APPENDIX B

WORK PLAN FOR EOP

VERIFICATION AND VALIDATION

WORK PLAN FOR EOP VERIFICATION AND VALIDATION AT HOPE CREEK GENERATING STATION

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Public Service Electric & Gas Company

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1.0 INTRODUCTION

1.1 Purpose

This Work Plan defines the process that will be used to implement the Emergency Operating Procedure Verification and Validation (EOP V&V) Program, as described in Hope Creek Generating Station's Procedures Generation Package (December 1984). This plan is modeled after the guidelines for EOP verification and validation developed under the sponsorship of the Institute of Nuclear Power Operations (INPO-83-004, March 1983; and INPO 83-006, July 1983). It is consistent with the Nuclear Regulatory Commission's guidance for EOP preparation contained in NUREG-0899 (August 1982).

1.2 Scope

The Work Plan addresses the following V&V activities:

- o Technical Verification (Section 2.0)
- o Editorial Verification (Section 3.0)
- o Validation (Section 4.0)
- o Assessment and Resolution (Section 5.0).

Each activity is defined in terms of objective, method, personnel needs, facilities/materials, and specific instructions for performing the activity.

This Work Plan will be applied to all EOPs for Hope Creek Generating Station, as listed below:

- o OP-EO.ZZ-099, Post-Scram Recovery
- o OP-EO.ZZ-100, Reactor Scram
- o OP-EO.ZZ-101, Reactor/Pressure Vessel Control
- o OP-EO.ZZ-102, Containment Control
- o OP-EO.ZZ-103, Reactor Building Control
- o OP-EO.ZZ-104, Radioactivity Release Control
- o OP-EO.ZZ-201, Level Restoration
- o OP-EO.ZZ-202, Emergency Depressurization
- o OP-EO.ZZ-203, Steam Cooling
- o OP-EO.ZZ-204, Spray Cooling
- o OP-EO.ZZ-205, Alternate Shutdown Cooling

- OP-EO.ZZ-206, Reactor Flooding
- OP-EO.ZZ-207, Level/Power Control.

2.0 TECHNICAL VERIFICATION

2.1 Objective

The objective of technical verification is to ensure that the EOPs accurately reflect the generic BWROG Emergency Procedure Guidelines (EPGs), the Hope Creek Plant-Specific Technical Guidelines (PSTGs), and other EOP source documents. Technical verification will include:

- o Verification of the correctness and completeness of the plant-specific information merged with the generic guidelines.
- o Verification of the compliance of the resultant EOPs with the generic guidelines from which they were developed.
- o Verification of the compliance of the EOPs with applicable operating, system, and administrative procedures.

Technical verification will also address the objective of ensuring that the level of information detail provided in the EOPs is consistent with the qualifications, training, and experience of the operating staff. (This objective will also be addressed in other activities of the EOP V&V Program.)

2.2 Applicability

The verification process will be performed on all procedures before their approval for use. In addition, should an approved procedure be completely rewritten, the complete verification process will be performed on the rewrite.

When a step, subsection, or attachment to an approved procedure is changed, verification steps will be performed as necessary to ensure: (a) that procedure changes accurately reflect technical source data; (b) that the plant-specific technical guidelines are maintained up-to-date; and (c) that all procedure changes are written in accordance with the Writer's Guide.

The instructions given in Section 2.6, 2.7 cover verification of entire procedures and verification of partial changes separately.

2.3 Summary of Method

Technical verification is a "tabletop analysis" activity. It will be done by comparing each procedure to the applicable EPG and PSTG, and to data from other sources such as the Final Safety Analysis Report (FSAR).

Revision 3 of the EPGs will be used. OP-EO.ZZ-101 through 104 were developed based on Revision 3 of the principal EPGs. OP-EO.ZZ-201 through 207 were developed based on Revision 3 of the contingency guidelines.

The BWROG EPGs do not separately address Post-Scram Restoration and Reactor Scram, which are covered by Hope Creek EOPs OP-EO.ZZ-099 and 100. Technical verification in those cases will refer to other source documents that provide the EOP bases. (The EPG for RPV Control does include reactor scram and will be used in the verification of that EOP.)

A checklist will be used to ensure that key points of comparison are covered consistently. Any apparent discrepancies will be documented, and assessed and resolved as described in Section 5.0.

2.4 Personnel

The following types of personnel will participate in the technical verification of the EOPs. Minimum qualifications and responsibilities are listed for each personnel category identified:

1. V&V Coordinator

   a. Qualifications:

      - Experience as a Senior Reactor Operator and/or currently in the SRO license training program at Hope Creek Generating Station
      - Thorough knowledge of the EOPs and associated documentation
      - Thorough knowledge of plant systems
      - Authority to schedule technical verification activities and assign duties to personnel.

   b. Responsibilities:

      - Schedule activities, facilities, and personnel
      - Ensure that copies of EOPs, reference documents, and materials are available
      - Conduct preverification briefings to explain the overall purpose of the EOP V&V Program and the specific process of technical verification

- Coordinate and participate in technical verification activities
- Ensure that all documentation of activities is properly completed, filed, and distributed.

2. Technical Evaluators (minimum of 2 for each procedure in addition to the V&V Coordinator; they will be personnel who did not participate in writing the procedure)

   a. Qualifications:

      - One will have experience as a Senior Reactor Operator and/or will be currently in the SRO license training program at Hope Creek Generating Station.
      - One will have experience as a Reactor Operator and/or will be currently in the RO license training program at Hope Creek Generating Station.

   b. Responsibilities:

      - Perform technical verification in accordance with Work Plan
      - Perform other duties related to technical verification as directed by V&V Coordinator.

3. Other evaluator

   a. Qualifications (must meet one of the following)

      - Training department personnel
        - o Knowledge of the EOPs and associated documentation
        - o Thorough knowledge of plant systems
        - o Familiarity with the Procedures Generation Package and EOP V&V objectives and requirements.
      - Human Factors Specialist
        - o M.A./M.S. in human factors discipline
        - o Two years experience in application of human factors in nuclear power industry
        - o Experience in procedures development and/or conduct of EOP V&V in accordance with NRC and INPO guidance.

   b. Responsibilities:

      - Assist V&V Coordinator in explanation and implementation of technical verification requirements and documentation of results.

2.5 Facilities/Materials

- o Work room with table space to accommodate the participants and a place to store reference documents and other materials
- o A copy of the generic and plant-specific technical guidelines for each participant
- o A copy of each EOP to be evaluated
- o A copy of the Guideline Conversion Documentation
- o A copy of the Procedural Step Conversion Documentation
- o Access to technical source documents
- o A copy of the Technical Verification Checklist for each EOP to be evaluated (see Section 2.6).

2.6 Specific Instructions for Performing Technical Verification

1. Brief participants on the following: (V&V Coordinator)

   a. Purpose and scope of overall EOP V&V Program

   b. Participants and their roles

   c. Steps of technical verification; use of the Technical Verification Checklist.

2. Conduct Technical Verification. (Tech Evaluation Team)

   a. For each EOP, perform a three-way comparison of the generic and plant-specific technical guidelines and the EOP, in accordance with the Technical Verification Checklist.

      This will be done in group sessions, with one evaluator assigned to complete the Checklist, recording all participants' comments about discrepancies and any unresolved questions.

   b. Verify the accuracy of each plant-specific value given in the PSTG/EOP by comparison to source data.

3. Code checklist items for assessment and resolution process. (V&V Coordinator or designee)

   a. Review all checklist responses

   b. Determine which responses describe acceptable differences between the PSTG, EOP, and source documentation and which responses identify discrepancies or questions that require assessment and resolution

   c. Write a code by each response on the checklist that requires assessment and resolution. Include the following in the code:

      - Procedure number (e.g., OP-EO.ZZ-101 would be 101)
      - Response number (e.g., which comment? The first is 1, the second is 2, etc.).

      For example: 101-1

4. Assemble Checklists and Results Forms for documentation file and for assessment and resolution of V&V results. (V&V Coordinator)

2.7 Specific Instructions for Performing Partial Technical Verification

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A partial Technical Verification should be done when revisions are suggested for a limited portion of the procedure:

- o Setpoint change for instrumentation
- o Addition or removal of an alarm
- o Addition or removal of a control, controller, display
- o Changes in a table, graph or attachment.

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1. Brief evaluators on the following: (V&V Coordinator)
   a. Scope of the revision
   b. Purpose and scopes of overall EOP V&V Program
   c. Participants and their roles
   d. Steps of technical verification, use of technical verification checklist.
2. Conduct Technical Verification. (Technical Evaluation Team)
   a. Identify the portions of the Technical Verification Checklist to be used to evaluate scope of the revisions)
   b. Identify the reason for the revision and write this on the top of the first sheet of the checklist. Verify the accuracy of the revision with respect to the applicable portions of the three-way comparison of the generic and plant-specific technical guidelines, and the EOP, using the Technical Verification Checklist. (Technical Verification Team)
   c. Ensure that the applicable portions of the Technical Verification Checklist were completed by one team member. This team member should record all participants' comments about discrepancies and unresolved questions. (V&V Coordinator)
   d. Verify the accuracy of each plant specific value that required change. (Technical Evalulation Team)

3. Code checklist items for assessment and resolution process. (V&V Coordinator or designee)

   a. Review all checklist responses

   b. Determine which responses describe acceptable differences between the PSTG, EOP, and source documentation and which responses identify discrepancies or questions that require assessment and resolution

   c. Write a code by each response on the checklist that requires assessment and resolution. Include the following in the code:

      - Procedure number (e.g., OP-EO.ZZ-101 would be 101)
      - Response number (e.g., which comment? The first is 1, the second is 2, etc.).

      For example: 101-1

4. Assemble Checklists for documentation file and for assessment and resolution of V&V results. (V&V Coordinator)

2.8 Technical Verification Checklist

The checklist that will be used in Technical Verification is presented on the following pages.

TECHNICAL VERIFICATION CHECKLIST

Procedure & Rev No._____ Date of Review:_____

Procedure Title:_____

Applicable EPG: _____

Evaluator Names:	Licenses:		Job Titles:
_____	___RO	___SRO	_____
_____	___RO	___SRO	_____
_____	___RO	___SRO	_____
_____	___RO	___SRO	_____
_____	___RO	___SRO	_____

INSTRUCTIONS

Checklist items 1 through 5 are applicable to all EOPs except OP-EO.ZZ-099 and 100. Use checklist items 6 through 9 to verify those two procedures.

Each checklist item contains instructions for making comparisons and recording findings. After completing the checklist you are asked to review the checklist findings and notes, and to summarize them on the Technical Verification Results Form.

1. Compare each section of the EPG to the corresponding PSTG section.

   a. Identify each substantive difference found, other than insertion of plant-specific information called for by the EPG, by completing columns 1 and 2 of Table 1a.

      Then read the justification of the difference in the Guideline Conversion Documentation and complete column 3 of the table.

Table 1a: Verification of EPG-PSTG differences. (Use next page for continuation if needed.)

1 EPG/PSTG Section, Step No.	2 Difference (summarize)	3 Adequate Justification? Yes	No (explain)*

*Also note any difference that does not appear to be justified adequately on a copy of the PSTG.

Table 1a: Verification of EPG-PSTG differences (cont'd).

1 EPG/PSTG Section, Step No.	2 Difference (summarize)	3 Adequate Justification? Yes	No (explain)*

*Also note any difference that does not appear to be justified adequately on a copy of the PSTG.

1b. For each place where the EPG indicates that plant-specific information is needed, verify that the PSTG accurately specificies the plant-specific requirement. Refer to Appendix C calculation results and curves, to the Guideline Conversion Documentation, to the Setpoint Index, and to other sources as applicable.

Identify any omitted or questionable plant-specific data in Table 1b.

Table 1b: Verification of plant-specific information. (Use next page for continuation if needed.)

1 EPG/PSTG Step No.	2 Information Required	3 Problem (describe)*

*Also note any problem on a copy of the PSTG.

Table 1b: Verification of plant-specific information (cont'd).

1 EPG/PSTG Step No.	2 Information Required	3 Problem (describe)*

*Also note any problem on a copy of the PSTG.

Note 2,3,4,5

The accuracy of the PSTG with reference to the EPG and other source documents was verified in checklist item 1. The following items will compare the EOP to the PSTG. Use the findings from item 1 to make sure that you take into account any discrepancies between the PSTG and the EPG.

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2. Compare the purpose stated in Section 1.0 of the EOP text to the purpose stated in the PSTG. Does the EOP purpose statement clearly cover the intended scope as defined in the PSTG? ____Yes ____No

   If No, explain:

3. Review the EOP flowchart. Are the steps and the final plant status it defines consistent with the purpose stated in both the PSTG and the EOP text? ____Yes ____No

   If No, explain:

4. Compare the entry conditions stated in the PSTG to those indicated on the EOP flowchart.

   Are the entry conditions shown on the flowchart complete and consistent with the PSTG? ____Yes ____No

   If No, explain:

5. Compare each numbered block (step) of the EOP flowchart to the corresponding step in the PSTG. Ensure consistency of the following:

   - o Intent of step.
   - o Place of step in the total sequence of steps.
   - o Conditions for starting and stopping actions.
   - o Any time period or time limits for completing actions.
   - o Plant systems and components identified.
   - o Parameters to be monitored, and parameter units.
   - o Parameter ranges, values, or trend directions given as criteria or cues for decisions or actions.
   - o Point of entry from another procedure. Review the other procedure to make sure that the interface between the two is correct.
   - o Instructions to go to other steps within the procedure or to other procedures. Check the referenced step or the point of entry into the referenced procedure to make sure the interface is correct.
   - o Referrals to curves or other operator aids. Check the aid to make sure it is appropriate in light of step content.
   - o Use of Cautions and Notes. Where a Caution is referenced by number, review its content to verify that it is applicable to the steps indicated.

   In reviewing the EOP, also evaluate the completeness and clarity of steps, notes, and cautions. If you find places that seem to need clarification, or where operators may need additional information, identify and explain the need in Table 5 (next page).

   When a technical difference between the EOP flowchart and the PSTG is found, review the Procedural Step Conversion Documentation and source documentation to determine whether there is a basis for the difference. Record your findings in Table 5 (next page).

Table 5: Verification of EOP flowchart accuracy and consistency with PSTG.

EOP Step No.	Description of Difference, Recommended Action

Note 6,7,8,9

These remaining checklist items apply only to OP-EO.ZZ-099 (Post-Scram Restoration) and OP-EO.ZZ-100 (Reactor Scram).

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6. Review the source documentation that defines the bases for the procedure. Then review the Purpose stated in Section 1.0 of the EOP text.

   Is the EOP Purpose consistent with the scope of the action requirements identified in the source documentation? ____Yes ____No

   If No, explain:

7. Does the Purpose stated in the EOP text clearly and adequately summarize response defined in the EOP flowchart and the final plant status to be achieved as indicated by the flowchart? ____Yes ____No

   If No, explain:

8. Compare the entry conditions shown on the EOP flowchart to those indicated in the source documentation. Are they consistent?
   ____Yes ____No

   If No, explain:

9. Review each numbered block (step) of the EOP flowchart and verify the following by reference to source documentation:

   - o Intent of step.
   - o Place of step in the total sequence of steps.
   - o Conditions for starting and stopping actions.
   - o Any time period or time limits for completing actions.
   - o Plant systems and components identified.
   - o Parameters to be monitored, and parameter units.
   - o Parameter ranges, values, or trend directions given as criteria or cues for decisions or actions.
   - o Point of entry from another procedure. Review the other procedure to make sure that the interface between the two is correct.
   - o Instructions to go to other steps within the procedure or to other procedures. Check the referenced step or the point of entry into the referenced procedure to make sure the interface is correct.
   - o Referrals to curves or other operator aids. Check the aid to make sure it is appropriate in light of step content.
   - o Use of Cautions and Notes. Where a Caution is referenced by number, review its content to verify that it is applicable to the steps indicated.

   In reviewing the EOP, also evaluate the completeness and clarity of steps, notes, and cautions. If you find places that seem to need clarification, or where operators may need additional information, identify and explain the need in Table 9 (next page).

   When a technical difference between the EOP flowchart and source documentation is found, or where no source can be identified, complete Table 9 (next page).

Table 9: Verification of EOP flowchart accuracy and consistency with source documentation.

1 EOP Step No.	2 Source Identification	3 Difference, Recommended Action

3.0 EDITORAL VERIFICATION

3.1 Objective

The objective of editoral verification is to ensure that Hope Creek EOPs are written in accordance with the Hope Creek Procedure Writer's Guide. This activity will ensure that procedures are written consistently, clearly and succinctly. Content, style and format specifications will be reviewed. Editorial verification will also check that EOPs are written in vocabulary familiar to the operators.

3.2 Applicability

The editorial verification process will be performed on all procedures before their approval for use. In addition, should an approved procedure be completely rewritten, the complete verification process will be performed on the rewrite.

When a step, subsection or attachment to an approved procedure is changed, editorial verification steps will be performed as necessary to ensure all procedure changes are written in accordance with the Writer's Guide and are typographically correct. When a technical verification is completed on only specific parts of a procedure, editorial verification of only those sections will be required.

The instructions given in Sections 3.6 and 3.7 cover editorial verification of an entire procedure and verification of partial revisions separately.

3.3 Summary of Method

Editorial verification is also a "tabletop" activity. Procedure text and flowcharts are reviewed to determine if they comply with the guidance in the Writer's Guide. Persons participating in the editorial verification exercises will use a checklist to review each item and document problems. Where the checklist and the procedure disagree, notations will be made on the checklist itself. Later, these notations will be reviewed, assessed and resolved following the method outlined in Section 5.0.

