Enclosure 2

HOPE CREEK GENERATING STATION

SAFETY PARAMETER DISPLAY SYSTEM

DISPLAY DESIGN

AND

IMPLEMENTATION

OEI Document No. 8407-1

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Prepared for

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Hope Creek Generating Station

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APPENDIX A: DEFINITIONS

1.0 OVERVIEW

The design of Safety Parameter Display System (SPDS) displays for the Hope Creek Generating Station (HCGS) will use a methodology based on a function and task anlaysis of the plant's Emergency Operating Procedures (EOPs). The HCGS EOPs are being developed from the symptomatic Emergency Procedure Guidelines (EPGs) that have been developed by the BWR Owners' Group and approved for implementation by the NRC.

Section 4.1.f of NUREG-0737 Supplement 1 stipulates that the SPDS shall present information sufficient to assess plant safety status. Plant conditions affecting reactivity control, reactor core cooling and heat removal, reactor coolant system integrity, radioactivity control, and containment integrity are specifically identified as parameters for which information should be provided. The plant's EOPs fully address these conditions through the symptom-based approach to emergency response. Information requirements are identified through a function and task analysis of the plant EOPs, and a structured set of SPDS and associated supplemental displays is then designed to provide this information in a format directly usable by the plant operating staff.

An overview of the process to be followed for SPDS display design and implementation is presented in Figure 1-1 (Page 1-2). Information requirements are identified through the EOP Function and

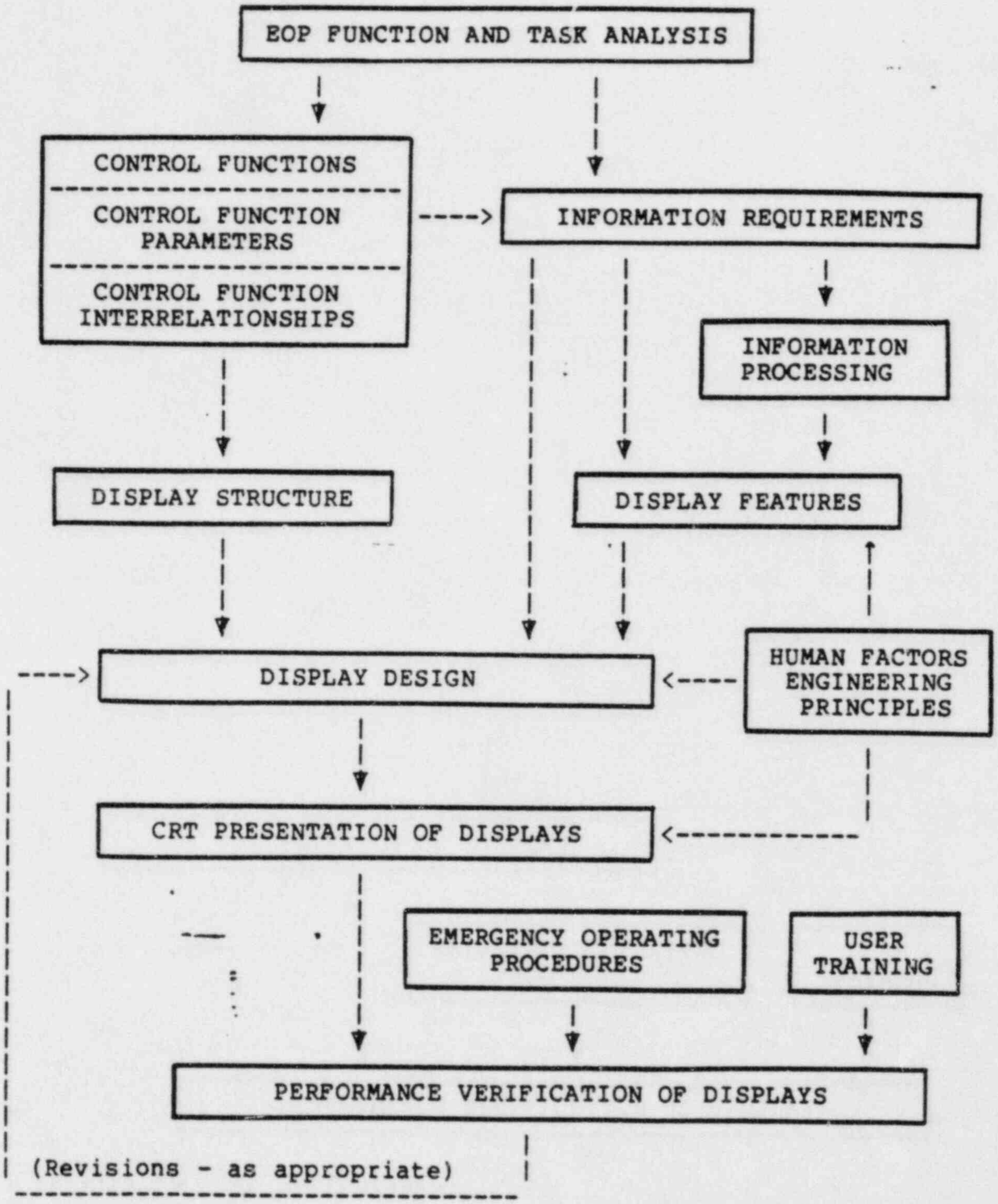


Figure 1-1: SPDS DISPLAY DEVELOPMENT PROCESS

Task Analysis. Display features are designed to support these information requirements directly, and also to support the information processing (including decision making) performed by the operating staff when executing the EOPs.

