPV depressurization is anticipated, rapidly depressurize the RPV with Main Turbine Bypass Valves. #13

- o Emergency RPV depressurization or RPV flooding is required and less than seven (number of SRV's dedicated to ADS) SRV's are open, enter CONTINGENCY #2.

- o RPV flooding is required and at least seven (number of SRV's dedicated to ADS) SRV's are open, enter CONTINGENCY #6.

Emergency RPV depressurization is not expected to be required within the first few minutes following a reactor scram, i.e, while the operators are using the flowcharts. The only times the operator is directed to rapidly depressurize the RPV on the flowcharts is in extremely degraded, low water level situations, e.g., the water level is below the top of active fuel or the RPV pressure must be maintained below 350 psig to accommodate low pressure system injection.

It is unlikely that the Main Condenser would be available in this case. If depressurization is required while in the End Path Procedure, the operator is directed tc first attempt to use the Main Turbine Bypass Valves and then the SRV's.

In both flowcharts and End Path Procedures, if depressurization is required and cannot be accomplished with SRV's or to the Main Condenser, the operators are directed to Contingency #2 (Emergency Depressurization Procedure).

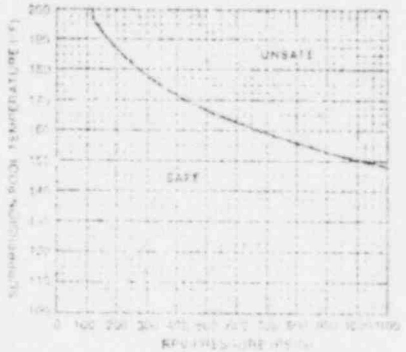
If flooding is required, the operator will be directed to Contingency #6 (Flooding Procedure) from the End Path Procedure. The Depressurization Steps are contained in Contingency #6. This simplifies the procedure by not going from an End Path Procedure, to a Depressurization Procedure, and then to a Flooding Procedure.

3. RC/P-1 If any SRV is cycling, manually open SRV's until RPV pressure drops to 950 psig (RPV pressure at which all Turbine Bypass Valves are fully open).

The flowchart directs the operator to prevent SRV cycling, e.g., immediately following the key parameters, the HPCI, RCIC and SRV's are used to control RPV pressure below 950 psig. This guidance is repeated several times throughout the flowchart at the appropriate locations. The End Path Procedures also contain adequate RPV pressure control guidance.

4. If while executing the following steps:

o Suppression pool temperature cannot be maintained below the heat capacity temperature limit, maintain RPV pressure below the limit. #8 #13 #14

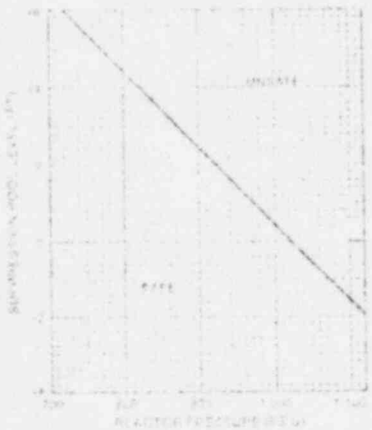


Heat Capacity Temperature Limit

The heat capacity temperature limit is included in the Brunswick Containment Control Procedure (Suppression Pool Temperature Control-SP/T) as follows: Step 3 of SP/T - IF suppression pool temperature CANNOT be maintained below the heat capacity temperature limit (See Figure 1, SP/T), REDUCE reactor pressure with the Bypass Valve Opening Jack or SRV's to maintain reactor pressure below the limit.

o Suppression pool water level cannot be maintained below the suppression pool load limit, maintain RPV pressure below the limit.

#13
#14



Suppression Pool Load Limit

The suppression pool load limit guidance is included in the Suppression Pool Level Control - High Level (SP/L) Procedure in the End Path Manual as follows: Step 4 of SP/L-High - IF suppression pool water CANNOT be maintained below the suppression pool limit (see Figure 1, SP/L-High), REDUCE reactor pressure with the Bypass Valve Opening Jack or SRV's to maintain reactor pressure below the limit.

o Steam cooling is required, enter procedure developed from CONTINGENCY #3.

If steam cooling is required the operator is directed to leave the Level Restoration Procedure at Section 4, Step 5. a. as follows: IF no ·igh pressure, low pressure or alternate coolant injection system is available, THEN EXIT this procedure and ENTER the "Steam Cooling Procedure" in the Contingency section of this End Path Manual.

5. If while executing the following steps:

- o Boron injection is required, and
- o The Main Condenser is available, and
- o There has been no indication of gross fuel failure or steam line break,

open MSIV's to reestablish the Main Condenser as a heat sink. #16

When entering the Brunswick EOP's, if an ATWS condition exists, the operator is quickly directed to Path-1 by the first (highest priority) key parameter. Path 1 directs ths operator to reopen the MSIV's and to reestablish the Main Condenser as a heat sink whether or not boron injection is required. At all locations in the EOP's, when this guidance is provided, the operator is directed to check the availability of the condenser and to check for indications of fuel failure or steam line break.

6. RC/P-2 Control RPV pressure below 1105 psig (lowest SRV lifting pressure) with the Main Turbine Bypass Valves. #14

RPV pressure control may be augmented by one or more of the following systems:

- o SRV's. If the continuous SRV pneumatic supply is or become unavailable, depressurize with sustained SRV opening. #15
- o HPCI #12
- o RCIC
- o RWCU (recirculation mode) if no boron has been injected into the RPV.
- o Main Steam Line Drains
- o RWCU (blowdown mode) if no boron has been injected into the RPV. Refer to sampling procedures prior to initiating blowdown.