3.4 Personnel

The qualifications and responsibilities of the personnel required to conduct the editorial verification are listed below:

1. V&V Coordinator

   a. Qualifications:

      - Experience as a Senior Reactor Operator and/or currently in SRO license training program at Hope Creek Generating Station
      - Thorough knowledge of Hope Creek EOPs, Writer's Guide, and procedures
      - Authority to schedule editorial verification activities and assign duties to personnel.

   b. Responsibilities

      - Schedule activities, facilities, and personnel
      - Ensure that copies of the EOPs, reference documents and materials, Writer's Guide and checklists are available
      - Conduct preverification briefings to explain the overall purpose of the EOP V&V program and the specific process of editorial verification
      - Coordinate and supervise editorial verification activities
      - Ensure that all documentation of activities is properly completed, filed and distributed.

2. Editorial Evaluators (minimum of 1 for each procedure; will be a person who did not participate in writing the procedures)

   a. Qualifications

      - Expertise as an editor, and/or
        - o Is a Shift Technical Advisor
        - o Is a PSE&G employee whose normal job duties require preparation, review and revision of written materials
        - o Is a human factors specialist
          - M.A./MS in a human factors discipline
          - Two years experience in application of human factors in nuclear power industry
          - Experience in procedures development and/or conduct of EOP V&V in accordance with NRC and INPO guidelines.

   b. Responsibilities

      - Perform the verification of written correctness, completing the applicable checklist

- Prepare written comments to identify and explain any deviations from the Writer's Guide or other information presentation problems areas found in the procedures
- Through the V&V Coordinator, resolve any questions about written correctness that may require input from operations personnel.

3.5 Facilities/Materials

- o Work room with table space to accommodate the participants and a place to store reference documents and materials
- o A copy of the Hope Creek Procedures Generation Package including the Writer's Guide
- o Copies of the Editorial Verification Checklist for each participant for each EOP to be evaluated.

3.6 Specific Instructions for Performing Editorial Verification

1. For each EOP, complete an Editorial Verification Checklist. Identify any section or step that does not conform to criteria, as instructed in the Checklist.
2. Review completed Checklist to ensure all items were reviewed and that locations of discrepancies in the EOP are identified explicitly.
3. Assemble all Checklists for documentation files and later assessment and resolution of comments.

3.7 Specific Instructions for Partial Editorial Verification of a Procedure

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Partial editorial verification will only be performed in conjunction with partial technical verification.

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1. Review the procedure revisions and the Editorial Verification Checklist to decide which checklist parts and items will be applicable. Complete these and identify any section or step that does not conform to criteria, as instructed in the checklist.
2. Review completed checklist items to ensure the locations of discrepancies in the EOP are identified explicitly.
3. Assemble the checklist for documentation files and later assessment and resolution of comments.

3.8 Editorial Verification Checklist

The checklist that wil be used in Editorial Verification is presented on the following pages.

EDITORIAL VERIFICATION CHECKLIST

Procedure & Rev No.: _____

Procedure Title: _____

Evaluator Name:_____ Job Title:_____

Evaluator License: RO_____ SRO _____ N/A _____

INSTRUCTIONS

The checklist is designed to address major parts of the procedure in turn: title page, table of contents, major sections, attachments/tables and flowchart.

All checklist items call for a "yes" or "no" answer. "No" indicates a discrepancy from the Writer's Guide. In such cases, use the "Comments" column to identify the problem (e.g., record the step number) and describe the deviation in detail . If an item is not applicable to a particular procedure, please note in the comments column

Upon completion of the checklist, read the statement below and sign.

SIGN-OFF

All Checklist items have been reviewed and all comments were written in the space provided.

_____ _____

Evaluator Signature Date

EDITORIAL VERIFICATION CHECKLIST

Identification	YES	NO	COMMENTS
1. Does the EOP have a unique identification number?	_____	_____	
2. Is the title of the EOP descriptive and in accordance with information contained in the purpose?	_____	_____	
3. Is the EOP number in accordance with the guidance provided in the Writer's Guide, page 3?	_____	_____	
4. Following the "REV" abbreviation, is a two digit number defining the revision number present?	_____	_____	
5. Are changes incorporated to the current revision of the EOP defined on the EOP title page in the "Remarks" section?	_____	_____	
6. Is the EOP number provided on each page (including table of contents) in upper right and lower left corners?	_____	_____	
7. Is a page number provided on each page?	_____	_____	
8. Is the revision number written on each page in the bottom right corner?	_____	_____	
9. Are pages numbered sequentially?	_____	_____	
10. Does title page contain:			
o EOP number	_____	_____	
o EOP title	_____	_____	
o Revision number	_____	_____	
11. Do the words "LAST PAGE" appear to the right of the page number on the final procedure page (i.e., last page of Section 4.0, Responsibilities)?	_____	_____	

EDITORIAL VERIFICATION CHECKLIST (cont.)

Format	YES	NO	COMMENTS
12. Is there sufficient contrast provided (black print with white paper) for all EOP pages, attachments and flowcharts?	_____	_____	
13. Does the title page conform to the format shown in the Writer's Guide, Attachment 1?	_____	_____	
14. Is the Table of Contents numbered page 1?	_____	_____	
15. Does the table of contents conform to the format shown in Attachment 2 of the Writer's Guide?	_____	_____	
16. Do all the section and major division titles listed in the EOP appear in the Table of Contents?	_____	_____	
17. Are each of the following sections contained within the EOP:			
o Section 1.0, Purpose	_____	_____	
o Section 2.0, References	_____	_____	
o Section 3.0, Definitions	_____	_____	
o Section 4.0, Responsibilities	_____	_____	
o Section 5.0, Procedure	_____	_____	
18. If this procedure is in the 100 or 200 series, the steps are presented as a flowchart?	_____	_____	
19. If this procedure is in the 300 series, the steps are presented as written text?	_____	_____	
20. Are the parts of the procedure, prior to the flowchart, on 8 1/2 x 11 inch paper?	_____	_____	
21. On the 8 1/2 x 11 inch paper, is the left margin approximately 3/4 inch to allow hole punching without document obliteration?	_____	_____	

EDITORIAL VERIFICATION CHECKLIST (cont.)

Attachments and Tables	YES	NO	COMMENTS
22. Is this attachment, form, diagram, special instruction or checklist providing supplemental information to the EOP?	_____	_____	
23. Are all attachments/tables or graphs identified as attachments?	_____	_____	
24. Do tables include lists or tabular information?	_____	_____	
25. Are forms labeled as attachments?	_____	_____	
26. Does this form have a unique identifier which links it to the procedure (e.g., Form OP-EO.ZZ 101 (Q) -1)?	_____	_____	
27. Are attachments and tables placed at the end of the procedure (following the flowchart or text)?	_____	_____	
28. Is each attachment/table or graph numbered independently?	_____	_____	
29. Are all attachments/tables:			
o Descriptively titled?	_____	_____	
o Clearly labeled?	_____	_____	
o Readable?	_____	_____	
30. For each attachment/table containing multiple pages, is the page number and total number of pages (page x of y) on each page?	_____	_____	
31. Do attachment/table numbers appear on all applicable pages?	_____	_____	
32. Are attachments or tables in the correct relative order to other attachments (i.e., they should be numbered and appear in the order in which they are cited within the EOP)?	_____	_____	
33. Are the attachment pages on 8 1/2 x 11 inch paper in size?	_____	_____	
34. Is the left margin approximately 3/4 inch to allow hole punching without document obliteration?	_____	_____	

EDITORIAL VERIFICATION CHECKLIST

Flowchart Step Format	YES	NO	COMMENTS
35. Are steps written in a simple, concise manner?	_____	_____	
36. Overall, is the step written in proper English?	_____	_____	
37. Are the steps written to avoid combinations of "and/or" terms?	_____	_____	
38. Are logic terms in conditional statements emphasized by using underscoring (If, Then, And, Or, When)?	_____	_____	
39. Are conditional steps expressed such that the condition is stated before the action which is to be performed?	_____	_____	
40. Do commands appear in bold print?	_____	_____	
41. Are flowpath actions written in short, concise, identifiable steps as opposed to paragraphs?	_____	_____	
42. Are steps with more than one action minimized?	_____	_____	
43. Are numerous objects or actions listed and bulleted?	_____	_____	
44. Are items listed when there are five or more?	_____	_____	
45. Do acronyms and abbreviations conform to the abbreviation list provided in the Writer's Guide (Attachment 4)?	_____	_____	
46. Is the panel number provided for steps to be performed at a local panel?	_____	_____	
47. When a deviation from a setpoint is allowed, is it given as a range or limiting value rather than as a percentage?	_____	_____	

EDITORIAL VERIFICATION CHECKLIST (cont.)

Flowchart Step Format (cont.)	YES	NO	COMMENTS
48. Are all referenced documents clearly identified by procedure number?	_____	_____	
49. Are citations for referenced procedures accurately stated?	_____	_____	
50. If calculations are required, is space provided to perform them?	_____	_____	
51. Are formulas for calculation provided when needed?	_____	_____	
52. Are Caution indicators (i.e., circles) placed immediately adjacent the step(s) to which they apply?	_____	_____	
53. Do Caution statements avoid the use of action statements?	_____	_____	

Flowchart Style and Format	YES	NO	COMMENTS
54. Do flowchart symbols, conform to those provided in the Writer's Guide, Attachment 3?	_____	_____	
55. Are major symbol blocks (action, decision or retainment steps) easy to detect and discriminate?	_____	_____	
56. Are symbols for entries and exits (including procedure to procedure) coded?	_____	_____	
57. Do all decision steps require a choice of one of two opposite possibilities (i.e., YES/NO, HIGH/LOW, etc.)?	_____	_____	
58. In decision steps, is the direction of YES/NO, HIGH/LOW, etc., paths consistent?	_____	_____	
59. Does the spacing of paths allow operator easy and accurate movement through the different flowchart branches?	_____	_____	

EDITORIAL VERIFICATION CHECKLIST (cont.)

Flowchart Style and Format (cont.)	YES	NO	COMMENTS
60. Is the direction of flowchart paths indicated by arrows?	_____	_____	
61. Are path and loop logic complete so there is no ambiguity about how to proceed?	_____	_____	
62. Are entries to flowpaths indicated as illustrated in the Writer's Guide, Attachment 3?	_____	_____	
63. Are entrances to the left of the EOP steps?	_____	_____	
64. Do entry arrows contain the EOP number and step that directed the operator to this EOP?	_____	_____	
65. Are exits from flowpaths indicated as illustrated in the Writer's Guide, Attachment 3?	_____	_____	
66. Are all exit arrows directed toward the right side of the procedure?	_____	_____	
67. Do exit arrows contain the procedure number and step to be entered?	_____	_____	
68. If a graph or table is cited in the flowchart, does it provide:			
o Readable information	_____	_____	
o Information that can be extracted to the necessary level of detail	_____	_____	
o Values that correspond to plant instrumentation?	_____	_____	
69. Are margins sufficient, so that all information is clear and readable?	_____	_____	
70. Is the quality of the copy so that the flowchart is readable?	_____	_____	

4.0 VALIDATION

4.1 Objective

The objective of validation is to ensure that the actions specified in the EOPs can be followed by trained operators to manage emergency conditions in the plant. Validation addresses the operational usability and effectiveness of the procedures, and their compatibility with plant responses, hardware, and shift staffing.

4.2 Applicability

The validation process will be performed on all new procedures prior to their approval for operational use. In addition, validation will be performed when existing, approved procedures are revised, depending on the nature of the revision. A revised procedure must be validated when:

- The revision arises from a plant equipment change (hardware or software) that alters the functions or response characteristics of a system or subsystem, or alters interrelationships between systems or subsystems.
- The revision arises from a change in equipment characteristics that alters the functions or response characteristics of a system or subsystem, or alters interrelationships between systems or subsystems.
- The revision arises from a change in plant equipment that could affect radioactive release control or that raises an environmental question not previously addressed.
- The revision changes cues for operator actions or the expected results of operator actions.
- The revision changes the sequence of operator actions on one or more branches of the procedure.

Validation should in all cases be preceded by verification.

4.3 Summary of Methods

Two methods of validation will be used:

1. Simulation -- Control room personnel perform the procedure on the plant simulator for an observer team. This will be done for each EOP insofar as the emergency conditions addressed by the EOP can be simulated.
2. Walk-Through -- Control room personnel perform a step-by-step enactment of the procedure for an observer team, without

actually executing control actions. This will be done for EOPs that cannot be simulated adequately.

In addition, a nonperformance walk-through will be done during the DCRDR to check consistency of terminology between each EOP and the displays and controls provided in the control room.

Scenarios will be prepared for use in simulator exercises and control room walk-throughs. A scenario is a structural plan of parameter and plant symptom changes. Its purpose is to provide the cues needed to guide the path of performance. This is necessary since there are decision points in the procedures where the appropriate course of action depends on plant conditions which may be variable.

4.4 Selection of Validation Method

Either simulator or walk-through exercises can be used to validate an EOP. When possible, simulator validation is the preferred method. Simulator validation allows the operators to perform actions in real time with plant responses similiar to those of the actual unit. When the computer models on the simulator do not allow certain scenarios to be performed, or when most actions in the procedure are performed outside the control room, walk-through validation exercises will be performed. Some additional guidelines for the selection of EOPs for simulator validation are given below:

- If several EOPs are to be validated, the selection should be made to represent the array of symptoms which the procedures involve (e.g., Drywell pressure above 1.68 psig, Reactor pressure above 1037 psig, Scram conditions, Drywell temperature above 135°F). Parts of the EOPs may be selected for simulation to avoid repetition of comparable steps in different procedures.
- Simulator validation is desirable where branching occurs (within a single procedure or from one procedure to another). Enough of each procedure should be performed to ensure that transitions are possible and operationally correct.
- If an EOP directs operators to go to another procedure and perform it concurrently, the feasibility of this should be examined using the simulator.
- Where response times could affect plant conditions, simulator validation is recommended.

- An EOP or part of an EOP should be validated using a simulator if it requires close coordination of actions by different operators.
- Where multiple problems or failures exist, simulator validation is recommended.

4.5 Specification of Scenarios

A brief narrative statement should be written to specify the conditions under which the procedure is assumed to be performed and the path to be followed through the procedure.

Several kinds of scenarios may be used: (1) A scenario may be limited to one flowpath of a single procedure; (2) a scenario may require that more than one flowpath of a single procedure be executed; or (3) a scenario may require concurrent execution of two or more procedures. At a mimimum, at least one of each of the following cases should be simulated:

- A scenario in which execution of the Reactor Scram procedure, OP-EO.ZZ-100, is followed by the Post-Scram Recovery procedure, OP-EO.ZZ-099.
- A scenario in which multiple flowpaths within one procedure are executed (e.g., OP-EO.ZZ-101).
- A scenario in which concurrent performance of two or more procedures occurs (OP-EO.ZZ-102 and 202, OP-EO.ZZ-103, 100, and 202, OP-EO.ZZ-201 and 203).
- A scenario in which Reactor Flooding, OP-EO.ZZ-206, is entered via Emergency Depressurization, OP-EO.ZZ-202.
- A scenario in which Alternate Shutdown Cooling, OP-EO.ZZ-205, is executed.

The scenario descriptions should include the following:

- Conditions prior to procedure initiation - Include plant mode, power level (e.g., full power) and the status of system and major components that will affect or be affected by events. Unless otherwise stated, systems will be assumed to be in normal lineup and operating status.
- Initiating event - This is a statement of what causes the operators to enter the EOP. Include the underlying cause and the major symptoms observable in the control room (e.g., unisolable small break inside the RPV, high drywell pressure, decrease in suppression pool level, initiating alarms, etc.).

- o Subsequent events - Identify the major operator actions and plant changes (plant factors requiring operator action and plant response to operator action).

  When different flowpaths may be chosen in executing the procedure, specify the flowpath to be followed in the validation exercise. State any assumptions about plant variables that underlie the flowpath chosen.

  When branching to or concurrent execution of another procedure is a part of the scenario, specify the procedure and the point of entry in the "subsequent events." Also, if applicable, specify when a return to the original procedure occurs and where it is reentered.

- o Final conditions - Specify the plant status at the end of the scenario. Also specify the status of systems and major components affected by the events of the scenario (e.g., Scram, all control rods inserted, cooldown in progress, etc.).

If the procedure will be validated on the simulator, the scenario should be reviewed by the simulator operator to ensure that it is feasible as written. Also, there may be plant response delays, or long periods required to bring plant conditions to a desired state, during which operator actions would be essentially repetitive. Such delays may be eliminated. The stop and restart points should be identified so that they may be programmed in advance. The scenario description should be annotated to show when time-slicing is to be used and to identify the stop and restart cues.

4.6 Personnel

The following types of personnel will participate in the validation exercises. Minimum qualifications and responsibilities are listed for each personnel catagory identified:

1. V&V Coordinator

   a. Qualifications

      - Experience as a Senior Reactor Operator and/or currently in the SRO license training program at Hope Creek Generating Station
      - Thorough knowledge of the EOPs and associated documentation

- Thorough knowledge of plant systems
- Authority to schedule simulator sessions and control room activities
- Authority to schedule and assign duties to personnel.

a. Responsibilities

- Schedule activities, facilities and personnel
- Ensure that copies of EOPs, reference documents and materials are available
- Conduct prevalidation briefings to explain the overall purpose of the EOP V&V Program and the specific process of validation exercises
- Coordinate and supervise validation activities; participate as required
- Ensure that all documentation of activities is properly completed, filed and distributed.