Additionally, the EOP Function and Task Analysis is used to identifiy the specific set of emergency response control functions and control function parameters for the Hope Creek plant. The interrelationships between control functions are then analyzed, and the results of this interrelationships analysis are used to define a logical structure for the SPDS and associated supplemental displays.

The defined display structure, identified information requirements, and display features incorporating information processing are integrated in the design of individual displays. This process provides a basis for structuring, organizing, and accessing the set of displays in a manner which directly facilitates execution of the plant's EOPs.

Human factors engineering princples are applied in the design of display features, in the design of each individual display, and in the presentation of displays on the system CRT.

After the displays are designed, a dynamic evaluation is conducted using the plant EOPs. Operators will be trained on the use of procedures and on the SPDS design prior to participating in the dynamic evaluation of the displays. Where evaluation results indicate that revisions to the displays are appropriate and necessary, such modifications will be incorporated prior to final system implementation.

The display design process interfaces with system hardware as shown in Figure 1-2 (Page 1-5):

- o Data aquisition and input to the computer system evolves from the information requirements identified in the EOP Function and Task Analysis.
- o Data processing takes the aquired data and processes it consistent with the information processing incorporated in the design of the various display features.
- o Display structure and composition considers hardware provided for accessing and presenting the displays on the computer system's CRTs.

Additional detail on the aspects of SPDS display design is provided in the subsequent sections of this report.

Definitions of terms used to describe the program for developing the Hope Creek Generating Station SPDS and associated supplemental displays are provided in Appendix A.

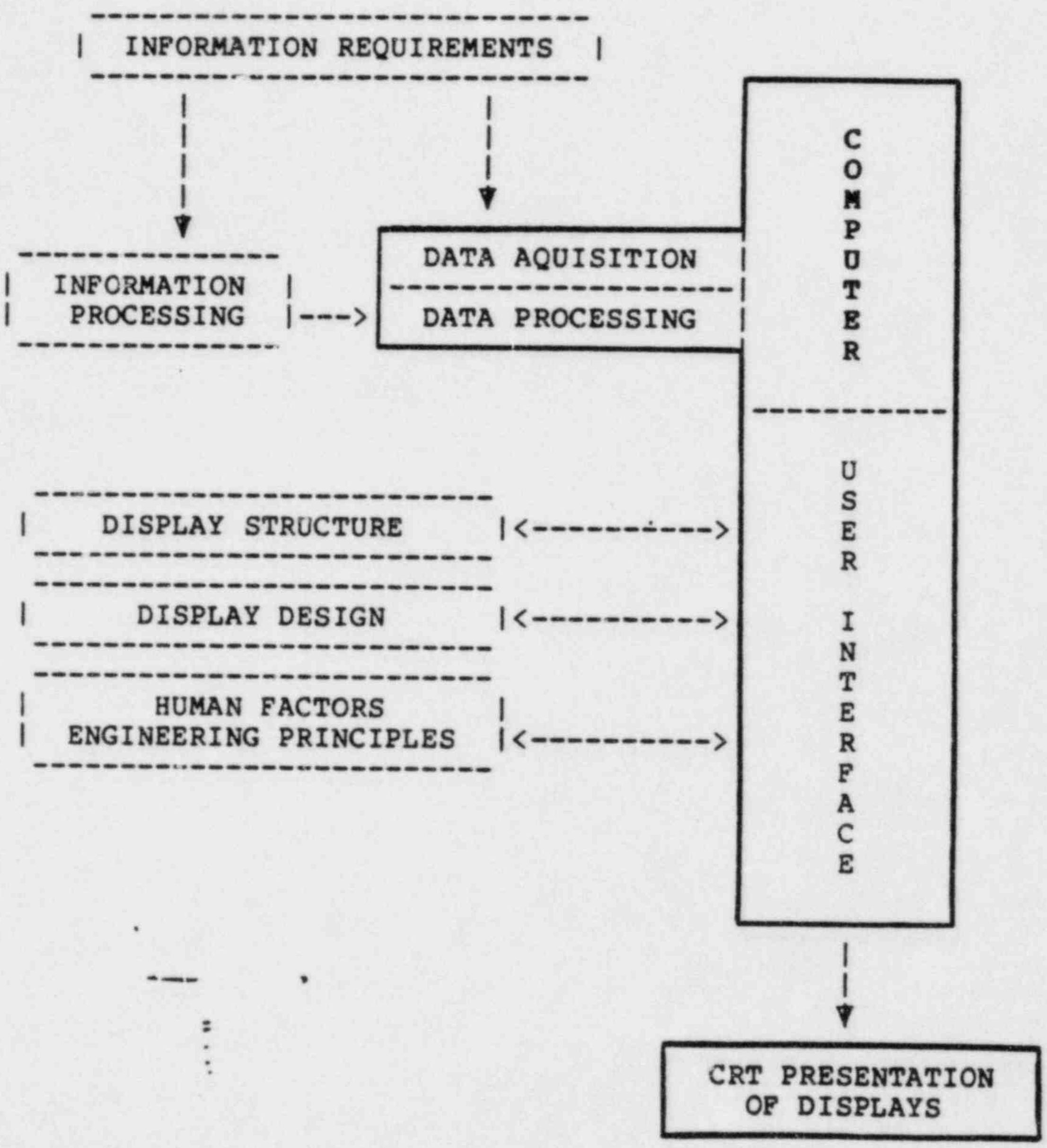


Figure 1-2: SPDS DISPLAY DESIGN - INTERFACES WITH SYSTEM HARDWARE

2.0 DESIGN BASIS OF DISPLAYS

The Hope Creek Generating Station SPDS employs a procedures-based display concept. Whereas displays could be developed to serve as an incipient accident detector, industry experience with previous SPDS designs indicates that displays would be more meaningful and useful to operators if the displayed information would closely support emergency response (e.g., the operators' actions, and the decisions that must be made in order for the correct emergency response actions to be taken).

