Examination Outline Cross-reference:	Level	RO	SRO
	Tier #		3
Question 97	Group #		4
Part 1 – Original Question			
	K/A #	G2.4.6	
	Importance Rating		4.7

Knowledge of EOP mitigation strategies.
Proposed Question: SRO 97
Given the following conditions:

- Reactor Power is at 6%
- Reactor Pressure is being controlled by SRV's at 950 psig
- Reactor Water Level is (-10) inches, slowly lowering
- Drywell Temperature is 355°F, and rising
- Drywell Pressure is 23 psig, and rising
- Suppression Pool Temperature is 115°F, and rising
- Suppression Pool Level is 85 inches, steady
- Suppression Chamber Pressure is 21.7 psig, and rising
- NO operator actions have been taken

Which one of the following action(s) is(are) required?

A. ONLY initiate Drywell Sprays IAW EOP-102.

B. ONLY initiate Drywell Sprays and Suppression Pool Cooling/Sprays IAW EOP-102.

C. Enter EOP-202 and Emergency Depressurize.

D. Place Suppression Pool Cooling/Sprays in service then Emergency Depressurize IAW EOP-202.

Proposed Answer: C

Explanation (Optional): C. Correct

IAW EOP-102 Step DWT-8, If DW temp cannot be maintained below 340 degrees F., ED is required.
C. Correct.

A. Incorrect. – ED is required
B. Incorrect. – ED is required
D. Incorrect. – All RPV injection must be secured prior to ED (EOP-202, step ED-3)

Technical Reference(s) EOP-102 (Attach if not previously provided)

Proposed references to be provided to applicants during examination: None

Learning Objective: EO102PE007 (As available)

Question Source: Bank # _____
Modified Bank # _____ (Note changes or attach parent)
New X

Question History: Last NRC Exam _____

Question Cognitive Level: Memory or Fundamental Knowledge _____
Comprehension or Analysis X

10 CFR Part 55 Content: 55.41 _____
55.43 5

Comments:

Question 97
Part 2 – Justification

Analysis:

The stem condition presents the plant in an ATWS condition (6%). RPV level is (-10") and lowering slowly, while RPV pressure is being controlled by SRVs at 950 psig. The drywell pressure is at 23 psig and rising and 355 degrees F temperature and rising. The suppression pool is at 85" and steady and 21.7 psig and rising.

The stem states NO operator actions have been taken, therefore RHR has realigned automatically to LPCI mode when drywell pressure reached 1.68 psig.

The above parameters progress the operator to step DW/T-8 of EOP-102 which asks: "Can Drywell Temperature be Restored and Maintained <340F?".

HC.OP-EO.ZZ-0102, Containment Control, defines the following terms:
Restore – take appropriate action to return the value of an identified parameter to within its specified limits.
Maintain – take appropriate action to hold the value of an identified parameter within specified limits.

"Restore" has operators take action to return drywell temperature to within its stated band. It is only after it is determined that this action did not lower temperature within limits, that it is required to answer 'NO' to DW/T-8 and continue to DW/T-9 which requires EOP-202 entry and emergency depressurization. Per HC.OP-EO.ZZ-0102, the definition of Can/Cannot be restored above/below is "the value of the identified parameter(s) is/is not able to be returned to above/below specified limits after having passed those limits. This determination includes the evaluation of both current and future system performance in relation to the current value and trend of the parameter(s). Does not imply any specific time interval but does not permit prolonged operation beyond a limit without taking the specified action."

Step DWT-7 of EOP-102 states: Initiate one loop of drywell spray at rated flow. Performing all legs of the EOP concurrently, step SP/T-3 states: Operate all available suppression pool cooling . DW/P-5 states: Initiate suppression chamber sprays. Based on these actions, all actions of exam choice 'B' are required by EOP-102.

In the drywell, with typical drywell spray flowrates, evaporative cooling process results in an immediate, rapid, large reduction in pressure, and therefore temperature per lesson plan NOH01EO102P-01, HC.OP-EO.ZZ-0102 Primary Containment Control Drywell/Temperature/Pressure And Hydrogen for step DWT-7.

When the question was originally written and validated answer C was determined to be correct. It was mistakenly overlooked that operators would first take actions to address the EOP step which asks "Can Drywell Temperature be Restored and Maintained <340F?" The "restore" portion of the EOP statement "restore and maintain" was inadvertently not taken into account when originally determining a correct answer for this question.

Conclusion:

Initiating Drywell Spray IAW EOP-102 is the correct action to restore and maintain drywell temperature less than 340F. Initiating Suppression Pool Cooling and Sprays are required by other steps of EOP-102. Therefore "B" is the correct answer.

Recommendation:

Change the answer key to accept choice B as correct.

Operations Approval: _____ 2/17/09
Signature Date

Operations Training Approval: _____ 2/17/09
Signature Date

HOPE CREEK GENERATING STATION

HC.OP-EO.ZZ-0102(Q) Rev. 12

CONTAINMENT CONTROL

USE CATEGORY: I

REVISION SUMMARY:

This revision summary documents changes to the Flowchart and this text procedure.

1. Revised the flowchart to be consistent with Revision 2 of the BWROG EPGs/SAGs and recent changes approved by the BWROG Emergency Procedures Committee.
2. Revised Curves DWT-P, SCP-L, and SPT-P to reflect Cycle 15-EPU calculation results for Extended Power Uprate to 3840 MWt. The format and limits of the Drywell Spray Initiation Limit Curve (DWT-P) was changed by EPG/SAG Revision 2. Significant changes in the HCTL Curve values was the result of the higher EPU decay heat values.
3. The definition of Adequate Core Cooling has been modified to permit use of spray cooling in preference to maximizing injection and primary containment flooding. Spray Cooling followed by Steam Cooling are listed instead of Steam Cooling with or without injection to the RPV.

IMPLEMENTATION REQUIREMENTS

Effective Date: 11/6/07

APPROVED: _____ for
Operations Manager

11.3.07
Date

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

CONTAINMENT CONTROL

TABLE OF CONTENTS

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

1. PURPOSE

The Containment Control Procedure provides guidance to respond to an emergency or to conditions that may degrade into an emergency. The purpose of this procedure is to maintain primary containment integrity and protect equipment in the primary containment. This purpose is achieved by controlling Suppression Pool temperature and level, Drywell temperature and pressure, and primary containment hydrogen concentration. The Procedure Category applies to the flowchart.

2. REFERENCES

2.1 BWROG Emergency Procedure and Severe Accident Guidelines, Rev. 2

2.2 NC.NA-AP.ZZ-0002(Q), Nuclear Business Unit Organization

2.3 Closing Documents incorporated:

CD-096B (DW/T train and DW/P train)
CD-621D (step SC/L-29)
CD-733A (SC/T train)
CD-138X (DW/P train)
CD-088X (SC/L train)
CD-087X (SC/L train)
CD-086X (SC/L train)
CD-085X (SC/T train)
CD-084X (SC/L train)
CD-268X (SC/T-3)
CD-478F
CD-079A (PC/H train)
CD-195Y (PC/H train)
CD-137X (PC/H train)
70041971 (SP/L-12)

3. DEFINITIONS

Interpretations, definitions, and discussions regarding the usage of key EOP words and phrases are provided below. This information is provided to promote a uniform understanding of the actions intended by the Cautions and steps in the EOPs.

3.1 Adequate Core Cooling - defined to be heat removal from the reactor sufficient to prevent rupturing the fuel clad.

Three viable mechanisms of adequate core cooling exist; in order of preference, they are:

1. Core submergence
2. Spray cooling
3. Steam cooling

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

3.1 Continued

Core submergence is the mechanism of core cooling whereby each fuel element is completely covered with water. Indicated RPV water level at or above the top of the active fuel (TAF) constitutes the principal means of confirming the adequacy of core cooling via this mechanism. Assurance of continued adequate core cooling through core submergence is achieved when RPV water level can be maintained at or above TAF.

Spray cooling is the mechanism of core cooling whereby the uncovered portion of the core is cooled by spray flow. Adequate spray cooling exists by design when at least one Core Spray loop is operating at design flow (6150 gpm) and RPV water level is at or above the elevation of the jet pump suctions (-215 in.). The covered portion of the core is then cooled by submergence while the uncovered portion is cooled by the spray flow.

