BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE

March 5, 1985

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I. INTRODUCTION

A. Purpose

The purpose of this Procedure Generation Package (PGP) is to describe how the Braidwood Station Unit 1 Emergency Operating Procedures (EOPs) will be developed and implemented based upon the Westinghouse Emergency Response Guidelines (ERGs), Revision 1. This PGP also describes how revisions will be made to the upgraded Braidwood EOPs after they are implemented. Braidwood Station Unit 1 is a four-loop Westinghouse PWR plant.

B. Scope

This document was developed in response to Supplement 1 to NUREG-0737, Item 7.2.b, page 15.

C. Organization

This document consists of the following six parts:

- Introduction
- Plant-Specific Technical Guidelines
- Braidwood Station Emergency Operating Procedure Writers Guide
- Braidwood Station Verification Program for EOPs
- Braidwood Station Validation Program EOPs
- Braidwood Station Training Program for EOPs

Each part describes the approach to be taken as part of the overall EOP implementation plan for Braidwood Station Unit 1.

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
SECTION II
PLANT SPECIFIC TECHNICAL GUIDELINES

March 5, 1985

II. PLANT-SPECIFIC TECHNICAL GUIDELINES

A. General

Braidwood Station will use the Westinghouse Emergency Response Guidelines (ERGs), Revision 1 (High Pressure version) as the generic technical guidelines to develop plant-specific EOPs. This is due to the similarities between Braidwood Station Unit 1 and the reference plant used for the ERGs. The differences between Braidwood Station Unit 1 and the reference plant are described in the Braidwood Station Plant Description (Attachment A) and the Braidwood Station Instrumentation Descriptions (Attachment B).

This instruction: 1) specifies the personnel who will write the initial upgraded EOPs; 2) specifies the source documents to be used to develop EOPs; and 3) describes the method that will be used to convert generic technical guidelines into Braidwood EOPs.

B. Personnel

Personnel who write the initial upgraded EOPs are to be knowledgeable in plant operations, plant systems, the Braidwood Station EOP Writers Guide and have an understanding of WOG guideline development.

C. Source Documents

Emergency procedure writers will use the following source documents to prepare Braidwood EOPs:

Braidwood Station EOP Writers Guide
WOG ERG (Revision 1) and background documents
Braidwood Station Electrical Drawings
Braidwood Station Piping and Instrumentation Drawings
Licensing Commitments relating to EOPs
Braidwood FSAR
Westinghouse Bulletins and Memos (as appropriate)
Braidwood Station Plant Descriptions (Attachment A)
Braidwood Station Instrumentation Description (Attachment B)
Braidwood Administrative Procedures
Braidwood System Operating Procedures
Braidwood General Operating Procedures
Braidwood Abnormal Operating Procedures
Braidwood Technical Specifications
Byron Station Emergency Operating Procedures
Revision 0/Revision 1 (Draft)
Byron/Braidwood Precautions, Limitations and Setpoints
Document

D. Method

The writer will review the source documents and then construct a draft EOP. Concurrently, the writer will complete the Braidwood Step Deviation Document. This document (Figure 1) will be used to explain any variance between a Braidwood procedure step and an ERG step.

Information and controls needed for each generic guideline step will be identified by reviewing the ERG and background document for that step. The generic background document will identify for each step the system and subsystems involved and the performance required by these systems and subsystems to achieve the functional requirement of the step. After each system or subsystem has been identified and its operational performance specified, the EOP writer will specify the required operator actions to achieve this system performance level in the form of operator actions steps written in accordance with the Writers Guide. The Braidwood Station Plant Description (Attachment A) and the Braidwood Station Instrumentation Description (Attachment B) identify the differences in plant equipment and instrumentation and controls between the Braidwood Station Unit 1 and the reference plant. Justification for significant deviations between the Braidwood plant and the reference plant are provided in Attachment C. The Plant Description and Instrumentation Description documents will be utilized as source documents during draft EOP writing and subsequent verification of procedures.

The following are additional instructions for developing Braidwood EOPs from the generic ERG's.

1. If it is determined that a generic step is compatible with Braidwood, then the step should be inserted into the Braidwood procedure. Since the technical basis of the step is explained in the WOG Background Document, there is no need to repeat this on the Step Deviation Document.

2. When a generic step specifies a numerical value to be calculated, the value will be determined and inserted into the Braidwood procedure.

3. When a generic step requests plant-specific details of actions to be added to the procedure, the plant-specific information will be added to the procedure. However, if the operator actions are highly routine or well within the knowledge of the operator, the specific steps may be deleted. Consideration will be given to the minimum number, qualification, training and experience of the operating crew.

4. If the generic guideline fails to identify or address systems or actions that are unique to Braidwood, then steps should be included to encompass the necessary actions.

5. If a generic step specifies an action that cannot be performed at Braidwood, the step will be deleted or modified.

6. Minor modifications to generic steps are acceptable without extensive justification provided that the change does not alter the intent of the guideline. Examples of these types of changes are as follows:

   a. Deletions of level of detail (See item #3 above).

   b. Deletions of overly obvious actions called for under the RESPONSE NOT OBTAINED column of the generic guidelines.

   c. Recording of generic steps to conform to standard Braidwood terminology.

   d. Rearranging generic steps to streamline the procedure due to Braidwood control room design and for operator convenience as long as this re-arrangement does not deviate from the possible step sequences given in the Step Sequence Requirement section of the background document.

After the draft EOPs are written, they will be verified for technical accuracy and written correctness in accordance with the Braidwood Station EOP Verification Program. Each procedure will also be validated for usability in accordance with the Braidwood Station EOP Validation Program. All discrepancies found during the verification and validation programs will be corrected prior to a final review by an On-Site Review committee. Procedure approval will be in accordance with Braidwood Administrative Procedure, On-Site Reviews of Procedures (BwAP 1205-2).

Training on EOPs will be conducted per the Braidwood Station EOP Training Program for all licensed operating personnel prior to EOP implementation. During the EOP training, plant operators will be encouraged to supply comments on the technical accuracy and usability of the EOPs. All comments from each training session will be supplied to the EOP writers for consideration of revision to the EOPs. A Verification Discrepancy Form (Attachment C to the Braidwood Station Verification Program) or a Validation Discrepancy Form (Attachment E to the Braidwood Station Validation Program) will be used to inform the EOP writers of potential problems found during operator training and to provide resolutions to these potential problems.

E. Documentation

Completed Braidwood Step Deviation Document should be entered in the Central File System and maintained in the EOP upgrade program. Additionally, this completed document will be provided as a source document to assist the EOP Verification and Validation, Training, Task-Analysis, and Control Room Design Review programs.

Documentation collected during the Braidwood Station Verification Program and the Braidwood Station Validation Program will be retained in accordance with these procedures in the Central File System. These two programs will document discrepancies identified with the EOPs and their resolution.

BRAIDWOOD EOP STEP DEVIATION DOCUMENT

Procedure No: ________________ Rev: _______ Title: ___________________

Writer ___________________________ Date: _____________ Page ___ of ___

BRAIDWOOD STEP NO.	ERG STEP NO.	CHANGE DESCRIPTION	REASON FOR CHANGE

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
SECTION III
ABNORMAL AND EMERGENCY OPERATING
PROCEDURE WRITERS GUIDE

March 5, 1985

Braidwood Station Abnormal and Emergency
Operating Procedure Writers Guide

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Braidwood Station Abnormal and Emergency
Operating Procedure Writers Guide

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BRAIDWOOD ABNORMAL AND EMERGENCY RESPONSE
PROCEDURE WRITERS GUIDE

I. INTRODUCTION

A. PURPOSE

The purpose of this writers guide is two-fold:

1. Ensure the utility of the abnormal and emergency operating procedures by providing administrative and technical guidance governing their preparation. (Utility of the procedures is considered by the NRC to be a measure of their usability, completeness, accuracy, readability, convenience of use, and acceptability to control room personnel.)

2. Provide guidance to support upgrading of the procedures and thus ensure their long-term consistency.

B. SCOPE

This writers guide establishes requirements and provides guidance for the writing of the following procedures and for the preparation of their subsequent revisions:

1. Braidwood Operating Abnormal (BwOA) Procedures

   The BwOA procedures direct operator action during off normal conditions which in themselves do not constitute an actual emergency condition (reactor trip and/or safety injection), but which conceivably can degrade into an actual emergency (reactor trip and/or safety injection) in the absence of positive corrective action.

   The BwOA procedures include:

   a. Electrical (ELEC) procedures direct actions to be taken when certain electrical equipment is lost.

   b. Environmental (ENV) procedures direct actions to be taken when undesirable environmental conditions occur that could affect plant operations.

   c. Instrumentation (INST) procedures direct actions to be taken when certain plant instrumentation fails.

   d. Primary (PRI) procedures direct actions to be taken upon the failure of important equipment or upon the development of specific adverse conditions.

   e. Radiation (RAD) procedures direct actions to be taken in the event of high radiation conditions.

f. Reactor Coolant Pumps (RCP) procedures direct action to be taken for various RCP malfunctons.

g. Refueling (REFUEL) procedures direct action to be taken to combat malfunctions relating to the safe handling of nuclear fuel.

h. Rod Control System (ROD) procedures direct actions to be taken in the event of malfunctions which occur in various reactivity control systems.

i. Secondary (SEC) procedures direct actions to be taken to combat malfunctions in the secondary systems.

2. Braidwood Emergency Operating Procedures (BwEOPs)

BwEOPs are procedures which utilize the concepts of Optimal Recovery and Critical Safety Function Restoration to provide systematic and prioritized guidance for symptom- based response to emergency transients.

a. Optimal Recovery Procedures (ORPs)

Instruction for diagnosis of and recovery from a broad spectrum of pre-defined event sequences determined to be the significant risk contributors is contained in the ORPs. These procedures provide pre-defined, symptom-based, event-related recovery strategies for responding to emergency transients. The ORPs include:

1) Braidwood Emergency Procedures (BwEPs)

There are four BwEPs which provide for the diagnosis and mitigation of design basis events such as loss of coolant accident (LOCA), steam generator tube rupture (SGTR), and loss of secondary coolant (LOSC). The first BwEP (1BwEP-0, REACTOR TRIP OR SAFETY INJECTION) is the ORP entry point.

2) BwEP Event Specific (BwEP ES) Subprocedures

When certain conditions are met or exceeded in the BwEPs, the BwEP ES subprocedures are entered. These will direct actions designed to implement the instruction of the BwEPs. The BwEP ES subprocedures are grouped under the appropriate BwEPs.

3) Braidwood Contingency Actions (BwCAs)

The BwCAs are procedures which supplement both the BwEPs and the BwEP ES subprocedures by providing recovery actions for low probability or unique event sequences which can not be easily addressed in the BwEPs and BwEP ES subprocedures, or which may complicate or reduce the effectiveness of these procedures if those actions were included in them.

b. Critical Safety Function Restoration

Methods for diagnosis and restoration of challenges to critical safety functions are presented here. The basis for use of these procedures is a symptom-based, function-related approach.

1) Braidwood Critical Safety Function Status Trees or Braidwood Status Trees (BwSTs)

The BwSTs are a set of six decision trees that are used to evaluate six respective critical safety functions to determine which functions are intact and which are being challenged. An unsatisfactory condition leads to use of the Functional Restoration Procedures.

2) Braidwood Functional Restoration (BwFR) Procedures

The BwFR procedures direct operator action to recover/restore the degraded safety functions.

I. <u>REFERENCES</u>

A. Westinghouse Owners Group (WOG) High Pressure Revision 1 Emergency Response Guidelines (ERGs)

B. WOG ERG Executive Volume

C. NUREG-0737, Requirements for Emergency Response Capability

D. Supplement 1 to NUREG-0737

E. NUREG-0899, Guidelines for the Preparation of Emergency Operating Procedures

F. INPO 82-017, Emergency Operating Procedures Writing Guideline

III. PROCEDURE DESIGNATION AND IDENTIFICATION

Each procedure shall be uniquely identified. This identification facilitates administration of preparation, review, revision, distribution, and operator use of procedures.

A. COVER SHEET

1. Each BwEOP (except the BwSTs) and BwOA procedure shall have a cover sheet (see IV.B.1).

2. The cover sheet shall uniquely identify the procedure by:

   a. Giving the procedure's title and alphanumeric designator.

   b. Giving the Braidwood revision number and issue letter and the WOG ERG revision number and issue letter of the guide on which the procedure (BwEOP's only) was based.

   c. Stating the purpose of the procedure.

   d. Providing the symptoms or entry conditions that require use of the procedure.

B. REVISION AND ISSUE ALPHANUMERICS

1. For BwOA procedures, the first approved version of a given procedure shall be designated "REV.1." As a procedure undergoes changes requiring approval and re-distribution, it shall be published with the next sequential revision number.

2. For BwEOPs, the revision numbers and issue letters shall be a combination of the "Rev./Issue" alphanumeric of the ERG on which the BwEOP was based, and an alphanumeric which is indicative of the local treatment of the procedure. These designators are described below:

   a. Each guideline has an assigned "Rev. Issue" designator to identify its time of origin. On a given BwEOP page, "WOG" shall be hyphenated to the ERG "Rev. Issue" alphanumeric, the latter being determined directly from the ERG based on the following convention:

      1) The "Rev." number designates a republication of the <u>entire ERG set</u> following the BASIC publication.

      2) An "Issue" letter appended to the revision number indicated that the <u>individual</u> guideline has been modified after publication of the numbered revision.

3) Absence of an "Issue" letter following the "Rev." number denotes that the guideline is part of the latest revision that was published, and has not been changed.

Examples: WOG-1 First republication of the entire ERG set. Each guideline has the same designator.

WOG-1A First modification to a Rev. 1 guideline; only those guidelines modified for the first time after Rev. 1 publication have this designator.

WOG-3B Second modification to a Rev. 3 guideline; only those guidelines modified twice after Rev. 3 publication have this designator.

4) Any new guideline(s) added to the ERG set will be assigned the latest "Rev." number and no "Issue" letter. Likewise, the corresponding BwEOP (if written) would receive the same alphanumeric following "WOG-".

b. The additional alphanumeric that is used is indicative of the local treatment of the procedures both individu- ally and as a set, and is reflective of whether changes made are due to plant specific needs or to a change in the ERG(s). On a given BwEOP page, "REV." shall be single-spaced from the local "Rev. Issue" alphanumeric, the latter being determined as described below:

1) Initially, all of the BwEOPs are written based on the latest published ERGs. Whatever the "Rev." and "Issue" of these ERGs (though for simplicity we shall start with "Rev." 1 and no "Issue" letter) all of the procedures would have a local revision number of 1 since this would be the first revision of the BwEOPs written to the ERGs.

Example: All 49 BwEOPs are written to ERG Revision 1, no issue letter. All 49 BwEOPs newly written from these ERGs would be designated:

REV. 1
WOG-1

2) If BwEOPs are changed due to plant design modifications or as a result of a review which finds problems with the procedures (with no ERG changes from the WOG), then an "Issue" letter A, B, C, etc., as appropriate, will be appended to the local number (with no change to the "WOG-" alphanumeric).

Example: Four BwEOPs are updated due to a detailed procedure review. These BwEOPs are now designated:

REV. 1A
WOG-1

whereas the remaining 45 BwEOPs continue to be designated as in III.B.2.b.1).

Example: Subsequently, two of the four are again modified, whereupon the designators for the set are:

(45)	(2)	(2)
REV. 1 WOG-1	REV. 1A WOG-1	REV. 1B WOG-1

3) If the utility deems it appropriate to change all the procedures in a set (with no ERG changes from the WOG), then all of the procedures would receive the next sequential local number with no issue letter (with no change to the "WOG-" alphanumeric).

Example: Taking the procedures shown in three different stages of local revision and issue given in the second example of III.B.2.b.2); the utility decides to make changes affecting the set as a whole. All of the procedures are now designated:

REV. 2
WOG-1

4) If several individual ERGs are changed by the WOG (but not the whole set) these modified ERGs are given new "Issue" letters (with no change of their "Rev." number). Regardless of what the local alphanumerics of the corresponding procedures were, they now revert to 1. The remaining procedures retain their "WOG-" and local alphanumeric.

Example: Taking the procedures shown in three different stages of local revision and issue given in the second example of III.B.2.b.2); the WOG has noted that several other plants besides Braidwood have had problems with the four procedures Braidwood changed. To improve emergency response capability, the WOG re-issues the four. The applicable designators are now:

(45)	(4)
REV. 1	REV. 1
WOG-1	WOG-1A

5) If the entire ERG set is re-published by the WOG, these modified ERGs are sent out with the next sequential "Rev." number, and no "Issue" letter. Regardless of what the local alphanumerics were, they now <u>all</u> revert to 1, and the "WOG-" alphanumeric becomes the same as the ERG "Rev." number.

Example: Taking the procedures shown in three different stages of local revision given in the second example of III.B.2.b.2); the WOG notes that many plants have had problems with the four procedures Braidwood has changed. It is also noted that there is sufficient impact on all of the ERGs to re-write and re-publish a new set. The applicable designators <u>all</u> become:

REV. 1
WOG-2

C. PROCEDURE ALPHANUMERIC DESIGNATION

1. BwOA Procedures

These procedures shall be designated by unit numbering, followed by "BwOA," then the type of BwOA single-spaced from "BwOA," and the number of the procedure in the type group hyphenated from the type:

Example: 1BwOA PRI-5

The unit number at Braidwood shall be either 0, 1 or 2, the type of BwOA shall be from ELEC, ENV, INST, PRI, RAD RCP, REFUEL, ROD, SEC, and the numbering of the type group shall be 1, 2, 3, etc.

2. BwEOPs

The BwEOP designators closely follow those of the ERGs. All BwEOP alphanumeric designators shall be prefixed by the unit number.

a. Design basis event procedures (Braidwood Emergency Procedures) shall be designated "_BwEP" hyphenated to the number of the parent ERG.

   Example: 1BwEP-0, 1BwEP-1, etc.

b. Event-specific subprocedures to the BwEPs (BwEP Event-Specific subprocedures) shall be designated "_BwEP ES" hyphenated to the number of its parent ERG.

   Example: 1BwEP ES-0.1, 1BwEP ES-0.2, etc.
   1BwEP ES-1.1, 1BwEP ES-1.2, etc.
   etc.

c. Emergency contingency procedures (Braidwood Contingency Actions) shall be designated "_BwCA" hyphenated to the number of its parent ERG.

   Example: 1BwCA-0.0, 1BwCA-0.1, etc.

d. Critical Safety Function Status Trees (Braidwood Status Trees) shall be designated "_BwST" hyphenated to 1, 2, 3, 4, 5, 6.

   Example: 1BwST-1, 1BwST-2, etc.

e. Braidwood Function Restoration Procedures shall be designated "_BwFR" hyphenated to the alphanumeric of its parent ERG.

   Example: 1BwFR-S.1, 1BwFR-P.2, etc.

D. PAGE NUMBERING

Each page of a procedure shall be specified as "Page __ of __" (page number of total number of pages in the procedure) centered at the bottom of the page (see VII.A.5).

IV. FORMAT

A. PROCEDURE ORGANIZATION

A procedure shall consist of the following elements with the exceptions noted:

1. Cover sheet (excluding BwSTs).

2. Instruction pages.

3. Attachments, figures, tables (as applicable).

4. Foldout pages (generally BwEOPs only).

B. COVER SHEET

1. Cover sheet information described here shall be word processed onto a pre-printed format as shown in Figure 1 in accordance with the instructions given in VII.B to produce the example cover sheet shown in Figure 2.

2. The following information shall be found at the top of each cover page:

   a. Procedure number.

   b. Procedure title.

   c. Unit to which the procedure applies.

   d. WOG and local revision numbers and issue letters (as applicable).

3. Purpose Section

   Each procedure shall include a Purpose section which shall contain a brief statement that describe the intent of the procedure.

4. Symptoms Or Entry Conditions Section

   a. Symptoms are indications used to identify, charac- terize, and diagnose plant conditions. Entry conditions to a procedure are those steps from other procedures that direct entry into a given BwEOP or BwOA procedure. The section including these shall immediately follow the Purpose section.

   b. A procedure can have either symptoms, or entry conditions, or both. If a procedure has both, the symptoms shall be listed first.

   c. The order of the symptoms is left to the discretion of the writer, as well as the choice to use a strict ordering employing numbers/letters or a loose ordering employing closed/open bullets.

   d. The entry conditions shall be ordered and numbered first by procedure then by step number.

C. INSTRUCTION PAGES

1. Instruction pages shall contain steps and amplifying remarks to direct action intended to mitigate the consequences of an emergency transient. This information shall be developed as given here and in Section VI, and shall be word processed on a pre-printed format as shown in Figure 3 in accordance with the instructions given in VII.B and VII.C to produce the example instruction page shown in Figure 4.

2. The following information shall be found at the top of each instruction page:

   a. Procedure number.

   b. Procedure title.

   c. Unit to which the procedure applies.

   d. The WOG and local revision numbers and issue letters (as applicable).

3. The body of an instruction page shall be in two-column format. The left column is entitled "ACTION/EXPECTED RESPONSE" (AER), and the right column is entitled "RESPONSE NOT OBTAINED" (RNO). A third auxiliary column is placed to the far left and is used for high level step numbering; it is entitled "STEP."

4. Immediate Operator Actions are the first steps performed and are indicated as being immediate actions by boxing the high level step numbers; Subsequent Operator Actions follow the immediate actions.

5. Instruction Step Numbering

   a. High-level instruction steps are those steps which present a major thought in a procedure by directing an action or observation, or by introducing a series of related actions or observations. High-level steps are found on the AER side of the procedure.

   b. High-level instruction steps shall be sequentially numbered using Arabic numerals. The sequence is maintained through the procedure regardless of switch from immediate to subsequent actions.

   c. Steps and indented substeps are alternately designated by number/letter/number/letter, etc., as shown below:

      5. Check FW Status:

         a. Check feedwater isolation

            1) Verify the following valves - <u>closed</u>:

               a) • 1FW510
                  • 1FW520

   Specific instructions for indentation and vertical spacing are found in VII.C. Bulleted items are similarly indented.

6. Interruptions to the flow of information should be minimized; each action step should be wholly contained on a single page. If it is necessary to complete a step on the following page, the phrase "Step continued on next page", should appear in the bottom corner of the page.

7. Following the last step of the instruction pages, the word "-END-" shall be appended.

D. FIGURES, TABLES, AND ATTACHMENTS

1. Information to be presented on figures, tables and attachments shall be placed on a pre-printed format as shown in Figure 1 in accordance with the instruction in this section and those given in VII.E to produce examples shown in Figures 5.

2. Figures and Tables

a. Figures and tables which are less than one page in length and applicable only to the step which introduces them should be left in the text of the procedure. In addition, the figure or table should appear on the same page as the verbiage which introduces it. Such figures and tables shall neither be titled or numbered as given in IV.D.2.c, rather, it could be referred to as "Step 5 Table" or "Table in substep 6c"; this choice is left to the writer.

b. Figures and tables which are a page or more in length, or which are applicable to more than one step, shall be placed at the back of the procedure.

c. When a figure is referenced in a procedure, the word Figure and the figure's sequential Arabic number is given, e.g.:

   1) Determine RCS subcooling from Attachment A, Step A and Figure 1BwEP 0-1.

   On the page on which the figure appears, the procedure alphanumeric as well as the figure number and title shall appear at the bottom of the page within the border, e.g.:

   Figure 1BwEP 0-1
   RCS Subcooling Margin

d. When a table is referenced in a procedure, it will be completely enclosed by a distinct outline; if necessary, it may extend into the adjacent column because of this delineation. All information present in the table shall be at least as legible (type size and spacing) as the instruction steps in the procedure. All columns and rows of information in a table will be defined by solid lines. All column and row headings shall be presented in all Courier Caps and underlined.

3. Attachments

a. Attachments are used exclusively at the end of procedures for information which needs to be segregated from the body of the procedure regardless of the volume of the material or the number of steps to which it is applicable (the writer may assign material to an attachment as desired).

b. Attachments are identified by the title "ATTACHMENT" followed by a single letter designator. This title is centered at the top of a standard format page. The title block will be the same as for the procedure. Attachments will use a single-column, full-page-width format.

4. Arrangement

Tables, attachments, and figures shall be assembled at the end of the procedure text; regardless of the order in which they are called out in the text, they shall be segregated by type (Tables, Figures and then Attachments.)

E. FOLDOUT PAGES

1. Foldouts contain information which supplements and amplifies the material found in the procedure text, tables, figures and attachments. They specify action to be taken when certain conditions are met regardless of the point in a procedure at which the operator finds himself.

2. Foldouts shall be placed in accordance with this section and VII.F to produce Figure 6.

3. The BwEOP foldouts are based on the WOG ERG foldouts which appear at the end of each of the last event specific guidelines of a series (ES-0.4, ES-1.4, ES-3.3) and at the end of four other guidelines (ECA-2.1, ECA-3.1, ECA-3.2, ECA-3.3).

   A foldout appearing at the end of the last event specific guideline of a series applies to all of the guidelines in that series, e.g., the foldout at the end of ES-0.4 applies to the E-0 series consisting of E-0, ES-0.0, ES-0.1, ES-0.2, ES-0.3, and ES-0.4; likewise for the ES-1.4 foldout for the E-1 series, and the ES-3.3 foldout for the E-3 series (E-2 is the only procedure in its series and has no foldout).

   This principle carries over to the BwEOPs, i.e., the plant-specific foldout for 1BwEP ES-0.4 generated from the generic foldout in ES-0.4 applies to the 1BwEP-0 series, consisting of 1BwEP-0, 1BwEP ES-0.0, 1BwEP ES-0.1, 1BwEP ES-0.2, 1BwEP ES-0.3, and 1BwEP ES-0.4.

   The foldouts appearing at the end of ECA-2.1, 3.1, 3.2, and 3.3 apply only to their respective guidelines, and are used to generate plant-specific foldouts applicable only to the respective BwCAs.

4. The alphanumeric designators for the foldouts in the 1BwEP-0, 1BwEP-1, and 1BwEP-3 series shall be 1BwEP-F.0, 1BwEP-F.1, and 1BwEP-F.3, respectively. Those for the BwCAs shall be 1BwCA-2.1, 1BwCA-3.1, 1-BwCA-3.2, and 1-BwCA-3.3 (these are the same designators used for the procedures themselves). These shall appear in the left heading box.

5. The foldout titling for the 1BwEP-0,1,3 series of procedures is exemplified by that for the 1BwEP-0 series:

   1BwEP-F.0 FOLDOUT FOR 1BwEP-0 SERIES UNIT 1

   The foldout titling for the BwCAs is exemplified by the following:

   FOLDOUT FOR 1BwCA-2.1 UNIT 1

6. A two-column format shall be used to present the material, but no bordering is required.

7. The material presented in the ERG foldouts should be carried over to the BwEOP foldouts with modifications as required; additional material may be included to ensure plant specificity.

8. The foldouts shall use a step numbering scheme as given in IV.C.5.c and VI.B.4.c, except that the title of each category, equivalent to a high-level step, shall not be numbered.

9. The symbols "<," for "less than," and ">," for greater than, should be used on the foldout pages.

F. BRAIDWOOD STATUS TREES

1. The BwSTs shall be generated using the ERG status trees in the block and branch format.

2. The information shall be placed on a pre-printed format as shown in Figure 7 in accordance with this section and VII.G to produce Figure 8.

V. MECHANICS OF STYLE

The BwEOPs and BwOA procedures must be written in a style that presents information in a simple, familiar, specific, and unambiguous manner. This is done using the principles presented in the following sections:

A. WRITING STYLE

The simplest, most familiar, and most specific words that accurately convey the intended meaning should be used. Operators should understand all the words used in the procedures. To achieve this end:

1. Use simple words, such words are generally short, of few syllables, and are in common usage.

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

3. Uniquely define key words that may be understood in more than one sense.

4. Use verbs with specific meanings.

5. Avoid using adverbs/adjectives that are difficult to define precisely (e.g., slowly, frequently/approximately).

6. Equipment status should be denoted as follows:

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

   b. Operating - This means that a system, subsystem, train, component, or device is in operation and is performing its specified function(s), and that "Out of Service Cards" or other conditions do not prevent it from maintaining that service.

   c. Available - This word means that a system, subsystem, train, component, or device is operable and can be used as desired; however, it need not be operating.

B. NUMERICAL VALUES

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

1. Arabic numerals should be used.

2. For quantities less than unity, the decimal point should be preceded by a zero, e.g., 0.1, 0.023.

3. The number of significant digits should be consistent with the accuracy available from the instrument and the reading ability of the operator.

4. Acceptance values should be specified in such a way that addition and subtraction by the user is avoided, if possible. This can generally be done by stating acceptance values as limits.

   Examples: 510°F maximum
   300 psig minimum
   500° to 600°F

   For calibration points, statement of the midpoint and its lower and upper limits for each data cell would accomplish the same purpose, e.g., 9.5 to 10.5 milliamperes instead of 10 ± 0.5 milliamperes; the latter should be avoided.

5. Engineering units should always be specified for numerical values of process variables. They should be the same as those used on the control room displays.

C. PHRASEOLOGY

The syntax of the procedures should be consistent with the following rules:

1. Use simple word order as much as possible. i.e., subject, verb, object.

2. Restrict use of adjectives and adverbs to those necessary for technical completeness and accuracy; aesthetic descriptions are extraneous.

3. Use definite and indefinite articles only as needed to distinguish a thought, object, or operations from others.

4. There should be only one main thought per sentence.

5. When addressing a concept, object, or operation, be consistent in referring to it throughout the procedure.

D. SPELLING

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

E. HYPHENATION

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

1. When doubt exists as to how to hyphenate a compound word, the words should be restructured to avoid hyphenation.

2. Hyphens should be used in the following circumstances:

   a. In compound numbers from twenty-one to ninety-nine; e.g., one hundred thirty-four, forty-seven.

   b. In fractions; e.g., one-half, two-thirds.

   c. In compounds with "self"; e.g., self-contained, self-lubricating.

   d. When the last letter of the first word is the same vowel as the first letter of the second word. As an alternative, two words may be used; e.g., fire-escape or fire escape.

   e. When misleading or awkward consonants would result by joining the words; e.g., bell-like is preferable to belllike. (The alternative "bell like" would not convey as clearly the implication that something is akin to a bell because of the one-space separation.)

   f. To avoid confusion with another word; e.g., re-cover, implying to cover again, to distinguish it from recover, implying improvement or restoration; pre-position, implying to place in advance, to distinguish it from preposition, a part of speech.

   g. When a letter is linked to a noun; e.g., X-ray, O-ring, U-bolt, I-ring.

   h. To separate chemical element names or symbols and their atomic weights; e.g., Uranium-235, U-235, Helium-4, He-4.

   i. To separate an action from an expected response on the AER side of a step; e.g.: Verify PZR Level - <u>LESS THAN 92%</u>.