Emergency response actions and the associated decision-making carried out by the operating crew are directly supported by developing the SPDS displays and the additional displays which supplement the SPDS displays such that they support execution of the HCGS EOPs. Since the EOPs address unanticipated multiple failures and severely degraded plant conditions, use of procedures-based displays fully satisfies this system's purpose as defined in NUREG-0737, Supplement 1. The HCGS SPDS displays will fully cover the information required to be presented on this system as shown in Table 2-1 (Page 2-2).

TABLE 2-1

NUREG-0737 SPDS INFORMATION REQUIREMENTS
AS ADDRESSED BY THE HCGS EOPs

NUREG-0737 Supplement 1 Section 4.1.f Information Requirements	Associated HCGS EOPs
1. Reactivity Control	a. OP-EO.ZZ 101, "Reactor/ Pressure Vessel Control"
	b. OP-EO.ZZ 207, "Level/Power Control"
2. Reactor Core Cooling and Heat Removal	a. OP-EO.ZZ 101, "Reactor/ Pressure Vessel Control"
	b. OP-EO.ZZ 201, "Level Restoration"
	c. OP-EO.ZZ 202, "Emergency Depressurization"
	d. OP-EO.ZZ 203, "Steam Cooling"
	e. OP-EO.ZZ 204, "Spray Cooling"
	f. OP-EO.ZZ 205, "Alternate Shutdown Cooling"
	g. OP-EO.ZZ 206, "Reactor Flooding"
	h. OP-EO.ZZ 207, "Level/Power Control"

TABLE 2-1
(Continued)

NUREG-0737 Supplement 1 Section 4.1.f Information Requirements	Associated EOPs
3. Reactor Coolant System Integrity	a. OP-EO.ZZ 101, "Reactor/ Pressure Vessel Control"
	b. OP-EO.ZZ 207, "Level/Power Control"
	c. OP-EO.ZZ 102, "Containment Control"
4. Containment Integrity	a. OP-EO.ZZ 102, "Containment Control"
	b. OP-EO.ZZ 103, "Reactor Building Control"
5. Radioactivity Control	a. OP-EO.ZZ 103, "Reactor Building Control"
	b. OP-EO.ZZ 104, "Radioactivity Release Control"

The EOPs are utilized in the display design process via function and task analysis of the procedures. The EOP Function and Task Analysis satisfies the requirements stated in NUREG-0737 Supplement 1, Sections 5.1.b(ii) and 4.2.a. In fact, although the results of the analysis are to be used as the basis for SPDS display development, the analysis was initially developed as part of the HCGS Control Room Design Review (CRDR). Therefore, function and task analysis is used as design input for display development rather than post-implementation review criteria.

Since the EOPs address all of the functions and conditions specified in NUREG-0737 Supplement 1, Section 4.1.f, and since the EOP Function and Task Analysis identifies the operator's emergency response information requirements, the display development methodology being employed binds Section 4.1.f with Sections 4.2.a (design basis of SPDS displays) and 5.1.b.ii (use of EOP function and task analysis). As a result, the displays developed through this process fully support emergency response information requirements, which in turn encompasses the basis functions and conditions specified in Section 4.1.f.

The HCGS EOPs are symptom-based in that they specify operator actions for restoring and maintaining a small set of control function parameters (e.g., RPV water level, suppression pool temperature, etc.) within ranges which assure continued safe plant operation. This small set of control function parameters is defined such that the plant will be maintained in a safe condition as long as these few parameters are maintained in the specified ranges. Since the actions specified in the symptom-based EOPs are directly keyed to the values of these parameters, the status of these control function parameters constitutes "the SPDS". Additional information identified through the EOP

Function and Task Analysis will be displayed by the system to supplement the SPDS information.

In executing these EOPs, the operator is not required to identify the event or sequence of events which initiated the emergency. Rather, actions are specified to directly control a few parameters which can be directly monitored. By designing the SPDS displays based on the information required to execute the EOPs, this same symptomatic approach to emergency response is totally integrated for the operating crew.