All flowcharts contain Pressure Control Steps following the key parameters. The instruction is to maintain pressure below 950 psig with SRV's, if necessary. Following a scram, the Main Turbine Bypass Valves should automatically control reactor pressure if the MSIV's are open. If the bypass valves fail to control reactor pressure or the MSIV's close, it is appropriate to use SRV's to control pressure at this early point in a transient. All flowcharts also contain instructions to use HPCI and RCIC for pressure control if required. Flowcharts 1, 3, 4 and 5 also attempt to restore the Main Condenser as a heat sink if plant conditions allow.

The End Path Procedures prioritize the systems used for pressure control. The first priority is the Main Condenser, followed by SRV's, HPCI, RCIC, Steam Condensing mode, MSL Drains and RWCU. The choice at this point is left to the discretion of the operator.

7. If while executing the following steps the Reactor is not shut down, return to Step RC/P-2.

Reactor Pressure Control Steps are repeated throughout the flowcharts and End Path Procedures to ensure adequate pressure control is maintained.

8. RC/P-3 When RPV water level is stabilized and either:

- o All control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), or
- o 618 pounds (cold shutdown boron weight) of boron have been injected into the RPV, or
- o The Reactor is shut down and no boron has been injected into the RPV,

Depressurize the RPV and maintain cooldown rate below 100°F/hr (RPV cooldown rate LCO).

#14, #17

If all control rods inserted past position 06 following a scram, the operator would enter Flowchart 2, 3, 4 or 5. When the reactor and containment parameters have stabilized, the End Path Procedure will direct operators to GP-01 for Hot Standby or Cold Shutdown, as required.

If boron has been injected, End Path Manual 1 requires 618 pounds of boron to be injected or all control rods to be inserted past position 06 before a cooldown is commenced.

In either case, cooldown rate is limited to less than 100°F/hr by the procedure.

9.	RC/P-4	When the RHR shutdown cooling interlocks clear, initiate the shutdown cooling mode or RHR. #18 If the RHR shutdown cooling mode cannot be established and further cooldown is required, continue to cool down, using one or more of the systems used for depressurization. If RPV cooldown is required but cannot be accomplished and all control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), ALTERNATE SHUTDOWN COOLING IS REQUIRED; enter CONTINGENCY #5.

Shutdown cooling is established per GP-01 or in End Path Manual 1 if boron has been injected. In either case, if normal shutdown cooling cannot be established, operators are directed to Abnormal Operating Procedure-15 (Alternate Shutdown Cooling Methods) for the proper guidance to establish an alternate means of shutdown cooling.

10.	RC/P-5	Proceed to cold shutdown in accordance with GP-01.

End Paths 2, 3, 4 and 5 direct the operator to proceed to cold shutdown per GP-01. If boron has been injected, operators will remain in End Path 1, which contains the necessary guidance to prevent inadvertent criticality and limit the spread of boron to other plant systems.

11. Cautions associated with Step RC/P.

a. Caution #8 is to be placed on the RTGB as NPSH graphs for HPCI, RCIC, RHR and Core Spray.

b. Caution #12 is to be placed on the RTGB near the HPCI and RCIC Speed Controllers.

c. Caution #13 is included in the Users' Guide. If the Reactor is rapidly depressurized, the operator is aware that cooldown rates will be exceeded.

d. Caution #14 is included in the EOP's anytime the Reactor is depressurized.

e. Caution #15 is mounted on the RTGB and is included in the flowcharts and End Path Manuals anytime the operator is directed to use the SRV's.

f. Caution #16 is written into the Level/Power Control Flowchart and the associated End Path Procedures.

g. Caution #17 is included in the Users' Guide. If cooldown rates in excess of 100°F/hr are required, the procedure will direct the operator to do so.

h. Caution #18 is included in the flowcharts and End Path Manuals anytime RHR is to be used in any mode other than LPCI.

F. REACTOR CONTROL/POWER - RC/Q

1. RC/Q Monitor and control reactor power.

The Brunswick Operators are trained to monitor reactor power. The first key parameter on the Brunswick Flowchart directs the operator to determine whether or not the control rods are inserted beyond position 06 and that reactor power is less than 3%.

2. If while executing the following steps:

- o All control rods are inserted beyond position 06 (maximum subcritical banked withdrawal position), terminate boron injection.
- o The Reactor is shut down and no boron has been injected into the RPV, enter GP-01.

If the Reactor fails to shut down upon the initiation of a scram signal, the operator is directed, by the first key parameter, to go to Path 1. If boron is not injected and if the control rods can be fully inserted, the operator will be directed to return to one of the other flowcharts, i.e., Path 2, 3, 4 or 5. However, if boron injection is initiated, the operator remains on Path 1 or End Path Manual 1. Normal Operating Procedures (GP-01) will not be entered if boron has been injected into the Reactor.

3. RC/Q-1 Confirm or place the Reactor Mode Switch in SHUTDOWN.

All flowcharts require placing the mode switch to shutdown. Path 1 places the mode switch in shutdown only if the MSIV's are closed. This prevents an MSIV closure and subsequent loss of the Main Condenser as a heat sink.