F. PUNCTUATION

Punctuation should be used as necessary to aid reading and prevent misunderstanding. Word order should be selected to require a minimum of punctuation. When extensive punctuation is necessary to ensure clarity, the sentence should be rewritten and separated into several sentences as necessary to clearly present the ideas the writer wishes to convey. Punctuation should be in accordance with the following rules:

1. Commas

These may be used to separate thoughts or equipment which must be presented in the same sentence. Overuse of commas is a sign that the sentence is too complex and needs to be rewritten. Commas shall be used after conditional phrases; e.g.:

IF level decreases to 17%,
THEN secure heaters.

2. Periods

Use periods at the end of complete sentences and for indicating the decimal place in numbers. Periods should not be used at the end of the Expected Response part of a diagnostic instruction (see VI.E.1.b).

3. Parentheses

Parentheses shall be used to indicate alternative items in a procedure, and demarcate instrument alphanumerics and parameter values for adverse containment conditions. The writer may also use parentheses as required for emphasis of other information.

4. Colon

Use colons to indicate that a list of items is to follow, e.g.: Restore cooling flow as follows:

5. Brackets

Brackets may be used by the writer as desired to emphasize particular information. Since parentheses already have this function, use of brackets should be minimized to these situations in which it is clear that use of parentheses is insufficient.

G. ABBREVIATIONS, LETTER SYMBOLS, AND ACRONYMS

1. An abbreviation shall not be used if it is seldom seen or is unfamiliar to the operators, or if it does not flow well with the procedure text. They should be used where it is necessary to save time and space and when their meaning is unquestionably clear to the reader.

2. Periods should be omitted from abbreviations except in cases where the omission would result in confusion.

3. Letter symbols may be used to represent particular quantities or items in a procedure. Normally such symbols should be widely known, such as the alphabetical designators for pumps, loops, steam generators, tables, attachments. If the symbol is needed but not commonly known, the writer shall define it; e.g., quantities to be calculated on an attachment.

4. An acronym is a type of abbreviation formed by the initial letter(s) of each of the successive parts or major parts of a compound term.

5. Abbreviations, symbols, and acronyms should not be overused or they will lose their effectiveness.

6. Only abbreviations, acronyms and symbols appearing in this Writers Guide and Braidwood Administrative Procedure, Conventions, Definitions and Approved Station Abbreviations (BwAP 1300-2A2) should be used.

VI. WRITING THE PROCEDURES

A. TYPES OF STEPS

Several types of steps and actions are used in writing BwEOPs and BwOA procedures:

1. Immediate Operator Actions

   These are actions that operators take immediately upon entering a procedure. They are designed to stop further degradation of existing conditions, to mitigate their consequences, and to allow operator evaluation of the situation. The substance of these actions is generally a verification of the following:

   a. Automatic actions which should have occurred as a result of protective system reaction to plant conditions.

   b. Adequate reactor shutdown margin.

   c. Availability of electrical power.

   d. Availability of emergency core cooling systems.

   Immediate actions should be memorized and performed without having to refer to the procedure. If the operator executes any or all of the immediate actions in this manner, he should check his progress against the procedure before going on with the subsequent operator actions.

2. Subsequent Operator Actions

   These are actions that operators use to return the plant to a safe, stable, steady-state condition. In the procedure body, they follow the immediate operator actions and fulfill their role by performing the following:

   a. Diagnosing the reactor/plant conditions and specifying actions which enhance safety and stability.

   b. Providing transitions to appropriate procedures by identifying specific symptoms.

   c. Though not written explicitly in the procedure, the verification that all immediate actions have been performed and done properly is a part of the subsequent actions.

3. Non-Sequential Steps

These are steps which may be performed at any point in a procedure. They should be written into the procedure using an approach that clearly identifies to the operator where and when these steps apply (in addition to the point at which they appear in the procedure), the conditions under which they apply, and the time sequences required for their performance.

Often a non-sequential step will be seen in the RNO side of the procedure. This is due to the operative instructions (see VI.E.1.c) of the AER side not having been performed because the criteria specified in the diagnostic instructions (see VI.E.1.b), on which the operative instructions were contingent, were not fulfilled; consequently, the RNO side says that the actions are to be taken when the conditions are met. The conditional "WHEN . . ., THEN . . ." structure is a format well-suited for non-sequential actions. Example:

5. CHECK IF ACCUMULATOR ISOLATION VALVES CAN BE CLOSED	
a. Accumulator isolation valves - OPEN	a. Go to Step 6.
b. RCS pressure - GREATER THAN 1000 PSIG	b. Continue with Step 6. WHEN RCS pressure is greater than 1000 PSIG, THEN shut accumulator isolation valves.
c. Shut accumulator isolation valves.	

4. Concurrent Steps

These are steps which have to be performed at the same time. The procedures should explicitly indicate which steps are concurrent so that the operator quickly realizes the scope of his task. The maximum number of concurrent steps should not be beyond the capability of the control room staff to perform them.

5. Recurrent Steps

This term characterizes steps which require the operator to perform them throughout the procedure. These items are generally of a discrete (in time) and active nature (as opposed to the passive nature of continuing steps; see VI.A.6).

The frequency may be on a regular basis (in which case the operator should be told when or how often the step is to be performed), or it may be determined by the operator and be contingent upon plant status. In either case, he should know the conditions for which the steps should no longer be carried out.

6. Continuing Steps

These are steps that, although similar in nature to recurrent steps, normally encompass more passive operations such as monitoring, maintaining, observing and controlling, and which are performed on a continuous basis rather than at a specific time.

7. Diagnostic Steps

Diagnostics is a function of many steps of the BwEOPs and BwOA procedures. These steps are used on the diagnosis of problems to determine if conditions are such that certain ameliorating operative instructions should be used.

B. STEP SEQUENCING

1. Steps should be sequenced according to the overriding consideration of technical necessity.

2. The physical layout and organization of the control room is also to be considered when determining step sequencing. This is done for the sake of optional staff movement in the control room. Though secondary to technical necessity, this consideration should be carefully evaluated for its impact.

3. The WOG ERG writers have already undertaken in large part the task of determining step sequence, using both technical necessity and control room configuration as factors.

For each guideline, a high-level step sequence has been given in the corresponding generic background document. The rules of usage governing application of these sequences are given in the WOG ERG Executive Volume, "Writers Guide for ERG Background Documents," subsection 4.6.2, Step Sequence Requirements, pp. 19-21, and "Users Guide for ERGs and Background Documents," section 8.1, Guideline Background Documents, Step Sequence Requirements, pp. 29-31.

The alternatives allowed by this sequencing system are intended to be applicable to all W NSSS plants. If the writer must deviate even from this liberal step sequencing allowance of the ERGs, he shall document this on the step documentation forms (change sheets).

4. Sequencing Notation

   a. High-level steps are designated with Arabic numerals and are performed in the order in which they appear.

   b. Substeps are designated with lower case Roman letters, and are performed in the order in which they appear. Sub-substeps are performed in the same manner, but with Arabic numeral designators.

   c. When the sequence of performance of substeps (or of operation of listed equipment) is not important, the substeps or equipments shall be preceded by bullets. A closed bullet (•) requires that all the tasks so bulleted be completed in any order convenient to the operator or required by plant conditions. An open bullet (o) requires that only tasks applicable at that time for the particular conditions be performed; the order of performance is the same as for closed bullets. Open bullets shall also be used with the conjunction or to indicate a choice between two or more alternatives.

C. INSTRUCTIONAL STEP LENGTH AND CONTENT

1. One of the most important factors to be considered when writing BwEOPs and BwOA procedures is "when" they will be used; that "when" is during high stress conditions.

2. Steps consisting of several actions which are poorly grouped and prioritized can be complex and confusing, resulting in increased reading time, reduced comprehension of the requirements, and omission of some actions; ultimately this degrades plant safety.

3. To prevent this, steps must be concise and precise, which respectively means "brief" and "exactly defined." Information so presented can greatly assist the operator under stressful conditions because he need not interpret the text.

4. To ensure conciseness and precision, procedure steps should be written consisting of a single sentence or sentence fragment; the procedures should specify what is to be done, rather than what is to be avoided. Positive action statements are preferred over negative, passive statements as the latter are likely to be misunderstood in a stressful situation.

5. The following guideline is also applicable to step length and content:

   a. High-level steps should deal with only one major idea.

   b. Complex evolutions should be prescribed by a series of steps (or substeps), with each (sub)step as simple as possible.

   c. Limits should be expressed quantitatively whenever possible.

D. LEVEL OF DETAIL

The degree of detail must be evaluated on a case-by-case basis keeping in mind that these procedures are for abnormal and emergency situation, and not startup, shutdown, normal operation, or maintenance. The amount of detail should address this and the following principles:

1. Detail shall not be excessive as to adversely affect the utility of the procedures.

2. The level of detail shall be:

   a. Sufficient for the operator to perform the required task without unnecessary reference to other documents.

   b. Sufficient for effective use by a newly trained and qualified operator.

E. INSTRUCTION STEP DUAL-COLUMN USAGE

BwEOPs and BwOA procedures employ as part of their logic structure (see VI.F for detail) a dual-column format which contains two parallel sets of instructions, one of a primary nature, the other of a contingency nature.

1. Action/Expected Response (AER) Column

   a. The left-hand column of the procedure is titled "Action/Expected Response." This column has the primary instructions to be carried out by the operator. These primary instructions for the most part are of two types:

      1) Diagnostic instructions.
      2) Operative instructions.

b. Diagnostic instructions provide criteria which must be satisfied so that an operator may perform certain actions contingent upon those criteria; such instructions impact on how equipment should be run, as well as ascertaining whole-plant status which aids in determining how in general the event should be treated.

Diagnostic instructions specify the:

1) <u>Action</u> to take; this normally directs the operator to check or verify the:

2) <u>Expected Response</u>, meaning the desired position, status, or value of a specific:

3) <u>Item/Parameter</u>, such as a valve, pump, or process variable.

The order of these ideas in a diagnostic instruction is Action-Item/Parameter-Expected Response. The Expected Response shall be in all cap and underlined, and shall be hyphenated from the Action-Item Parameter part, e.g.:

Check power to isolation valves - <u>AVAILABLE</u>.

As a general rule, diagnostic instructions shall not appear in high-level steps. High-level diagnostic instructions which are given in the ERGs shall be broken up as needed to keep the BwEOP high-level verbiage as introductory material and to place the diagnostic material in the substeps (although BwOA procedures do not have guidelines such as the ERGs, this policy shall apply to them as well); e.g.:

ERG: 1. Check RCS Pressure - <u>GREATER THAN 2000 PSIG</u>

becomes:

BwEOP: 1. CHECK RCS PRESSURE:

a. RCS pressure - <u>GREATER THAN 2000 PSIG</u>

c. Operative instructions direct the operator to perform active physical tasks such as operating a valve (regardless of method), breaker, pump, sampling system, etc., and passive tasks such as monitoring, controlling, observing, maintaining, etc. The actions directed by these instructions may or may not be contingent on the results of a diagnostic instruction.

d. As a general rule, the AER column for BwEOPs shall not contain conditional statements, e.g.: "IF. . ., THEN. . ." or "WHEN. . ., THEN. . ." This is in close keeping with the ERGs which neither have nor need them in the AER side. (Conceptually, the AER-RNO contingency format implies conditional logic; see VI.F.)

BwOA procedures may incorporate them as needed for special purposes and because these procedures do not have generic models.

2. Response Not Obtained (RNO) Column

a. The right-hand column of the procedure is titled "Response Not Obtained." The RNO column is used to list contingency actions which are taken when a diagnostic instruction does not yield an expected response and/or when an operative action can not be performed.

b. All information in the RNO column is numbered, lettered, bulleted, typed and formatted in the same way as is AER information, with the RNO material appearing directly across from its corresponding AER material; e.g.:

a. Open the following valves:	a. Open the following valves:
1) 1SI8801A	1) 1SI8802A
2) 1SI8801B	2) 1SI8802B
3) 1SI8801C	3) 1SI8802C

There is one-to-one correspondence here; in this case, if none of the valves on the AER side could be opened, then the operator would go to "a." on the RNO side. If any one of the valves on the AER could not be opened, e.g.: 1SI8801B, then the operator would open its counterpart on the RNO side, i.e., 1SI8802B, and then continue with the AER side.

The following are modifications to this:

1) If there is any RNO information corresponding directly to the high-level step, it shall be in Courier type vice Narrator, and it shall not be numbered; e.g.:

5 START AN RCP	Go to Step 8.

2) There shall be no one-to-one correspondence between individual bulleted items/actions on the AER side and individual bulleted items/actions on the RNO side; e.g.:

a. Open the following valves:	a. Open the following valves:
• 1SI8801A	• 1SI8802A
• 1SI8801B	• 1SI8802B
• 1SI8801C	• 1SI8802C

Since the solid bullets imply that all of the valves must be opened, but in an order determined by the operator as a function of plant conditions, an unambiguous one-to-one correspondence would be difficult for the writer to prescribe.

Another way of looking at this is as follows: the AER side is taken to mean that the 1SI8801 set of three valves needs to be opened to fulfill the intent of the procedure. If the set can not be opened, meaning that even if only one valve cannot be opened, then the 1SI8802 set must be opened because the 1SI8801 set can not do the required job.

3) If the AER contains a list of items/actions which must all be carried out in a particular order to achieve the desired results (hence no substitution of a specific item/action from the RNO side is allowed), then there is no one-to-one correspondence between the AER and RNO items/actions, and the RNO material must be used if any one or more of the AER items/actions cannot be implemented. Normally the RNO items/actions would be done in a particular order. This idea is illustrated by the notation given in the example which follows. Take special note of the use of numbers for the AER list and letters for the RNO list.

a. Open the following valves:	a. Open the following valves:
1) 1SI8801A	a) 1SI8802A
2) 1SI8801B	b) 1SI8802B
3) 1SI8801C	c) 1SI8802C

In this example, the 1SI8801 valves must be operated in the order given. If 1SI8801B could not be opened, the operator does not go to 1SI8802B. Instead, he leaves the AER side and performs all of the RNO side substep "a."

4) Consider this example:

a. Open the following valves:	a. Open the following valves:
• 1SI8801A	1) 1SI8802A
• 1SI8801B	2) 1SI8802B
• 1SI8801C	3) 1SI8802C

There is no one-to-one correspondence here; regardless of order; if any of the 1SI8801 valves can not be opened, then the operator must go to the RNO side and open all the valves in the order given.

5) Consider this example:

a. Open the following valves:	a. Open the following valves:
1) 1SI8801A	• 1SI8802A
2) 1SI8801B	• 1SI8802B
3) 1SI8801C	• 1SI8802C

There is no one-to-one correspondence here; if any one or all of the 1SI8801 valves cannot be opened, then the operator must go to the RNO side and open all the valves in the order prescribed by plant conditions.

c. Unlike the AER side, RNO instructions are to be written in sentence format in the BwEOPs; the diagnostic instruction format may, however, be used in the BwOA procedures.

F. CONDITIONAL ACTION STATEMENTS

The two-column format usage for BwEOPs and BwOA procedures equates to the following logic: "IF the expected response or action in the AER column is NOT obtained, THEN perform the contingency action given in the RNO column." The logic terms and the conditional action statement formats given below should normally not be used for the first response given to a situation in the RNO column; they should be used for subsequent contingency actions for the same problem; e.g., the following is not preferable:

a. Start RCP A.	a. IF RCP A can NOT be started, THEN start RCP B. IF RCP B can NOT be started, THEN start RCP C.

Whereas the following <u>is</u> preferable:

a. Start RCP A.	a. Start RCP B. <u>IF</u> RCP B can <u>NOT</u> be started, <u>THEN</u> start RCP C.

Conditional action statements of the format given below should be used only in the RNO column of the BwEOPs; the format may be used for both columns in BwOA procedures.

1. Logic Terms

The terms <u>AND</u>, <u>OR</u>, <u>IF</u> <u>IF NOT</u>, <u>NOT</u>, <u>THEN</u>, and <u>WHEN</u> should be used to logically construct conditional statements and to express complex combinations of conditions and actions. These logic terms must be written into the procedure in a manner that will clearly identify the conditions that must be satisfied prior to taking the required action. It is important that these statements use the principles and techniques of formal logic so that they are correct, unambiguous, and complete.

2. Conjunctive Uses of "And," "Or," "Then"

a. When used to connect words or short phrases <u>in a sentence</u>, the words "and" and "or" shall not be emphasized by being in all caps and underlined, e.g.:

1) Read and record temperatures.

2) Place controller in auto or manual to maintain temperature.

b. When presenting paragraphs, substeps, or equipment whose use is mandatory but which can be applied in any order by the operator, it is sufficient to list these items using closed bullets. It is permissible however, for the sake of emphasis, to connect no more than three items with "-AND-" between them in all Courier caps, hyphenated as shown and centered with respect to the longest item, e.g.:

• Control charging and letdown.

-AND-

• Continue cooldown to shrink RCS inventory.

c. When presenting paragraphs, substeps or equipment whose use is determined by plant conditions but which can be applied in any order by the operator, it is sufficient to list these items using open bullets. It is permissible, however, for the sake of emphasis, to connect no more than three items with "-OR-" between them in all Courier caps, hyphenated as shown and centered with respect to the longest item, e.g.:

o Use normal spray

-OR-

o Use auxiliary spray

d. The word "then" should not be used as a conjunction at the end of one action to instruct the operator to perform the next action; e.g.:

2) Verify all SI accumulators isolated, then continue cooldown.

3. Structure and Use of Conditional Action Statements

a. Conditional action statements have two parts, the <u>conditional statement</u> and the <u>action statement</u>.

The conditional statement contains certain criteria which, if met, allow or require execution of the action statement wherein it is given how to operate particular equipment, what other procedures should be used, or how to ameliorate any adverse situations specifically referred to in the conditional statement.

b. Logic terms and sequences shall be emphasized so that operators can clearly identify all conditions and actions given in a conditional action statement.

c. Conditional statements shall begin with the words <u>IF</u>, <u>IF NOT</u>, or <u>WHEN</u>, followed by a description of the condition. The action statement which follows shall begin with <u>THEN</u>.

d. The logic terms <u>IF</u>, <u>IF NOT</u>, <u>WHEN</u>, <u>THEN</u>, <u>OR</u>, <u>AND</u> shall be left-justified, i.e., the information they introduce shall begin on a new line with the logic term as the first word of that line; e.g., a conditional action statement would be written as:

<u>WHEN</u> PZR level reaches 66%
<u>THEN</u> stop charging pump

rather than:

WHEN PZR level reaches 66%, THEN stop charging pump

(an exception to this left-justified placement of THEN is given in VI.F.3.e below)

e. The use of IF NOT should be limited to those cases where the operator might have to respond to the second of two possible conditional action statements; in this case the first conditional action statement which would be considered begins with IF. In addition, when using an IF NOT conditional statement, the THEN heading the action need not be left-justified. All of this is shown in this example:

IF pressure is increasing.
THEN stop the charging pump.

IF NOT, THEN start an additional pump.

The writer is not bound to use IF NOT. He may instead expand the statement if using it might cause confusion:

IF pressure NOT increasing.
THEN start an additional charging pump.

f. The word AND should not be used to join more than two conditions, e.g.:

IF pressure is increasing,
AND spray valves are operable,
THEN lower pressure using spray.

When more than two conditions are required, they shall be listed and normally flagged with closed bullets, e.g.:

IF all of the following conditions are met:

- RCS pressure above 2000 PSIG,
- PZR level above 17%,
- CNMT pressure 5 PSIG,
- RCS temperature below 585°F,

THEN reset SI.

If the conditions must be met or monitored in a particular order, they may be lettered or numbered.

g. The word OR should not be used to join more than two conditions, e.g.:

IF RCS pressure is increasing,
OR PZR level is decreasing,
THEN go to Step 12.

When more than two conditions are applicable, but not all are required to perform the action statement's instruction, they shall be listed and normally flagged with open bullets, e.g.:

IF one or more of the following conditions is met:

- o RCS pressure above 2200 PSIG,
- o PZR level above 92%,
- o CNMT pressure 5 PSIG,
- o RCS temperature above 590°F,

THEN DO NOT reset SI.

If the conditions must be monitored in a particular order, they may be lettered or numbered.

G. CAUTIONS AND NOTES

1. Cautions

a. Cautions shall be used to alert operators to conditions that could result in health hazards, equipment damage, or plant damage. The critical information needed to identify these potential problems can include:

1) Specific nature of the problem.
2) Location of the problem.
3) Time considerations if applicable.
4) Consequences of not heeding the caution, if not obvious.

b. Mechanics

1) The caution statement shall be identified with the heading CAUTION in all caps and underlined.

2) The caution statement text shall be in all caps.

3) The entire statement shall be centered on the page and boxed with asterisks (see VII.D for spacing details).

4) Short, concise sentences should be used.

5) A Caution is to be placed immediately before the step to which it applies, and it should be on the same page as that step.

6) If two or more cautions apply to the same step, they shall be separately boxed.

7) Cautions shall not direct actions.

8) Cautions may use a conditional action statement format, but the logic words should not be underlined.

9) Cautions shall always precede notes before the step to which they apply.

2. Notes

a. Notes shall be used to provide important supplemental information to the operator which if included in the step text might lose its impact or clutter the step text.

b. Mechanics

1) The note statement shall be identified with the heading NOTE in all caps and underlined.

2) The note statement text shall be in normal type.

3) The entire statement shall be centered on the page and boxed with asterisks (see VII.D for spacing details).

4) Short, concise sentences should be used.

5) Present information to the operator in the order in which it is needed. If the information in the note is intended to aid in the performance of a step, place the note immediately before the step and on the same page as the one on which the step begins. If it pertains to the results of a step, place it after that step and on the same page as the one on which the step ends.

6) If two or more notes apply to the same step they should be separately boxed.

7) Notes shall not direct actions.

8) Notes may use a conditional action statement format, but the logic terms should not be in all caps and underlined.

H. TRANSITIONS TO OTHER PROCEDURES OR STEPS

While using a given procedure, certain conditions might occur which would require the use of a different procedure or step sequence. These transitions are of two distinct types: referencing and branching.

1. Referencing

   a. Referencing implies that the cited procedure will be used as a supplement to, and that it will be performed concurrently with the one in effect.

   b. When it is necessary to reference another procedure, the word "per" shall be used, e.g.:

      IF letdown is NOT in service,
      THEN establish letdown per BwOP CV-35,
      ESTABLISHING CV LETDOWN.

      When only a particular part of a procedure is to be used, then the number and title of the applicable section shall be included, e.g.:

      Manually establish seal injection per BwOP CV-02, ESTABLISHING REACTOR COOLANT PUMP SEAL INJECTION AND CHARGING PUMP OPERATION, Step F.2, establishing seal injection.

2. Branching

   a. Branching implies that the procedure in use shall be exited and the procedure cited shall be entered.

   b. When it is necessary to branch to another procedure, the term "go to" shall be used, e.g.:

      Go to 1BwEP ES-0.2, NATURAL CIRCULATION COOLDOWN, Step 1.

   c. Branching normally should not have a return feature, e.g.:

      Go to BwOP CV-35, ESTABLISHING CV LETDOWN, perform Steps 3 through 10, and return to Step 5 of this procedure.

      This method should be used only when absolutely necessary in the BwOA procedures. The WOG ERGs have no provision for it and this should be adhered to in the BwEOPs. Once the operator has branched to a BwEOP, he is under the provisions of the new procedure and branches according to its instructions.

3. General Considerations

   a. If the information can be included in the steps of the procedure without appreciably increasing its length, referencing and branching to the other procedure(s) which contain the needed information should be avoided.

   b. If the information is brief enough but is needed several times in the same procedure, placing the material in an attachment should be considered.

I. COMPONENT IDENTIFICATION

Nomenclature that will assist the operator in accurately and quickly identifying equipment, controls, and displays should be used. Several methods to accomplish this are available and it is up to the discretion of the writer to choose the method which best fits the situation. To make instructions as specific as possible without restricting the operator, a combination of these methods may be appropriate.

1. Verbatim Nameplate Identification

   Used when the operator should have no option but to use the equipment, control, or display identified. This is the most restrictive method and it could be confusing if the item has a long abbreviation and/or alphanumeric, e.g.: Start CNDR VCM PP 1CAD1CA.

2. Word Paraphrasing

   Uses key identifying words to eliminate the potential confusion of the verbatim method. This method can be used to allow operator flexibility in choosing among alternate equipment by deleting the complex alphanumeric designator, e.g.: Start Condenser Vacuum Pump A.

3. Common Usage

   Although this method of identifying equipment can be the most concise and recognizable, the use of this method should not hinder formality, e.g.: Start Connie A (no operator flexibility); Start one Connie pump (with operator flexibility).

4. Identification by Location

   Because some procedures may involve relatively unfamiliar or infrequently performed tasks, the search for valves, switches, instruments, or other items referred to in the procedure might be time consuming. The procedure writer should include location information in such cases.

J. METHODS OF EMPHASIS

Key instructions can be enhanced if certain types of words, phrases, or nomenclature are consistently emphasized. Capitalization, underlining, special indenting and spacing, and infrequently used characters (e.g.: asterisks) are methods which can be used. Excessive use of these methods should be avoided to prevent loss of effectiveness. Whether Narrator or Courier type is used depends on the location of the material.

1. Generally the following terminology applies:

    a. "Capitalize" means capitalize only the first letter of a word in upper case.

    b. Placing in "all caps" means capitalizing the entire word.

    c. "Underline" means to underscore an entire word or phrase with a horizontal line.

2. The following items are to be capitalized:

    a. Organizations, institutions, companies, and associations, e.g.: Commonwealth Edison.

    b. Titles of works and publications, e.g.: Final Safety and Analysis Report.

    c. Titles of staff positions and personal titles, e.g.: Plant Manager.

3. The following items are to be in all caps:

    a. Abbreviated titles of plant systems, e.g.: SI, RH.

    b. System component and device identifiers, e.g.: 1AF013A, 1RY-455B.

    c. Verbatim equipment nameplates, e.g.: ROD BANK SELECTOR.

    d. Engraved switch positions, e.g.: Place ROD BANK SELECTOR in MANUAL.

    e. Verbatim annunciator light wording, e.g.: ROD CONTROL URGENT FAILURE ALARM.

    f. Procedure titles, e.g.: REACTOR TRIP OR SAFETY INJECTION.

    g. Undesirable actions or conditions, e.g.: DO NOT reset SI (the entire phrase may also be in all caps if desired).

4. The following items are to be in all caps and underlined:

   a. Logic words, e.g.: IF, THEN, NOT, AND.

   b. CAUTION and NOTE headings.

   c. The expected response from a diagnostic instruction, e.g.: Check RCS pressure - LESS THAN 2000 PSIG.

   d. High-level steps, e.g.: 4. START AN RCP.

   e. PURPOSE and SYMPTOM OR ENTRY CONDITION headings.

   f. Parameter values appearing in the text, e.g.: RCS pressure should be trending to 400 PSIG prior to lining up the RH system.

VII. <u>TYPING AND DRAFTING FORMAT</u>

A. GENERAL CONSIDERATIONS

1. The forms shown in Figures 1, 3, and 7 should be used.

2. Two type elements are needed:

   a. Narrator (pitch 10)

   b. Courier (pitch 10)

3. With the exception of spelling, do not edit the procedure without the writer's/editor's approval.

4. Typed procedures should be returned to the writer for proofing.

5. Pagination shall use the "Page ___ of ___" format, horizontally centered from the bottom of the page, and below the lower border of each page of the procedure.

B. COVER SHEET (Figures 1 and 2)

1. The two small blocks in the heading are for procedure alphanumeric designator, and rev./issue. The large block is for titling.

2. In the main title block, on separate lines double-spaced from each other, shall be typed in all Narrator caps the unit number, and procedure title. (If the title requires more than one line, the title lines shall be single-spaced from each other.) This material overall should be vertically centered in the block. Each line should also be horizontally centered in the block.

   The number of the line on which this material will start depends on the number of lines that will be required to type and center both items.

3. The procedure's alphanumeric designator shall be vertically and horizontally centered in the heading's left box, in Narrator type with the letters in all caps.

4. The revision designator for BwOA procedures should be vertically and horizontally centered in the heading's right box, in Narrator type with the letters in all caps.

   The BwEOP's WOG rev./issue designator should be horizontally centered in Narrator type, with the letters in all caps, and in the heading's right box. The local rev./issue designator, also in Narrator type with the letters in all caps, shall be single-spaced below and left-justified to the WOG designator. The two lines as a unit should be vertically centered.

5. On line ten from the top of the page shall appear the Purpose section heading in all Narrator caps; the letter "A" shall be in space three and <u>PURPOSE</u> shall start in space seven.

   Double-spaced from the heading and left-justified under the "P" of <u>PURPOSE</u> shall be the single-spaced text in Courier type.

6. Double-spaced from the last line of the Purpose text shall be the Symptoms OR Entry Conditions section heading. The heading and the text of this section is typed and spaced exactly as is the Purpose section.

7. If more space is required, the overflow may be continued on a sheet such as shown in Figure 6 with heading as described in VII.C.1.2.3.

8. If it is not possible to exactly center a line or group of lines exactly horizontally or vertically because of a word processing computer or pre-printed format restriction, the centering should be as close as possible within these restraints.

C. INSTRUCTION PAGES (Figures 3 and 4)

1. If the procedure's alphanumeric designator requires only one line, e.g., 1BwEP-0, 1BwCA-2.1, it should be vertically and horizontally centered in Narrator type, with the letters in all caps, and in the heading's left box.

