ATTACHMENT 1

DESIGN PROCESS
OF THE
FARLEY STATUS TREE MONITORING
SYSTEM DISPLAYS

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1 INTRODUCTION

The purpose of this report is to document the human factors concepts that were used in the development of the Farley nuclear plant computer-based system for monitoring critical safety functions, called the Status Tree Monitoring System (STMS). The process that was used to develop the displays for the system is diagrammed in Figure 1.

The first step in the design of any display system is to analyze the system being represented in the displays. An analysis of the current system for monitoring critical safety functions is presented in the next section.

The result of this initial design step is the determination of information transfer goals—a description of all the information which must be communicated on the displays to the user. These goals usually include such topics as:

- which parameters must be apparent to the user
- which relationships between variables must be portrayed
- how the significance of the data will be communicated

Knowledge of human factors principles for effective person-computer communication determines how the information transfer goals are best achieved. The human factors principles especially relevant to the types of data output from the STMS are discussed in Section 3. The goals for information transfer are listed in Section 4.

The final step in designing displays is to specify the prototype system. The information transfer goals and the principles for effective person-computer communication are used to generate criteria for evaluating the prototype, and the display designs are iteratively evaluated until all criteria are met. The final design for the prototype status tree monitoring system is described briefly in Section 5. The final design has resolved the evaluation questions of earlier iterations. Therefore, the "evaluation" in Section 6 is an explanation of how certain display design techniques were used to accomplish the information transfer goals for the system.

At the conclusion of developing the Farley CSF monitoring system, there was consensus between the designers that the human factors criteria incorporated into the STMS design ensures that the displayed information is readily perceivable, easily comprehended, and not misleading to STMS users.

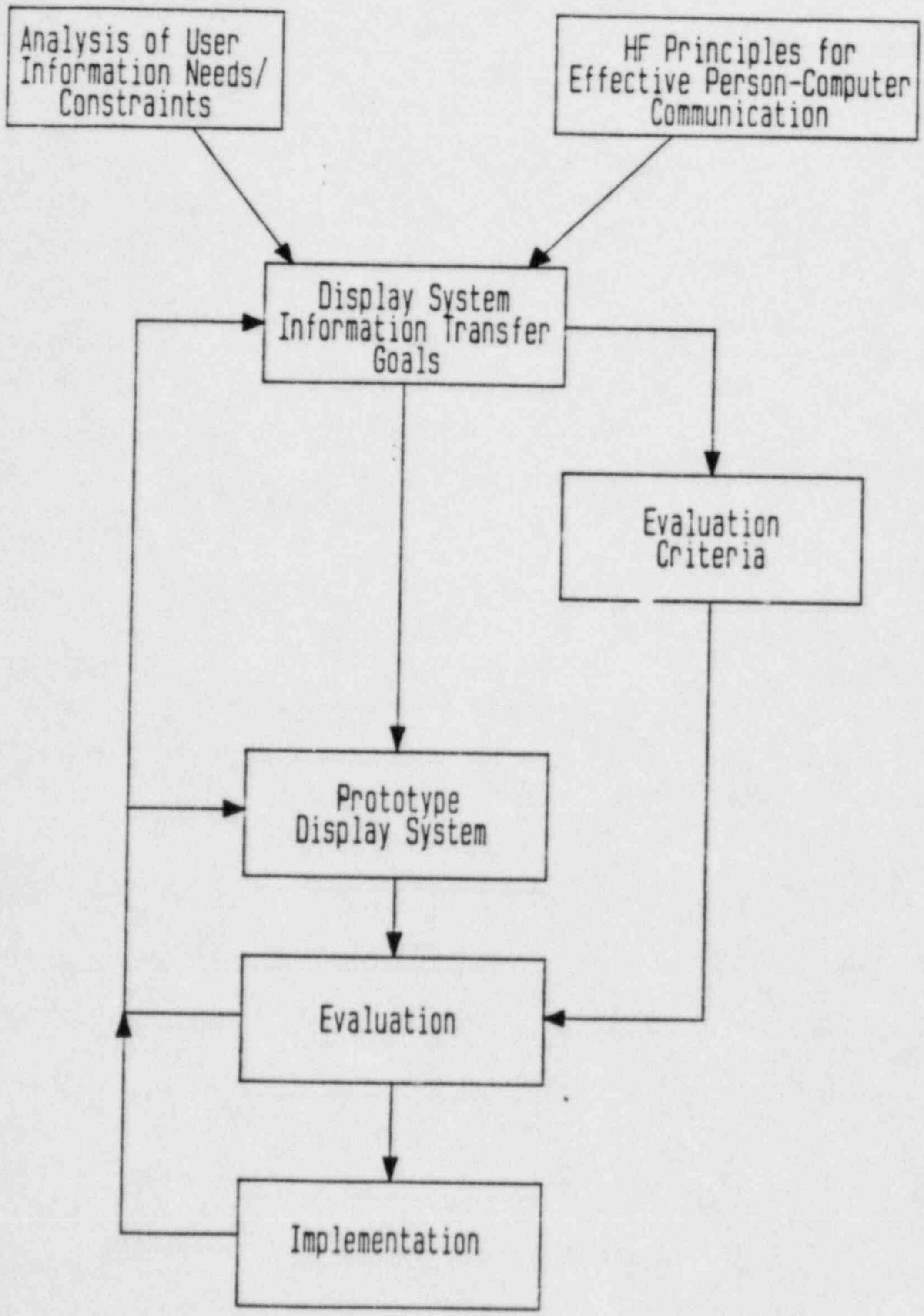

Figure 1. Westinghouse Computer-Based Display Approach

2 BACKGROUND

The present system for monitoring critical safety functions (paper Status Trees) and how it relates to overall plant operations is described in the Westinghouse Owners Group (WOG) Emergency Response Guideline Background Documents. This section will look at the critical features of the present system.

2.1 THE CRITICAL SAFETY FUNCTIONS

The job of protecting a nuclear power plant from the dangers of escaping radiation is conceived as a process of maintaining a series of barriers, ranging from the material surrounding the radiation-producing elements, to the physical barrier separating the plant from the outside world.

The job of maintaining those barriers is defined by the WOG to be based upon the successful operation of certain plant functions, called the Critical Safety Functions (CSFs).

The mapping of functions to barriers is as follows:

Barrier	Critical Safety Function
Fuel Matrix and Fuel Clad	SUBCRITICALITY CORE COOLING HEAT SINK INVENTORY
Reactor Coolant System Pressure Boundary	HEAT SINK INTEGRITY INVENTORY
Containment Vessel	CONTAINMENT

To simplify the above mapping, the CSFs have been ordered into a priority sequence which maintains the priority of the barriers in terms of "distance" from the core:

SUBCRITICALITY
CORE COOLING
HEAT SINK
INTEGRITY
CONTAINMENT
INVENTORY

The status of each Critical Safety Function is derived from evaluating a small set of plant parameters which have been selected because of their relevance to the status of that CSF. The Critical Safety Functions have four status categories: SATISFIED, NOT SATISFIED, SEVERE CHALLENGE, and JEOPARDY. The increasing severity of each category means that an increasing number of parameters have been evaluated unfavorably.