2. Validation Exercise Participants

a. Qualifications

- Shift Supervisor - experience as a Senior Reactor Operator and/or currently in the SRO license training program at Hope Creek Generating Station
- Nuclear Control Operators - experience as Reactor Operators and/or currently in the RO license training program at Hope Creek Generating Station.

b. Responsibilities

- Fulfill the roles assigned by the V&V Coordinator
- Participate in implementation of the EOPs either in simulator or control room walk-through exercises
- Complete Review Checklists with Comment Sheets following exercises.

3. Observers (minimum of 2 for each procedure; they will be personnel who did not participate in writing the procedures)

a. Qualifications

One observer may be an Operations Specialist with the following minimum qualifications:

- Operations experience in a commercial nuclear station
- One year of experience in the application of human factors in the nuclear power industry
- Experience in procedures development.

One observer may be a Human Factors Specialist with the following minimum qualifications:

- M.A./M.S. in a human factors discipline
- Two years experience in the application of human factors in the nuclear power industry
- Experience in procedures development and/or conduct of EOP V&V in accordance with NRC and INPO guidance.

Observers may be personnel from the PSE&G Hope Creek Generating Station training department with the following minimum qualifications:

- Knowledge of the EOPs and related documentation
- Thorough knowledge of the plant systems
- Familiarity with the Procedures Generation Package and EOP V&V objectives and requirements.

b. Responsibilities

- Observe assigned operators performing the procedures
- Prepare comments on the procedures
- Assist the V&V Coordinator in explaining and implementing EOP validation requirements and documenting results.

4. Simulator Instructor (necessary for simulation exercises only)

a. Responsibilities

- Initialize the simulator as required by the scenario to be run
- Operate the simulator
- Play the roles of all personnel outside the control room
- Support the simulator validation effort as assigned by the V&V Coordinator.

4.7 Facilities/Materials

- o Designated time periods on the simulator or in the control room, as appropriate
- o Copies of the EOPs to be evaluated
- o Copy of "Guidelines for EOP Validation Observations" for each observer
- o Copies of the Comment Form for validation exercise participants and observers

- o Copies of Validation Comment Form Cover Sheet
- o Copies of the EOP Performance Review Checklist for each validation exercise participant.

4.8 Specific Instructions for Performing Simulator Validation

1. Brief participants on the following: (V&V Coordinator)
   - a. Purpose and scope of validation process
   - b. Steps of simulator validation
   - c. Responsibilities/assignments of each participant
   - d. Procedure to be performed.
2. Prepare the simulator. (Simulator Instructor)
   - a. Establish initial conditions according to the scenario
   - b. Plan/program stop points and restart points if applicable to the scenario
   - c. Initialize the simulator.
3. Perform a practice run of scenario to ensure there is no confusion about roles and no simulation problems. (All participants)
4. Reinitialize simulator. (Simulator Instructor)
5. Perform validation exercise. (All participants)
   - a. Control room personnel execute procedural steps according to scenario, as they would be done in actual performance
   - b. Simulator instructor monitors and controls simulator and acts as "other personnel" when required
   - c. Observers watch performance and record comments.
6. Conduct review session after performance of each scenario. (All participants)
   - a. Discuss any questions that arose during observation
   - b. Discuss the use of the Review Checklist and Comment forms
   - c. Have each participant independently complete a Review Checklist and Comment Form
   - d. Collect all checklists and forms to include in documentation package.
7. Code comments for assessment and resolution process. (V&V Coordinator or designee)
   - a. Review all comments written by observers and participants

b. Determine which are general comments or opinions and which comments require investigation and formal resolution

c. Assign a code to all comments requiring assessment and resolution. Include the following in code:

- Activity identifier (SIM for simulator validation)
- Participant (SS, RO1, RO2, OB1, HF)
- Comment sequence number.

For example: SIM-RO1-1.

d. Write code on Comment Forms adjacent to comment.

4.9 Specific Instructions for Performing Walk-through Validation

1. Brief participants on the following: (V&V Coordinator)

   a. Purpose and scope of validation process

   b. Steps of walk-through validation

   c. Responsibilities/assignments of each participant

   d. Scenarios to be performed — review each in relation to procedure just before it is to be performed. Discuss action cues and assumptions about parameter changes that will guide the course of action.

2. Perform a practice walk-through approximating real performance, to ensure there is no confusion about cues and to establish how activity is divided and phased among the personnnel. (All participants)

   a. Shift Supervisor verbalizes cues

   b. Control room personnel enact procedural steps, according to scenario, representing actual performance as much as possible

   c. Personnel point to controls and displays they would use

   d. Observers watch the action to identify where cues and feedback are needed and to determine how activity may be phased in final walk-through.

3. Discuss practice walk-through. (All participants)

   a. Resolve any problems about cues and feedback, or other matters

   b. Establish phasing of activity for final walk-through.

4. Perform walk-through exercise. (All participants)

   a. V&V Coordinator reviews scenario with participants

   b. Shift Supervisor verbalizes cues

c. V&V Coordinator directs phasing of activity

d. Control room personnel enact procedure according to scenario, pointing out controls and displays used.

5. Conduct review session after performance of each scenario. (All participants)

a. Discuss any questions that arose during observation

b. Discuss the use of the Review Checklist and Comment Forms

c. Have each participant independently complete a Review Checklist and Comment Form

d. Collect all completed Review Checklists and Comment Forms to include in documentation package.

6. Code comments for assessment and resolution process. (V&V coordinator or designee)

a. Review all comments written by observers and participants

b. Determine which are general comments or opinions and which comments require assessment and formal resolution

c. Assign a code to all comments requiring assessment and resolution. Include the following in the code:

- Activity identifier (CR for control room walk-through)
- Participant (SS, RO1, RO2, OB1, HF)
- Comment sequence number.

For example: CR-SS-3.

d. Write code on comment forms adjacent to comment.

4.10 Validation Forms

The forms that will be used in validation are presented on the following pages.

EOP PERFORMANCE REVIEW CHECKLIST

Each participant in the validation performance exercise should complete a Performance Review Checklist. If a problem or question related to any item is identified, the reviewer should explain it on a Comment Form. The Checklists and Comment Forms completed by all reviewers should be assembled in one package and given to the V&V Coordinator.

Procedure No. & Rev:_____ Title:_____

Validation Method (check one) ____Simulator ____Walk-Through

Reviewer Name:_____

Job Title:_____ License: ____RO ___SRO

Role in validation performance exercise:_____

____ 1. Is sufficient information provided in the EOP for qualified operators to perform each required action?

____ 2. Is sufficient information available for the operator to make a correct choice at each decision point?

____ 3. Does the EOP adequately handle needs for recurrent verifications or actions?

____ 4. Did personnel use system responses or other information that is not indicated in the EOP? If so, should this information be in the EOP?

____5. Did personnel perform any action that were not specified in the EOP? If so, should the action be specified in the EOP?

____6. Was an alternate path used, not in the procedure, that should be identified?

____7. Is any terminology, nomenclature, abbreviation, acronym, or symbol used in the EOP that is not familiar to operators?

____ 8. Are locations of equipment, controls, or displays that are infrequently used, are in out-of-the-way places, or are at local panels adequately described?

____ 9. Did equipment responses correspond to what is in the procedure?

____10. Did the procedure accurately predict what actually happened?

____11. Did the procedure achieve the expected objective?

____12. Is the procedure consistent with the manning philosophy?

____13. When the procedure was performed by more than one person, did the Shift Supervisor define their individual responsibilities clearly?

____14. Did the operators have enough time to accomplish what was required?

____15. Where setpoints or other limiting values apply, was enough guidance presented to ensure timely operator action?

____16. Was sufficient information given to allow the operators to find the appropriate controls and displays?

____17. Were prerequisites for starting equipment clearly identified?

____18. Did the procedure instruct the operators to start equipment at the appropriate time?

____19. Did communications occur at the appropriate points?

____20. Was any interference in communications observed?

____21. Is the information provided in the procedure in a form that is easily used?

____22. Was the coordination of multiple flow paths or multiple procedures handled in a manner that resulted in each operator being aware of his responsibilities and of current plant conditions?

____23. Were instructions concerning actions to be taken presented clearly?

Reviewer Signature:_____ Date:_____

VALIDATION COMMENT FORM

COVER SHEET

The Comment Form should be used to record any problems or questions identified during each validation activity. Make sure this cover sheet is completed and attached to the set of Comment Forms prepared for each procedure during each activity.

Procedure No.& Rev:_____

Procedure Title:_____

Validation Method (check one) ___Simulator ___Walk-Through

Participants (please record name, job title, license if applicable, and role in the validation activity, for each participant):

_____

_____

_____

_____

_____

_____

_____

_____

COMMENT FORM

PAGE _____ OF _____.

PROCEDURE NUMBER:

PROCEDURE STEP #	COMMENT	SUGGESTED RESOLUTION

5.0 ASSESSMENT AND RESOLUTION

An assessment will be performed to determine the disposition of the findings from technical verification, editorial verification, and validation for each EOP. Changes to be made in the EOP and associated documentation will be specified as part of the assessment and resolution activity, taking into account any recommendations made during the preceding review activities.

5.1 Objectives

The objectives of assessment and resolution are:

- To ensure that all questions that arise during review activities are resolved.
- To ensure that any changes to correct or enhance an EOP will be consistent with the applicable source documents and with the guidance provided in the Procedures Generation Package.
- To ensure that the PSTG and conversion documentation will be updated as necessary to maintain them as accurate documentation of the EOP bases.
- To ensure that a change made in one EOP is reflected as necessary in the other EOPs.
- To provide documentation of the disposition of EOP V&V findings.

5.2 Personnel

The V&V Coordinator will direct and participate in all assessment and resolution activities. The V&V Coordinator will be responsible for ensuring clear documentation of the disposition of all findings.

The assessment and resolution team will include a minimum of one additional person with the following qualifications:

- Knowledge of the EOPs and associated documentation
- Thorough knowledge of plant systems
- Familiarity with the Procedures Generation Package and EOP V&V objectives and requirements.

5.3 Materials

- A complete documentation package from technical verification, editorial verification, and validation of each EOP

- A copy of each EOP and its source documentation (EPG, PSTG, the EPG-to-PSTG Conversion Documentation, the PSTG-to-EOP Step Conversion Documentation, Appendix C calculation results)
- Access to other technical source documents (e.g., Technical Specifications, Setpoint Index, etc.)
- Copies of the EOP V&V Resolution Form (see Section 5.5)
- Copies of the EOP V&V Acceptance Form (see Section 5.5).

5.4 Method

For each EOP, the assessment team will review all discrepancies and all comments and questions requiring resolution that were identified during technical verification, editorial verification, and validation. The disposition of each item will be recorded on the Resolution Form (see Section 5.5) with an item identification code.

Technical Verification findings that require attention during assessment and resolution will be flagged by an item identification code on the Technical Verification Checklist. Similarly, comments from the validation exercises will be coded on the validation Comment Forms. These item codes may simply be transferred to the Resolution Form as each item is considered by the assessment team.

Findings and questions from editorial verification are noted in the comments column of the Editorial Verification Checklist. For each of these comments, it should be determined if changes to the text or flow chart are required. Actual changes should be marked on copies of the procedure.

For each coded comment from the Technical Verification or Validation exercises, a disposition should be made and recorded on Resolution Forms. The code number of each disposition should appear adjacent to the appropriate disposition.

If it is determined that no change should be made in response to an item, the reason should be noted in the disposition column of the Resolution Form. All changes to be made should be described in the disposition column. If a particular disposition cannot be specified, the item and the follow-up action needed should be described. The Resolution Form will then provide a single, complete record of all items and decisions pertaining to each procedure.

In addition, all changes to be made will be marked on a copy of the procedure. This ensures that changes will be made in an integrated way, so that their possible effects on each other, and on other parts and steps of the procedure, will be taken into account.

Other EOPs referenced in the EOP under consideration should also be checked to determine whether the proposed change requires that a change also be made in a referenced EOP.

Any such changes needed in associated documentation or in a referenced EOP should be noted in the item disposition.

When all dispositions have been completed, an EOP V&V Acceptance Form will be prepared (see Section 5.5). The Acceptance Form will be attached to the V&V documentation package and submitted for final review and approval by the Operations Manager.

5.5 Assessment and Resolution Forms

The forms that will be used to document the assessment and resolution of EOP V&V findings are presented on the following pages.

RESOLUTION OF EOP V&V FINDINGS

Procedure & Rev No.: _____ Date: _____

Procedure Title: _____

Participants in Assessment and Resolution (name, job title, license):

_____

_____

_____

Item Code	Disposition

HOPE CREEK EOP V&V PROGRAM
Resolution of Findings (contd)

Procedure & Rev No.:_____ _____

Item Code	Disposition

HOPE CREEK EOP V&V PROGRAM

EOP VERIFICATION & VALIDATION ACCEPTANCE FORM

Procedure & Rev No.: _____

Procedure Title: _____

1. This procedure has been evaluated using the steps for technical verification, editoral verification and validation, as defined in the Work Plan for the Hope Creek Verification and Validation Program.

2. An assessment of the findings from those Verification and Validation activities has been performed and changes in the EOP have been specified, as necessary, to correct any problems identified.

3. Any open items that remain to be resolved concerning this procedure are described on the Resolution Form.

4. The steps performed were adequate to ensure that the objectives of the Hope Creek EOP Verification and Validation Program have been met with respect to this procedure.

Signature: _____ _____ Date: _____

The verification and validation of this procedure is accepted as complete:

Signature: _____ Date: _____

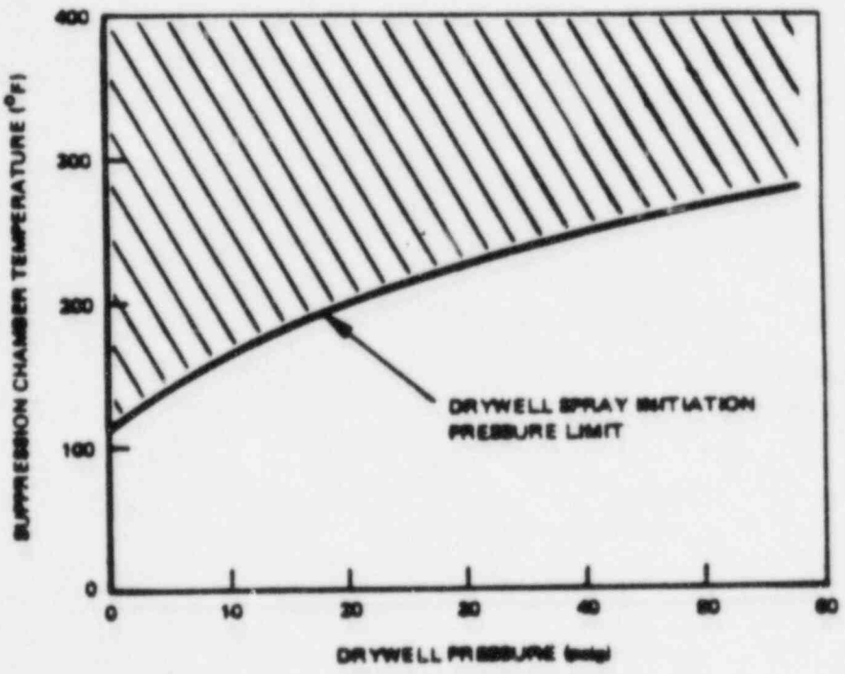
ENCLOSURE 2

APPENDIX C
CALCULATIONAL PROCEDURE

9.0 DRYWELL SPRAY INITIATION PRESSURE LIMIT

9.1 APPLICABLE GUIDELINE STEPS

DW/T-3 *Before drywell temperature reaches [340°F (maximum temperature at which ADS qualified or drywell design temperature, whichever is lower)] but only if (suppression chamber temperature and drywell pressure are below the Drywell Spray Initiation Pressure Limit], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [restricting flow rate to less than 720 gpm (Maximum Drywell Spray Flow Rate Limit)].*



PC/P-3 *If suppression chamber pressure exceeds [17.4 psig (Suppression Chamber Spray Initiation Pressure)] but only if [suppression chamber temperature and drywell pressure are below the Drywell Spray Initiation Pressure Limit], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays (restricting flow rate to less than 720 gpm Maximum Drywell Spray Flow Rate Limit)].*

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

- *If [suppression chamber temperature and drywell pressure are below the Drywell Spray Initiation Pressure Limit], (shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [restricting flow rate to less than 720 gpm (Maximum Drywell Spray Flow Rate Limit)].*

SP/L-3.2 1. *When suppression pool water level reaches [17 ft. 2 in. (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 drywell pressure are below the Drywell Spray Initiation Pressure Limit], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [restricting flow rate to less than 720 gpm (Maximm Drywell Spray Flow Rate Limit)].*

9.2 INPUT DATA AND PHYSICAL CONSTANTS

Note

Some input parameters must be obtained from the calculated procedure of Section 8.0 in Appendix C. It is therefore necessary to complete that section prior to calculating the Drywell Spray Initiation Pressure Limit.