If the procedure's alphanumeric designator requires two lines, (i.e., the BwEP ES subprocedure, e.g., 1BwEP ES-0.3, 1BwEP ES-1.1, and the BwOA procedures, e.g., 1BwOA PRI-5, 1BwOA ELEC-1), the 1BwEP and 1BwOA (2 for Unit 2) designator should be vertically and horizontally centered in Narrator type, with the letters in all caps, and in the heading's left box. The rest of the designator shall be in the same type and case, and single-spaced below and left-justified to the first half of the designator.

2. The procedure title shall be in all Narrator caps, and vertically and horizontally centered in the central heading box.

3. The procedure's rev./issue designator shall be placed in the heading's right box and should be treated as given in VII.B.5.

4. High-level steps shall be in Narrator type, with the letters in all caps, and underlined. The step number shall be in space three, and the step text shall begin in space seven; as shown in Figure 4, the next level of indentation shall be in space 10, then 13, followed by space 16, and every third space thereafter as needed, except that excessive indenting shall be avoided. AER substeps shall be in Courier type.

5. All RNO material (even the line corresponding to the AER high-level) shall be in Courier type and indented as shown in Figure 4, beginning in space 45, then 48, followed by space 51, and every third space thereafter as needed, except that excessive indenting shall be avoided.

6. All instructional material shall begin on line ten from the top of the page.

7. The high-level portion of a step shall be double-spaced from the last line of the previous step; the following as a minimum shall be double-spaced from each other:

   a. High-level step/substep.

   b. Substep/substep.

   c. Substep/valve, switch, component listing (hereafter, listing).

   d. Any item/conjunctive or conjunctive/any item.

e. Conditional action statement/conditional action statement.

f. Substep/conditional action statement.

g. CAUTION or NOTE asterisk border/any item, including another NOTE or CAUTION.

8. Listings, conditional action statements, and the text of steps and substeps shall be single-spaced internally.

9. The phrase "Step continued on next page" shall be placed within the border of any page for which the step must be continued on the next page.

10. On the last instructional page (i.e., the last page containing procedure steps, and excluding figure, attachment, and table pages), the word "-END-" in all Courier caps and hyphenated as shown, shall be horizontally centered within the border, and vertically triple-spaced from the last line of the procedure text.

11. The provision for the relaxing of the centering requirements given in VII.B.9 apply here as well.

D. CAUTIONS AND NOTES

1. Cautions and notes shall be bordered on four sides by asterisks; the left vertical asterisk border shall be along space twenty (20) and the right vertical asterisk border shall be along space sixty (60).

2. The CAUTION/NOTE headings shall be in all Courier caps, underlined, single-spaced from the top asterisk border and horizontally centered in the box.

3. The caution/note text shall be single-spaced from the heading, and start at line ten (10); the entire text shall be left-justified to this space.

   The caution text shall be in all Courier caps, and the note text shall be typed as normal usage.

4. The lower asterisk border shall be single-spaced from the last line of the caution/note text.

5. There shall be only one caution/note in a given asterisk box.

6. The entire caution/note shall be placed on the same page as the step to which it applies (the writer shall make this clear). An exception to this will occur on the first page of many procedures where several cautions and notes are listed which may fill the entire page.

7. The entire caution/note shall be contained on one page; continuing the caution/note is not permitted.

8. The next item after the caution/note shall be double-spaced from the lower asterisk line.

E. FIGURES, TABLES, AND ATTACHMENTS

1. Figures (Figures 1 and 5)

   a. The heading of a figure shall be completed as given in VII.C.1.2.3. The specifications for an instruction page, with the exception that the lettering shall be hand drafted using standard mechanical lettering equipment.

   b. Scaling and titles for both ordinate and abscissa shall be hand drafted using standard mechanical lettering equipment.

   c. The alphanumeric and title of the figure shall be hand drafted and shall be at the bottom of the page, within the border, and centered horizontally. The alphanumeric, comprised of procedure alphanumeric and figure number shall be above the figure's title, e.g.:

      FIGURE 1BwFR P.2-1
      COOLDOWN LIMITS

   d. The figure may be labeled in hand draft using standard mechanical lettering equipment.

2. Tables

   a. Tables shall be word processed as given in VII.C.1.2.3.

b. The column headings shall be in all Courier caps and underlined. If a column heading requires more than one line, all the lines shall be centered with respect to each other; only the last line of the heading shall be underlined, and that line shall be as long as the longest line in that heading.

c. The first data entry in a column shall be double-spaced from the last line of the column heading.

d. Subsequent data entries shall be single-spaced.

e. Two or more columns of data whose entries have one-to-one correspondence shall have that matching preserved by underlining the applicable information.

3. Attachments

a. The heading of an attachment shall be word processed as given in VII.C.1.2.3.

b. The designator ATTACHMENT A, ATTACHMENT B, etc., shall be placed on line ten (10), in all Courier caps, underlined and horizontally centered.

c. The rest of the attachment shall be word processed in Courier type in a format specified by the writer.

F. FOLDOUT PAGES (Figure 6)

The word processing of foldout pages shall closely follow that of instruction pages.

1. The heading of a foldout page shall be completed as given in IV.E.5.

2. Since there are no other borders, the printed material may extend further down the page than would be possible on the instruction page. There should be at least one blank line between the last line of text and the pagination.

3. The foldout material shall begin on the line ten (10) from the top of the page.

4. The major paragraphs of a foldout page shall have an underlined title (equivalent to a high-level step) in Narrator type, with the letters in all caps. These titles shall be unnumbered and begin in space seven. Further indenting shall be done as described in VII.C.4 for AER substeps.

5. If there are more major paragraphs to the foldout than can fit on the equivalent of the AER side, they shall be placed on the equivalent of the RNO side, and shall be indented as described in VII.C.5 for RNO steps with the title starting in space 45.

6. Material below the title shall be in Courier type.

G. BRAIDWOOD STATUS TREES (Figures 7 and 8)

1. The BwST title and rev./issue designator shall be placed in the heading's main and right box, respectively, as given in VII.C.2 and VII.C.3, respectively, with the exception that the lettering shall be hand drafted using standard mechanical lettering equipment.

2. The BwST alphanumeric shall be of the form:

```
1 BwST      1 BwST      1 BwST
  1           3           5
```

It shall be placed in the heading's left box, vertically and horizontally centered.

3. The block and branch format shall be used, as well as the ERG black and white branch/endpoint design convention which allows the operator to distinguish red, orange, yellow and green paths when they are not presented in color.

4. The information in the blocks and at the endpoints shall be hand drafted using standard mechanical lettering equipment.

5. Pagination shall be of the "Page ___ of ___" format, centered and at the bottom of the page (exact position depends on vertical extent of the status tree).

VIII. PROVISIONS

A. IMPERATIVES

Throughout this procedure, two important words have been used: "should" and "shall."

"Should" implies that although the specification with which it is associated is highly desirable and strongly recommended, the writer is not bound to use it. He may substitute an alternate format or methodology, etc., if it will enhance plant safety. Use of a step deviation documentation form to record this is recommended.

"Shall" implies that the specification with which it is associated is to be used as directed by the writers guide. Nevertheless, even in this case, the writer has the responsibility to judiciously apply this precept. If, in his opinion, an alternate format or methodology must be used because it is better than the writers guide or use of the writers guide detracts from plant safety in the particular case under study, the writer may depart from the writers guide specification and write the part in a manner that enhances plant safety. In this case, the writer shall document that departure on a step deviation documentation form, just as he would were he writing a plant specific step which deviated from generic guidance.

B. SAFETY AND CONSISTENCY

Imperatives, allowances, exceptions, requirements, all notwithstanding, the primary goal is safe operation governed and directed by procedures which are internally consistent to the greatest extent possible without jeopardizing safety.

TABLE A

BwEOP NUMBERING AND LISTING

BRAIDWOOD DESIGNATOR	TITLE
1BwEP-0	Reactor Trip Or Safety Injection
1BwEP ES-0.0	Rediagnosis
1BwEP ES-0.1	Reactor Trip Response
1BwEP ES-0.2	Natural Circulation Cooldown
1BwEP ES-0.3	Natural Circulation Cooldown With Steam Void In Vessel (With RVLIS)
1BwEP ES-0.4	Natural Circulation Cooldown With Steam Void In Vessel (Without RVLIS)
1BwEP-1	Loss of Reactor Or Secondary Coolant
1BwEP ES-1.1	SI Termination
1BwEP ES-1.2	Post LOCA Cooldown And Depressurization
1BwEP ES-1.3	Transfer To Cold Leg Recirculation
1BwEP ES-1.4	Transfer To Hot Leg Recirculation
1BwEP-2	Faulted Steam Generator Isolation
1BwEP-3	Steam Generator Tube Rupture
1BwEP ES-3.1	Post SGTR Cooldown Using Backfull
1BwEP ES-3.2	Post SGTR Cooldown Using Blowdown
1BwEP ES-3.3	Post SGTR Cooldown Using Steam Dump
1BwCA-0.0	Loss Of All AC Power
1BwCA-0.1	Loss Of All AC Power Recovery Without SI Required
1BwCA-0.2	Loss Of All AC Power Recovery With SI Required
1BwCA-1.1	Loss of Emergency Coolant Recirculation
1BwCA-1.2	LOCA Outside Containment
1BwCA-2.1	Uncontrolled Depressurization Of All Steam Generators
1BwCA-3.1	SGTR With Loss Of Reactor Coolant - Subcooled Recovery Desired
1BwCA-3.2	SGTR With Loss Of Reactor Coolant - Saturated Recovery Desired
1BwCA-3.3	SGTR Without Pressurizer Pressure Control
1BwST-1	Subcriticality
1BwST-2	Core Cooling
1BwST-3	Integrity
1BwST-4	Heat Sink
1BwST-5	Containment
1BwST-6	Inventory

TABLE A (Continued)

BwEOP NUMBERING AND LISTING

BRAIDWOOD DESIGNATOR	TITLE
1BwFR-S.1	Response To Nuclear Power Generation/ATWS
1BwFR-S.2	Response To Loss Of Core Shutdown
1BwFR-C.1	Response To Inadequate Core Cooling
1BwFR-C.2	Response To Degraded Core Cooling
1BwFR-C.3	Response To Saturated Core Cooling
1BwFR-H.1	Response To Loss Of Secondary Heat Sink
1BwFR-H.2	Response To Steam Generator Overpressure
1BwFR-H.3	Response To Steam Generator High Level
1BwFR-H.4	Response To Loss of Normal Steam Release Capabilities
1BwFR-H.5	Response To Steam Generator Low Level
1BwFR-P.1	Response To Imminent Pressurized Thermal Shock Conditions
1BwFR-P.2	Response To Anticipated Pressurized Thermal Shock Conditions
1BwFR-Z.1	Response To High Containment Pressure
1BwFR-Z.2	Response To Containment Flooding
1BwFR-Z.3	Response To High Containment Radiation Level
1BwFR-I.1	Response To High Pressurizer Level
1BwFR-I.2	Response To Low Pressurizer Level
1BwFR-I.3	Response To Voids In Reactor Vessel

TABLE B

PROPOSED BwOA PROCEDURE NUMBERING AND LISTING

BRAIDWOOD DESIGNATOR	TITLE
1BwOA ELEC-1	Loss Of DC Bus, Unit 1
1BwOA ELEC-2	Loss Of Instrument Bus, Unit 1
1BwOA ELEC-3	Local Emergency Start of a Diesel Generator, Unit 1
1BwOA ELEC-4	Loss of Offsite Power, Unit 1 for Modes 3 or 4
1BwOA ELEC-5	Local Emergency Control of Safe Shutdown Equipment
0BwOA ENV-1	Operation During Tornado or Sustained Wind Conditions Unit 0, 1, 2
0BwOA ENV-2	Low Water Unit 0, 1, 2
1BwOA INST-1	Nuclear Instrumentation Malfunction, Unit 1
1BwOA INST-2	Operation With Failed Instrument Channel, Unit 1
1BwOA PRI-1	Excessive Primary Plant Leakage
1BwOA PRI-2	Emergency Boration, Unit 1
1BwOA PRI-3	Charging/Letdown Failure Line Break, Unit 1
1BwOA PRI-4	High Reactor Coolant Activity, Unit 1
1BwOA PRI-5	Control Room Inaccessibility, Unit 1
1BwOA PRI-6	Component Cooling Malfunction, Unit 1
1BwOA PRI-7	Essential Service Water Malfunction 0, 1, 2
0BwOA PRI-8	O_2/H_2 Explosive Mixture, Unit 0, 1, 2
0BwOA RAD-1	Process Monitor High Activity, Unit 0, 1, 2
0BwOA RAD-2	Area Monitor High Radiation, Unit 0, 1, 2
1BwOA RCP-1	Reactor Coolant Pump Seal Failure, Unit 1
1BwOA RCP-2	Loss of Seal Injection, Unit 1
0BwOA REFUEL 1	Fuel Handling Emergency, Unit 0, 1, 2
0BwOA REFUEL 2	Reactor Cavity Level Loss, Unit 0, 1, 2
0BwOA REFUEL 3	Spent Fuel Pool Level Loss, Unit 0
1BwOA REFUEL 4	Loss of RH During Refueling, Unit 1
1BwOA ROD 1	Uncontrolled Rod Motion, Unit 1
1BwOA ROD 2	Failure of Rods to Move, Unit 1
1BwOA ROD 3	Stuck or Misaligned Rod, Unit 1
1BwOA ROD 4	Dropped Rod Recovery, Unit 1
1BwOA SEC-1	Condensate/Feedwater Malfunction, Unit 1
1BwOA SEC-2	Steam Generator High Conductivity, Unit 1
1BwOA SEC-3	Loss of Condenser Vacuum, Unit 1
1BwOA SEC-4	Turbine High Vibration, Eccentricity or Differential Expansion

TABLE B (Continued)

PROPOSED BwOA PROCEDURE NUMBERING AND LISTING

BRAIDWOOD DESIGNATOR	TITLE
1BwOA SEC-5	TGTMS Trouble, Unit 1
1BwOA SEC-6	Loss of Stator Water Flow
1BwOA SEC-7	Stator Water High Conductivity, Unit 1
1BwOA SEC-8	Generator Condition Monitor Trouble, Unit 1
0BwOA SEC-9	SAC Startup During Abnormal Conditions, Units 0, 1, 2
0BwOA SEC-10	WS System Malfunction, Unit 0, 1, 2
1BwOA SEC-11	High Temperature in AF Nozzle Piping, Unit 1

FIGURE 1

FIGURE 2

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

FIGURE 3

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8	<u>CHECK RCS VENT PATHS</u>:	
	a. Power to PZR PORV isolation valves -<u>AVAILABLE</u>	a. Restore power to isolation valves: 1) Locally check the appropriate isolation valve breakers on the following MCCs: • MCC 131X2B A5 (1RY8000A) • MCC 132X2 C4 (1RY8000B) 2) Close any open PZR PORV isolation valve breaker.
	b. PZR PORVs - <u>CLOSED</u> • 1RY-455A • 1RY-456	b. Manually close PZR PORVs. <u>IF</u> any valve can <u>NOT</u> be closed, <u>THEN</u> manually close its isolation valve.
	c. Isolation valves - <u>AT LEAST ONE OPEN</u>: • 1RY8000A • 1RY8000B	c. Open isolation valve unless it was closed to isolate an open PZR PORV.
	d. RX head vent valves - <u>CLOSED</u>: • 1RC014A • 1RC014B • 1RC014C • 1RC014D	d. Close any open RCS vent path.

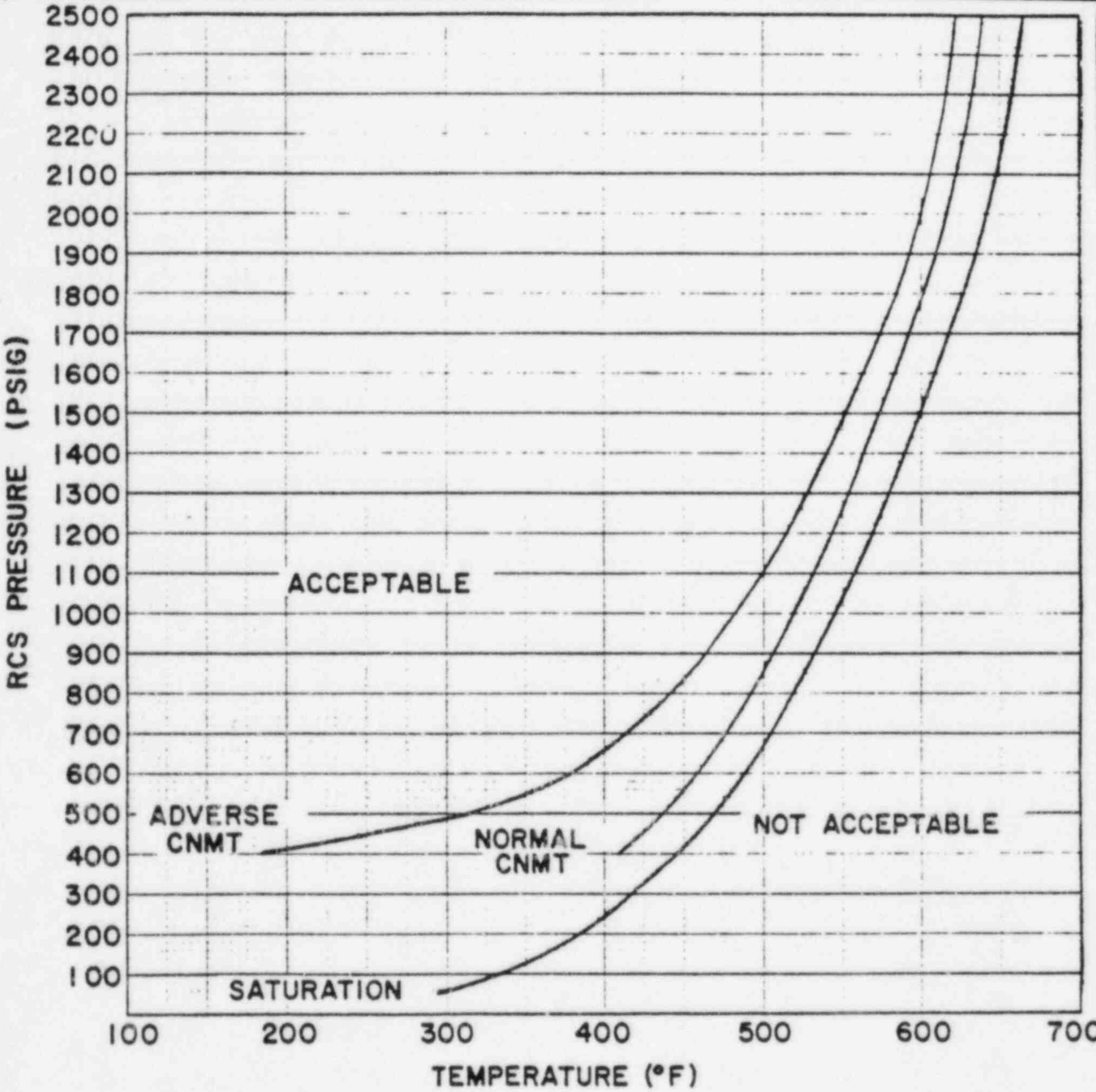

FIGURE 1BwEP ES0.1-1

RCS SUBCOOLING MARGIN

FIGURE 5

TRIP RCPs WHEN:

- o CC Water to RCP lost (affected pumps only)
- o CNMT phase B actuation
- o BOTH of the following conditions exist:
  - • RCS pressure - <1370 PSIG (1670 PSIG ADVERSE CNMT)

    -AND-

  - • CENT CHG pump(s) or SI pump(s) - POSITIVE FLOW

SI ACTUATION

Actuate SI and go to 1BwEP-0, REACTOR TRIP OR SAFETY INJECTION, Step 1, for

- • RCS subcooling - NOT ACCEPTABLE VALUE FROM ICONIC DISPLAY OR ATTACHMENT A STEP A.

  -OR-

- o PZR level - <4% (38% ADVERSE CNMT)

CST LEVEL <20%:

- o Crosstie unit CSTS
- o Makeup from MUDS radwaste
- o Reduce cooldown rate
- o Prepare to isolate 3 SG secondaries

CST LEVEL 3%:

1. Verify secondary side of 3 SGs isolated
2. Switch AF suction to SX

CENT CHG PUMP MINIFLOW VALVES:

Close 1CV8110, 1CV8111

- • RCS pressure <1370 PSIG (<1670 PSIG ADVERSE CNMT)

  -AND-

- • SI actuated

Open 1CV8110, 1CV8111

- • RCS pressure >2000 PSIG

RED PATH SUMMARY:

1. Subcriticality - NUCLEAR POWER >5%
2. Core cooling - CORE EXIT TCs >1200°F
3. Heat sink - ALL SGs <34% NR and TOTAL AF <500 GPM AVAILABLE
4. Integrity - DECREASE >100°F/60 MINUTES and RCS COLD LEG <246°F
5. Containment - CNMT PRESSURE >50 PSIG

FIGURE 6

FIGURE 7

1 BwST 1	SUBCRITICALITY	REV. 1 WOG-1

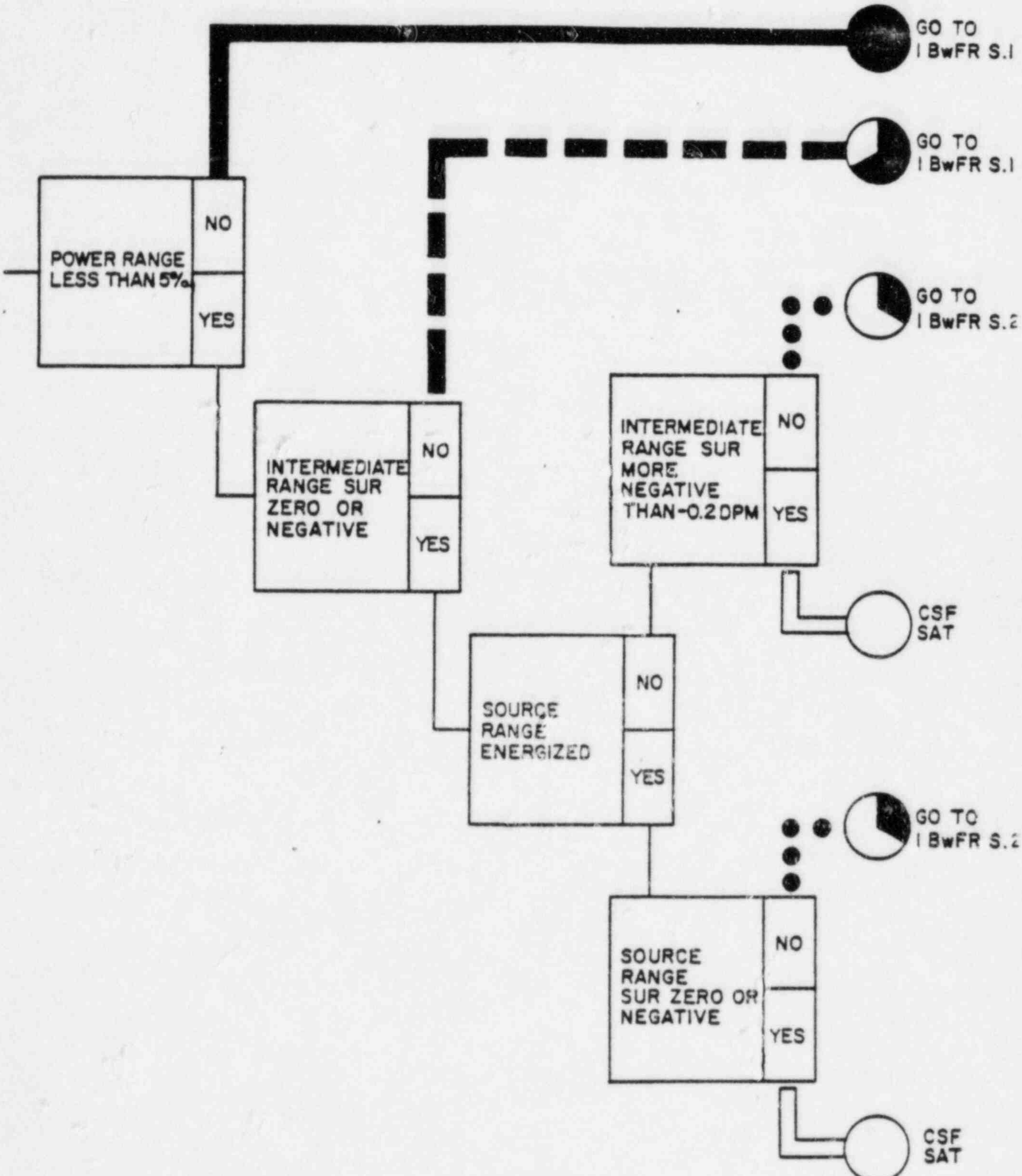

FIGURE 8

(0680M)

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
SECTION IV
EOP VERIFICATION PROGRAM

March 5, 1985

BRAIDWOOD STATION

EMERGENCY OPERATING PROCEDURE VERIFICATION PROGRAM

1.0 PURPOSE

The purpose of this program is to define the administrative process to be used in the verification of the Braidwood Emergency Operating Procedure (EOPs) and to assign responsibilities for carrying out the activities of the process.

Verification is the evaluation performed to confirm the written correctness of the EOPs, and to ensure that the generic and/or Braidwood plant-specific technical aspects have been properly incorporated.

2.0 REFERENCES

2.1 Component Verification and System Validation Guideline - by NUTAC (INPO 83-047)

2.2 Emergency Operating Procedures Verification Guideline - by EOPIA (INPO 83-004)

2.3 Guidelines for the Preparation of Emergency Procedures - NUREG 0899

2.4 Braidwood Abnormal and Emergency Operating Procedure Writers Guide

3.0 EOP SOURCE DOCUMENTS

The EOP source documents are the documents or records upon which the EOPs are based. The EOP source documents include:

Braidwood Station Abnormal and Emergency Operating Procedure Writers Guide
WOG ERG (Revision 1) and background documents
Braidwood Station Electrical Drawings
Braidwood Station Piping and Instrumentation Drawings
Licensing Commitments relating to EOPs
Braidwood FSAR
Westinghouse Bulletins and Memos (as appropriate)
Plant System Descriptions
Braidwood Station Plant Description (Attachment A)
Braidwood Station Instrumentation Description (Attachment B)
Braidwood Administrative Procedure
Braidwood Operating Procedure
Braidwood General Operating Procedures
Vendor Technical Manuals (as appropriate)
Braidwood Abnormal Operating Procedures
Braidwood Technical Specifications
Byron Emergency Operating Procedures, Rev. 0
Braidwood Step Deviation Documents
Byron/Braidwood Precautions, Limitations and Setpoint Document

4.0 OBJECTIVES

The verification program objective is to ensure that the Emergency Operating Procedures are consistent with the EOP source documents. this objective will be met by evaluating the EOPs in two phases:

- o Written Correctness - to insure the EOPs conform to the format and other principles as specified in the Writers Guide.

- o Technical Accuracy - to ensure the EOPs are consistent with the generic and/or Braidwood plant-specific technical information from the EOP source documents and with plant hardware.

5.0 APPLICABILITY

This verification program applies to the initial implementation of the EOPs (based on the WOG ERGs) and to subsequent permanent revisions to the EOPs for the Braidwood Unit 1 plant.

Verification must be completed prior to final approval of all EOPs and prior to final approval of subsequent permanent revisions to upgraded EOPs.

Verification will also interact with initial licensed operator training on the EOPs and with annual licensed operator retraining. Operator feedback obtained from classroom or simulator retraining classes will be evaluated with regard to its affect on the EOPs and appropriate changes made. Operator feedback may be related to 1) training, 2) procedures, 3) the plant, or 4) the operator himself; and to the interfaces between these four elements. A Verification Discrepancy Sheet, Attachment C, will be used to document potential problems with the EOPs and provide resolutions to these potential problems.

6.0 RESPONSIBILITIES

6.1 The Assistant Superintendent Operations or designee:

A. Shall have overall responsibility for both phases of the verification process.

B. Shall designate personnel as required to perform the verification process. The verifier shall be familiar with the Writers Guide, the Braidwood Control Room, plant hardware, operations, operator knowledge level, and have an understanding of the EOPs and their technical requirements. The verifier shall be a person other than the procedure writer.

C. Shall resolve discrepancies identified during the verification process.

7.0 WRITTEN CORRECTNESS VERIFICATION PROCESS

7.1 Overall Procedure Specific Review

The verifier will make a general review of the Emergency Operating Procedure and document his review by initialing the Procedure - General portion of the evaluation criteria (Attachment A, Section I). If a criteria is not met, the verifier will record his comments on a Verification Discrepancy Sheet (Attachment C).

7.2 Step-by-Step Review

After a general review has been made, the verifier will then make a step-by-step review of the Emergency Operation Procedure (or of the applicable changes if it is a procedure revision) using the evaluation criteria of Attachment A, Section II. This review will be documented step-by-step on Attachment D. For the EOP as a whole (or of the applicable changes as a whole if it is a procedure revision), the review will be documented by initialing the Step - Specific portion of the evaluation criteria (Attachment A, Section II). If a criteria is not met, the verifier will record his comments on a Verification Discrepancy Sheet (Attachment C).

8.0 TECHNICAL ACCURACY VERIFICATION PROCESS

The verifier will make a step-by-step review of the Emergency Operating Procedure (or of the applicable changes if it is a procedure revision) using the evaluation criteria of Attachment B. This review will be documented step-by-step on Attachment D. For the EOP as a whole (or of the applicable changes as a whole if it is a procedure revision), the review will be documented by initialing by the evaluation criteria in Attachment B. If a criteria is not met, he will record his comments on a Verification Discrepancy Sheet (Attachment C).

9.0 RESOLUTION OF DISCREPANCIES

Discrepancies are to be documented on Verification Discrepancy Sheets (Attachment C). The verifier will forward the reviewed procedure, with Attachments A, B, C and D to the Assistant Superintendent Operations or designee for resolution if a discrepancy is identified. The Assistant Superintendent Operations will obtain assistance as necessary to develop a resolution to resolve the discrepancy. The resolution will be documented on Attachment C.