4. RC/Q-2 If the Main Turbine Generator is on line and the MSIV's are open, confirm or initiate recirculation flow runback to minimum.

On Path 1, the Reactor Recirculation Pumps are placed at minimum speed as one of the initial actions.

5. RC/Q-3 If reactor power is above 3% (APRM downscale trip) or cannot be determined, trip the recirculation pumps.

On Path 1, the Reactor Recirculation Pumps are tripped following runback to minimum speed if power is above 3%.

6. Execute Steps RC/Q-4 and RC/Q-5 concurrently.

Flowchart 1 contains the necessary guidance for boron injection and also requires the execution of Local Emergency Procedure-02 (Alternate Control Rod Insertion) concurrently with the flowchart.

7. RC/Q-4 If the Reactor cannot be shut down before suppression pool temperature reaches 110°F (boron injection initiation temperature), BORON INJECTION IS REQUIRED; inject boron into the RPV with SLC and prevent automatic initiation of ADS. #19

This guidance is contained on Path 1.

8.	RC/Q-4.1	If boron cannot be injected with SLC, inject boron into the RPV by one or more of the following methods: o CRD o RWCU o Feedwater o HPCI o RCIC

If neither SLC Pump will operate, the operator is directed to LEP-03 (Alternate Boron Injection) which contains the steps necessary to inject boron from systems other than SLC.

9.	RC/Q-4.2	If boron is not being injected into the RPV by RWCU, confirm automatic isolation of or manually isolate RWCU.

If boron injection is required and a SLC Pump is successfully started, RWCU will be isolated. If an SLC Pump cannot be started, RWCU will be isolated in LEP-03, if it is not being used to inject boron.

10.	RC/Q-4.3	Continue to inject boron until 618 pounds (cold shutdown boron weight) of boron have been injected into the RPV.

If boron injection is required, operators will be directed to Contingency #7 (Level/Power Control Flowchart).

11. RC/Q-5 Insert control rods as follows:

Local Emergency Procedure-02 (Alternate Control Rod Insertion) contains Steps RC.Q-5.1 through RC/Q-5.6. This LEP will be entered anytime all control rods are not inserted past position 06 following a scram.

12. Cautions associated with Step RC/Q.

a. Caution #19 is in Flowchart 1 End Path Procedures.

b. Caution #20 is in LEP-02 (Alternate Control Rod Insertion).

G. CONTAINMENT CONTROL

The Brunswick Containment Control Procedures are located in the Containment Control section of each End Path Manual. These procedures are not expected to be needed immediately following the onset of a potential emergency condition. However, for those conditions requiring entry into the Containment Control Procedures prior to the time the Reactor is scrammed, the initial EOP guidance has been included in other procedures. For example, should the suppression pool temperature exceed 95°F during normal operation, an Abnormal Operating Procedure (AOP-14) provides guidance for the operator to initiate suppression pool cooling and to scram the Reactor prior to the pool temperature reaching 110°F.

Upon manual scram, the EOP would be entered, Immediate Action (flowchart) Steps executed and the End Path Procedure entered, at which time the operator is directed to enter the Containment Control Procedures (if an entry condition exists) and to execute the Containment Control Procedure concurrently with the End Path Procedure.

1. Entry Conditions

The entry conditions to the Brunswick Containment Control Procedures are identical to the Technical Guideline entry conditions.

The entry condition to the Primary Containment High Pressure Procedure (2 psig) is also a reactor scram, which is the entry condition to the Brunswick EOP's. Upon entry to the EOP's the operator is directed to Path 5. This path provides guidance for the operator to get the Reactor into a safe condition, i.e., bounds the potential emergency conditions by directing the operator to perform the correct initial actions to ensure safe shutdown. The operator exits the flowchart and is then directed, by the End Path Procedure, to enter the Containment Control Procedures as necessary.

2. Operator Actions

The Brunswick Operators are trained to enter the Containment Control Procedures from the End Path Procedures and execute them concurrently.

3. Suppression Pool Temperature Control (SP/T)

Technical Guideline Steps	Brunswick Operator Action Steps
SP/T-1	Annunciator Procedure A-3, 1-10
Caution #18	SP/T Prior to Step 1
SP/T-2	SP/T Step 1
SP/T-3	Abnormal Operating Procedure-14
Caution #8	Mounted on RTGB
Caution #13	Training - Users' Guide
Caution #14	SP/T Prior to Step 4 a.
SP/T-4	SP/T Steps 3, 4 a. and 4 b.

4. Drywell Temperature Control (DW/T)

Technical Guideline Steps	Brunswick Operator Action Steps
Caution #6	RTGB, Users' Guide and Training
DW/T-1	DW/T Steps 1 and 2
DW/T-2	DW/T Step 3
Caution #18	Prior to DW/T Step 4
DW/T-3	DW/T Step 4
DW/T-4	DW/T Step 5

5. Primary Containment Pressure - High (PC/P)

Technical Guideline Steps	Brunswick Operator Action Steps
Caution #21	Prior to PC/P Step 4
PC/P-1	PC/P Step 9
Caution #8	RTGB
Caution #18	Prior to PC/P Step 10
PC/P-2	PC/P Step 10
Caution #18	Prior to PC/P Step 10
PC/P-3	PC/P Steps 11 a. and 11 b.
PC/P-4	PC/P Steps 12 a. and 12 b.
PC/P-5	PC/P Step 13
PC/P-6	PC/P Steps 14 a. and 14 b.
PC/P-7	PC/P Step 15