2.2 THE CSF STATUS TREES

The parameters that are evaluated to determine CSF status have been arranged into decision trees whose endpoints indicate the different status categories for the CSFs. These "status trees" have been developed to portray the data points in an order that evaluates situations of the highest severity first. As a consequence, the endpoints of the trees are also in this type of order, to the extent that the tree format allows.

2.3 EVENT RECOVERY

Monitoring the CSF status trees is an established component in the procedures for recovery after an event. Obviously, the CSFs are related to a function-based approach to event recovery. In fact, each endpoint in the status trees (except for the "SATISFIED" endpoints) directs the operator to one procedure from a whole series of recovery procedures which are function-based (the Function Restoration Procedures—the FRPs).

It is also possible to try to take an event-based approach to plant recovery. Event-based recovery strategies rely on the ability of the operator to match the current plant state to a predefined set of conditions. These conditions relate to a separate set of recovery procedures (the Optimal Recovery Procedures—which consist of Emergency Event, Emergency Specific, and Emergency Contingency Procedures). If the operator can accomplish this match, the event-based procedures provide the most efficient means of plant recovery. However, to ensure that the barriers to radiation are not being violated, the operator must also continuously monitor the CSF status trees at all times. If the status trees tell him protection is not being maintained, he must leave the event-based guidelines and use the function-based guidelines entirely.

2.4 RULES OF USAGE

The operator's decision to leave the function-based procedures is based upon the status of the CSFs:

- If any CSF indicates JEOPARDY, the operator must stop the ORP, verify that the CSF status is accurate, and begin the appropriate function-based procedure (FRP).

- If no CSF indicates JEOPARDY, but one does indicate SEVERE CHALLENGE, the operator must stop the ORP, verify the CSF status, and initiate the FRP associated with the SEVERE CHALLENGE.

- If no CSF is higher than NOT SATISFIED, the operator may decide whether or not to leave the ORP and initiate the appropriate FRP instead.

- If all CSFs are SATISFIED, the operator should continue with the current procedures.

The operator continues to monitor the CSFs while using the function-based procedures. If at any time a check of the CSFs yields a higher priority CSF status, the operator must stop the current procedure and switch to the one associated with the higher priority status.

The status trees are monitored after reactor trip until the procedures indicate that transition to normal operation can be attempted.

3 HUMAN FACTORS ISSUES

3.1 A CHANGING PURPOSE FOR THE SYSTEM

The impetus for designing the automated STMS is to have the computer take over the burden of continuously monitoring the status trees from the operator. This means that an additional, primary task of the computer system is to alert the operator as to its conclusions. Thus the messages of the system are now more like alarms. There are three characteristics of a good alarm system: 1) The operator must be able to detect an abnormality. 2) He must be able to evaluate or verify the abnormality. 3) He must be able to determine the correct response.

3.1.1 Detection

There are six critical safety functions which are evaluated against four status categories indicating the degree of severity. The status categories are determined by multiple data points in a logical relationship, i.e., the status trees. In the paper system, the operator arrived at the status of each CSF by working his way through the appropriate status tree. Once the status of the CSFs had been determined, the predefined priorities of the CSFs and their status categories aided the operator in determining which FRP was appropriate for current plant conditions. Since the computer will now be determining the status of each CSF, it will be possible to display the status of all the CSFs at one time. This "collected status" of CSFs will be the new primary focal point of the data system.

3.1.2 Evaluation/Verification

The operator will evaluate the significance of the status of the collected CSFs by assessing their priorities. The status trees essentially use a two-dimensional priority system. There are priorities across CSFs—and between the status categories for each CSF. A presentation method must be used which integrates the two priority dimensions, and enables the operator to quickly evaluate which CSF to pursue based upon the rules of usage outlined previously.

In order to verify the status of the CSFs, the operator will need to be able to examine the logic that the computer used to determine its conclusions.

3.1.3 Response

The basic purpose of the status trees is to indicate CSF status to the operator. It is crucial that the operator also know what action to take as a result of CSF status. That is, the new displays must make salient the link between CSF status and the correct procedure to follow.

Also, the operator continues to monitor the status trees while he executes both the event and function-based procedures. He should be able to see the results of the actions he has taken to recover from the event in the parameters contained in the trees.

3.2 MAPPING ACROSS LEVELS OF DATA

The CSFs are determined from multiple sensor inputs. The operator must have a way of assessing the accuracy of those inputs (i.e., the data quality). In the paper system, the operator obtains data directly from control room meters and makes a determination about the legitimacy of those readings by evaluating the behavior of those meters. In this new system, the operator must have a presentation of sensor inputs so that he can check the accuracy of the data. Thus the operator will be dealing with the concepts of CSF status at three levels: he will be comparing the status of collected CSFs, he will be examining parameters relating to CSF status, and he will be looking at sensor inputs to those parameters. The operator must be able to work between the levels in any direction. This is another example of the derived parameter issue in display design. The operator must understand how to work down from the more abstract levels to the specific to check his concerns about data quality; he must also be able to think "upward" and understand how the data values were combined.

3.3 PRESENTING THE VARIOUS TYPES OF DATA

One of the first questions in selecting formats in which to display data is to ask whether a parameter should be presented in digital or analog form. Two requirements are apparent:

- Status conditions are discrete parameters. A format must be used which presents that quality clearly.

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In addition, the status trees have been developed to a point where they portray the relevant decision parameters in a certain order. As a consequence, the endpoints of the trees are also ordered, to the extent that the tree format allows. It would be desirable to preserve this order in the computerized system.

4 INFORMATION TRANSFER GOALS

4.1 DISPLAY SYSTEM TASKS

The display system tasks have been identified in the functional requirements for the STMS. They are listed again (verbatim) in the left column of Table 1. After analyzing the present system, it was determined that four types of display windows were needed to accomplish the system tasks.

- Tasks 16.1.1 - 16.1.4: In order to identify the highest priority CSF, the operator needs to see the status of all six critical safety functions collected in one location. Thus this is referred to as the "COLLECTED STATUS" window. Because the collected status window has the current status condition for each CSF and the current action priority of each FRP, it also satisfies display system tasks 16.1.1 - 16.1.3.