T_{DS}	Lowest expected drywell spray temperature	T_{DS} = 40 °F
P_{CND}	Containment negative design pressure (values greater than design may be used if justified by design margin)	P_{CND} = 3 psid
T_{RB}	Temperature of the reactor building during normal operation	T_{RB} = 75 °F
V_{DW}	Total free volume in drywell and vents	V_{DW} = 69,??? ft^3
V_{WW}	Total airspace volume in wetwell at normal operating suppression pool level	V_{WW} = ???,??? ft^3
DWSL	Reduced drywell spray flow rate from Appendix C, Section 8.0 if rate spray appropriate, no entry is required)	DWSL = ~~5???~~ gpm N/A SAR 10/26/84

$\dot{m}_{DW,SP}$	The mass flow rate of the drywell sprays at rated conditions	$\dot{m}_{DW,SP}$ = _____ gpm
$\dot{m}_{WW,SP}$	The mass flow rate of the wetwell sprays at rated conditions	$\dot{m}_{WW,SP}$ = _____ gpm
ΔP_{VBO}	The differential pressure for the wetwell-to-reactor building vacuum breakers at which the vacuum breaker is fully open	ΔP_{VBO} = _____ psid
AVB_{C-R}	LCO area of the containment-to-reactor building vacuum breakers	AVB_{C-R} = _____ ft^2
KVB_{C-R}	Loss coefficient of each containment-to-reactor building vacuum breaker	KVB_{C-R} = _____
R_a	Gas constant for containment atmosphere, excluding water vapor	R_a = _____ $\frac{lbf\text{-}ft}{lbm\text{-}^oR}$
$h_f(T_{DS})$	Specific enthalpy of saturated liquid at T_{DS} 40°	$h_f(T_{DS})$ = _____ Btu/lbm
$v_f(T_{DS})$	Specific volume of saturated liquid at T_{DS} 40°	$v_f(T_{DS})$ = _____ $\frac{ft^3}{lbm}$
$P_{sat}(T_{DS})$	Saturation pressure of steam at T_{DS} 40°	$P_{sat}(T_{DS})$ = _____ psia

$u_a(T_{DS})$ Specific internal energy of air at T_{DS}* = 40 + 460 = 500

$u_a(T_{DS})$ = [illegible] Btu/lbm

$u_a(T_{RB})$ Specific internal energy of air at T_{RB}* [illegible] = 535

540 = [illegible]

500 = 82.62

$u_a(T_{RB})$ = [illegible] Btu/lbm

*Reference internal energy to 0.0 Btu/lbm at a temperature of 0.0°R.

Note that $u_a = h_a - Pv$ or $u_a = h_a - R_aT \left(\frac{1\ Btu}{777.66\ ft\text{-}lbf}\right)$

where h_a is the specific enthalpy of air.

For example, at 80°F = 540°R, h_a = 129.06 Btu/lbm

Therefore u_a = 129.06 Btu/lbm - 53.34 $\frac{lbf\text{-}ft}{lbm\,°R}$ * 540°R x $\frac{1\ Btu}{777.66\ ft\ lbf}$

= 92.02

9.3 TECHNICAL DESCRIPTION AND DERIVATION OF THE CALCULATIONAL PROCEDURE

9.3.1 Introduction

Appendix C, Sections 8.0 and 9.0 contain the calculational procedures which restrict the operation of Drywell sprays in Mark I/II containments. The procedures are:

8.0 Maximum Drywell Spray Flow Rate Limit

9.0 Drywell Spray Initiation Pressure Limit for

A. Rated drywell spray flow
B. Maximum drywell spray flow rate limit.

The plant unique implementation of the drywell spray restrictions will include either

- Spray at rated flow and a single limit curve which results from calculation 9.4A, or

- Spray at a restricted flow as calculated in Section 8.4 step 9 and a single limit curve which results from calculation 9.4B.

9.3.2 Containment-to-Reactor Building Δp Limit for

A. Rated Drywell Spray Flow
B. Maximum Drywell Spray Flow Rate Limit

Under certain conditions the drywell and wetwell sprays could lower the total containment pressure such that the containment-to-RB negative design pressure differential limit is exceeded. The containment-to-RB vacuum breakers mitigate this effect and are factored into this

calculational procedure. This procedure calculates the initial conditions, such that after the sprays cool the entire containment to the spray temperature the containment negative design pressure is not exceeded.

The calculational procdure assumes the following

(1) Initially the wetwell is saturated and the drywell is full of steam.

(2) There are no containment-to-RB vacuum breaker failures.

(3) When the containment-to-RB vacuum breakers open, the drywell is full of saturated air.

The final condition is defined by

$$P_f = 14.7 - P_{CND} \tag{15}$$

and the air partial pressure is

$$P_{a,f} = P_f - P_{sat}(T_{DS}) \tag{16}$$

or

$$P_{a,f} = 14.7 - P_{CND} - P_{sat}(T_{DS}) \tag{17}$$

From the ideal gas law, the air mass is

$$M_{a,f} = \frac{P_{a,f}\,(V_{DW} + V_{WW})}{R_a\,(T_{DS} + 460)} \tag{18}$$

The final air mass, $M_{a,f}$, that is distributed between the drywell and wetwell at the final condition, was originally in the wetwell or was added to the containment thru the wetwell-to-RB vacuum breakers. If the total flow thru the vacuum breakers is $\dot{m}_{VB}t$, then the initial air pressure is

$$P_{a,i} = \frac{(M_{a,f} - \dot{m}_{VB}t)\, R_a\, (T_i + 460)}{V_{WW}} \qquad (19)$$

And the initial total pressure is

$$P_i = P_{a,i} + P_{sat}\,(T_i) - 14.7 \qquad (20)$$

where P_i is in psig.

The term $\dot{m}_{VB}t$ is the vacuum breaker flow times the time to depressurize the containment from the wetwell-to-RB vacuum breaker full open pressure to the negative design pressure. Note that the time, t, is inversely proportional to the vacuum breaker flow times internal energy plus the spray flow times enthalpy. Therefore, the calculation is performed twice; for rated spray flow and reduced spray flow.

An approximation is used for $\dot{m}_{VB}t$ where $\dot{m}_{VB}$ is for containment pressure at its design value as defined in equation (21) and t is approximated by equation (22). The approximation was developed such that this hand calculational method matches the results from the more sophisticated computer calculation which was performed by General Electric in the development of this limit. It is not intended that $\dot{m}_{VB}t$ be an exact analytic derivation, but rather that it conceptually models the phenomena and gives reasonable results.

The vacuum breaker flow is

$$\dot{m}_{VB} = \frac{A}{\sqrt{K}} \sqrt{2 g_c \rho g P}$$

where

$$\rho = \frac{M}{v} = \frac{P_{atm}}{R_a (T_{RB} + 460)}$$

and $\Delta P = P_{CND}$

$$\therefore \dot{m}_{VB} = \frac{A}{\sqrt{K}} \sqrt{\frac{2 g_c P_{CND} P_{atm}}{R_a (T_{RB} + 460)}} \qquad (21)$$

The time is approximated by

$$t = \frac{M_{a,f} (u_a(T_{VBO}) - u_a(T_{DS}))}{\dot{m}_{VB} u_a(T_{RB}) + \dot{m}_{D+W\ SP} h_f(T_{DS})} \qquad (22)$$

where

$u_a(T)$ = the specific energy of the air at temperature T and is referenced to 0.0 Btu/lbm at $0^{\circ}R$. Note that if data is available for specific enthalpy, h_a, the relationship $u_a = h_a - Pv$ or $u_a = h_a - R_a T$ may be used to determine u_a,

$\dot{m}_{D+WSp}$ = The drywell and wetwell spray flow rate ($\dot{m}_{DW,SP}$ or DWSL plus $m_{WW,SP}$), and

P_{atm} = atmospheric pressure = 14.7 psia.

9.4 CALCULATIONAL WORKSHEET

1. Determine the final air mass

$$P_{a,f} = 14.7 - P_{CND} - P_{sat}(T_{DS})$$

$P_{a,f}$ = _____ psig

$$M_{a,f} = \frac{P_{a,f} * 144 (V_{DW} + V_{WW})}{R_a (T_{DS} + 460)}$$

$M_{a,f}$ = _____ lbm

= 11.58 [illegible]

2. Calculate the vacuum breaker flow

$$\dot{m}_{VB} = \frac{AVB_{C-R}}{\sqrt{KVB_{C-R}}} \sqrt{\frac{2*32.2*P_{CND}*144*14.7*144}{R_a (T_{RB} + 460)}}$$

$\dot{m}_{VB}$ = _____ lbm/sec

$\dot{m}_{VB} = \frac{5.6 ft^2}{\sqrt{3.7}} \sqrt{\frac{2*32.2*3 psig*144*14.7*144}{53.34 lbm-°R (75+460)}}$

$\dot{m}_{VB} = 134.12$

3. Determine the total spray flow rate

A. Rated flow

$$\dot{m}_{D+W\ SP\ (Rated)} = \frac{(\dot{m}_{DW,SP} + \dot{m}_{WW,SP}) * 0.13368}{60 * v_f (T_{DS})}$$

[illegible] = 10000 x 0.13368 / 60 x [illegible]

$\dot{m}_{D+W\ SP\ (Rated)}$ = _____ lbm/sec

= [illegible]

B. Reduced flow

$$\dot{m}_{D+W\ SP}\ (Rated) = \frac{(DWSL + \dot{m}_{WW,SP}) * 0.13368}{60 * v_f\ (T_{DS})}$$

$\dot{m}_{D+W\ SP} = \frac{(856.64 + 500_{SP}) * 0.13368}{60 * .0169019}$ $\frac{12.365}{1.014114}$ $\boxed{\dot{m}_{D+W\ SP}\ (Reduced)} = \underline{178.93}$ lbm/sec

N/A JSH 10/26/84

4. Determine the conditions when the wetwell-to-RB vacuum breakers are full open

$$P_{VBO} = 14.7 - \Delta P_{VBO}$$

$= 14.7 - .025$

$= 14.675$

$\boxed{P_{VBO}} = \underline{14.675}$ psia

From steam tables determine

$$T_{sat}(P_{VBO}) = T_{VBO}$$

$\frac{14.675}{12} = 14.696$

$211 = 14.707$

$\boxed{T_{VBO}} = \underline{211.8}\ ^{o}F$

From air tables determine

$$u_a(T_{VBO})$$

$660 = 112.67$

$680 = 116.12$

$\boxed{u_a(T_{VBO})} = \underline{114.72}$ Btu/lbm

5. Calculate the depressurization time

$$t = \frac{M_{a,f}\ (u_a(T_{VBO}) - u_a\ (T_{DS}))}{\dot{m}_{VB}\ u_a\ (T_{RB}) + \dot{m}_{D+W\ SP}\ h_f(T_{DS})}$$

$t = 19.13 \times 10^3 * (114.72 - 85.20) / (134.12 \times 71.19 - (178.93 \times 8.32))$

$= 2 \times 14$ RATED

~~$t = 19.13 \times 10^3 * (114.72 - 85.20) / (134.12 \times 71.19 - 178.93 \times 8.32)$~~

~~RATED~~

$= 41.222$ N/A

A. For Rated flow — t (Rated) = ____ sec

B. For Reduced flow — t (Reduced) = ____ sec

6. Select values for the initial wetwell airspace temperature and enter in Tables C9-1 or C9-2. The values should range from normal operating pool temperature to wetwell design temperature and be sufficient to define a locus of points to be plotted on Figures C9-1 or C9-2 for rated or reduced spray flow respectively. (__)

7. Calculate the initial pressure, $P_{a,i}$, for T_i in Tables C9-1 or C9-2

$$P_{a,i} = \frac{(M_{a,f} - \dot{M}_{VB} t)\, R_a\, (T_i + 460)}{144\, V_{WW}} \qquad (\_\_)$$

$$= \frac{[\quad - (\quad)(\quad)]\,(\quad)(\quad + 460)}{(\quad)(\quad)}$$

$$= 0.0427\,[T_i + 460]$$

where

t = t (Rated) for rated spray flow in Table C9-3, and
t = t (Reduced) for reduced spray flow in Table C9-4.

8. Determine the saturation temperature, $P_{sat}(T_i)$, for each initial temperature and enter in Tables C9-1 or C9-2. (__)

9. Calculate the initial total pressure in the suppression chamber, P_i, from the following equation and enter in Tables C9-1 or C9-2. (✓)

$$P_i = P_{a,i} + P_{sat}(T_i) - 14.7$$

10. Plot T_i and P_i from Table C9-1 on Figure C9-1 or from Table C9-2 on Figure C9-2. This is the Drywell Spray Initiation Pressure Limit for rated or reduced drywell spray flow rates respectively. (✓)

Table C9-1
(RATED FLOW)

(6) T_i (°F)	(7) $P_{a,i}$ (psia)	(8) $P_{sat}(T_i)$ (psia)	(9) P_i (psig)
40	21.49	.12163	6.9
80	23.20	.50283	7.0
120	24.92	1.6927	9
[illegible]	26.64	4.744	[illegible]
200	28.36	11.526	25.19
240	30.08	29.[illegible]	40.35
280	31.80	49.200	66.3
320	33.52	89.[illegible]3	107.5
270	31.37	41.856	58.52

Table C9-2
(REDUCED FLOW)

(6) T_i (°F)	(7) $P_{a,i}$ (psia)	(8) $P_{sat}(T_i)$ (psia)	(9) P_i (psig)

N/A

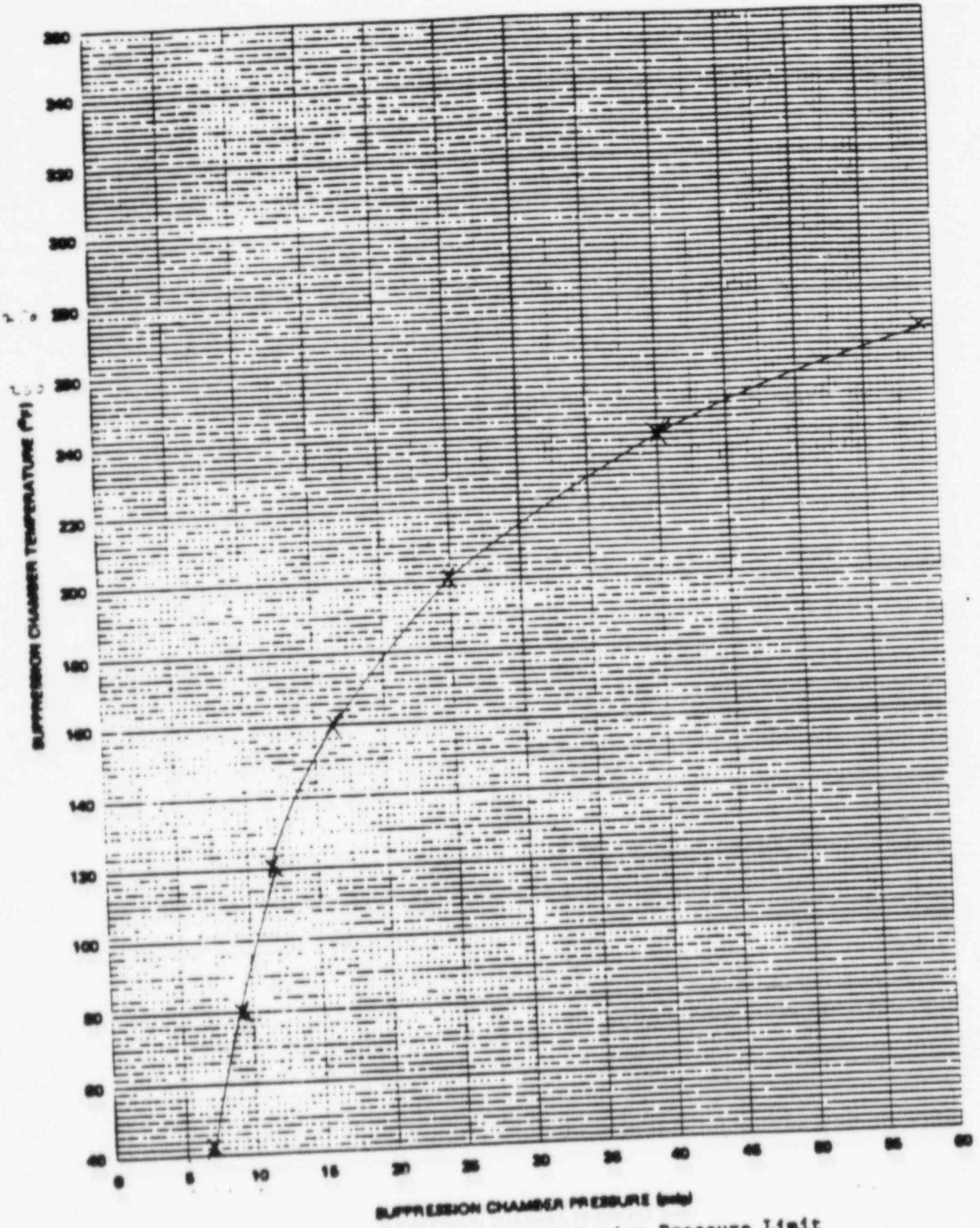


Figure C9-1. Drywell Spray Initiation Pressure Limit (C9.A Containment-to-RB ΔP Limit for Rated Spray)