6. Suppression Pool Level Control

Technical Guideline Steps	Brunswick Operator Action Steps
Caution #8	RTGB
Caution #9	RTGB
SP/L-1	SP/L-Low Step 3
SP/L-2	SP/L-Low Steps 6 a. and 6 b.
SP/L-3	SP/L-Low Step 3
SP/L-3.1	SP/L-High Step 3
SP/L-3.2	SP/L-High Steps 4 and 5
Caution #18	Prior to SP/L-High Step 5 a.
SP/L-3.3	SP/L-High Step 6
Caution #23	Prior to SP/L-High Step 6
SP/L-3.4	SP/L-High Step 7

H. LEVEL RESTORATION (CONTINGENCY #1)

Box prior to Cl-1 - Special level resotration guidance is provided, in the Brunswick EOP's, when boron injection is required.

During ATWS conditions the operator is directed to Path 1. If boron injection is then required, the operator is directed to the Level/Power Control Procedure (flowchart) which contains appropriate level restoration guidance.

This arrangement simplifies the Brunswick EOP's by separating the Reactivity Control Operator Actions from the normal (non-ATWS) Operator Actions.

If flooding is required, Step 8 of the Brunswick Level Restoration Procedure directs the operator to the Flooding Procedure in the Contingency section of the End Path Manual.

Technical Guideline Steps	Brunswick Operator Action Steps
C1-1 Injection	Level Restoration Procedure (LRP) Step 1 - 4
Alternate Injection Subsystems	LRP Step 7 (LEP-01)
C1-2	LRP Step 10
C1-2 Box (Trend) (ADS)	LRP First step of each section LRP Step 9
C1-3	LRP Section 1
C1-4	LRP Section 2
C1-5	LRP Section 3
C1-6	LRP Section 4
C1-7	LRP Section 5

I. EMERGENCY RPV DEPRESSURIZATION

Technical Guideline Steps	Brunswick Operator Action Steps
C2-1	This guidance is provided in the Brunswick Level/ Power Contingency
C2-1.1	This guidance is included in the procedures prior to entering this Contingency, e.g., in the End Path Procedures or the Containment Control Procedures
C2-1.2	Emergency Depressurization Procedure (EDP) Step 1
C2-1.2 Box	If flooding is required, the Brunswick End Path or Containment Control Procedures direct the operator to the Flooding Procedure
C2-2	EDP Step 3

J. STEAM COOLING

The Steam Cooling Procedure in the Brunswick EOP's consists of a small flowchart printed on a standard page size and is located in the Contingency section of each End Path Manual.

The Brunswick Steam Cooling Flowchart directs the operator to depressurize the RPV if RPV depressurization is required or if any injection source is or becomes available while executing the Steam Cooling Steps.

The procedure directs the operator to open one SRV when the RPV water level decreases to -100 inches or cannot be determined.

The procedure directs the operator to open all ADS Valves when reactor pressure decreases to 700 psig and to enter the Emergency Depressurization Procedure if normal depressurization methods do not work.

K. SPRAY COOLING

The Spray Cooling Procedure consists of a small one-page flowchart similar to the Steam Cooling Procedure.

The flowchart directs the operator to terminate injection external to the primary containment when the RPV pressure is below 290 psig.

The Spray Cooling Procedure then directs the operator to enter the Level Restoration Procedure when RPV level can be maintained above the top of active fuel.

Caution #13 is included in operator training and in the Users' Guide.

L. ALTERNATE SHUTDOWN COOLING

This guidance is included in Brunswick AOP-15.

M. FLOODING PROCEDURE

ATWS and non-ATWS guidance has been separated in the Brunswick EOP's.

1. Non-ATWS Condition

In the non-ATWS condition, if RPV flooding is required, the operator is directed to enter the Flooding Procedure, which is located in the Contingency section of End Path Manuals 2, 3, 4 and 5.

Technical Guideline Steps	Brunswick Operator Action Steps
C6-1	Flooding Procedure (FP) Steps 3 and 4
C6-2	N/A
C6-3	FP Step 7
C6-3.1	FP Steps 7 and 8
C6-3.2	FP Step 9
C6-4	FP Steps 6 and 15
C6-5	FP Step 6
C6-5.1	FP Step 10
C6-5.2	FP Step 11
C6-5.2 (Box)	FP Step 14
C6-5.3	FP Step 12
C6-5.4	FP Step 14
C6-6	FP Steps 16 and 17

2. ATWS Condition

In the ATWS condition, if boron injection is not required, the operator will be directed to complete the Path 1 Steps, then enter the End Path Procedure. If flooding is required, the operator is directed to the ATWS Flooding Procedure, which is located in the Contingency section of the Path 1 End Path Manual.

In the ATWS condition, if boron has been injected, the operator is directed to enter the Level/Power Control Procedure (flowchart). The Level/Power Control Procedure contains the boron injection guidance and the ATWS flooding guidance.

If the Reactor is shut down, due to boron injection on the Level/Power Control Flowchart, the operator is directed to enter the Path 1 End Path Manual. If flooding is required, the operator is directed to enter the ATWS Flooding Procedure in the Contingency section of the End Path Manual.