The solution to some discrepancies may involve correcting the procedure. while others may be addressed by increasing the level of operator training. No actions may be necessary for some discrepancies. Resolutions for discrepancies shall be approved by the Assistant Superintendent Operations or designee. These approvals are to be documented on Attachment C. Incorporation of the resolution into the EOPs will also be documented on Attachment C.

10.0 DOCUMENTATION

The completed Written Accuracy Evaluation Criteria Checklist (Attachment A) and the Technical Accuracy Evaluation Criteria Checklist (Attachment B) are to be approved by the Assistant Superintendent Operations or designee. Attachment A, B, C (if applicable), and D shall accompany the procedure (or procedure change) for final approval and be retained with the procedure (or procedure change) in the Central File System.

ATTACHMENT A

WRITTEN CORRECTNESS EVALUATION CRITERIA CHECKLIST

EOP TITLE ______________________________

EOP NUMBER ______________________ REVISION ________

PERFORMED BY ______________________ DATE ________

APPROVED BY ______________________ DATE ________

I. Procedure - General

A. Format and Style

_____ 1. Printed borders are visible on all procedure pages.

_____ 2. The text, tables, figures and graphs are legible.

_____ 3. The general format of the procedure is consistent with the Braidwood Emergency Procedure Writers Guide (i.e., dual column format, page layout and required sections are present per Writers Guide).

_____ 4. Procedure contains all its pages in the correct order with correct procedure number, titles and page numbers on each page.

_____ 5. "Step continued on next page", typed at the bottom of each page where required.

_____ 6. The last page clearly identified by the word -END-.

_____ 7. Each page contains the correct revision number.

_____ 8. Attachments are labeled with number and title.

_____ 9. The title is descriptive of the purpose of the procedure.

II Step - Specific

A. Format and Style

_____ 1. Steps are numbered correctly.

_____ 2. Nonsequential substeps are designated with bullets.

_____ 3. Steps deal with only one idea.

_____ 4. Steps are short with ambiguous words and phrases avoided.

_____ 5. The tests stipulates precisely what actions or decisions are required.

_____ 6. If there are more than two actions or objects in a step, they are listed separately.

_____ 7. Punctuation conforms with standard American English usage.

_____ 8. Capitalization conforms with standard American English or with specifications for emphasis in Writers Guide.

_____ 9. Only abbreviations, acronyms and symbols appearing in the Writers Guide and Braidwood Administrative Procedure, Conventions, Definitions and Approved Station Abbreviations (BwAP 1300-2A2) should be used.

_____ 10. Instruction steps make proper use of logic structure.

_____ 11. CAUTION statements are emphasized to standout from the text and precede NOTE statements for the same step.

_____ 12. CAUTION and NOTE statements avoid action steps.

_____ 13. CAUTION and NOTE statements (where required) precede the applicable step(s).

_____ 14. Formulas and calculations are minimized. Where calculations are necessary, space is provided.

_____ 15. Referenced procedures are identified by both title and number.

_____ 16. The use of referencing other procedures is minimized and is used only to eliminate excessive detail.

_____ 17. The instructions "refer to" and "go to" other procedures are used correctly and avoid routing user past important information such as cautions preceding steps.

_____ 18. Exit conditions are compatible with the entry conditions of the referenced procedure.

19. When an action instruction is based on receipt of an annunciator alarm, the alarm setpoint is identified.

B. Control Board Compatibility

_____ 1. Equipment or instrumentation referenced is available and located where specified.

_____ 2. Equipment or instrumentation nomenclature either matches control room or local labeling or is consistent with normal operator terminology.

_____ 3. Unit of measure used in the procedure are the same as those used on control board indicators.

_____ 4. Where sequence of order is not specified or required, equipment is listed in a left to right, top to bottom order.

ATTACHMENT B

TECHNICAL ACCURACY EVALUATION CRITERIA CHECKLIST

EOP TITLE ____

EOP NUMBER ______________________________ REVISION ________

PERFORMED BY ______________________________ DATE ________

APPROVED BY ______________________________ DATE ________

A. Entry Conditions and Symptoms

_____ 1. The entry conditions of the EOP are listed correctly.

_____ 2. The list of symptoms for entry into the EOP is correct.

_____ 3. The list of symptoms is not excessive.

B. Steps, Cautions and Notes

_____ 1. EOP/ERG discrepancies are documented and explained.

_____ 2. The EOP step/cautions/note is technically correct.

_____ 3. The ERG technical foundation (strategy) is not changed by the following changes in the development of the EOP.

a). elimination

b). addition

_____ 4. Correct Braidwood plant-specific information is incorporated into the EOP's (per the ERGs) for:

a). systems

b). instrumentation

c). limits

d). controls

e). indications

_____ 5. Licensing commitments applicable to EOPs are addressed.

_____ 6. Differences between licensing commitments and the EOPs or ERGs are documented.

C. Quantitative Information

_____ 1. The quantitative values, including tolerance bands, used in the EOPs are consistent with the ERGs and licensing commitments.

_____ 2. Where ERG values are not used in the EOPs, the EOP values are computed correctly.

_____ 3. When calculations are required by the EOPs, the equations used supply sufficient information for operator use.

D. Plant Hardware

_____ 1. The following plant hardware specified in the EOP is available for use:

a). equipment

b). instrumentation

c). controls

d). indicators

This requirement will be met by performing a plant/control room walk-through as appropriate.

ATTACHMENT C

VERIFICATION DISCREPANCY SHEET

VERIFICATION DISCREPANCY SHEET NUMBER ____________________

EOP ______________________________ REV __________ STEP NUMBER __________

DISCREPANCY: ____

____

____

____

____

____

EVALUATOR: ____________________________________ DATE: ______________________

RESOLUTION: ____

____

____

____

____

APPROVED BY: ____ DATE: _______________
ASSISTANT SUPT. OPERATIONS

RESOLUTION INCORPORATED BY: ___________________________ DATE: _____________

ATTACHMENT D

VERIFICATION STEP CHECKSHEET

EOP VERIFICATION

Verifier (Written Correctness): ______________________ EOP ________ REV____

Verifier (Technical Accuracy): ________________________ Page ____ of ____

STEP, CAUTION, NOTE-SPECIFIC VERIFICATION

STEP NUMBER, CAUTION OR NOTE	WRITTEN CORRECTNESS		TECHNICAL ACCURACY	
	ACCEPTABLE	DISCREPANCY SHEET #	ACCEPTABLE	DISCREPANCY SHEET #

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
SECTION V
EOP VALIDATION PROGRAM

March 5, 1985

0138E(030585)
A

BRAIDWOOD STATION

Emergency Operating Procedure Validation Program

1. Purpose

The purpose of this program is to define the administrative process to be used in the validation of Emergency Operating Procedures (EOPs) and to assign responsibilities for carrying out the activities of the process.

EOP validation is the evaluation performed to determine that the actions specified in the EOPs can be followed by trained operators to effectively manage emergency conditions in the plant.

This program is an amplification of the Westinghouse Owners Group (WOG) Emergency Response Guidelines Validation Program (WCAP 10599) and will reference these results as applicable.

This program will apply to both the initial Braidwood validation process as well as to an ongoing validation process for significant EOP revisions.

2. References

2.1 Emergency Operating Procedures Validation Guidelines - by EOPIA. (INPO 83-006).

2.2 Guidelines for the Preparation of Emergency Operating Procedures, NUREG 0899.

3. Objectives

The validation program objective is to ensure that the Emergency Operating Procedures are effective in mitigating transients and accidents in the plant when used by control room operators. This objective will be met by evaluating the EOPs in two phases.

- o Usability - to ensure the EOPs provide sufficient information that is understandable to the operator to effectively manage emergency conditions in the plant.

- o Operational Correctness - to ensure the EOPs are compatible with plant responses, plant hardware and shift manpower to effectively manage emergency conditions in the plant.

4. Applicability

This program applies to initial implementation of the EOPs (based on the Westinghouse Emergency Response Guidelines) and to subsequent significant permanent revisions to the upgraded EOPs for Braidwood Station Unit 1.

Validation must be completed prior to final approval of all initial EOPs and prior to final approval of subsequent significant revision to the upgraded EOPs.

Validation will also interact with initial operator training on the EOPs and with annual licensed operator retraining. Operator feedback obtained from classroom or simulator retraining classes will be evaluated with regard to its effect on the EOPs and appropriate changes made. Operator feedback may be related to 1) training, 2) procedures, 3) the plant, or 4) the operator himself; and to the interfaces between these four elements. A Validation Discrepancy Sheet, Attachment E, will be used to document potential problems with the EOPs and provide resolutions to these potential problems.

5. <u>Responsibilities</u>

The Assistant Superintendent Operations or designees:

A. Shall have overall responsibility for both phases of the validation process.

B. Shall determine if validation is needed and its scope. Validation for procedure revisions will only be required for significant revisions that consist of major changes which affect the usability or operational correctness.

C. Shall select the validation method(s) to be used.

D. Shall designate personnel as required to participate in the validation process.

E. Shall resolve discrepancies identified during the validation process.

6. <u>Validation Methods</u>

Four different validation methods will be available for use to ensure the validation objectives are met for an EOP. The appropriate method to be used will be determined by the Assistant Superintendent Operations or designee based on which method most effectively and efficiently meets the validation needs.

- o Table Top Validation - Method of validation whereby personnel explain and/or discuss procedure steps for an observer/reviewer in response to a scenario or as part of an actual event that occurred at Braidwood Station or at another nuclear station.

- o Simulator Validation - Method of validation whereby control room operators perform actual control functions on the Braidwood simulator during a scenario for an observer/reviewer team.

- o Walk-Through Validation-Method of validation whereby control room operator(s) conduct a step by step enactment of their actions during a scenario for an observer/reviewer team without carrying out the actual control function.

- o Reference Validation - Method of validation whereby data developed in a common EOP validation program is referenced for Braidwood Station. For the initial EOPs, the common validation program would be the Westinghouse Emergency Response Guideline (ERG) Validation Program for Revision 1 of the ERGs (WCAP 10599).

Specific guidance for implementing each method is given in Attachments A, B, C and D.

7. Resolution of Discrepancies

Discrepancies found during any of the validation methods for an EOP are to be documented on Validation Discrepancy Sheets (Attachment E). The Validation Discrepancy Sheets are to be routed to the Assistant Superintendent Operations or designee for resolution. The Assistant Superintendent Operations will obtain assistance as necessary to develop a resolution to resolve the discrepancy. The resolution will be documented on Attachment E. Discrepancies may be due to deficiencies in the EOPs themselves, or due to other causes such as deficiencies in control room hardware or training. Discrepancies related to procedure deficiencies must be resolved prior to final procedure approval and implementation.

Resolution for discrepancies shall be approved by the Assistant Superintendent Operations or designee. These approvals are to be documented on Attachment E. Incorporation of the resolution into the EOPs will also be documented on Attachment E.

8. Documentation

The completed EOP Validation Form (Attachment G) is to be approved by the Assistant Superintendent Operations or designee. Attachment E (if applicable) F (if applicable), G and supporting validation information shall accompany the procedure (or procedure change) for final approval and be retained with the procedure (or procedure change) in the Central File System.

9. Attachments

Attachment A Table Top Method of EOP Validation
Attachment B Simulator Method of EOP Validation
Attachment C Walk-Through Method of EOP Validation
Attachment D Reference Method of EOP Validation
Attachment E Validation Discrepancy Sheet
Attachment F Observer Checklist and Debriefing Form
Attachment G EOP Validation Form

ATTACHMENT A

TABLE TOP METHOD OF EOP VALIDATION

1. PURPOSE

The purpose of this attachment is to describe the use of the Table Top method of validating EOPs.

2. DESCRIPTION

The Table Top method of EOP validation consists of four phases:

- Preparation
- Conducting the Validation
- Evaluation of Results
- Resolution of Discrepancies

2.1 Preparation

A. Personnel

An observer/reviewer team whose members are knowledgeable in plant operations, procedure, and their technical requirements, and training shall be appointed by the Assistant Superintendent Operations or designee to conduct the Table Top method of validation. The operators who participate in the validation process should consist of members from each shift position (Shift Engineer/Shift Foreman (SRO), Shift Control Room Engineer (SRO), and Nuclear Station Operator (RO)).

B. Selecting Table Top Scenarios/Industry Events

The observer/reviewer team will select scenarios/industry events to review based on satisfying the validation objectives. Industry events may come from actual events that occurred at Braidwood Station or at another nuclear station. Information on industry events may come from LERs, SERs, SOERs, or other appropriate documents.

C. Observer Checklist and Debriefing Form

The Observer Checklist and Debriefing Form (Attachment F) will be used to measure and record operator performance during the validation trial.

D. Operator Training on EOPs

Prior to conducting the validation, the operating crews will become familiar with the new procedures during plant training sessions.

2.2 Condu_ting the Validation

A. For discussion of scenarios, the observer/reviewer team shall perform the following:

- o Review the overall objective and techniques of the Table Top with the operators participating in the validation.

- o Review the use of the Observer Checklist and Debriefing Form, Attachment F, with the operators.

- o State the initial plant conditions for the scenario to the operators, and then give the operators the changing plant parameters while talking-through the procedures.

- o Ask appropriate "what if" questions.

- o Stop the Table Top assessment for discussions of any identified discrepancies.

- o During the Table Top scenarios each observer/reviewer will complete the Observer Checklist in Attachment F. Enter N/A for those items not applicable during the Table Top discussion of the scenarios.

B. For discussion of scenarios, the operator(s) shall perform the following during the Table Top scenario:

- o Talk-through the use of the EOPs as the observer/reviewer team leads him through the scenarios.

C. For review of Braidwood Station and industry events, observer/reviewer team personnel will study and discuss the event reports (i.e. LERs, SERs, SOERs, etc.) to evaluate the EOPs. In this case the validation team will consist of only the observer/reviewer team personnel with no operators.

2.3 Evaluation of Results

A. Immediately after the scenario trial is completed, an in-depth debriefing between the observer/reviewer team and the operating crew will be conducted. Before the operators are questioned, they will be allowed to make any general comments concerning the scenario. These comments will be recorded on the Debriefing Form of Attachment E. After each operator concludes his remarks, the observers will ask questions based on those outlined in Attachment F and on the deviations which were recorded on their Observer Checklists.

B. After the debriefing, data gathered from the Observer Checklist and Debriefing Forms must be evaluated. Each item noted on an Observer Checklist and Debriefing Form should be considered to be a potential discrepancy. These items should be examined on a case-by-case basis to determine if it should be listed as a discrepancy or be deleted from further consideration. Those items which are considered to be actual discrepancies will be documented on Validation Discrepancy Sheets (Attachment E) and forwarded to the Assistant Superintendent Operations or designee for resolution.

2.4 Resolution of Discrepancies

Resolution of discrepancies is to be conducted per section 7.0 of this program.

ATTACHMENT B

SIMULATOR METHOD OF EOP VALIDATION

1. PURPOSE

The purpose of this attachment is to describe the use of the Simulator method of validating EOPs.

2. DESCRIPTION

The Simulator method of EOP validation requires the coordination of hardware, software and personnel during relatively short periods of simulator time. This method consists of four phases:

- o Preparation
- o Conducting the Validation
- o Evaluation of Results
- o Resolution of Discrepancies

2.1 Preparation

A. Personnel

An observer/reviewer team, whose members are knowledgeable in plant operations, procedures, and their technical requirements, and training shall be appointed by the Assistant Superintendent Operations or designee to conduct the Simulator method of validation. The operators who participate in the validation scenarios will consist of personnel from each shift position [Shift Engineer/Shift Foreman (SRO), Shift Control Room Engineer (SRO), and Nuclear Station Operator (RO)].

B. Simulator Selection

The Braidwood plant-specific simulator located at the Commonwealth Edison Production Training Center will be used for all validation trials.

C. Selecting Simulator Scenarios

The validation team will select scenarios for implementation based on recommendations of WCAP 10599, and on simulator software considerations. Refer to Table 1 for example scenarios which may be used.

D. Observer Checklist and Debriefing Form

The Observer Checklist and Debriefing Form (Attachment F) will be used to measure and record operator performance during the validation trial.

E. Operator Training on EOPs

Prior to their session at the simulator, the operating crews will become familiar with the new procedures during plant training sessions.

2.2 <u>Conducting the Validation</u>

A. The observer/reviewer team shall perform the following:

- o Review the overall objective of the validation program with the operators.
- o Review the use of the Observer Checklist and Debriefing Form, Attachment F, with the operators.
- o Brief the operators on the initial plant conditions for each scenario run.
- o During each scenario run each observer/reviewer will complete the Observer Checklist in Attachment F.

B. For each scenario run, the operators shall perform the control room actions as required to mitigate the consequences of the transient or accident while using the EOPs.

2.3 <u>Evaluation of Results</u>

A. Immediately after the scenario trial is completed, an in-depth debriefing between the observer/reviewer team and the operating crew will be conducted. Before the operators are questioned, they will be allowed to make any general comments concerning the scenario. These comments will be recorded on the Debriefing Form of Attachment E. After each operator concludes his remarks, the observers will ask questions based on those outlined in Attachment F and on the deviations which were recorded on their Observer Checklist.

B. After the debriefing, data gathered from the Observer Checklist and Debriefing Forms must be evaluated. Each item noted on an Observer Checklist and Debriefing From would be considered to be a potential discrepancy. These items would be examined on a case-by-case basis to determine if it should be listed as a discrepancy or be deleted from further consideration. Those items which are considered to be actual discrepancies will be documented on Validation Discrepancy Sheets (Attachment E) and forwarded to the Assistant Superintendent Operations or designee for resolution.

2.4 Resolution of Discrepancies

Resolution of discrepancies is to be conducted per Section 7.0 of this program.

TABLE 1

EXAMPLE VALIDATION TEST SCENARIOS

1	Loss of offsite power - Reactor trip
1A	Natural Circulation cooldown
2	Spurious SI
3	Small LOCA
4	Intermediate - size LOCA
4A	Post-LOCA cooldown
5	Large LOCA - No RHR pumps
6	Inadequate Core Cooling
7	Small LOCA plus subsequent SGTR
8	Small LOCA - no AFW
9	Small LOCA - No SI and Charging Pumps - Return to critical
10	Secondary break outside containment
11	Secondary break - All MSIVs fail to close
12	Secondary break plus subsequent secondary break
13	Secondary break - MSIV failure (all) - plus LOCA
14	Secondary break - MSIV failure (all) - plus SGTR
15	Secondary break inside containment - plus LOCA
16	Secondary break plus SGTR in faulted SG
17	Secondary break in 3 SGs plus SGTR
18	Secondary break in 2 SGs plus SGTR (1 intact)
19A	Post SGTR cooldown using backfill
20	SGTRs in different SGs (subsequent)
21	SGTR plus secondary break in non-ruptured SG

TABLE 1 (Cont.)

EXAMPLE VALIDATION TEST SCENARIOS

22 SGTR, Loss of SI and Charging Pumps - Return to Critical

23 SG tube leak plus spurious SI

24 SGTR plus loss of AFW

25 SGTR plus secondary overpressure

26 Loss of all ac power

26A Loss of all ac power recovery plus SGTR

27 ATWS from full power

28 Loss of all feedwater - power available

29 Loss of all feedwater - offsite power lost

30 Spurious SI at low pressure (1000 psi, 350°F)

31 LOCA while on RHR

32 SGTR while on RHR

33 Large LOCA with Switchover to Cold Leg Recirculation

34 SGTR plus cooldown

35 Reactor trip

36 Loss of AFW

37 LOCA without SI and Charging pumps

38 LOCA outside containment

39 Non-isolable LOCA outside containment

40 SGTR without PZR pressure control

ATTACHMENT C

WALK-THROUGH METHOD OF EOP VALIDATION

1. PURPOSE

The purpose of this attachment is to describe the use of the Walk-Through method of validating EOPs.

2. DESCRIPTION

The Walk-Through method of EOP validation requires the coordination of plant personnel, observer, reviewer team personnel and various types of equipment on which the validation occurs. This method consists of four phases:

- o Preparation
- o Conducting the Validation
- o Evaluation of Results
- o Resolution of Discrepancies

2.1 Preparation

A. Personnel

An observer/reviewer team whose members are knowledgeable in plant operations, procedures, and their technical requirements, and training shall be appointed by the Assistant Superintendent Operations or designee to conduct the Walk-Through method of validation. The operators who participate in the validation scenarios will consist of personnel from each shift position [Shift Engineer/Shift Foreman (SRO), Shift Control Room Engineer (SRO), and Nuclear Station Operator (RO)].

B. Potential Walk-Through Equipment:

- o Braidwood Station Control Room
- o Braidwood Simulator

C. Selecting Walk-Through Scenarios

The observer/reviewer team will select scenarios for implementation based on recommendations from WCAP 10599, and the experience of the observer/reviewer team personnel. The selection will also be based on satisfying the validation objectives.

D. Observer Checklist and Debriefing Form

The Observer Checklist and Debriefing Form (Attachment F) will be used to measure and record operator performance during the validation trial.

E. Operator Training on EOPs

Prior to their walk-through session the operating crews will become familiar with the new procedures during plant training sessions.

2.2 Conducting the Validation

A. The observer/reviewer team shall perform the following:

- o Review the overall objective and techniques of the Walk-Through method with the operators participating in the validation.
- o Review the use of the Observer Checklist and Debriefing Form, Attachment F, with the operators.
- o State the initial plant conditions for the scenario to the operators, and then give the operators the changing plant parameters while walking-through the procedures.
- o Ask appropriate "what if" questions.
- o Stop the Walk-Through assessment for discussion of any identified discrepancies.
- o During the Walk-Through scenarios each observer/reviewer will complete the Observer Checklist in Attachment F. Enter N/A for those items not applicable during the walk-through of the scenarios.

B. The operators shall perform the following during the Walk-Through scenario:

- o Walk-through actions in the EOPs they would take during the specific situations covered by the scenario(s).
- o Describe the actions they are taking.
- o Identify controls used to carry out actions, expected plant responses, how responses are detected, and actions to be taken if responses do not occur.

2.3 Evaluation of Results

A. Immediately after the scenario trial is completed, an in-depth debriefing between the observer/reviewer team and the operating crew will be conducted. Before the operators are questioned, they will be allowed to make any general comments concerning the scenario. These comments will be recorded on the Debriefing Form of Attachment F. After each operator concludes his remarks, the observers will ask questions based on those outlined in Attachment F and on the deviations which were recorded on their Observer Checklists.

B. After the debriefing, data gathered from the Observer Checklist and Debriefing Forms must be evaluated. Each item noted on an Observer Checklist and Debriefing Form would be considered to be a potential discrepancy. These items would be examined on a case-by-case basis to determine if it should be listed as a discrepancy or be deleted from further consideration. Those items which are considered to be actual discrepancies will be documented on Validation Discrepancy Sheets (Attachment E) and forwarded to the Assistant Superintendent Operations or designee for resolution.

2.4 Resolution of Discrepancies

Resolution of discrepancies is to be conducted per Section 7.0 of this program.

ATTACHMENT D

REFERENCE METHOD OF EOP VALIDATION

1. PURPOSE

The purpose of this attachment is to be describe the use of the Reference method of validating EOPs.

2. DESCRIPTION

The reference method of EOP validation consists of three phases:

- o Preparation
- o Conducting the Validation
- o Resolution of Discrepancies

2.1 Preparation

A designated reviewer(s) who is knowledgeable in plant operations, procedures and their technical requirements, and training shall be appointed by the Assistant Superintendent Operations or designee to conduct the Reference method of validation.

2.2 Conducting the Evaluation

The designated reviewer will perform the following:

- o Evaluate the difference in hardware and shift manning for Braidwood Station against the reference plant for which a common EOP validation program has been successfully completed.

- o Evaluate the differences in the format and the level of detail.

- o Record discrepancies found on Validation Discrepancy Sheets (Attachment E).

2.3 Resolution of Discrepancies

Resolution of discrepancies is to be conducted per Section 7.0 of this program.

ATTACHMENT E

VALIDATION DISCREPANCY SHEET

VALIDATION DISCREPANCY SHEET NUMBER____

EOP:______________ REV.__________________ STEP NUMBER________________________

VALIDATION METHOD____

DISCREPANCY:

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EVALUATOR:____ DATE:______________________

<u>RESOLUTION</u>

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APPROVED BY:______________________________________ DATE:______________________
Assistant Superintendent Operations

RESOLUTION INCORPORATED BY:_______________________ DATE:______________________

OBSERVER CHECKLIST AND DEBRIEFING FORM

VALIDATION METHOD__________________________ OBSERVER___________________

SCENARIO TITLE____________________________________

I. OBSERVER CHECKLIST

The following checklist should be completed during the validation trial by each observer. Any negative answer should be explained after the step.

1.0 USABILITY

A. Level of Detail

_____ 1. Was there sufficient information to perform the specified actions at each step?

_____ 2. Were the alternatives adequately described at each decision point?

_____ 3. Were the labeling, abbreviations, and location information as provided in the EOP sufficient to enable the operator to find the needed equipment?

_____ 4. Was the EOP missing information needed to manage the emergency condition?

_____ 5. Were the titles and numbers sufficiently descriptive to enable the operator to find referenced and branched procedures?

B. Understandability

_____ 1. Was the EOP easy to read?

_____ 2. Were the figures and tables easy to read with accuracy?

_____ 3. Could the values on figures and tables be easily determined?

_____ 4. Were caution and note statements readily understandable?

_____ 5. Were the EOP steps readily understandable?

2.0 OPERATIONAL CORRECTNESS

A. Plant Compatibility

_____ 1. Could the actions specified in the procedure be performed in the designated sequence?

_____ 2. Were there alternate success paths that are not included in the EOPs?

_____ 3. Could the information from the plant instrumentation be obtained, as specified by the EOP?

_____ 4. Were the plant symptoms specified by the EOP adequate to enable the operator to select the applicable EOP?

_____ 5. Were the EOP entry conditions appropriate for the plant symptoms displayed to the operator?

_____ 6. Was information or equipment not specified in the EOP required to accomplish the task?

_____ 7. Did the plant responses agree with the EOP basis?

_____ 8. Were the instrument readings and tolerances stated in the EOP consistent with the instrument values displayed on the instruments?

_____ 9. Was the EOP physically compatible with the work situation (too bulky to hold, binding would not allow them to lay flat in work space, no place to lay the EOPs down to use)?

_____ 10. Were the instrument readings and tolerances specified by the EOP for remotely located instruments accurate?

B. Operator Compatibility

_____ 1. Could the procedure action steps be performed by the operating shift?

_____ 2. Could the operating shift follow the designated action step sequences?

_____ 3. Could the procedure exit point be returned to without omitting steps when required?

_____ 4. Could procedure branches be entered at the correct point?

_____ 5. Were EOP exit points specified adequately?

3.0 GENERAL OBSERVER COMMENTS

II. DEBRIEFING FORM

A. The following questions should be asked of the operating crew during the debriefing (potential solutions to any problems should be included):

1.0 USABILITY

A. Level of Detail

_____ 1. Was there sufficient information to perform the specified actions at each step?

_____ 2. Were the alternatives adequately described at each decision point?

_____ 3. Were the labeling, abbreviations, and location information as provided in the EOP sufficient to enable the operator to find the needed equipment?

_____ 4. Was the EOP missing information needed to manage the emergency condition?

_____ 5. Were the titles and numbers sufficiently descriptive to enable the operator to find referenced and branched procedures?

B. Understandability

_____ 1. Was the EOP easy to read?

_____ 2. Were the figures and tables easy to read with accuracy?

_____ 3. Could the values on figures and tables be easily determined?

_____ 4. Were caution and note statements readily understandable?

_____ 5. Were the EOP steps readily understandable?

2.0 OPERATIONAL CORRECTNESS

A. Plant Compatibility

_____ 1. Could the actions specified in the procedure be performed in the designated sequence?

_____ 2. Were there alternate success paths that are not included in the EOPs?

_____ 3. Could the information from the plant instrumentation be obtained, as specified by the EOP?

_____ 4. Were the plant symptoms specified by the EOP adequate to enable the operator to select the applicable EOP?

_____ 5. Were the EOP entry conditions appropriate for the plant symptoms displayed to the operator?

_____ 6. Was information or equipment not specified in the EOP required to accomplish the task?

_____ 7. Did the plant responses agree with the EOP basis?

_____ 8. Were the instrument readings and tolerances stated in the EOP consistent with the instrument values displayed on the instruments?

_____ 9. Was the EOP physically compatible with the work situation (too bulky to hold, binding would not allow them to lay flat in work space, no place to lay the EOPs down to use)?

_____ 10. Were the instrument readings and tolerances specified by the EOP form remotely located instruments accurate?

B. Operator Compatibility

_____ 1. Could the procedure action steps be performed by the operating shift?

_____ 2. Could the operating shift follow the designated action step sequences?

_____ 3. Could the procedure exit point be returned to without omitting steps when required?

_____ 4. Could procedure branches be entered at the correct point?

_____ 5. Were EOP exit points specified adequately?

3.0 GENERAL OPERATOR COMMENTS (including potential solutions to problems)

ATTACHMENT G

EOP VALIDATION FORM

EOP Title:____

EOP Number:________________________________ Revision:________________________________

Scope of Validation: ____

Validation Method: ____

Observers/Reviewers:

Operator(s) Involved: Qualifications: (SRO, RO, OTHER)

Initial Conditions:____

Primary Sequence:____

Special Instructions:____

Discrepancies: YES NO (Circle One)

Resolution of Discrepancies Incorporated By:______________________________
(N/A if Not Applicable) Date:______________________________

Approved By:____________________________________ Date:________________________
Assistant Superintendent Operations

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
SECTION VI
EOP TRAINING PROGRAM

March 5, 1985

0142E(030585)
A

BRAIDWOOD STATION

EMERGENCY OPERATING PROCEDURE TRAINING PROGRAM

1.0 Purpose

The purpose of this document is to describe the method and schedule of training for the WOG Rev 1 based Emergency Operating Procedures (EOPs) for Braidwood Station Unit 1.