- Task 16.1.5: In order to verify the computer's execution of the logic used to arrive at CSF status, the operator will need to examine the structure of the decisions represented by the status trees (the "INDIVIDUAL STATUS" displays). The operator will also need to consult a set of display windows which contain the inputs to algorithms and which describe those algorithms for determining the plant parameters used in the status tree--the "SENSOR INPUTS" windows.

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- Task 16.2: In order to display the sensor inputs from the plant to the status tree logic, the operator will need a full set of "SENSOR INPUTS" displays.

4.2 DISPLAY SYSTEM ORGANIZATION

Before determining specific information transfer goals, it is useful to consider the relationships between display windows in the system to enhance the use of the system for status tree monitoring. The result is an organization of displays which lays the groundwork for individual display design.

- First, the operator should be able to see the status of the CSFs at all times while using the display system. It was decided that a variant of the collected status display should be designed which could fit into a small space and thus could be included as an alert window on all applicable displays. The operator's need to understand how the computer evaluated the CSFs status can be satisfied with separately accessed displays as long as he can be kept aware of each CSF status (i.e., with the alert window).

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Table 1: Allocation of Display System Tasks to Display Windows

16.1	1. Identify the current status condition of each CSF.	COLLECTED STATUS
	2. Identify the current action priority of each Function Restoration Procedure.	
	3. Identify the current Function Restoration Procedure associated with each CSF.	
	4. Identify easily ... the currently highest action priority CSF, its current status condition, and its current Function Restoration Procedure.	COLLECTED STATUS
	5. Verify the computer's execution of the logic used in determining the status condition and Function Restoration Procedure for each CSF.	INDIVIDUAL STATUS AND SENSOR INPUTS

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16.2	The Status Tree Monitoring System shall display to the user the sensor inputs from the plant to the status tree logic. These inputs shall be displayed in a manner that presents the impact of each sensor on CSF status.	SENSOR INPUTS

4.3 DISPLAY WINDOW TASKS

The following description of display window tasks has intentionally been written in outline format. When developing the displays, the designers found it useful to have a checklist of generic goals from which to start (i.e. the topics in upper case). The specific goals become the criteria for evaluating the displays and are used as the structure for the discussion in Section 6.

Each set of goals is organized into three subsets—goals for communicating the purpose of the display window, the structure [i.e., relationships] of the groups of data in the window, and the values of the data themselves.

4.3.1 DISPLAY WINDOW: Collected status of six critical safety functions

1. PURPOSE

1a. GLOBAL PURPOSE: Show status of highest priority CSF.

1b. ASSOCIATED PURPOSE: Show status of each of the lower priority CSFs.

1c. ASSOCIATED PURPOSE: Alert operator to change in highest priority CSF.

1d. ACTIONS ASSOCIATED WITH PARAMETERS: (If status other than satisfied,) show correct function restoration procedures for--

- highest priority CSF
- other CSFs

1e. SIGNIFICANCE OF PARAMETER STATES OR ACTIONS: Show degree of urgency of action.

2. STRUCTURE

2a. DECISION MODES: Show conditions for containment instrumentation [adverse or normal].

2b. RELATIONSHIPS BETWEEN PARAMETERS: Show priorities--

- between CSFs
- between status categories
- dominance of status priorities over CSF priorities

Show associations--

- CSF + status
- CSF status + procedure

3. DATA

3a. PARAMETER IDENTITIES: Provide identifiers for–

- all CSFs—"SUBCRITICALITY", "CORE COOLING", "HEAT SINK", "INTEGRITY", "CONTAINMENT", "INVENTORY"
- procedures for all CSF status categories (i.e., FRP numbers)

3b. PARAMETER STATES: Show names of CSF status categories–

- "JEOPARDY", "SEVERE CHALLENGE", "NOT FULLY SATISFIED", "SATISFIED"

4.3.2 DISPLAY WINDOW: Alert variant of collected status

The goals for the alert variant of the collected status window are the same as for the full-sized format. There will simply be less space in which to accomplish them. The following criteria offer some possibilities for compromise:

- 2a. DECISION MODES: Conditions of adverse containment may be shown on another window.
- 3a, 3b. PARAMETER IDENTITIES AND STATES: Identifiers will have to be shown in an abbreviated format.

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4.3.4 DISPLAY WINDOW: Status of individual critical safety functions

1. PURPOSE

1a. GLOBAL PURPOSE: **Present the decisions the computer made in determining CSF status, i.e., the current decision path.**

1b. ASSOCIATED PURPOSE: **Show all alternative decision paths, and consequences of each path.**

1c. ASSOCIATED PURPOSE: **Present the computer decisions in a format closely similar to the one the operator uses to determine CSF status in the paper status trees.**

1d. ACTIONS ASSOCIATED WITH PARAMETERS: **For alternative (and current) decision paths, if status is other than satisfied, identify the applicable function restoration procedure.**

1e. SIGNIFICANCE OF PARAMETER STATES OR ACTIONS: **Portray current path and endpoint containing CSF status and procedure identifiers.**

2. STRUCTURE

2a. DECISION MODES: **Show condition for containment instrumentation [adverse or normal].**

2b. RELATIONSHIPS BETWEEN PARAMETERS: **Show the following relationships—**

- **Show decisions in order of priority and (thus) endpoint status of alternative paths in order of severity.**
- **Emphasize current decision path over alternative paths.**

3. DATA

3a. PARAMETER IDENTITIES: **Show the following—**

- **Provide full and precise text for each decision statement.**
- **Articulate decision ("YES" or "NO") to each decision statement.**
- **Provide identifiers for all parameters used to determine outcome of decision statements.**

- Provide identifiers (FRP #s) for all procedures associated with endpoint status.

3b. PARAMETER STATES: Show the following–

Show value of all parameters used to determine outcome of decision statements.

Provide identifiers for endpoint status of each alternative path–

- "JEOPARDY", "SEVERE CHALLENGE", "NOT FULLY SATISFIED", "SATISFIED"

4.3.5 DISPLAY WINDOW: Sensor Inputs

1. PURPOSE

1a. GLOBAL PURPOSE: Show sensor inputs to parameters which are used to evaluate CSF status trees.

1b. ASSOCIATED PURPOSE: Where appropriate, show algorithms used for determining value of status tree parameters.

1c. ACTIONS ASSOCIATED WITH PARAMETERS: None.

1d. SIGNIFICANCE OF PARAMETER STATES OR ACTIONS: Show the results of decisions made by the computer using these sensor inputs.

2. STRUCTURE

2a. DECISION MODES: Show condition for containment instrumentation [adverse or normal].

2b. RELATIONSHIPS BETWEEN PARAMETERS: Show the following:

[ ] a,c

- Show relationship of multi-channel average value and channel inputs.
- Present redundant and diverse sensor inputs in a way that promotes comparison of their values.