Technical Guideline Steps	Brunswick Operator Action Steps
C6-1	ATWS-FP Steps 7 and 8
C6-2	ATWS-FP Step 2
C6-2 (Box)	ATWS-FP Step 1
C6-2.2	ATWS-FP Steps 9, 10 and 11
C6-2.3	ATWS-FP Step 13
C6-3	N/A
C6-4	ATWS-FP Steps 19 and 27
C6-5	ATWS-FP Step 19
C6-5.1	ATWS-FP Step 22
C6-5.2	ATWS-FP Step 23
C6-5.2 (Box)	ATWS-FP Step 26
C6-6	ATWS-FP Step 28

N. LEVEL/POWER CONTROL

The format used for level/power control at Brunswick is a flowchart. The entry condition to this procedure is, "boron injection is required."

The Reactor will be shut down prior to the operator exiting the Level/Power Control Flowchart. When the flowchart steps are completed, the operator is directed to the Path 1 End Path Procedures.

Box prior to Step C7-1 - The flowchart directs the operator to maintain the reactor power above 8% but as low as practicable anytime the RPV level cannot be determined. If the power cannot be determined or maintained above 8%, the flowchart directs the operator to flood the Reactor.

Step C7-1 - The Level/Power Control Flowchart directs the operator to lower the RPV water level, as necessary to suppress the power while boron is being injected. The procedure directs the operator to lower the water level until one of the following criteria is met: reactor power drops below 3%, RPV water level reaches top of active fuel or all SRV's remain closed and drywell pressure remains below 2.0 psig.

Box preceding Step C7-1 - A decision symbol on the flowchart directs the operator to the depressurization guidance. The operator is trained to return to this step if RPV depressurization is required.

Second box preceding Step C7-1 - The Brunswick Flowchart is designed to direct the operator to constantly monitor these parameters and to return to the steps when required.

Step C7-2 - The flowchart directs the operator to, "maintain reactor vessel level at the point to which it was lowered or if it wasn't deliberately lowered, to maintain the level between +170 and +200 inches.

The Level/Power Flowchart directs the operator to maintain the RPV water level above the top of active fuel, if it cannot be maintained at the level to which it was lowered.

If the RPV level cannot be maintained above the top of active fuel, the flowchart directs the operator to depressurize the Reactor.

Step C7-21 - The flowchart directs the operator to, "lower reactor vessel level by terminating and preventing injection from all sources, with the exception of SLC and CRD."

Step C7-2.2 - The Level/Power Control Flowchart directs the operator to flood the Reactor by injecting into the RPV with the injection systems and, if necessary, the Alternate Injection Systems.

The End Path Procedure associated with the Level/Power Control Flowchart reminds the operator that if the Reactor does not shut down upon raising the water level, the boron has not been injected into the Reactor. The operator should return to Step C7-1 to control reactor power.

Step C7-3 - When 319 pounds of boron have been pumped into the Reactor, the flowchart directs the operator to restore the RPV water level to normal. If the level cannot be maintained in the normal range, the operator is directed to maintain it above the top of the active fuel and to depressurize the RPV.

Step C7-4 - The Path 1 End Path Procedures contain guidance to take the Reactor to cold shutdown.

Cautions associated with level/power control are listed below:

1. Caution #9 is to be placed on the RTGB.

2. Caution #10 is to be covered in training and in the Users' Guide.

3. Caution #11 is to be covered in training and in the Users' Guide.

4. Caution #12 is to be placed on the RTGB.

5. Caution #24 is contained in the flowchart as follows: "Caution: A rapid increase in injection flow may induce a power excursion and result in core damage."

6. Caution #25 is included in the Flowchart Procedure.

ATTACHMENT C
APPENDIX III

ATTACHMENT C
APPENDIX III

Deviations from the Generic Guideline

A. RPV CONTROL GUIDELINE

1. Generic Guideline Entry Conditions

a. RPV high pressure 1045 psig.

b. RPV level below +162.5 inches.

c. Drywell pressure above 2.0 psig.

d. An isolation which requires or initiates a reactor scram.

e. A condition which requires a reactor scram and reactor power is above 3% or cannot be determined.

2. Plant-Specific Guideline Entry Condition

A condition which requires or has initiated a reactor scram.

The entry condition for Brunswick EOP's is conservatively defined as any reactor scram signal, manual or automatic. If a true emergency condition does not exist, the EOP will be exited when plant parameters are stable. If a true emergency does exist, the operator will be in the proper procedure and taking appropriate steps very early in the accident. The entry condition is also very clear; there is little room for doubt as to which procedure applies.

B. CONTAINMENT CONTROL GUIDELINE

1. Entry Conditions

The containment temperature entry condition applies to Mark III containments only and is deleted from the Brunswick Plant-Specific Guideline.

2. DW/T-3

Two separate limitations exist for drywell spray initiation. In order to combine these two limits into one (as in the Generic Guideline), the drywell spray flow rate must be restricted to less than 730 gpm. Brunswick, as currently designed, has no way to realistically measure drywell spray flow rate in this range. (The instrument's range is 0 - 30,000 gpm in 500 gpm increments.) Both limitations must, therefore, be observed and the statement will read as follows:

> Before drywell temperature reaches 300°F (maximum drywell design temperature) but only if suppression chamber temperature and pressure are below the Drywell Spray Initiation Pressure Limit A AND drywell temperature and pressure are below Drywell Spray initiation Pressure Limit B, shut down Recirculation Pumps and Drywell Cooling Fans and initiate drywell sprays.

Both graphs are included in the Plant-Specific Guideline and EOP's.