3.0 EMERGENCY RESPONSE FUNCTIONAL ANALYSIS

3.1 Identification of Control Functions

The HCGS EOPs define eleven emergency response control functions performed by the operating crew when responding to off-normal conditions defined by the EOP entry conditions. These control functions are the following:

	EOP Control Function	ACRONYN
1.	Monitor and control RPV water level.	RPVWLC
2.	Monitor and control RPV pressure.	RPVPC
3.	Monitor and control reactor power.	RXPC
4.	Monitor and control suppression pool temperature.	SPTC
5.	Monitor and control drywell temperature.	DWTC
6.	Monitor and control primary containment (drywell and suppression chamber) pressure.	PCPC
7.	Monitor and control suppression pool water level.	SPWLC
8.	Monitor and control reactor building area temperatures.	RBTC
9.	Monitor and control reactor building radiation levels.	RBRLC
10.	Monitor and control reactor building sump and area water levels.	RBWLC
11.	Limit radioactivity release into areas outside the primary and secondary containments.	RRC

3.2 Identification and Analysis of Decision and Action Functions

The EOPs specify performance of the control functions in a series of procedural steps containing decision and action functions. These decision and action functions were identified in the EOP Function and Task Analysis. In the display design development process, these functions will be separately analyzed as follows:

Action Function - how the specified action directly affects status of each control function; mechanisms by which an action may affect a control function include energy transfer, neutronics, mass transfer, etc.

Decision Function - what control function status and system status information is required in order to make the decision

3.3 Control Function Interrelationships

The results of the decisions and actions analysis will be used to determined which EOP steps are closely related to which control functions and, subsequently, how the control functions themselves are interrelated.

For example, consider the following EOP step sequence of the "Reactor/Pressure Vessel Control" procedure (OP-EO.ZZ 101):

> "Are any SRVs cycling or open?" ... "Manually open SRVs until RPV pressure drops to 935 psig."

This step sequence addresses the reactor pressure control function (RPVPC), and in the functional analysis is broken down into one decision function and one action function:

> Decison Function: "Are any SRVs cycling or open?"
>
> Action Function: "Manually open SRVs until RPV pressure drops to 935 psig."

For the decision function, in order for an operator to be able to make the decision asked for, knowledge of the value of the control function parameter "reactor pressure" is required (current value and trend) and a comparison is then made to the lifting pressure setpoint of the lowest set SRV. Additionally, knowledge of SRV status is required (position: open/closed/cycling) in order to make the decision.

For the action function, opening SRVs affects the status of three control function parameters:

> Reactor pressure: directly
>
> Suppression pool temperature: through transfer of heat

energy (steam) from the reactor to the water in the suppression chamber via the open SRV

Suppression pool water level: through transfer of mass (steam) from the reactor to the water in the suppression chamber via the open SRV

All steps of the EOPs will be analyzed in likewise fashion, and the complete interrelationships analysis results documented.

By grouping EOP steps under their respective principal control functions, the relative strength of the interrelationship between each control function and all other control functions can be determined. For the example step previously discussed, this step sequence is grouped under the RPVPC control function and, via this step, the interrelationship that control function RPVPC has with control functions SCWTC and SCWLC is identified and documented.

3.4 Application

The results of this interrelationships analysis, conducted for all the steps of the EOPs, determines a logical structure for the displays: developing a hierarchical structure based on grouping control function and systems information on one display for multiple control functions that are closely related. (Refer to Section 5.0 for a discussion of display structure development.)

4.0 INFORMATION REQUIREMENTS ANALYSIS

In the EOP Function and Task Analysis, each step is subjected to evaluation to determine associated information requirements.

In the evaluation of decision functions, each identified decision function is examined in terms of the information that the operator requires to effect an evaluation of plant conditions and make the decision.

In the evaluation of action functions, each identified action function is examined in terms of system status information, plant condition information, and information feedback required to execute the action.

In the EOPs the operator must exercise controlling action over various systems. Since there is frequent, multiple reference to the use, status and performance of these systems, the information requirements and interrelationships analysis format will incorporate reference mechanisms whereby system information requirements need not be unduely repeated.

At the conclusion of the information requirements analysis of action and decision fucntions, a compilation of information needs is assembled. This information set then serves as the data base for the displays.