2.0 Objectives

The objectives for initial training on the Braidwood Station Unit 1 EOPs are as follows:

Classroom Training:

- o To enable the operators to understand the structure of the EOPs.
- o To enable the operators to understand the technical bases of the EOPs.
- o To enable the operators to have a working knowledge of the technical content of the EOPs.
- o To provide an understanding of all graphs and parameter limitations, including bases for concern.

Simulator Training:

- o To enable the operators to use the EOPs under operational conditions.
- o To allow the operators to practice EOP usage and reinforce technical bases learned in the classroom phase of EOP training.
- o To enable the operators to obtain competence in entering and exiting EOPs and making correct transitions between EOPs.

Description

This program is intended for all license candidates who certified prior to implementation of the WOG Rev 1 based EOPs. Personnel who license after implementation will receive training on the procedures as part of the normal training program.

Retraining will be accomplished through required reading and the normal requalification training program.

The training shall be conducted at the Commonwealth Edison Production Training Center. It will be five (5) days in length. Each day will consist of four hours of classroom instruction followed by four hours on the Braidwood simulator.

1 The classroom instruction will cover the generic issues, purpose of each procedure and bases for procedure steps. The simulator instruction will cover the procedures discussed in the classroom for that day.

a. Verification Discrepancy Sheet (Attachment C to the Braidwood Verification Program) or a Validation Discrepancy Sheet (Attachment E to the Braidwood Validation Program) will be used to document potential problems with the procedures and provide resolutions to these problems.

Schedule

The training program will be completed before implementation of the procedures. Time and simulator capability limitations prohibit complete coverage of each procedure during the simulator portion. However, all procedures will be covered in the classroom portion.

The training program will commence on or about August 1, 1985. Each operator will receive complete initial training on the procedures prior to taking their NRC licensing examination.

BRAIDWOOD STATION UNIT 1
PROCEDURE GENERATION PACKAGE
ATTACHMENT A
BRAIDWOOD STATION UNIT 1 PLANT DESCRIPTION

TABLE OF CONTENTS

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1. INTRODUCTION

The "High Pressure Reference Plant Description" was developed by the Westinghouse Owners Group to define the high pressure reference plant for which the generic Emergency Response Guidelines (ERGs) were developed. The Braidwood Station plant-specific Emergency Operating Procedures (EOPs) will be developed utilizing the ERGs and plant-specific technical guidance from EOP source documents. The "Braidwood Station Plant Description" has been developed to define the Braidwood plant systems for Unit 1 as it differs from the reference plant system.

The Braidwood Station Plant Description has been written in the same format and using the same section numbering as the generic document to simplify the task of comparing the generic and Braidwood documents. This approach will aid the plant personnel writing EOPs from ERGs and the regulatory personnel who perform the review of the Braidwood EOPs.

Throughout this document, when a Braidwood system is the same as the generic system, the generic description was inserted from the Reference Plant Description. For systems which are different, the sections were rewritten or minor revisions were made as appropriate. In all cases, when the Braidwood document differs from the generic document, a line was drawn down the right-hand margin to indicate the difference from the reference plant document.

2. PLANT SYSTEMS

The Braidwood plant is defined in terms of twenty-five separate plant systems. The plant systems are grouped into four categories:

1) Control and Protection Actuation Systems
2) Instrumentation Systems
3) Process Control Systems
4) Support Systems

Each system is defined to the extent necessary to maximize technical guidance with respect to system operation in response to an emergency transient.

The Braidwood plant systems are identified by category in Table 1. The following subsections describe the systems from an emergency operations perspective. Figures are included to show the Braidwood plant systems where appropriate. Detail shown on the figures is consistent with the instrumentation and equipment specifically identified in the EOPs, aiding the user of this document in identifying and comparing the reference plant instrumentation and equipment to Braidwood plant instrumentation and equipment used for Braidwood EOPs. Additional detail (e.g., valves) is not shown where the detail exceeds that specifically identified in the EOPs. Braidwood Station EOPs may contain instrumentation and equipment not listed in this document. Additional Braidwood plant equipment may be added to the EOPs by the staff performing the development of EOPs as appropriate for response to emergency conditions.

TABLE 1

PLANT SYSTEMS

Control and Protection Actuation Systems

Reactor Trip Actuation System
Engineered Safeguards Features Actuation System

Instrumentation Systems

Nuclear Instrumentation System
Control Rod Instrumentation System
Radiation Instrumentation System
Containment Instrumentation System

Process Control Systems

Reactor Coolant System
Safety Injection System
Residual Heat Removal System
Chemical and Volume Control System
Component Cooling Water System
Essential Service Water System
Containment Spray System
Containment Atmosphere Control System
Main Steam System
Main Feedwater and Condensate System
Auxiliary Feedwater System
Steam Generator Blowdown System
Sampling System
Spent Fuel Storage and Cooling System
Control Rod Drive Mechanism Cooling System
Control Rod Control System
Turbine Control System

Support Systems

Electrical Power System
Pneumatic Power System

2.1 Reactor Trip Actuation System

The reactor trip actuation system monitors specified process parameters and equipment status and actuates reactor trip if conditions exceed specified limits. The reactor trip actuation system includes automatic actuations that occur concurrent with actuation of reactor trip.

A reactor trip signal is automatically generated if any condition exceeds its specified limit. Concurrent with opening of reactor trip breakers, a P-4 signal is generated and provides the following:

- o Turbine trip
- o Input signal to feedwater isolation logic
- o Input signal to SI block logic

2.2 Engineered Safeguards Features Actuation System

The engineered safeguards features (ESF) actuation system monitor specified process parameters and actuates ESF operation if conditions exceed specified limits. The ESF Actuation System consists of the following automatic actuation signals.

Safety Injection Signal

The safety injection (SI) signal is the primary ESF actuation signal. It is automatically generated on any of the following:

- o Low pressurizer pressure
- o Low steamline pressure
- o High-1 containment pressure
- o Manual operator actuation

The following plant equipment are automatically actuated by an SI signal:

- o Reactor trip
- o Feedwater isolation (including closure of feedwater isolation, flow control and bypass valves)
- o Auxiliary feedwater start (including start of both AF pumps) |
- o Diesel-generator start
- o Emergency fan cooler start
- o Safety injection system start
- o Component cooling water system start
- o Essential service water system start |
- o Containment isolation Phase A
- o Containment ventilation isolation
- o Control room ventilation system start |

The signal actuation logic includes the following reset/block features:

- o Manual block/auto reset for low pressurizer pressure actuation signal (concurrent with a P-11 low pressurizer pressure permissive signal)
- o Manual block/auto reset for low steamline pressure actuation signal (concurrent with a P-11 low pressurizer pressure permissive signal)
- o Manual block/auto reset for SI signal (concurrent with expiration of the SI signal reset time delay and P-4 reactor trip input signal)

Containment Spray Signal

The containment spray signal automatically actuates on any of the following:

- o High-3 containment pressure
- o Manual operator actuation

The following plant equipment automatically actuate on a containment spray signal:

- o Containment spray system start
- o Containment isolation Phase B

The containment spray signal actuation logic includes the following reset capabilities:

- o Manual reset for containment spray system start signal
- o Manual reset for containment isolation Phase B signal

Auxiliary Feedwater Start Signal

The auxiliary feedwater (AFW) system consists of one diesel driven and one motor-driven AFW Pump. These pumps are started on different actuation signals.

The motor-driven AFW pump automatically start on any of the following:

- o SI signal
- o Undervoltage, on ESF bus 141
- o Undervoltage on 2/4 RCP buses
- o Low-Low level in any steam generator

The diesel-driven AFW pump automatically starts on any of the following:

- o Low-Low level in any steam generator
- o Undervoltage on 2/4 RCP buses
- o SI signal

Containment Isolation Phase A Signal

The containment isolation Phase A signal automatically isolates non-essential containment penetrations to prevent or minimize the release of radioactive material outside containment. This signal automatically actuates on any of the following input signals:

- o SI signal
- o Manual operator actuation of Phase A signal

The containment isolation Phase A signal closes valves in plant systems that penetrate containment. The actuation logic includes separate reset capability for each input actuation signal.

Containment Isolation Phase B Signal

The containment isolation Phase B signal automatically isolates essential containment penetrations to prevent the release of radioactive material outside containment. This signal automatically actuates on any of the following input signals:

- o High-3 Containment pressure
- o Manual operator actuation of containment spray signal

The containment isolation Phase B signal automatically closes the containment isolation valves in the component cooling water lines to the reactor coolant pumps. The actuation logic includes separate reset capability for each input actuation signal.

Main Steamline Isolation Signal

Main Steamline isolation is actuated on any of the following:

- o High-2 containment pressure
- o Low steamline pressure in any steamline (when pressurizer pressure above P-11)
- o Manual operator actuation
- o High steam pressure rate in any main steamline (when pressurizer pressure below P-11)

The following plant equipment automatically actuate on a main steamline isolation signal:

- o Main steamline isolation valves close
- o Main steamline isolation bypass valves close

The main steamline isolation logic includes the following reset capabilities:

- o Manual block/reset for low steamline pressure actuation signal (concurrent with a P-11 low pressurizer pressure permissive signal)
- o Manual block/reset for high steam pressure rate actuation signal (concurrent with a P-11 low pressurizer pressure permissive signal)
- o Manual reset for main steamline isolation signal

Containment Ventilation Isolation Signal

The containment ventilation isolation signal automatically isolates containment ventilation penetrations to prevent the release of radioactive material outside containment. This signal automatically actuates on any of the following input signals.

- o SI signal
- o High containment radiation
- o Manual operator actuation of containment isolation Phase A signal
- o Manual operator actuation of containment spray signal

The containment ventilation isolation signal closes valves in the ventilation system. The actuation logic includes separate reset capability for each input actuation signal.

Main Feedwater Isolation Signal

The main feedwater isolation signal automatically isolates the main feedwater lines to prevent excessive filling of the steam generators. The signal automatically actuates as follows:

- o SI signal
- o High-high level (P-14) in any steam generator
- o Reactor trip (P-4 signal) coincident with low reactor coolant system average temperature (Tavg)

The main feedwater isolation signal closes the following valves:

- o Main feedwater regulating valves (1FW510, 520, 530 & 540)
- o Main feedwater regulating bypass valves (1FW510A, 520A, 530A & 540A)
- o Main feedwater isolation valves (1FW009A-D)
- o Main feedwater tempering flow control valves (1FW034A-D)
- o Main feedwater tempering isolation valves (1FW035A-D)
- o Main feedwater preheater bypass isolation valves (1FW039A-D)
- o Main feedwater isolation valves bypass valves (1FW043A-D)

The main feedwater isolation signal includes the following reset/block capabilities:

- o Manual reset for the reactor trip (P-4) signal coincident with RCS low T_{avg}
- o Manual reset/block for the SI signal. This is the same reset/block feature discussed under SI signal.

2.3 Nuclear Instrumentation System

The nuclear instrumentation system (NIS) monitors and displays the reactivity state of the reactor core. It consists of instrumentation that monitors leakage neutron flux outside the reactor vessel. Neutron flux is monitored over the source, intermediate, and power ranges. Startup rate is calculated over the source and intermediate ranges. The NIS includes a neutron flux recorder that can be switched to record different ranges. The source range neutron flux detectors automatically energize when intermediate range level decreases below the source range permissive (P-6) setpoint following a reactor trip, permitting the neutron flux recorder to be manually transferred to the source range scale.

2.4 Control Rod Instrumentation System

The control rod instrumentation system monitors and displays the position of the control rods in the reactor core. It provides control rod position and rod bottom light indications.

2.5 Radiation Instrumentation System

The radiation instrumentation system monitors radiation levels in specified process systems and specified areas internal and external to the plant. It consists of the following:

- o Radiation instrumentation located inside containment
- o Radiation instrumentation located in the main steam system and steam generator blowdown system
- o Radiation instrumentation located inside the auxiliary building

2.6 Containment Instrumentation System

The containment instrumentation system monitors the environmental condition and isolation status of containment. It consists of containment pressure and temperature instrumentation, containment hydrogen concentration instrumentation, containment recirculation sump level instrumentation, narrow and wide range containment level instrumentation, and position indication for containment isolation valves.

2.7 Reactor Coolant System

The reactor coolant system (RCS) transfers heat from the reactor core to the main steam system or residual heat removal system and provides a barrier against the release of reactor coolant or radioactive material to the containment environment.

The RCS consists of four identical heat transfer loops (connected in parallel to the reactor vessel), a pressurizer and a pressurizer relief tank. Each loop includes a RTD bypass loop. Flow from the RCS hot leg and cold leg enters the RTD bypass loop and returns via a common header to the reactor coolant pump (RCP) suction. Each RTD bypass loop contains a hot leg and cold leg manifold that includes RTD temperature sensors used in plant control and protection. The RTDs located in the bypass loop are used for RCS average temperature and delta T instrumentation and control. RTDs are also located in the hot leg and cold leg providing wide range RCS hot and cold leg temperature indication in the Main Control Room.

The pressurizer is connected to the hot leg of D loop via the pressurizer surge line and the cold legs of loops C and D via the pressurizer spray lines. The pressurizer has two power operated relief valves (PORVs) with associated isolation valves, three ASME code safety valves, and heaters. RCS pressure is controlled by use of the pressurizer where water and steam are maintained in equilibrium through use of the heaters, water spray, and steam release.

The pressurizer PORVs and safety valves discharge to the pressurizer relief tank where steam discharge is condensed and cooled by mixing with water.

Normal operating pressure of 2235 psig in the RCS is maintained by a Pressure Control System which automatically energizes heaters and normal spray in the pressurizer as necessary to maintain pressure. Pressurizer PORVs are automatically controlled to open at 2335 psig, and the safety valves have a lift pressure of 2485 psig.

A Cold Overpressure Protection System functions to limit RCS pressure to a programmed maximum (as a function of temperature) at low RCS temperatures. This control system must be manually placed in service and utilizes only the pressurizer PORVs to limit RCS pressure.

A typical reactor coolant loop in the Braidwood plant is shown in Figure 1. The pressurizer is shown in Figure 2.

2.8 Safety Injection System

The Safety Injection (SI) System provides borated water to the reactor coolant system for events that require engineered safeguards features operation. The Safety Injection System is designed to operate in three physical configurations or modes depending on the plant transient and time into the plant transient:

- o Cold leg injection mode (short-term core cooling mode)

The cold leg injection mode is defined as that configuration in which borated water is delivered from the refueling water storage tank (RWST) to the RCS cold legs.

- o Cold leg recirculation mode (long-term core cooling mode)

The cold leg recirculation mode is defined as that configuration in which borated water is recirculated from the containment sump to the RCS cold legs. This mode is initiated by an automatic opening of the containment sump isolation valves to the Safety Injection System resulting from a combined "low-low RWST level and SI" signal.

- o Hot leg recirculation mode (long-term cooling and boron concentration control)

The hot leg recirculation mode is that configuration in which borated water is recirculated from the containment sump to both the RCS hot legs and RCS cold legs. This mode is initiated by manual operator action based on time into the transient (18 hours).

The Safety Injection System consists of the following four major subsystems.

Centrifugal Charging Subsystem

The centrifugal charging subsystem consists of two centrifugal charging pumps. These pumps are part of the chemical and volume control system and provide charging and RCP seal injection flow during normal operation. Upon receipt of an SI signal, these pumps are automatically isolated from the normal charging function and aligned for SI cold leg injection. The centrifugal charging pump miniflow isolation valves (8110, 8111), remain open following SI actuation until an RWST low-low level is received coincident with the SI signal. The remaining two miniflow isolation valves which are installed in series with 8110 and 8111 (8114/8116 respectively) close on a low RCS pressure signal coincident with an SI signal. In the injection alignment the charging pumps take suction from the RWST and discharge to all RCS cold legs (and RCP seal injection). During recirculation modes, the charging pump suction is aligned to the discharge of the RHR pumps and discharge remains to the RCS cold legs.

The discharge shutoff pressure of the centrifugal charging pumps is greater than the RCS pressurizer PORV setpoint pressure.

The Braidwood plant Emergency Core Cooling System (which includes the centrifugal charging subsystem) is shown in Figure 3. Those portions of the centrifugal charging subsystem that are part of the chemical and volume control system are shown in Figure 4.

SI Subsystem

The SI subsystem consists of two centrifugal high-head SI pumps. These pumps are part of the SI system and are normally aligned for SI cold leg injection. Upon receipt of an SI signal, the SI pumps automatically start in the SI cold leg injection mode. In this mode the SI pumps take suction from the RWST and discharge to all RCS cold legs (through the accumulator discharge lines). During recirculation modes, the SI pumps are aligned to take suction from the RHR pump discharge and to discharge to all RCS cold legs or hot legs depending on recirculation mode.

The discharge shutoff head pressure of the SI pumps is approximately 1590 psig.

The Braidwood plant Emergency Core Cooling System (which includes the SI subsystem) is shown in Figure 3.

Residual Heat Removal (RHR) Subsystem

The RHR subsystem consists of two centrifugal pumps and two heat exchangers. These pumps and heat exchangers are part of the residual heat removal system and provide normal plant shutdown heat removal. During normal operation, these pumps are aligned for SI cold leg injection. Upon receipt of an SI signal, the RHR pumps automatically start in the SI cold leg injection mode. In this mode the RHR pumps take suction from the RWST and discharge to all RCS cold legs (through the accumulator discharge lines).

During recirculation modes, the RHR pumps are aligned to take suction from the containment recirculation sump and to discharge to the suction of the centrifugal charging pumps and SI pumps as well as to all RCS cold legs or two RCS hot legs depending on recirculation mode.

The discharge shutoff pressure of the RHR pumps is approximately 215 psig.

The heat exchangers are supplied with component cooling water during SI recirculation modes.

The Braidwood plant Emergency Core Cooling System (which includes the RHR subsystem) is shown in Figure 3.

<u>SI-Accumulator Subsystem</u>

The SI-accumulator subsystem consists of four accumulator tanks, each connecting to one RCS cold leg via an accumulator injection line. Each tank contains borated water and is pressurized to a nominal 650 psig with a nitrogen cover gas. A single isolation valve is provided in each accumulator injection line and series vent valves are provided in the accumulator nitrogen supply lines. During normal operation the injection isolation valves are open with power removed from the valve operators. The accumulators are available to deliver their contents to the RCS cold legs during the injection mode of any emergency transient that is accompanied by RCS depressurization below the accumulator pressure.

The Braidwood plant Emergency Core Cooling System (which includes the SI-accumulator subsystem) is shown in Figure 3.

2.9 Residual Heat Removal System

The residual heat removal (RHR) system removes heat from the reactor coolant system during plant shutdown operations at lower reactor coolant system pressures.

The RHR system consists of two RHR pumps (that also function as low-head SI pumps) and two RHR heat exchangers. The RHR system provides normal shutdown heat removal when RCS pressure and temperature are reduced to approximately 360 psig and 350°F. During normal shutdown heat removal operations, each RHR pumps suction is aligned to one RCS hot leg and the RHR pump discharge is aligned to all RCS cold legs.

Portions of the RHR system also function as part of the low-head SI subsystem. This shared function is described in Sections 2.8.

The Braidwood plant residual heat removal system is shown in Figure 3.

2.10 Chemical and Volume Control System

The chemical and volume control system (CVCS) provides water to the reactor coolant system and provides one means of core reactivity control for normal operations and any event that does not require ESF operation.

The CVCS consists of charging and letdown capability for control of RCS inventory. Letdown capability is provided by two letdown paths (the letdown line and the excess letdown line, with the excess letdown line providing a lower capacity alternate letdown path. Charging capability is provided by three charging pumps (two centrifugal pumps that also inject during an SI and one positive displacement pump) that deliver flow to the RCS through a charging line and RCP seal injection lines. The RCP seal injection lines deliver to each RCP and provide RCP seal cooling. A single RCP seal return line returns RCP seal leakoff flow to the suction of the charging pumps or to the volume control tank (VCT). The charging line is automatically isolated on an SI signal and the letdown line and RCP seal return lines are automatically isolated on a containment isolation Phase A signal.

Suction flow to the charging pumps is provided by the volume control tank (VCT) which is connected to the letdown line or by the refueling water storage tank (RWST) located in the SI system. The charging pumps suction is normally aligned to the VCT, but is automatically transferred to the RWST on any of the following:

- o SI signal
- o VCT low level signal
- o SR flux doubles in less than ten (10) minutes when shutdown

The CVCS includes boric acid tanks (BATs) that provide boric acid solution to the VCT or to the suction of the charging pumps for core reactivity control. Each BAT contains 4 weight percent (7000 ppm boron) boric acid solution.

Portions of the CVCS also function as part of the centrifugal charging subsystem. This shared function is described in Section 2.8.

The Braidwood plant CVCS is shown in Figure 4.

2.11 Component Cooling Water System

The component cooling (CC) water system provides heat removal from potentially radioactive system processes and equipment, including the following equipment:

- o RHR heat exchangers
- o Seal water heat exchanger
- o RCPs (motor bearing oil coolers and thermal barrier)

The Braidwood plant CC water system is shown in Figure 5a and b.

2.12 Essential Service Water System

The essential service water (SX) system provides heat removal from non-radioactive system processes and equipment and the CC water system to the ultimate heat sink (cooling pond). The SX also serves as a backup water supply for the auxiliary feedwater (AF) system and the fire protection (FP) system.

2.13 Containment Spray System

The containment spray system provides containment pressure suppression and airborne fission product removal for events that require ESF operation.

The containment spray system is designed to operate in two modes:

o Injection mode

The injection mode is defined as the configuration in which water is delivered from the RWST via the containment spray pumps to the containment atmosphere.

o Recirculation mode

The recirculation mode is defined as that configuration in which water is recirculated from the containment recirculation sump to the containment atmosphere. The piping and valves which connects the containment spray system to the containment recirculation sump is shared with the RHR subsystem.

The containment spray system includes two centrifugal containment spray pumps.

The Braidwood plant containment spray system is shown in Figure 6.

2.14 Containment Atmosphere Control System

The containment atmosphere control system provides containment atmosphere heat removal, filtration, and combustible gas mixture control. It includes the containment fan coolers, the containment electric hydrogen recombiners and containment ventilation equipment that provide for mixing of the containment atmosphere.

The Reactor Containment Fan Coolers (RCFCs) are used for containment heat removal during emergency transients and also during normal reactor operation.

The RCFCs are run in fast speed during normal reactor operation (as required) to circulate and cool the containment atmosphere (see Figure 7). Following an SI signal, the RCFCs shift to slow speed.

2.15 Main Steam System

The main steam (MS) system provides controlled heat removal from the reactor coolant system via the steam generators. It consists of separate main steamlines from each steam generator that join outside containment to form a common steam header leading to the turbine-generator and condenser. The steam generators can be isolated from the main steam header by main steamline isolation and bypass valves located in the individual main steamlines. The valves can be selectively closed via operator action in the control room to isolate a specific steam generator. All main steamline isolation and bypass valves close on a manual or automatic main steamline isolation signal.

Main steam release capability is provided via the condenser steam dump system and the steam generator (SG) atmosphere relief valves. The condenser steam dump system uses the main steam header and steam dump valves to the condenser. The SG atmospheric relief valves, located upstream of the main steamline isolation valves, release steam to the atmosphere.

Each main steamline contains five ASME code safety valves for overpressure protection.

The design and normal operating (no-load) pressures of the main steam system are approximately 1185, and 1092 psig, respectively. The setpoint pressures of the main steamline safety valves and SG atmospheric relief valves are 1175 psig (lowest safety valve setpoint) and 1115 to 1175 psig respectively. In the "pressure control mode", condenser steam dumps are set to maintain no-load pressure.

The Braidwood plant main steam system is shown in Figure 8.

2.16 Main Feedwater and Condensate System

The main feedwater and condensate system provides water to the secondary side of the steam generators during plant power operation. It consists of separate main feedwater lines to each steam generator that originate from a common main feedwater header. The steam generators can be isolated from the main feedwater header by feedwater flow control valves, bypass valves and MOV isolation valves located in the individual main feedwater lines.

The main feedwater system includes one motor-driven and two turbine-driven feedwater pumps. In addition, a motor-driven startup feedwater pump is installed for use during plant startup and shutdown. The condensate system includes four motor-driven condensate-condensate booster pumps. The discharge shutoff pressure of the condensate booster pumps is approximately 800 psig.

2.17 Auxiliary Feedwater System

The auxiliary feedwater (AF) system provides coolant to the secondary side of the steam generators during events that require ESF operation. It consists of one motor-driven AF pump and one diesel-driven AF pump that deliver water from the condensate storage tank (CST) to each steam generator. Both pumps are normally aligned to all four steam generators.

The AF pumps can be aligned to alternate water supplies (i.e. essential service water) if the CST inventory is depleted. The AF system includes capability to permit AF flow to be isolated to any steam generator while continuing to supply AF flow to the other steam generators.

The Braidwood plant AF system is shown in Figure 9.

2.18 Steam Generator Blowdown System

The steam generator blowdown system provides letdown from the secondary side of the steam generators. It consists of two separate blowdown lines from each steam generator that join to form a common header to a recirculation or discharge location. The steam generators can be isolated by blowdown isolation valves located in the individual blowdown lines.

2.19 Sampling System

The sampling system provides means for sampling process systems. It consists of the sampling system equipment that can be used to sample the RCS, steam generators, and containment sump.

2.20 Spent Fuel Storage and Cooling System

The spent fuel storage and cooling system controls fuel storage positions to ensure a subcritical geometric configuration and provides heat removal to maintain stored fuel within specified temperature limits. It includes the level instrumentation for the spent fuel pit.

2.21 Control Rod Drive Mechanism Cooling System

The control rod drive mechanism (CRDM) cooling system provides heat removal from the control rod drive mechanisms. It consists of the ventilation fans used to circulate air around the control rod drive mechanisms.

2.22 Control Rod Control System

The control rod control system controls the position of the control rods in the reactor core. It includes those controls used to manually insert control rods.

2.23 Turbine Control System

The turbine control system controls the turbine-generator. It includes those controls used to manually or automatically runback the turbine-generator.

2.24 Electrical Power System

The electrical power system provides ac and dc electrical power to equipment that require electrical power to accomplish their functions. It consists of an offsite ac power supply and onsite emergency ac and dc power supplies. The emergency ac power supply is a two train system, powered by separate diesel-generators. The dc power supply is a two train system powered by separate battery banks. Vital ac instrument power can be supplied by either the emergency ac power supply or the dc power supply via inverters.

The emergency diesel-generators (DGs) automatically start on the following:

- SI signal
- Undervoltage on ESF bus (associated DG only)

The diesel-generators automatically energize their associated emergency busses if offsite power is not available. The following major loads are sequenced on the energized ac emergency busses in accordance with the associated start signal.

- Undervoltage on ESF bus
  - Centrifugal charging pumps
  - Control room refrigeration units
  - CC water pumps
  - Essential service water pumps
  - AF pump (motor-driven)
- SI signal:
  - Centrifugal charging pumps
  - SI pumps
  - RHR pumps
  - Control room refrigeration units
  - CC water pumps
  - Essential service water pumps
  - AF pump
- High-High containment pressure with SI
  - Containment spray pumps

2.25 Pneumatic Power Systems

The pneumatic power system supplies pneumatic power (typically control air) to equipment that require pneumatic power to accomplish their functions. Equipment in this category include:

- Pressurizer PORVs (each pressurizer PORV has a nitrogen accumulator located inside containment to provide motive power when valve is closed
- Steam generator atmospheric relief valves (hydraulic unit provides motive power when valve is actuated
- Condenser steam dump valves (air operated)
- Letdown line isolation valves (air operated)
- Pressurizer auxiliary spray valve (air operated)
- Charging line containment isolation valves (air operated)

The air supply to equipment located inside containment is automatically isolated on a containment isolation Phase A signal which closes the containment isolation valves in the air supply line(s).

3. PLANT INSTRUMENTATION AND CONTROLS

The Braidwood plant consists of instrumentation and controls necessary to operate the Braidwood plant systems in response to the emergency transient. Instrumentation and controls are defined to the extent necessary to maximize technical direction with respect to system operation.

The instrumentation and controls associated with the Braidwood plant systems are identified in Table 2. These instruments and controls are within the defined scope of the Braidwood plant and will be specifically identified in the EOPs. These instruments and controls are also consistent with the figures in Section 2. Braidwood plant systems utilize instruments and controls in addition to those itemized in Table 2. Table 2 is provided to aid the user of this document in identifying and comparing the referenced plant instrumentation and controls to the Braidwood plant instrumentation and controls.

Instrumentation and control requirements are discussed, as appropriate, in the GENERIC INSTRUMENTATION document in the Generic Issues section of the Executive volume of the ERGs and in the ERG background documents in Background Volumes. Braidwood instrumentation and control requirements are discussed further in the BRAIDWOOD STATION INSTRUMENTATION DESCRIPTION (Attachment B of the Procedures Generation Package).