Steam cooling is the mechanism of core cooling whereby steam updraft up through the uncovered portion of each fuel bundle is sufficient to prevent the temperature of the hottest fuel rod from exceeding the appropriate limiting value, which is specific to the mode of steam cooling being employed (i.e., with and without injection of makeup water to the RPV).

With injection of makeup water into the RPV established, adequate core cooling exists when steam flow through the core is sufficient to preclude the peak clad temperature of the hottest fuel rod from exceeding 1500°F, the threshold temperature for fuel rod perforation. This mechanism of core cooling is employed during RPV flooding when the reactor may not be shutdown and during level/power control and alternate level control when RPV level is controlled below TAF. RPV pressure and the number of open SRVs, or RPV water level, provide the means of confirming the adequacy of core cooling achieved via this mechanism.

Assurance of continued adequate core cooling is achieved when RPV pressure can be maintained at or above the Minimum Steam Cooling Pressure or RPV water level can be maintained at or above the Minimum Steam Cooling RPV Water Level (-185").

With no injection into the RPV established, adequate core cooling exists only so long as the covered portion of the reactor core generates sufficient steam to preclude the peak clad temperature of the hottest fuel rod from exceeding 1800°F, the threshold temperature for significant metal-water reaction. This mechanism of core cooling is employed as part of alternate level control. Indicated RPV water level at or above the Minimum Zero Injection RPV Water Level (-200") is the only means available for confirming the adequacy of core cooling achieved via this mechanism. The transient nature of this mechanism of adequate core cooling prevents being able to assure that it can be maintained.

3.2 Available - the state or condition of being ready and able to be used (placed into operation) to accomplish the stated (or implied) action or function; as applied to a system, this requires the operability of necessary support systems (electrical power supplies, cooling water, lubrication, etc.).

3.3 Before - any time prior to. Utilized where an event-independent margin is not appropriate or cannot be defined.

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

3.4 Undetermined/Cannot be determined - using all available indications (direct and indirect, individually or in combination), the current value or status of the identified parameter is not ascertainable.

3.5 Can/Cannot be maintained above/below -The value of the identified parameter(s) is/is not able to be maintained above/below the specified limits. This determination includes the evaluation of both current and future system performance in relation to the current value and trend of the parameter(s). Additionally, "cannot" does not imply that the actual value of the parameter must first pass the specified limit.

3.6 Can/Cannot be restored above/below - the value of the identified parameter(s) is/is not able to be returned to above/below specified limits after having passed those limits. This determination includes the evaluation of both current and future system performance in relation to the current value and trend of the parameter(s). Does not imply any specific time interval but does not permit prolonged operation beyond a limit without taking the specified action.

3.7 Defeat/Defeating - modifying the logic or circuitry of a system so as to prevent an automatic function from occurring; as used in the EOPs, this term may involve positioning an interlock bypass or override switch, installing jumpers in relays or terminal strips, or removing fuses.

3.8 Drywell temperature - the volumetric average drywell temperature.

3.9 Monitor - observe and evaluate at a frequency that is sufficient to remain apprised of the value, trend, and rate of change of the identified parameter(s).

3.10 Purge - force flow through an enclosed volume. Includes establishing both an influent (driving) and effluent (exhaust) flowpath.

3.11 Restore - take appropriate action to return the value of an identified parameter to within specified limits.

3.12 Shutdown - as applied to the reactor, subcritical with reactor power below the heating range.

3.13 Suppression Pool Temperature - average Suppression Pool water temperature.

3.14 Suppression Chamber Pressure - pressure in the air space of the Suppression Chamber.

3.15 Terminate - take the appropriate action to stop the stated action, process, or evolution. Generally, the most direct action which will stop the stated action is preferred; however, a wide variety of actions may be employed.

3.16 Vent - open an effluent (exhaust) flowpath from an enclosed volume.

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

3.17 Verify - use available indications (status lights, plant and system parameters) and/or physical observation to determine that the specified action has occurred; if the specified action has not occurred then take the necessary actions to cause it to occur.

4. RESPONSIBILITIES

4.1 Shift Manager (SM) - In an emergency:

- Directs personnel to take the necessary action to minimize personnel injury and damage to the facility and to protect the health and safety of the general public.
- Call out additional personnel as required to ensure safe operation of the station.
- Control access to the control room as he/she deems necessary.
- Classifies the event if appropriate and initiates the Station Emergency Plan in a timely manner

4.2 Control Room Supervisor (CRS) - directs plant operations by providing specific instructions and orders directly to shift personnel.

4.3 Nuclear Control Operator (NCO) - initiate immediate action necessary to maintain the plant in a safe condition during normal, abnormal, and emergency operating conditions and shut the reactor down when he or she determines that parameters exceed reactor protection setpoints or safety limits and an automatic shutdown fails to occur.

USER RESPONSIBLE FOR VERIFYING REVISION, STATUS AND CHANGES

L.P. NO.: NOH01EO102P-01

PREVIOUS L.P. NO.: NOH01EO102P-00

NUCLEAR TRAINING CENTER
LESSON PLAN

Program Title:	Hope Creek Licensed Operator Training
Course Section/Module:	Operating Experience
Topic/Sub Module:	Emergency Operating Procedures
Lesson:	HC.OP-EO.ZZ-0102 Primary Containment Control Drywell (Temperature / Pressure And Hydrogen)
Duration:	4 Hours (Initial) / 2 Hour (Requal)
Prerequisites:	Hope Creek Systems, Introduction To EOPs (LP NO: NOH01INTEOPC)
JTA NO. or Qualification Statement no.	
Submitted By:	Peter Doran DATE: 5/30/08

Review and Approval Signatures

Qualified Nuclear Engineer Review (If applicable):	N/A	EMP #	N/A	DATE:
Training Supervision Review:	PR Dan	EMP #	21487	DATE: 6/4/08
Program Owner Approval:	[signature]	EMP #	18225	DATE: 6/5/08

This lesson plan has been reviewed and satisfies management expectations for inclusion of OE, HPI, error-reduction techniques and safety standards. Specific applications and/or opportunities for reinforcement of management expectations are noted in the lesson plan text, key aide section(s) or Attachment(s) where applicable.

L.P. NO.: NOH01EO102P-01

PREVIOUS L.P. NO.: NOH01EO102P-00

NUCLEAR TRAINING CENTER
LESSON PLAN

Program Title:	Hope Creek Licensed Operator Training
Course Section/Module:	Operating Experience
Topic/Sub Module:	Emergency Operating Procedures
Lesson:	HC.OP-EO.ZZ-0102 Primary Containment Control Drywell (Temperature / Pressure And Hydrogen)
Duration:	4 Hours (Initial) / 2 Hour (Requal)
Prerequisites:	Hope Creek Systems, Introduction To EOPs (LP NO: NOH01INTEOPC)
JTA NO. or Qualification Statement no.	
Submitted By:	Peter Doran DATE: 5/30/08

Review and Approval Signatures

Qualified Nuclear Engineer Review (If applicable):	N/A	EMP #	N/A	DATE:	
Training Supervision Review:		EMP #		DATE:	
Program Owner Approval:		EMP #		DATE:	

This lesson plan has been reviewed and satisfies management expectations for inclusion of OE, HPI, error-reduction techniques and safety standards. Specific applications and/or opportunities for reinforcement of management expectations are noted in the lesson plan text, key aide section(s) or Attachment(s) where applicable.