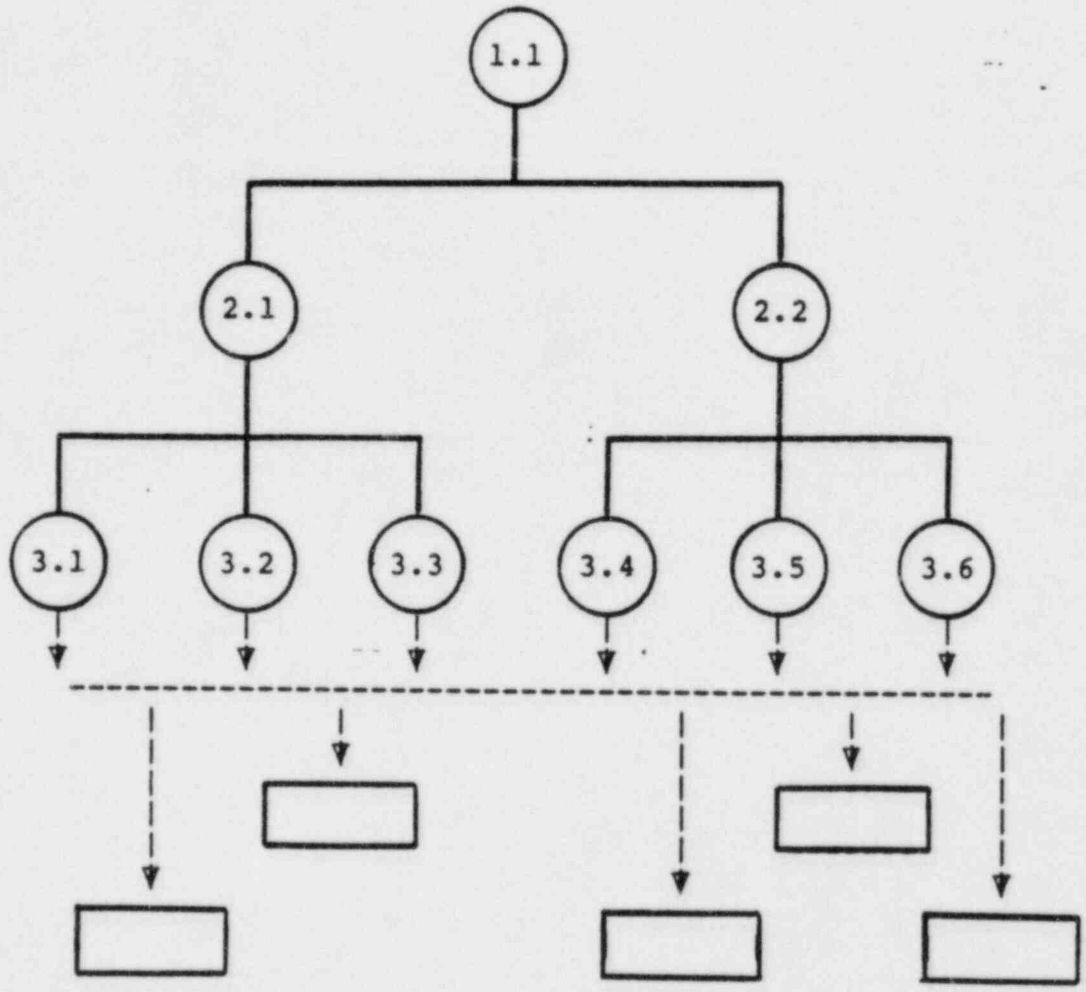
5.0 DISPLAY STRUCTURE DEVELOPMENT

The EOP control functions and the interrelationships between these control functions (refer to Section 3.0) provides the basis for developing the structure of the displays.

A hierarchical structure evolves by assigning an individual display to each control function on a one-for-one basis, and then grouping displays according to the relative strength of the identified interrelationships between the included control functions at progressively higher levels.

Below the hierarchical structure, supplemental displays are incorporated to provide additionally detailed information on the status of individual systems, plant status relative to setpoints and limits, data aquisition and processing, etc.

The structure described above is illustrated, conceptually, in Figure 5-1 (Page 5-2). Note: the actual number of levels in the HCGS SPDS display structure may or may not be 3, as is shown in Figure 5-1, depending upon the results of the control function interrelationships analysis when it is completed for HCGS.



——— Hierarchical display structure

-------- Supplemental display structure

Hierarchical display

▭ Supplemental display

NOTE: Any display can be reached by direct access

Figure 5-1: SPDS DISPLAY STRUCTURE

6.0 DISPLAY DESIGN CONSIDERATIONS

6.1 Display Format

Display format development (general composition and organization of displays) proceeds after the display structure has been defined.

As stated previously, the purpose of the displays is to assist plant operations personnel in the action-taking and decision-making processes required to execute the EOPs. The status of plant and system parameters is monitored, assessed, and then acted upon. Systems and components are subsequently operated to control these parameters relative to defined limits, setpoints, and other operational criteria.

The plant parameter set compiled from the information requirements analysis (refer to Section 4.0) identifies and categorizes information required to support EOP action and decision functions. Monitoring primarily involves the processing of information directly related to the control function parameters. Controlling primarily involves the processing of information directly related to system availability and performance. This categorization of information requirements provides the technical basis for defining the general format of the displays.

While all displays located at one level in the hierarchical display structure will present information in basically the same format, the format adopted at one level differs from that at another level. The format at a given level is a function of the intended primary user of the display and that person's functions, duties, and responsibilities.

Development of display formats begins at the functional control level (the lowest level in the hierarchical display structure), with the display area being divided into approximately equal quadrants (Figure 6-1).

INFORMATION ON PLANT PARAMETERS AND CONDITIONS DIRECTLY RELATED TO THE CONTROL FUNCTION PARAMETER	INFORMATION ON THE CONTROL FUNCTION PARAMETER
SYSTEMS INFORMATION	SYSTEMS INFORMATION

Figure 6-1: FORMAT OF CONTROL FUNCTION DISPLAYS

Located in the top right quadrant is information specific to the control function parameter of that display. Information on associated plant parameters and conditions directly related to the control function parameter is located in the left-adjacent quadrant. The remainder of the display field, the bottom two quadrants, presents information on the status of systems specifically identified in the EOPs which may be used to control the control function parameter.

The display format described above reflects both the monitor and control functions of the operator in that a proportionate amount of space is provided for displaying information on plant conditions and information on systems status.

At levels in the display structure above the functional control level displays, progressively less systems information is provided and more space is allocated to providing information on control function parameters and overall plant status (Figure 6-2, Page 6-4). This format reflects the broader role of supervisory personnel, the anticipated primary users of the higher level displays, and directly supports assessment of overall plant operating status with respect to execution of the EOPs.

The formats described above may be slightly modified to accommodate unique considerations as each individual display evolves.