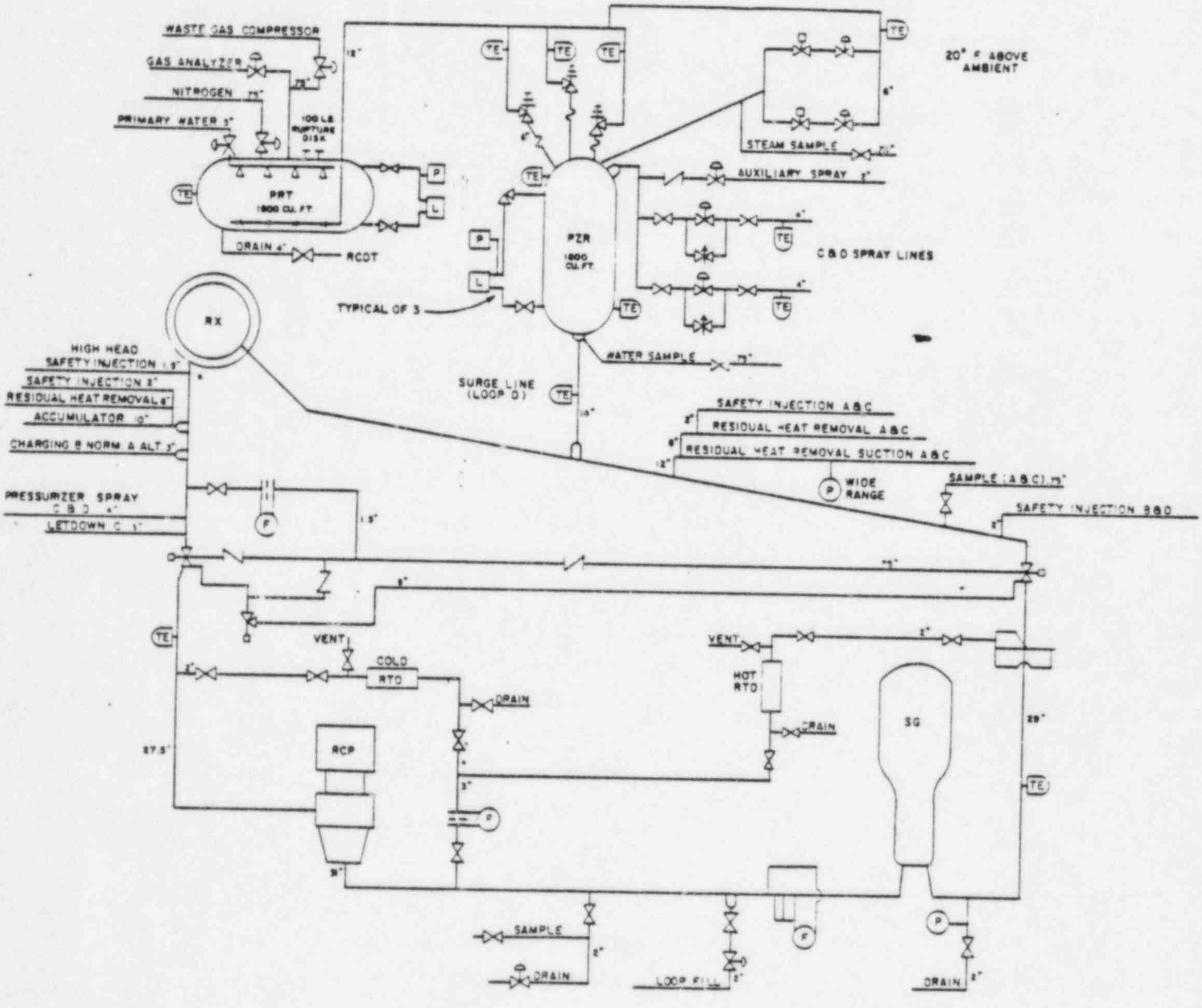

FIGURE 1 REACTOR COOLANT LOOP

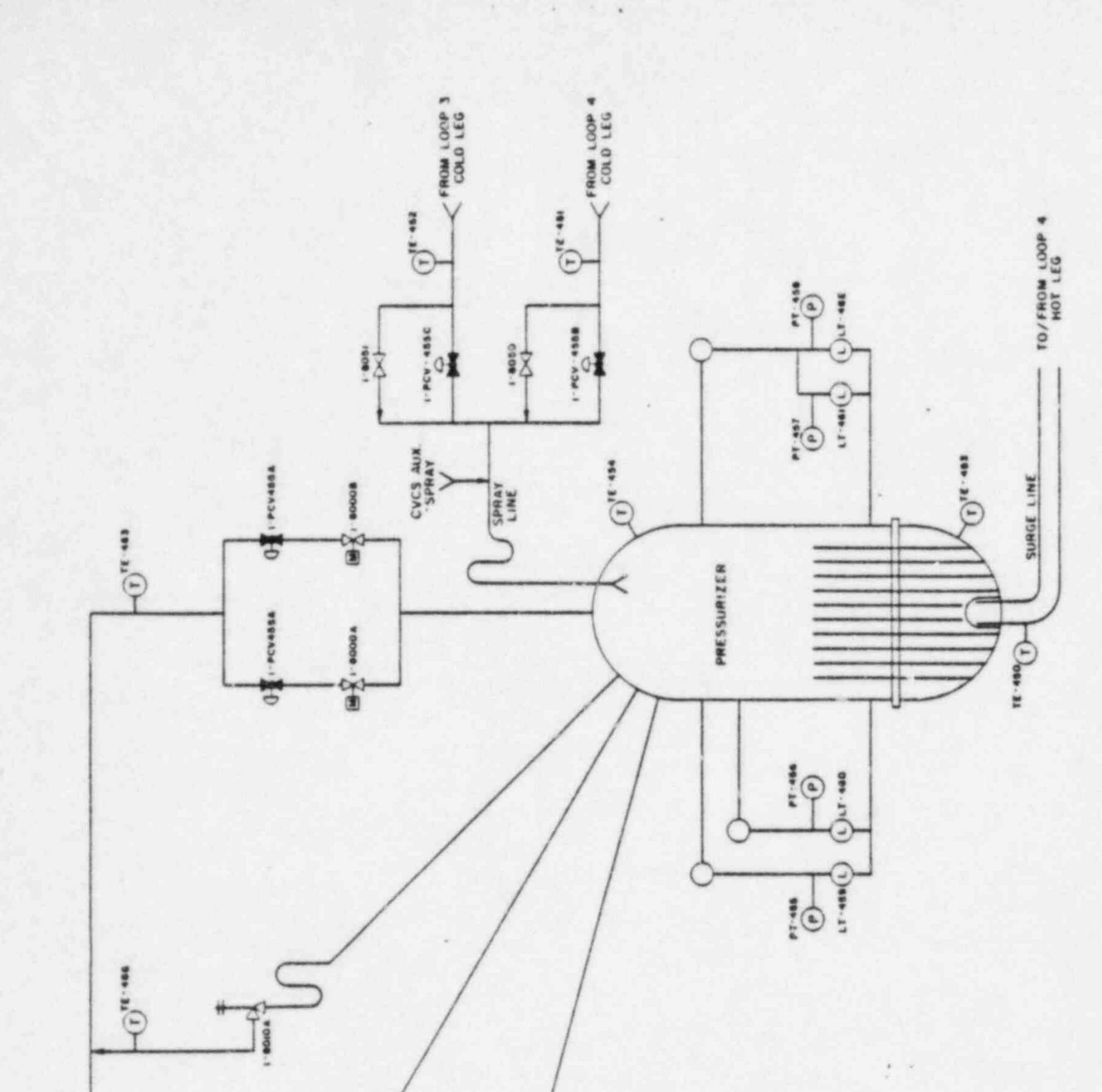

FIGURE 2 PRESSURIZER SYSTEM

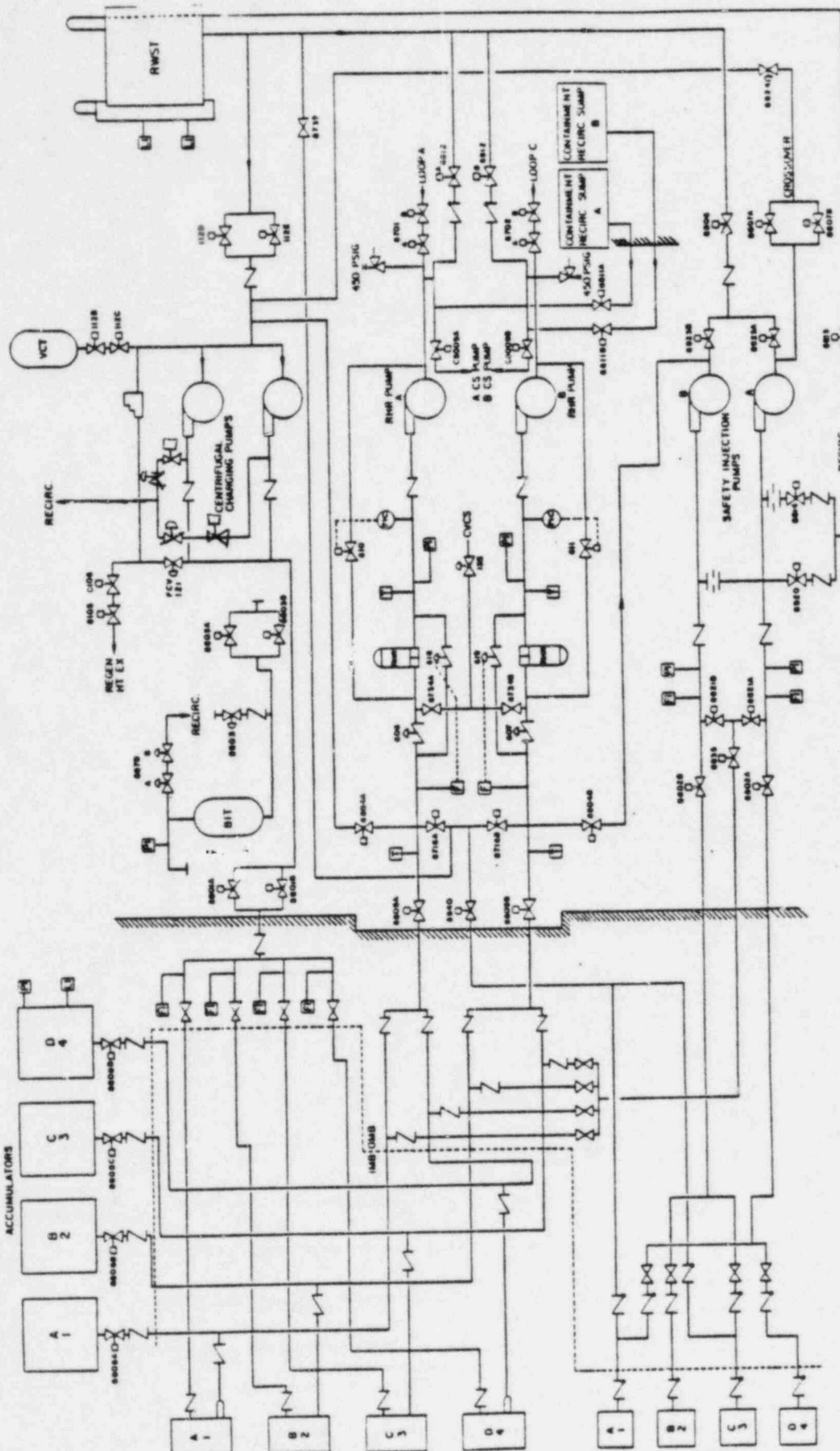

FIGURE 3 EMERGENCY CORE COOLING SYSTEM

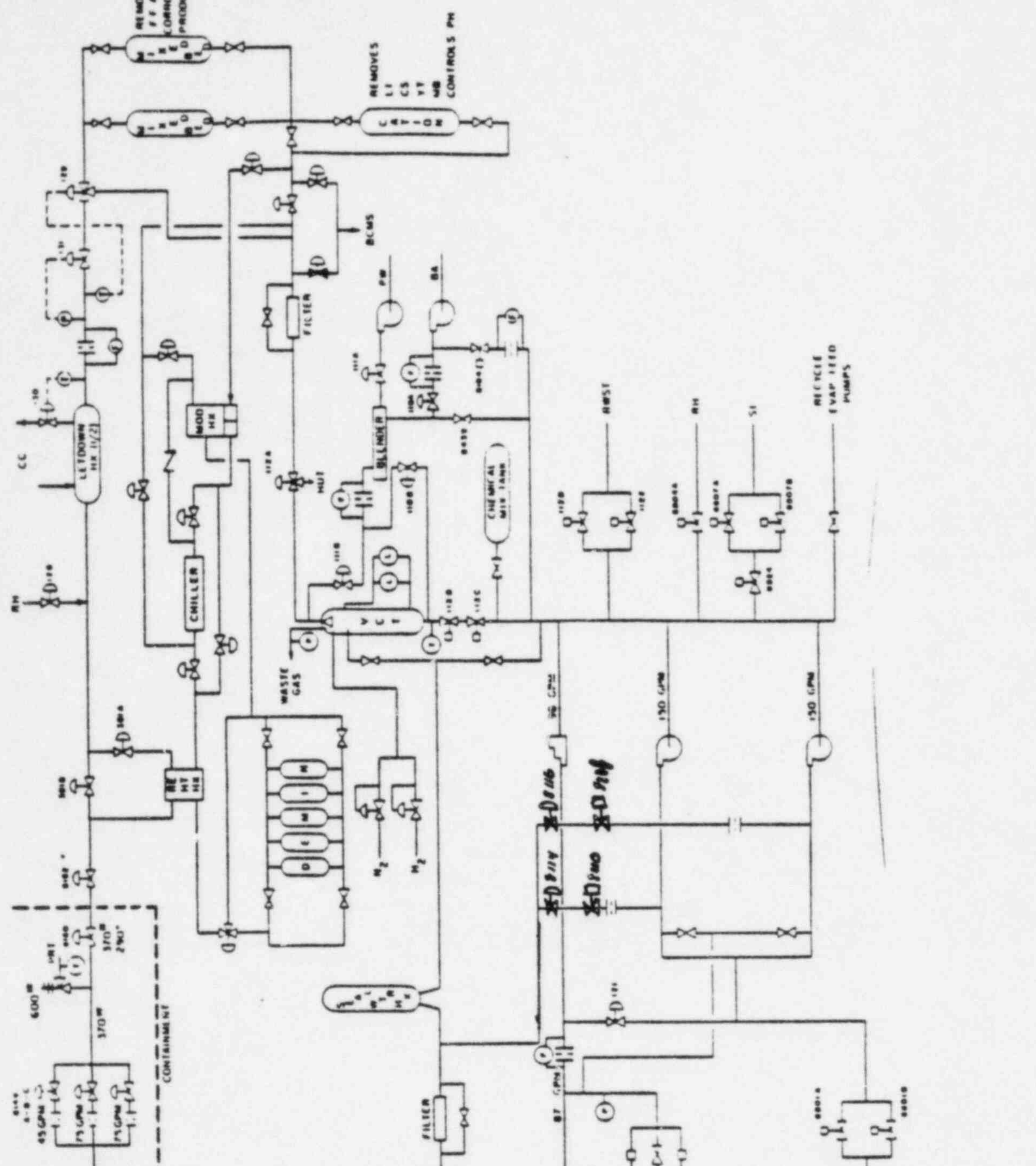

FIGURE 4 CHEMICAL AND VOLUME CONTROL SYSTEM

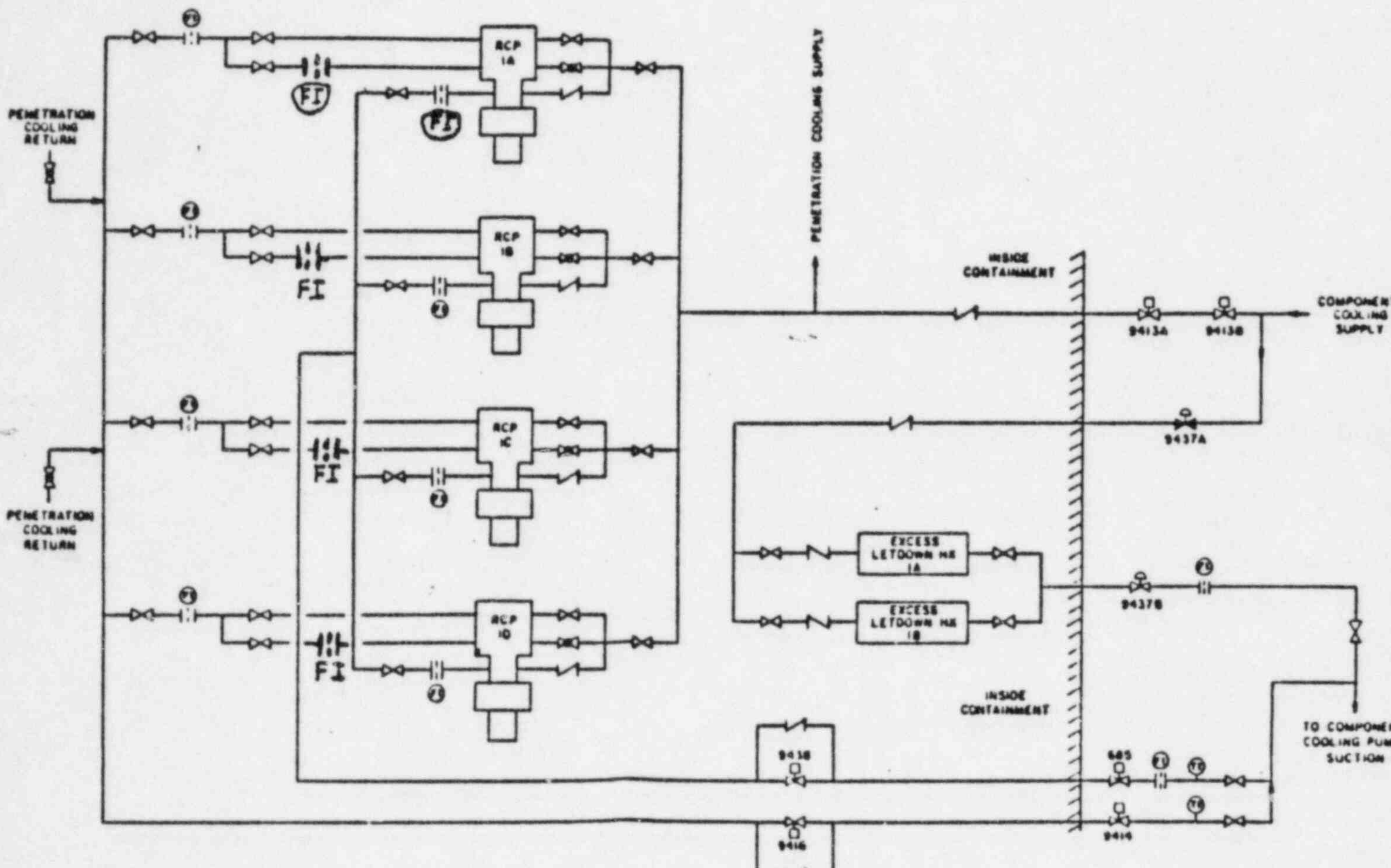

FIGURE 5a COMPONENT COOLING SYSTEM

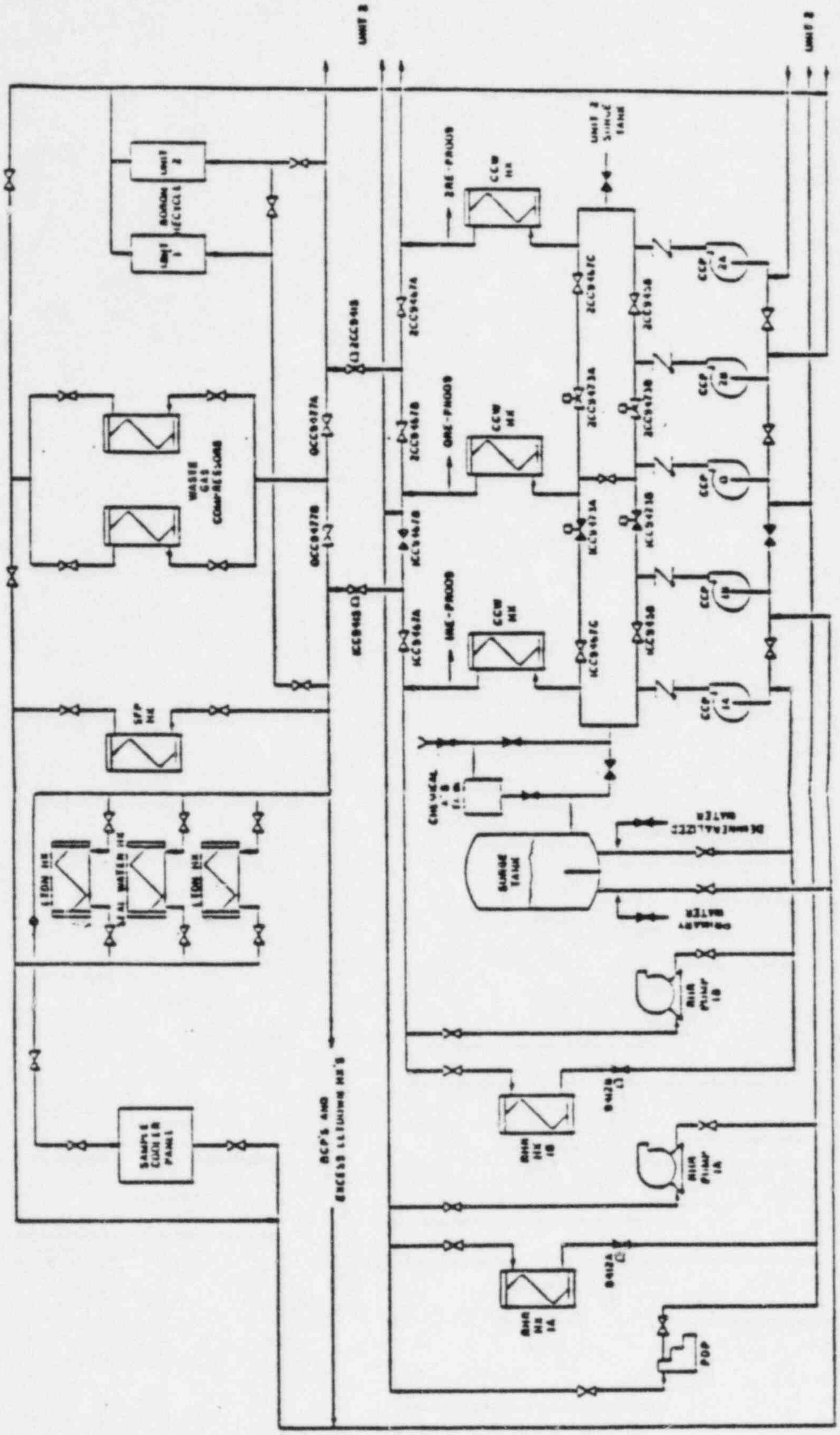

FIGURE 5b COMPONENT COOLING SYSTEM

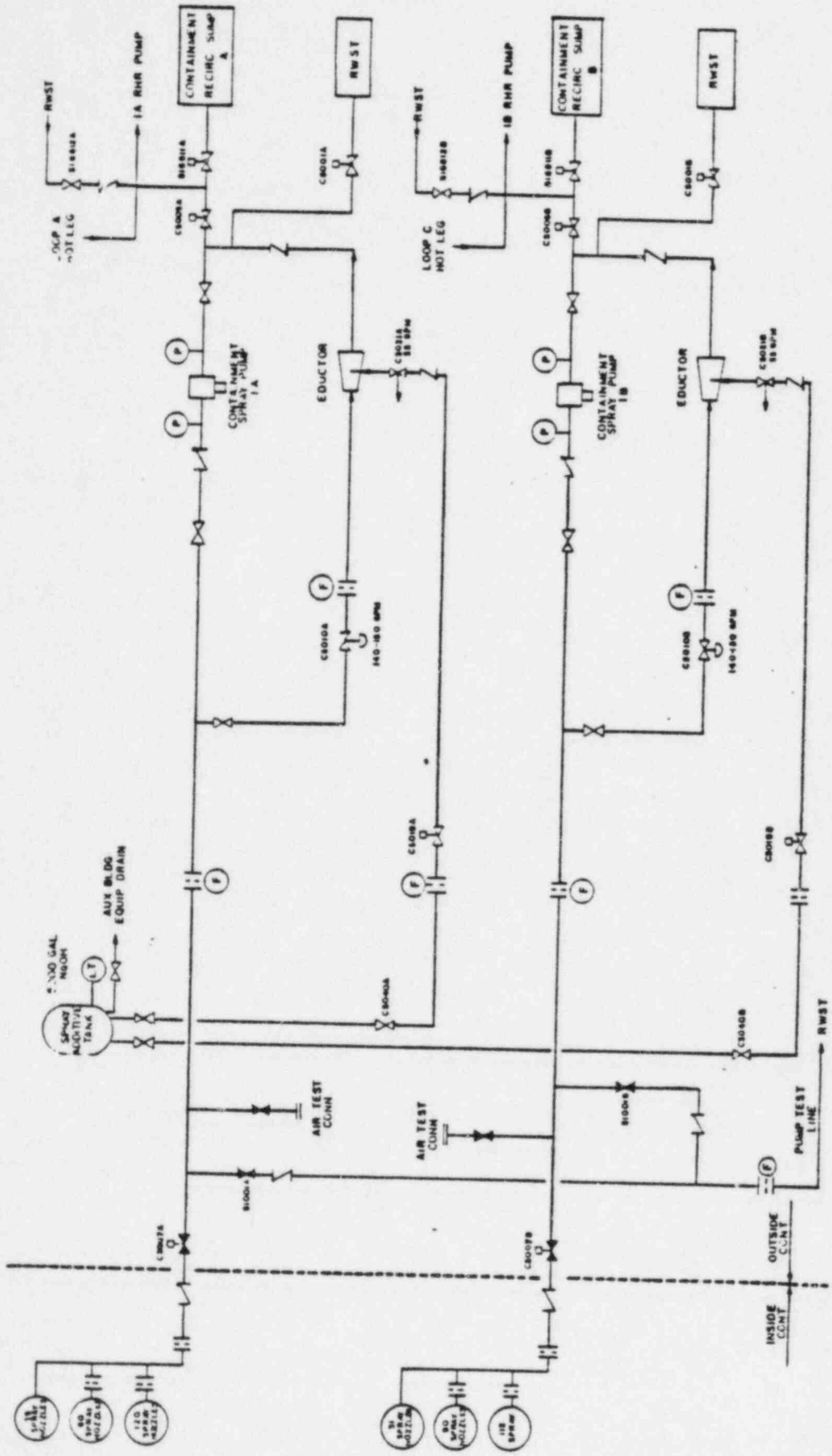

FIGURE 6 CONTAINMENT SPRAY SYSTEM

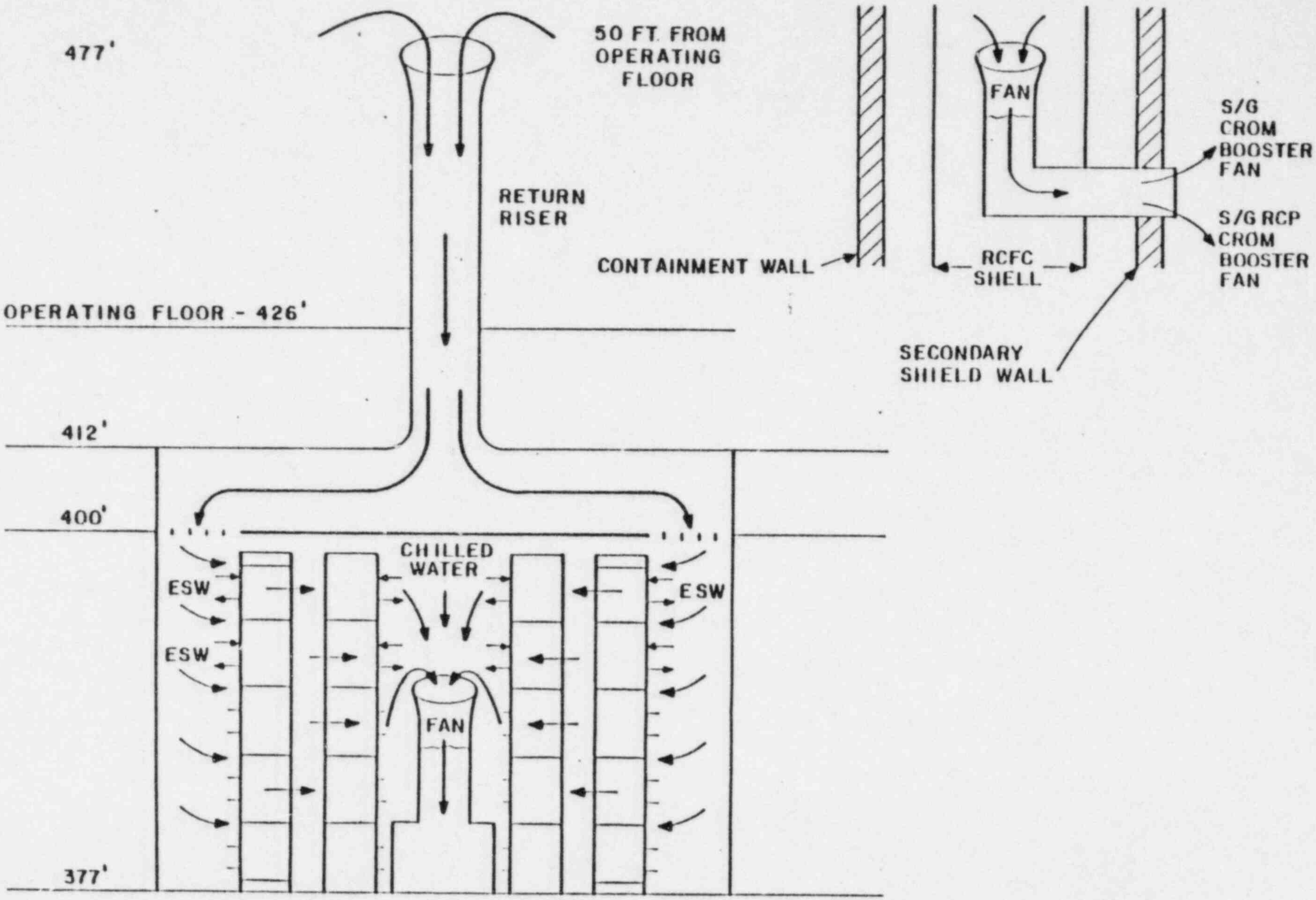

FIGURE 7 REACTOR CONTAINMENT FAN COOLER UNIT

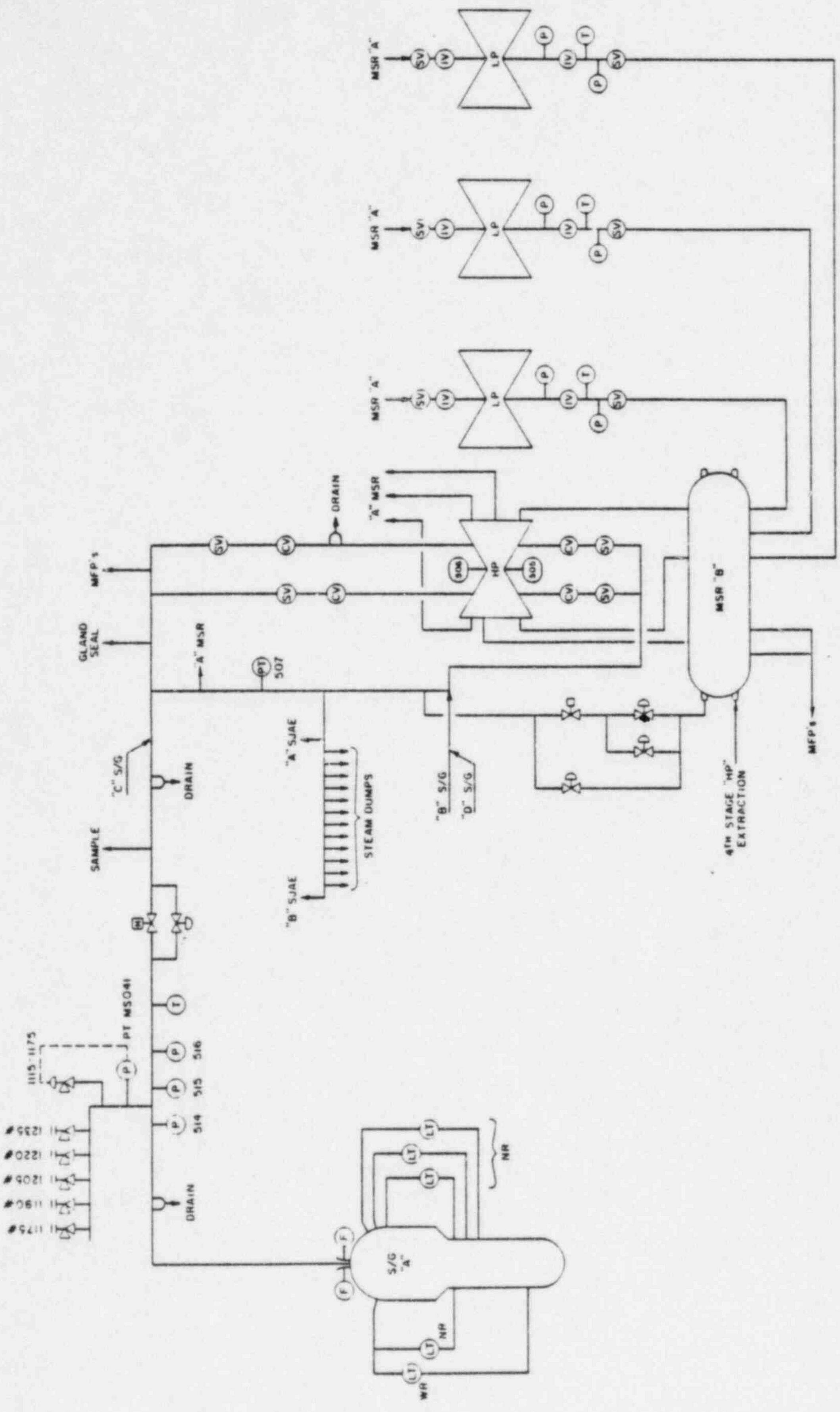

FIGURE 8 MAIN STEAM SYSTEM

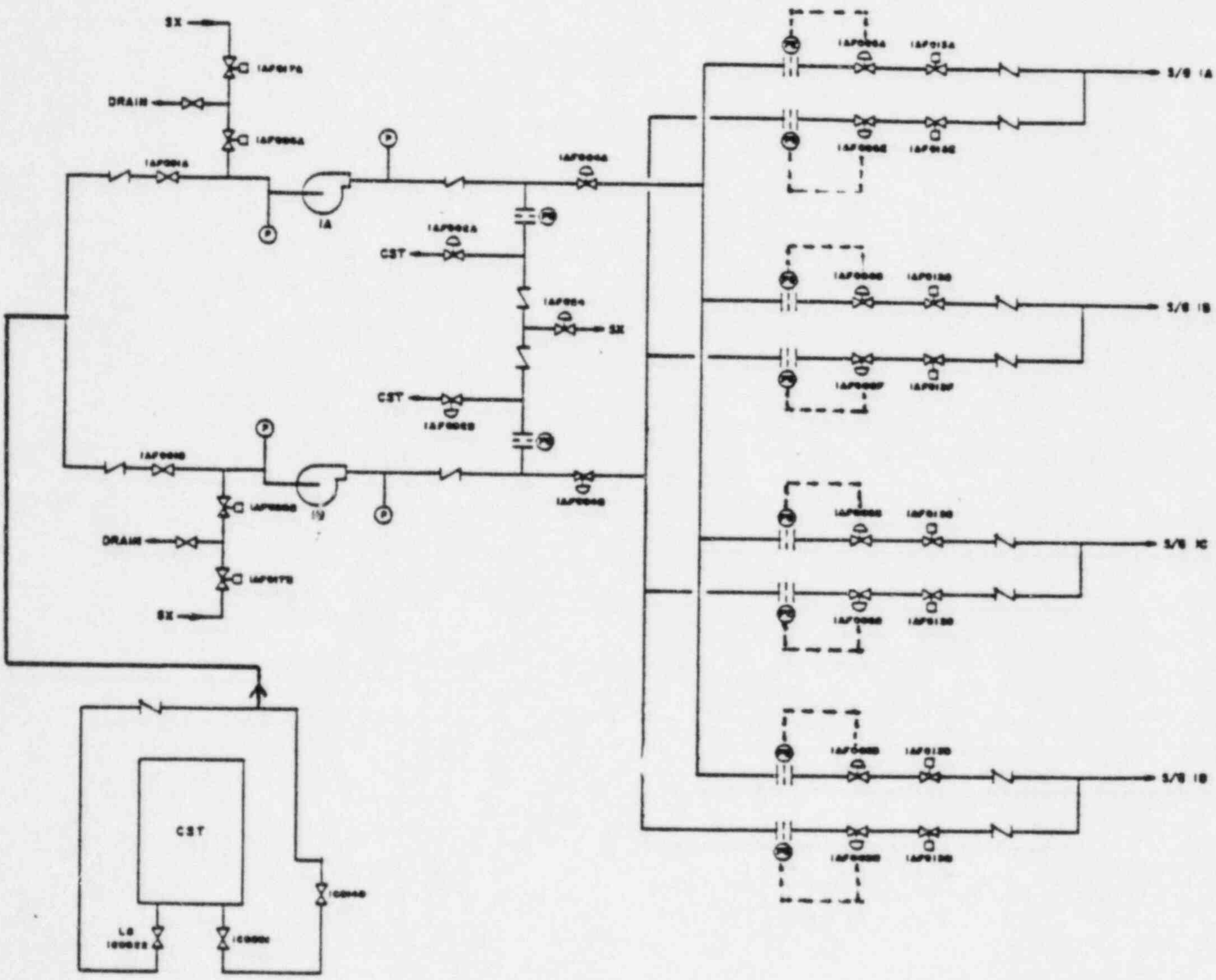

FIGURE 9 AUXILIARY FEEDWATER SYSTEM

TABLE 2

INSTRUMENTATION AND CONTROL REQUIREMENTS

ITEM	REQUIREMENTS I[1]	C[1]
Reactor Trip Actuation System		
Reactor Trip Annunciator	X	-
Reactor Trip and Bypass Breakers	X	-
Reactor Trip Signal	X	X
Turbine Trip Signal	X	X
ESF Actuation System		
SI Annunciator	X	-
SI Signal	X	X
SI Signal Reset/Block	X	X
Low Steamline Pressure SI Actuation Signal Block	X	X
Low PZR Pressure SI Actuation Signal Block	X	X
Containment Isolation Phase A Signal	X	X
Containment Isolation Phase A Signal Reset	X	X
Containment Isolation Phase B Signal Reset	X	X
Feedwater Isolation Signal Reset	X	X
Containment Spray Signal	X	X
Containment Spray Signal Reset	X	X
Main Steamline Isolation Signal	X	X
Nuclear Instrumentation System		
Power Range Neutron Flux	X	-
Intermediate Ragne Neutron Flux	X	-
Intermediate Range Startup Rate	X	-

Notes

(1)

I - Instrumentation requirements column

C - Control requirements column

An "X" entry indicates an instrumentation or control requirement within the scope of the Braidwood plant.

An "-" entry indicates no requirement.

TABLE 2 (Continued)

INSTRUMENTATION AND CONTROL REQUIREMENTS

ITEM	REQUIREMENTS	
Nuclear Instrumentation System (Continued)	I(1)	C(1)
Source Range Neutron Flux	X	-
Source Range Startup Rate	X	-
Neutron Flux Recorder	X	X
Source Range Detectors (Energize)	X	X
Control Rod Instrumentation System		
Control Rod Position	X	-
Control Rod Bottom Lights	X	-
Radiation Instrumentation System		
Containment Radiation	X	-
SG Blowdown Radiation	X	-
Condenser Air Ejector Radiation	X	-
Auxiliary Building Radiation	X	-
SG Steamline Radiation	X	-
Containment Instrumentation System		
Containment Pressure	X	-
Containment Temperature	X	-
Containment Recirculation Sump Level	X	-
Containment Hydrogen Concentration	X	-
Phase A Containment Isolation Valves	X	X
Phase B Containment Isolation Valves	X	X
Containment Ventilation Isolation Valves	X	X
Containment Sump Level (Narrow Range Level)	X	-
Containment Wide Range Level	X	-
Reactor Coolant System	I(1)	C(1)
RCS Pressure	X	-
PZR Pressure	X	-
RCS Hot Leg Wide Range Temperature	X	-
RCS Cold Leg Wide Range Temperature	X	-
RCS Average Temperature	X	-
Core Exit TC Temperature	X	-
PZR Water Temperature	X	-
PZR Level	X	-
Reactor Vessel Liquid Inventory System (RVLIS)	X	-
Reactor Coolant Pumps	X	X
PZR PORVs	X	X
PZR PORV Block Valves	X	X
PZR Spray Valves	X	X
Reactor Vessel Vent Valves	X	X
Pressurizer Heaters	X	X

INSTRUMENTATION AND CONTROL REQUIREMENTS

ITEM	REQUIREMENTS	
Safety Injection System	I(1)	C(1)
Refueling Water Storage Tank (RWST) Level	X	-
Centrifugal Charging Pump SI Flow	X	-
SI Pump Flow	X	-
SI Pumps	X	X
Accumulator Isolation Valves	X	X
Accumulator Vent Valves	X	X
RHR Pump Suction Valves from Containment Recirculation Sump	X	X
RHR Pump Suction Valves from RWST	X	X
RHR Pump Discharge Valves to RCS Hot Legs	X	X
RHR Pump Discharge Valves to RCS Cold Legs	X	X
SI Pump Suction Valves from RWST	X	X
SI Pump Discharge Valves to RCS Hot Legs	X	X
SI Pump Discharge Valves to RCS Cold Legs	X	X
SI Valves	X	X
Residual Heat Removal System	I(1)	C(1)
Low-Head SI (RHR) Flow	X	-
Low-Head SI (RHR) Pumps	X	X
Low-Head SI (RHR) Pump Suction Valves from RCS	X	X
Chemical and Volume Control System		
Boric Acid Tank Temperature	X	-
Charging Flow	X	-
RCP Seal Injection Flow	X	-
Letdown Flow	X	-
RCP Number 1 Seal Leakoff Flow	X	-
RCP Number 1 Seal Differential Pressure	X	-
Centrifugal Charging Pumps	X	X
Positive Displacement Charging Pump	X	X
Charging Pump Suction Valves from RWST	X	X
Charging Pump Suction Valves from VCT	X	X
Charging Line Isolation Valves	X	X
Charging Line Flow Control Valve	X	X
Charging Line Hand Control Valve	X	X
Pressurizer Auxiliary Spray Valve	X	X
RCP Seal Return Outside Containment Isolation Valve	X	X
Letdown Isolation Valves	X	X
Letdown Orifice Isolation Valves	X	X
Low Pressure Letdown Control Valves	X	X
Excess Letdown Isolation Valves	X	X

INSTRUMENTATION AND CONTROL REQUIREMENTS

ITEM	REQUIREMENTS	
Chemical and Volume Control System (Continued)	I[1]	C[1]
VCT Makeup Control System	X	X
VCT Makeup Control System (mode selector)	X	X
Component Cooling Water System		
CC Water Pumps	X	X
RCP Thermal Barrier CC Water Return Inside Containment Isolation Valve	X	X
RCP Thermal Barrier CC Water Return Outside Containment Isolation Valve	X	X
CC Valves	X	X
Essential Service Water System		
Essential Service Water Pumps	X	X
Essential Service Water Valves	X	X
Containment Spray System		
Containment Spray Pumps	X	X
Containment Spray Valves	X	X
Containment Atmosphere Control System	I[1]	C[1]
Containment Ventilation Isolation Valves	X	X
Containment Fan Coolers (provide containment heat removal, air circulation, and filtration)	X	X
Hydrogen Recombiners (local control only)	X	X
Main Steam System		
SG Pressure	X	-
SG Narrow Range Level	X	-
SG Wide Range Level	X	-
SG PORVs	X	X
Condenser Steam Dump Valves	X	X
Main Steamline Isolation Valves	X	X
Main Steamline Isolation Bypass Valves	X	X
Turbine Stop Valves	X	-
Main Feedwater and Condensate System		
FW Regulating Valves	X	X
FW Regulating Bypass Valves	X	X
FW MOV Isolation Valves	X	X

INSTRUMENTATION AND CONTROL REQUIREMENTS

ITEM	REQUIREMENTS	
Auxiliary Feedwater System	I(1)	C(1)
Auxiliary Feedwater Flow	X	-
Condensate Storage Tank Level	X	-
AF Pumps	X	X
Condensate Storage Tank to Hotwell Isolation Valves (local indication and control only)	X	X
AF Valves	X	X
Steam Generator Blowdown System		
SG Blowdown Isolation Valves	X	X
Sampling System		
SG Blowdown Sample Isolation Valves	X	X
Spent Fuel Storage and Cooling System		
Spent Fuel Pit Level	X	-
Control Rod Drive Mechanism Cooling System		
Control Rod Drive Mechanism Fans	X	X
Control Rod Control System	I(1)	C(1)
Control Rods	X	X
Turbine Control System		
Turbine Runback	X	X
Electric Power System		
Diesel-Generators	X	X
Pneumatic Power System		
Instrument Air Compressors	X	X
Instrument Air Valves	X	X

PROCEDURES GENERATION PACKAGE
ATTACHMENT B
BRAIDWOOD STATION UNIT 1
INSTRUMENTATION DESCRIPTION

March 5, 1985

TABLE OF CONTENTS

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A

1. INTRODUCTION

Of utmost importance to the operator in implementing the Emergency Operating Procedures (EOPs) is the availability of pertinent plant instrumentation. This document identifies and describes the key Braidwood plant instrumentation that is necessary for the operator to effectively detect, diagnose and mitigate postulated accidents. Furthermore, this document discusses the backup plant instrumentation which supplements the key instrumentation and supports operator action to recover the plant. The format and section numbering of this document is similar to the Westinghouse Emergency Response Guideline (ERG) Generic Instrumentation document. This approach will aid the plant personnel writing EOPs from ERGs and the regulatory personnel who perform the review of the Braidwood EOPs.

Throughout this document, when Braidwood instrumentation is the same as the generic instrumentation, the generic description was inserted from the Generic Instrumentation document of the ERGs. For instrumentation which is different, the sections were rewritten or minor revisions were made as appropriate. In all cases, when the Braidwood document differs from the generic document, a line was drawn the right-hand margin to indicate the difference from the generic document.

2. DESCRIPTION

This section provides a description of the Braidwood instrumentation to be used in performing the Emergency Operating Procedures. The information is contained in the following two subsections.

2.1 Key Plant Instrumentation

This subsection identifies the key instrumentation that is available for developing the EOPs for the Braidwood plant design. In particular, the instrumentation is identified that monitors those plant variables which provide the primary information required to permit the control room operating staff to:

a. Perform the diagnosis specified in the EOPs for design basis accidents;

b. Perform the specified pre-planned manual actions, for which no automatic control is provided, that are required for safety systems to accomplish their safety function for mitigation of design basis accidents; and

c. Achieve and maintain a safe shutdown condition for design basis accidents.

In addition, the instrumentation is identified that monitors those plant variables that provide information to assess the status of the plant Critical Safety Functions, i.e., Subcriticality, Core Cooling, Heat Sink, Integrity, Containment, and Inventory.

This instrumentation is generally redundant (or diverse), electrically independent, powered from safeguards electrical busses, immediately accessible to the operator and has at least one channel of each variable recorded. This instrumentation is, in general, environmentally qualified.

A brief description of the key instrumentation to be used in the EOPs is provided below.

RCS Pressure

The reactor coolant system (RCS) has two wide range pressure transmitters connected to the residual heat removal (RHR) hot leg suction lines. The range of these channels is 0 to 3000 psig. This instrumentation is subject to adverse containment conditions.

The detector layout is shown in Figure 1.

RCS Hot and Cold Leg Temperature

Each RCS hot and cold leg has a deep well RTD to monitor wide range RCS temperature. The range of these channels is 0 to 700°F. Trending of temperatures is necessary for monitoring RCS natural circulation and cooldown rates. The instrumentation is not subject to adverse containment conditions and is environmentally qualified.

The detector layout is shown in Figure 1.

Reactor Vessel Level