Revision/Change Summary		
Applicable Section	Material Changed(provide brief description of change) (i.e. Operating Experience included in Attachment 1)	Justification (i.e. Procedure Rev, setpoint change, notf# or Order/Op. #)
DW/P	Split step DW/P-3 into DW/P-3 and DW/P-4, renumbered remaining steps	Aligned with Revision 2 of the BWROG EPGs
DW/P	Split former step DW/P-6 into three steps DW/P-7/8/9	Aligned with Revision 2 of the BWROG EPGs
DW/P	Reworded steps for venting the Suppression Chamber and Drywell for exceeding offsite radioactivity release rate limits if necessary versus irrespective	Aligned with Revision 2 of the BWROG EPGs
DW/T	Added steps DW/T-4 and concurrent execution of EOP-101 previously directed under step DW-T-6, renumbered remaining steps	Aligned with Revision 2 of the BWROG EPGs
Figures	Added latest SCP-L and DWT-P curves	Aligned with Revision 2 of the BWROG EPGs
Table 1	Modified location of SRV "T-Quencher" in relation to bottom of Suppression Pool	UFSAR

INSTRUCTOR REFERENCES:

1. BWROG Emergency Procedure Guidelines/Severe Accident Guidelines
2. BWROG Emergency Procedure, Guidelines/Severe Accident Guidelines, Appendix A, B, C and D
3. HCGS Plant Specific Technical Guidelines
4. HCGS Technical Specifications
5. HCGS Event Classification Guide NUMARC Revision
6. HCGS FSAR Response to question 421.21
7. HC.OP-EO.ZZ-0102 Primary Containment Control
8. HC.OP-EO.ZZ-0102 Primary Containment Control Flowchart
9. HC.OP-EO.ZZ-0318 Containment Venting
10. HC.OP-SO.GS-0001 Containment Atmospheric Control System Operation
11. HC.OP-SO.GS-0003 Containment Hydrogen Recombiner System Operation
12. NOH04SPDS00C SPDS Licensed Operator Lesson Plan
13. EOP Caution 1
14. EOP Caution 2
15. UFSAR F3BII-2-Elevation Section View T-Quencher Support Detail

TRAINING MATERIAL REQUIRED:

1. Lesson Plan
2. EOP Flowcharts (Current Revision)
3. HC.OP-EO.ZZ-0102 Bases document
4. Procedures referenced will be available in the classroom for student reference

STUDENT HANDOUTS:

1. Primary Containment Control - Drywell Temperature Lesson Plan:
2. EOP Flowcharts (Current Revision)
3. HC.OP-EO.ZZ-0102 Bases document
4. Procedures referenced will be available in the classroom for student reference.

SPECIAL CLASSROOM REQUIREMENTS:

No special considerations for classroom size or arrangement are required.

LEARNING OBJECTIVES:

TERMINAL LEARNING OBJECTIVES:

Provided a scenario of plant/system status or previous plant conditions, the trainee will be able to:

1.0 Recognize the entry conditions for Primary Containment Control and provided access to Emergency Operating procedures, determine actions necessary to control the following parameters IAW HC.OP-EO.ZZ-0102: (1-8)

a. Suppression Pool Temperature

b. Suppression Pool Level

c. Drywell Temperature

d. Drywell Pressure

e. Containment Hydrogen

ENABLING LEARNING OBJECTIVES:

NOTE: All ELOs are required to be covered during initial training. Those with an "R" prefix are the minimum required to be covered during requal training.

1. Identify the purpose of the Primary Containment Control Emergency Operating Procedure IAW HC.OP-EO.ZZ-0102.
2. Identify the reason(s) drywell temperature, pressure and hydrogen generation are controlled IAW the Primary Containment Control - Drywell Lesson Plan.
3. Given plant conditions, recognize the five (5) entry conditions for the Primary Containment Control Emergency Operating Procedure IAW HC.OP-EO.ZZ-0102.
4. Recall the reasons why the following are used for determining the entry condition and / or subsequent actions IAW the Primary Containment Control - Drywell Lesson Plan.
   a. Drywell Pressure
   b. Average Drywell Temperature
   c. H_2 and O_2 concentrations in the drywell
5. Define the term "Drywell Spray Initiation Limit" IAW the Primary Containment Control - Drywell Lesson Plan.

R6. Given plant conditions and access to the following curves determine the region of acceptable operation and explain the bases for the curve IAW the Primary Containment Control - Drywell Lesson Plan:

a. Drywell Spray Initiation Limit

b. Pressure Suppression Pressure

R7. Given any step of the procedure, determine the reason for performance of that step and/or predict expected system response to control manipulations prescribed by that step IAW the Primary Containment Control - Drywell Lesson Plan.

R8. Given any caution within the procedure, explain the bases for the caution IAW the Primary Containment Control - Drywell Lesson Plan.

R9. Given plant conditions and access to EOPs, select the value of the Suppression Chamber Spray Initiation Pressure and explain the basis for this limit IAW the Primary Containment Control - Drywell Lesson Plan.

R10. Given plant conditions and access to EOPs, select the value of the Primary Containment Pressure Limit and explain the basis for this limit IAW the Primary Containment Control - Drywell Lesson Plan.

INSTRUCTIONAL CONTENT:

TABLE OF CONTENTS

INSTRUCTIONAL CONTENT:

I. PURPOSE

Obj. 1

A. The purpose of the Primary Containment Control Procedure, HC.OP-EO.ZZ-0102, is to protect safety related equipment in the primary containment and to maintain primary containment integrity.

1. This is accomplished through concurrent control of five (5) key parameters. They are:

   a. Suppression pool level

   b. Suppression pool temperature

   c. Drywell temperature

   d. Drywell pressure

   e. Primary containment hydrogen concentration

Obj. 2

B. This section of the Primary Containment Control Procedure (HC.OP-EO.ZZ-0102) specifies operator actions to be taken to control and maintain drywell temperature, pressure and hydrogen/oxygen generation.

1. The purpose of controlling drywell temperature is to:

   a. Prevent exceeding the drywell design temperature limit of 340°F.

   b. Prevent exceeding the environmental qualification temperature limit of safety related electrical equipment inside the drywell (also 340°F).

   c. Minimize the effect of drywell temperature induced RPV water level indication and trend errors.

2. The purpose of controlling drywell pressure is to prevent the failure of the primary containment due to overpressure.

3. The purpose of controlling hydrogen and oxygen concentration is to prevent failure of the primary containment due to the pressure/temperature changes associated with the ignition of these combustible gases.

II. GENERAL OVERVIEW

A. The purpose of HC.OP-EO.ZZ-0102, Primary Containment Control, relates directly to five (5) basic functions performed by the primary containment:

1. Provides a barrier to the uncontrolled release of fission products.
2. Contains and condenses steam discharged from Safety Relief Valves (SRVs) and primary system breaks inside the primary containment.
3. Shields personnel from radiation emitted by the reactor.
4. Provides a protected environment for key equipment important to safety.
5. Provides a suction source of water for ECCS pumps.

B. The initial action taken to control drywell temperature and pressure employ the same method used during normal plant operations. They include:

1. Monitoring drywell temperature and pressure status
2. Placing available cooling in service and maximizing drywell cooling using the Drywell Ventilation System to maintain drywell parameters below the Technical Specification LCO value (135°F) and high pressure scram setpoint.
3. Venting the primary containment using the Containment Atmosphere Control System (CACS) and/or the Filtration, Recirculation and Ventilation System (FRVS).

C. The DW/T leg and DW/P leg , provide a smooth transition from normal plant operating procedures to emergency operating procedures, and assures that the normal methods of drywell parameter control are attempted in advance of initiating more complex actions to terminate the changing drywell parameters.

D. As long as drywell parameters remain below the Technical Specification LCO value (135°F), and the high drywell pressure scram setpoint (1.68 PSIG) no further operator action is required in this section of the procedure, other than to continue to monitor and control drywell parameters.

E. Measurable levels of hydrogen could appear in the primary containment from the following sources:

1. The high temperature reaction of metals (typically zirconium) with water to produce hydrogen gas and metal oxide.
2. Radiolysis of water to produce hydrogen and oxygen.
3. Feedwater injection of hydrogen to control reactor chemistry.

F. Elevated concentrations of oxygen are not expected during normal power operations except during brief periods of startup and shutdown of the plant when the containment atmosphere is not inerted. However, oxygen may be generated due to:

1. The Radiolysis of water
2. From operation of reactor building-to-suppression chamber vacuum breakers.

G. Oxygen concentration is routinely monitored and controlled during reactor operation in accordance with Technical Specification requirements.