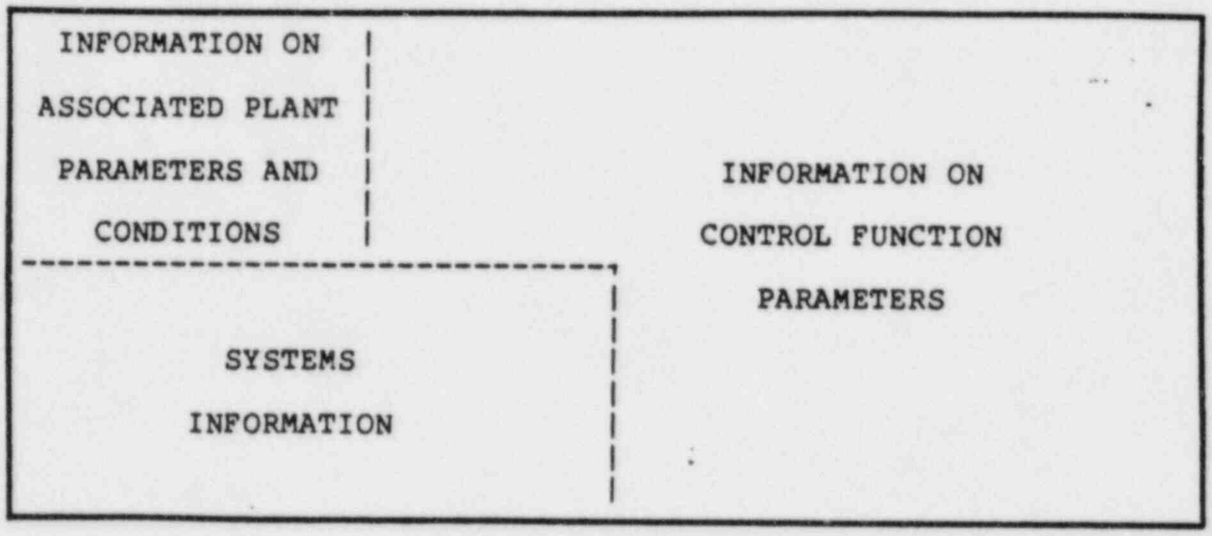


Figure 6-2: FORMAT OF DISPLAYS ABOVE THE CONTROL FUNCTION LEVEL

The uniqueness of displays in the supplemental display structure precludes being able to establish one generic format for all of the types of displays at this level. However, within a type, consistency of display formats is maintained to the maximum degree possible. For example: data displays read left-to-right; curves depicting variable limits and setpoints have their axes oriented such that increasing values progress to the right or upward.

Like other displays in the structure, the format of the supplemental displays may be slightly modified to accommodate unique considerations as the specific design of each individual display evolves.

6.2 Display Features

Individual display features are developed to directly assist the operator's decision-making process. The methods chosen to present information on the displays must have a technical basis and must do more than simply replicate existing control room instrumentation. To meet these criteria, the following process will be employed for designing display features:

1. Each identified decision function is examined to determine the information required to make the decision (refer to Section 4.0).

2. Each decision and its associated information are then examined to determine what processing the operator is required to perform on the information in order to be able to make the decision.

3. The result of this information processing is identified.

4. A display feature to present this information processing result is designed.

This process results in the development of display features which relieve the operator of the task of processing much of the information contained in the parameter set in order to make the decisions required for execution of the EOPs.

Display features designed to support the decision functions, and the explicit information requirements supporting action functions, are combined in a display consistent with the general principles of display format, the technical scope of the display, and the location of the display within the display structure.

6.3 Application of Human Factors Engineering Principles

Consistent with the guidance provided in Section 4.1.e of NUREG-0737 Supplement 1, "accepted human factors principles" will be employed in the SPDS display development process. Relevant criteria will be derived from the Computer System Survey results of the HCGS CRDR conducted by PSE&G's human factor's consultant. Additionally, the guidance provided in "Computer-Generated Display System Guidelines, Volume 1: Display Design," (EPRI Report NP-3701, September 1984) will be consulted and followed where appropriate. In general, the following human factor's aspects of display design will be emphasized:

- o Logical, functional arranagements and groupings of information
- o Consistency in the manner of presenting information
- o Acceptable content density
- o Readability of presented information

- Effective, unambiguous, consistent, and readily identifiable color usage
- Understandability of presented information
- Efficient utilization of display area
- Use of hierarchical labeling to promote readability and unambiguous interpretation of presented information

7.0 CRT PRESENTATION OF DISPLAYS

SPDS and associated supplemental displays and the supplemental displays will be presented on control room CRTs via the Control Room Integrated Display System (CRIDS), a part of the Plant Computer Systems (PCS). CRIDS utilizes dual redundant Honeywell TDC 45,000 computers with Honeywell 7100 remote I/O. For a description of the PCS and CRIDS, refer to HCGS FSAR Section 7.5.1.3.3.

The plant computer systems are not Class 1E. However, the systems do present information to the operator during all plant conditions using data acquired from both Class 1E and non-Class 1E circuits. Where the computer input/output is connected to Class 1E circuits, isolation devices are provided. (Refer to the response to HCGS FSAR question 421.13 for a complete discussion of these isolation devices.)

8.0 VALIDATION OF CONTROL FUNCTION PARAMETER VALUES

This section describes the processing employed in validating the displayed values of the eleven control function parameters as presented on the SPDS displays.

RPV Water Level:

The value of RPV water level presented on the SPDS displays is a compensated averaged value, determined by the processing of information listed below.