A Reactor Vessel Liquid Inventory System (RLVIS) is used to measure level. The RVLIS system consist of eight (8) heated junction thermocouples (HJTC) sensors. The sensors are electrically independent and located at eight levels from the reactor vessel head to the upper core plate.

Two sensors are located in the upper head region and six sensors are located in the upper plenum region.

One of the upper head sensors is located at the top of the vessel head (sensor 1). The other is located just above the upper internals support plate which separates the upper head region from the upper plenum region.

The six sensors in the upper plenum region are used to provide more detail information on RCS inventory. These locations include the top of the upper plenum region (sensor 3), midpoint region (sensor 4), top of the hot leg elevation (sensor 5), hot leg midpoint (sensor 6) and bottom of the hot leg elevation (sensor 7). The remaining location is just above the upper core plate (sensor 8).

Main control board readout (digital) provides discrete vessel level from 0% (sensor 8) to 100% (sensor 3) for upper plenum region and 0% (sensor 2) to 100% (sensor 1) for upper head region.

The RVLIS layout and indication is shown in Figure 2a & b.

Steam Generator Narrow Range Water Level

Each steam generator has four channels of a narrow range delta P measurement system. The range of the narrow range measurement channels is 0 to 100 percent of span. The narrow range instruments are hot calibrated and provide level indications in the steam generator between the U-tubes and the secondary moisture separators. This instrumentation is not qualified for adverse containment conditions. When determining the level values for the BwEOPs, the values must be compensated for errors attributed to calibration conditions. The location of the level measurement system taps is shown in Figure 3.

Steam Generator Wide Range Water Level

Each steam generator has one wide range delta P measurement system. The wide range instruments are cold calibrated (ambient containment conditions, depressurized steam generator and secondary inventory at containment temperature conditions). They are used for monitoring steam generator water level during normal and adverse containment conditions, and for performing steam generator "wet layup" following plant shutdown. The instrument provides level indication in the steam generator between the tubesheet and the secondary moisture separators. This instrument is subject to adverse containment conditions and will be environmentally qualified.

When determining the level values for the BwEOPs the values must be compensated for errors attributed to calibration conditions and reference leg heatup effects.

The location of the level measurement system taps is shown in Figure 3.

Pressurizer Pressure

Four pressure transmitters are connected to the pressurizer. The range of the channels is 1700 to 2500 psig.

The detector layout is shown in Figure 4.

Pressurizer Level

The pressurizer has three channels of a delta P level measurement system. The instruments provide level indications for approximately the total height of the pressurizer. The range of the measurement system is 0 to 100 percent of span. This instrumentation is subject to adverse containment conditions and will be environmentally qualified. When determining the level values for the BwEOPs, the values must be compensated for errors attributed to the calibration conditions and reference leg heatup effects.

The location of the level measurement system taps is shown in Figure 4.

Steam Generator Pressure

Each steam generator has three pressure transmitters located in its main steamline upstream of the main steamline isolation valve. This instrumentation is not subject to adverse containment conditions. These pressure transmitters are located outside containment in the steam tunnel area. The range of these instruments is 0 to 1300 psig.

The location of the steamline pressure transmitter taps is shown in Figure 5 for Braidwood Unit 1 plant.

Core Exit Temperature

Core exit thermocouple temperatures are necessary for providing an indication of inadequate core cooling and an input in the determination of RCS subcooling. Several of the thermocouples are located to monitor the most probable highest temperature area of the core. Also, several of the core exit thermocouples are located in the vicinity of the vessel hot leg nozzle outlets. This instrumentation is subject to adverse containment conditions.

The range of the core exit thermocouple temperature readout is from plant cold shutdown conditions to the maximum core temperature following a design basis LOCA. The readout range is 35°F to 2300°F.

The core exit thermocouples layout and indication is shown in Figure 2a & b.

RCS Subcooling

RCS subcooling can either be computed manually using a steam table or using a computer based algorithm. The computer uses a pressure input supplied by pressurizer pressure above 1750 psig and RCS wide range pressure below 1750 psig. The temperature input that is used in the computation is the average of the ten highest core exit thermocouple temperatures. The instrumentation inputs to the RCS subcooling calculation are subject to adverse containment conditions. Furthermore, subcooling uncertainty increases as RCS pressure decreases.

The RCS Subcooling instrumentation layout and indication is shown in Figure 2a & b.

Auxiliary Feedwater Flow

The two auxiliary feedwater supply lines to each steam generator has an auxiliary feedwater flow measurement indicated in the control room. The range of the measurement system is 0-250 gpm. Total auxiliary feedwater flow to all steam generators is determined by adding the auxiliary flow to each of the steam generators.

RWST Level

Two channels of a delta P measurement system are available to monitor the refueling water storage tank (RWST) level. The instruments provide level indications for the minimum required water supply to the charging, SI and RHR pumps following a LOCA and key the switchover from the injection to the cold leg recirculation mode. The range of the measurement system is 0 to 100 percent.

CST Level

One channel of a delta P measurement system is available to monitor the level in each condensate storage tank (CST) that provides the normal water source to the auxiliary feedwater pumps. The instruments provide level indications for the minimum required water supply for the auxiliary feedwater system. The range of the measurement system is 0 to 100 percent of span.

Containment Pressure

Six channels of containment pressure are available to monitor the containment. The instruments extend over the range from normal condition containment pressure to containment design pressure. For Braidwood containment, this range is 0 to 60 psig for 4 of the channels, and -5 to 200 psig for the other two channels.

Containment Water Level

Three ranges with two channels per range are available to monitor water level in the containment building. The narrow range containment sump level instrument indicates level from 0 to 100 inches in the containment sump. Wide range containment level overlaps the narrow range and indicates level from 0 to 100 inches. Containment recirculation sump level is indicated by incremental lights on the control board up to 150 inches in the recirculation sump. Containment recirculation sump channels or wide range containment level indicate whether sufficient water level is available for the recirculation mode of SI. The two wide range channels are used to indicate containment flood level. Figure 6 shows containment water level ranges.

Containment Radiation Level

Two radiation detectors are available for containment radiation monitoring. The radiation monitors are capable of providing an indication of radiation levels from background levels to design basis accident dose levels. Both monitors indicate from 10 to 10^8 R/hr. An additional radiation detector is installed to increase the sensitivity at the lower radiation levels.

Secondary Radiation Level

Three monitors exist for detecting secondary radiation levels. One main steamline radiation monitor per steam generator is located upstream of each MSIV. The range of these monitors is 0.1 to 10^4 Mr/hr. The condenser steam jet air ejectors are monitored by the off-gas radiation monitor. The blowdown from all four steam generators is sequentially sampled and monitored by the blowdown radiation monitor. The range for the off-gas and blowdown monitors is 10 to 10^7 CPM. The secondary radiation monitors provide an indication of radiation levels from normal operation with maximum Technical Specification leakage, to the level expected following a design basis steam generator tube rupture.

Neutron Flux

Two channels of instrumentation are available to monitor core neutron flux. The instrumentation is capable of monitoring neutron flux from source range levels to the maximum expected core return to power levels due to excessive RCS cooldown. Several installed instruments are capable of monitoring the required range. These include the source, intermediate, and power range detectors.

2.2 Backup Plant Instrumentation

In addition to the instrumentation identified in subsection 2.1 that is required for the control room operating staff to: 1) perform event diagnosis; b) take specified pre-planned manually controlled actions; c) achieve and maintain a safe shutdown condition; and d) monitor the plant critical safety functions, other instrumentation is available to permit the operator to:

a. operate plant safety systems employed for mitigating the consequences of an accident and subsequent plant recovery to attain a safe shutdown condition, including verification of the automatic actuation of safety systems;

b. operate other systems normally employed for attaining a safe shutdown condition.

The instrumentation that provides this plant information to the operator is generally not required to meet as stringent design, qualification and display requirements as the instrumentation discussed in subsection 2.1. For example, this instrumentation is not required to be redundant, and is not needed to be either accessible on demand or recorded.

Refer to Section 3 of the BRAIDWOOD STATION PLANT DESCRIPTION document for a listing of key and backup Braidwood plant instrumentation used in developing the BwEOPs.

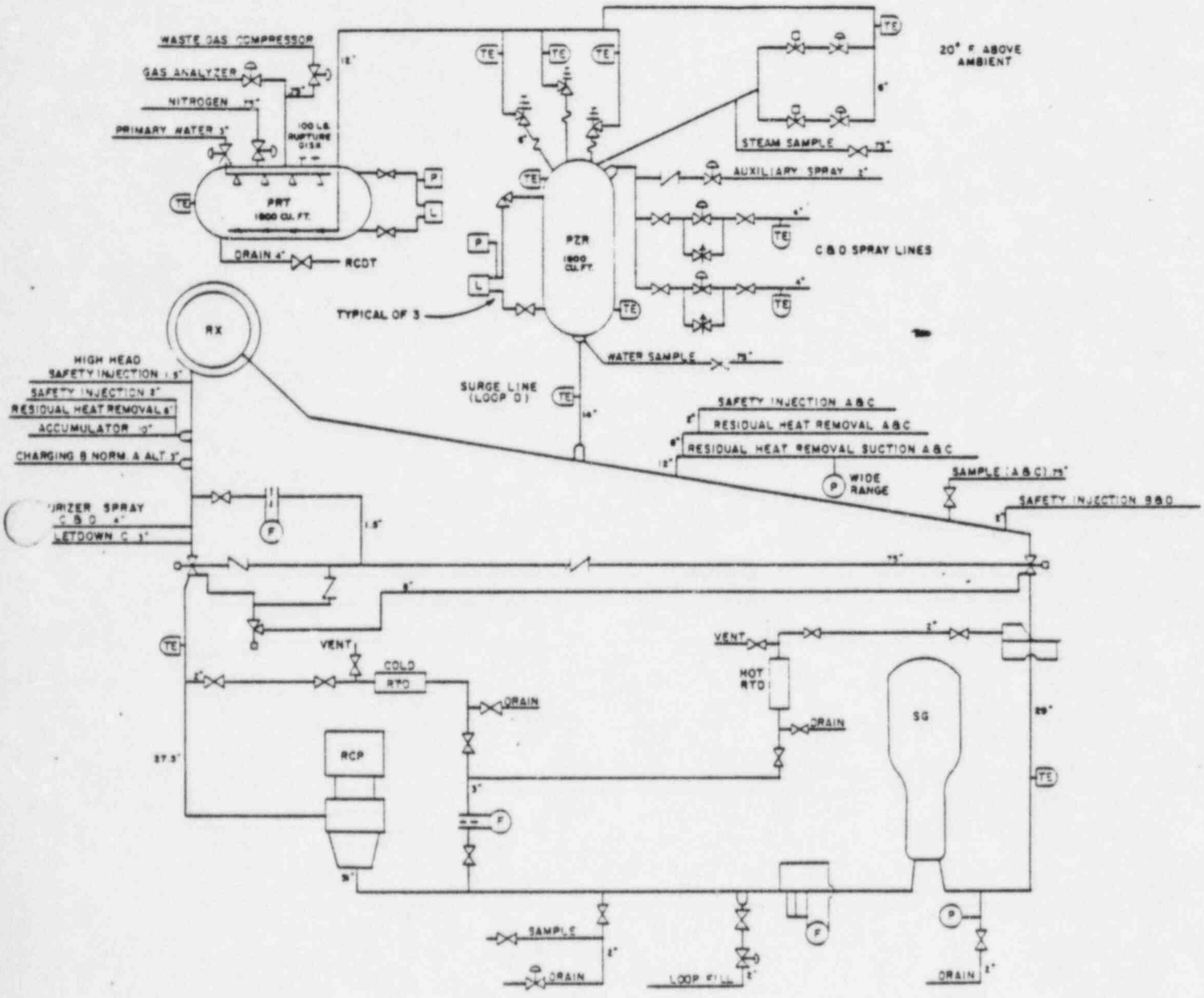
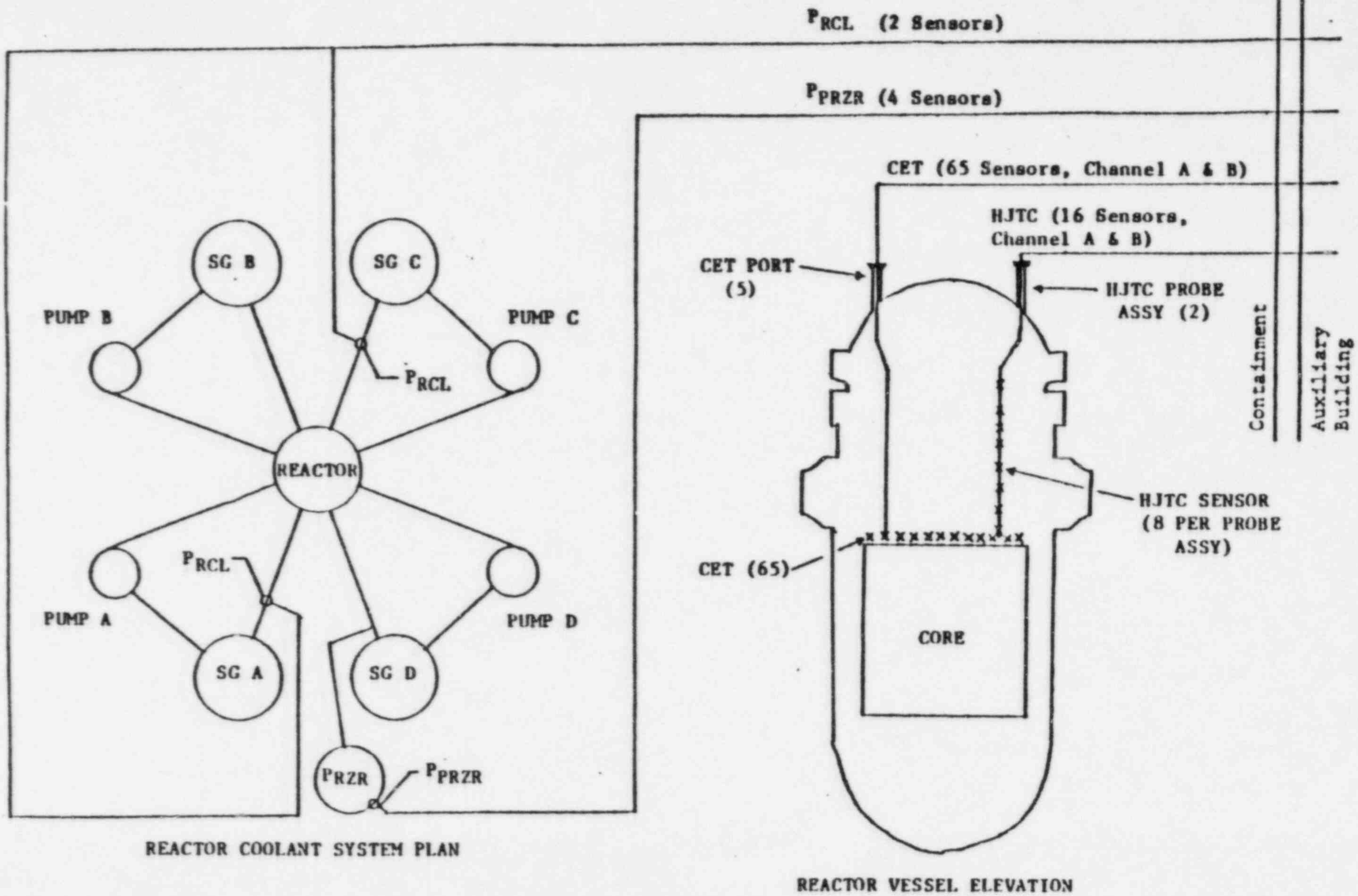