III. EOP –0102 PROCEDURE

A. Entry Conditions

1. The operator is required to execute all legs of the Primary Containment Control Procedure (HC.OP-EO.ZZ-0102) if any of the following conditions are reached:

Obj. 3

a. SUPP POOL TEMP ABOVE 95°F

1) This entry condition addresses the controlling of suppression pool temperature, which:

a) Prevents exceeding the suppression pool/chamber design temperature limits.

b) Maintains the pressure suppression function of the primary containment.

c) Maintains adequate NPSH requirements for pumps which taken suction on the suppression pool.

2) The setpoint of 95°F was chosen because it is easily identifiable and is the most limiting suppression pool temperature value addressed by Technical Specifications.

Obj. 3

b. DRWL TEMP ABOVE 135°F

1) This entry condition addresses the controlling of drywell temperature, which:

a) Prevents exceeding the drywell design temperature limit of 340°F.

b) Prevents exceeding the environmental qualification temperature limit of safety related electrical equipment in the drywell, which is also 340°F.

c) Minimizes the effect of drywell temperature induced RPV water level indication and trend errors.

2) The setpoint of 135°F was chosen because it is easily identifiable and is the Technical Specification LCO for drywell temperature.

Obj. 3

c. DRWL PRESS ABOVE 1.68 PSIG

1) This entry condition addresses the control of drywell pressure which prevents the failure of the primary containment due to overpressure.

2) The setpoint of 1.68 PSIG was chosen because it is easily identifiable; it is the Technical Specification Limiting Safety System Setting (LSSS); and it is an ECCS actuation setpoint.

Obj. 3

d. SUPP POOL LEVEL ABOVE 78.5 IN

1) This entry condition addresses the controlling of a high suppression pool level, which:

a) Prevents the failure of the primary containment due to static and/or dynamic loadings.

b) Prevents the failure of the primary containment due to the coverage of the primary containment vent path.

2) The setpoint of 78.5 in was chosen because it is easily identifiable and is the Technical Specification LCO for maximum suppression pool level.

Obj. 3

e. SUPP POOL LEVEL BELOW 74.5 IN

1) This entry condition addresses the controlling of a low suppression pool level, which:

a) Preserves the pressure suppression function of the suppression pool.

b) Ensures suppression pool equipment designed to be submerged, will remain adequately submerged (i.e.,

SRV T-quenchers, drain lines, and HPCI turbine exhaust line).

c) Ensures sufficient level to provide adequate NPSH for pumps which take a suction on the suppression pool (i.e., ECCS pumps).

2) The setpoint of 74.5 in was chosen because it is easily identifiable and is the Technical Specification LCO for minimum suppression pool level.

B. Procedural Steps

Obj. 7

1. PCC-1 RETENTION OVERRIDE STEPS

IF while executing the following steps	THEN
All entry conditions have cleared	**EXIT** this procedure
Drwl sprays have been initiated	BEFORE Drwl press reaches **0 psig** **TERMINATE** Drwl sprays
Supp chamber sprays have been initiated	BEFORE suppression chamber press reaches **0 psig** **TERMINATE** suppression chamber sprays
SAG entry is required	**EXIT** THIS PROCEDURE AND **ENTER** SAG

a. This step is entered from any one of the previously described entry conditions.

b. This is a retainment override step and applies throughout the remainder of this procedure. This retainment override step contains four (4) conditions:

1) The first condition directs the operator to exit the Primary Containment Control Procedure (HC.OP-EO.ZZ-0102) when all entry conditions have cleared.

2) The second condition directs the operator to terminate drywell sprays once drywell pressure drops to (0.0 psig). This prevents developing and/or exceeding the negative design pressure of the primary containment (-3 PSID) and ensures the integrity of the primary containment.

3) The third condition directs the operator to terminate suppression chamber sprays when initiated, once suppression chamber pressure reaches 0.0 psig. This also prevents developing and/or exceeding the negative design

pressure of the primary containment (-3 PSID) and ensures the integrity of the primary containment. Additionally it precludes air from the Reactor Building being drawn if the suppression chamber was allowed to go negative.

4) The fourth condition directs exit of this procedure:

a) If primary containment flooding is required

or

b) Hydrogen concentration above 2% is generated

c) All EOPs are exited and the SAGs are entered.

d) The SAGs then remain in effect until an emergency no longer exists.

c. Review HC.OP-EO.ZZ-0102 bases for discussion on these steps

Obj. 7

2. PCC-2 **EXECUTE** the following steps concurrently

a. This step is entered from PCC-1.

b. The Primary Containment Control Procedure (HC.OP-EO.ZZ-0102) is structured along five (5) parallel action paths.

c. Actions taken to control any one of the key primary containment parameters may either directly or indirectly affect control of the other parameters. Additionally, the procedure cannot prioritize the control of one parameter at the sacrifice of another. The operator must utilize his judgment and analysis of current plant conditions to direct recovery actions. Therefore, all sections of the Primary Containment Control Procedure are executed concurrently.

d. The operator continues at DW/P-1.

IV. DRYWELL PRESSURE LEG

A. Procedural Steps

Obj. 7

1. DW/P-1 **MONITOR** AND **CONTROL** Drwl pressure below **1.68 psig** using 1 OR more of the following systems:

- Drwl Ventilation (GT)
- Containment Atmosphere Control (GS)
- FRVS (GU)

a. Entry from PCC-2 or any of the following:

1) A **yes** response to DW/P-2

2) The completion of actions directed by DW/P-6 or DW/P-11.

Obj. 4a

b. Since all paths of this procedure are entered concurrently, irrespective of the entry conditions, this step reminds the operator to monitor drywell pressure and to utilize normal methods of pressure control, as necessary, to maintain drywell pressure below the high drywell pressure scram setpoint (1.68 PSIG).

c. SPDS provides a PRI CNTMT PRESSURE CONTROL display providing a more detailed source of information to aid the operator in the execution of this leg of the procedure.

d. Review HC.OP-EO.ZZ-0102 bases for this step.

Obj. 7

2. DW/P-2 Can Drwl Press be maintained below **1.68 psig**

a. Entry from DW/P-1

b. Operator required to evaluate plant conditions and available systems to control drywell pressure.

c. Two directions are provided

1) **Yes** response directs return to DW/P-1 to monitor and control drywell pressure

2) **No** response directs additional actions see DW/P-3

Obj. 7

3. DW/P-3 **BEFORE** Supp Chamber Press exceeds **9.5 psig**

a. Entered on a **no** response from step DW/P-2

b. As with all BEFORE steps a condition will follow

c. Review HC.OP-EO.ZZ-0102 bases for this step.

Obj. 7

4. DW/P-4 Is Supp Pool level below 180 in.

a. Requires determination of Suppression pool level to determine the correct action

b. A **YES** directs actions per DW/P-5

c. A **NO** directs actions per DW/P-6

d. Review HC.OP-EO.ZZ-0102 bases for this step.

Obj.7

5. DW/P-5 **INITIATE** Supp Chamber Sprays,

   USE only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode

   a. Action step directed by DW/P-4

   b. Review HC.OP-EO.ZZ-0102 bases for these steps.

   c. Spraying the suppression chamber will not prevent chugging, it can reduce primary containment pressure. If steam is bypassing the suppression pool and entering the suppression chamber directly, initiation of suppression pool sprays may thus obviate the need for drywell sprays.

Obj. 8
Caution 2

   d. The reference to Caution #2 in this override indicates that, if possible, RHR pumps should be operated within the RHR NPSH limits when drawing suction from the suppression pool.

Obj. 7

6. DW/P-6 Can Supp Chamber Press be maintained below **9.5 psig**

   a. Entry from step DW/P-4 or DW/P-5

   b. This decision step determines the success of the previous actions taken to maintain suppression chamber pressure below the Suppression Chamber Spray Initiation Pressure.

   c. A **yes** response indicates that the upward trend in suppression chamber pressure has been halted or reversed. The operator is directed to return to DW/P-1.

   d. A **no** response indicates that primary containment pressure is continuing to rise . The operator is directed to continue in this procedural leg at DW/P-7.