1. RPV water level as determined by each SHUTDOWN RANGE RPV water level instrument channel
2. RPV water level as determined by each WIDE RANGE RPV water level instrument channel
3. RPV water level as determined by each NARROW RANGE RPV water level instrument channel
4. RPV water level as determined by each FUEL ZONE RPV water level instrument channel
5. Reactor recirculation flow rate
6. Temperature near the RPV water level instrument cold reference leg vertical runs
7. RPV pressure (determination of the validated value of

this control function parameter is described separately)

8. "Instrument Zero" for each of the RPV water level instruments identified above

9. Calibration conditions (RPV pressure and temperature, drywell and secondary containment temperature) for each of the RPV water level instruments identified above

The validated value of RPV water level is obtained by performing data processing as follows:

1. Determining which indicated values of RPV water level are within the instrument indicating range (i.e., confirming that the value indicated by the instrument channel is not up-scale high or down-scale low), taking into account the criteria detailed in EPG Caution #7.

2. For each on-scale indication (as determined by #1 above), applying appropriate corrections to the indicated value of RPV water level to compensate for off-calibration conditions (recirculation flow, instrument reference leg temperature, RPV pressure, RPV temperature, etc.).

3. Linearly compensating the results of #2 above to reference all RPV water level values to a common "instrument zero".

4. Arithmetically averaging the results of #3 above.

RPV Pressure:

The value of RPV pressure presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. RPV pressure as determined by each WIDE RANGE RPV pressure instrument channel
2. RPV pressure as determined by each NARROW RANGE RPV pressure instrument channel

The validated value of RPV pressure is obtained by performing data processing as follows:

1. Determining which indicated values of RPV pressure are within the instrument indicating range (i.e., confirming that the value indicated by the instrument channel is not up-scale high or down-scale low).
2. Arithmetically averaging all on-scale indications (as determined by #1 above).

<u>Reactor Power</u>:

For APRM reactor power: the value presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. Reactor power as determined by each neutron monitoring system APRM instrument channel

2. APRM bypass switch positions (each channel)

3. APRM INOP logic status (each channel)

The validated value of APRM reactor power is obtained by performing data processing as follows:

1. Determining which APRM instrument channels have an indicated value within the instrument indicating range (i.e., confirming that the value indicated by an instrument channel is not up-scale high or down-scale low).

2. Determining which APRM instrument channels are not bypassed.

3. Determining which APRM instrument channels are operable (as defined by INOP logic status).

4. Arithmetically averaging all on-scale, un-bypassed, and operable APRM instrument indications (as determined by #1, #2, and #3 above, respectively).

For IRM reactor power: the value presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. Reactor power as determined by each neutron monitoring system IRM instrument channel (accounting for the position of each channel's range switch)

2. IRM bypass switch positions (each channel)

3. IRM INOP logic status (each channel)

4. IRM detector postitions (each channel)

The validated value of IRM reactor power is obtained by performing data processing as follows:

1. Determining which IRM instrument channels have an indicated value within the instrument indicating range (i.e., confirming that the value indicated by an instrument channel is not up-scale high or down-scale low).

2. Determining which IRM instrument channels are not bypassed.

3. Determining which IRM instrument channels are operable (as defined by INOP logic status).

4. Determining which IRM detectors are fully inserted.

5. Arithmetically averaging all on-scale, un-bypassed, and operable IRM instrument indications for channels with the respective detector fully inserted (as determined by #1, #2, #3, and #4 above, respectively).

For SRM reactor power: the value presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. Reactor power as determined by each neutron monitoring system SRM instrument channel

2. SRM bypass switch positions (each channel)

3. SRM INOP logic status (each channel)

4. SRM detector postitions (each channel)

The validated value of SRM reactor power is obtained by performing data processing as follows:

1. Determining which SRM instrument channels have an indicated value within the instrument indicating range

(i.e., confirming that the value indicated by an instrument channel is not up-scale high or down-scale low).

2. Determining which SRM instrument channels are not bypassed.

3. Determining which SRM instrument channels are operable (as defined by INOP logic status).

4. Determining which SRM detectors are fully inserted.

5. Arithmetically averaging all on-scale, un-bypassed, and operable SRM instrument indications for channels with the respective detector fully inserted (as determined by #1, #2, #3, and #4 above, respectively).

<u>Suppression Pool Temperature</u>:

The value of suppression pool temperature presented on the SPDS displays is a bulk average value, determined by the processing of suppression pool temperature monitoring system information (all monitors and channels).

The validated value of suppression pool temperature is obtained by performing data processing as follows:

1. Determining which indicated values of suppression pool temperature are within the instrument indicating range (i.e., confirming that the value indicated by the instrument is not up-scale high or down-scale low).
2. Arithmetically averaging all on-scale indications (as determined in #1 above).

Suppression Pool Water Level:

The value of suppression pool water level presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. Suppression pool water level as determined by the WIDE RANGE suppression pool water level instrument (all channels)

2. Suppression pool water level as determined by the NARROW RANGE suppression pool water level instrument (all channels)

The validated value of suppression pool water level is obtained by performing data processing as follows:

1. Determining which indicated values of suppression pool water level are within the instrument indicating range (i.e., confirming that the value indicated by the instrument is not up-scale high or down-scale low).