3. DATA

3a. PARAMETER IDENTITIES: Show the following–

[ ] a,c

Provide identifiers for–

- all evaluative parameters and their units

- all train, leg, or channel distinctions

3b. PARAMETER STATES: Show values of all summary parameters and all sensor inputs.

4.4 DATA QUALITY

The goals for representing data quality have been stated in the Functional Requirements:

> "Four (4) quality attributes shall be associated with each variable. The data qualities are Good, Manual, Poor, and Bad. Manual data shall indicate the value has been manually entered into the data base rather than from a scanned sensor. Poor data shall be used to indicate that one or more sensors of a redundant or diverse set of sensors are no longer Good. Bad data shall be used to indicate that a sensor value is either removed from scan, currently being calibrated [without a value being manually entered to replace the datum under calibration], or detected by the system as resulting from failed input devices."

5 DESCRIPTION OF THE DESIGN

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5.3 DESCRIPTION OF THE DISPLAYS

While reading the following description of the displays, please refer to the figures at the end of this report.

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a,c,

a,c

a,c

a,c,

5.3.4 LEVEL 2: Status of individual critical safety functions

The status of each critical safety function is derived by determining the value of a series of parameters which are connected together in a tree-type decision structure to promote ease of use in the paper format. This format was also selected to depict the computer's evaluation of the status of each CSF in order to provide a tie to the paper status trees. Since there are six CSFs, there are six separate tree diagram display windows.

The tree diagrams are shown in a "block" format; that is, the statements to be evaluated are portrayed as enclosed decision points from which the tree branches emanate. The values of the parameters needed to evaluate the statements are shown outside of the boxes. At the endpoint of every branch is the descriptor of CSF status obtained by following that path, and the identifier of its associated procedure. Since the questions in the tree are arranged in order of priority, starting from top left and progressing right and down, the sequence of endpoints, from top to bottom, is generally in order of CSF priority.

The current decision path is shown by thickening the line along the decision route the computer took. When a path is not active, its line and endpoint data are in the neutral color. When a path is currently active, the (thickened) line stays the neutral color, but a box surrounds the endpoint data. Both the box and the identifiers of the CSF status and procedure inside are shown in the color associated with the category of CSF status. Thus the only color to show on each tree is the endpoint containing the current CSF status.

During conditions of bad, poor, and manually input data quality, the lines connecting the decision boxes are interspersed at regular intervals by the letters "B", "P" and "M", respectively. The paths are retained during all quality conditions so the operator may trace alternate routes. However, during bad quality conditions, the active path and endpoints are not highlighted.

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6 EVALUATION OF THE DESIGN

6.1 GENERAL HUMAN FACTORS ISSUES

This display system has been designed to address the human factors issues described in Section 3. The system has three characteristics of a good alarm and therefore STMS system:

- The operator detects the status of the critical safety functions by viewing a display which collects the CSFs in a summary format. He does not have to draw those conclusions himself from separate presentations of individual CSF status.

- The operator is aided in evaluating the priorities of the CSFs because the format chosen for the collected status display integrates the two dimensional nature of the priorities into one presentation.

[ ] a,c

- The operator can easily determine what response to take as a result of CSF status because the displays present that data to him in a format which directly connects CSF status and procedure identifiers.

The structure for mapping across levels is contained within the displays. The operator will be able to work his way down from the parameters presented on the top level displays to their underlying inputs. And the description of algorithms used in the third level displays was included to aid the operator in understanding how the sensor inputs affect overall CSF status.

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[ ] a,c

6.2 SPECIFIC PRESENTATION TECHNIQUES

The goals for the display windows were set up in a hierarchy—to communicate first the purpose, then the structure, then the values of the data in the display window. Often, in the process of satisfying a goal pertaining to the purpose of a display, a lower level goal will be satisfied. Therefore, in the following explanations of how information transfer goals were attained, some repetition occurs. Furthermore, since certain aspects of the displays have already been discussed, compliance with a goal is sometimes noted only briefly.

6.2.1 DISPLAY WINDOW: Collected status of critical safety functions

Goal 1a: Show status of highest priority CSF.

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Goal 1b: Show status of lower priority CSFs.

Method: Collected status display defined to include all CSFs.

Advantage: Operator is aware of status of all CSFs, not just highest priority.

Goal 1c: Alert operator to change in highest priority CSF.

[ ]a,c,f

Advantage: By reserving blinking for change to highest priority, the operator is not overwhelmed by a field of blinking elements.

Goal 1d: Show correct function restoration procedures for the highest priority CSF and other CSFs.

[ ]a,c,f

Advantage: Grouping FRPs together with CSF identifiers makes it unmistakable which procedure to follow.

Goal 1e: Show degree of urgency of action.

[ ]a,c,f

Goal 2a: Show condition for containment instrumentation [adverse or normal].

Method: There will be a message showing the status of containment conditions. This message will appear in the upper left hand corner of all collected status displays.

Advantage: Consistency between displays.

Goal 2b: Show priorities: between CSFs, between status categories, dominance of status priorities over CSF priorities.

Method: See Goal 1a.

Goal 2c: Show associations: CSF + status, CSF status + procedure.

[ ]a,c,f

Advantage: See Goal 1d.

Goal 3a: Provide identifiers for all CSFs, and procedures for all CSF status categories.

[ ]a,c,f

Goal 3b: Show names of CSF status categories.

[ ]a,c,f

6.2.2 DISPLAY WINDOW: Alert variant of collected status window

Goal: Achieve goals of collected status window in smaller format.

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a,c

a,c

6.2.4 DISPLAY WINDOW: Status of individual critical safety functions

Goal 1a: **Present the decisions the computer made in determining CSF status, i.e., the current decision path.**

Method: **Active path in decision tree--block format.**

Advantage: **There was some discussion whether to use branch or block format. In the paper version, it**

was determined that the block format was easier to use for purposes of tracing the active path. The relative advantages and disadvantages of the two formats does not outweigh the concern for consistency between these displays and the paper back-up. Therefore, it was determined that the block version was the most appropriate for the application in this medium.

Goal 1b: Show all alternative decision paths, and consequences of each path.

Method: Status trees.

Advantage: The impact of individual parameters on the determination of the active path is clear in the branching nature of the format.

Goal 1c: Present the computer decisions in a format closely similar to the one the operator uses to determine CSF status with paper status trees.

Method: The status trees in the individual status displays are similar—but not identical—to the paper version of the status trees. In order to portray the current status category, the paper version encodes the lines in different patterns, portrays the endpoints of the trees with symbols, and uses the appropriate color in the line and endpoint. This information is desirable when the trees are used to trace the current path. However, the purpose of the computerized version is to present the conclusion of tracing through the path. Thus the computer version uses line coding to show only the active path, and color coding on the endpoint of the current status only.