Obj. 7

7. DW/P-7 **WHEN** Suppression Chamber Pressure exceeds **9.5 psig**

   a. Entered on a no response from step DW/P-6

Obj. 7

8. DW/P-8 Is Supp Pool Level is below **124 in**.

   a. Entered from step DW/P-7

   b. A **YES** response requires addition determination in step DW/P-9

   c. A **NO** response directions action per step DW/P-11

Obj. 7

9. DW/P-9 Is Drwl Temp below curve DWT-P

   a. Entered on a **YES** response from step DW/P-8

   b. A **YES** response requires actions directed in DW/P-10

   c. A **NO** response directs action per DW/P-11

   d. Determination of **YES** in steps DW/P-8 and DW/P-9 Drywell sprays are initiated when suppression chamber pressure exceeds the Suppression Chamber Spray Initiation Pressure (9.5 psig)

OBJ. 9

   e. The Suppression Chamber Spray Initiation Pressure is defined to be the lowest suppression chamber pressure which can occur when 95% of the non-condensibles in the drywell have been transferred to the air space of the suppression chamber.

   f. The Suppression Chamber Spray Initiation Pressure is utilized to preclude chugging; the cyclic condensation of steam at the downcomer openings of the drywell vents.

      1) When a steam bubble collapses at the exit of the downcomers, the rush of water filling the void (some of it drawn up into the downcomer pipe) induces a severe stress at the junction of the downcomer and the vent header.

      2) Repeated application of this stress can cause these joints to experience fatigue failure, thereby creating a pathway which bypasses the pressure suppression function of the primary containment.

      3) Subsequent steam discharges through the downcomers would directly pressurize the suppression chamber air space rather than being discharged to and condensed in the suppression pool.

g. Scale model tests have demonstrated that chugging will not occur if the drywell atmosphere contains at least 1% noncondensibles.

h. Review HC.OP-EO.ZZ-0102 bases for this step.

i. As with all WHEN steps a conditional action follows

Obj. 7

10. DW/P-10 **SHUTDOWN** Recirc Pumps (BB) AND Drwl Cooling Fans (GT)

AND

INITIATE 1 loop of Drwl Spray at rated flow.

USE only an RHR pump NOT required to assure adequate core cooling by continuous operation in the LPCI mode.

a. Conditional action from step DW/P-9

b. Review HC.OP-EO.ZZ-0102 bases for this step.

Obj. 8

Caution 2

c. The reference to Caution #2 in this override indicates that, if possible, RHR pumps should be operated within the RHR NPSH limits when drawing suction from the suppression pool.

Obj. 7

Figure 1

11. DW/P-11 Can supp chamber press be maintained below curve SCP-L

a. Entry from DW/P-8 or DW/P-9 or DW/P-10

b. This step asks the operator if the actions being taken have been effective in maintaining suppression chamber pressure below the Pressure Suppression Pressure Curve (SCP-L)

Obj. 6b

c. The Pressure Suppression Pressure is defined to be the lesser of either of the following:

1) The highest suppression chamber pressure which can occur without steam in the suppression chamber air space.

2) The highest suppression chamber pressure at which initiation of RPV depressurization will not result in exceeding the Primary Containment Decay Heat Removal Pressure.

3) The highest suppression chamber pressure which can be maintained without exceeding the suppression pool design load if SRVs are opened.

d. The Pressure Suppression Pressure is utilized to assure the pressure suppression function of the primary containment is maintained while the RPV is at pressure.

e. The PRI CNTMNT PRESSURE CONTROL display of SPDS provides the operator with margin to Pressure Suppression Pressure calculation.

1) The margin to limit value of suppression chamber pressure is obtained by subtracting the current value of suppression chamber pressure from the suppression chamber pressure value of the Pressure Suppression Pressure function, as determined by the current value of suppression pool level.

2) The margin to limit value of suppression pool level is obtained by subtracting the current value of suppression pool level from the suppression pool water level value of the Pressure Suppression Pressure function as determined by the current value of suppression chamber pressure.

f. A **yes** response to this step indicates that the upward trend in primary containment pressure has been halted or reversed. The operator is directed to continue in this procedural leg at DW/P-1.

g. A **no** response to this step indicates that primary containment pressure is still rising . The operator is directed to continue at DW/P-12

Obj. 7

12. DW/P-12 **EMERGENCY RPV DEPRESSURIZATION IS REQUIRED**

Execute this procedure and EOP-202 concurrently

a. Entered on a **no** response from step DW/P-11

b. To enter this step either of the following occurred:

1) Suppression chamber and/or drywell sprays could not be initiated,

OR

2) Suppression chamber and/or drywell spray operation was not effective in reversing the upward trend in primary containment pressure.

c. Review HC.OP-EO.ZZ-0102 bases for this step

d. Rapid depressurization of the RPV serves to terminate, or reduce as much as possible, any continued primary containment pressure rise.

e. Because drywell pressure must be above 1.68 PSIG to reach this step, EOP-101 has also been entered. The retainment override in step RC/P-2 will also direct the operator to enter EOP-202.

Obj. 7

13. DW/P-13 **MAINTAIN** Drwl Press below **65 psig**

a. Entered from DW/P-12 and concurrent actions of EOP-202

b. This step directs the operator to continue to use the available primary containment pressure control systems to maintain suppression chamber pressure below the Primary Containment Pressure Limit (65 PSIG)

Obj. 10

c. This step directs the operator to continue to use the available primary containment pressure control systems to maintain suppression chamber pressure below the Primary Containment Pressure Limit (65 PSIG)

1) Primary Containment Pressure Limit A (PCPL-A)is the lesser of:

a) The pressure capability of the primary containment. [≈ 96 psig]

b) The maximum primary containment pressure at which vent valves sized to reject all decay heat from the containment can be opened and closed. [65 psig]

c) The maximum primary containment pressure at which SRVs can be opened and will remain open. [69 psig]

d) The maximum primary containment pressure at which RPV vent valves can be opened and closed. [N/A to Hope Creek since MSL Drain MOVs are used]

Obj. 7

14. DW/P-14 Can Drwl Press be maintained below **65 psig**

    a. Entered from DW/P-13

    b. This decision step determines the success of the previous actions taken to maintain suppression chamber pressure below the Primary Containment Pressure Limit (65 PSIG).

    c. A **yes** response indicates that the upward trend in suppression chamber pressure has been halted or reversed. The operator is directed to return to DW/P-1.

    d. A **no** response directs the operator to continue in this procedural leg at DW/P-15.

    e. Review HC.OP-EO.ZZ-0102 bases for these steps.

Obj. 7

15. DW/P-15 Is Supp Pool Level below **180 in**

    a. Entered from DW/P-11

    b. Since primary containment pressure is continuing to rise, the next alternative method of pressure reduction is primary containment venting. The suppression chamber is the preferred method for primary containment venting because this path:

        1) Takes advantage of the scrubbing effect

        2) Minimizes the offsite radioactivity release rate.

    c. This step determines the status of suppression pool level, in order to utilize the most optimum primary containment venting path based on the plant conditions.

Table 1

    d. The suppression pool level restriction (less than 180 in) is required to ensure that the suppression chamber vent line is not submerged. Although the actual elevation of the suppression chamber vent line corresponds to 254 in indicated, 180 in is the maximum level at which installed instruments can detect and display suppression pool level.

    e. If indicated level is 180 in or above, it must be assumed that the suppression chamber vent line is submerged.

    f. A **yes** response indicates that the suppression chamber spray header and vent line are not submerged. The operator is directed to

continue in this procedural leg at DW/P-16, where actions to vent the suppression chamber are addressed.

g. A **no** response directs the operator to continue in this procedural leg at DW/P-19, where actions to vent the drywell are addressed.

Obj. 7

16. DW/P-16 **BEFORE** Drwl Press reaches **65 psig**

a. Entered on a yes response from step DW/P-15

b. As with any BEFORE step a conditional action follows see DW/P-14

Obj. 7

17. DW/P-17 **VENT** the **Supp Chamber** using OP-EO.ZZ-318 to restore and maintain Drwl Press below **65 psig**.
DEFEAT isolation interlocks if necessary
EXCEEED offsite radioactivity release rate limits if necessary

a. Suppression chamber venting is performed because the consequences of not venting may result in a catastrophic loss of primary containment integrity with a subsequent uncontrolled release of radioactivity much greater than that which might otherwise occur.

b. Suppression chamber venting is accomplished by defeating isolation interlocks if necessary in accordance with HC.OP-EO.ZZ-0318, Containment Venting, in order to reduce primary containment pressure.