3. PC/P-1

Delete instructions to use the containment pressure control system which applies to Mark III containments only.

4. PC/P-2

a. Delete reference to Mark III Containment Spray Initiation Pressure Limit.

b. Delete reference to elevation of suppression pool spray nozzles and simply require initiation of suppression pool sprays before pressure reaches the Suppression Chamber Initiation Pressure.

The suppression pool spray nozzles at Brunswick are at elevation +12 feet 10 inches. The upper end of the suppression pool level instrument's range is +6 feet. If suppression pool level increases above +6 feet, the operator would not be able to determine the actual suppression pool level. Since the only concern with initiating suppression pool sprays with the nozzles submerged is that is would have no effect upon containment pressure, it is more conservative to simply require spraying, in an attempt to control containment pressure.

5. PC/P-3

See Step B2 - DW/T-3 (Page 2 of 5).

6. PC/P-5

The operating margin gained through the use of the curve in the Generic Guideline does not warrant the additional complication imposed by a two dimensional limit. Brunswick has opted not to use the graph and to simply require RPV depressurization at the most limiting suppression chamber pressure.

7. PC/P-6

See Step B6 - PC/P-5 (Page 3 of 5).

First bullet - Delete reference to elevation of suppression spray nozzles. See Step B4 - PC/P-2 (Page 2 of 5).

Second bullet - Delete reference to Maximum Drywell Spray Flow Rate Limit and use both limits. See Step B2 - D/T-3 (Page 2 of 5).

8. PC/P-7

See Step B6 - PC/P-5 (Page 3 of 5).

9. SP/L-1

Delete reference to SPMS, which applies to Mark III containments only.

10. SP/L-2

In order to determine ΔT_{HC}, the Heat Capacity Temperature Limit must be obtained from the HCTL graph and then subtracted from the actual suppression pool temperature. In order to simplify the procedure, a table has been generated which lists the HCTL for all ranges of reactor pressure.

11. SP/L-3.3

See Step B2 - DW/T-3 (Page 2 of 5).

12. SP/L-3.5

Delete this step from the Plant-Specific Guideline. Instrumentation is not provided at Brunswick to measure the water level to the top of the Drywell. The Calculation Procedure for the Technical Guideline has shown that the hydrostatic pressure resulting from complete flooding of the Drywell will not exceed design pressure. In addition, the Suppression Pool Level Control Procedure will require terminating injection from sources external to Primary Containment if suppression pool level is above +6 feet and adequate core cooling is assured.

C. CONTINGENCIES

1. Level Restoration

a. C1-1

Delete this step. Brunswick does not have an IC.

b. C1-6

Delete this requirement to depressurize if no CRD Pump is operating and at least two injection subsystems are lined up for injection with pumps running. This step could lead to depressurization of the RPV with water level anywhere above the top of active fuel. The Brunswick Plant-Specific Guideline will require depressurization at the top of active fuel. This will allow additional time to restore level before depressurization.

2. Emergency RPV Depressurization

C2-1.1

Delete requirement that suppression pool level be above top of T-quencher prior to operating all ADS Valves. The Suppression Pool at Brunswick is encased in concrete. Each room below the suppression pool elevation is independent, i.e., flooding in one room will not cause all rooms to be flooded. If an unisolable leak were to occur in four of the five rooms simultaneously, they could equalize with the Suppression Pool and the T-quencher would remain covered. If the fifth room was also flooded by a leak from the Suppression Pool, i.e., the entire area below the suppression pool elevation was flooded, the T-quencher would only be partially covered.

The elevation of the top of the T-quencher is -9 feet. The Brunswick EOP's, i.e., Suppression Pool Low Level Procedure, directs the operator to depressurize the Reactor at -6 feet 6 inches. In order for the suppression pool level to be below the top of the T-quencher, a simultaneous leak would have to occur in both RHR rooms, both core spray rooms and the HPCI room. This is not considered credible; therefore, this step has been deleted from the Brunswick EOP's.

APPENDIX IV

Brunswick Steam Electric Plant
Symptomatic Emergency Operating Procedure Training

DESCRIPTION OF EMERGENCY OPERATING PROCEDURE TRAINING AT BRUNSWICK

1. Licensed Personnel EOP Training

TITLE:

Training Course for Symptomatic Emergency Operating Procedures at Brunswick Steam Electric Plant

OBJECTIVES:

Upon satisfactory completion of this course, the participant will be able to:

a. Explain the background that led up to the development of the new procedures and why the change was made from event based procedures to symptom based procedures.

b. Demonstrate an acceptable level of skill in the use of the new procedures during simulated emergency conditions.

c. Explain the advantages of the new procedures and appreciate the increased effectiveness of these procedures during abnormal or emergency conditions.

REASONS FOR STUDY:

a. To prepare the licensed personnel for the implementation of the new Function Oriented, i.e., symptomatic, Emergency Operating Procedures.

b. Familiarize the operator with the GE Owners' Group Guidelines.

c. Learn proper techniques of flowchart and End Path Manual use.

DURATION:

72 Hours

DESCRIPTION:

An introduction to the new concept of Symptomatic Emergency Operating Procedures (EOP's) which are to replace the current BSEP Emergency Instructions (see Figures 1 through 7).