FIGURE 1 RCS INSTRUMENTATION LOCATIONS

(0660M)

(0660M)

FIGURE 2a ICC DETECTION INSTRUMENTATION SENSORS, PROCESSING AND DISPLAY



ICC DETECTION INSTRUMENTATION SENSORS, PROCESSING AND DISPLAY 1

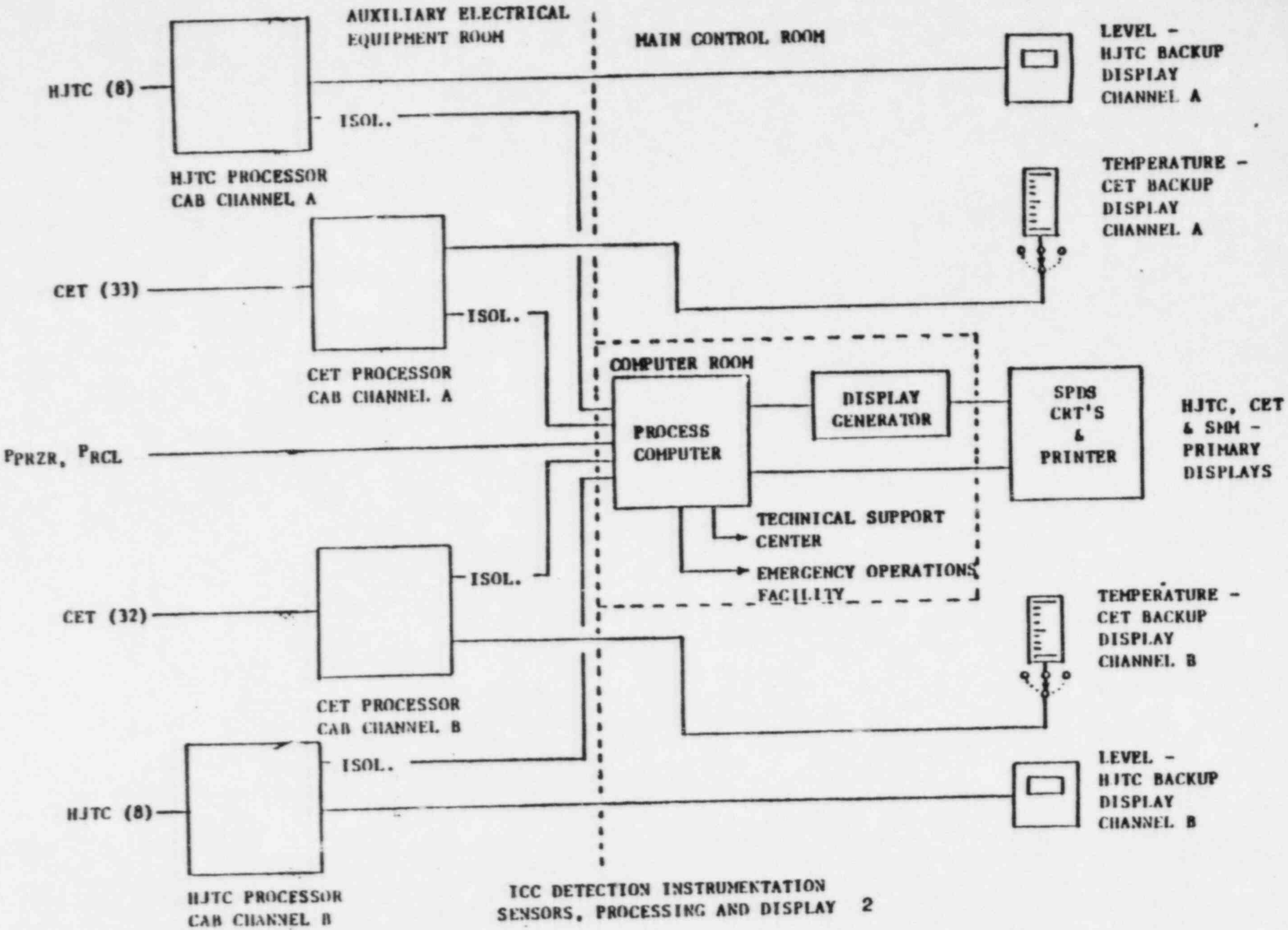


FIGURE 2b ICC DETECTION INSTRUMENTATION SENSORS,
PROCESSING AND DISPLAY

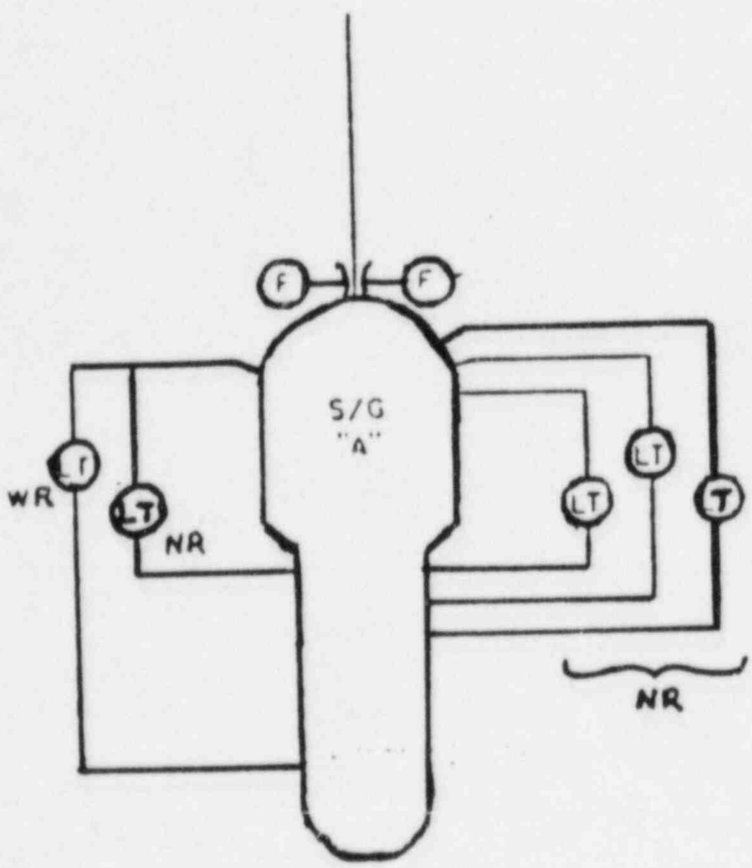


FIGURE 3 STEAM GENERATOR LEVEL MEASUREMENT SYSTEM LAYOUT

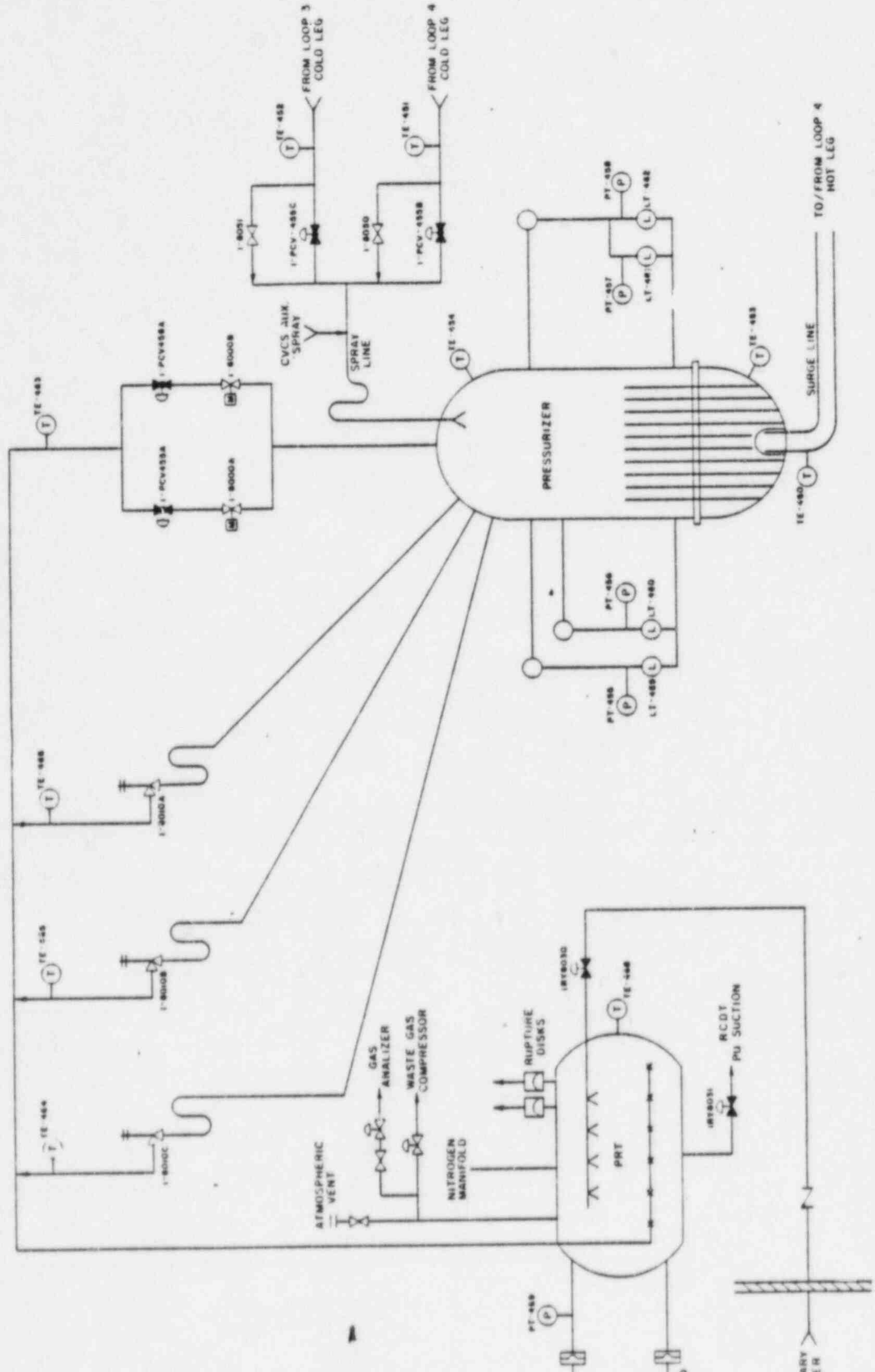


FIGURE 4 PRESSURIZER INSTRUMENT SYSTEM LAYOUT

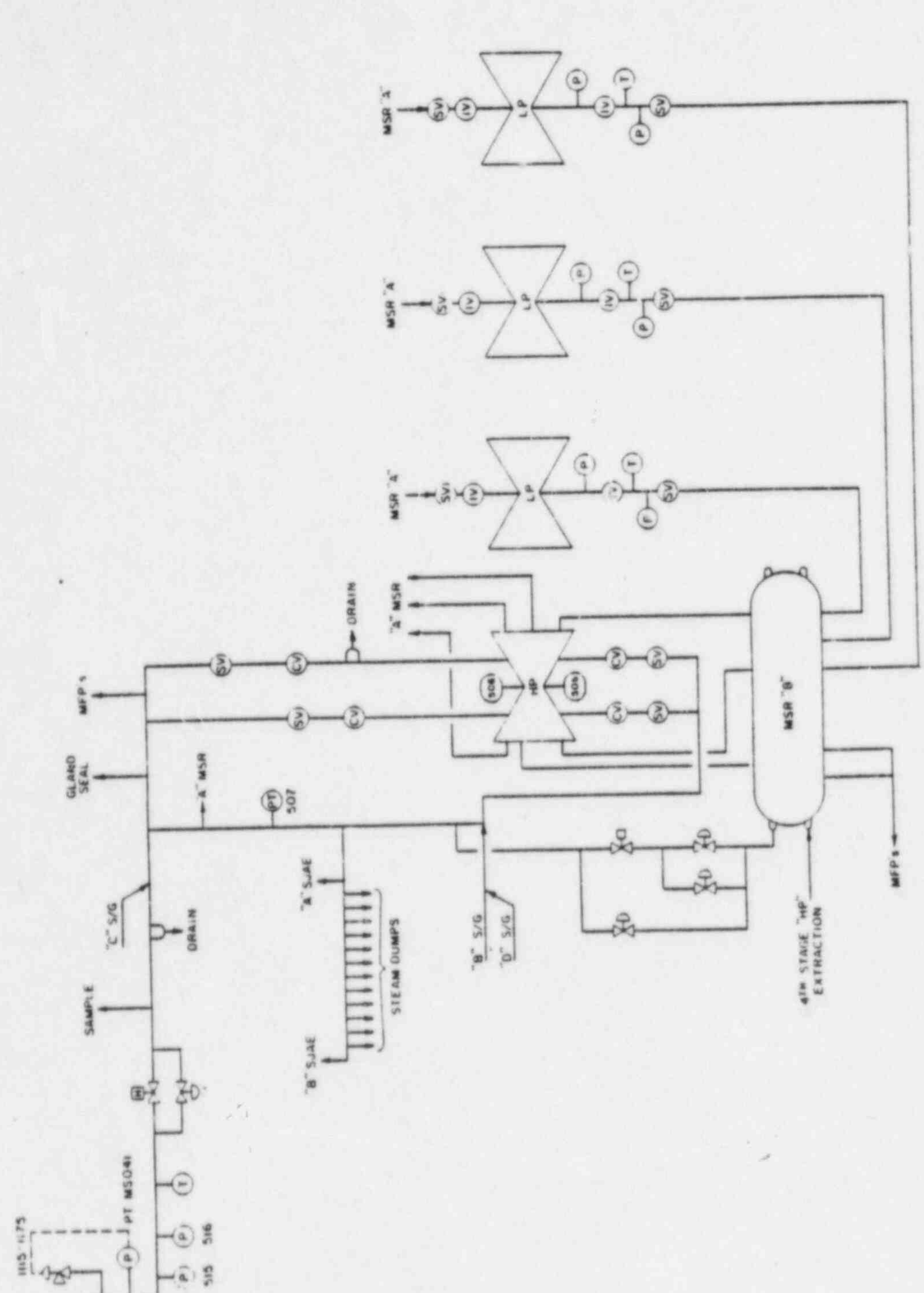


FIGURE 5 MAIN STEAM SYSTEM

CONTAINMENT WATER LEVEL INDICATORS

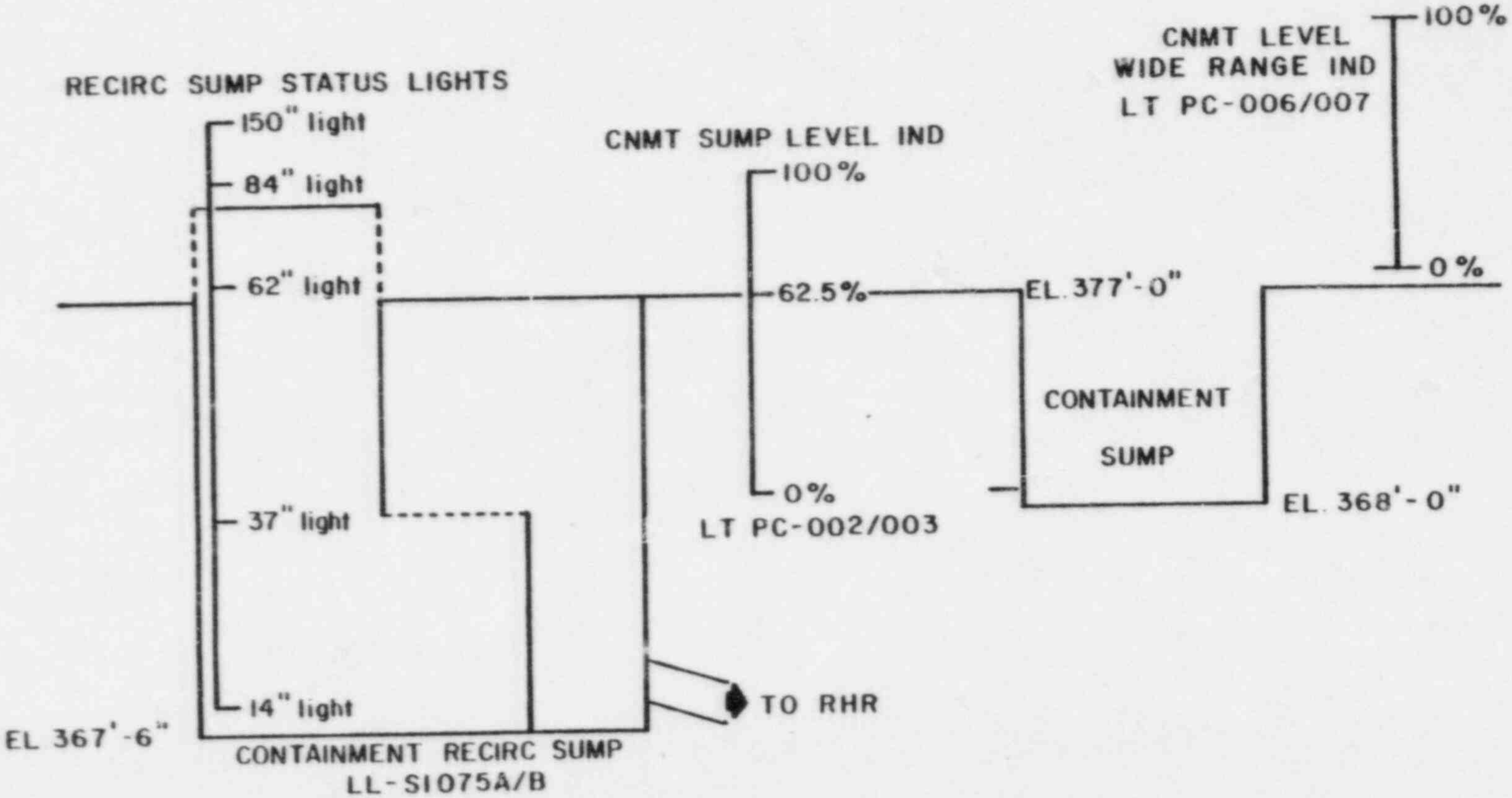


FIGURE 6 CONTAINMENT WATER LEVEL INDICATION

BRAIDWOOD STATION UNIT 1
PROCEDURES GENERATION PACKAGE
ATTACHMENT C
JUSTIFICATION FOR SIGNIFICANT DEVIATIONS BETWEEN
BRAIDWOOD STATION UNIT 1 AND REFERENCE PLANT

March 5, 1985

ATTACHMENT C
JUSTIFICATION FOR SIGNIFICANT DEVIATIONS BETWEEN
BRAIDWOOD STATION UNIT 1 AND REFERENCE PLANT

A. INTRODUCTION

This document summarizes the significant differences between the generic reference plant described in the Westinghouse Emergency Response Guidelines (ERGs) and Braidwood Station Unit 1. The Braidwood Station Unit 1 Plant Description, Attachment A, was developed using the ERG Reference Plant Description as a model. The format of these two documents is similar to aid in comparison. The same approach has been taken for the Braidwood Station Instrumentation Description, Attachment B. This summary explains the differences between the generic reference plant and the Braidwood Station Unit 1 plant. The summary includes explanation of how the plant differences will affect the development of Braidwood plant-specific EOPs from Westinghouse ERGs.

B. PLANT DESCRIPTION

All significant differences between the generic reference plant and the Braidwood plant (as described in Attachment A) are itemized and explained in the following section. The words within the parentheses next to each item refers to the location(s) of the item in the Braidwood Station Plant Description (Attachment A).

1. Safety Injection Signal

   a. (Section 2.2) At Braidwood Station, when an SI signal is actuated, both AFW pumps (motor and diesel driven) automatically start. However, the auxiliary feedwater start signal does not actuate closure of steam generator blowdown isolation and sample valves as occurs in the reference plant. In addition, an SI signal automatically start Essential Service Water System pump which are safety related pumps.

   b. (Section 2.2) An SI also actuates the Control Room Ventilation System. This feature is not present in the reference plant. This system is utilized to clean the incoming air of gaseous iodine and particulates which are potentially present in incoming air following an accident.

2. Auxiliary Feedwater Pump Start Signal

   a. (Section 2.2) At Braidwood Station the motor-driven AFW pump does not receive a start signal upon a trip of the main FW pumps, as is the case for the reference plant. Upon loss of main feedwater, both AFW pumps start on Low-Low level on 2/4 channels in any steam generator. The Braidwood AFW system thus satisfies its functional requirement to provide AFW flow to the steam generators (SGs) in the case of a trip of all main feedwater pumps.

b. (Section 2.2) Blowdown isolation and sample valves do not close on an AFW start signal at Braidwood. The blowdown and sample systems will be available unless a Safety Injection signal occurs. This allows Braidwood to utilize these systems after a Reactor Trip with no SI. Since SG blowdown isolation and sample valves actuate closed on an SI signal, the AFW pumps will meet the same functional requirements under emergency conditions as the reference plant will.

3. Main Feedwater Isolation Signal

a. (Section 2.2) Braidwood Station Unit 1 steam generators are provided with several water hammer prevention features. These features are provided to minimize the possibility of various water hammer phenomenens in the steam generator preheater, steam generator main feedwater inlet piping and the steam generator upper nozzle feedwater piping. Therefore, several additional valves are provided with automatic closure on a main feedwater isolation signal. These valves are main feedwater tempering flow control valves, main feedwater tempering isolation valves, main feedwater preheater bypass isolation valves and main feedwater isolation valves bypass valves.

4. Containment Instrumentation System

a. (Section 2.6 and Table 2) In addition to the features described for the reference plant, Braidwood Station also has instrumentation in the control room to monitor containment hydrogen concentration, and narrow range (containment sump) and wide range containment level. This additional instrumentation will be utilized when necessary to monitor for explosive gaseous mixtures inside containment and to determine if the containment flood level is reached.

5. Safety Injection System

a. (Section 2.8) Closure of the miniflow isolation valves 8110 and 8111 prior to recirculation from the containment sump avoids the necessity of upgrading the design/operating pressure of the miniflow loop to withstand the higher pressures which can result if the charging suction is boosted by the low head SI pumps with the miniflow open. The miniflows can be closed at this time because charging pump deadheading is no longer a concern by the time the RWST has been exhausted.

b. (Section 2.8) The Safety Injection System at Braidwood Station Unit 1 does not use a Boron Injection Tank (BIT). Safety analysis results for steamline ruptures on the Braidwood Station Unit 1 plant has concluded that the BIT is not required to provide additional negative reactivity to compensate for the accident.

c. (Section 2.8) The centrifugal charging pumps at Braidwood Station Unit 1 plant take suctions from the RWST on an SI signal rather than from the Boric Acid Tank (BAT) as described in the reference plant. Functional requirements for the SI system are not affected by this plant difference.

6. Component Cooling Water System

a. (Section 2.11) The Component Cooling Water System at Braidwood Station Unit 1 does not supply cooling water the Reactor Containment Fan Coolers (RCFCs), as is the case for the reference plant. Essential Service Water System provides this function at Braidwood Station Unit 1 plant. Essential service water pressure to the RCFCs is maintained above the peak accident containment design pressure to preclude release of containment activity to the ESW system.

7. Essential Service Water System

a. (Section 2.12) The Essential Service Water System at Braidwood Station Unit 1 is a safety related system. It provides heat removal from non-radioactive system process. Braidwood Station Unit 1 plant Service Water System is a non-safety related system.

8. Main Steam System

a. (Section 2.15) Braidwood Station Unit 1 plant Auxiliary Feedwater System utilizes a diesel-driven AFW pump rather than a steam-driven AFW pump. Therefore there is no need for steam supply lines to the AFW System.

9. Main Feedwater and Condensate System

a. (Section 2.16) Braidwood Station Unit 1 plant utilizes a motor-driven start-up feedwater pump for feeding steam generator during startup and shutdown. This allows the auxiliary feedwater pumps to be used only for feeding steam generators during events that require ESF operation.

10. Auxiliary Feedwater System

a. (Section 2.17) Braidwood Station Unit 1 plant has two auxiliary feedwater pumps of the same capacity. One pump is motor-driven and the other is diesel driven. Each pump can be aligned to supply all four steam generators with water from the Condensate Storage Tank (CST). This arrangement provides greater flexibility within the system design requirements and eliminates the need for high pressure steam to a turbine-driven auxiliary feedwater pump.

11. Electrical Power System

a. (Section 2.24) At Braidwood Station Unit 1 plant, reactor containment fan coolers (RCFC's) do not start on loss of power to ESF buss. The motor-driven AFW pump, essential service water pumps and control room refrigeration units will start on loss of power to the ESF bus or an SI signal. The starting of RCFC's on loss of power is not considered necessary to sequence onto the emergency busses. Starting of the motor-driven AFW pump during loss of power or safety injection, insures a reliable source of feedwater to the steam generator. Essential service water pumps provide the same function as service water pumps in the reference plant. Control room refrigeration units are started in both cases to insure habitable conditions for Control Room personnel during an accident.

12. Pneumatic Power System

a. (Section 2.25) The pressurizer PORVs have individual nitrogen accumulators for operation of the valves. Therefore they are unaffected by isolation of instrument air to containment on an SI signal.

b. (Section 2.25) The Steam Generator atmospheric relief valves have individual hydraulic units that provide motive power for operation. This design allows for more efficient operation during emergency conditions.

C. INSTRUMENTATION DESCRIPTION

All significant differences between the reference plant instrumentation and the Braidwood Station Unit 1 plant instrumentation (as described in Attachment B) are itemized in the following sections:

1. Reactor Vessel Level

a. At Braidwood Station Unit 1, the Reactor Vessel Liquid Inventory System (RLVIS) is a combustion Engineering (CE) system rather than a Westinghouse system that is used in the reference plant. The system consist of eight heated junction thermocouple sensors. The system will accomplish the same purpose as the Westinghouse system used in the reference plant, with one major exception. The CE system will not identify the level of core uncovery since the lowest sensor in the system is located just above the upper internals support plate. Therefore, wherever the requirement is given in the ERG's to check core uncovery level at 3.5 feet above the bottom of the active fuel, this cannot be accomplished at the Braidwood Station Unit 1 plant. The purpose of the requirement was to measure a collapsed level indicating significant core uncovery beyond that expected for a design basis small LOCA. The Braidwood Station Unit 1 procedures will specify a more conservative vessel level in the range of the RVLIS system. This level will be above the top of the fuel and greater than sensor 8 position which is above the upper core support plate.

b. For identifying transitions to 1BwFR-C.1 (Inadequate Core Cooling), Braidwood will use a different transition value. Upon the recommendation of Westinghouse, Braidwood will use only core thermocouple temperatures greater than 1200°F vice 3.5 feet RVLIS indication as stated for the reference plant.

2. CST Level

At Braidwood Station Unit 1 plant, there is only one channel of level indication as compared to two channels in the reference plant. However, adequate indications are available to determine the CST level locally.

3. Containment Pressure

At Braidwood Station Unit 1 plant, there are four containment pressure channels (0 to 60 psig) which are the same as used in the reference plant. Braidwood has two additional containment pressure channels indicating from -5 to 200 psig. This gives Braidwood Station Unit 1 enhanced capabilities for monitoring containment pressure.

4. Containment Water Level

At Braidwood Station Unit 1 plant, three ranges of containment water level indications are available as compared to two for the reference plant. The operator has more information to enhance operation at Braidwood Station. No adjustment in accident response will be necessary since the functional requirements for containment water level indication are met at Braidwood.