Goal 1d: For alternative [and current] decision paths, if status is other than satisfied, identify the applicable function restoration procedures.

Method: FRPs shown in endpoints of decision trees.

Goal 1e: Portray current path and endpoint containing CSF status and procedure identifiers.

Method: See Goal 1c.

Goal 2a: Show condition for containment instrumentation [adverse or normal].

Method: There will be a message showing the status of containment conditions. This message will appear in the upper left hand corner of the displays.

Advantage: Consistency between displays.

Goal 2b: Show the following relationships--

Show decisions in order of priority and [thus] show endpoint status of alternative paths in order of severity.

Emphasize current decision path over alternative paths.

Method: Decision priority--order of paper status trees was preserved.

Current path--the line connecting applicable decision points is highlighted.

Advantage: The format of the paper status trees is preserved to provide continuity when the paper version is used as the system back-up. Highlighting techniques make the current path immediately apparent.

Goal 3a: Show the following--

Provide full and precise text for each decision statement.

Articulate decision ["YES" or "NO"] to each decision statement.

Provide identifiers for all parameters used to determine outcome of decision statements.

Provide identifiers (FRP #s for all procedures associated with endpoint status.)

Method: Text--inside decision boxes.

Answer--within decision boxes.

Parameter identifiers--repeated outside of decision boxes with parameter values.

Procedure identifiers--at endpoints of decision trees.

Goal 3b: Show the following--

Show value of all parameters used to determine outcome of decision statements.

Provide identifiers for endpoint status of each alternative path-- "JEOPARDY", "SEVERE CHALLENGE", "NOT SATISFIED", "SATISFIED".

Method: Values--outside of decision boxes.

Status identifiers--in endpoints of decision trees.

6.2.5 DISPLAY WINDOW: Sensor Inputs

Goal 1a: Show sensor inputs to parameters which are used to evaluate CSF status trees.

[ ] a,c

Advantage: The operator can expect to find a type of information by looking in the appropriate location.

Goal 1b: Show algorithms used for determining value of status tree parameters.

[ ] a,c

Goal 1c: Show the results of decisions made by the computer using these sensor inputs.

[ ] a,c

Goal 2a: Show condition for containment instrumentation [adverse or normal].

Method: There will be a message inserted in the displays to show containment conditions, where those containment conditions are relevant to sensor accuracy.

Advantage: Operator is aware of containment status where it is necessary.

Goal 2b: Show the following:

Show link between statement on status trees and values used as inputs.

Show relationship of multi-channel average value and channel inputs.

Present redundant and diverse sensor inputs in a way that promotes comparison of their values.

Method: [ ] a,c

Comparison--whenever values are presented for comparison, they are aligned so that their decimal points are (or would be) in the same vertical position. For example, the individual sensor inputs are lined up below the summary statement.

Goal 3a: Show the following--

Show text of [and answer to] all status tree statements.

Show applicable algorithms in succint format.

Provide identifiers for all evaluative parameters and their units.

Provide identifiers for all train, leg, or channel distinctions.

[ ] a,c

Goal 3b: Show values of all summary parameters and all sensor inputs.

Method: Tables, lists.

[ ] a,c

WESTINGHOUSE CLASS 3

7 REFERENCES

1. ST&S-MMFD-293. Functional Requirements Document for Farley Status Tree Monitoring System, Rev. 1. Westinghouse Nuclear Center. September 7, 1984.

2. Westinghouse Owner's Group (WOG). Background Information for Westinghoure Owner's Group Emergency Response Guidelines, F-0, Critical Safety Function Status Trees, HP/LP-Rev. 1. September 1, 1983.

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CONTAINMENT

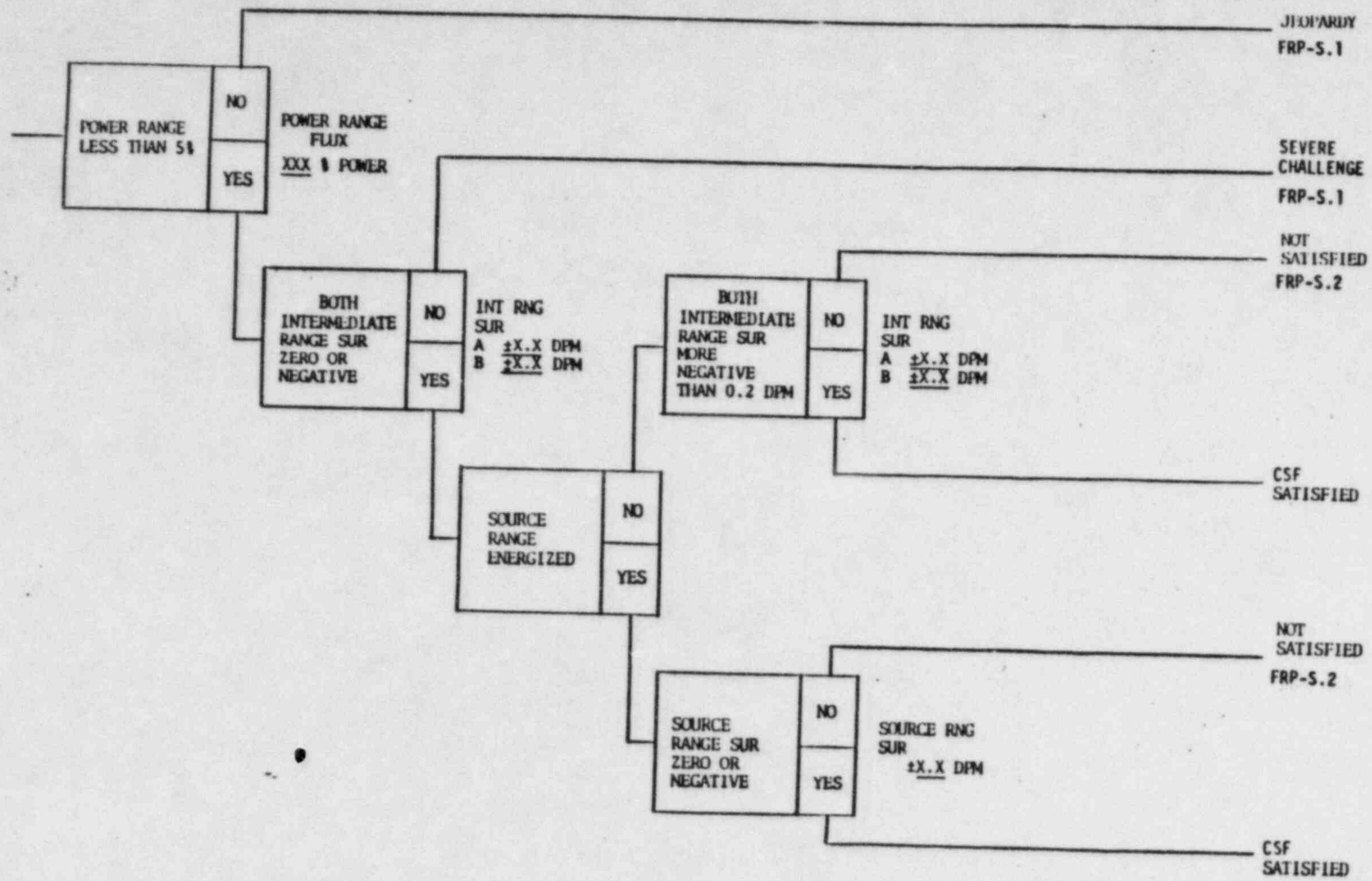

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Figure 8. Subcriticality – 2nd Level