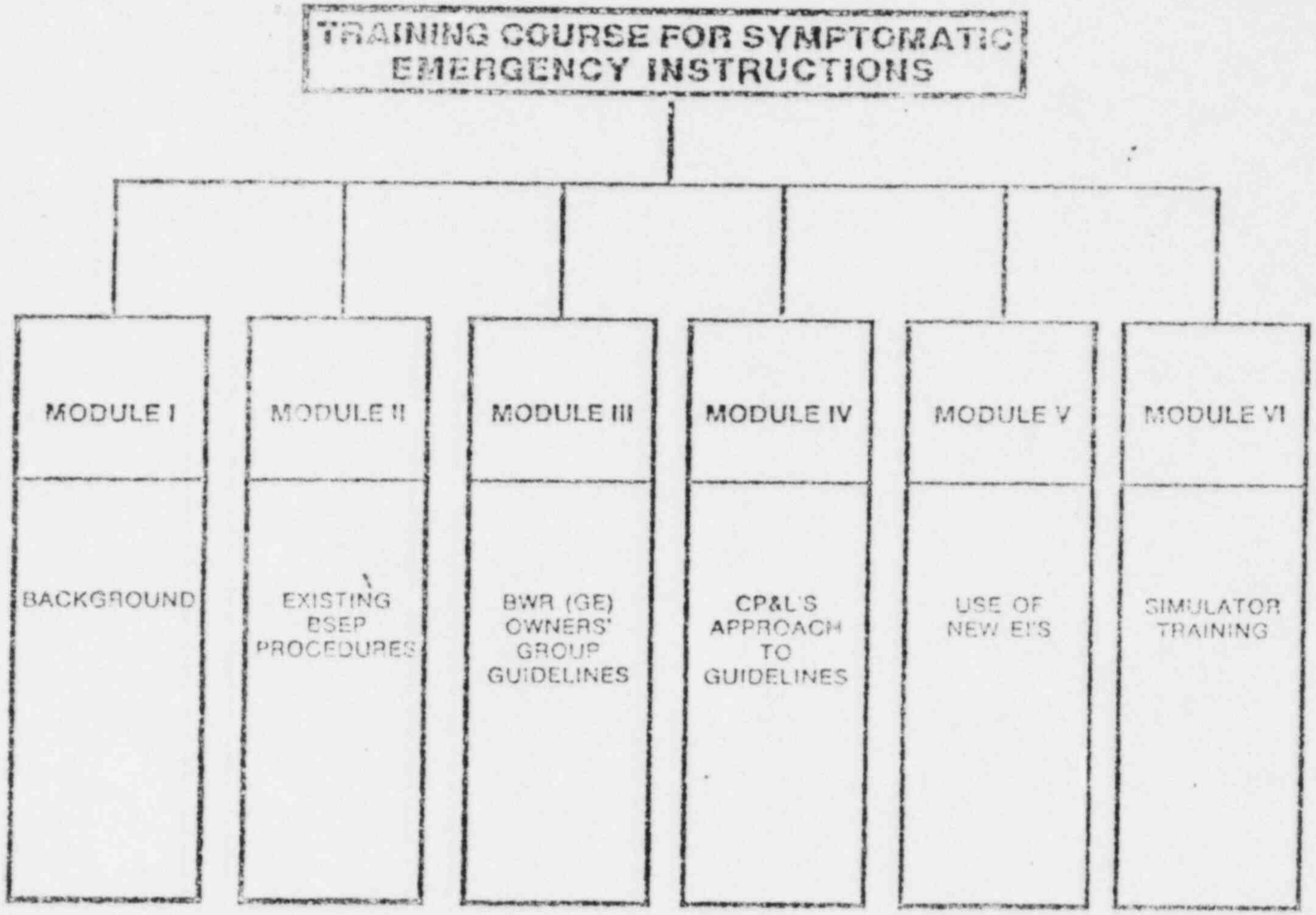

TRAINING COURSE FOR SYMPTOMATIC EMERGENCY INSTRUCTIONS
MODULE I
BACKGROUND
MODULE II
EXISTING BSEP PROCEDURES
MODULE III
BWR (GE) OWNERS' GROUP GUIDELINES
MODULE IV
CP&L'S APPROACH TO GUIDELINES
MODULE V
USE OF NEW EI'S
MODULE VI
SIMULATOR TRAINING