1) Direction is given to only continue venting until Drwl pressure can be restored and maintained below the Primary Containment Pressure Limit (65 PSIG).

2) This action minimizes the offsite radioactivity release rate while still assuring primary containment integrity.

c. Review HC.OP-EO.ZZ-0102 bases for these steps

Obj. 7

18. DW/P-18 Can the Supp Chamber be vented

a. This step is entered from DW/P-14 and determines the success of the actions taken in DW/P-14.

b. A **yes** response indicates that all components in the suppression chamber are operating properly and that suppression chamber

venting is in progress. The operator is directed to DW/P-1 to monitor and control Drwl pressure.

c. A **no** response indicates that for some reason other than suppression pool level the suppression chamber vent path cannot be established. The operator is directed to continue in this procedural leg at DW/P-19.

Obj. 7

19. DW/P-19 **BEFORE** Drwl Press reaches **65 psig**

a. Entered from a no response from either step DW/P-12 or DW/P-15

b. In either case the suppression chamber was not able to be vented.

c. As with all BEFORE steps a conditional action follows see DW/P-17

Obj. 7

20. DW/P-20 **VENT** the Drwl using OP-EO.ZZ-318 to restore and maintain Drwl Press below **65 psig**.
DEFEAT isolation interlocks if necessary.
EXCEEED offsite radioactivity release rate limits if necessary

a. Entered from DW/P-19

b. Drywell venting is performed because the consequences of not venting may result in a catastrophic loss of primary containment integrity with a subsequent uncontrolled release of radioactivity much greater than that which might otherwise occur.

c. Drywell venting is accomplished by defeating isolation interlocks if necessary in accordance with HC.OP-EO.ZZ-0318, Containment Venting, in order to reduce primary containment pressure.

1) Direction is given to only continue venting until Drwl pressure can be restored and maintained below the Primary Containment Pressure Limit (65 PSIG).

2) This action minimizes the offsite radioactivity release rate while still assuring primary containment integrity.

d. Review HC.OP-EO.ZZ-0102 bases for these steps

e. At completion of venting actions the operator is returned to DW/P-1 to monitor and control Drwl pressure.

V. DRYWELL TEMPERATURE LEG

A. Procedural steps

1. DW/T-1 **MONITOR** AND **CONTROL** Drwl Temp below **135°F** using available Drwl Cooling.

   a. This step is entered from PCC-2, or from a yes response to DW/T-2 & DW/T-5, and at the completion of actions from DW/T-6.

   b. The operator may have entered the Primary Containment Control Procedure (HC.OP-EO.ZZ-0102) on any of the five (5) entry conditions. This step reminds the operator to monitor average drywell temperature and to take normal actions as necessary to maintain drywell temperature below the Technical Specification LCO value (135°F).

   c. Review HC.OP-EO.ZZ-0102 bases for this step.

   d. The operator is reminded to use average drywell air temperature because:

Obj. 4b

      1) The drywell is a large volume where wide variations in temperature are possible, resulting in local temperatures that may not be representative of the entire volume.

      2) Utilization of local temperatures will result in an overly conservative and restrictive approach to drywell temperature control, and is not consistent with the guidelines of the Emergency Operating Procedures.

      3) Average drywell temperature is available on each SPDS display.

   e. The Primary SPDS display provides indication of average drywell temperature. The output signal from all operable drywell temperature sensors is summed and represents a weighted average of the temperature sensor outputs at the various drywell elevations.

   f. The SPDS also provides a DRYWELL TEMPERATURE CONTROL display, presenting more detailed information directly relating to drywell temperature to aid the operator in execution of this procedural leg.

Obj. 8
Caution 1

   g. Caution #1 applies to this procedural leg and alerts the operator that density changes in the "reference" leg water column of RPV water

level instruments, caused by changes in drywell temperature, will affect RPV water level indication and trend.

1) Part A of Caution #1 alerts the operator to the fact that under elevated drywell temperature conditions, channel A and B (wide, narrow, and upset RPV water level ranges) level instrumentation will provide the most reliable indication. Design changes incorporated into instrument piping runs for the A and B channel level instrumentation minimize the effect of elevated drywell temperatures on RPV level indication.

   a) Channels A and B of RPV level instrumentation reference legs are routed in the Drywell with a maximum 1ft elevation drop. The instruments using the rerouted lines will indicate a level that is 1.3 feet higher than normal under worst case conditions.

   b) Flashing or boiloff of the sensing lines may occur when RPV pressure is less than 118 psia when the drywell temperature is 340°F.

   c) Both the DRYWELL TEMPERATURE CONTROL and RPV WATER LEVEL CONTROL SPDS displays present information to allow the operator to monitor the margin to reference leg flashing.

2) Part B of Caution #1 identifies the limiting conditions beyond which boiling of the water in RPV water level instrument legs may occur.

   a) Water in the RPV water level instrument legs is maintained in a liquid state by the cooling action of the surrounding atmosphere and the pressure in the RPV. The water in the instrument legs will boil, however, if its temperature exceeds the saturation temperature for the existing RPV pressure.

   b) Boiloff of the reference leg water inventory reduces the reference head of water, decreases the differential pressure sensed by the RPV water level instrument, and results in an erroneously high indicated RPV water level. Boiling of the variable leg water inventory exerts increased pressure on that side of the differential pressure cell, which results in a lower sensed differential pressure and an erroneously high indicated RPV water level.

   c) The RPV Saturation Temperature is based simply on the properties of water.

- The RPV pressure range over which the RPV Saturation Curve is plotted extends from atmospheric pressure (0 PSIG) to 1108 PSIG (pressure setpoint of the lowest lifting SRV).

- The temperature axis of the RPV Saturation curve is a function of the drywell temperature near the associated RPV water level instruments.

d) The table below the RPV Saturation Curve delineates the SPDS temperature points which should be utilized to determine localized drywell temperature conditions. Additionally, the RPV water level instrumentation (associated with that SPDS point) which may provide inaccurate indication at local temperatures above the RPV Saturation Curve are also listed. The operator will need to analyze plant conditions to determine instrument indication accuracy.

Obj. 7

2. DW/T-2 Can Drwl Temp be restored and maintained below **135°F**

   a. This step is entered from DW/T-1.

   b. This step asks the operator if the actions being taken have been effective in restoring and maintaining drywell temperature below the Technical Specification LCO.

   c. A **yes** response indicates that the upward trend in drywell temperature has been halted or reversed. The operator is directed to DW/T-1.

   d. A **no** response will direct the operator to DW/T-3.

   e. Review HC.OP-EO.ZZ-0102 bases for this step.

Obj. 7

3. DW/T-3 **BEFORE** DRWL TEMP REACHES **340°F**

   a. Entered on a no response from DW/T-2

   b. As with all BEFORE steps a conditional action follows see DW/T-4

Obj. 7

4. DW/T-4 **RUNBACK** Reirc (BB)
AND
INITIATE a manual scram

ENTER and EXECUTE EOP-101 concurrently

a. With no automatic scram specifically assigned to Drywell temperature there may be a condition where and automatic scram has not occurred these actions ensure the reactor is shutdown or attempted to be shutdown prior to Initiating Drywell spray.

b. Review HC.OP-EO.ZZ-0102 bases for this step

Obj. 7

5. DW/T-5 Is suppression pool level below 124in.
   a. Requires the operator to evaluate conditions that will allow Drywell spray
   b. A **yes** response sends the operator to step DW/T-6
   c. A **no** response sends the operator to DW/T-8

Obj. 7
Figure 2

6. DW/T-6 Is Drwl Temp. below curve
   a. Requires the operator to evaluate conditions that will allow Drywell spray
   b. A **yes** response sends the operator to step DW/T-7
   c. A **no** response sends the operator to DW/T-8
   d. Review HC.OP-EO.ZZ-0102 bases for this steps

Obj. 7

7. DW/T-7 **SHUTDOWN** Recirc Pumps (BB) AND Drwl Cooling Fans (GT)

AND

INITIATE 1 loop of Drwl spray at rated flow.