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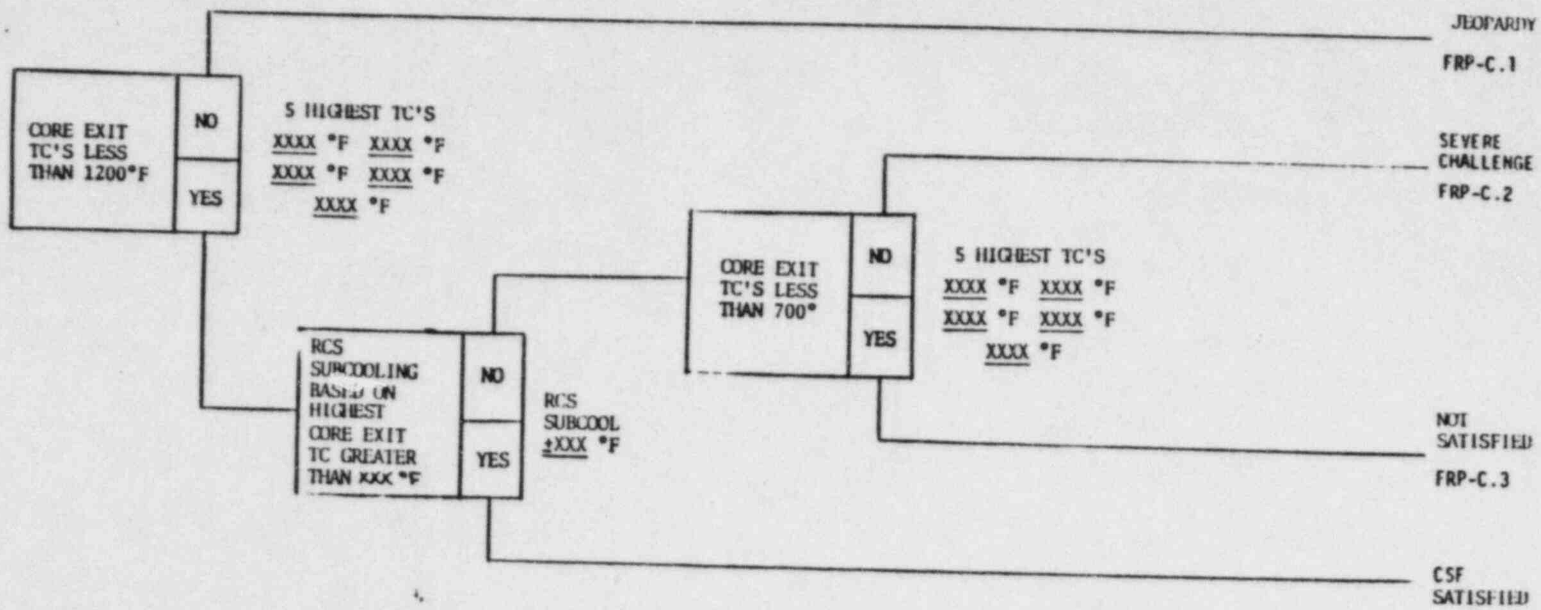
CONTAINMENT