Figure 1

MODULE I

BACKGROUND

A. ANS STANDARDS FOR EMERGENCY PROCEDURES ANS 3.2

B. THREE MILE ISLAND ACCIDENT

C. NRC GUIDANCE FOLLOWING THE TMI ACCIDENT

D. ESSEX CORPORATION REVIEW OF TMI

E. BWR (GE) OWNERS' GROUP

F. QUIZ

Figure 2

MODULE II

EXISTING BSEP OPERATING PROCEDURES

A. REVIEW BSEP INSTRUCTIONS CURRENTLY USED BY OPERATIONS PERSONNEL

B. PHILOSOPHY OF EMERGENCY INSTRUCTIONS - WHAT ACTUALLY CONSTITUTES AN EMERGENCY

C. SYMPTOM ORIENTED VERSES EVENT ORIENTED EMERGENCY INSTRUCTIONS

D. USE OF CURRENT BSEP EMERGENCY INSTRUCTIONS IN THE EVENT OF MULTIPLE FAILURES

E. DISADVANTAGES

F. SUMMARY

G. QUIZ

Figure 3

MODULE III

BWR (GE) OWNERS' GROUP GUIDELINES

A. INTRODUCTION TO GUIDELINES

B. OPERATOR CAUTIONS

C. REACTOR PRESSURE VESSEL CONTROL GUIDELINES

D. CONTAINMENT CONTROL GUIDELINES

E. CONTINGENCIES

F. SUMMARY

G. QUIZ

Figure 4

MODULE IV

BSEP APPROACH TO OWNERS' GROUP GUIDELINES

A. FLOWCHARTS

B. END PATH PROCEDURES

C. SYSTEM RECOVERY

D. CONTINGENCIES

E. CONTAINMENT CONTROL PROCEDURES

F. HOW EXISTING BSEP PROCEDURES ARE TO BE MODIFIED

G. SUMMARY

H. QUIZ

Figure 5

MODULE V

USE OF NEW BSEP EMERGENCY PROCEDURES

A. SYMBOLS USED ON BSEP FLOWCHARTS

B. GENERAL DESCRIPTION OF THE FIVE BSEP FLOWCHARTS- PATHS

C. TECHNIQUES FOR CHART AND END PATH MANUAL USE

D. EOP EXERCISES

E. ADVANTAGES OF NEW EOP'S

F. SUMMARY

G. QUIZ

Figure 6

MODULE VI

SIMULATOR TRAINING USING NEW SYMPTOMATIC EMERGENCY PROCEDURES

A. ENTRY CONDITION-REACTOR SCRAM

B. SYMPTOMS

C. IMMEDIATE ACTIONS

D. END PATH MANUALS

E. SIMULATOR FAMILIARIZATION

F. EOP EXERCISES

G. SIMULATOR EVALUATION OF EACH TRAINEE

Figure 7

During this course the background for the new type procedures will be discussed, including the events that led up to the changes and why it was necessary to make them.

The course will be conducted in the classroom and at the simulator.

PREREQUISITES:

The participants should have basic knowledge of GE BWR plant operation.

PARTICIPANT ELIGIBILITY:

This course is appropriate for licensed Reactor Operators (RO), Senior Reactor Operators (SRO), individuals who are in training for an operator's license and other plant personnel who are familiar with plant operation and frequently monitor or review operational events.

TRAINING SCHEDULE:

The training schedule for Brunswick's EOP's is listed as follows:

1. Initial Classroom Training

   a. Location: Plant Training Facility

   b. Subjects: Lessons 1, 2, 4 and 5

   c. Duration of Training Per Group: Four Days

   d. Number of Groups: Five

   e. Schedule: Beginning February 3, 1982 (Three Days Each Week), Ending March 5, 1982

2. Initial Simulator Training

   a. Location: Limerick Simulator

   b. Subject: Lesson 6

   c. Duration of Training Per Group: Four Days

   d. Number of Groups: 12

   e. Schedule: Beginning March 13, 1982, Ending May 18, 1982

3. Additional Classroom Training

   a. Location: Plant Training Facility

   b. Subject: Lesson 3

   c. Duration of Training Per Group: Four Days

   d. Number of Groups: Eight

   e. Schedule: Beginning December 1982, Ending May 1983

4. Simulator Training

   a. Location: Hatch Simulator

   b. Subject: Lesson 6

   c. Duration of Training Per Group: Four Days

   d. Number of Groups: 14

   e. Schedule: Beginning January 31, 1983, Ending May 29, 1983

5. Final EOP Training

   a. Location: Brunswick Simulator/Classroom

   b. Subject: Brunswick Flowcharts and End Path Manuals

   c. Duration of Training Per Group: Three Days

   d. Estimated Schedule: Beginning October 3, 1983, Ending November 14, 1983

2. Non-Licensed Personnel (Auxiliary Operator) EOP Training

TITLE:

EOP Training for Auxiliary Operators

OBJECTIVES:

Upon satisfactory completion of this course, the participant will be able to:

a. Explain the purpose of each EOP task that is the responsibility of the Auxiliary Operator during emergency operations.

b. Give the plant location where each task is to be performed.

c. Demonstrate by walk-through examination, an acceptable level of skill in performing each task.

REASONS FOR STUDY:

a. To prepare the Auxiliary Operator for the implementation of the new Function Oriented, i.e., symptomatic, Emergency Operating Procedures.

b. To prepare the Auxiliary Operator to carry out emergency actions that may be required by the new EOP's.

c. To introduce the new Local Emergency Procedures to the Auxiliary Operator.

DURATION:

Eight Hours

DESCRIPTION:

An introduction to the new Emergency Operating Procedures which consists of the BSEP Flowcharts and End Path Manuals.

During this course, all Auxiliary Operator activities associated with the new EOP's will be identified.

The course consists of classroom and walk-through training.

PREREQUISITES:

The participants should be classified Auxiliary Operator A or B.

An example of the Auxiliary Operator evaluation form is included (see Figure 8).

BRUNSWICK STEAM ELECTRIC PLANT

AO'S NAME: ______________________ DATE: ____________

EVALUATOR'S NAME: ________________ DATE: ____________
(Signature - RO or SRO)

	SAT (S) NEEDS IMP (NI) UNSAT (U) EVALUATE EACH CATEGORY		
	A	B	C
FLOWCHART STEPS -			
ALTERNATE COOLANT INJECTION - (LEP-1)			
ALTERNATE CONTROL ROD INSERTION - (LEP-2)			
ALTERNATE BORON INJECTION - (LEP-3)			

CATEGORY A = LOCATION

CATEGORY B = PURPOSE

CATEGORY C = REQUIRED ACTION

REMARKS:

Figure 8