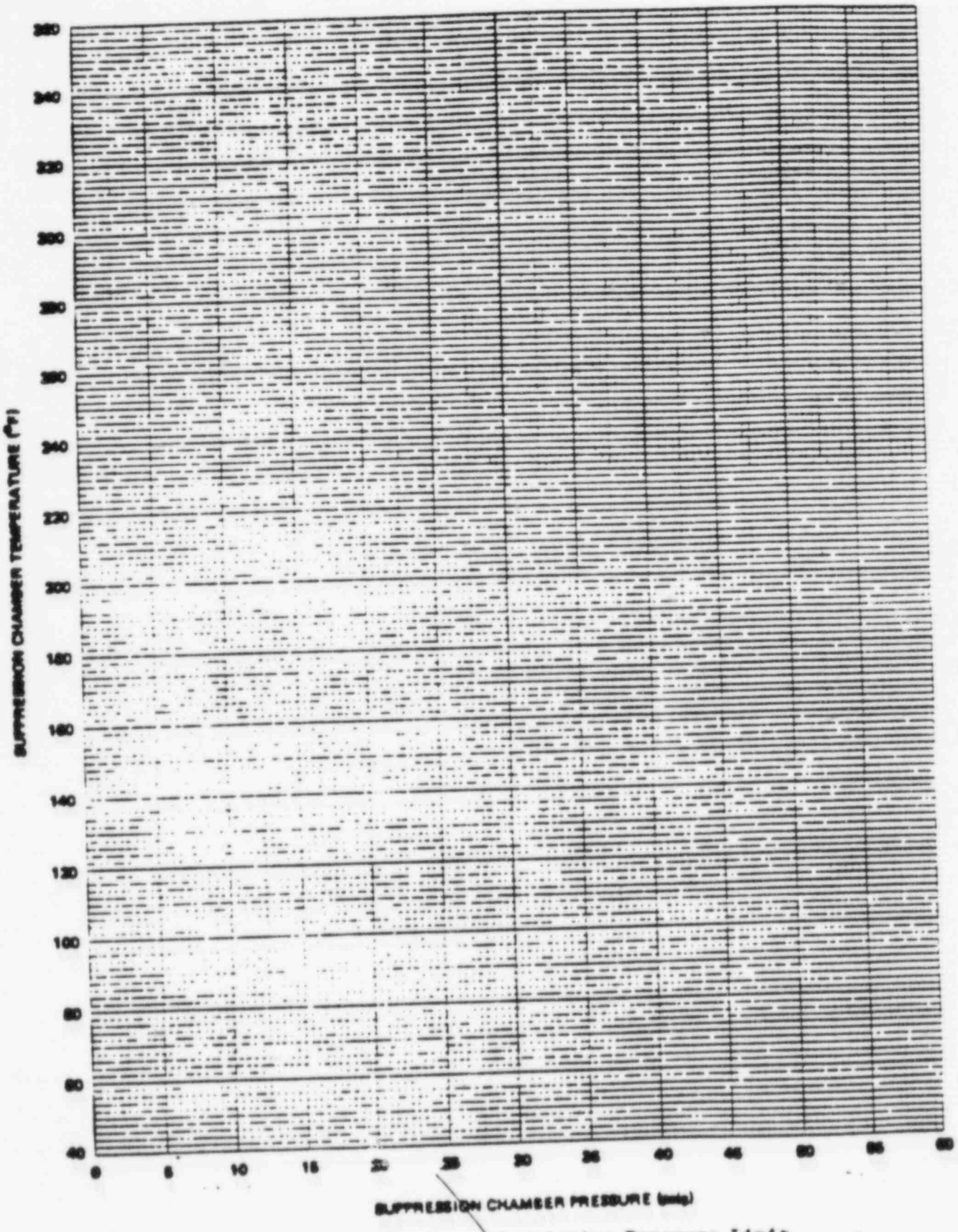


Figure C9-2. Drywell Spray Initiation Pressure Limit (C9.B Containment-to-RB ΔP Limit Reduced Spray)

N/A

ENCLOSURE 3

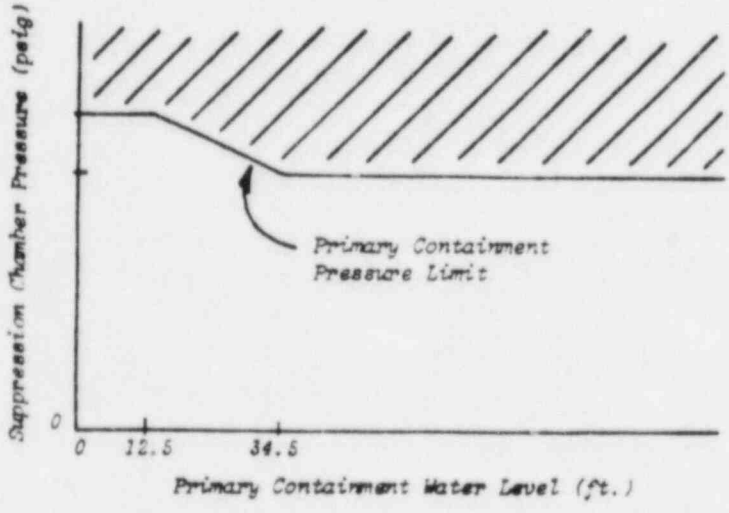
APPENDIX C

CALCULATIONAL PROCEDURES

14.0 PRIMARY CONTAINMENT PRESSURE LIMIT

14.1 APPLICABLE GUIDELINE STEPS

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



PC/P-7 *If suppression chamber pressure exceeds the Primary Containment Pressure Limit, vent the primary containment in accordance with [procedure for containment venting] to reduce and maintain pressure below the Primary Containment Pressure Limit.*

14.2 INPUT PARAMETERS AND PHYSICAL CONSTANTS

$E_{SP,FSAR}$ Elevation corresponding to the suppression pool water level assumed in FSAR transient analyses*

$E_{SP,FSAR}$ = _____ ft

$P_{SC,MAX}$ Maximum pressure at which the suppression chamber is not expected to fail with suppression pool water level at $E_{SP,FSAR}$

$P_{SC,MAX}$ = 192 psig

E_{SCPI} Elevation of the suppression chamber pressure instrument top*

E_{SCPI} = _____ ft

*Elevation 0.0 is defined to be the bottom of the suppression pool.

14.3 TECHNICAL DESCRIPTION AND DERIVATION OF THE CALCULATIONAL PROCEDURE

The Primary Containment Pressure Limit is the maximum pressure at which failure is not expected to occur at the most limiting containment location. Calculation of the limit is based on the same considerations discussed in the Primary Containment Design Pressure calculational procedure, Appendix C, Section 13. If the maximum allowable pressure is substituted for design pressure, the two procedures are identical.

NOTE TO NRC REVIEWERS: SECTION 13 IS ATTACHED TO THIS ENCLOSURE

14.4 CALCULATIONAL WORKSHEET

1. Plot Point (A) on Figure C14-1 at coordinates $(E_{SP,FSAR}, P_{SC,MAX})$.

   14.37 ft, 190 psig

   ____ (✓)

2. Calculate P_{SC}^{B}, the suppression chamber pressure at Point (B) on Figure C14-1.

   $$P_{SC}^{B} = P_{SC,MAX} - 0.433\ (E_{SCPI} - E_{SP,FSAR})$$

   $\boxed{P_{SC}^{B}}$ = 185.2 psig

   $= 190 - 0.433(25.53 - 14.37)$

   $= 185.2$

3. Plot Point (B) on Figure C14-1 at coordinates (E_{SCPI}, P_{SC}^{B}).

   25.53 ft, 185.2 psig

   ____ (✓)

4. Complete construction of the Primary Containment Pressure Limit Curve as follows:

(1) Extend a horizontal line from Point (A) to the graph's vertical axis.

_____ (✓)

(2) Layout $\overline{AB}$.

_____ (✓)

(3) Extend a horizontal line to the right from Point (B).

_____ (✓)

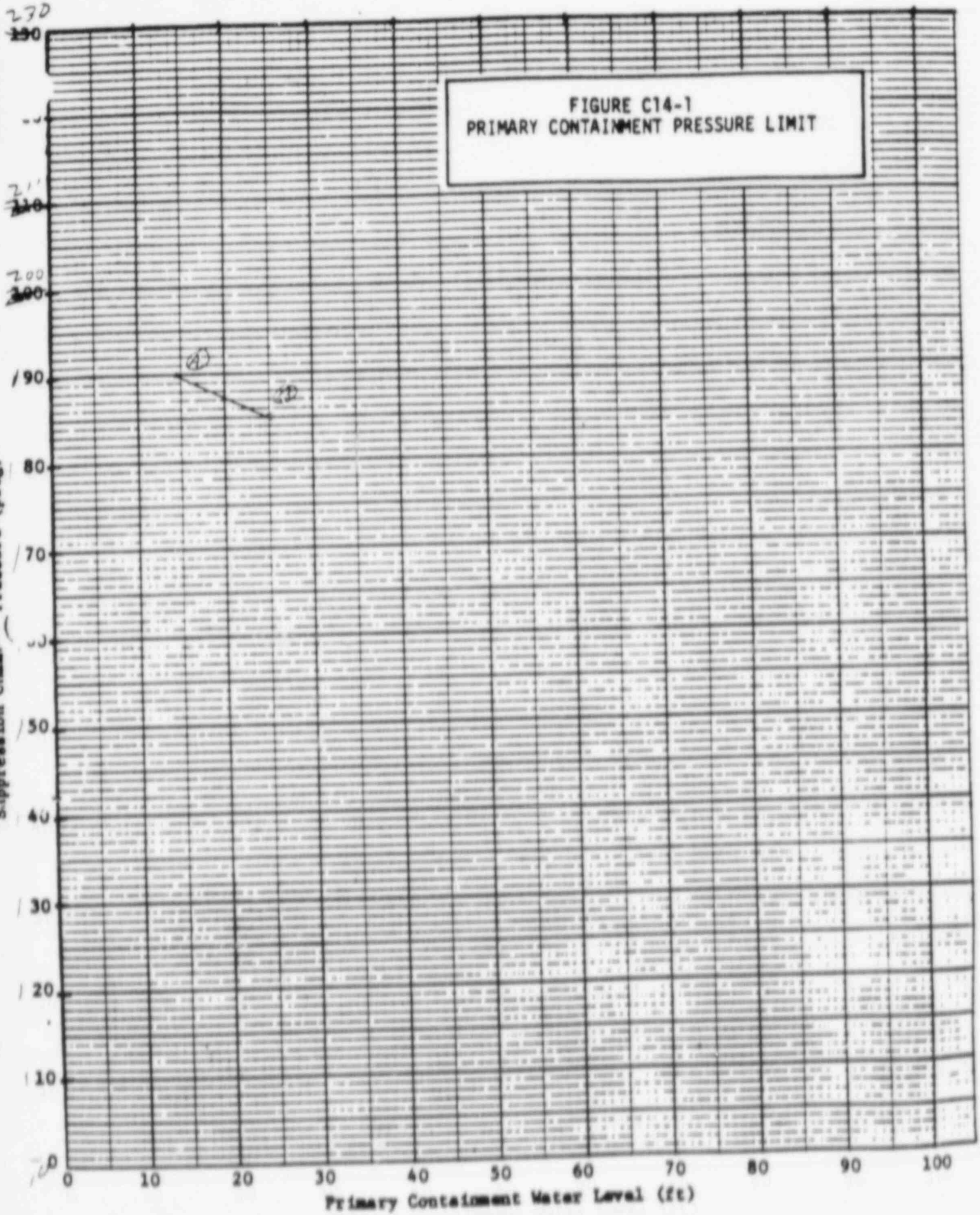


FIGURE C14-1
PRIMARY CONTAINMENT PRESSURE LIMIT
Suppression Chamber Pressure (psig)
270
210
200
190
80
70
50
40
30
20
10
0
A
B
0
10
20
30
40
50
60
70
80
90
100
Primary Containment Water Level (ft)

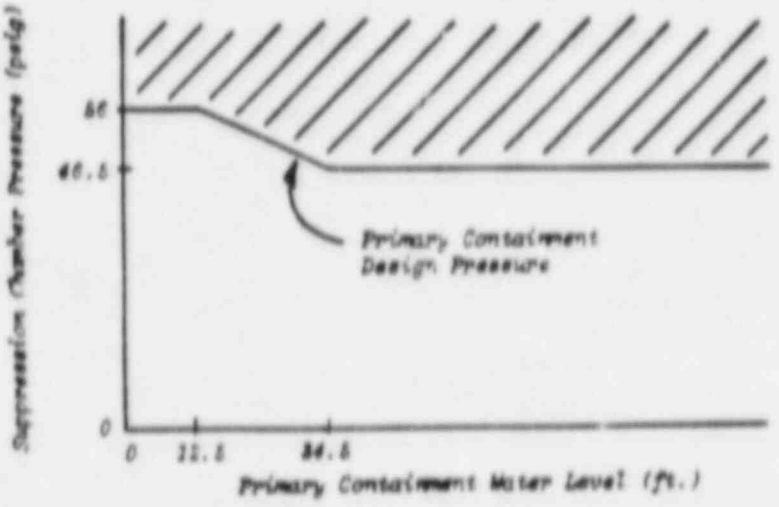
APPENDIX C

CALCULATIONAL PROCEDURES

13.0 PRIMARY CONTAINMENT DESIGN PRESSURE

13.1 APPLICABLE GUIDELINE STEPS

PC/P-5 *If suppression chamber pressure cannot be maintained below [the Primary Containment Design Pressure], RPV FLOODING IS REQUIRED.*



C6-6 *When suppression chamber pressure can be maintained below the Primary Containment Design Pressure, enter [procedure developed from the RPV Control Guideline] at [Steps RC/L and RC/P-4] and execute these steps concurrently.*

13.2 INPUT PARAMETERS AND PHYSICAL CONSTANTS

$E_{SP,FSAR}$ Elevation corresponding to the suppression pool water level assumed in FSAR transient analyses*

$E_{SP,FSAR}$ = _____ ft

$P_{SC,D}$ Suppression chamber design pressure (defined with suppression pool water level at $E_{SP,FSAR}$)

$P_{SC,D}$ = _____ psig

E_{SCPI} Elevation of the suppression chamber pressure instrument tap*

E_{SCPI} = _____ ft

*Elevation 0.0 is defined to be the bottom of the suppression pool.

13.3 TECHNICAL DESCRIPTION AND DERIVATION OF THE CALCULATIONAL PROCEDURE

The Primary Containment Design Pressure curve derates the standard design pressure ($P_{SC,D}$) for suppression pool water levels above that assumed in design calculations ($E_{SP,FSAR}$).

Below $E_{SP,FSAR}$, the standard design pressure is valid. The design pressure to the left of Point (A) on Figure C13-1, is therefore constant. Higher suppression pool water levels exert an increased hydrostatic head upon the bottom of the suppression pool at the rate of 0.433 psi per foot of water level increase. Since this increased pressure cannot be detected by instruments located above the water surface, the design pressure must be derated by 0.433 psi/ft, the slope of $\overline{AC}$ in Figure C13-1.

Once suppression pool water level reaches the elevation of the suppression chamber pressure instrument tap (E_{SCPI}), further increases in hydrostatic head will be sensed directly by the instrument. Continued deration is therefore unnecessary and the pressure to the right of Point (B) in Figure C13-1 is constant.

Throughout these calculations it is assumed that the limiting containment location with respect to static pressure is below $E_{SP,FSAR}$. If the limiting location is above $E_{SP,FSAR}$, plant-unique modifications to the calculational procedure will be required.

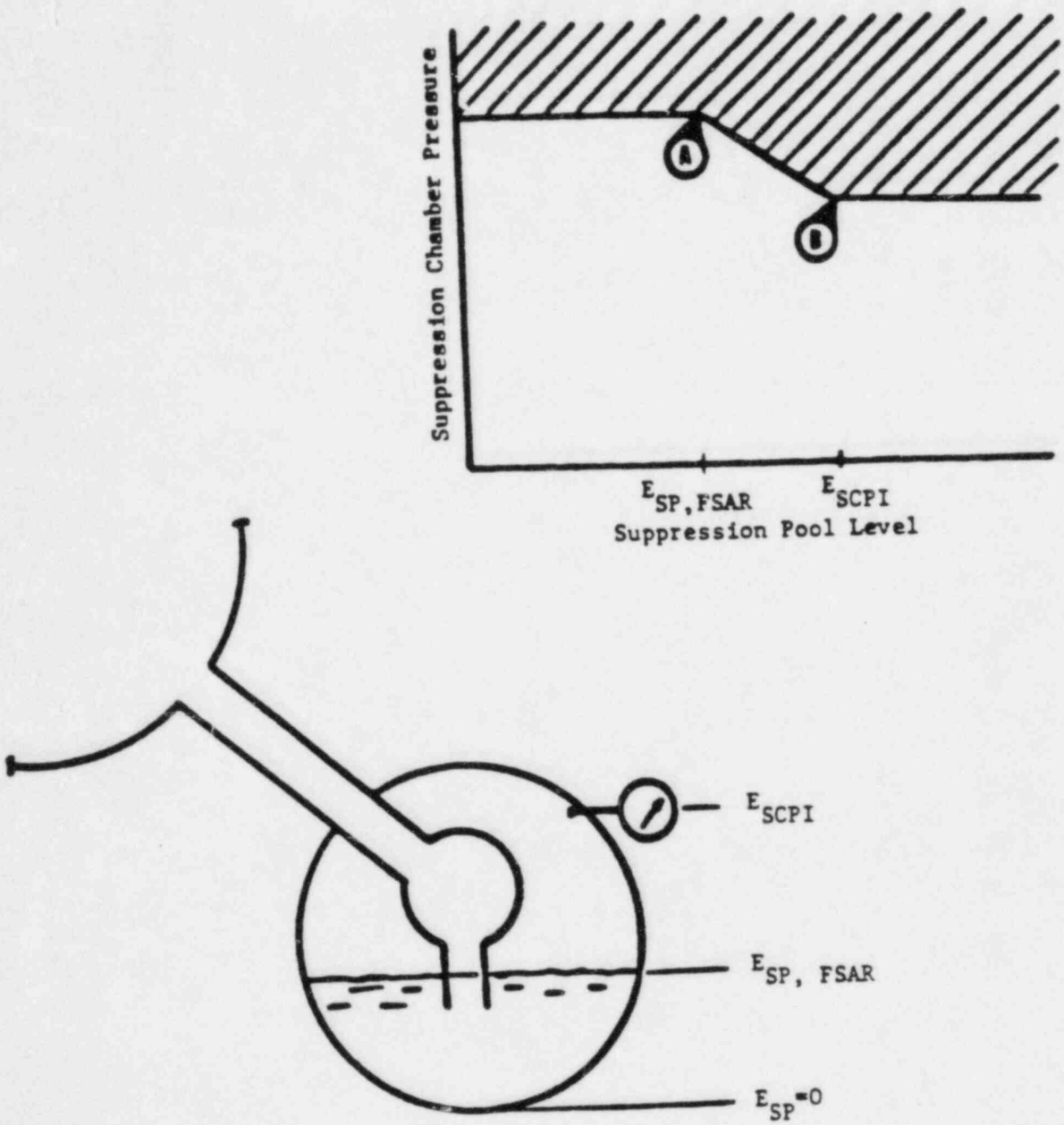


Figure C13-1. Primary Containment Design Pressure

13.4 CALCULATIONAL WORKSHEET

1. Plot Point (A) on Figure C13-2 at coordinates $(ESP,FSAR', P_{SC,D})$.

   ✓ (✓)

   4.37, 62 psig

2. Calculate P_{SC}^{B}, the suppression chamber pressure at Point (B) on Figure C13-2:

   $$P_{SC}^{B} = P_{SC,D} - 0.433\ (E_{SCPI} - E_{SP,FSAR})$$

   $\boxed{P_{SC}^{B}}$ = 57.2 psig

   P_{SC}^{B} = 62 - 0.433 (25.53 - 12.37)
   = 57.2

3. Plot Point (B) on Figure C13-2 at coordinates (E_{SCPI}, P_{SC}^{B}).

   25.53, 57.2 psig

   ✓ (✓)

4. Complete construction of the Primary Containment Design Pressure Curve as follows:

(1) Extend a horizontal line from Point (A) to the graph's vertical axis.