USE only an RHR pump not required to assure adequate core cooling by continuous operation in the LPCI mode

a. This step is entered from DW/T-6.

b. Drywell spray effects a reduction in both drywell temperature and pressure, but is initiated only if:

1) Suppression pool level is below 124 in, and

2) Drywell temperature and pressure are within the limits of the Drywell Spray Initiation Limit (Curve DWT-P).

Table 1

c. The suppression pool level restriction (less than 124 in) is required to ensure that the suppression chamber-to-drywell vacuum breakers are not submerged.

1) Although the actual elevation of the suppression chamber-to-drywell vacuum breakers is 134 in. (minus the opening pressure in feet of water) , 124 in is conservatively used because this value can be accurately detected and displayed on available suppression pool level instrumentation.

2) If the suppression chamber-to-drywell vacuum breakers were submerged, no suppression chamber-to-drywell relief capability would exist and the design negative differential pressure capability (-3 PSID) of the primary containment could be exceeded if drywell sprays were initiated.

d. Maintaining adequate core cooling takes precedence over maintaining drywell temperature/pressure since catastrophic failure of the primary containment is not expected to occur at this temperature. In addition, further action still remains available for reversing an increasing drywell temperature/pressure trend.

e. Review HC.OP-EO.ZZ-0102 bases for this step

Obj. 5
Obj. 6a
Figure 2

f. The Drywell Spray Initiation Limit is defined to be the highest drywell temperature at which initiation of drywell sprays will not result in an evaporative cooling pressure drop to below either:

1) The drywell-below-suppression pool differential pressure capability (-3 PSID), or

2) The high drywell pressure scram setpoint (1.68 PSIG).

g. Drywell spray operation effects a drywell pressure and temperature reduction through evaporative cooling.

1) Evaporative cooling occurs when water is sprayed into a superheated atmosphere.

a) The water at the surface of each droplet is heated and flashes to steam. The steam will continue to absorb heat energy until saturated conditions exist in the atmosphere.

b) In the drywell, with typical drywell spray flowrates, this cooling process results in an immediate, rapid, large reduction in pressure which will occur at a rate much faster than can be compensated for by the primary containment vacuum relief system.

c) By restricting the operation of drywell sprays to within the limits of the Drywell Spray Initiation Limit (Curve DWT-P), the design negative differential pressure capability (-3 PSID) of the primary containment will not be exceeded, thus assuring primary containment integrity.

h. This step provides guidance for the initiation of drywell sprays. The second override statement in PCC-1 provides guidance for termination of drywell sprays.

i. SPDS provides the operator with margin to Drywell Spray Initiation Limit data on the following SPDS displays:

1) RPV Pressure Control

2) Drywell Temperature Control

3) Drywell Pressure Control

4) Suppression Pool Water Level Control

5) Dedicated DSIPL display

j. Recirculation pumps and drywell cooling fans are shutdown to prevent electrical damage because neither are designed to operate in a spray environment.

k. The operator continues at DW/T-8.

Obj. 7

8. DW/T-8 Can Drwl Temp be maintained below **340°F**

a. This step is entered from DW/T-7.

b. This step determines if the actions being taken at this time are able to maintain drywell temperature below 340°F.

c. A **yes** response to this step directs the operator to return to DW/T-1, for continued drywell cooling efforts.

d. A **no** response to this step directs the operator to DW/T-9, where actions to rapidly depressurize the RPV are addressed.

e. Review HC.OP-EO.ZZ-0102 bases for this step.

f. To assist the operator in determining the appropriate path to execute, the DRYWELL TEMPERATURE CONTROL display of SPDS provides a margin to action table.

g. SPDS subtracts the average drywell temperature value from the fixed 340°F action level and presents the result in the margin to action column.

Obj. 7

9. DW/T-9 **EMERGENCY RPV DEPRESSURIZATION IS REQUIRED**

a. This step is entered as the result of a no response to DW/T-8.

b. The intent of this step is to remove the source of heat addition to the primary containment by lowering the saturation temperature of the coolant.

c. 340°F is the drywell design temperature and the environmental qualification temperature of safety related electrical equipment in the drywell.

d. With drywell temperature above 340°F, operation of the ADS valves cannot be assured. Therefore, emergency RPV depressurization is performed prior to reaching 340°F to ensure that the ADS valves will function as required.

e. Completion of actions in EOP-202 will direct the operator to return to DW/T-1 and monitor and control drywell temperature.

VI. HYDROGEN CONTROL LEG

A. Retention Overrides

1. PC/H-1

IF while executing the following steps:	THEN:
Primary containment isolation occurs	**PLACE** H2/O2 analyzers back in service, if necessary.
H2/O2 analyzer system is OR becomes unavailable after warmup	**SAMPLE** the drwl AND supp chamber for H_2 AND O_2
H2 concentrations exceeds **2%**	**EXIT** this procedure and **ENTER** SAG

a. Entered from PCC-2

b. Review HC.OP-EO.ZZ-0102 bases for these overrides

B. Procedural Steps

Obj. 7
Obj. 4c

1. PC/H-2 **MONITOR** H_2 AND O_2 concentrations in the Supp Chamber AND the Drwl

a. Entered from PC/H-1

b. Measurable levels of hydrogen could appear in the primary containment from the following sources:

1) The high temperature reaction of metal (typically zirconium) with water to produce hydrogen gas and metal oxide.

$$Zr + H2O \xrightarrow{\gamma} ZrO2 + H2 + energy$$

2) Radiolysis of water to produce hydrogen and oxygen

$$2H2O \xrightarrow{\gamma} 2H2 + O2$$

3) Feedwater injection of hydrogen to control reactor chemistry

c. Review HC.OP-EO.ZZ-0102 bases for this step.