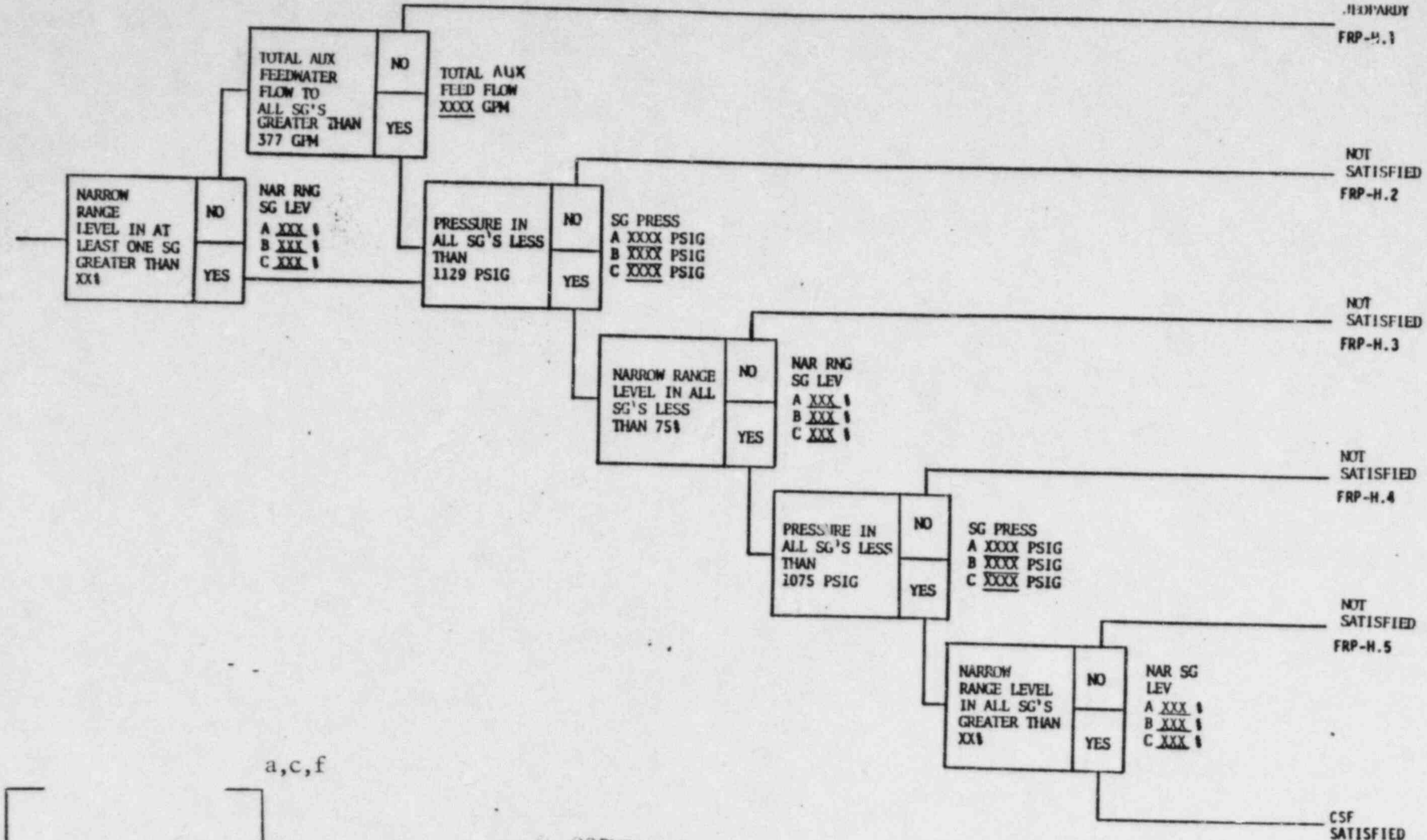


[ ]a,c,f

Figure 9. Core Cooling – 2nd Level

XXXXXX\
CONTAINMENT

WESTINGHOUSE CLASS 3



a,c,f

[ ]

Figure 10. Heat Sink – 2nd Level

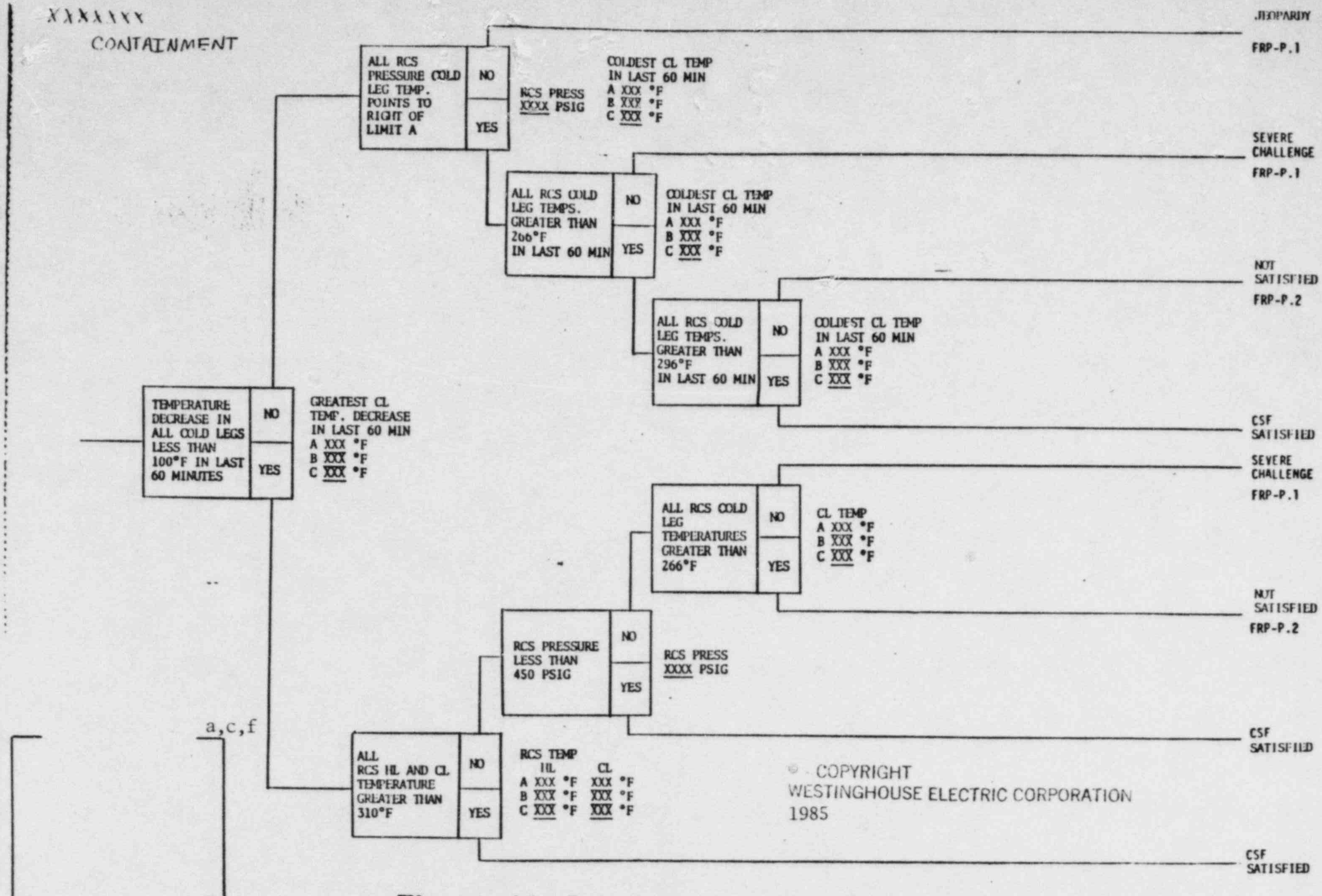
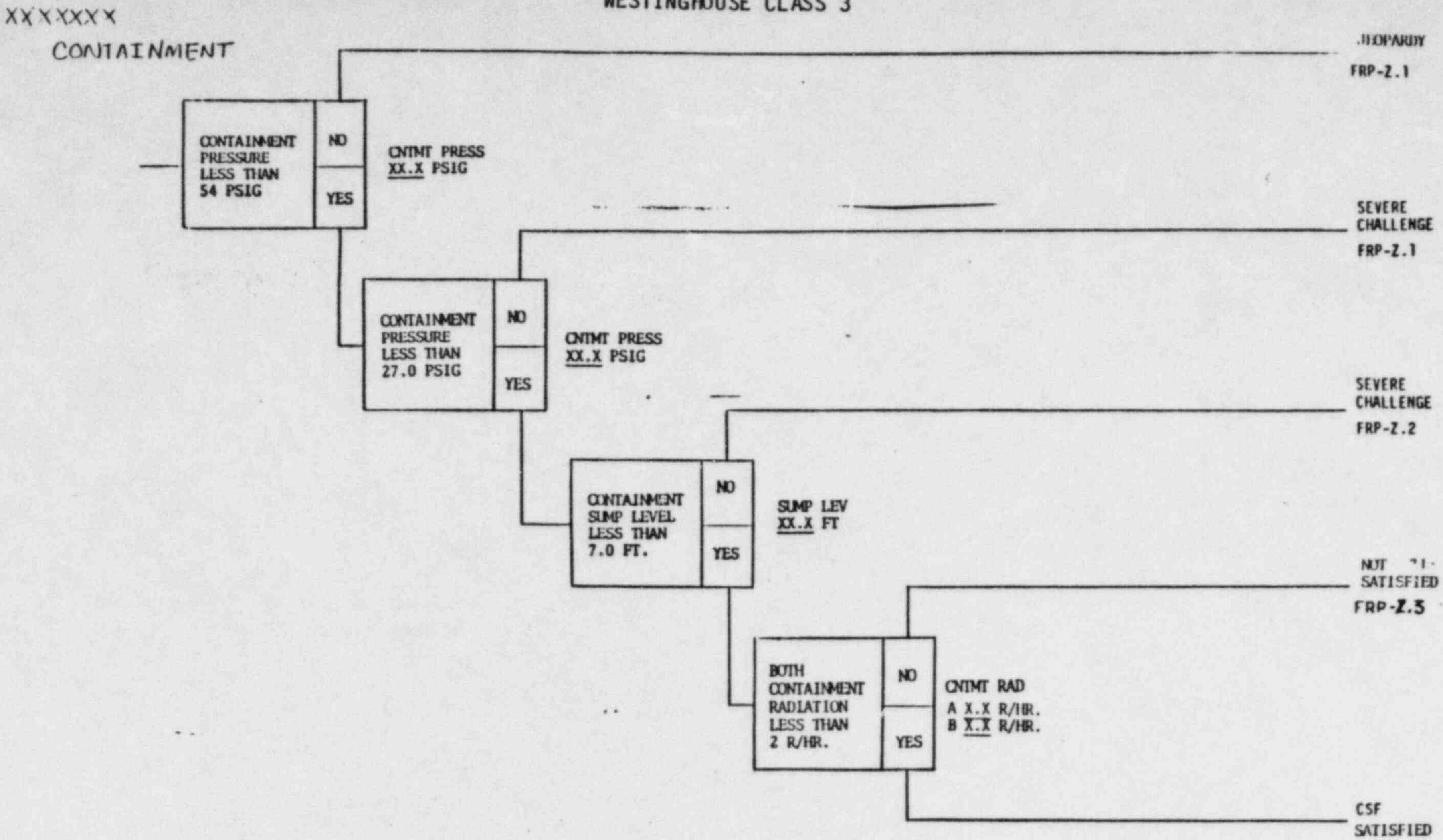