_____ (✓)

(2) Layout $\overline{AB}$.

_____ (✓)

(3) Extend a horizontal line to the right from Point (B).

_____ (✓)

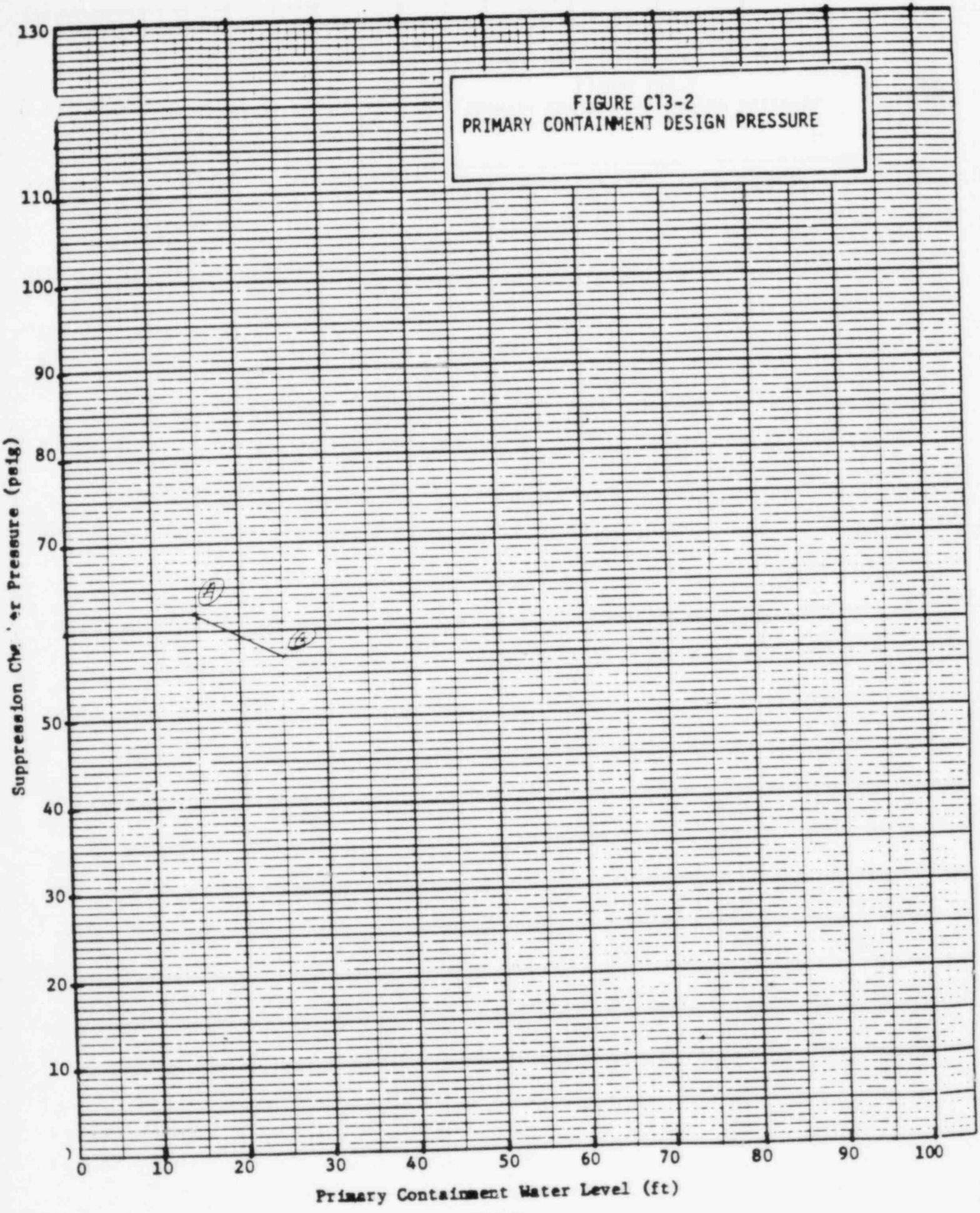
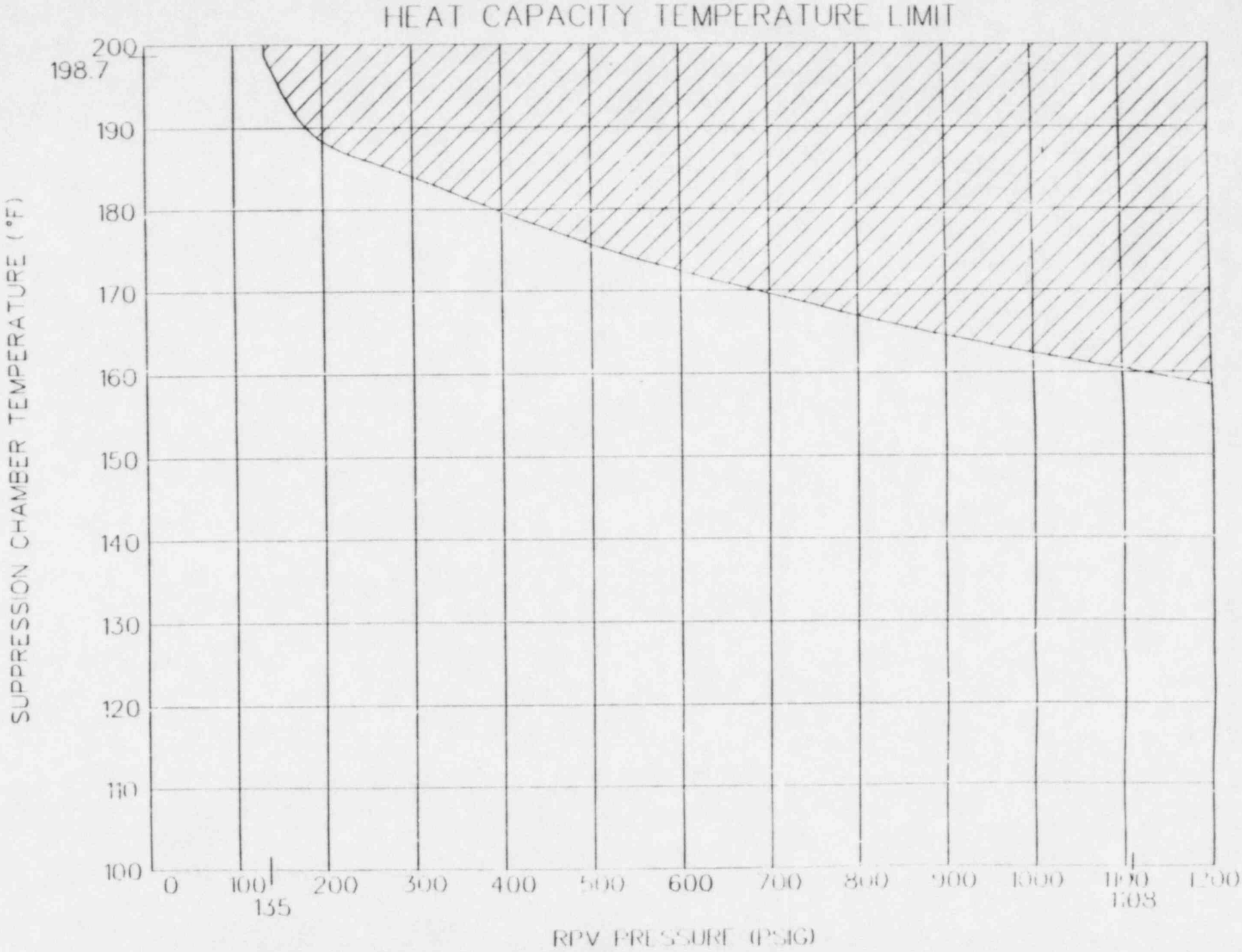
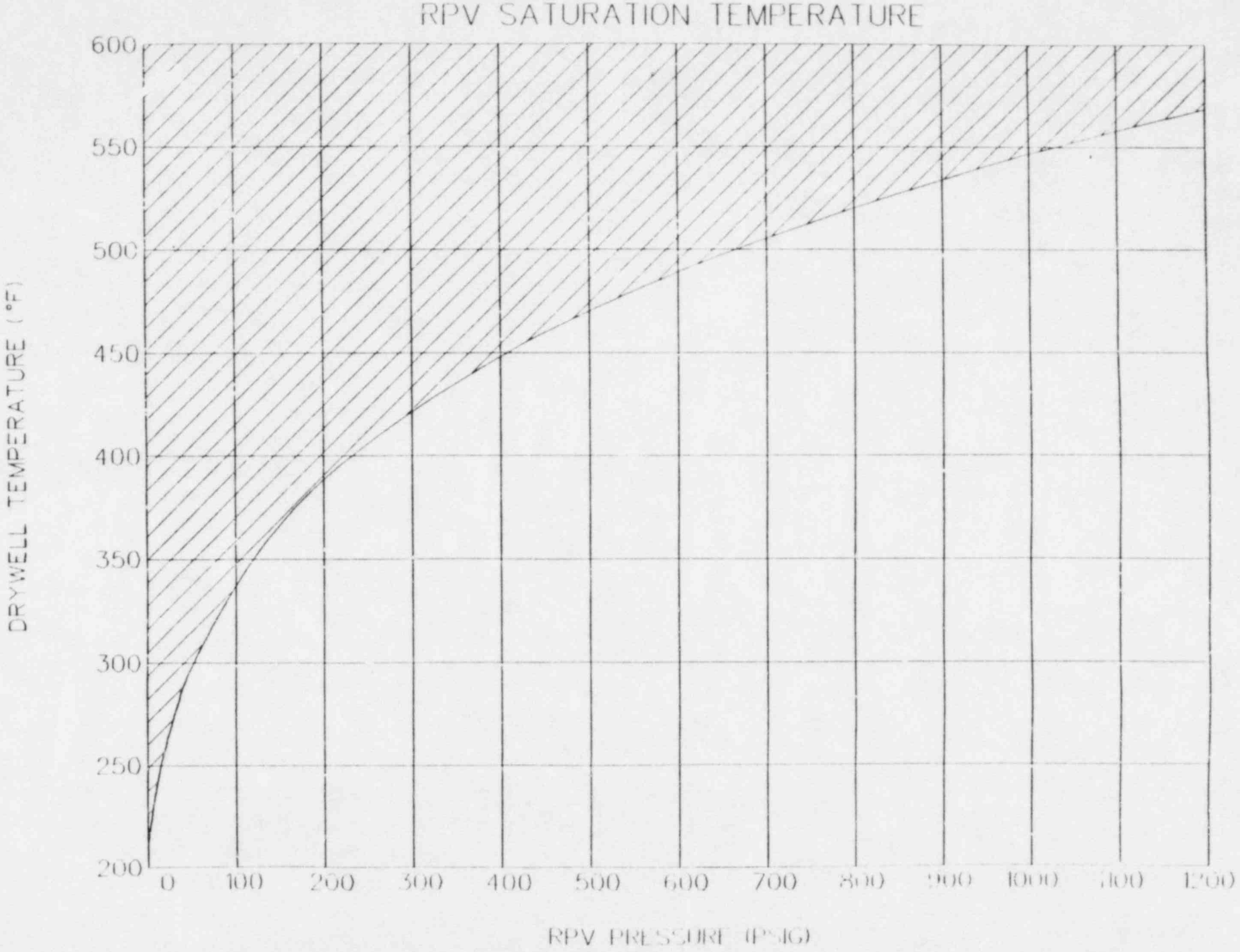


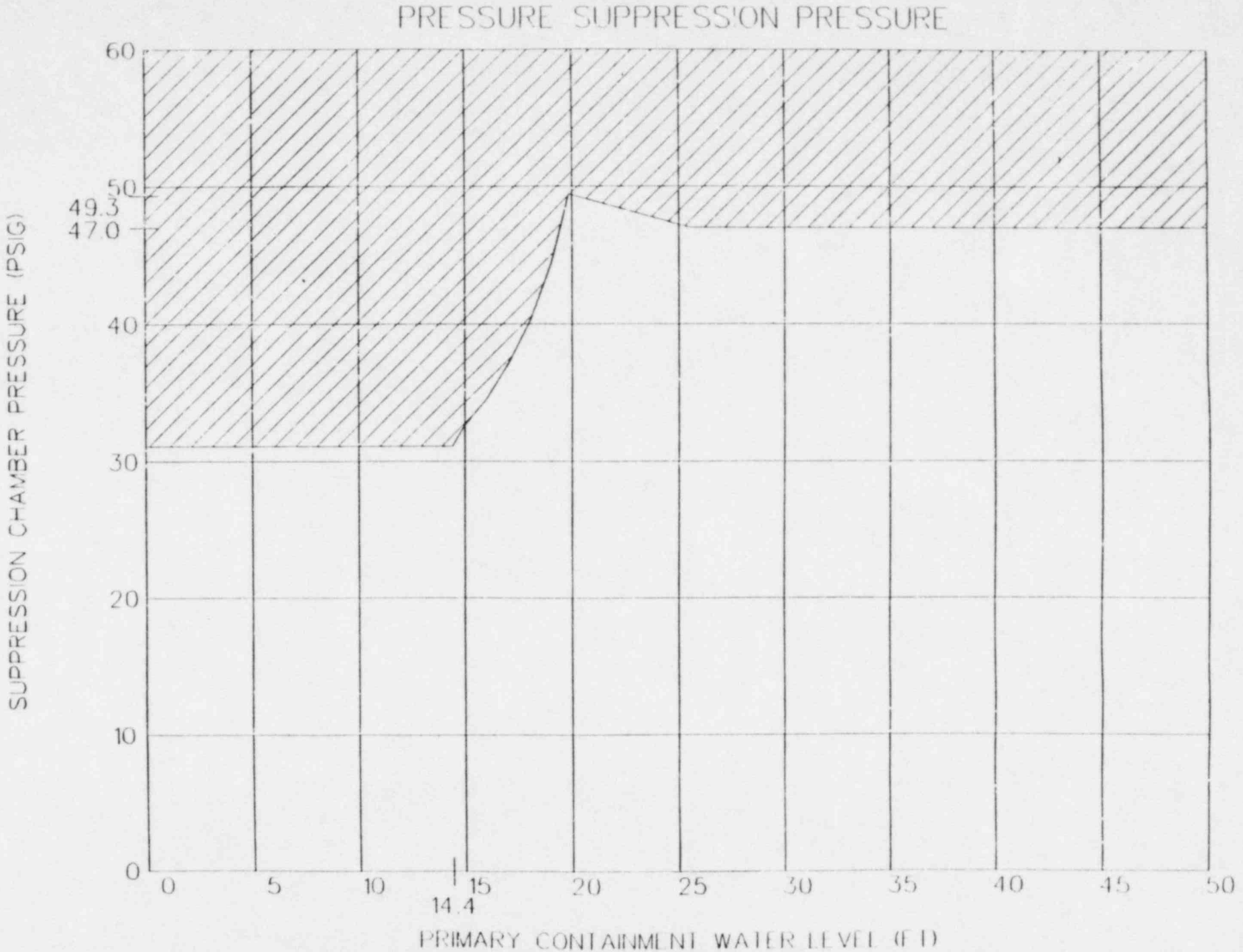
FIGURE C13-2
PRIMARY CONTAINMENT DESIGN PRESSURE
Suppression Chamber Pressure (psig)
130
110
100
90
80
70
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
Primary Containment Water Level (ft)
A
B