VII. SUMMARY

A. Review learning objectives

B. Review operating experience (when applicable) and any safety concerns

C. Introduce the title of the next lesson (when applicable)

VIII. FIGURES and TABLES

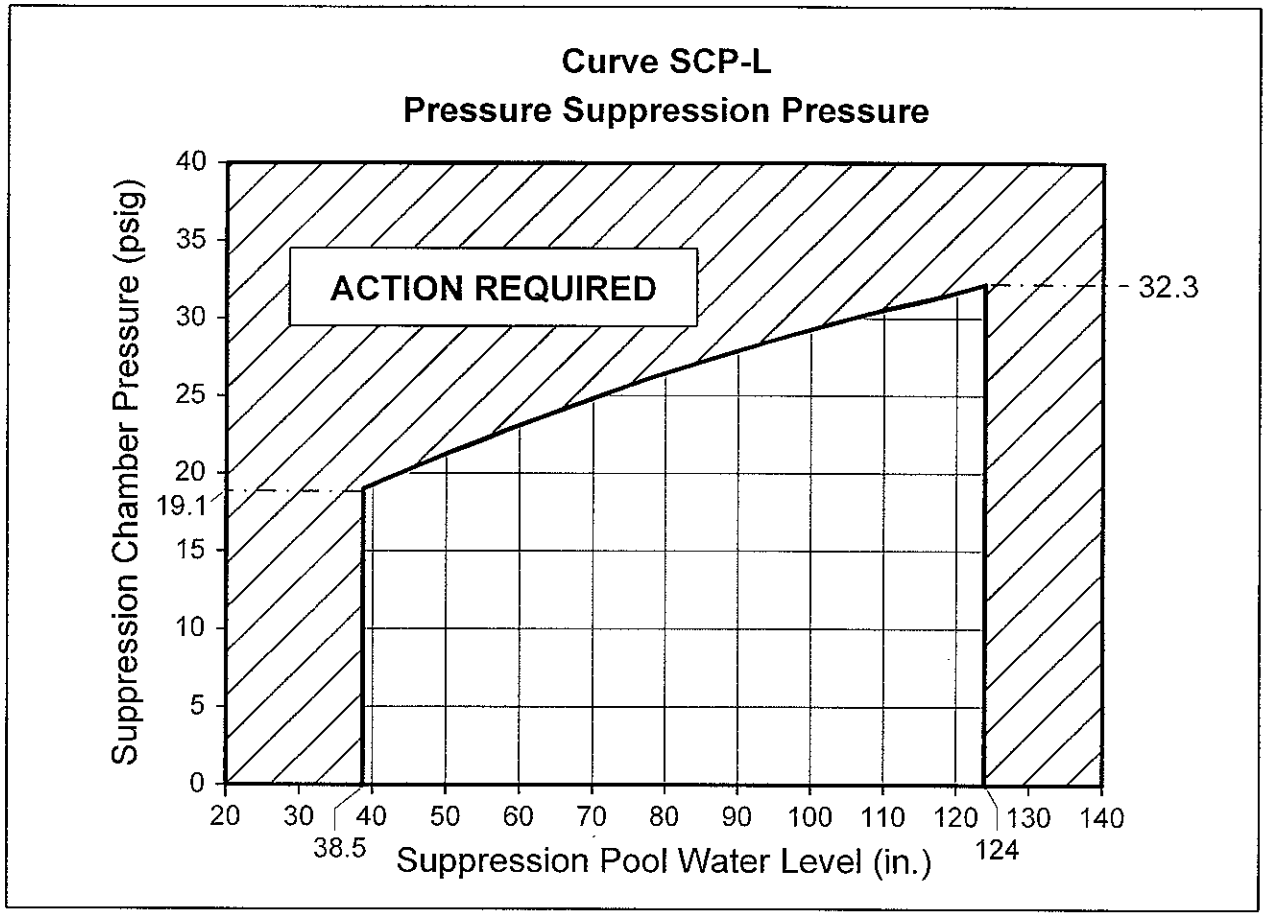
A. Figures

1. Pressure Suppression Pressure (SCP-L)
2. Drywell Spray Initiation Curve Limit (DWT-P)

B. Tables

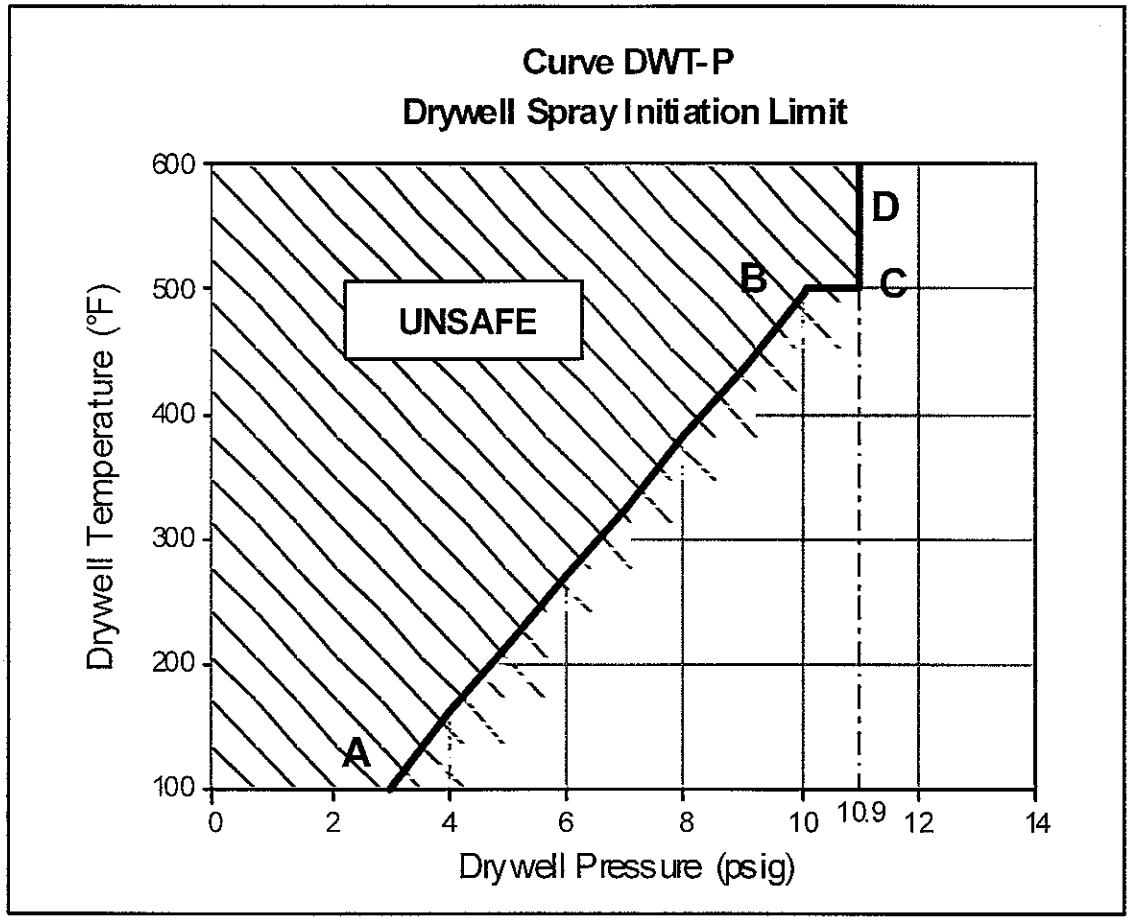
1. Torus Water Indicated Level Vs Actual Level

Figure 1



Point Location	Curve Explanation
Left Vertical Line	**38.5 in** - is the suppression pool water level corresponding to the elevation of the downcomer vent openings. If suppression pool water level is below this elevation, the RPV may not be kept in a pressurized state since steam discharged through the vents may not be condensed. The PSP is therefore vertical at this elevation
19'1" to 32'3'	Corresponds to the highest suppression chamber pressure which can occur without steam in the suppression chamber airspace.
Right Vertical Line	**124 in** - is the suppression pool water level corresponding to the Maximum Pressure Suppression Primary Containment Water Level. Above this elevation, the pressure suppression function of the containment cannot be assured. The PSP is therefore vertical at this elevation

Figure 2



Point Location	Curve Explanation
A to B	Line A-B defines the drywell temperature and pressure from which evaporative cooling will reduce drywell pressure to the scram setpoint (1.68 psig). Initiating sprays to the left of the line could result in a final pressure below atmospheric, causing the vacuum breakers to open.
B to C	The maximum indicated drywell temperature (500°F). the curve has been truncated at the highest indicated temperature.
C to D	The drywell pressure (10.9 psig) at which the calculated value of the Drywell Spray Initiation Limit equals 545°F, the maximum drywell temperature assumed possible under emergency conditions. spray initiation is unrestricted above 10.9 psig.

TABLE 1
TORUS WATER INDICATED LEVEL vs ACTUAL LEVEL

EOP Action Level	Torus Instrument	Level Actual	Significance of Elevation	Required Action
	(254")	348"	Torus Vent Valves	
	(230")	324"	Torus Spray Header	
180"	180"	274"	Top of Indication Level in Control Room	**Do Not** Spray Supp Chamber OR Vent Primary Containment if **not** below this level
	134"	228"	Torus to DW Vacuum Breakers	
124"	124"	218"	Ensure Torus to DW Vacuum Breakers not covered	**Do Not** Spray the DW if above this level
78.5"	78.5"	172.5"		TS High LCO Limit
	77"	171"	Normal Level	
	75"	169"	Bands	
74.5"	74.5"	168.5"		TS Low LCO Limit
55"	55"	149"	Ensure Vent Header Drain Lines not Uncovered	Runback Recirc & Initiate a Manual Scram
38.5"	38.5"	132.5"	Downcomers Uncovered	Minimum on PSP Emergency Depressurization required
30"	30"	124"	Ensure HPCI Exhaust not Uncovered	Secure HPCI irrespective of Adequate Core Cooling
	26"	120"	HPCI/RCIC Exhaust Uncovered	
0"	0"	94"	Instrument Zero Ensures SRV T- Quenchers not uncovered	Do Not use SRV's for Depressurization if not above this level
	(-27")	67"	SRV T-Quenchers	
	(-94")	0"	Bottom of Torus	

( ) = Non Readable instrument level