Figure 11. Integrity – 2nd Level

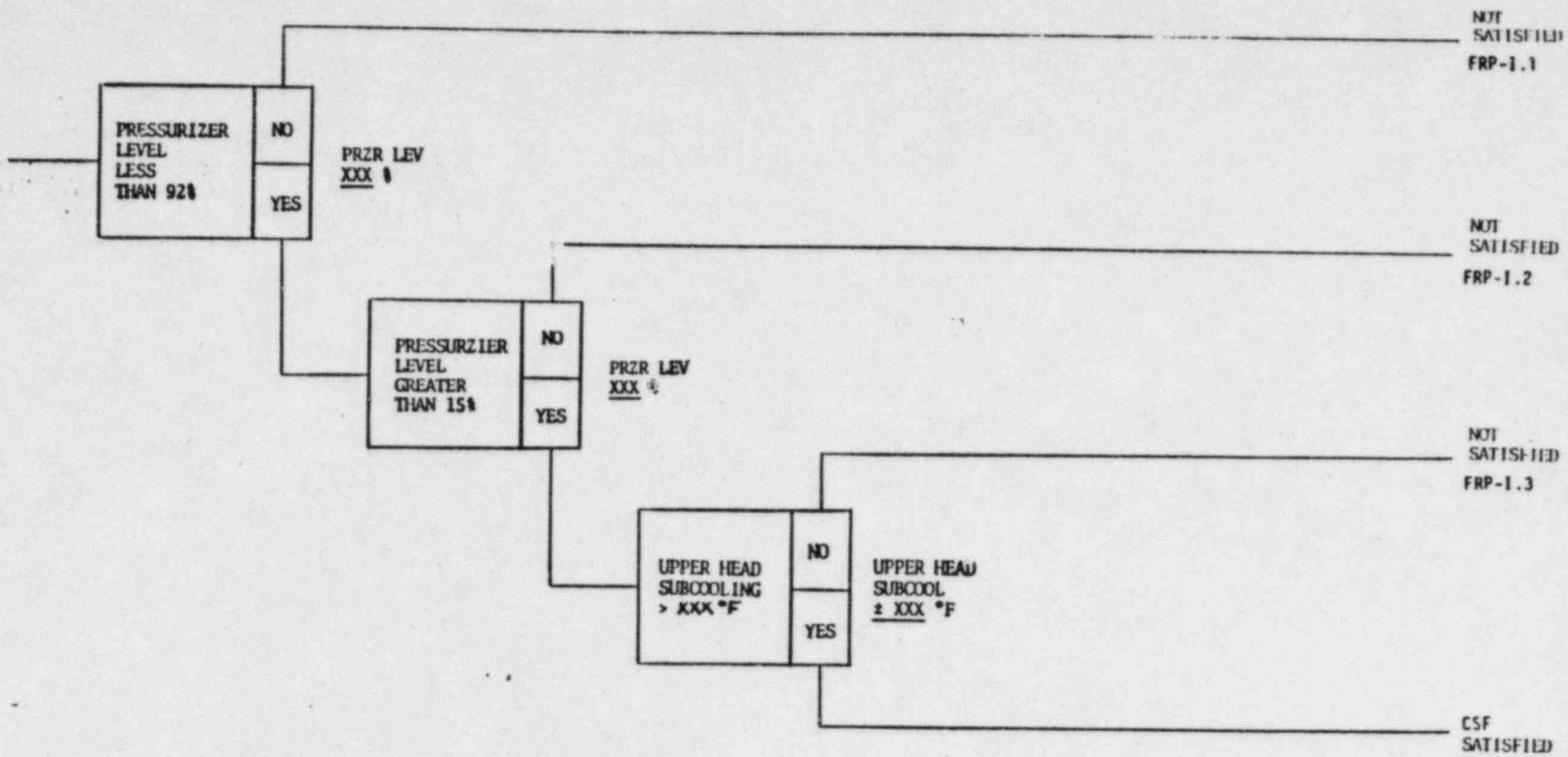
WESTINGHOUSE CLASS 3



[ ]a,c,f

Figure 12. Containment – 2nd Level

XXXXXXX
CONTAINMENT



[ ] a,c,f

Figure 13. Inventory – 2nd Level

WESTINGHOUSE CLASS 3

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

a,c,f

a,c,f

a,c,f

WESTINGHOUSE CLASS 3

a,c,f

a,c,f

WESTINGHOUSE CLASS 3