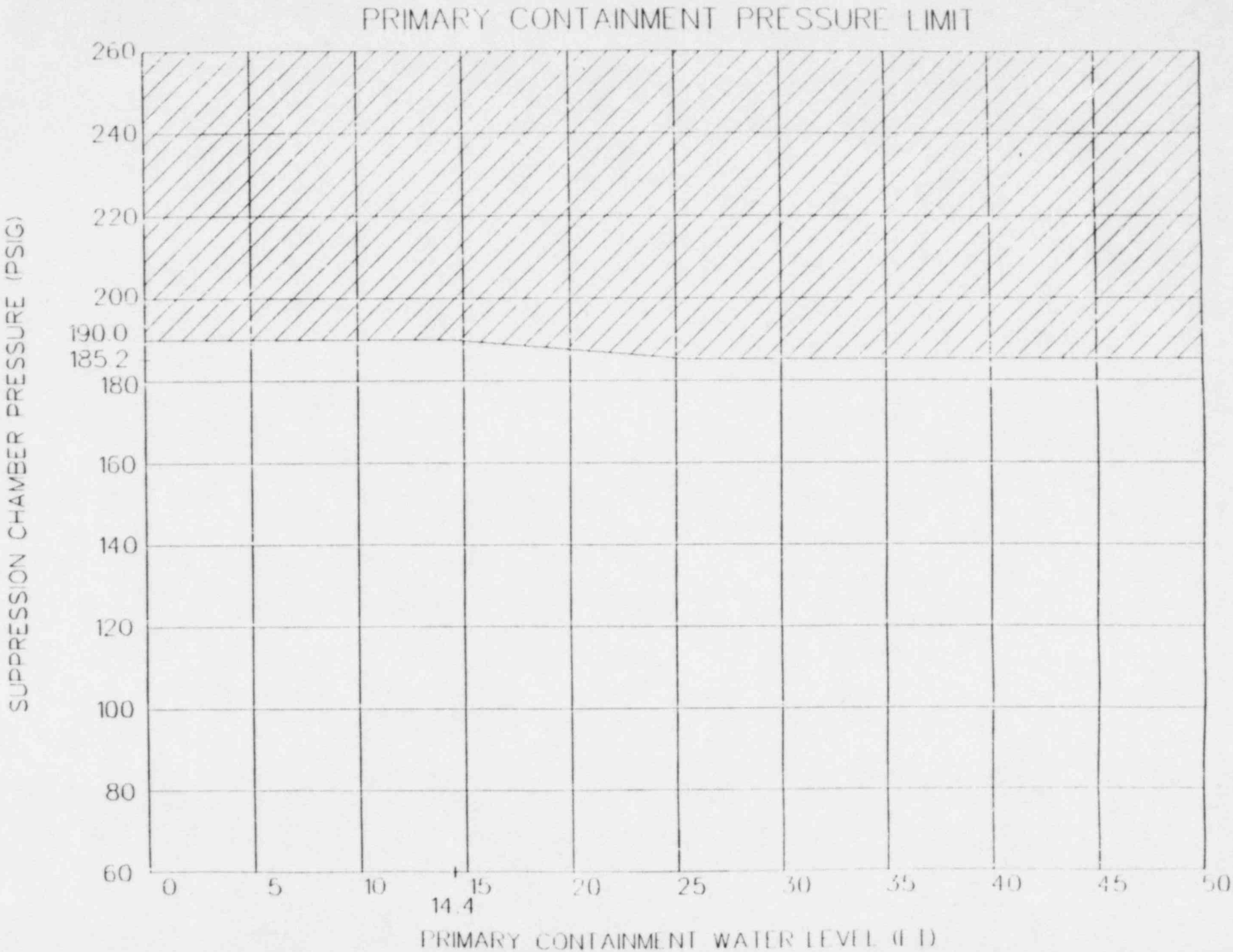
ENCLOSURE 4

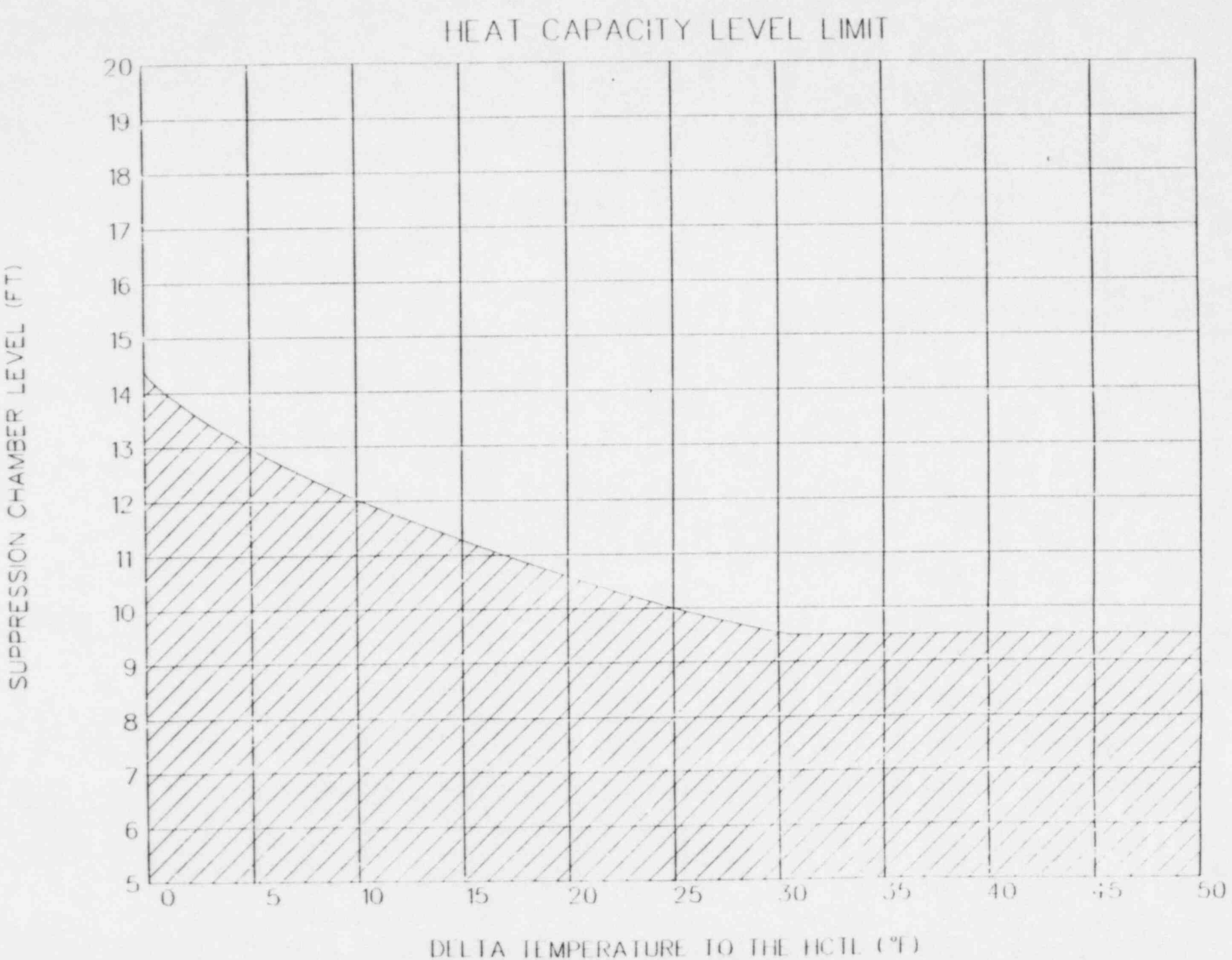

HEAT CAPACITY TEMPERATURE LIMIT
SUPPRESSION CHAMBER TEMPERATURE (°F)
200
198.7
190
180
170
160
150
140
130
120
110
100
0
100
135
200
300
400
500
600
700
800
900
1000
1090
1208
1200
RPV PRESSURE (PSIG)


SUPPRESSION CHAMBER LOAD LIMIT
SUPPRESSION CHAMBER LEVEL (FT)
25
24
23
22
21
20
19
18.4
18
17
16
15
14
13
12
11
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1108
RPV PRESSURE (PSIG)

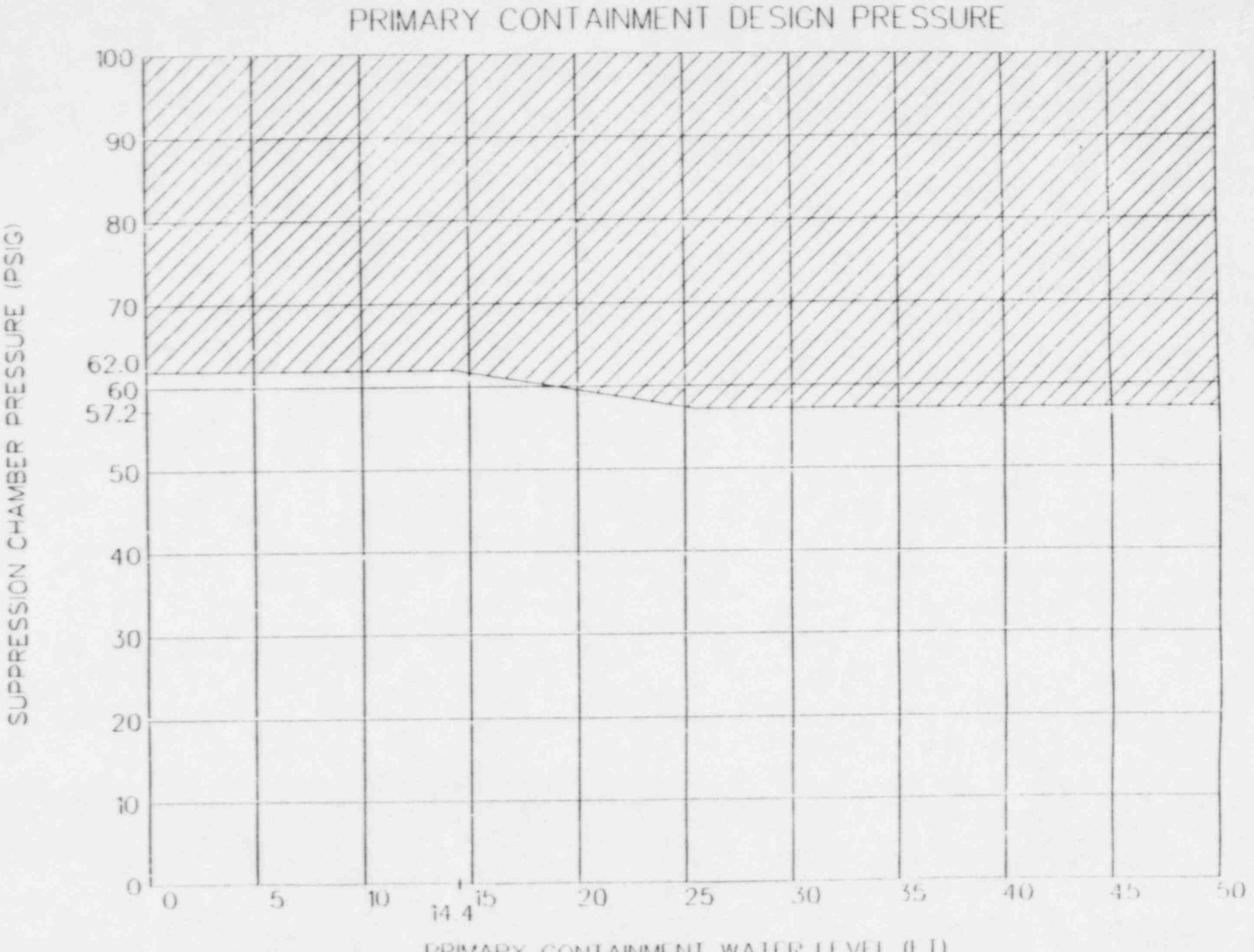

RPV SATURATION TEMPERATURE
DRYWELL TEMPERATURE (°F)
600
550
500
450
400
350
300
250
200
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
RPV PRESSURE (PSIG)

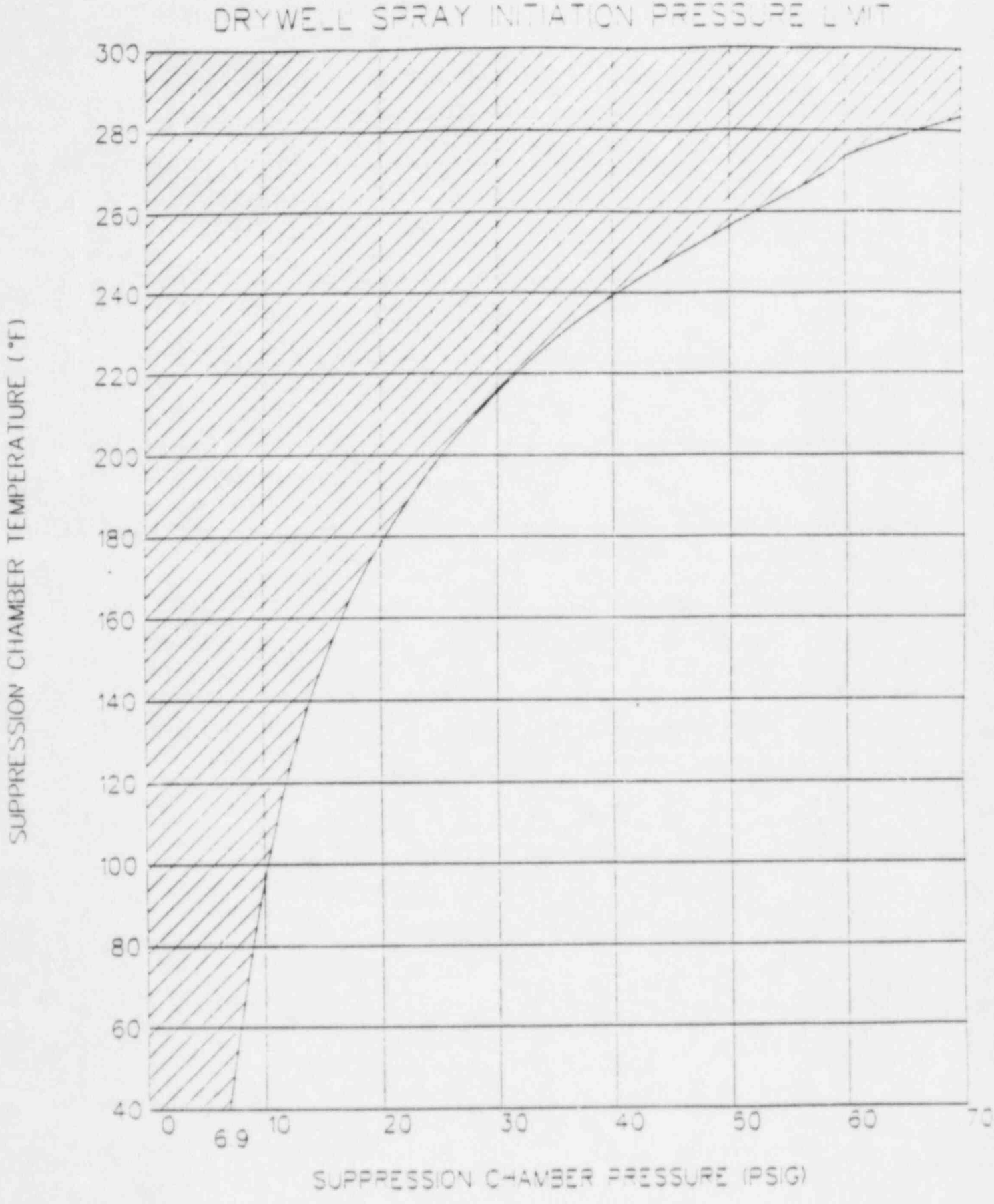

PRESSURE SUPPRESSION PRESSURE
SUPPRESSION CHAMBER PRESSURE (PSIG)
60
50
49.3
47.0
40
30
20
10
0
0
5
10
14.4
15
20
25
30
35
40
45
50
PRIMARY CONTAINMENT WATER LEVEL (FT)

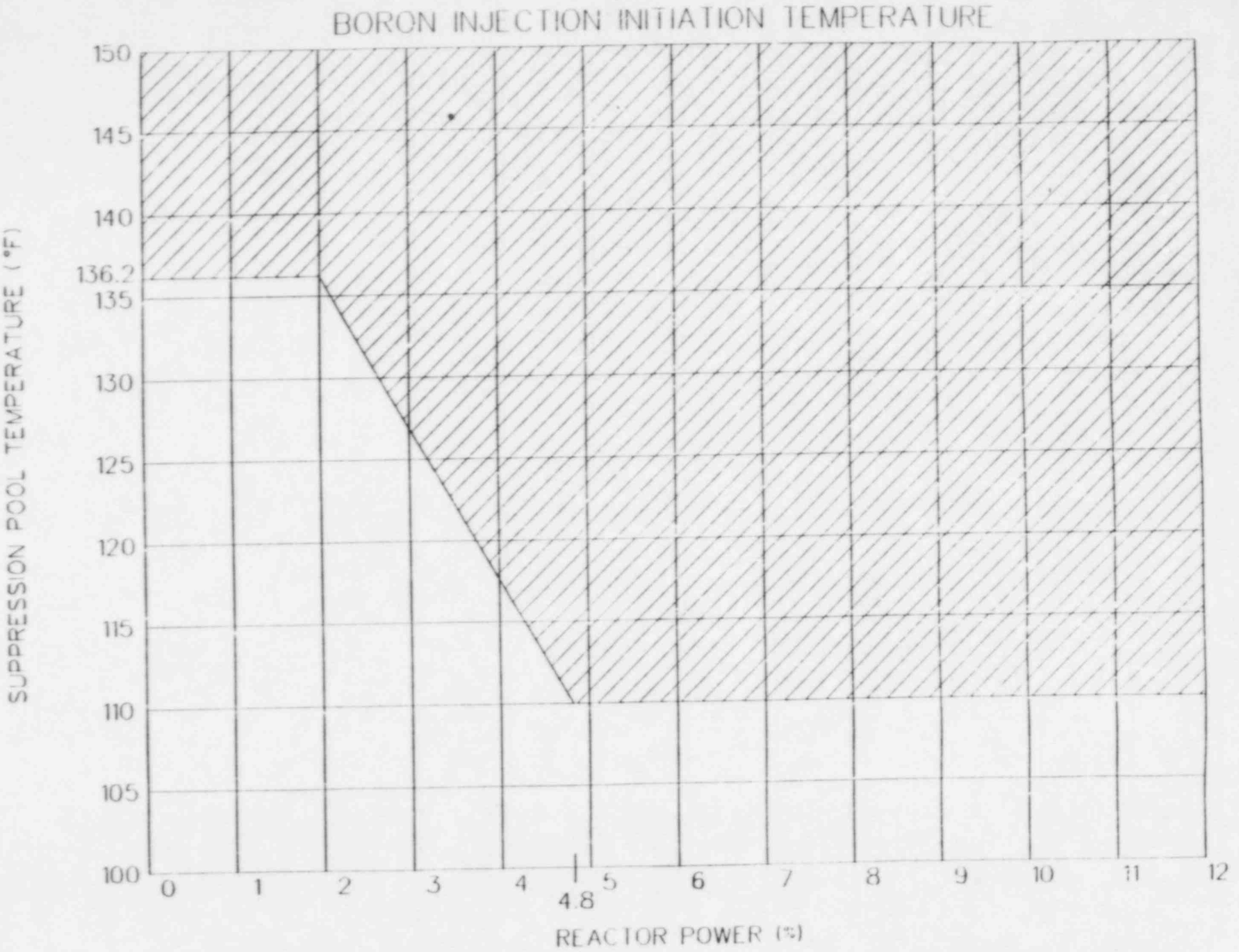

PRIMARY CONTAINMENT PRESSURE LIMIT
SUPPRESSION CHAMBER PRESSURE (PSIG)
260
240
220
200
190.0
185.2
180
160
140
120
100
80
60
0
5
10
14.4
15
20
25
30
35
40
45
50
PRIMARY CONTAINMENT WATER LEVEL (FT)