2. Arithmetically averaging all on-scale indications (as determined in #1 above).

Drywell Pressure:

The value of drywell pressure presented on the SPDS displays is an averaged value, determined by the processing of information listed below.

1. Drywell pressure as determined by the WIDE RANGE drywell pressure instrument (all channels)

2. Drywell pressure as determined by the NARROW RANGE drywell pressure instrument (all channels)

The validated value of drywell pressure is obtained by performing data processing as follows:

1. Determining which indicated values of drywell pressure are within the instrument indicating range (i.e., confirming that the value indicated by the instrument is not up-scale high or down-scale low).

2. Arithmetically averaging all on-scale indications (as determined in #1 above).

Drywell Temperature:

The value of drywell temperature presented on the SPDS displays is an averaged value, determined by the processing of drywell temperature monitoring system information (all channels).

The validated value of drywell temperature is obtained by performing data processing as follows:

1. Determining which indicated values of drywell temperature are within the instrument indicating range (i.e., confirming that the value indicated by the instrument is not up-scale high or down-scale low).

2. Arithmetically averaging all on-scale indications (as determined in #1 above).

Reactor Building Water Level:

The value of reactor building water level presented on the SPDS displays is selected from the sump/area water level instruments for areas identified in OP-EO.ZZ 103, "Reactor Building Control," as follows.

1. If no reactor building floor drain sump or area water level is above its respective maximum normal operating value, the water level with the smallest margin to its maximum normal operating value (as a percentage of full-scale indicating range) is displayed.

2. If any reactor building floor drain sump or area water level is above its respective maximum normal operating value, the water level with the smallest margin to its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

3. If any reactor building floor drain sump or area water level is above its respective maximum safe operating value, the water level most above its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

Reactor Building Radiation Level:

The value of reactor building radiation level presented on the SPDS displays is selected from radiation monitors for the areas identified in OP-EO.ZZ 103, "Reactor Building Control," as follows.

1. If no reactor building area radiation level is above its respective maximum normal operating value, the radiation level with the smallest margin to its maximum normal operating value (as a percentage of full-scale indicating range) is displayed.

2. If any reactor building area radiation level is above its respective maximum normal operating value, the radiation level with the smallest margin to its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

3. If any reactor building area radiation level is above its respective maximum safe operating value, the water level most above its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

Reactor Building Temperature:

The value of reactor building temperature presented on the SPDS displays is selected from temperature monitors for the areas identified in OP-EO.ZZ 103, "Reactor Building Control," as follows.

1. If no reactor building area temperature is above its respective maximum normal operating value, the temperature with the smallest margin to its maximum normal operating value (as a percentage of full-scale indicating range) is displayed.

2. If any reactor building area temperature is above its respective maximum normal operating value, the temperature with the smallest margin to its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

3. If any reactor building area temperature is above its respective maximum safe operating value, the temperature most above its maximum safe operating value (as a percentage of full-scale indicating range) is displayed.

Radioactivity Release Rate:

The value of off-site radioactivity release rate presented on the SPDS displays is a computed value, determined by the processing of containment effluent noble gas radioactivity release rate information as specified in HCGS FSAR Table 11.5-1.

9.0 VERIFICATION OF DISPLAY DESIGN

Verification that the SPDS meets system performance requirements will be completed prior to SPDS implementation. An integrated program will be developed detailing verification criteria and objectives, qualification requirements of review team members, assessment of evaluation findings, and the mechanism for incorporating recommended modifications to the displays as appropriate and necessary.

10.0 OPERATOR TRAINING

Control room operators will be trained on the use of the displays, their information content, the means of accessing displays, and the anticipated use of displays during both normal and off-normal plant conditions prior to implementation of the SPDS. Formal operator training on these topics will be conducted after the SPDS verification process (Section 9.0) has been completed.

Use of SPDS will also be incorporated in the EOP Verification and Validation Program, and in the EOP Training Program.

APPENDIX A

DEFINITIONS

DEFINITIONS

Although many of the terms listed below are often used in a broader sense, the following definitions have been adopted for use in describing the Hope Creek Generating Station SPDS Display Design program.

ACTION FUNCTION:

An operator function involving the performance of a conscious movement, operation of controls, or execution of a series of procedural steps.

Example: "Inject boron into the RPV with SLC."

DECISION ANALYSIS:

A specialized form of task analysis in which operator decisions are identified and systematically examined to identify associated information requirements.

DECISION FUNCTION:

An operator function involving a determination, evaluation, or judgement through which a procedural branch path or action is selected.

Example: "If suppression pool temperature cannot be maintained below the Heat Capacity Temperature Limit, ... "

FUNCTION:

A higher order activity by which the plant operating crew meets the objectives of the operating procedures. Within the context of the SPDS Display Design description, functions include decisions and actions.

FUNCTIONAL ANALYSIS:

The process of identifying and analyzing the functions performed by the control room operating crew in executing the Emergency Operating Procedures.

INFORMATION REQUIREMENT:

Knowledge of system or plant status required as an input to making a decision or taking an action.

Examples: RPV pressure, pump status, spray flow, etc.

TASK:

A well defined subdivision of a function; a specific activity contributing toward the accomplishment of a function.

Examples: Starting a pump, opening a valve, etc.

TASK ANALYSIS

The process of identifying and analyzing the tasks performed by the control room operating crew in executing the Emergency Operating Procedures.