HEAT CAPACITY LEVEL LIMIT
SUPPRESSION CHAMBER LEVEL (FT)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
0
5
10
15
20
25
30
35
40
45
50
DELTA TEMPERATURE TO THE HCTL (°F)


MAXIMUM CORE UNCOVERY TIME LIMIT
MAXIMUM CORE UNCOVERY TIME LIMIT (MIN
40
35
30
25
20
15
10
5
0
1
10
100
500
1000
10000
TIME AFTER REACTOR SHUTDOWN (MIN)


PRIMARY CONTAINMENT DESIGN PRESSURE
SUPPRESSION CHAMBER PRESSURE (PSIG)
100
90
80
70
62.0
60
57.2
50
40
30
20
10
0
0
5
10
14.4
15
20
25
30
35
40
45
50
PRIMARY CONTAINMENT WATER LEVEL (FT)


DRYWELL SPRAY INITIATION PRESSURE LIMIT
SUPPRESSION CHAMBER TEMPERATURE (°F)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
0
6.9
10
20
30
40
50
60
70
SUPPRESSION CHAMBER PRESSURE (PSIG)


BORON INJECTION INITIATION TEMPERATURE
SUPPRESSION POOL TEMPERATURE (°F)
150
145
140
136.2
135
130
125
120
115
110
105
100
0
1
2
3
4
4.8
5
6
7
8
9
10
11
12
REACTOR POWER (%)

ENCLOSURE 5

ATTACHMENT 2

SYSTEM OPERATING PROCEDURE GUIDELINE

Scope

The purpose of this guideline is to illustrate the format and define the content of the system operating procedures (SOPs). As such, this guideline will first define the purpose of the SOP and then provide a discussion of the content and format of the various sections of the SOP.

Purpose

The SOP should provide step by step instructions for filling, venting, starting up, shutting down, changing modes, energizing, and other operational evolutions necessary for the proper operation of a plant system.

Procedure Format and Content

The SOPs shall utilize the procedure format delineated in Station Administrative Procedure SA-AP.ZZ-001(Q), Preparation and Approval of Station Procedures. As such, the procedure shall utilize the following items/sections in the order presented:

- Title Page
- Table of Contents
- Purpose (Section 1.0)
- Prerequisities (Section 2.0)
- Precautions and Limitations (Section 3.0)
- Equipment Required (Section 4.0)
- Procedure (Section 5.0)
- Attachments (Section 6.0)
- References (Section 7.0)
- Physical Attachments

Each of the above mentioned items are discussed separately. With the exception of the title page and table of contents, the items are numbered consistent with the manner in which they would appear in the procedure.

Title Page:

The title page format shall be consistent with that given on Form 1 in this guideline. The procedure title shall be consistent with that which appears in the Operations Department Procedure Index.

Table of Contents:

The table of contents format shall be consistent with that given on Form 2 in this guideline.

ATTACHMENT 2

1.0 PURPOSE

This section shall give an accurate description of the purpose of the procedure. While the purpose should be stated concisely, it should provide the operator with enough information to clearly identify the intent of the procedure.

Example

1.0 PURPOSE

This procedure outlines the steps necessary for the startup, shutdown, and operation of the Containment Atmosphere Control System.

2.0 PREREQUISITES

This section shall identify the conditions which must exist or actions required to be performed prior to performing various sections of the procedure. The guidelines for prerequisites are as follows:

a. Prerequisites can include but are not limited to the following:

- Completing valve/damper lineups
- Completing electrical lineups
- Ensuring support systems in service

b. The prerequisites should be grouped according to the procedure sub-section to which they apply. Thus all prerequisites for performing subsection 5.1 of the procedure will be grouped under subsection 2.1 of the prerequisite section with each individual prerequisite being numbered, in this case, 2.1.1, 2.1.2, etc.

c. The following note shall be included at the beginning of the prerequisite section.

2.0 PREREQUISITES

NOTE 2.0
Prerequisites within a subsection may be performed in any order.

d. The prerequisites for completing valve/damper/root valve/breaker lineups shall reference the appropriate attachments to the SOP. The guidelines for preparing the attachments are given in paragraph 6.0 of this guideline.

e. Support systems shall be referred to as being "in service" if required.

f. If possible, the specific reason why a prerequisite is required should be included.

Example

The RACS system is in service and capable of supplying flow to the extruder/evaporator booster pumps.

g. Prerequisites should not be overrestrictive.

3.0 PRECAUTIONS AND LIMITATIONS

This section shall provide a listing of all generic and system specific precautions and limitations which the operator should be cognizant of in performance of the procedure. In addition, this section shall also include all major system component interlocks and trips. All precautions shall be repeated in the procedure section (5.0) as necessary to assure safe system operation. The guidelines for precautions and limitations are as follows:

a. The Precautions and Limitations section shall be divided into three subsections: Precautions (3.1), Limitations (3.2), and Interlocks (3.3).

b. The following statement shall appear as 3.2.1 in all SOPs:

"All steps within each subsection of this procedure are to be completed in sequence unless otherwise specified."

c. For potentially contaminated systems, the following standard precaution shall be included:

"The _____ system contains potentially radioactive contaminated fluid. Contact RP for any additional precautions and equipment required for fill and vent."

d. All major component trips/auto starts shall be included in this section.

e. If the procedure requires a somewhat out-of-the-ordinary task which may not be covered under standing Radiation Work Permits (RWP), a statement to such effect shall be included as a precaution.

f. Precautions with regard to technical specifications should be provided when applicable. To avoid misinterpretation of the technical specifications, the specification should not be paraphrased or even written out. However, some identification terminology should be included along with the specification number.

Example

3.1.2 Observe the Standby Liquid Control System Operability requirements of Technical Specifications 3.1.5.

g. For all systems with valves, the following limitation shall be included:

"If valve lineup cannot be completed as required, the SNSS/NSS shall determine whether the deviations are such that the system should not be placed in service or standby, as required."

4.0 EQUIPMENT REQUIRED

This shall list all special equipment or tools required to perform the procedure. Additional guidelines for this section are as follows:

a. In cases where some type of communication equipment is required to carry out the SOP, the preferred communication device should be stated but also qualified by saying "or equivalent."

Example

4.1 Refueling PA system or equivalent is required...

b. It is not necessary to state what equipment is required for normal fill and vent procedures.

ATTACHMENT 2

5.0 PROCEDURE

This section shall provide step-by-step instructions to the degree required by a qualified operator for the performance of various system operational evolutions. In addition to providing step-by-step instructions, this section shall also identify to the operator the specific prerequisites which are required for a particular operation/evolution, the precautions which the operator should be cognizant of in the performance of the evolution, and the locations(s) where the operations take place. The guidelines for the procedure section are as follows:

a. A separate subsection (i.e. 5.1, 5.2, etc) shall be provided for each distinct system operational evolution. The operational evolutions which should be discussed are the normal system operational modes as well as infrequent yet reasonable/probable operational modes. Examples of normal operational modes which should be included are as follows:

- Startup (S/U).
- Shutdown (S/D).
- Placing system in standby.

Examples of infrequent yet probable/reasonable operating modes are:

- Fill and Vent (should be included for all fluid systems unless justified as unnecessary).
- Emergency system actuation/verification
- Shifting of redundant components (if deemed necessary due to complexity of evolution.)

It is not the intent of the SOPs to cover all possible system operating modes or configurations. The SOPs should only cover those modes/configurations which are likely to be utilized on a semi-routine basis. Abnormal operations (i.e. loss of a major component) should not be covered in the SOP but rather by the Abnormal Operating Procedures (AOP).

ATTACHMENT 2

b. For systems in which the majority of the operations occur in the main control room, the following note should be inserted before subsection 5.1.

5.1 Placing the Condensate System in Service

> NOTE 5.0
>
> All operations are performed from Panel 10C651E unless otherwise noted.

c. If an operations also require manipulation of controls at local panels, the location of the panels shall be included as part of Note 5.0.

> NOTE 5.0
>
> A. All operations are performed from Panel 10C650 unless otherwise noted.
>
> B. Local Panel locations are as follows:
>
> 1. 10C120 Stator Cooling Water Control Panel, Turbine Bldg 102

d. For operations which take place outside the main control room, the location should be identified by a note after the section/subsection (if the majority of the operations are at a common panel) or by stating the location in the specific step. An illustration of the latter is given in the example at the end of this section.

e. Generally, the first step of the procedure section will be to ensure that the applicable prerequisites have been completed.

Example

5.1.1 Ensure that all Prerequisites have been satisfied IAW Section 2.1 of this procedure.

f. Anytime the operator is required to read a system parameter (ex. verify pump discharge pressure greater than 50 psig), instrument name and number shall be included in the format of PI-XXXX INSTRUMENT NAME.

ATTACHMENT 2

g. Anytime large pieces of equipment are started, the procedure should instruct the operator to ensure proper operation by monitoring component parameters (i.e., flow, pressure). This type of verification should also be used when energizing buses in electrical procedures or whenever deemed necessary.

h. The shutdown of a system should place the system in such a configuration that it could be started up via the startup section without having to perform major valve lineup. This can't always be done but the writer should make the procedure flow as well as possible.

1. For systems requiring a fill and vent, the valve lineup shall be prepared to support this fill and vent. In addition, a table showing the alignment of control room operated (or local panel operated, if applicable) valves for system startup should be included in the startup section. The intent here is two-fold. First, its assumed that wholesale valve alignments need only be performed occasionally and thus would probably be performed prior to the fill and vent. Thus, the lineups should support the fill and vent. Second, the table at the beginning of the startup section allows the operator to place a system in service without having to perform wholesale valves alignments. Only a motor operated valve lineup is required since manual valve should not have be realigned and should be in their proper position.

i. The above as well as additional guidelines are illustrated in the following example.

Example

5.0 PROCEDURE

Note applies to the entire procedure

NOTE 5.0

A. All operations are performed from Panel 10C650B unless otherwise noted.

B. 10C120 Feedwater Control Panel, Turbine Bldg 137

ATTACHMENT 2

5.1 Filling and Venting the Condensate System

CAUTION 5.1

The Condensate System contains potentially radioactively contaminated fluid. Contact RP for any additional precautions and equipment required for fill and vent.

5.1.1 Ensure that all Prerequisites have been satified IAW Section 2.1, 2.3 of this procedure.

5.1.2 OPEN HV-2111 (CONDENSATE FLOW PATH) COND MN HDR ISLN VLV

5.1.3 OPEN V026 Cond Mn Hdr Vent Vlv until a solid stream of water issues then CLOSE (local).

5.1.4 CLOSE AE-HV-2000 FDW HDR REC LINE ISLN VLV (local panel 10C120).

NOTE 5.1.5

HV-2066 will auto close if condenser level drops below (later).

sution applies nly to sub- ection 5.1

ndicate bezel eadings. ncluded when hanging panel ections.

ommand statement, apitalized and in lined

alve tag in ain control oom. All caps.

alve not part of system covered by SOP. System designator provided.

Valve operated from local panel. Panel no. given.

Note applies only to step 5.1.5.

Local valve manually operated. Caps on first letters.

Contingency statement Underlined.

ATTACHMENT 2

5.1.5 OPEN HV-2066 //COND DRN VLV//.

Hash marks indicate that although the valve is operated from a control panel, no switch tag appears on the panel. The name given here is a functional description.

6.0 ATTACHMENTS

This section shall provide a listing of all attachments to the SOP. The attachments provide listing of the following:

-206A
-415A
- Valve/Damper lineups
- Major component electrical lineup
- Missing information

The guidelines and format of the various attachments are provided on Forms 3 through 5 to this procedure.

7.0 REFERENCES

This section shall list all reference material used in the preparation of the SOP. The list shall be arranged as follows:

7.1 P & ID
7.2 Logic Diagram:
7.3 Electrical Drawing:
7.4 Vendor Manual:
7.5 Panel Drawings:
7.6 Valve Index:
7.7 DITS:
7.8 GE Documents
7.9 System Description:
7.10 FSAR
7.11 Standard Technical Specifications
7.12 Other references

The use and listing of references material should adhere to the following guidelines:

a. All reference sources except 7.9 and 7.11 can be considered prime source material. The SOP should be written with regard to prime source material.

b. Items 7.9 (System Descriptions) and 7.11 (Standard Tech Specs) should be considered secondary source material. These documents are considered secondary source since at this time they are not controlled and therefore may not reflect the actual plant design.

ATTACHMENT 2

c. All of the items listed above should be investigated in preparing an SOP. If an item is not applicable, "None" should be inserted next to the item.

d. The Bechtel Document numbers should be used as opposed to GE or vendor numbers.

e. An example of the above guidelines is presented below:

Example

7.1 P & ID: M-51-1, Sht. 1, Rev. 2
M-65-2, Sht. 2, Rev. 3
Sht. 3, Rev. 1

7.2 Logic Diagrams: None

7.3 Electrical Diagrams: E-0562-1, Sht. 2 Rev. 4

Form No. 1

HCGS SYSTEM OPERATING PROCEDURE

OP-SO.

(Title)

Prepared By: _____ Date

Reviewed By: _____ SRO Date

Reviewed By: _____ Operating Engr - Hope Creek Date

ALARA Review: _____ Radiation Protection Dept. Date

Reviewed By: _____ Site Engineering Dept. Date

Reviewed By: _____ SQAE Date

SORC Review: _____ Chairman Date _____ Mtg. No.

Approved By: _____ Operations Mgr - Hope Creek Date

ATTACHMENT 2

Form No. 2

(Title)

TABLE OF CONTENTS

ATTACHMENT 2

Form No. 3

ATTACHMENT
- - - - - - - - SYSTEM
MANUAL AND REMOTE OPERATED VALVE LINEUP

NUMBER		FUNCTIONAL NAME DESCRIPTION	POSITION		INITIAL
VALVE*	OPERATOR		REQUIRED	AS FOUND	

1. All system valves including instrument root valves should appear on ATTACHMENT 1 and be listed in numerical order.

2. Valve numbers shall appear as "V025", not "V-025".

   Valve operator numbers shall appear as "HV-F026", not "HVF026"

4. Valves which do not have numbers but appear on the system P&ID should be listed after the numbered valves in the system with "LATER" for a valve number.

5. Valves which are not part of the system covered by the SOP but are required in the SOP should appear after the non-numbered valves in alpha-numeric order with the system designator included.

6. Valves which are part of the system covered by the SOP but have been listed in another SOP valve lineup for operability reasons should appear in the valve lineup in their proper numeric place and a reference should be made to the SOP which controls the valve. The reference should be listed under functional name description.

7. Damper alignments (HVAC Systems) will follow essentially the same rules as valves.

☐ 1st Verification

☐ 2nd Verification

Performed By _____ / _____ Date _____

Reviewed By _____ SNSS/NSS _____ Date _____

ATTACHMENT 2

Form No. 4

ATTACHMENT
- - - - - - - - SYSTEM
MAJOR COMPONENT ELECTRICAL LINEUP SHEET

EQUIPMENT NUMBER*	COMPONENT DESCRIPTION	MCC/PANEL NUMBER	BREAKER NUMBER	POSITION		INITIAL
				REQUIRED	AS FOUND	

1. The major component electrical lineup shall include all loads 480V and up as well as 250VDC.
2. The lineup shall be arranged by load center.
3. Component description should be identified to that which appears on MCC or load center.

☐ 1st Verification

☐ 2nd Verification

Performed By _____/_____ _____
Date

Reviewed By _____ _____
SNSS/NSS Date

ATTACHMENT 2

Form No. 5

ATTACHMENT __
- - - - - - - - SYSTEM
LIST OF LATERS

The following is a list of missing items of setpoints, nomenclature, etc., contained in this procedure to be identified at a later date. When all "laters" have been removed, this attachment will be deleted.

Section #

The following procedures, referenced within this document were not approved at the time of issuance of this procedure: