VOLUME 2

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APPENDIX A

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

DETAILED INSTRUCTIONS FOR REVIEW

PHASE TASKS

D. C. COOK

CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN FOR THE LICENSEE

EVENT REPORTS REVIEW

1.0 INTRODUCTION

1.1 Purpose.

The purpose of the Licensee Event Review LER is to examine the available documentation of operating difficulties outlined in Licensee Event Reports to identify conditions that may cause human performance problems.

1.2 `Scope

The Scope of the review will cover the LERs from D. C. Cook Nuclear Plant Units 1 and 2 for the time period of 1975 through 1982.

An industry wide survey of similar plants that were in commercial operation for the period of January 1978 through September 1983 will be conducted.

2.0 REVIEW METHODOLOGY

All LERs from the D. C. Cook plant covering the time period of 1975 through 1982 will be screened to eliminate those LERs not involving Control Room functions. The LERs from similar plants covering the period from January 1978 through September 1983 will also be screened to eliminate those not involving control room functions.

The LERs remaining from the screening process will then be examined to determine the specific problem, the probable cause and the corrective action. Each of the LERs will then be compared to the existing control room equipment and/or condition to verify the corrective action and/or fix. For those conditions that have not been corrected or that could still cause a human performance problem, the LER will be reviewed against the Control Room Human Factors Surveys to determine if the problem has been identified as a Checklist Observation Report (CLO).

If no CLO exists for any human performance problem identified by an LER, a CLO shall be generated.

3.0 DOCUMENTATION PHASE

Documentation generated and LERs reviewed during the LER review will be collected and maintained as a part of the DCRDR documentation file. This documentation will consist of the following:

1. Lists of LERs to be reviewed as a result of the screening process

2. Copies of the LERs reviewed

3. LER Summary Report

D. C. COOK

CONTROL ROOM DESIGN REVIEW

CONTROL ROOM OPERATING PERSONNEL SURVEY

PROCEDURE

CONDUCT OF THE D. C. COOK CONTROL ROOM OPERATING PERSONNEL SURVEY

The survey of D. C. Cook personnel is a part of Phase 2, Task 1 of the DCRDR. This survey will include both Units 1 and 2. Our general approach to conducting the survey will be to interview those individuals who have sufficient experience in the D. C. Cook control rooms to provide knowledgeable and useful insights into the design features of the control room and its equipment. Most of this survey will be conducted with interviews of control room personnel. It may be useful to provide questionnaires to some of the RO/SRO staff who have heavy time constraints. Specific information regarding the selection of these individuals is given below followed by suggestions for implementing the survey.

Based on information presently available, there are 83 operating shift personnel who have an appropriate level of control room experience for the survey. At least half of these individuals, representing a range of experience and responsibilities, should be represented in the survey.

NUREG-0700 describes two basic classifications to use when selecting staff for the survey. One classification is based on current position description and the other is based on type of previous experience.

The table below presents the range of job descriptions to be sampled in this survey. Also shown is the recommended number of individuals which should be surveyed from each category. These job descriptions represent a wide range of operational responsibilities and familiarity with the D. C. Cook control rooms. The actual number of individuals selected for each category can vary somewhat to allow for several variables (e.g., plant conditions, vacations, and shift schedules) insofar as each job category is still represented and the total minimum number of individuals is still present.

Table 1

Sample Selection by Position Description

Operations Managers/Staff	8
Shift Supervisors	10
Shift Technical Advisors	2
Senior Reactor Operators	5
Reactor Operators	7
Trainees	6
Auxiliary Operators	6

The second classification for staff selection is amount and type of previous control room experience. At least one person from each experience category shown below should be in the survey in order to provide different perspectives of the control room. It is possible, of course, that not all of these categories are represented at D. C. Cook.

Table 2

Amount and Type of Previous Experience

1. More than two years at D. C. Cook.
2. Between six months and two years at D. C. Cook.
3. Less than six months at D. C. Cook but has licensed experience at other commercial nuclear power plants.
4. Less than six months at D. C. Cook but has been reactor operator in nuclear navy.
5. Less than six months at D. C. Cook but has been licensed operator in non-nuclear control room.
6. Less than six months at D. C. Cook and has no previous experience in control room.

Most of the personnel will be interviewed individually and in small groups of two or three persons. Whereas the individual interviews allow privacy between interviewer and interviewee, the small group interview provides an opportunity for an interaction between operators which could result in useful information for the survey which may not appear in individual interviews. Persons selected for group interviews should be given the option of participating in an individual interview instead of a group interview. The members of a group should all be within the same job classification (e.g., Reactor Operator). Questionnaires can be given to those operations managers/staff, and possibly STAs and supervisors who have heavy time constraints.

We recommend that the numbers shown in the following table be used as a guideline for selecting participants for the survey.

Table 3

Distribution of Survey Types

Survey Type	Number of Individuals
Individual Interviews	20
Group Interviews For example: 6 groups of 3 or 9 groups of 2 or a combination of these	18
Questionnaires	5

The average length of the interview is about two hours. This should allow the interviewers to complete three interviews per day while allowing for shift change and breaks. Except for unanticipated events, operators should be able to give undivided attention to the interview.

We prefer that both the 8-4 shift and the 4-12 shift be available for interviews. This should allow a sampling of at least four of the five shifts during a two-week period.

The maximum number of interviewers will be two. The following schedule is proposed for the interviewers.

On the first day at D. C. Cook both interviewers will receive control room orientation and badging procedures. The interviews for the remainder of the week will be conducted by the two interviewers during the 8-4 shift in order to allow the interviewers access to both the operations shift and the training shift. During the second week, one interviewer will be present during the 4-12 shift. This should allow access to two additional shifts or groups of operators because of the changeover of shifts at approximately mid-week in the 4-12 time slot. It is possible that these interviews and the meetings described below will require a portion of a third week.

Questionnaires will be available on the first day of interviews. They should be returned preferably within a week to allow for possible follow-up interviews, if necessary, before the analysis of the data.

After the interviews, the results will be tabulated and examined. Two days should be allowed for this activity. Then two meetings should be scheduled for the next day with available operating personnel to discuss significant survey results. One meeting should be attended by AEOs, trainees, and new ROs. The other meeting should be attended by more experienced personnel. Figure 1 indicates a proposed schedule for the two interviewers.

The Technical Support Center is a possible location for conducting the interviews due to its privacy and visual access to both control rooms through remotely controlled cameras.

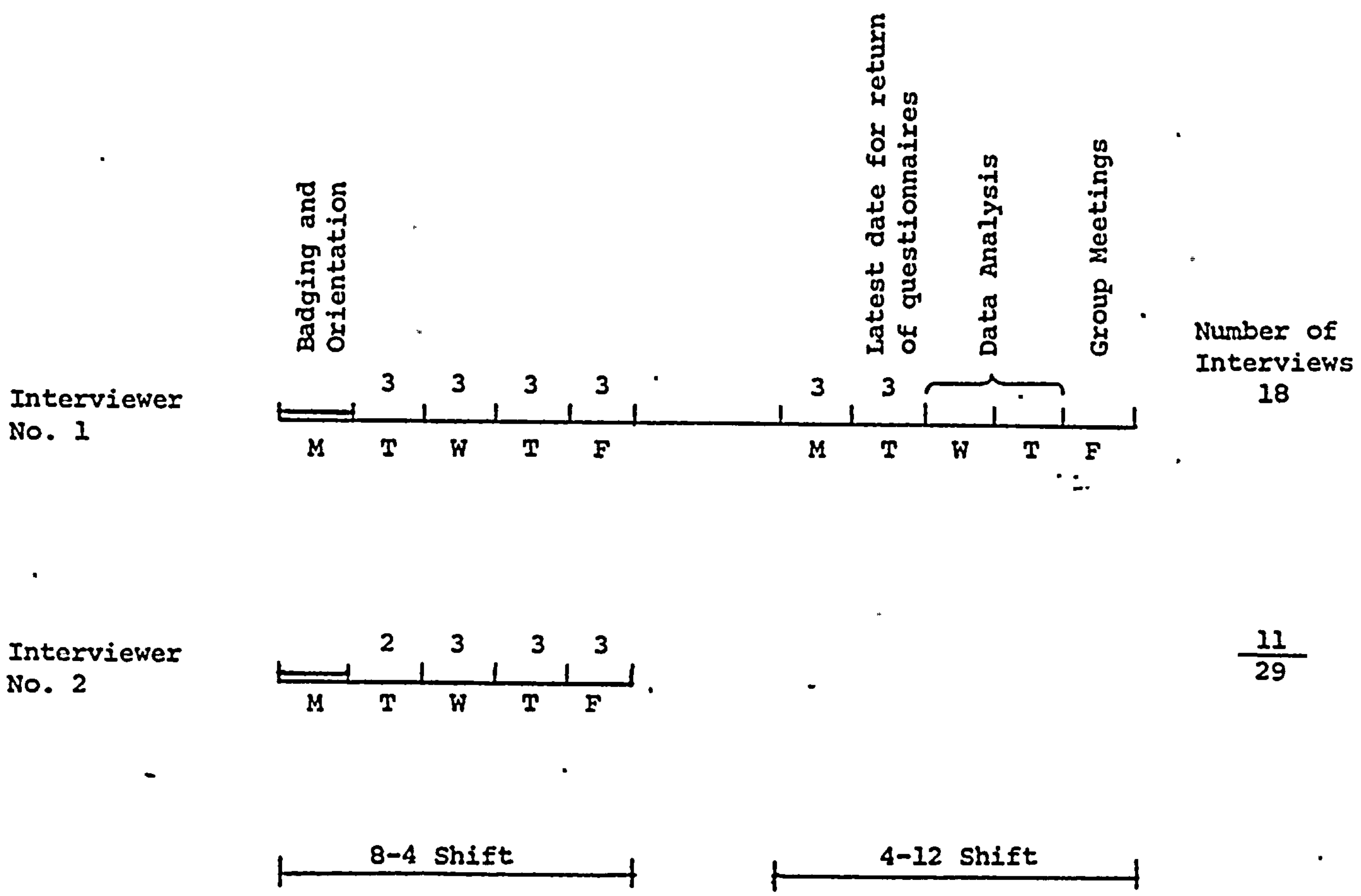

Figure 1. Schematic interview schedule showing estimated number of interviews conducted by each interviewer

D. C. COOK

SYSTEM REVIEW AND TASK ANALYSIS

PROGRAM DESCRIPTION

July 25, 1985

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1. INTRODUCTION

The System Review and Task Analysis (SRTA) program systematically evaluates and identifies the needs of the control room operations crew to permit acceptable performance of operator functions in response to emergency transients. The SRTA process and documentation are based on the methodology (see Reference 1) developed by the Westinghouse Owners Group (WOG) and the NRC clarification comments (see Reference 2) on task analysis provided to the WOG at the March 29, 1984 meeting. The SRTA documentation provides the information required by the control room design review (CRDR) team to perform the Verification of Operator Task Performance Capability review phase of the CRDR and evaluates the operator information and control needs as a basis for the identification of instrumentation and control characteristics.

1.1 Background

The SRTA program was initiated in early 1984 concurrent with the EOP Upgrade Program for D. C. Cook. The initial SRTA program was based on the task analysis methodology developed by the WOG. Following the March 29, 1984 meeting with the NRC (see Attachment A), the SRTA program was augmented to include an activity to define operator information and control needs and instrumentation and control characteristics. This additional activity has been coordinated with the initial task analysis activity to provide a comprehensive SRTA program consisting of two phases as defined in this program plan.

1.2 Objectives

The first objective of the SRTA program is to provide task analysis requirements for emergency operations based on the D. C. Cook Emergency Operating Procedures (EOPs) and to compile and organize these requirements in a manner that supports the CRDR. The task analysis documentation provides the CRDR team with documentation that systematically identifies operator task requirements and associated instrumentation and control requirements. This objective addresses the recommendations in Section 3.4 of NUREG-0700, Guidelines for Control Room Design Review.

The second objective of the SRTA program is to define the instrumentation and control characteristics that are necessary for proper operator response to emergency transients. This objective addresses item 2 (development of a process), item 3 (identification of generic instrumentation and control characteristics and plant specific deviations) and item 4 (development and justification of instrumentation and control characteristics based on operator information and control needs) of the March 29, 1984 NRC meeting.

The documentation developed as a result of the SRTA program will satisfy the needs of the CRDR program and the requirements of the NRC.

2. TASK ANALYSIS PROGRAM

The SRTA program consists of two phases: 1) Identification of operator actions that are necessary for proper operator response to emergency transients, including requirements for instrumentation and controls, and 2) Identification of instrumentation and control characteristics that are necessary for proper operator response to emergency transients.

As discussed in the Introduction, the two SRTA program phases were developed with Phase 2 being added to the program following the March 29, 1984 NRC meeting. Phase 1 documentation is based on the plant specific EOPs for D. C. Cook. Phase 2 documentation is based on both generic documentation (WOG Emergency Response Guidelines (ERGs) and background documents) and the plant specific EOPs for D. C. Cook, consistent with the NRC clarification provided at the subject NRC meeting. Use of both the generic ERGs and the plant specific EOPs in Phase 2 facilitates identification of generic requirements and plant specific differences, in compliance with Item 2 of the NRC clarification comments provided at the March 29, 1984 meeting.

2.1 Phase 1 - Identification of Operator Actions and Required Instrumentation and Controls

The first phase of the SRTA program consists of a systematic evaluation of representative plant emergency operations to identify operator actions and associated instrumentation and controls necessary to support operator response to emergency transients. The methodology and documentation for this phase are based on that developed by the WOG (see Reference 1). The following subsections describe the selection of event sequences and EOPs for task analysis and the process to be used to analyze the EOPs to identify and document operator actions and required instrumentation and controls.

Selection of Event Sequences and EOPs for Task Analysis

Task analysis data will be developed for event sequences that reflect a spectrum of plant emergency operations. The event sequences selected comply with the recommendations in NUREG-0700 (see Reference 3), and ensure that the task analysis documentation addresses the important areas of emergency operations (e.g., event diagnosis, critical safety function monitoring, high risk event sequences, etc.). In addition, the event sequences selected will representatively exercise the EOPs. The event sequences selected for task analysis are itemized in Table 1.

Based on the selected event sequences, the EOP set is reviewed to determine which procedures are used in response to the above event sequences. In the symptomed based EOP set, at least two EOPs (or portions thereof) and the critical safety function status trees are implemented in response to an emergency transient. Figure 1 schematically illustrates EOP implementation in response to a small break loss of coolant accident. The review of EOP implementation for the selected event sequences identifies the selected EOPs to be task analyzed. The selected EOPs to be task analyzed are itemized in Table 2. This table also shows the event sequences for which the EOP is implemented. Note that the Critical Safety Function Status Trees are implemented for all event sequences. Through task analyzing these status trees, documentation will be developed for monitoring the plant safety state during emergency operations, independent of the emergency transient.

TABLE 1

SELECTED EVENT SEQUENCES FOR TASK ANALYSIS

	1.	Spurious Safety Injection
	2.	Loss of reactor coolant (small break ~ 1 inch diameter)
*	3.	Loss of reactor coolant (small break ~ 4 inch diameter)
	4.	Loss of reactor coolant (large break)
	5.	Loss of secondary coolant
	6.	Combined loss of reactor and secondary coolant
	7.	Steam generator tube rupture (design basis)
*	8.	Steam generator tube rupture (multiple ruptures in one steam generator)
*	9.	Steam generator tube rupture (ruptures in more than one steam generator)
*	10.	Anticipated transient without scram
*	11.	Inadequate core cooling (resulting from failures in emergency core cooling system)
	12.	Inadequate core cooling (resulting from loss of secondary heat sink)
	13.	Pressurized thermal shock transient
	14.	High containment pressure transient

*Event sequences recommended in NUREG-0700

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Figure 1

EOP USAGE FOR LOSS OF REACTOR COOLANT (SMALL BREAK)

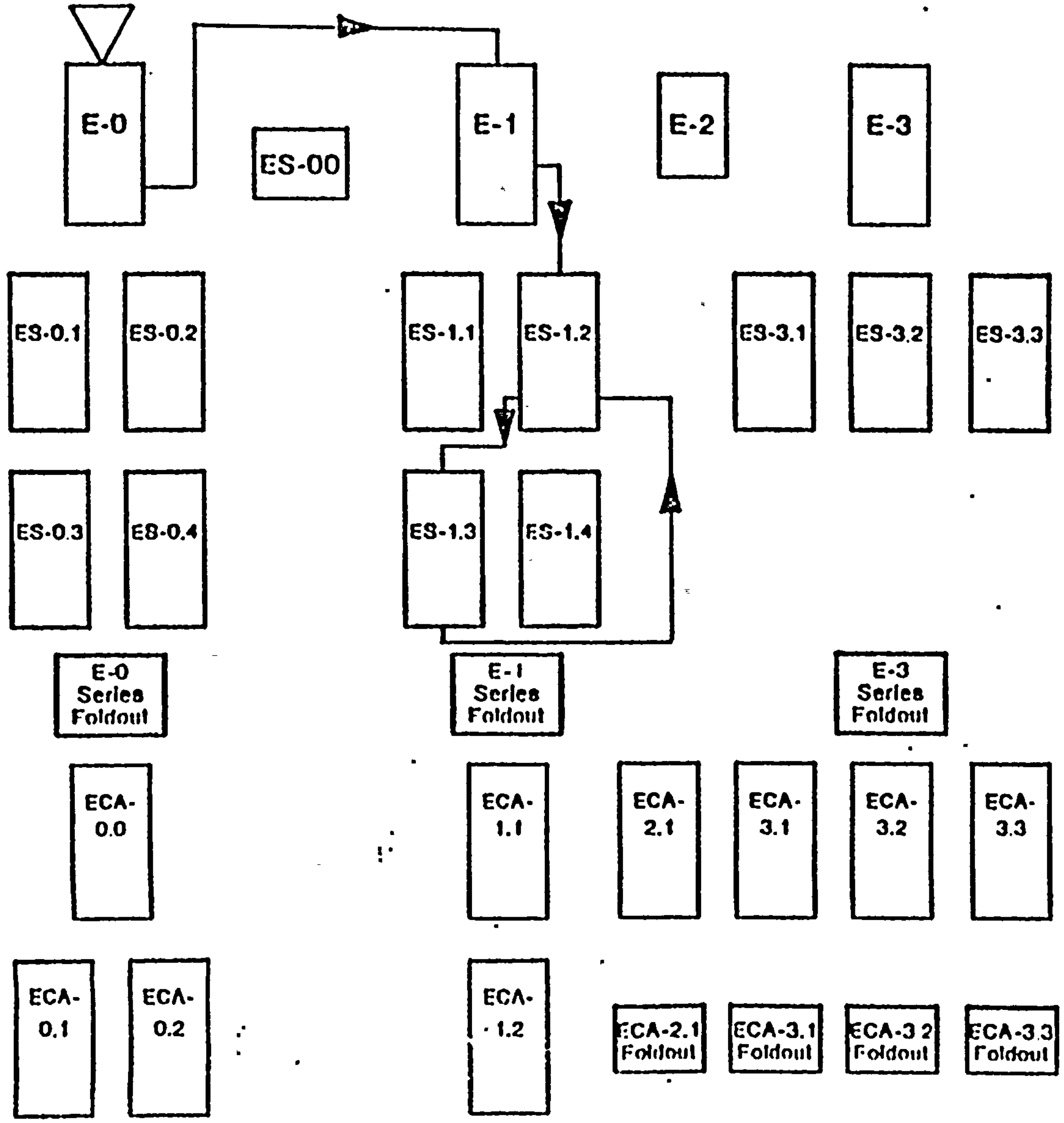

TABLE 2

SELECTED EOPs FOR TASK ANALYSIS

EOPs	Sequences
Reactor Trip or Safety Injection	All
SI Termination	1,2,5,12
Loss of Reactor or Secondary Coolant	2,3,4,5,6
Post-LOCA Cooldown and Depressurization	2
Transfer to Cold Leg Recirculation	4
Transfer to Hot Leg Recirculation	4
Faulted Steam Generator Isolation	5,6
Steam Generator Tube Rupture	7,8,9
Post-SGTR Cooldown Using Steam Dump	7,8,9
Critical Safety Function Status Trees	All
Response to Nuclear Power Generation/ATWS	10
Response to Inadequate Core Cooling	11
Response to Loss of Secondary Heat Sink	12
Response to Imminent Pressurized Thermal Shock Conditions	13
Response to High Containment Pressure	14

Process for Identification of Operator Actions

Having selected the subset of EOPs to be used, the task analysis process can be applied to each EOP to identify the operator actions necessary to implement the EOP in response to emergency transients. Following identification of operator actions, the necessary instrumentation and control requirements to support the operator actions can be identified. This detailed information (in addition to general information on the operator function and the purpose of each EOP step) is documented on Element Tables (see Figure 2) which are similar in format to that developed in the WOG SRTA program.

The documents used for task analysis are the plant specific EOPs and the plant specific design and operational source documentation (flow diagrams, system descriptions, electrical diagrams, etc.) needed to analyze the system operational aspects of the EOPs. The WOG ERGs and Background Documents are also used as a generic source document for task analysis. The task analysis activity is a table top evaluation of the plant specific EOPs relative to the plant specific and generic source documentation to identify the operator actions and associated instrumentation and control requirements necessary to support operator response to emergency transients. The table top evaluation is performed based on the existing plant design but is independent of the existing control room configuration and specific instruments and controls contained therein.

The task analysis process is as follows:

1) Each EOP step will be evaluated to identify the operator function(s) that the step supports and the purpose for the step. This information will be entered at the top of the table.

ELEMENT TABLE FOR E-0   STEP 1

FUNCTION: Verify automatic actuations
Diagnose plant condition

STEP: Verify Reactor Trip

PURPOSE: To ensure that the reactor has tripped

ACTIONS:

- o Determine if the reactor has tripped:
  - Rods are at bottom
  - Reactor trip and bypass breakers open
  - Rod position indication at zero
  - Neutron flux decreasing
- o Trip the reactor

INSTRUMENTATION:

- o Control rod bottom lights indication (rods at bottom)
- o Power range neutron flux indication (decreasing)
- o Intermediate range neutron flux indication (decreasing)
- o Source range neutron flux indication (decreasing)
- o Control rod position indication (at zero)
- o Reactor trip and bypass breaker position indications (open)

CONTROL/EQUIPMENT:

Reactor trip switches (trip)

Figure 2

2) The step will then be systematically reviewed to identify the operator actions necessary to implement each EOP step. Since the EOPs frequently utilize concise task statements to trigger operator actions, all actions that are needed for operation of plant systems are not explicitly identified in the EOPs. Where appropriate, the task analysis will include identification of the specific actions necessary to perform the tasks identified in the EOPs. The operator actions will be entered on the Element Table.

3) Each operator action will then be evaluated to identify the instrumentation and controls necessary for the operator to perform the necessary actions. This evaluation of instrumentation and controls will also identify the instrumentation and control criteria requirements necessary for proper performance of operator actions. The instrumentation and controls will be entered on the Element Table. Criteria requirements (e.g. decreasing, at zero, etc.) will be shown in parenthesis following the associated instrumentation and controls.

With respect to the task analysis process, any cautions and notes that precede EOP steps will be considered as part of the step and will be analyzed on separate Element Tables.

Following preparation of the Element Tables for the selected EOPs, the remaining EOPs will be reviewed to identify any operator actions, instrumentation or controls that exist in the remaining EOPs but not the selected EOPs. This review will ensure that the selected EOPs are representative of emergency operations. Any unique actions, instrumentation or controls identified in this review will be included in the task analysis process and identified on Element Tables. This approach provides representative task analysis documentation in an efficient manner while ensuring complete identification of operator actions, instrumentation and controls utilized in emergency operations.

Compilation of Instrumentation and Control Requirements

Following completion of the task analysis process, the resulting information can be compiled on summary tables which highlight specific information. This is especially advantageous for instrumentation and controls since all uses for a specific instrument or control can be presented on a single Requirements Table, precluding the need for a user to review all Element Tables to obtain the same data. Consequently, following completion of the Element Tables for the selected EOPs and unique emergency operator actions, the instrumentation and control requirements will be compiled on Instrumentation Requirements Tables (see Figure 3) and Control/Indication Requirements Tables (see Figure 4), respectively, similar in format to those developed in the WOG SRTA program.

Compilation of System Sequence Requirements

As part of the task analysis process to identify and evaluate operator actions, plant systems are reviewed to identify equipment (instrumentation and controls) that must be used to accomplish operator actions. Following completion of the task analysis process, the resulting information on operator actions and plant systems can be compiled to show the sequence in which the operator uses the plant systems in implementing the EOPs. A System Sequence Matrix will be prepared for each selected EOP to show the plant systems that are used to perform each step in the EOP. As with other task analysis documentation, the System Sequence Matrices (see Figure 5) will be similar in format to that developed in the WOG SRTA program.

INSTRUMENTATION REQUIREMENTS TABLE

SYSTEM: Reactor Coolant

INSTRUMENTATION: RCS Pressure (NPS-121,122)

CRITERIA REQUIREMENTS	PROCEDURE	STEP
1. Less than 1630 psig	E-0	10
2. Less than 300 psig	E-0	10 35C
3. Less than 1250 psig	E-0 E-1 E-3	21 1 1
4. Stable or increasing	E-0	25 35
	E-1	6 9
	ES-1.1	5 9
	ES-1.2 E-3	5 2
5. Greater than 300 psig	E-0 E-1	35 9 14
	ES-1.2 E-3	5 12C 12

Figure 3

CONTROL/INDICATION REQUIREMENTS TABLE

SYSTEM: Emergency Core Cooling

CONTROL/INDICATION: SI Pump Discharge Valves Control and Status (ICM-260, 265)

CRITERIA REQUIREMENTS	PROCEDURE	STEP
Open/Close	E-0	11
	FR-C.1	16
		23
	FR-H.1	11

Figure 4

SYSTEM SEQUENCE MATRIX TABLE

PROCEDURE: E-O, REACTOR TRIP OR SAFETY INJECTION

STEP	AFS	APS	BMS	CAS	CCW	CIS	CON	CSS	CVC	CVS	ECC	EDG	ESF	ESW	FWS	GEN	HMS	MIS	MSS	NES	NHS	NIS	NSS	PWS	RCS	RDC	RHR	RMS	RPS	SDS	SGP	WDS
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Matrix Table

Figure 5

2.2 Phase 2 - Identification of Instrumentation and Control Characteristics

The second phase of the SRTA program will identify and justify the instrumentation and control characteristics that are necessary for proper operator response to emergency transients. This phase addresses item 2 (development of a process), item 3 (identification of generic instrumentation and control characteristics and plant specific deviations) and item 4 (development and justification of instrumentation and control characteristics based on operator information and control needs) of the March 29, 1984 NRC meeting.

This Instrumentation and Control Characteristics Review (ICCR) phase includes the definition of a process and the development of documentation to identify instrumentation and control characteristics based on operator information and control needs during emergency operations. The process and documentation will address all instrumentation and controls used in the WOG ERGs and plant specific EOPs. Basis documentation will be based on the same representative event sequences and emergency operating procedures utilized in Phase 1 of the program.

Definition of ICCR Process

The ICCR phase will first identify generic characteristics based on the WOG high-pressure reference plant design, followed by the identification of plant specific deviations (i.e., differences and detail) and their characteristics. Characteristics will be justified through development of or reference to appropriate generic or plant specific basis documentation.

The ICCR process to be used is as follows:

1) The set of operator functions for response to emergency transients will defined.

2) The generic ERGs will then be reviewed and guideline steps will be associated with operator functions.

3) For each operator function, the generic ERG background documentation (Step Description Tables) will be reviewed to identify:

   o major operator actions necessary to support the operator functions.

   o operator information and control needs necessary to support the operator functions and major actions.

   o plant systems necessary to provide information and control needs.

   o plant instrumentation and controls necessary to provide information and control needs.

4) For plant instrumentation and controls identified in item 3) above, generic characteristics will be identified based on the required information and control needs

   a) Characteristics for instrumentation will include:

      o Units - the identification of a parameter in terms of specific quantities for which timely and accurate information can be viewed (examples: psig; %; °F; etc.).

      o Range - the interval over which a parameter may vary during the task performance based on analysis or engineering judgement (examples: 0 to 3000 psig; 250-500°F, 0-100%; etc.).

- Resolution - the quality of a display required to make an adequate determination of a parameter's value or performance for task cueing, or timely and accurate feedback information during a task (examples: greater than 1837 psig; less than 14%; greater than 1200°F, etc.)

- Accuracy - a quantitative minimum for an information loop's performance to ensure entry into a task is appropriately cued, or the task performance is maintained within any specific limits (analytical or engineering). (Examples: plus or minus 31 psi; plus or minus 2°F; etc.)

- Response Time - the quantitative maximum for which feedback information on a task's performance and subsequent cueing is required based on analysis or engineering judgement. (Example: 10 sec.).

- Display type - the type of visual information required to support task performance, classified as one or more of the following:

  a) discrete or instantaneous (single value)
  b) continuous (multiple values within a range)
  c) trending (changing values within a range over a time period)

b) Characteristics for indications and controls will include:

- o Positions - the identification of the status of a control or indication required for making an adequate determination for verification of or performance of a specific task (examples: open; closed; throttled; on; off; etc.).

- o Response time - a quantitative maximum for which the feed back performance is adequate to prevent excessive rates of change during the task performance (example: stroke time of 10 sec.).

- o Type - the type of control required to support task performance, classified as one or both of the following:

  a) continuous (variable control)
  b) discrete (individual position(s) control)

5) From the information gathered in items 3) and 4) above, a Characteristics Justification Table will be developed for instrumentation and controls. This table will identify operator action categories and associated operator information needs, criteria (e.g., specific values for instrumentation) and characteristics (e.g., range, resolution, accuracy, etc. for instrumentation). The basis for each action category or information need will be described or a reference to other documentation will be given.

The Characteristics Justification Tables are formatted to present both generic and plant specific characteristics, facilitating their development and the comparison of generic to plant specific characteristics. Figure 6 (instrumentation) and Figure 7 (controls/indications) show examples of the subject tables. These figures show example information for the action categories and associated generic characteristics. These example tables appear as they will upon completion of ICCR process item 5).

6) Following identification of the generic characteristics in item 5), the plant specific characteristics will be identified. The plant specific characteristics will consist of applicable generic characteristics and plant specific deviations (i.e., characteristics that differ from generic due to design differences and characteristics for plant specific design features beyond the scope of the generic design).

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CHARACTERISTICS JUSTIFICATION TABLE

INSTRUMENTATION: RCS Pressure

ERG REQUIREMENTS		CHARACTERISTICS							
ACTION CATEGORY/INFORMATION NEEDS		CRITERIA	VALUE	RANGE	ACC	RESOL	UNITS	RESP	TYPE
1. RCP Trip RCS Pressure in SG U-tubes less than RCS saturation pressure. (RCP Trip/Restart Generic Issue Background Document, Section 2.3.1.1.)	P								
	G	Less than	P1	NA	NA	NA	PSIG	NA	D
2. SI Termination a. Flow into RCS exceeds flow out of RCS (SI Termination/Reinitiation Background Document, Section 2.1)	P								
	G	Stab or Incr	Value	NA	NA	NA	PSIG	NA	T
b. SI pump flow is zero; RCS pressure greater than SI pump shutoff head (SI Termination/Reinitiation Background Document, Section 2.1)	P								
	G	Greater than	P2	NA	NA	NA	PSIG	NA	D.
c. RHR pump flow is zero; RCS pressure greater than RHR pump shutoff head. (E-1 Background Document, Section 4.0, SDT for Step 9)	P								
	G	Greater than	P3	NA	NA	NA	PSIG	NA	D.

Characteristics Table

Figure 6

CHARACTERISTICS JUSTIFICATION TABLE

CONTROLS / INDICATION: SI Pump Discharge Valves

ERG REQUIREMENTS			CHARACTERISTICS			
ACTION CATEGORY/INFORMATION NEEDS		CRITERIA	POSITIONS	RESP. TIME	TYPE	COMMENTS
1. Verify equipment status: Valves that are required to be open to provide SI flow to the RCS are open. (E-0 Background Document, Section 4, SDT for Step 11)	P					
	G	open	open	NA	Discrete	
2.	P					
	G					

Characteristics Table

Figure 7

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To identify plant specific characteristics, the selected subset of plant specific EOPs will be reviewed to identify deviations from the generic ERGs. These deviations will be evaluated with respect to ICCR process items 3) and 4) above. Characteristics for deviations will be identified consistent with ICCR process item 5) above. These plant specific characteristics (consisting of identified deviations and applicable generic characteristics) will then be entered on the Characteristics Justification Tables.

Figure 8 (instrumentation) and Figure 9 (controls/indications) show examples of the subject tables with plant specific characteristics included. These example tables are identical to Figures 6 and 7, respectively, except that they include plant specific characteristics, appearing as they will upon completion of ICCR process item 6). The tables facilitate comparison of generic (identified by the letter G) and plant specific (identified by the letter P) characteristics for each operator action category/information need entry.

7) Generic and plant specific characteristics will be summarized on Characteristics Comparison Summary Tables for instrumentation (see Figure 10 for example) and controls/indications (see Figure 11 for example). These tables will summarize the limiting requirements for each characteristic.

8) The limiting plant specific characteristics identified in item 7) will then be added to the Instrumentation Requirements Tables (see Figure 12 for example) and Control/Indication Requirements Tables (see Figure 13 for example). This will consolidate all criteria and characteristics on a single Requirements Table for each instrument and control.

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CHARACTERISTICS JUSTIFICATION TABLE

INSTRUMENTATION: RCS Pressure

ERG REQUIREMENTS		CHARACTERISTICS							
ACTION CATEGORY/INFORMATION NEEDS		CRITERIA	VALUE	RANGE	ACC	RESOL	UNITS	RESP	TYPE
1. RCP Trip RCS Pressure in SG U-tubes less than RCS saturation pressure. (RCP Trip/Restart Generic Issue Background Document, Section 2.3.1.1.)	P	Less than	1300	1170-1430	300 A 100 N	20	PSIG	10	D
	G	Less than	P1	NA	NA	NA	PSIG	NA	D
2. SI Termination a. Flow into RCS exceeds flow out of RCS (SI Termination/Reinitiation Background Document, Section 2.1)	P	Stab or Incr	Value	1600-2235	300 A 100 N	50	PSIG	10	T
	G	Stab or Incr	Value	NA	NA	NA	PSIG	NA	T
b. SI pump flow is zero; RCS pressure greater than SI pump shutoff head (SI Termination/Reinitiation Background Document, Section 2.1)	P	Greater than	1630	1470-1790	100 A 100 N	20	PSIG	10	D.
	G	Greater than	P2	NA	NA	NA	PSIG	NA	D.
c. RHR pump flow is zero; RCS pressure greater than RHR pump shutoff head. (E-1 Background Document, Section 4.0, SDT for Step 9)	P	Greater than	300	270-330	100 N	20	PSIG	10	D.
	G	Greater than	P3	NA	NA	NA	PSIG	NA	D.

Characteristics Table

Figure 8

CHARACTERISTICS JUSTIFICATION TABLE

CONTROLS / INDICATION: SI Pump Discharge Valves

ERG REQUIREMENTS			CHARACTERISTICS			
ACTION CATEGORY/INFORMATION NEEDS		CRITERIA	POSITIONS	RESP. TIME	TYPE	COMMENTS
1. Verify equipment status: Valves that are required to be open to provide SI flow to the RCS are open. (E-O Background Document, Section 4, SDT for Step 11)	P	open	open	NA	Discrete	
	G	open	open	NA	Discrete	
2.	P					
	G					

Characteristics Table

Figure 9

CHARACTERISTICS COMPARISON SUMMARY TABLE

INSTRUMENTATION		RANGE	ACCURACY	RESOL	UNITS	RESP	TYPE	COMMENTS
1. RCS Pressure	P	0-2750	300 A	20	PSIG	10 sec.	C, T, D	
	G	NA	NA	NA	PSIG	NA	C, T, D	
2. Pressurizer Level	P	0-100	10 A, 5 N	5	%	5 sec.	C, T	
	G	NA	NA	NA	%	NA	C, T	
3. PRZR Pressure	P	1700-2500	80 A, 10 N	20	PSIG	5 sec.	C, T, D	
	G	NA	NA	NA	PSIG	NA	C, T, D	
4. SG Narrow Range Level	P	0-100	25 A, 5 N	5	%	5 sec.	C, T, D	
	G	NA	NA	NA	%	NA	C, T	

Characteristics Summary Table

Figure 10

5607Y

CHARACTERISTICS COMPARISON SUMMARY TABLE

CONTROLS / INDICATION		POSITIONS	RESP. TIME	TYPE	COMMENTS
1. SI Pump Discharge Valves	P	open,closed	60 secs.	Discrete	
	G	open,closed	NA	Discrete	
2.	P				
	G				
3.	P				
	G				
4.	P				
	G				

Characteristics Summary Table

Figure 11

INSTRUMENTATION REQUIREMENTS TABLE

SYSTEM: Reactor Coolant

INSTRUMENTATION: RCS Pressure (NPS-121,122)

UNITS: PSIG

RANGE: 0 to 2750

RESOLUTION: 20

ACCURACY: 100 (normal containment); 300 (adverse containment)

RESPONSE TIME: 10 seconds

TYPE: Continuous; trending; discrete

CRITERIA REQUIREMENTS	PROCEDURE	STEP
1. Less than 1630 psig	E-0	10
2. Less than 300 psig	E-0	10 35C
3. Less than 1250 psig	E-0 E-1 E-3	21 1 1
4. Stable or increasing	E-0	25 35
	E-1	6 9
	ES-1.1	5 9
	ES-1.2 E-3	5 2
5. Greater than 300 psig	E-0 E-1	35 9 14
	ES-1.2 E-3	5 12C 12

Figure 12

CONTROL/INDICATION REQUIREMENTS TABLE

SYSTEM: Emergency Core Cooling

CONTROL/INDICATION: SI Pump Discharge Valves Control and Status (ICM-260, 265)

POSITIONS: Open/Close

RESPONSE TIME: 10 seconds

TYPE: Discrete

CRITERIA REQUIREMENTS	PROCEDURE	STEP
Open/Close	E-0	11
	FR-C.1	16
		23
	FR-H.1	11

Figure 13

ICCR Basis Documentation

The results of the ICCR evaluation process will be provided in an Instrumentation and Control Characteristics Basis Document. This document will consist of the following major sections:

1) Introduction

2) Description of Operator Function Evaluation Process

3) Description of Operator Function Information and Control Needs

   For each operator function summary documentation will be provided to describe:

   a) operator action categories
   b) information and control needs
   c) plant systems required to provide information and control needs
   d) instrumentation and controls required to provide information and control needs

4) Description of Instrumentation and Control Characteristics

   For each instrument and control identified in Item 3), the Characteristics Justification Tables will be provided to identify the required generic and plant specific characteristics. The basis for the identified characteristics will be established by referencing appropriate discussion in Section 3 above, and/or the appropriate information in the generic ERG background documentation or plant specific documentation.

5) Comparison of Instrumentation and Control Characteristics

Characteristics Comparison Tables will be provided for instrumentation and controls. These tables will identify generic and plant specific characteristics.

Compliance with NRC Clarification

The primary intent of the ICCR activity is to address clarification items 2, 3 and 4 from the NRC March 29, 1984 meeting. Item 2 (development of a process) is described in Section 2.2, Definition of the ICCR process. Item 3 (identification of generic instrumentation and control characteristics and plant specific deviations) is described in Section 2.2, subsections 5 and 6. Item 4 (development and justification of instrumentation and control characteristics based on operator information and control needs) will be provided in the ICCR Basis Documentation as described in Section 2.2. In summary, the ICCR program plan described herein defines a process which identifies instrumentation and control characteristics based on the information and control needs identified in the ERG background documentation and the plant-specific EOPs. In addition, basis documentation will be provided to identify how the needed characteristics of the instruments and controls were determined and to justify any deviations from the generic ERG instrumentation and controls.

3. SUMMARY OF TASK ANALYSIS DOCUMENTATION

The documentation resulting from the SRTA program will consist of the following:

- Element Tables

  The element tables identify the operator actions necessary for response to emergency transients, including identification of specific instrumentation and control requirements necessary for implementation of operator actions. These tables are developed in Phase 1 of the SRTA program.

- Instrumentation and Control Requirements Tables

  The Requirements Tables compile the specific criteria and characteristic requirements for instrumentation and controls necessary for implementation of operator actions. These tables are developed and specific criteria are identified in Phase 1 of the SRTA program. Characteristics are identified in Phase 2 and added to the subject tables. Separate tables are provided for each instrument or control.

- System Sequence Matrice

  The System Sequence Matrices identify the sequence in which the operator uses plant systems in response to emergency transients. Separate matrices are provided for each selected EOP that is task analyzed. These matrices are developed in Phase 1 of the SRTA program.

- Instrumentation and Controls Characteristic Basis Documentation

  The basis for instrumentation and controls characteristics will be provided in this basis documentation. This document will describe the ICCR process and the operator functional response to emergency transients. It will include the following tables that are developed as part of the ICCR process.

  - Characteristics Justification Tables

    These tables will identify and justify operator actions, associated information and control needs and characteristics for instrumentation and controls. Separate tables are provided for each instrument and control.

  - Characteristics Comparison Summary Tables

    These tables will summarize the limiting characteristics for instrumentation and controls. Separate tables are provided for instrumentation and controls.

  This document and included tables will be developed in Phase 2 of the SRTA program.

4. USE OF TASK ANALYSIS DOCUMENTATION IN VERIFICATION OF OPERATOR TASK PERFORMANCE CAPABILITY

The objective of Verification of Operator Task Performance capability is to assure that operator tasks can be performed in the existing control room with minimum potential for human error. Verification evaluates task execution at each work station and consists of:

- Verification of Availability

  Verification of the presence (or absence) of instruments and equipment that provide the information and control capabilities necessary to implement operator actions.

- Verification of Suitability

  Verification that the man-machine interfaces provided by the displays controls and other control room features are effectively designed to support operator actions.

The task analysis documentation is structured to support a Verification process consisting of verification of operator action performance capability and verification of instrumentation and control characteristics. The following subsections describe the use of the task analysis documentation in supporting these two activities of the verification process.

Verification of Operator Action Performance Capability

The first verification activity consists of evaluating the availability and suitability of control room instrumentation and controls to support performance of operator actions. The Element Tables are used for this activity. These tables present the operator actions and associated instrumentation and control requirements identified in Phase 1 of the task analysis program.

For each Element Table, the multidisciplinary CRDR review team systematically reviews the operator actions itemized under the ACTIONS heading. As each action is reviewed, the CRDR team locates the instrumentation and controls in the control room necessary to support the operator actions. Having located the instrumentation and controls, the team evaluates the suitability of the instrumentation and controls for performing the operator actions. The suitability evaluation is structured to evaluate the specific operator action criteria (e.g., greater than 1500 psig, less than 700°F, etc.) upon which operator actions are based. The team utilizes the information under the INSTRUMENTATION and the CONTROLS headings to identify criteria requirements. In working through each Element Table, the team evaluates all entrees under the ACTIONS, INSTRUMENTATION and CONTROLS headings to ensure that the task analysis documentation is complete and self-consistent.

Verification of Instrumentation and Control Characteristics

The second verification activity consists of evaluating the adequacy of instrumentation and control characteristics to support performance of operator actions. The Instrumentation and Controls Requirements Tables are used for this activity. These Tables summarize the required characteristics identified and justified in Phase 2 of the Task Analysis program.

Characteristic verification consists of both verification of the human factors characteristics associated with the instrumentation (i.e., units, range, resolution and type) and controls (i.e., type and positions) and verification of design characteristics associated with the instrumentation (i.e., accuracy and response time) and controls (response time).

Verification of human factors characteristics is performed in the control room mockup. The multidisciplinary CRDR team evaluates the subject characteristics for each instrument and control using the information on the Requirements Tables. Each table is systematically reviewed as part of this activity.

Verification of design characteristics is accomplished through a table top evaluation of the actual design characteristics relative to the required characteristics identified through the task analysis program.

5. USE OF TASK ANALYSIS DOCUMENTATION IN VALIDATION OF OPERATOR FUNCTIONS

The objective of Validation of Control Room Functions is to determine whether the functions of the control room operating crew can be accomplished effectively within (1) the structure of defined emergency operating procedures, and (2) the design of the control room as it exists. Validation evaluates operator function execution within the integrated control room configuration and consists of walk and talk-throughs of selected event sequences with control room personnel.

The emergency operating procedures are the appropriate documents for use by the control room personnel in directing their response to the selected event sequences. Although not specifically developed or needed for Validation, the Element Tables of the SRTA program will be used by the multidisciplinary CRDR team as a source document with which to observe the response of the operators to the event sequences. Since the Element Tables are developed based on the procedures, these tables itemize detailed operator actions and associated instrumentation and control requirements necessary for proper response to emergency transients. This documentation should be consistent with and reflect the actions and associated instrumentation and controls that are used by the operators in the walk and talk-throughs. Through comparing the actions in the Element Tables with the operator walk-through actions, discrepancies will be noted and discussed in the talk-through portion of the validation.

6. REFERENCES

1) Westinghouse Owners Group, Emergency Response Guidelines System Review and Task Analysis, Volumes 1, 2A, 2B and 3, April 1, 1983.

2) NRC Memorandum from H. Brent Clayton to Dennis L. Ziemann, Meeting Summary-Task Analysis Requirements of Supplement 1 to NUREG-0737, March 29, 1984. Meeting with Westinghouse Owners Group (WOG) Procedures Subcommittee and Other Interested Persons, April 5, 1984.

3) U.S. Nuclear Regulatory Commission, NUREG 0700, Guidelines for Control Room Design Reviews, September, 1981.

APPENDIX A

NRC CLARIFICATION OF TASK ANALYSIS REQUIREMENTS

General

Section 5 (Detailed Control Room Design Review) of Supplement 1 to NUREG-0737 requires the use of function review and task analysis techniques to identify control room operator information and control needs during emergency operations. Section 7 (Upgrade Emergency Operating Procedures) of Supplement 1 to NUREG-0737 states that the reanalysis of transients and accidents required in Item I.C.1 of NUREG-0737 will identify operator information and control needs for emergency operations. In their review of utility procedure generation package (PGP) submittals and control room design review (CRDR) program plan submittals (including the WOG System Review and Task Analysis documentation referenced in a number of program plans), the NRC saw instrumentation and control (equipment) requirements identified but did not see information and control needs identified. This resulted in a number of NRC comments on utility PGPs and program plans in the area of task analysis, requesting the identification of operator information and control needs. To support utilities in addressing these NRC comments on task analysis, the WOG participated in a March 29 meeting with the NRC to clarify this topic and describe how operator information and control needs were addressed in the Emergency Response Guideline Development Program.

At the March 29 meeting, the WOG representatives told the NRC that the operators' needs (information and control) were identified and evaluated as part of the development program for the Emergency Response Guidelines. The process for ERG development was a multidisciplined and iterative process wherein operator response strategies and technical guidance were developed to address operator needs in response to emergency transients. The technical guidance (guidelines) defines the actual generic tasks (guideline steps and actions) and generic instrumentation and control requirements necessary to implement these response strategies. Consequently, operator information and

control needs are not explicitly identified in the guidelines. Although not specifically required per NUREG-0737 Item I.C.1, these information and control needs that were identified during the development program for the ERGs are contained in the ERG background documentation (the background documentation for the Revision 1 ERGs was subsequently transmitted to the NRC in early May 1984).

To put the ERG System Review and Task Anaysis (SRTA) program in perspective, the WOG representatives told the NRC that this program was developed to provide a task analysis methodology and example documentation based on the ERGs (Basic version). The program was structured to compile operator tasks and instrumentation and control requirements as an input to the CRDR process. It was not intended to identify operator information and control needs.

Following the WOG presentation and subsequent NRC caucus, the NRC provided the following comments:

1) Based on the presentations by Mr. McKinney and Mr. Surman, it appears that Revision 1 of the ERG and background documents do provide an adequate basis for generically identifying information and control needs.

2) Each licensee and applicant, on a plant-specific basis, must describe the process for using the generic guidelines and background documentation to identify the characteristics of needed instrumentation and controls. For the information of this type that is not available from the ERG and background documentation, licensees and applicants must describe the process to be used to generate this information (e.g., from transient and accident analyses) to derive instrumentation and control characteristics. This process can be described in either the PGP or DCRDR Program Plan with appropriate cross-referencing.

3) For potentially safety-significant plant-specific deviations from the ERG instrumentation and controls, each licensee and applicant must provide in the PGP a list of the deviations and their justification. These should be submitted in the plant-specific technical guideline portion of the PGP, along with other technical deviations.

4) For each instrument and control used to implement the emergency operating procedures, there should be an auditable record of how the needed characteristics of the instruments and controls were determined. These needed characteristics should be derived from the information and control needs identified in the background documentation of Revision 1 of the ERG or from plant-specific information.

5) It appears that the basic version of the ERG and background documentation provides an adequate basis for generically deriving information and control needs. However, because of the differences in the organization of the material in the background documents between Basic and Revision 1, it is apparent that it would be easier to extract the needed information from the Revision 1 background documents.

In summary, the March 29 meeting served to clarify the subject of task analysis. The NRC comments identified and discussed above further clarify (at the program level) their requirements. These comments recognize the ERG background documentation as the generic documentation which identifies operator information and control needs. Utilities must develop a process and actual documentation which identifies instrumentation and control characteristics based on the information and control needs identified in the ERG background documentation and other plant-specific documentation. Definition and clarification as to this process and the resultant documentation was not discussed at the March 29 meeting.

D. C. COOK

CONTROL ROOM DESIGN REVIEW

CONTROL ROOM INVENTORY

PROCEDURE

Cook DCRDR

Control Room Inventory

Procedure

1. Referring to the latest revisions of drawings 5523 thru 5530 and 5560 for D. C. Cook Unit One, enter panel abbreviation and item number on a Control Room Inventory Data Sheet for each and every item called out on the drawings, one sheet per panel item. Also enter unit number.

2. Organize Control Room Inventory Data Sheets into sections by panel in alphabetical order. For example, the first panel is BA, the second is C, etc.

3. Organize all CRI Data Sheets for a panel into numerical order. For example, BA-1, BA-2, etc.

4. Referring the above mentioned drawings, and the Material Control Record Cross Reference by Control Panel, transfer all pertinent data contained thereon to the appropriate CRI Data Sheet, such as MED or EED Mark No., Make and Type of device, such as SB-1 switch or FOX boro H/A Station.

5. Referring the above mentioned drawings, locate each panel item on the Photograph Mosaic, and fill out the CRI Data Sheets with the following information; exact name plate inscription, equipment position and color for switches and indicating lights; functions & meters for controller station; all applicable data for meters, recorders and knife switches. Note that annunciators status and monitor lights are further defined on Dwgs 98601 thru 98605. Note that Westinghouse control panel devices have special Data Sheets.

6. Referring to the above mentioned drawings, check each panel item on the drawing found on the control panels in the Cook control rooms. Mark out items not found on Cook panels. Sketch in outline of any item found on panel but not on drawings and give it temporary item number and fill out CRI Data Sheet with all pertinent data.

7. Remove marked out items Data Sheets from the CRI and add new Data Sheets for extra items found in Cook Control rooms.

8. Refer to the MSK or ECP Drawings, System Descriptions, Flow Diagrams, Electrical Elementaries, Functional Diagrams, Mechanical Material Control Record. Fill in System and Subsystem on CRI Data Sheet. Often the nameplate inscription is very useful for this purpose.

9. Check that nameplate inscription gives primary function of the device. If not, use reference material in step 8 to determine and enter after nameplate inscription, first word to be "Function:"

10. Periodically repeat steps 6 and 7 above to up date CRI with actual Cook control room status.

11. Periodically check latest revisions of Dwgs 5523 thru 5530 and 5560 to update previously mentioned temporary panel item numbers.

12. Periodically distribute latest revisions of Dwgs of 5523 thru 5530 and 5560 and corrected, updated or new CRI Data Sheets and list of necessary deletions.

Staffing

1.. DCRDR Lead Engineer
2. AEPSC Engineers and Technicians from I&C Section as assigned, under direction of Lead Engineer.

Cook DCRDR

Control Room Inventory

Reference Documents & Drawing

1. Dwg. No. (1 or 2) - 5521 General Arr'g't Control Room Unit No. (1 or 2)

   Shows location of each control panel in the control room and which panels are on Dwgs. 5523 thru 5530 and 5560.

2. Dwg. No. (1 or 2) - 5523 thru 5530 Main Control Boards Front Panels (Panel Name Abbreviations, such as SG) Unit No. (1 or 2).

   Shows all equipment mounted on front of Control panels with a unique number for each item. The panel name abbreviation, plus the number identifier, are the Panel Item No., such as SG-209. The items on a particular panel are contained within the Control Room Inventory panel listing in numerical order.

   Thus the panels are listed within the Control Room Inventory in alphabetical order and each item within a panel are in numerical order.

3. Material Control Record Cross-Reference by Control Panel

   Computer Data Listing printout sheets listing all items by panel and panel item number and showing function, description, vendor and mark number. The mark number is the MED (Mechanical Engineering Division) mark number, which is the unique identifier used for any item shown on all mechanical and electrical drawings, such as flow diagrams, metering and tubing drawings, electrical elementaries and wiring diagrams, MSK and ECP drawings, etc.

   Thus the panel item number is cross referenced to all mechanical, electrical and instrument/control drawings and documents. The operating procedures, operator training documents and system description documents use the MED or EED Mark No. identifier scheme also. The description and vendor show what the panel mounted equipment is, for example, a General Electric (GE) SB-1 control switch.

4. MSK Drawings

   Shows control and instrument loops in schematic form with MED and EED Mark No. identifiers.

   Thus the panel item function within a control/instrument loop can be identified as well as the loop function.

5. ECP Drawings

   Shows all information shown on MSK's plus additional information.

   The MSK plus ECP drawings show all significant instrument/control loops in schematic form with MED or EED Mark No. identifiers for individual items.

6. System Descriptions

Describes overall system functions, general description of system, design basis and description of equipment, instrumentation and controls and operation.

7. Mechanical Material Control Record

Lists MED or EED Mark No., Vendor, Manufacturer, Make and Model Number, Description, Purchase Order Number.

Thus all specifications, limits, features, applications, ranges, etc. can be identified as necessary.

8. Control Room Inventory Data Sheet

Data entry sheet for all pertinent inventory data with panel item number and MED or EED Mark No. identifiers. This data sheet has been formatted to provide a unique page for each panel item.

This data sheet is a general purpose data sheet for all the various types of control panel equipment contained in the control rooms, therefore, all data entry blanks will not be filled in on each sheet, but only those necessary to the inventory. A sample sheet is attached. Detailed instructions for data entries are attached.

9. Functional Diagrams 98501 thru 98514

Shows Reactor, Reactor Coolant, Steam Generators and Containment instrumentation, control and protection systems functions.

10. Flow Diagrams 5104 thru 5150B & 5660 thru 5662

Shows schematic arrangement of process piping, equipment and instrumentation.

11. Electrical Elementaries 98001 thru 98999

Shows schematic arrangement of all electrical equipment instrumentation, control and protection systems.

Cook DCRDR
Control Room Inventory Sheet

Line by line description of entries, starting at top left of page, refer to attached blank sample.

Name Plate Inscription (2,35)__________________________________

The exact lettering as found on name plates and tags located on, beside, above or below the device.

Usually it is an engraved phenolic plate with black background and white lettering which is located directly above the device; many horizontal and vertical indicators have the name plate engraving on the meter scale plate itself. However, also included are temporary name plate legends such as stamped stick on tape.

The numbers in parenthesis above are for future computer data bank entry, the first set of numbers give the location; the second set the number of letters, numbers and spaces that can be entered. These numbers in parenthesis appear with all the succeeding entries also, and the rules are the same.

Location: Panel (3,3) ______________ Item # (4,3) ______________
The panel designation goes after Panel, such as BA for the Boric Acid Panel. The panel item number goes after Item # and is the same number found on AEP Cook drawings 1-5523 through 1-5530, each device on each control panel then has an unique identification number.

MED # (6,6) ________________, the AEP Mechanical Engineering Division tag numbers are entered here, such as RP1-100 or AJ -26. These tag numbers are the primary AEP identifier, and appear on flow diagrams, instrumentation and control drawings, system descriptions, etc.

EED # (7,6) ________________, the AEP Electrical Engineering Division tag numbers are entered here, such as 101-TD7. Again these numbers are a primary AEP identifier, and appear on flow diagrams, instrumentation and control drawings,system description, electrical elementaries and wiring drawings, etc. With rare exceptions, every panel mounted item will have either an MED or EED number. An example of the exception would be some of the General Electric EHC system control panel mounted equipment.

System (10,35) ____

Subsystem (11,35) ____________________________________
entries for system show the major equipment or group of equipments that perform a specific system function essential to system operation. Where possible, these entries follow the AEP flow diagram system designations or Westinghouse system nomenclatures. Entries for subsystem, where applicable, show the major components or group of components a particular activity or group of related tasks that are essential to system operation.

Equipment (12,35) ______________________________
entries here show the actual panel mounted device or the component that the panel mounted device interfaces with. The vast majority of the Cook Unit control panel mounted devices are control stations, such as General Electric SB-1 switches, Cutler Hammer switches or pushbuttons, Foxboro AT switches, Bailey Meter and Foxboro hand-auto stations or manual loaders or manual stations, etc; or indicators, such as pressure, temperature or flow indicators, recorders, indicating lights, status lights, monitor lights, annunciators, etc. Therefore, the remainder of the sheet has a standardized format for data entries for switches, indicating lights, controller stations, meters, recorders, annunciators and knife (test) switches. Only those categories that apply are filled out. In some cases, because of the data format, the equipment data entries may contain redundant information to the data entries under the below categories. A brief explanation of each category follows:

Switch: Model (13,6) _____ (S,M,P)
Entries here are SB-1 for General Electrics SB series switches, CH for Cutler Hammer, etc. The various labeled positions of the switch are circled where applicable, and nonstandard positions are written out after Other (20.1) ______________________________
An S entered in blank means spring return and an M means maintained position.

Indication Lights: Model (21,6) ________ (R,G,W,A,B,C) (#)
The entries after model are almost always ET-16 or blank to represent General Electrics ET-16 lights. The initials R,G,W,A,B or C are used in the blanks after (22,1), (23,1), (24,1), (25,1) or (26,1) where applicable. What the light represents is circled where applicable and the color of the lens is represented by the initial in the blank space; where R=Red, G=Green, W=White, A=Amber, B=Blue and C=Clear. Non standard entries are written out after Other (26,1) __________________

Controller Station: Model (27,15) __________________________
The entries after model are generally Bailey AJ for a Bailey Meter pneumatic hand-auto station, Bailey AL for Bailey Meter pneumatic manual loader, Fox 62HB for Foxboro electronic hand-auto station, Fish AC2 for Fisher Governor electronic H/A station, etc.

Functions; a checkmark after Manual (28.1) ________ means manual station only, a checkmark after Auto/Manual (29,1) ______ means a hand/auto station, and if the H/A station has a special feature, a entry is made after either Bias (30,1) ______, Tieback (31,1) ______ or Setpoint (32.1) ________.

Meters; (A,B,C,D), the scaling of the various meters on the station is entered after Output (33,1) ______, Position (34,1) ______, Deviation (35,1) ______, B,T,S (36,1) ______, Transfer (37,1) ______ and Measured Variable (38,1) ________. The scale range is entered first, such as 0-100 which represents zero to 100 per cent, or 0-14" which represents zero to 14 inches, the various scale divisions are entered next, such as 25,5 which represents 25 percent major divisions and 5 per

cent minor divisions. An example of a Bailey AJ station output meter would be Output (33,1) 0-100,10,5 which represents 0 to 100% scale range with 10% major divisions and 5% minor division marks.

Meter: Entries are made in this section for all gages, meters, indicators, etc., except those included on a H/A or manual station. Model (39.6)_____ examples of these entries would be GE AB-40 for General Electric Model AB-40, PG for Bailey Meter model PG, etc. Measured Variable (40,15) ________ would be AC for alternating current, DC for direct current, flow, pressure, temperature, etc. A checkmark after Digital (41,3) _______ or Analog (42,3) ______ is self explanatory, Engg. Units (44.6) ______ show the unit of measure, such as GPM = gallons per minute, PPH or #/hr or lbs/hr = pounds per hour, PSIG = pounds per square inch, °F = degrees Fahrenheit, etc.

Units/Graduation (45,3) ____________ and From (48,4) ______ and To (49,4) ___________ define the scale range and divisions. An example would be Units/Graduation (45,3) 100,50,10 . From (48,4) 0 To (49,4) 400 represents a range of zero to 400 which major divisions at 100, minor divisions at 50, and subminor marks at 10. On some meters after the number entered in To (49,4) _______ is shown Sq Rt which represents square root for flow meter scales without square root extraction on orifice or flow nozzle installations. A checkmark after Linear (46,1) ______ means the pointer moves in a straight line, horizontally or vertically, not the linearity of the scale divisions. So a checkmark will appear after Linear (46,1) ______ or Circular (47,1) _____ for all analog meters.

Recorder: Entries for recorders require a second sheet in addition to the entries on this sheet. Model (50,15) ______ are Fox for Foxboro, Hagan for Westinghouse Hagan, West for Westronics, etc. Chart Speed (in/min) (51,3) ______ are shown as 3/4in/hr or 3in/hr which represents 3/4 and 3 inches per hour. Continuous (C) or Cycletime (sec.) (52,3) ______ Enter C for all but multipoint recorders, enter number of seconds (time) between prints for multipoint recorders.

Knife Switch: E.E.I.D.# (56,15) ______

Switch #	Function	
1	(57,14)	________
thru	thru	
10	(66,14)	________

Fill in switch function data plate inscription for each switch used.

COOK DCRDR
Control Room Inventory Sheets

Line by line description of entries, starting at top left of supplementary page required for recorders, refer to blank sample attached.

Recorder: ID#(2,15)
Enter MED # from first page
Name (3,15)
Enter Name Plate Inscription from first page

Tag #, Enter point or pen identification plate inscription MED # for each input, for example, QLA-610
Description, Enter point or pen identification plate inscription description of each input, for example, Holdup Tank No. 1 Level
Pt #/Color, Enter point or pen identification plate data for point number or pen color
Alarm Contact Utilization, enter chart value where alarm contacts are energized and direction of action, for example 500°F dec (decreasing)
Engg. Units thru Circ/Linr entries use some rules described under Meter.

D. C. COOK

CONTROL ROOM DESIGN REVIEW

CONTROL ROOM HUMAN FACTORS

SURVEY

INTRODUCTION

The Control Room Human Factors Survey will be divided into fourteen separate tasks, each with a specific set of related control room design features organized into a task plan. These fourteen tasks are:

1.1 Workspace Survey

1.2 Anthropometric Survey

1.3 Emergency Equipment Survey

1.4 Heating, Ventilation and Air Condition Survey

1.5 Illumination Survey

1.6 Ambient Noise Survey

1.7 Maintainability Survey

2.1 Communications Survey

3.1 Annunciator System Review

4.1 Controls Survey

5.1 Displays Survey

6.1 Labels and Location Aids Survey

7.1 Computers System

8.1 Conventions

All task plans follow the general format of:

1) Introduction (to include the objectives)
2) Review Team Selection and Responsibilities
3) Criteria (from NUREG-0700, Section 6.0)
4) Procedures
5). Equipment and Facility Requirements
6) Inputs and Data Forms
7) Outputs and Results
8) Figures and Tables
9) Procedure Exceptions
10) Appendices (as required).

A copy of the Annunciator System review task plan is attached as an example.

Following the Control Room Human Factors surveys the completed Survey Task Plan will be added to the Control Room Design data file.

TP-3.1
1 May 1983

HUMAN FACTORS TASK PLAN
FOR THE
ANNUNCIATOR SYSTEM REVIEW

The

Essex Corporation
333 North Fairfax Street
Alexandria, Virginia 22314
(703) 548-4500

Conditionally Approved.
Pending Technical Review
Committee final approval.
~~Approved for Use:~~ Walter T. Talley (Signature) 1 May 1983 (Date)

Walter T. Talley - Manager, Systems Analysis Branch
(Printed Name and Title)

RECORD OF REVISIONS

Rev. No.	Rev. Date	Description

TABLE OF CONTENTS

APPENDICES

ANNUNCIATOR SYSTEM

1.0 OBJECTIVES

a. To assess to what degree the annunciator system conforms to the criteria in NUREG-0700.

b. To identify and document any features in the annunciator system design that do not conform to the criteria in NUREG-0700.

2.0 REVIEW TEAM SELECTION AND RESPONSIBILITIES

a. A human factors specialist to conduct the data collection and analysis and to prepare the task report.

b. A client nuclear operations specialist to supply plant systems information concerning alarm parameters and alarm response procedures.

c. A client plant I&C engineer to assist in identifying relevant plant systems information.

3.0 CRITERIA

The criteria are from NUREG-0700, paragraphs 6.3.1.1, 6.3.1.2a through d(2), 6.3.1.3a through d, 6.3.1.4a and b, 6.3.1.5a through b(3), 6.3.2.1a through f, 6.3.3.1a through b(2), 6.3.2.2a and b, 6.3.3.1a through c(3), 6.3.3.2a through f(2), 6.3.3.3a through f, 6.3.3.4a through d, 6.3.3.5a through d(6), 6.3.4.1a through d(2), 6.3.4.2a through c, 6.3.4.3a and b, 6.5.1.6a through d(2), and 6.6.6.2a (see Appendix A).

4.0 PROCEDURES

4.1 General Instructions

4.1.1 Preparation and Conduct of Procedures

a. Prior to conduct of this task, ensure that all required data forms, plant documentation, engineering drawings, equipment, and materials are available. Ensure that permission has been obtained for all required access to the control room or other plant areas.

b. Record all exceptions, deviations, or changes to these procedures in Section 9.0 of this Task Plan. Number each entry sequentially, starting with 1. Include an explanation (technical justification) as to why the exception, deviation, or change was made.

4.1.2 Task Plan Critique

Upon completion of this task, fill out the Task Plan Critique contained in Appendix D. Submit the completed critique to your supervisor or project manager.

4.2 Data Collection

a. Data are collected using various methods and procedures consisting of measurements, observations, interviews and questionnaires, and document reviews. Appendix C illustrates the distribution of the criteria for the various methods.

b. Measurements and observations should be made for all items contained on the Measurements data forms and Observations checklists contained in Appendix B.

c. The operator questionnaire (Appendix B) should be administered to at least 50 percent of the licensed reactor operators for the plant. Administration may be conducted singly or in a group, but should be proctored or monitored.

d. The results of the Conventions, Labels, Maintainability, and System Function and Task Analysis tasks should be reviewed for annunciator-relevant data (reference criteria 6.3.3.1c(1), (2), (3); 6.3.3.3b and d(2); 6.3.4.2b(1) through b(4); 6.3.4.3a; 6.5.1.6a through d; and 6.6.6.2(a).

e. In addition to the review results from d, above, plant documentation should be reviewed to verify the items listed in the Document Review Checklist in Appendix B. The required plant documents include:

1. Annunciator Response Procedures
2. Administrative Procedures relevant to annunciators.

4.3 Analysis

a. All deviations from the criteria shall be recorded on Human Engineering Discrepancy (HED) reports (Appendix B). Recorded information shall include the instrument or instruments involved (e.g., auditory alarm horns, specific light tiles, etc.), a description of the problem including the 0700 paragraph number of the criteria, and a recommended solution.

b. Data collection method(s) shall also be recorded on the HED form. Where data from two or more sources are contradictory, resolution of the conflict through data review and client interview shall be made.

c. Use the analysis aids from Appendix B for all data reduction and analysis. Upon completion of all analyses, ensure that the criteria in Appendix A are properly annotated (as specified in the analysis aids).

d. Submit the completed task plan to your immediate supervisor for review. Upon project management approval, initiate Task Report 3.1.

5.0 EQUIPMENT AND FACILITY REQUIREMENTS

a. Access to the control room.

b. Sound level meter.

c. Protractor and tape measure.

d. Flash comparator.

6.0 INPUTS AND DATA FORMS

a. Annunciator Response Procedures

b. Annunciator Administrative Procedures

c. Completed Task Reports for:
   1. System Function and Task Analysis
   2. Conventions
   3. Labels and Location Aids
   4. Maintainability

d. Criteria List (Appendix A)

e. The following from Appendix B:
   1. Measurements Data Forms
   2. Questionnaire
   3. Observations Checklist
   4. Documentation Review Checklist
   5. Analysis Aids
   6. HED Report Forms

f. Criteria Matrix (Appendix C)

g. Task Plan Critique Form (Appendix D)

7.0 OUTPUTS AND RESULTS

a. Completed HEDs

b. Completed Task Report.

8.0 FIGURES AND TABLES

None.

9.0 PROCEDURE EXCEPTIONS

The following exceptions, deviations, and changes were made to these procedures during conduct of the task (include a statement of justification on each item):

APPENDIX A

CRITERIA

6.3.1.1 GENERAL SYSTEM DESIGN

Annunciator warning systems are the primary control room interface to immediately alert the operator to out-of-tolerance changes in plant condition. Annunciator warning systems consist of three major subsystems: (a) an auditory alert subsystem, (b) a visual alarm subsystem, and (c) an operator response subsystem (see Exhibit 6.3-1). Together, these three subsystems should be designed to provide a preferred operational sequence for annunciator warnings as indicated in Exhibit 6.3-2.

6.3.1.2 ALARM PARAMETER SELECTION

a. SET POINTS—The limits or set points for initiating the annunciator warning system should be established to meet the following goals:

(1) Alarms should not occur so frequently as to be considered a nuisance by the operators.

(2) However, set points should be established to give operators adequate time to respond to the warning condition before a serious problem develops.

b. GENERAL ALARMS

(1) Alarms that require the control room operator to direct an auxiliary operator to a given plant location for specific information should be avoided.

(2) If general alarms must be used, they should only be used for conditions that allow adequate time for auxiliary operator action and subsequent control room operator action.

c. MULTICHANNEL OR SHARED ALARMS

(1) Annunciators with inputs from more than one plant parameter set point should be avoided. Multi-input alarms that summarize single-input annunciators elsewhere in the control room are an exception.

(2) Where multi-input annunciators must be used, an alarm printout capability should be provided. The specifics of the alarm should be printed on an alarm typer with sufficient speed and buffer storage to capture all alarm data.

N/A	YES	NO	COMMENTS

	N/A	YES	NO	COMMENTS
6.3.1.2 ALARM PARAMETER SELECTION (Cont'd) c. MULTICHANNEL OR SHARED ALARMS (Cont'd) (3) A reflash capability should be provided to allow subsequent alarms to activate the auditory alert mechanism and reflash the visual tile even though the first alarm may not have been cleared.				
d. MULTI-UNIT ALARMS– (1) Alarms for any shared plant systems should be duplicated in all control rooms.				
(2) When an item of shared equipment is being operated from one control room, a status display or signal should be provided in all other control rooms which could potentially control this equipment.				
6.3.1.3 FIRST OUT ANNUNCIATORS a. REACTOR SYSTEM (1) A separate first out panel should be provided for the reactor system.				
(2) The first out panel should consist of separate annunciator tiles for each of the automatic reactor trip functions.				
(3) In the event of a reactor trip, the tile associated with the event should illuminate, and no other.				
b. TURBINE-GENERATOR SYSTEM–A separate first out panel, similar in function to the reactor system panel, is recommended.				
c. POSITION–First out panels should be located directly above the main control work station for the system.				
d. APPLICATION–First out annunciators should conform to the general auditory, visual, and operator response guidelines of this section.				

Item	N/A	YES	NO	COMMENTS
6.3.1.4 PRIORITIZATION a. LEVELS OF PRIORITY (1) Prioritization should be accomplished using a relatively small (2-4) number of priority levels.				
(2) Prioritization should be based on a continuum of importance, severity, or need for operator action in one or more dimensions, e.g., likelihood of reactor trip, release of radiation. Exhibit 6.3-3 provides an example of prioritization based on three levels of prioritization.				
b. PRIORITY CODING (1) Some method for coding the visual signals for the various priority levels should be employed. Acceptable methods for priority coding include color, position, shape, or symbolic coding.				
(2) Auditory signal coding for priority level is also appropriate. See Guideline 6.2.2.3 for recommended coding techniques.				
6.3.1.5 CLEARED ALARMS a. AUDITORY SIGNAL—Cleared alarms should have a dedicated, distinctive audible signal which should be of finite duration.				
b. VISUAL SIGNAL—The individual tile should have one of the following: (1) A special flash rate (twice or one-half the normal flash rate is preferred, to allow discrimination), or				
(2) Reduced brightness, or				
(3) A special color, consistent with the overall control room color coding scheme, produced by a differently colored bulb behind the tile.				

6.3.2.1 SIGNAL DETECTION

	N/A	YES	NO	COMMENTS
a. INTENSITY—The signal should be such that operators can reliably discern the signal above the ambient control room noise. A nominal value of 10 dB(A) above average ambient noise is generally adequate.				
b. CONTROL—Signal intensity, if adjustable, should be controlled by administrative procedure.				
c. LIMITS—The signal should capture the operator's attention but should not cause irritation or a startled reaction.				
d. DETECTION—Each auditory signal should be adjusted to result in approximately equal detection levels at normal operator work stations in the primary operating area.				
e. RESET—The annunciator auditory alert mechanism should automatically reset when it has been silenced.				
f. IDENTIFICATION—The operator should be able to identify the work station or the system where the auditory alert signal originated. Separate auditory signals at each work station within the primary operating area are recommended.				

6.3.2.2 AUDITORY CODING

	N/A	YES	NO	COMMENTS
a. LOCALIZATION (1) Auditory coding techniques should be used when the operator work station associated with the alarm is not in the primary operating area.				
(2) Coded signals from a single audio source should not be used to identify individual work stations within the primary operating area.				
b. PRIORITIZATION—Coding may be used to indicate alarm priority. (See Guideline 6.3.1.4.)				

N/A	YES	NO	COMMENTS

6.3.3.1 VISUAL ANNUNCIATOR PANELS

a. LOCATION—Visual alarm panels should be located above the related controls and displays which are required for corrective or diagnostic action in response to the alarm. (See Exhibit 6.3-4.)

b. LABELING

(1) Each panel should be identified by a label above the panel.

(2) Panel identification label height should be consistent with a subtended visual angle of at least 15 minutes when viewed from a central position within the primary operating area.

6.3.3.2 VISUAL ALARM RECOG AND IDENT

a. FLASHING – The specific tile(s) on an annunciator panel should use flashing illumination to indicate an alarm condition.

b. FLASH RATE – Flash rates should be from three to five flashes per second with approximately equal on and off times.

c. FLASHER FAILURE – In case of flasher failure of an alarmed tile, the tile light should illuminate and burn steadily.

d. CONTRAST DETECTABILITY—There should be high enough contrast between alarming and steady-on tiles, and between illuminated and non-illuminated tiles, so that operators in a normally illuminated control room have no problem discriminating alarming, steady-on, and steady-off visual tiles.

e. "DARK" ANNUNCIATOR PANELS – A "dark" annunciator panel concept should be used. This means that under normal operating conditions no annunciators would be illuminated; all of the visual tiles of the annunciator panels would be "dark."

f. EXTENDED DURATION ILLUMINATION—If an annunciator tile must be "ON" for an extended period during normal operations (e.g., during equipment repair or replacement), it should be:

(1) Distinctively coded for positive recognition during this period, and

(2) Controlled by administrative procedures.

N/A	YES	NO	COMMENTS

6.3.3.3 ARRANGEMENT OF VISUAL ALARM TILES

a. MATRIX ORGANIZATION – Visual alarms should be organized as a matrix of visual alarm tiles within each annunciator panel.

b. FUNCTIONAL GROUPING–Visual alarm tiles should be grouped by function or system within each annunciator panel. For example, area radiation alarms should be grouped on one panel, not spread throughout the control room.

c. LABELING OF AXES

(1) The vertical and horizontal axes of annunciator panels should be labeled with alphanumerics for ready coordinate designation of a particular visual tile.

(2) Coordinate designation is preferred on the left and top sides of the annunciator panel.

(3) Letter height for coordinate designation should be consistent with a subtended visual angle of at least 15 minutes as viewed from a central position within the primary operating area.

d. PATTERN RECOGNITION –

(1) The number of alarm tiles and the matrix density should be kept low (a maximum of 50 tiles per matrix is suggested).

(2) Tiles within an annunciator panel matrix should be grouped by subsystem, function, or other logical organization.

e. OUT-OF-SERVICE ALARMS–Cues for prompt recognition of an out-of-service annunciator should be designed into the system.

f. BLANK TILES–Blank or unused annunciator tiles should not be illuminated (except during annunciator testing).

6.3.3.4 VISUAL TILE LEGENDS

a. UNAMBIGUOUS – Annunciator visual tile legends should be specific and unambiguous. Wording should be in concise, short messages.

b. SINGULARITY – Alarms which refer the operator to another, more detailed annunciator panel located outside the primary operating area should be minimized.

	N/A	YES	NO	COMMENTS
6.3.3.4 VISUAL TILE LEGENDS (Cont'd) c. SPECIFICITY – Tile legends should address specific conditions; for example, do not use one alarm for HIGH-LOW, TEMPERATURE-PRESSURE.				
d. ABBREVIATIONS – Abbreviations and acronyms should be consistent with those used elsewhere in the control room.				
6.3.3.5 VISUAL TILE READABILITY a. DISTANCE – The operator should be able to read all the annunciator tiles from the position at the work station where the annunciator acknowledge control is located.				
(1) Letter height should subtend a minimum visual angle of 15 minutes, or .004 x viewing distance. The preferred visual angle is 20 minutes, or .006 x viewing distance.				
(2) Letter height should be identical for all tiles, based on the maximum viewing distance. Separate calculations should be made for stand-up and sit-down work stations.				
b. TYPE STYLE–The size and style of lettering should meet the following: (1) Type styles should be simple.				
(2) Type styles should be consistent on all visual tiles.				
(3) Only upper-case type should be used on visual tiles.				
c. LEGEND CONTRAST–Legends should provide high contrast with the tile background. (1) Legends should be engraved.				
(2) Legends should be dark lettering on a light background.				
d. LETTER DIMENSIONS AND SPACING – (1) Stroke-width-to-character-height ratio should be between 1:6 and 1:8.				
(2) Letter width-to-height ratio should be between 1:1 and 3:5.				
(3) Numeral width-to-height ratio should be 3:5.				

	N/A	YES	NO	COMMENTS
6.3.3.5 VISUAL TILE READABILITY (Cont'd) d. LETTER DIMENSIONS AND SPACING — (Cont'd) (4) Minimum space between characters should be one stroke width.				
(5) Minimum space between words should be the width of one character.				
(6) Minimum space between lines should be one-half the character height.				
6.3.4.1 CONTROLS (See Exhibit 6.3-5.) a. SILENCE (1) Each set of operator response controls should include a silence control.				
(2) It should be possible to silence an auditory alert signal from any set of annunciator response controls in the primary operating area.				
b. ACKNOWLEDGE (1) A control should be provided to terminate the flashing of a visual tile and have it continue at steady illumination until the alarm is cleared.				
(2) Acknowledgement should be possible only at the work station where the alarm originated.				
c. RESET (1) If an automatic cleared alarm feature is not provided, a control should be provided to reset the system after an alarm has cleared.				
(2) The reset control should silence any audible signal indicating clearance and should extinguish tile illumination.				
(3) The reset control should be effective only at the work station for the annunciator panel where the alarm initiated.				
d. TEST (1) A control to test the auditory signal and flashing illumination of all tiles in a panel should be provided.				
(2) Periodic testing of annunciators should be required and controlled by administrative procedure.				

N/A	YES	NO	COMMENTS

6.3.4.2 CONTROL SET DESIGN

a. POSITIONING OF REPETITIVE GROUPS—Repetitive groups of annunciator controls should have the same arrangement and relative location at different work stations. This is to facilitate "blind" reaching.

b. CONTROL CODING—Annunciator response controls should be coded for easy recognition using techniques such as:

(1) Color coding;

(2) color shading the group of annunciator controls;

(3) demarcating the group of annunciator controls; or

(4) shape coding, particularly the silence control. (See Exhibit 6.3-5, Example 2.)

c. NONDEFEATABLE CONTROLS—Annunciator control designs should not allow the operator to defeat the control. For example, some pushbuttons used for annunciator silencing and acknowledgement can be held down by inserting a coin in the ring around the pushbutton. This undesirable design feature should be eliminated.

6.3.4.3 ANNUNCIATOR RESPONSE PROCEDURES

a. AVAILABILITY—Annunciator response procedures should be available in the control room.

b. INDEXING—Annunciator response procedures should be indexed by panel identification and annunciator tile coordinates.

6.5.1.6 COLOR CODING

a. REDUNDANCY—In all applications of color coding, color should provide redundant information. That is, the pertinent information should be available from some other cue in addition to color.

b. NUMBER OF COLORS

(1) The number of colors used for coding should be kept to the minimum needed for providng sufficient information.

(2) The number of colors used for coding should not exceed 11.

N/A	YES	NO	COMMENTS

6.5.1.6 COLOR CODING (Cont'd)

c. MEANING OF COLORS

(1) The meaning attached to a particular color should be narrowly defined.

(2) Red, green, and amber (yellow) should be reserved for the following uses:

Red: unsafe, danger, immediate operator action required, or an indication that a critical parameter is out of tolerance.

Green: safe, no operator action required, or an indication that a parameter is within tolerance.

Amber (yellow): hazard (potentially unsafe), caution, attention required, or an indication that a marginal value or parameter exists.

d. CONSISTENCY OF MEANING

(1) The meaning assigned to particular colors should be consistent across all applications within the control room.

(2) The meaning of a particular color should remain the same whether applied to panel surfaces or projected in signal lights or on CRTs.

6.6.6.2 DEMARCATION

a. USE—Lines of demarcation can be used to:

(1) Enclose functionally related displays.

(2) Enclose functionally related controls.

(3) Group related controls and displays.

b. CONTRAST—Lines of demarcation should be visually distinctive from the panel background.

c. PERMANENCE—Lines of demarcation should be permanently attached.

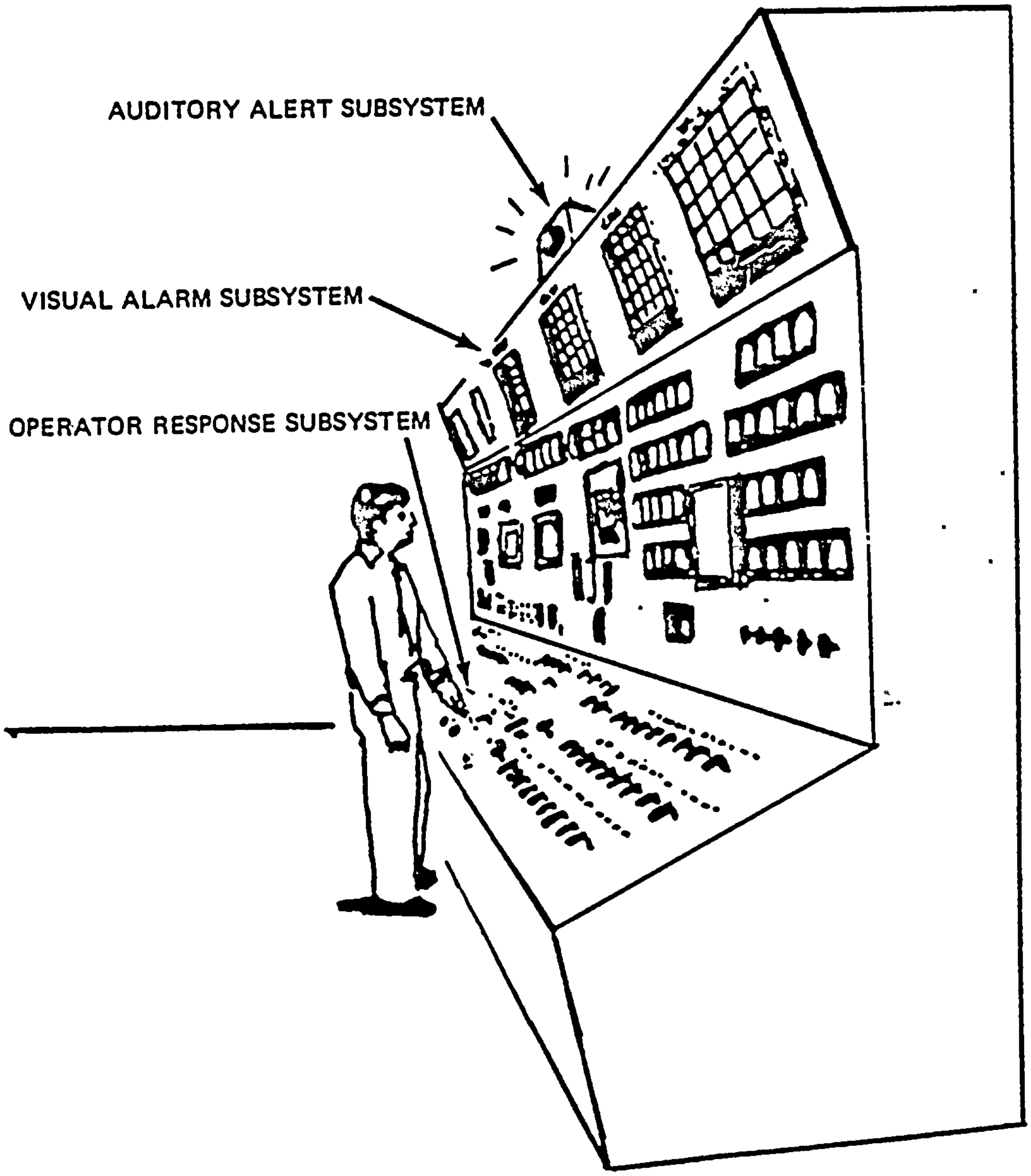


Exhibit 6.3-1. Annunciator warning system.

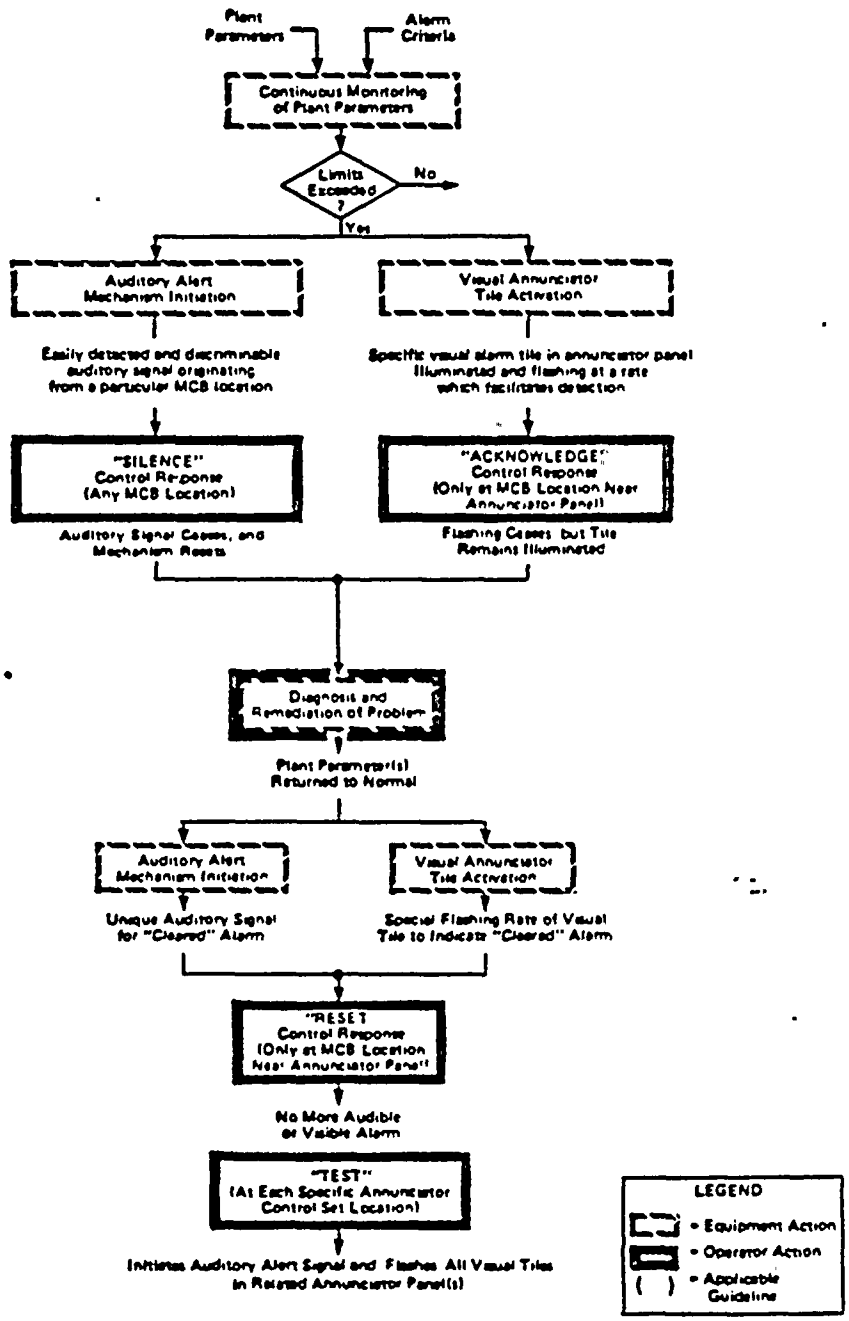


Exhibit 6.3-2. Annunciator system preferred operational sequence.

FIRST PRIORITY ALARMS

- Plant shut down (reactor trip, turbine trip)
- Radiation release
- Plant conditions which, if not corrected immediately, will result in automatic plant shutdown or radiation release, or will require manual plant shutdown.

SECOND PRIORITY ALARMS

- Technical specification violations which if not corrected will require plant shutdown
- Plant conditions which, if not corrected, may lead to plant shut down or radiation releases

THIRD PRIORITY ALARMS

- Plant conditions representing problems (e.g., system degradation) which affect plant operability but which should not lead to plant shutdown, radiation release, or violation of technical specifications

Exhibit 6.3-3. Three-level annunciator prioritization example.

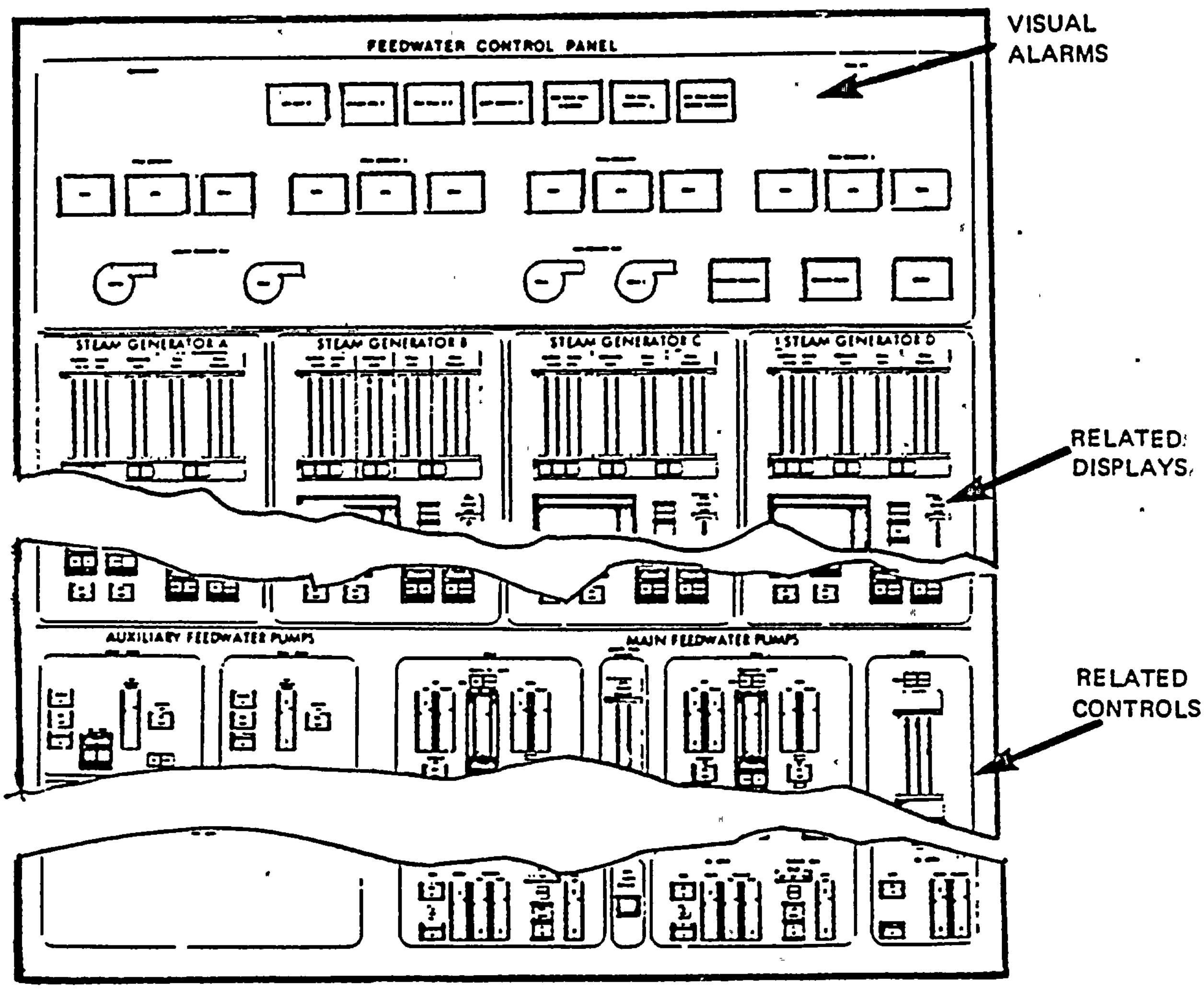


Exhibit 6.3-4. Visual alarms located above the related controls and displays. (From Seminara et al., 1979).

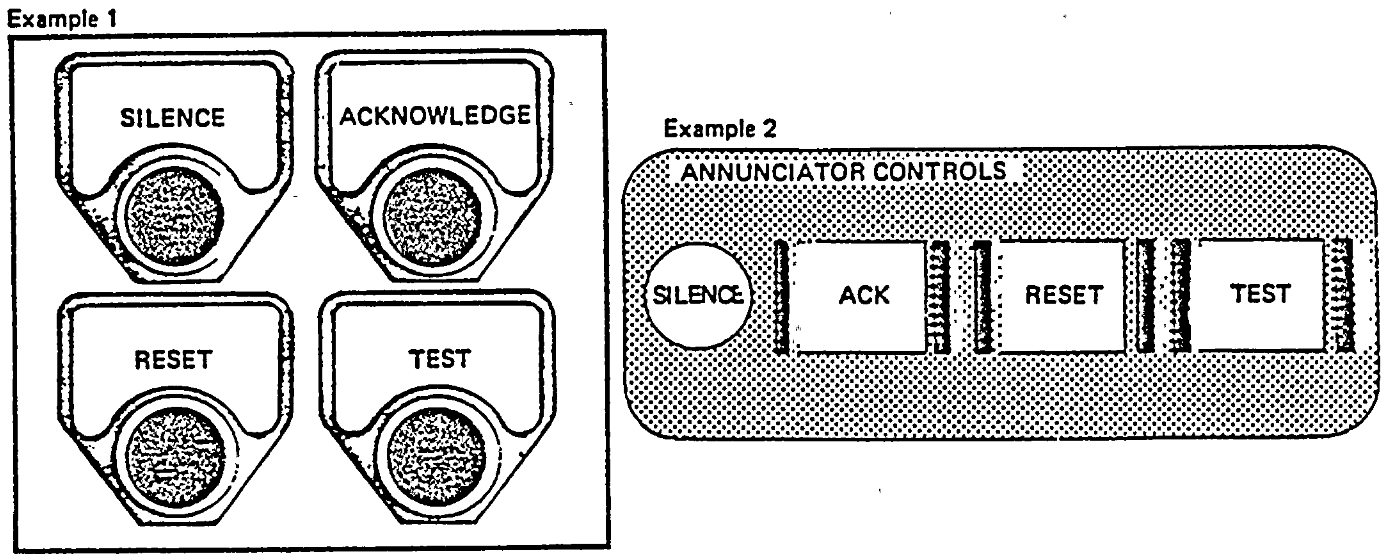


Exhibit 6.3-5. Annunciator response controls.

Color Serial or selection number	General color name	ISCC-NBS centroid number	ISCC-NBS color-name (abbreviation)	Munsell renotation of ISCC-NBS Centroid Color
1	white	263	white	2.5PB 9.5/0.2
2	black	267	black	N 0.8/
3	yellow	82	v.Y	3.3Y 8.0/14.3
4	purple	218	s.P	6.5P 4.3/9.2
5	orange	48	v.O	4.1YR 6.5/15.0
6	light blue	180	v.l.B	2.7PB 7.9/6.0
7	red	11	v.R	5.0R 3.9/15.4
8	buff	90	gy.Y	4.4Y 7.2/3.8
9	gray	265	med. Gy	3.3GY 5.4/0.1
10	green	139	v.G	3.2G 4.9/11.1
11	purplish pink	247	s.pPk	5.6RP 6.8/9.0
12	blue	178	s.B	2.9PB 4.1/10.4
13	yellowish pink	26	s.yPk	8.4R 7.0/9.5
14	violet	207	s.V	0.2P 3.7/10.1
15	orange yellow	66	v.OY	8.6YR 7.3/15.2
16	purplish red	255	s.pR	7.3RP 4.4/11.4
17	greenish yellow	97	v.gY	9.1Y 8.2/12.0
18	reddish brown	40	s.rBr	0.3YR 3.1/9.9
19	yellow green	115	v.YG	5.4GY 6.8/11.2
20	yellowish brown	75	deep yBr	8.8YR 3.1/5.0
21	reddish orange	34	v.rO	9.8R 5.4/14.5
22	olive green	126	d.OlG	8.0GY 2.2/3.6

Exhibit 6.5-7. Twenty-two colors of maximum contrast (from Kelly, 1965).

APPENDIX B

DATA FORMS

APPENDIX B
DATA FORMS

TABLE OF CONTENTS

APPENDIX B1.1
MEASUREMENTS DATA

1. LINEAR MEASUREMENTS (LABELING)

1.1 Annunciator Light Box (ALB) Summary Labels - 6.3.3.1b(2).

a. If there are no summary labels, check here: _______

b. If there are summary labels, measure and record in Table 1.1b the following information:

ITEM NO.	ITEM DESCRIPTION
1)	Character height
2)	Character width and/or numeral width
3)	Character strokewidth
4)	Character spacing
5)	Word spacing
6)	Line spacing

TABLE 1.1b

ITEM	ALB-____	ALB-____	ALB-____	ALB-____	ALB-____	ALB-____	ALB-____
1.	_____	_____	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____	_____	_____

1.2 Tile Labeling - 6.3.3.5a(1) and a(2), and 6.3.5.5d(1) through d(6).

a. Measure and record in Table 1.2a the character height(s) used in the tiles. If more than one size character is used, record the height for all of the represented heights. Also measure and record the farthest left and farthest right tile from its associated acknowledge station for each of the represented character heights (start at the left most acknowledge station and number the stations going clockwise around the MCB).

APPENDIX B1.1
MEASUREMENTS DATA

1.2 (Cont.)

TABLE 1.2a

	STA 1		STA 2		STA 3		STA 4		STA 5	
CHAR HT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

b. For each acknowledge station in the table above, measure and record in Table 1.2b the height from the floor for the farthest left and farthest right tile from this same table.

TABLE 1.2b

	TILE HEIGHT FROM FLOOR				
CHAR HT	STA 1	STA 2	STA 3	STA 4	STA 5

APPENDIX B1.1
MEASUREMENTS DATA

c. Measure and record the following for each of the different character heights from a, above:

TABLE 1.2c

	HT (ref)	CHAR/NUM WIDTH	STROKE WIDTH	CHAR SPACING	WORD SPACING	LINE SPACING
1.	______	______	______	______	______	______
2.	______	______	______	______	______	______
3.	______	______	______	______	______	______
4.	______	______	______	______	______	______
5.	______	______	______	______	______	______
6.	______	______	______	______	______	______

1.3 Data Reduction and Analysis.

For data reduction and analysis, obtain the appropriate analysis aids from Appendix B5 (ref. B5.1).

APPENDIX B1.2
MEASUREMENTS DATA

2. SOUND MEASUREMENTS (AUDIBLE SIGNALS)

2.1 Annunciator Audible Alarms - 6.3.2.1a.

Measure the sound level in dB(A) for each annunciator audible alarm at each of the following operator positions:

TABLE 2

	ALARM LOCATION	MCB SAFETY SYSTEMS POS 1	MCB SAFETY SYSTEMS POS 2	MCB REAC CONT	MCB TURB GEN	MCB ELEC DIST	RAD MON CONSOLE	OP'S DESK
1.								
2.								
3.								
4.								
5.								

2.2 Data Reduction and Analysis.

For data reduction and analysis, obtain the appropriate analysis aids from Appendix B5 (ref. B5.2).

APPENDIX B1.3
MEASUREMENTS DATA

3. LIGHT MEASUREMENTS (TILE FLASH CHARACTERISTICS) - 6.3.5b(1) and 6.3.3.2b

3.1 Using the Flash Comparator, measure the flash rate of tiles in alarm and in clear. Record the rates.

Alarm Flash Rate: ______________________

Cleared Flash Rate: ______________________

3.2 Using the Flash Comparator, measure the on-off ratio for the alarm flash rate and cleared flash rate.

On-Off Ratio (Alarm): ______________________

On-Off Ratio (Cleared): ______________________

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

INSTRUCTIONS

---

1. The following are questions concerning the general layout, functional organization, and operational considerations in your control room. Most of the questions will require a YES or NO answer, with some additional information.

2. When you have comments or suggestions, use the space provided below each question. If you need additional room, use the backs of the sheets.

3. If you do not understand a question, please ask the monitor for clarification.

4. Please answer all of the questions as completely as possible.

5. Take as much time as you need to complete the questionnaire.

6. All of your answers, and your biographical information, will be kept in the strictest confidence and will be used to aid in the performance of the detailed control room design review.

PLEASE BEGIN

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

BIOGRAPHICAL DATA:

Name: ______________________________ Age: __________

Sex: ____________ Height: ____________ Weight: ________

Current Position/Title: ______________________________

1. Do you have a current reactor operator's license? YES ___ NO ___
2. Amount of licensed experience at this plant: ________________
3. Total amount licensed experience: ______________________
4. Related experience and amount (example: operator-trainee, Hodge NPP Unit 1, 1 yr.):

5. Education:

   a. Highest level attained: ______________________________

   b. Specialized Schools or courses (list):

6. Military experience:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1. Do you have a first out annunciator panel where only the tile associated with the reactor trip event illuminates and all subsequent alarms on that panel are "locked out"? YES NO

2. Do you know of any automatic reactor trip functions that do not have a separate annunciator tile on the first out panel (either missing or shared with other functions)? YES NO

3. Are the annunciator panels in the control room identified by a label above each panel? YES NO

4. From your primary operating area, can you read all annunciator panel labels with a minimum of effort? YES NO

5. Is the annunciator system priority coded by color, position, shape, or symbolic coding of the tiles? YES NO

6. Does your annunciator system use color coding? YES NO

7. Are there more than eleven colors used for coding the panels? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

8. Is there a standard meaning attached to the colors used for coding the panels? YES NO

9. Is the color red ever used for a condition other than unsafe, danger, immediate operator action required, or as an indication that a critical parameter is out of tolerance? YES NO

10. Is the color green ever used for a condition other than safe, no operator action required, or as an indication that a parameter is within tolerance? YES NO

11. Is the color amber (yellow) ever used for a condition other than hazard (potentially unsafe), caution, attention required, or as an indication that a marginal value or parameter exists? YES NO

12. Do you know of any unnecessary color coding on the annunciator panels? YES NO

13. Do you know of any colors that are not used consistently across all applications within the control room, from panel-to-panel or in signal lights and on CRTs? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

14. Are auditory signals priority coded by pulse, frequency change (warbling), intensity, or different frequencies for different signals? YES NO

15. If you have separate alarm horns, can you easily identify the work station or system where the auditory signal originated? YES NO

16. Do you have different alarm horns for work areas not at the main control board? YES NO

17. If the auditory alarm signal has only one source, is the sound coded to direct you to different work areas? YES NO

18. Do any of the alarm horns startle or irritate you? YES NO

19. If you have different alarm horns, do any of them sound too loud or too soft in comparison to the others at your normal work station? YES NO

20. Do you have a silence control with each set of response controls in your primary operating area? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

21. Is a control provided which terminates a flashing visual tile, but allows a steady illumination until the alarm is cleared? YES NO

22. Can you acknowledge an alarm from more than one response control area? YES NO

23. If cleared alarms do not reset automatically, do you have a control to reset them yourself? YES NO

24. Does the reset control silence the auditory signal as well as extinguish the illumination? YES NO

25. Does the reset control operate from more than one response control area? YES NO

26. Can you defeat any of the annunciator controls, such as locking out the audible alarm or locking down the acknowledge control? YES NO

27. Can you test the auditory and flashing illumination signals of all tils for each panel? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

28. Is there an administrative procedure that controls the periodic testing of all annunciators? YES NO

29. Are all tiles dark on annunciator panels when no alarm is indicated? YES NO

30. Can you easily tell if a tile is normally on for an extended duration during normal operating conditions? YES NO

31. Are you immediately aware if an annunciator tile is out of service? YES NO

32. Can you immediately determine when the flasher of an alarm tile fails? YES NO

33. Do you know of any alarms that occur so frequently that you consider them a nuisance? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

34. Do you know of any alarms that do not give you ample time to respond to a warning condition? YES NO

35. When responding to an alarm tile, can you readily locate the controls and displays required for corrective or diagnostic action? YES NO

36. Do you have access to annunciator response procedures in the control room? YES NO

37. Do you know of any alarms which require you to obtain additional information from a source outside of the control room area? YES NO

38. Are there too many alarms which require additional information from panels outside your operating area? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

39. If alarms are used that require information outside the control room, do they allow you ample time to respond? YES NO

40. Are alarms provided for shared equipment in all control rooms? YES NO

41. Is there a status display or signal provided for shared equipment in all control rooms which indicates that the equipment is currently being operated? YES NO

42. Do you have any tiles with dual messages such as HIGH-LOW? YES NO

43. Does the multi-input alarm have a reflash capability that reflashes the visual tile after an auditory alert even if the first alarm has not been cleared? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

44. Do multi-input annunciators provide you with an alarm printout? YES NO

45. Does the multi-input alarm typer have sufficient speed to print the alarm data fast enough for your needs? YES NO

46. Does the alarm typer ever skip or loose information, or garble (mix up) the printing? YES NO

APPENDIX B3
OBSERVATIONS CHECKLIST

INSTRUCTIONS

1. Using the attached checklist, make all the noted observations.
2. Record all necessary information in the comments column to justify an N/A check and to detail a NO check.
3. Insure that all comments for NO checks include component, instrument, panel, equipment, etc. identification and location information.
4. Initiate HED reports on all NO checks per the directions contained in the checklist analysis aids.

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
1. A separate first out panel should be provided for the reactor system - 6.3.1.3a(1).				
2. A separate first out panel is recommended for the turbine-generator system that is functionally similar to the reactor system panel - 6.3.1.3b.				
3. First out panels should be located above their main work stations - 6.3.1.3c.				
4. All first out panels should conform to the general auditory and visual items in the rest of this checklist - 6.3.1.3d.				
5. A small number (2-4) of levels of priority coding are used - 6.3.1.4a(1).				
6. Priority coding of color, position, shape, or symbol is used for visual signals - 6.3.1.4b(1).				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
7. Auditory signal priority coding may be used - 6.3.1.4b(2).				
8. If more than one, each auditory signal should sound at approximately equal loudness at normal work stations in the primary operating area - 6.3.2.1d.				
9. An auditory signal should capture the operator's attention but should not irritate or cause a startled reaction - 6.3.2.1c.				
10. Separate auditory signals at each work station within the primary operating area are recommended - 6.3.2.1f.				
11. The operator should be able to identify the work station or area where the auditory alert originated - 6.3.2.1f.				
12. The auditory signal should automatically reset when silenced - 6.3.2.1e.				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
13. When an alarm clears (or is cleared) there should be a dedicated, distinct audible signal with a finite duration - 6.3.1.5a.				
14. Auditory alert signal(s), if adjustable, should be controlled by administrative procedure - 6.3.2.1b.				
15. The specific title(s) in an ALB should visually flash to indicate an alarm condition - 6.3.3.2a.				
16. In case of flasher failure, an alarming tile should illuminate and burn steadily - 6.3.3.2c.				
17. Contrast between tiles should present no problem discriminating between alarming, steady-on, and steady-off conditions - 6.3.3.2d.				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
18. Under normal (nonalarmed) conditions no annunciator tiles should be illuminated - 6.3.3.2e.				
19. If a tile must be on for an extended period during normal operations it should be distinctively coded for positive recognition during this period (see also 6.3.3.2f(2), item 2c on the Document Review Checklist) - 6.3.3.2f(1).				
20. Cleared tiles should have either a special flash rate, a reduced brightness, or a special color - 6.3.1.5b(1) through b(3).				
21. All tiles associated with a given acknowledge control should be readable when operating that control - 6.3.3.5a.				
22. Character style on all tiles should be simple - 6.3.3.5b(1).				
23. Character style should be consistent on all tiles - 6.3.3.5b(2).				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
24. Character style should be uppercase on all tiles - 6.3.3.5b(3).				
25. Tile legends should have high contrast with the tile background - 6.3.3.5c.				
26. Tile legends should be engraved - 6.3.3.5c(1).				
27. Tile legends should be dark and opaque on a light and translucent background - 6.3.3.5c(2).				
28. Tile legends should be specific, unambiguous, concise, and short - 6.3.3.4a.				
29. Tile legends should address specific conditions, HIGH TEMP, or LOW PRESS, not HIGH-LOW TEMP-PRESS - 6.3.3.4c.				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
30. Abbreviations and acronyms in legends should be consistent with those in other labeling in the control room - 6.3.3.4d.				
31. Tiles should be organized as a matrix within each ALB - 6.3.3.3a.				
32. The vertical and horizontal axes of the ALBs should be alphanumerically labeled for tile designation coordinates - 6.3.3.3c(1).				
33. Coordinate designators are preferred at the left and top sides of the ALBs - 6.3.3.3c(2).				
34. Character height for the coordinate labels should be the same height as those used in tile legends - 6.3.3.3c(3).				
35. The number of tiles in an ALB should be kept low, with a maximum of 50 tiles per ALB suggested - 6.3.3.3d(1).				

APPENDIX B3
OBSERVATIONS CHECKLIST

Item	N/A	YES	NO	COMMENTS
36. Cues for prompt recognition of an out-of-service annunciator should be designed into the system - 6.3.3.3e.				
37. Blank or unused tiles should not be illuminated except during annunciator testing - 6.3.3.3f.				
38. Demarcation lines may be used to enclose functionally related titles - 6.6.6.2a(1).				
39. Demarcation lines may be used to group tiles with their related controls and/or displays - 6.6.6.2a(1) through a(3).				
40. If used, demarcation lines should be visually distinctive from the panel background - 6.6.6.2b.				
41. If used, demarcation lines should be permanently attached - 6.6.6.2c.				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
42. ALBs should be located above the controls and displays required for corrective or diagnostic action when they alarm - 6.3.3.1a.				
43. Each ALB should be identified by a label directly above it - 6.3.3.1b(1).				
44. Each set of annunciator controls should include a silence control - 6.3.4.1a(1).				
45. An acknowledge control should be provided that terminates the flashing and causes the tile to continuously illuminate until it has cleared - 6.3.4.1b(1).				
46. If an automatic cleared alarm feature is not provided, a control should be provided to reset the system after an alarm has cleared - 6.3.4.1c(1).				

APPENDIX B3
OBSERVATIONS CHECKLIST

	N/A	YES	NO	COMMENTS
47. A control to test the auditory alarm and the flashing illumination of all tiles in a panel (i.e., in one or more ALBs) should be provided - 6.3.4.1d(1).				
48. Repetitive groups of annunciator controls should have the same arrangement and relative location at different work stations - 6.3.4.2a.				
49. Annunciator controls should be coded differently than other panel controls either by color, demarcation, or shape - 6.3.4.2b(1) through b(4).				
50. Shape coding is preferred for the silence control - 6.3.4.2b(4).				
51. Annunciator control designs should not allow the operator to defeat the control operation such as inserting a coin into a control guard ring - 6.3.4.2c.				
52. Annunciator response procedures should be available in the control room - 6.3.4.3a.				

APPENDIX B4
DOCUMENTATION REVIEW CHECKLIST

INSTRUCTIONS

Collect the following documents and review them for the information contained in the attached checklist:

1. Administrative Procedures concerning annunciators
2. Annunciator Response Procedures
3. Results from the following task reports:
    a. Convention Survey
    b. System Function Task Analysis
    c. Labeling Survey
4. Insure that all comments for NO checks include component, instrument, panel, equipment, etc. identification and location information.
5. Initiate HED reports on all NO checks per the directions contained in the checklist analysis aids.

APPENDIX B4
DOCUMENTATION REVIEW CHECKLIST

	N/A	YES	NO	COMMENTS
1. ANNUNCIATOR RESPONSE PROCEDURES a. Response procedures should be indexed by panel I.D. and tile coordinates - 6.3.4.3b				
b. There should be no alarms that require the operator to direct an auxiliary operator outside the control room to obtain more specific information - 6.3.1.2b(1).				
c. Annunciators with inputs from more than one plant parameter set point should be avoided (multi-input alarms that summarize single-input alarms elsewhere in the control room are an exception) - 6.3.1.2c(1)				
2. PLANT ADMINISTRATIVE PROCEDURES a. Periodic testing of annunciators should be required and controlled by administrative procedures - 6.3.4.1d(2).				
b. If audible alarm intensity is operator-adjustable, it should be controlled by administrative procedures - 6.3.2.1b.				

APPENDIX B4
DOCUMENTATION REVIEW CHECKLIST

	N/A	YES	NO	COMMENTS
PLANT ADMIN PROCESS (cont) c. When annunciator tiles must be on for an extended period during normal operations, it should be controlled by administrative procedures (see also 6.3.3.2f(1), item 19 on the Observations Checklist) - 6.3.3.2f(2).				
3. CONVENTIONS TASK REPORT a. Color meanings should not be the only means for identifying pertinent information, that is, all color coding used should be redundant information - 6.5.1.6a.				
b. The number of colors used for coding should be kept to the minimum needed to provide sufficient information and should not exceed 11 - 6.5.1.6b(1) and b(2).				
c. Color meanings should be narrowly defined - 6.5.1.6c(1).				
d. Red should mean unsafe, danger, immediate operator action required, or an indication that a critical parameter is out of tolerance - 6.5.1.6c(2). It is important to note that in one sense, a strict interpretation of				

APPENDIX B4
DOCUMENTATION REVIEW CHECKLIST

	N/A	YES	NO	COMMENTS
CONVENTIONS TR (Cont) this statement would mean that a standard, and broadly applied convention in the nuclear industry was incorrect. However, keep in mind that flowing electricity (closed breakers), flowing water or steam (running pumps and open valves), and an active reactor can be considered inherently less safe than a shut off or shut down condition.				
e. Green should mean safe, shut off, shut down, no operator action required, or an indication that a parameter is within tolerance - 6.5.1.6c(2).				
f. Amber or yellow should mean a hazard, potentially unsafe, caution, attention required, or an indication that a marginal value or parameter exists - 6.5.1.6c(2).				
g. Meanings assigned to a particular color should be consistent across all control room applications regardless of whether it is on a panel surface, in indicator lights or in CRTs - 6.5.1.6d(1) and (2).				
h. Abbreviations and acronyms should be consistent across control room applications - 6.3.3.4d.				

APPENDIX B4
DOCUMENTATION REVIEW CHECKLIST

	N/A	YES	NO	COMMENTS
4. SFTA TASK REPORT a. The annunciator warning system should be designed as the primary alerting interface with the operator for out-of-tolerance conditions. It should consist of three major subsystems: auditory alert, visual alarm, and operator response. These three subsystems should function to provide a prefered operational sequence for annunciator warnings - 6.3.1.1.				
b. Visual alarm tiles should be grouped by function, system, subsystem, or other logical organization within ALBs - 6.3.3.3b and d(2).				
c. Prioritization of annunciators should be based on a continum of importance, severity, or need for operator action in one or more dimensions such as, the likelihood of a reactor trip or the likelihood of a release of radiation - 6.3.1.4a(2).				
d. Tile legends should address specific conditions rather than a range of conditions and/or parameters. As an example, separate tiles should be used to indicate temperature-low, temperature-high, pressure-low, and pressure-high, rather than a single tile with the legend HIGH-LOW TEMP-PRESS - 6.3.3.4c.				

APPENDIX B5.1
MEASUREMENTS ANALYSIS

1. LINEAR MEASUREMENTS (LABELING)

1.1 ALB Summary Labels - 6.3.3.1.b(2)

a. If there are no summary labels, check N/A for criterion 6.3.3.1.b(2) in Appendix A.

b. If there are summary labels, calculate the visual angels for each label for the operator positions listed in Table 1.1b

Table 1.1b

	ALB IDENT	SAFETY SYSTEMS POS 1	SAFETY SYSTEMS POS 2	MCB REAC CONT	MCB TURB GEN	MCB ELEC DIST	RAD MON CONSOLE	OP'S DESK
1.								
2.								
3.								
4.								
5.								
6.								
7.								

Calculations (use extra sheets, as needed):

c. If all visual angles in Table 1.1b are 15 minutes of arc or greater, check YES for criterion 6.3.3.1b(2) in Appendix A.

d. If there are visual angles in Table 1.1b less than 15 minues of arc, record on an HED report form the position(s) and label(s) where this is so. Include the code number TP-3.1B5.1.1 in data collection description. For criterion 6.3.3.1b(2) in Appendix A, check the NO column and record the HED report number and the code number, TP-3.1B5.1.1 in the COMMENTS column

1.2 Tile Labels - 6.3.3.5a(1) and d(1) through d(6).

a. Calculate the visual angles for each character height at its farthest left and farthest right location for each workstation in Table 1.2a, below.

TABLE 1.2a

ALB NO/	STA 1		STA 2		STA 3		STA 4		STA 5	
CHAR HT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

Calculations (use extra sheets, as required):

APPENDIX B5.1
MEASUREMENTS ANALYSIS

b. If all visual angles in Table 1.2a are 15 minutes of arc or greater, check YES for criterion 6.3.3.5a(1) in Appendix A.

c. If any visual angles in Table 1.2a are less than 15 minutes of arc, record on an HED report form the position(s) and tile legend(s) where this is so. Include the code number TP-3.1B5,1.2 in the data collection description. For criterion 6.3.3.5a(1) in Appendix A, check the NO column and record the HED report number and the code number, TP-3.1B5.1.2, in the COMMENTS column.

d. Compare the character dimensions and legend measurements for each character height recorded with criteria 6.3.3.5d(1) through d(6).

e. If all character heights and legends meet the criteria, check the YES column for these criteria in Appendix A.

f. If any character dimensions or legend measurements fail to meet the criteria, record on an HED report form the tile coordinates, character height implicated, and a description of the failure. Include the code number TP-3.1B5.1.2 in the data collection description. For criteria 6.3.3.5d(1) through d(6) in Appendix A, check the NO column and record the HED report number and the code number TP-3.1B5.1.2, in the COMMENTS column.

APPENDIX B5.2
MEASUREMENTS ANALYSIS

2. SOUND MEASUREMENTS (AUDIBLE SIGNALS)

2.1 Annunciator Audible Alarms - 6.3.2.1a.

a. Obtain the average ambient noise level in db(A) from the Ambient Noise Survey Task Report (TR-1.6) and record below:

Average noise level: ___________ db(A)

b. Based upon the below adjustment factors, reduce each measured annunciator alarm level and record in Table 2.1b.

ABSOLUTE DIFFERENCE BETWEEN MEASURED LEVEL (Lm) AND AVERAGE NOISE LEVEL (Ln)	SUBTRACT THIS AMOUNT FROM MEASURED LEVEL (Lm) AND AND RECORD IN TABLE 2.1b
4	2.2
5	1.7
6	1.3
7	1.0
8	.8
9	.6
10	.4
11	.3
12	.3
13	.2
14	.2
15	.1

TABLE 2.1b

		MCB						
		SAFETY SYSTEMS						
	ALARM LOCATION	POS 1	POS 2	REAC CONT	TURB GEN	ELEC DIST	RAD MON CONSOLE	OP'S DESK
1.								
2.								
3.								
4.								
5.								

APPENDIX B5.2
MEASUREMENT ANALYSIS

c. Compare all adjusted dB(A) levels in Table 2.1b to the average noise level.

d. If all adjusted audible alarm levels are at least 10 dB(A) above the average noise level check the YES column for criterion 6.3.2.1a in Appendix A.

e. If any adjusted alarm levels are less than 10 dB(A) above the average noise level, record each occurance on an HED report form. Include the code number TP3.1B5.2.1 in the data collection description. For criterion 6.3.2.1a in Appendix A, check the NO column and record the HED report number and the code number, TP3.1B5.2.1 in the COMMENTS column.

APPENDIX B5.3
MEASUREMENT ANALYSIS

3. LIGHT MEASUREMENTS (TILE FLASH CHARACTERISTICS)

3.1 Alarmed Flash Characteristics - 6.3.3.2b.

a. From the recorded data, determine if the alarmed flash rate is between 3 to 5 flashes per second and that the on-off ratio is approximately 1:1.

b. If both parameters meet the criteria, check the YES column for criterion 6.3.3.2b in Appendix A.

c. If either parameter fails to meet the criteria, record the discrepancy on an HED report form. Include the code number TP-3.1B5.3.1 in the data collection description. For criterion 6.3.3.2b in Appendix A check the NO column and record the HED number and the code number, TP-3.1B5.3.1, in the COMMENTS column.

3.2 Cleared Flash Rate - 6.3.1.5b(1).

a. From the recorded data, determine if the cleared flash rate is approximately double or ½ the alarmed flash rate.

b. If the cleared flash rate passes the criterion, check the YES column for criteria 6.3.1.5b(1) in Appendix A.

c. If the cleared flash rate fails to meet the criterion, record the discrepancy on an HED report form. Include the code number TP-3.1B5.3.2 in the data collection discription. For criterion 6.3.1.5b(1) in Appendix A, check the NO column and record the HED number and the code number, TP-3.1B5.3.2, in the COMMENTS column.

APPENDIX B6
OPERATOR INTERVIEW/QUESTIONNAIRE ANALYSIS

1. GENERAL

   a. Review all questionnaires for completeness of biographical information and question responses.

   b. Delete incomplete and unusable questionnaires from the data base. If required by contract, re-schedule these questionnaires for correction/completeness.

   c. When the data base assembly is complete perform the anaylsis, below.

2. BIOGRAPHICAL DATA

   a. Assemble biographical data and determine ranges and distributions for all relevant dimensions.

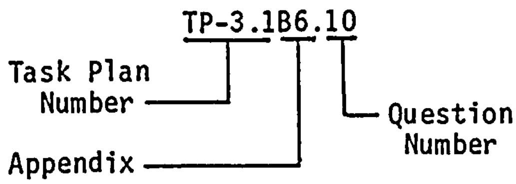
   b. Using appropriate statistics, determine the distribution (or its approximation) for this data.

3. RESPONSE DATA

   a. Summarize all responses and determine percent frequency response for each negative answer.

   b. For each negative answer, initiate Preliminary HEDs (PHEDs) for discrepancy review. Record frequency data, response question number and data collection code number on each PHED. Code numbers are developed as follows: (See List 3b for criteria)

      Example:



   c. Submit all PHEDs to your immediate supervisor.

   d. Subsequent verification, validation and disposition of all PHEDs will be conducted per TP-10.1 (HED Review Procedure).

APPENDIX B6
OPERATOR INTERVIEW/QUESTIONNAIRE
ANALYSIS

LIST 3b

1. 6.3.1.3a(3)
2. 6.3.1.3a(2)
3. 6.3.3.1b(1)
4. 6.3.3.1b(2)
5. 6.3.1.4b(1)
6. 6.5.1.6b(1)
7. 6.5.1.6b(2)
8. 6.5.1.6c(1)
9. 6.5.1.6c(2)
10. 6.5.1.6c(2)
11. 6.5.1.6c(2)
12. 6.5.1.6b(1)
13. 6.5.1.6d(1)&(2)
14. 6.3.1.4b(2)& 6.3.2.2b
15. 6.3.2.1f
16. 6.3.2.2a(1)
17. 6.3.2.2a(2)
18. 6.3.2.1c
19. 6.3.2.1d
20. 6.3.4.1a(1)&(2)
21. 6.3.4.1b(1)
22. 6.3.4.1b(2)
23. 6.3.4.1c(1)
24. 6.3.4.1c(2)
25. 6.3.4.1c(3)
26. 6.3.4.2c
27. 6.3.4.1d(1)
28. 6.3.4.1d(2)
29. 6.3.3.2e
30. 6.3.3.2f
31. 6.3.3.3e
32. 6.3.3.2c
33. 6.3.1.2a(1)
34. 6.3.1.2a(2)
35. 6.3.3.1a
36. 6.3.4.3a
37. 6.3.1.2b(1)
38. 6.3.3.4b
39. 6.3.1.2b(2)
40. 6.3.1.2d(1)
41. 6.3.1.2d(2)
42. 6.3.3.4c
43. 6.3.1.2c(3)
44. 6.3.1.2c(2)
45. 6.3.1.2c(2)
46. 6.3.1.2c(2)

APPENDIX B7
OBSERVATION CHECKLIST
ANALYSIS

1. For each checklist item checked NO, initiate an HED report. Enter the HED report number in the COMMENTS column of the checklist for that item. Include all necessary information on the HED report concerning identification of the discrepancy and the criteria (checklist item) not met.

2. Enter the following code number in the data collection description:

   TP-3.1B3.n

   n — Checklist Item Number

3. Find the appropriate criterion or criteria in Appendix A from the reference number in the checklist item. Check the NO column and enter the HED number and the data collection code number in the COMMENTS column for that criterion or criteria.

APPENDIX B8
DOCUMENTATION REVIEW CHECKLIST
ANALYSIS

1. For each checklist item checked NO, initiate an HED report. Enter the HED report number in the COMMENTS column of the checklist for that item. Include all necessary information on the HED report concerning identification of the discrepancy and the criteria (checklist item) not met.

2. Enter the following code number in the data collection description:

```
TP-3.1B4.n
          |
          └─── Checklist Item Number
```

3. Find the appropriate criterion or criteria in Appendix A from the reference number in the checklist item. Check the NO column and enter the HED number and the data collection code number in the COMMENTS column for that criterion or criteria.

APPENDIX B9
HUMAN ENGINEERING DISCREPANCY (HED) REPORT

____
PLANT/UNIT

ORIGINATOR: _________________________ HED NO.: __________________

VALIDATED BY: _________________________ DATE: __________________

a) HED TITLE: ____

____

b) ITEMS INVOLVED:
c) PROBLEM DESCRIPTION:
d) DATA COLLECTION DESCRIPTION   CODE NUMBER:
e) SPECIFIC HUMAN ERROR(S):

PLANT/UNIT ________ HED NO.: ________

f) SUGGESTED BACKFIT:

g) REVIEW AND DISPOSITION:

APPENDIX C

CRITERIA MATRIX

CRITERIA MATRIX

Criteria Distributed Across Data Collection Methods.

Notes:

1. The following codes apply to the matrix columns:

   M - Measurement (instruments and/or measuring devices required)

   O - Observations (observation notes taken)

   I - Interview/Questionnaire (generally a structured interview unless otherwise specified)

   D - Document Review (documentation review to include engineering drawings, CWDs, etc.)

   A - Auditory Criteria

   V - Visual Criteria

   C - Controls Criteria (physical characteristics)

   P - Physical Arrangement/Location Criteria

   F - Functional Criteria (usually requires some operational data for verification)

2. Data sources listed are suggested. Alternatives should be used when those listed are not available or are not adequate.

CRITERIA MATRIX

CRITERIA NUREG--0700 para number	Crit type	DATA COLLECTION METHODS M	O	I	D	SUGGESTED DATA SOURCES	REMARKS
6.3.1.1	F				X	SFTA Rpt	also in TP-9.1 (SFTA)
6.3.1.2a(1)	F			X		Ops	
a(2)	F			X		Ops	
b(1)	F			X	X	Ops, Ann Resp Procs	
b(2)	F			X		Ops	
c(1)	F				X	Ann Resp Procs	
c(2)	F			X		Ops	
c(3)	F			X		Ops	
d(1)	F			X		Ops	
d(2)	F			X		Ops	
6.3.1.3a(1)	PF		X			Pnl	
a(2)	PF			X		Ops	
a(3)	PF			X		Ops	
b	PF		X			Pnl	
c	PF		X			Pnl	
d	PF		N/A			All	see text para. 4.2a
6.3.1.4a(1)	PF		X			Pnl	
a(2)	PF				X	Pnl, SFTA Rpt	also in TP-9.1 (SFTA)
b(1)	F		X	X		Pnl	
b(2)	F		X	X		Pnl	
6.3.1.5a	F		X			Pnl	
b(1)	F	X	X			Pnl	
b(2)	F		X			Pnl	
b(3)	F		X			Pnl	
6.3.2.1a	F	X				CR	
b	F		X		X	CR, Admin Procs	
c	F		X	X		CR, Ops	
d	F		X	X		CR, Ops	
e	F		X			CR	
f	F		X	X		CR, Ops	
6.3.2.2a(1)	PF			X		Ops	
a(2)	F			X		Ops	
b	F			X		Ops	
6.3.3.1a	P		X			Pnl	
b(1)	P		X			Pnl	
b(2)	P	X				CR	
c(1)	P		N/A				in TP-1.8 (Maint)
c(2)	P		N/A				in TP-1.8 (Maint)
c(3)	P		N/A				in TP-1.8 (Maint)

APPENDIX D

TASK PLAN CRITIQUE

APPENDIX D
TASK PLAN CRITIQUE

INSTRUCTIONS

1. Attach a copy of Section 4.0.
2. Fill in the required information and answer all questions.
3. Explain all NO answers in detail.
4. When complete, turn in to your immediate supervisor.

1. Name of Respondent: ______________________________

2. Name of Plant: ______________________________

3. Date of Survey: ______________________________

4. Were all of the criteria correct and appropriate for this task (do not explain criteria that were N/A because System/CR did not have that design feature)? YES___ NO___

5. Did the task plan instructions present the easiest and best methodology for performing the assessment? YES___ NO___

6. Were the data collection forms adequate? YES___ NO___

D. C. COOK

CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN FOR VERIFICATION

OF TASK PERFORMANCE CAPABILITIES

1.0 INTRODUCTION

1.1 Purpose

The purpose of Verification of Task Performance Capabilities is to assure that operator tasks can be performed within the existing control room with minimum potential for human error. Verification evaluates the availability and suitability of the control room instrumentation and controls to support the performance of operator actions.

1.2 Scope

The scope of the Verification Task effort is to assure the availability and suitability of those controls and instrumentation identified in the element tables for the emergency operating procedures selected for task analysis. The remaining main control board devices will then be compared against NUREG-0700, Section 6 Guidelines that pertain to verification of task performance capabilities.

2.0 VERIFICATION METHOD

The D. C. Cook Control Rooms will be verified by an observation/comparison method using the control room "mockup", the control rooms inventory and the task analysis documents developed in the System Function Review and Task Analysis (SRTA). The Verification of Task Performance Capabilities will be accomplished in two parts: Verification of Availability and Verification of Suitability.

2.1 Verification of Availability

The control/indication requirements table and the instrumentation requirements table will be compared with the control board mockup and the control room inventory to verify the availability of the required equipment. Any missing equipment shall be recorded on a Checklist Observations Report form. Equipment not identified on the requirements tables shall be listed and verified with the D. C. Cook operating personnel as to use and need. If a use or need is not identified, this equipment shall be listed on a CLO form.

2.2 Verification of Suitability

The verification of suitability will be accomplished by comparing the actions required and equipment characteristics requirements of the control/indication requirements table and the instrumentation requirements table with the control room inventory and the control board mockup. Components that do not meet the requirements of the above tables will be listed on a CLO form.

3.0 DOCUMENTATION

The documentation used or generated during the verification task will be maintained as a part of the DCRDR data file. This documentation will consist of the following:

1. Control/indication requirements table - Verification Checklist
2. Instrumentation requirements table - Verification Checklist
3. Control Board Inventory
4. Checklist Observation Reports

D. C. COOK

CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN FOR VALIDATION

OF CONTROL ROOM FUNCTIONS

1.0 INTRODUCTION

1.1 Purpose

The purpose of this program is to define the process to be used for validation of control room functions. This document describes the preparation, implementation and documentation phases of the validation program and assigns responsibilities for execution of the validation program.

1.2 Scope

Validation is the process of determining whether the control room operating crew can perform their tasks effectively given the control room design (instrumentation and controls), the procedures and their training. These four considerations (operators, control room, procedures and training) are frequently referred to as the components of the Emergency Response Capability system, and the validation performed to evaluate their overall performance is termed a SYSTEM validation. The scope of this program plan includes definition of the SYSTEM validation necessary to exercise the ERC system, but is limited to the evaluation of the control room component of the ERC system.

2.0 RESPONSIBILITIES

The Detailed Control Room Design Review Program for the D. C. Cook Nuclear Plant is the responsibility of the Indiana and Michigan Electric Company. Westinghouse Electric Corporation has been contracted to assist in the performance of the DCRDR. This contract includes prime responsibility for the performance of the validation phase of the DCRDR program.

2.1 Westinghouse Electric Corporation

Westinghouse will conduct all phases of the DCRDR validation program.

2.2 Indiana and Michigan Electric Company

I&M will provide at least one team of Control Room operators to perform the walk-through/talk-through phase of the Validation program.

3.0 PREPARATION PHASE

This phase is necessary to identify the resources needed in a CRDR validation. Proper test methods with accompanying test scenarios must be selected and developed so that the control room is properly exercised during the testing phase. The operating crew must be trained in the proper use of the D. C. Cook Emergency Operating Procedures so that the validation scenarios are implemented as planned. The validation scenarios have been developed based on the correct use of the EOP's. Any deviations from proper EOP usage may hamper both the progress of the scenario and the accurate assessment of the control room.

3.1 Validation Method

The D. C. Cook control room will be validated using a walk-through/talk-through method at the Unit 1 full scale "mock up". The operating crew will walk-through each of the validation scenarios to identify and locate controls and displays used to perform each step of the scenarios. At the completion of each walk-through, a talk-through (debriefing) will be performed to resolve observation team questions or comments and to evaluate control and display availabilities and readabilities. In addition, human factors suitabilities will be evaluated. Each of the walk-through/talk-through sessions will be taped (video and audio) as part of the control room validation documentation.

3.2 Validation Evaluation Criteria

Evaluation criteria are needed to control and direct the talk-through sessions. The evaluation criteria listed on Attachment 1 will be used by the observation team leader to guide the talk-throughs.

3.3 Validation Scenarios

A scenario is the written description of a plant transient(s) and/or equipment failure(s) used to exercise the ERC System. It provides the background, prerequisite conditions, and the proper sequence of realistic plant symptoms and responses. The scenario should guide the system through a designated evaluation path so evaluation criteria can be addressed. Scenarios will vary in length, complexity and style.

The validation scenarios listed below have been selected for the validation phase of the DCRDR.

Scenario No.	Title
A-1	Reactor Trip
A-2	Anticipated Transient Without Scram (ATWS) from full power following loss of off site power
A-3	Loss of all feedwater
A-4	Secondary Break Outside Containment
A-5	Steam Generator Tube Rupture in Different Steam Generators, Plus Cooldown
A-6	Design Base Accident Loss of Coolant Accident (DBA LOCA) with Switchover
A-7	Intermediate LOCA-Post LOCA Cooldown
A-8	Steam Generator Tube Leak Plus Spurious Safety Injection (SI)
A-9	Inadequate Core Cooling
A-10	Secondary Break - All S/G Stop Valves Fail to Close

3.4 Validation Data Collection

Data collection will originate from the following sources:

1. Video and audio recordings of each scenario.

2. Observation team inputs during talk-through sessions.

3. Operating team inputs

   - o During walk-throughs
   - o During talk-throughs

Problems identified during the talk-through sessions will be recorded on a a talk-through problem report form shown on Attachment 2.

Validation data will be collected for later review by the observation team to identify Checklist Observation Reports.

3.5 Operating Crew Responsibilities

The operating crew is responsible for performing the walk-through in accordance with the scenarios and procedures identified and to respond to questions posed by the observation team during the talk-throughs.

The operating crew is also responsible for identifying known Control Room deficiency not identified during the walk-through session.

3.6 Observation Team Responsibilities

The Observation team is responsible for noting any deviations (real, suspected, negative or positive) from the expected performance observed during the walk-throughs, and to discuss such deviation with the operators during the talk-throughs to identify Control Room problems. It is also the responsibility of the Observation team to complete the talk-through problem report sheets for each of the identified problems.

4.0 IMPLEMENTATION PHASE

Implementation phase will be accomplished by applying the walk-through/talk-through process to the validation scenarios identified earlier.

Before starting the Implementation phase, the operating crew and Observation team will be briefed on the method and objectives of the validation process and on their responsibilities as Control Room validation team members. To insure that all participants understand both the scenarios and the walk-through process a short practice walk-through will be performed. This practice walk-through will not be taped.

At the start of each walk-through the operating crew will be advised of the initial plant conditions. The walk-through will then proceed through the applicable scenario. The operating crew will walk to the various work stations and identify the appropriate controls and and displays used to accomplish each procedure step. Plant parameters required by the procedure step will be supplied by an Observation team member.

During the walk-through Observation team members will note all deviations for later discussion during the talk-through session.

The talk-through session will be conducted by viewing the playback of the tape of the walk-through. The playback will be stopped at any deviation point or where a specific question is posed. The deviation or question will be resolved. Those resolutions which identify a problem will be documented on a talk-through problem report form.

In addition, Checklist observations from the DCRDR Verification Task will be introduced and verified.

The Validation Evaluation Criteria questions will introduce additional discussions and identification of Control Room problems to be resolved and documented.

5.0 DOCUMENTATION PHASE

Documentation generated during the Validation phase will be collected and maintain as part of the DCRDR documentation.

This documentation will consist of the following:

1. Walk-through video tapes
2. Talk-through video tapes
3. Talk-through Problems Reports

Following completion of the Validation program the documentation will be analysis to provide the Checklist Observation Reports for the DCRDR program.

D. C. COOK UNITS 1 AND 2

CRDR VALIDATION PROGRAM

VALIDATION EVALUATION CRITERIA

1. Are/were particular annunciators or instruments that the operator uses as cues adequate to make him realize that a step within a task should be expected.

2. Are/were annunciators redundant? Does more than one alarm tell him the same information?

3. Are/were controls reachable and displays readable for the appropriate system panel?

4. Are/were the identification labels of instrumentation and controls sufficiently detailed to permit the operator to locate the panel and the particular control without resorting to other documentation?

5. Do/did indications exist to allow the operator to determine that a step has been completed or that a condition has cleared? Does this indication convey the information satisfactorily?

6. If the primary cues, controls, or indicators are not available, is there still some way to complete a given step?

7. If it is necessary for the operator to take some action when a parameter reaches a particular value, is the instrument for that parameter accurate and readable to that value?

8. Are/were all instrument scales and ranges appropriate to the required reading precision?

ATTACHMENT 1

TALK-THROUGH PROBLEM

TASK ID NO. ____________

PROCEDURE ______________________________ STEP ________________

TASK ____

OPERATOR ___________________________ LOCATION ________________

EQUIPMENT ____

STATEMENT OF PROBLEM:

SUGGESTED SOLUTION(s):

APPENDIX B

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

NRC STAFF COMMENTS ON

THE PROGRAM PLAN

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket Nos. 50-315
and 50-316

Mr. John Dolan, Vice President
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

Dear Mr. Dolan:

In accordance with the requirements of Supplement 1 to NUREG-0737, Indiana and Michigan Electric Company (IMECo) submitted a Program Plan for conducting a Detailed Control Room Design Review (DCRDR) of the Donald C. Cook Nuclear Power Plant, Units 1 and 2, control rooms. The submittal has been reviewed with reference to the requirements of Supplement 1 to NUREG-0737 and the guidance contained in NUREG-0700 and draft NUREG-0801. The staff was assisted in its review by consultants from Science Applications, Inc. (SAI).

The DCRDR Program Plan submitted by IMECo demonstrates a commitment to meet the requirements of Supplement 1 to NUREG-0737. Additional information, however, is needed by the staff in a number of areas before a decision regarding the efficacy of the proposed DCRDR can be made. In particular, further detailed discussion of procedures and methodologies for the Function and Task Analysis is necessary to provide assurance that this activity will yield sufficient usable data.

It is requested that a meeting be held during April or May of this year to discuss the enclosed staff comments. A suggested agenda is included for IMECo consideration. Please let us know within 2 weeks of receipt of this letter when a meeting would be suitable and if the agenda should be modified.

The reporting and/or recordkeeping requirements of this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See attached list

cc: Mr. M. P. Alexich
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Nuclear Engineering
American Electric Power Service
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Resident Inspectors Office
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Gerald Charnoff, Esquire
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Honorable Jim Catania, Mayor
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U.S. Environmental Protection Agency
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NUCLEAR REGULATORY COMMISSION

STAFF COMMENTS

ON THE

DONALD C. COOK NUCLEAR POWER PLANT, UNITS 1 AND 2

DETAILED CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN

BACKGROUND

Licensees and applicants for operating licenses shall conduct a Detailed Control Room Design Review (DCRDR). The objective is to "improve the ability of nuclear power plant control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them" (NUREG-0660, Item I.D). The need to conduct a DCRDR was confirmed in NUREG-0737 and Supplement 1 to NUREG-0737. DCRDR requirements in Supplement 1 to NUREG-0737 replaced those in earlier documents. Supplement 1 to NUREG-0737 requires each applicant or licensee to conduct a DCRDR on a schedule negotiated with the Nuclear Regulatory Commission (NRC).

NUREG-0700 describes four phases of the DCRDR and provides applicants and licensees with guidelines for its conduct.

The phases are:

1. Planning
2. Review
3. Assessment and Implementation
4. Reporting.

Criteria for evaluating each phase are contained in draft NUREG-0801.

A Program Plan is to be submitted within two months of the start of the DCRDR. Consistent with the requirements of Supplement 1 to NUREG-0737, the Program Plan shall describe how the following elements of the DCRDR will be accomplished:

1. Establishment of a qualified multidisciplinary review team
2. Function and task analyses to identify control room operator tasks and information and control requirements during emergency operations

3. A comparison of display and control requirements with a control room inventory

4. A control room survey to identify deviations from accepted human factors principles

5. Assessment of human engineering discrepancies (HEDs) to determine which HEDs are significant and should be corrected

6. Selection of design improvements

7. Verification that selected design improvements will provide the necessary correction

8. Verification that improvements will not introduce new HEDs

9. Coordination of control room improvements with changes from other programs such as SPDS, operator training, Reg. Guide 1.97 instrumentation, and upgraded emergency operating procedures.

A Summary Report is to be submitted at the end of the DCRDR. As a minimum it shall:

1. Outline proposed control room changes

2. Outline proposed schedules for implementation

3. Provide summary justification for HEDs with safety significance to be left uncorrected or partially corrected.

The NRC will evaluate the organization, process, and results of the DCRDR. Evaluation will include review of required documentation (Program Plan and Summary Report) and may also include reviews of additional documentation, briefings, discussions, and on-site audits. In-progress audits may be conducted after submission of the Program Plan but prior to submission of the Summary Report. Preimplementation audits may be conducted after submission of the Summary Report. Evaluation will be in accordance with the requirements of Supplement 1 to NUREG-0737. Additional guidance for the evaluation is provided by NUREG-0700 and draft NUREG-0801. Results of the NRC evaluation of a DCRDR will be documented in a Safety Evaluation Report (SER) or SER Supplement.

Significant HEDs should be corrected. Improvements which can be accomplished with an enhancement program should be done promptly. Other control room upgrades may begin following publication of the SER (or SER Supplement), and staff approval of an implementation schedule for the design improvements.

DISCUSSION

The Indiana and Michigan Electirc Company (IMECo) submitted a Program Plan for conducting a Detailed Control Room Design Review (DCRDR) of the Donald C. Cook Nuclear Power Plant, Units 1 and 2 control rooms, by letter dated December 29, 1983. That Program Plan has been reviewed against the requirements of Supplement 1 to NUREG-0737. Consultants from Science Applications, Inc. (SAI) assisted the staff in this review. NRC approval of Program Plans is not required and, as a result, the licensee has initiated work on the DCRDR. A Summary Report is expected in December 1985. The results of the staff review of the IMECo Program Plan are provided below.

General Comments

The DCRDR Program Plan submitted by IMECo demonstrates a commitment to meet the requirements of Supplement 1 to NUREG-0737. Additional information however, is needed by the staff in a number of areas before a decision regarding the efficacy of the proposed DCRDR can be made. In particular, detailed discussion of procedures and methodologies for the Function and Task Analysis is necessary to provide assurance that this activity will yield sufficient usable data. The staff suggests that a meeting be held with the licensee to obtain the needed information. This may obviate the need of conducting an in-progress audit later on.

A human factors evaluation of the design of the remote shutdown capability provided to meet 10 CFR Part 50, Appendix A GDC-19, and 10 CFR Part 50, Appendix R is not specifically identified as a requirement in Supplement 1 to NUREG-0737. Staff review of this issue is not complete. In the interim, we recommend that the scope of the DCRDR include a human factors evaluation of the design of the remote shutdown capability. To the extent practicable, without delaying completion of the DCRDR, it should also address any control room modifications and additions (such as controls and displays for inadequate core cooling and reactor system vents) made or planned as a result of other post-TMI actions, and the lessons learned from operating reactor events such as the Salem ATWS events. Generic implications of the Salem ATWS events are discussed in NUREG-1000 and required actions are described in Section 1.2, "Post-Trip Review - Data and Information Capability," of the enclosure to Generic Letter 83-28.

Qualifications and Structure of the DCRDR Team

The licensee has proposed a multidisciplinary team for the DCRDR. The team will consist of three subteams, including personnel from IMECo, American Electric Power Service Corporation (AEPSC), Westinghouse, and the Canyon Research Group (human factors contractor). A "DCRDR Program Lead Engineer" will serve as the primary contact and will provide liaison between management and the Project Review and Assessment Teams. The manner in which these teams will interface is shown in Figures 2-2 through 2-6 of the Program Plan (Ref. 1).

Figure 2-1 (Ref. 1) shows the DCRDR program organizational structure. The DCRDR Program Lead Engineer appears in this structure as a member of all three subteams. The same is true of the individual designated as the "DCRDR Program Administrator." The function of this position has not been clearly defined. The rest of the personnel consists of eight mechanical engineers, five electrical engineers, one marine engineer, one industrial engineer, one human factors engineer, and one systems management engineer. The disciplines listed are based on the educational backgrounds shown in individual resumes, however, they do not exactly agree with the titles shown on Figure 2-1. Further review of the resumes indicates that a number of these persons had become specialists in areas beyond those indicated by their educational backgrounds and that expertise in the following fields will also be represented: nuclear safety, risk analysis, reliability and maintainability, and human factors.

Section 2-3 of the Program Plan provides a listing of the functions of management but it is not clear which persons comprise "management." In Figures 2-2 through 2-5 there is an activity identified as "Supervisory Review/Comments." Again, it is not clear which persons comprise the "supervisory" function.

Sections 2-4, 2-5 and 2-6 of the Program Plan present a listing of the functions of the Project Review Team, the Design Review Team, and the Assessment Team, respectively. Figure 2-1 presents the titles and names of each team's members but it is not clear which person, or persons, will be performing which functions (as suggested in draft NUREG-0801, Para. 2.1.1); likewise, there is no indication of the individual levels of effort for each person listed in Figure 2-1.

It is not clear to the staff, based upon the information provided in the Program Plan, that the human factors professional will have full-time involvement throughout the DCRDR. In the interest of consistency and continuity, the staff suggests that the human factors specialist be the same on all three teams even though the Program Plan states that one of the functions of the Design Review Team is to assist the Assessment Team in its activities.

In summary, while the staff finds that the licensee is planning to provide a qualified, multidisciplinary DCRDR review team and that plans for intra-DCRDR coordination and for cooperation with other planned and ongoing human factors programs will be implemented, more in-depth information regarding staffing, individual levels of effort, and individuals' responsibilities should be discussed in a meeting with the licensee.

Function and Task Analysis

Paragraph 5.1.bii of Supplement 1 to NUREG-0737 states: "The licensee shall employ ... function and task analysis (that had been used as a basis for developing emergency operating procedures Technical Guidelines and plant

specific emergency operator procedures) to identify control room operator tasks and information and control requirements during emergency operations." Subsection 5-5 of the Program Plan contains a very brief description of the system function and task analysis. The licensee states that: "The System Function and Task Analysis will establish instrumentation requirements and performance criteria for select normal and emergency conditions. This task will be performed by using plant-specific procedures generated from the Westinghouse Owners' Group Emergency Response Guidelines. These plant-specific procedures will be submitted to the Design Review Team. These data will provide input to the Design Review Team for the verification and validation of control room functions (Tasks 5 and 6)." The staff finds that this description, in addition to its brevity, ignores the guidelines of NUREG-0700, paragraphs: 3.4 and 3.4.2.1 through 3.4.2.4. The licensee has not provided enough information regarding what their system function and task analysis effort will involve for the staff to make any evaluation as to whether or not the requirement for function and task analysis will be satisfied. The staff suggests that the licensee describe in the proposed meeting the processes/methodologies to be used by the licensee to identify control room operator tasks and information and control requirements during emergency operations.

Control Room Inventory

The licensee's description of the DCRDR activity indicates their commitment to conduct a thorough and complete inventory of their control rooms, per the guidance contained in NUREG-0700. This indication of commitment should be reinforced by providing more detail regarding staffing and how the inventory will be conducted, e.g., documentation, use of engineering drawings, use of equipment lists, use of photography and combinations thereof. Discussion of these issues in the proposed meeting would give the staff a better understanding of the inventory process and its purpose, i.e., to ensure that the information requirements identified in the function and task analysis are implemented and that displays and controls satisfying the information and control requirements are indeed available in the control room and adequate for the job.

Control Room Survey

The licensee's description of the conduct of their Control Room Survey indicates it will be performed in close compliance with the guidance of NUREG-0700 (as indicated in Appendix C of the Program Plan). There are, however, two additional areas that should have been included in their survey plan: (1) Control/display integration and (2) Panel layout. If these two areas are included, the licensee's Control Room Survey should prove successful for identifying HEDs.

Subsection 4-3 of the Program Plan describes the development of a Control Room Human Engineering Criteria Report (CRHEC), which will be based on the guidelines provided in NUREG-0700, but reconstructed to be plant specific.

However, based on the information provided, it is not clear to the staff what is being planned or what the CRHEC report will contain. The idea of a review criteria document is good, but its inherent validity can not be assessed based upon the information contained in the Program Plan. This issue should be discussed in the proposed meeting.

Assessment of Human Engineering Discrepancies (HEDs)

The licensee's assessment of HEDs is based primarily on evaluation of CRHEC report deviations. Since this report has not been adequately described, it is difficult for the staff to evaluate this activity. If the CRHEC report conforms closely to NUREG-0700 guidelines and is adequately described, the HED assessment process would appear to be satisfactory, except for the following problems:

The licensee indicates in Subsection 6-2 of the Program Plan that the Assessment Team will evaluate and categorize each HED according to the methodology presented in Figure 6-2. The referenced figure is missing, therefore, the staff cannot comment on the licensee's methodology.

The fourth paragraph on Page 6-2 of the Program Plan gives the staff the impression that only Category IV HEDs will be assessed as to their possible cumulative and interactive effects on other HEDs. The last sentence in this paragraph states: "Those Category IV HEDs shown to possess the above effects will be recategorized to the appropriate Category II level." Reference to Figure 6-3 of the Program Plan shows only one Category II so the word "appropriate" should be deleted or its significance explained. Further, the arbitrary assignment of such a HED to Category II requires explanation. It seems possible to the staff (in the absence of HED assessment criteria) that such a HED might fall within category I or III.

The above problems should be discussed in the proposed meeting.

Selection of Design Improvements

While this DCRDR activity is not directly addressed by IMECo in the Program Plan, the licensee's description of HED assessment does indicate some considerations (in addition to the HED assessment) that will be given to design improvement selection.

The staff observes that during the course of the DCRDR and through implementation (Phase III-B) there will be a very large volume of paperwork generated. However, the Program Plan does not describe any system for the orderly handling and maintenance of the HED-related documentation, i.e., no evidence of an HED tracking system (from the point of HED identification through HED assessment and implementation of HED resolutions) has been presented by the licensee.

The staff finds that the licensee's Implementation Plan for HED resolution conforms to the guidance contained in draft NUREG-0801.

Verification That Improvements Will Provide the Necessary Correction

This requirement is not addressed by the licensee, therefore, the staff cannot comment as to whether or not the requirement will be satisfied by the licensee. If this verification process is part of the HED assessment process, the licensee should so state and the methodology clearly explained during the proposed meeting.

Verification That Control Room Modifications Do Not Introduce New HEDs

Brief mention of this requirement is made by the licensee, but the information provided in the Program Plan is too sparse for staff evaluation. This requirement should be discussed in the proposed meeting.

Coordination of the DCRDR With Other Programs

On Page 1-6 of the Program Plan, in the description of Phase III-B activities, the licensee states that: "... a schedule will be developed to ensure the integration of the proposed control room changes with other post-TMI programs..." On Page 6-1 of the Program Plan, one of the stated objectives of the Assessment Phase of the DCRDR Program is to: "Apply the assessment process to other projects related to the control room which are concerned with, or may be affected by, the human factors review (Regulatory Guide 1.97, Revision 2, Safety Parameter Display System, Procedures, and Training)." On Page 7-1 of the Program Plan, one of the considerations in the development of the HED resolution implementation schedule will be: "Integration With Other Post-TMI Programs." Section 9 of the Program Plan discusses coordination with other activities.

While the above indicates the licensee's awareness of the requirement for coordination between the DCRDR and other control room improvement programs, no plan/method showing how the coordination and integration of these efforts will be achieved is presented by the licensee. This, and the fact that Figure 9-1 of the Program Plan shows only a paralleling of activities but no connection between programs, leaves some doubt as to the licensee's understanding of the objectives and advantages of program coordination. This requirement should be discussed in the proposed meeting.

CONCLUSION

The DCRDR Program Plan submitted by IMECo for the Donald C. Cook Nuclear Power Plant, Units 1 and 2 demonstrates a commitment to meet the requirements of Supplement 1 to NUREG-0737. Additional information, however, is needed by the staff in a number of areas before a decision regarding the efficacy of the proposed DCRDR can be made. Further detailed discussion of procedures and methodologies for the Function and Task Analysis is necessary to provide

assurance that this activity will yield sufficient usable data. The Function and Task Analysis effort is particularly important because data from this activity are used as input data for many other review activities. Likewise, the identification and categorization of HEDs is an important task as the success of the control room improvement program depends on this task's output. While the licensee is committed to implementing the requirements of NUREG-0737, Supplement 1, some of the requirements were not addressed or were so briefly addressed, that it is not clear to the staff that they were understood by the licensee. The staff, therefore, recommends that a meeting be held at NRC with IMECo representatives to afford the licensee an opportunity to provide further detailed information. A suggested meeting agenda is provided which details the areas the staff believes need further clarification.

SUGGESTED AGENDA

- Qualifications and Structure of the DCRDR Review Team
    - Specific task assignments and levels of effort
    - full-time involvement of human factors specialist
- Function and Task Analysis
    - Contents of the CRHEC report
    - Scope of the F&TA
    - Methodology for conduct of the F&TA
- Assessment of HEDs
    - Criteria for categorization of HEDs
- Selection of Design Improvements
    - Methodology
    - System for tracking HEDs
- Verification That Improvements Will Provide Necessary Correction
    - Methodology
    - Criteria
- Verification That Control Room Modifications Do Not Introduce New HEDs
    - Methodology
- Coordination of the DCRDR With Other Improvement Programs
    - Plans for how this will be accomplished

REFERENCES

1. Program Plan Report for a Detailed Control Room Design Review for the Indiana & Michigan Electric Company, Donald C. Cook Nuclear Power Plant, Units 1 and 2, Revision 1, December 29, 1983.

2. "Requirements for Emergency Response Capability," NUREG-0737, Supplement 1, U.S. NRC, Washington, D.C., December 1982, transmitted to reactor licensees via Generic Letter 82-33, December 17, 1982.

3. NUREG-0700, "Guidelines for Control Room Design Reviews," September 1981, U.S. NRC.

4. NUREG-0801, "Evaluation of Detailed Control Room Design Reviews," Draft, April 17, 1983, U.S. NRC.

5. NUREG-0660, "NRC Action Plan developed as a Result of the TMI-2 Accident," May 1980; Revision 1, August 1980.

6. NUREG-1000, "Generic Implications of ATWS Events at the Salem Nuclear Power Plant," April 1983.

7. Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events," July 8, 1983.

APPENDIX C

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

SUMMARY OF MAY 8, 1984 MEETING

WITH NRC STAFF

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 22, 1984

Docket Nos. 50-315
and 50-316

LICENSEE: Indiana and Michigan Electric Company (IMECo)

FACILITY: Donald C. Cook Nuclear Plant, Unit Nos 1 and 2

SUBJECT: SUMMARY OF MEETING HELD ON MAY 8, 1984 WITH IMECO, SCIENCE APPLICATIONS INCORPORATED (SAI), WESTINGHOUSE (W), EXXON, AND THE NRC STAFF TO DISCUSS THE DETAILED CONTROL ROOM DESIGN REVIEW (DCRDR) PROGRAM PLAN

The subject meeting was held in Bethesda to resolve the outstanding NRC questions on the DCRDR program plan. This plan had been submitted by the licensee in their letter dated December 29, 1983. SAI, under contract to the NRC, has prepared the enclosed draft minutes of the meeting. These minutes have been reviewed by the NRC staff and are adoped as formal minutes as corrected. The licensee has agreed to provide the additional information requested on page 6 and 7 of enclosure 1; a schedule for submission will be developed by the licensee.

David L. Wiggînton, Project Manager
Operating Reactors Branch #1
Division of Licensing

Enclosures:
As stated:

cc w/enclosures:
See next page

Indiana and Michigan Electric Company

Donald C. Cook Nuclear Plant, Units 1 and 2

cc: Mr. M. P. Alexich
Vice President
Nuclear Engineering
American Electric Power Service
Corporation
1 Riverside Plaza
Columbus, Ohio 43215

Mr. William R. Rustem (2)
Office of the Governor
Room 1 - Capitol Building
Lansing, Michigan 48913

Mr. Wade Schuler, Supervisor
Lake Township
Baroda, Michigan 49101

W. G. Smith, Jr., Plant Manager
Donald C. Cook Nuclear Plant
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Bridgman, Michigan 49106

U.S. Nuclear Regulatory Commission
Resident Inspectors Office
7700 Red Arrow Highway
Stevensville, Michigan 49127

Gerald Charnoff, Esquire
Shaw, Pittman, Potts and Trowbridge
1800 M Street, N.W.
Washington, DC 20036

Honorable Jim Catania, Mayor
City of Bridgman, Michigan 49106

U.S. Environmental Protection Agency
Region V Office
ATTN: EIS COORDINATOR
230 South Dearborn Street
Chicago, IL 60604

Maurice S. Reizen, M.D.
Director
Department of Public Health
Post Office Box 30035
Lansing, Michigan 48109

The Honorable Tom Corcoran
United States House of Representatives
Washington, DC 20515

James G. Keppler
Regional Administrator - Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

J. Feinstein
American Electric Power Service
1 Riverside Plaza
Columbus, Ohio 43216

Draft Minutes
Meeting Between NRC and IMECo on
the DCRDR of the D.C. Cook Nuclear Power Plant,
Units 1 AND 2

Bethesda, Maryland
May 8, 1984

The following are minutes for a meeting held on May 8, 1984 between the NRC and IMECo. Also, in attendance were staff from SAI, Westinghouse and Essex. Specific attenders and the organizations which they represented are shown in Attachment 1.

The meeting was held to provide IMECo the opportunity to provide further detailed information and address comments as a result of the NRC review of the DRCDR program plan submitted by IMECo for D.C. Cook, Units 1 and 2. The results of the staff review of the IMECo Program Plan were provided to IMECo prior to the meeting. A copy of this transmittal is shown in Attachment 2. During the course of the meeting IMECo addressed NRC comments and questions and discussed issues that had surfaced relevant to their DCRDR activities. Highlights of the discussion are provided below. Copies of viewgraphs presented by IMECo during its discussion are included in Attachment 3.

Qualifications and Structure of the DCRDR Team

IMECo presented the organizational structure and personnel assigned to manage the various programs associated with their emergency response capabilities. Also described were the names and responsibilities of the lead individuals performing the DCRDR. IMECo also provided a handout addressing Key Personnel Job descriptions (see Attachment 3). This information provided some clarification of individual levels of effort for those performing the functions of the Project Review Team, the Design Review Team, and the Assessment Team. Also clarified were the responsibilities of the human factors professionals in the review and their levels of effort. Based upon the information provided most of NRC concerns regarding staffing, individual levels of effort, and responsibilities were resolved. However, one remaining issue not fully addressed during the meeting should be

clarified by the licensee. This issue concerns the specific tasks assigned to the human factors professionals (consultants from Essex) and the involvement of a human factors specialist in the Assessment Phase of the DCRDR. (This is discussed in greater detail in the section below on HED Assessment.)

System Function Review and Task Analysis

A presentation of IMECo's approach to the System Function Review and Task Analysis (SR&TA) was provided to describe the processes/methodologies used by the licensee to satisfy this requirement of NUREG-0737, Supplement 1. They indicated that the bulk of the effort will occur in the EOP development program which they intend to submit in July, 1984. They are presently gearing up for this activity. They indicated that they are aware of the results of the NRC meeting with the WOG on the task analysis and are using the WOG documents for the background of the analysis. In fact, consultants from Westinghouse will be performing this activity consistent with the WOG methodology. Documentation generated from the SR&TA will be given to the review team for the verification of task performance capabilities.

Briefly, the presentation provided a discussion of the scope and methodology that is basically derived from the top-down approach of NUREG-0700 as well as the plants own set of criteria (for event sequences). Beginning with a selection of event sequences, they will obtain input from WOG/ERGs and EOP usage for the operation path for each sequence they've identified. This step provides a high-level look at operator functions. Next they will identify systems operators must choose to recover from the event. The operator tasks will be derived from steps in the procedures. Documentation generated will include instrumentation and controls requirements tables, and system sequence matrices (for operator tasks). The documentation will provide a basis for a comparison and review of operator task requirements contained in task element tables. This documentation will also be used to conduct the verification of task performance capabilities and the assessment of design alternatives.

In addition to the SR&TA process IMECo briefly described the process to develop the new plant-specific EOPs from the WOG/ERGs. The licensee

contends that the ERGs will provide the operator information and control needs on a generic level. While reviewing this and other background documentation the EOP writers will look at operation information and control needs on a plant-specific level when noting the plant-specific deviations from the ERG instrumentation and controls. The licensee intends to list these deviations while generating the modified plant-specific procedures (from what is desired with what now exists in the control room). The list of deviations is available for scrutiny by the design review team while conducting walkthroughs of the procedures to assess whether the procedure can be performed and through a comparison with the inventory. In this manner they propose to evaluate the availability and suitability of the instrumentation and controls to meet the operators needs to perform the required tasks.

The information presented during the meeting led to discussion concerning items two and four contained in NRC summary comments from the meeting on task analysis with the WOG procedures subcommittee. Briefly, NRC staff expressed concern with IMECo's process and auditable documentation for (1) determining the operator information and control needs (that is not available from the ERG and background documentation) and (2) the process to derive the needed characteristics of the instruments and controls. The NRC provided comments to the licensee regarding the desirability of independently determining information and control needs while conducting the SR&TA in conjunction with the newly developed EOPs. Specifically they were advised to generate documentation on operator needs while documenting the instrumentation and control requirements in the SR&TA. A further consideration with the licensee's approach is one with the thoroughness and validity of evaluating operator needs while conducting walkthroughs of the procedures and reviewing plant-specific deviations from ERG documents. Concern stems from the apparent potential to uncritically accept what exists in the control room rather than scrutinizing what exists against a predetermined set of information and control needs and their characteristics.

In conclusion the NRC advised the licensee to develop and provide a thorough description of the process and intended documentation to support a Function and Task Analysis for both the DCRDR and the development of EOPs.

Control Room Inventory

IMECo provided information regarding the staffing and purpose of the inventory activity. R.F. Shoemaker is responsible for the development of the inventory and document control on a day-to-day basis. The licensee indicated the purpose of the inventory during discussions of the task analysis. The adequacy of instrument ranges, accuracy, etc., would be gained by comparing the results of the plant-specific EOP deviations against the control room inventory. While no concerns were raised with the inventory process those issues covered in the task analysis activity remain to be addressed before the purpose of the inventory can be accomplished, i.e., to ensure that the displays and controls are available and appropriate to meet the operator's information and control needs.

Control Room Survey

IMECo clarified that the control room survey would be performed by Westinghouse/Essex Design Review Team using the control room human engineering criteria report or task plans. The task plans will be based on guidelines provided in NUREG-0700 and will not be modified to plant-specific criteria as had been suggested in the program plan. The output of the task will be checklist observation forms (CLOs) which will be transferred to the assessment team to determine human engineering discrepancies (HEDs).

Assessment of HEDs

IMECo provided a presentation of the CLO-HED generation through assessment of HEDs and implementation of selected design changes. A lengthy flow chart was presented on viewgraphs and copies were provided for review (see Attachment 3). Because of the sizable amount of information shown, the NRC suggested that some time would be required to digest all that was presented. However, a few concerns were raised related to the involvement of a human factors member during the assessment and implementation phase. Specifically it was apparent that the Assessment Team did not contain a full-time human factors member; Dr. Sheridan, as a member, would be consulted only in the case of a conflict between the review team findings and the assessment team conclusions.

The process described by the licensee began with the transfer of CLOs from the review team to the assessment team who either accepts or rejects a CLO for HED status. If the CLO is rejected it will return to the design review team. The critical point raised by the NRC is that the assessment team, while containing no full-time human factors member, will not be adequate to assess the CLO's potential or probability to increase operator error nor to determine the cummulative effects of minor category 4 HEDs. This will influence the categorization or prioritization of the HED and likewise its rating/schedule for the implementation of a design solution. IMECo responded to NRC concerns by assuring involvement of the Essex team of human factors specialists in the loop of assessment of findings. Further discussion revealed that although Essex had been tasked to document the type of potential error associated with the CLO it appeared that the potential for error and the consequences of the error occurring was the assessment teams task. In conclusion, the NRC advised the licensee to provide documentation indicating the functions of each team, their level of effort, and their interface with the specific tasks allocated to each. In this documentation NRC concerns should be addressed.

Comments resulting from the NRC review of the program plan were addressed and those aspects of the process appeared to be satisfactory.

Selection of Design Improvements

IMECo's presentation included some information describing the process to identify and select corrections for HEDs that will be resolved. The NRC staff observed that the licensee's process to propose HED corrections through design study did not appear to have the level of human factors involvement that is appropriate. IMECo staff indicated that the selection of design improvements would be reviewed by a design review team member, however, the documentation/flow chart does not show that to be a human factors member. This concern should be addressed by the licensee by providing documentation showing the functions of the teams and the specific tasks allocated to the human factors members and the level of effort.

The NRC staff concerns raised from a review of IMECo's program plan were addressed during the presentation. The licensee has shown that there exist a system to orderly track an HED from the point of HED identification

through HED assessment and implementation of HED resolutions (see Attachment 3).

Verification That Improvements Will Provide the Necessary Correction and Do Not Introduce New HEDs

The licensee indicated during the presentation that design improvements would be assessed for new HEDs and for the extent of corrections. Design changes will be validated and verified using drawings, the mock-up and visits to the control room. It was indicated that a human factors specialist may be present during this stage.

Coordination of the DCRDR With Other Programs

The licensee briefly described the attempt to integrate the various efforts by indicating that members on a particular program are also involved in other programs. The licensee stated that personnel on the different programs are cognizant of the programs interface. A slide was shown to present the milestones for each program. The NRC mentioned that the licensee has yet to describe the dynamics of the interface of each program with the other. Some examples of the potential interfaces were discussed with the licensee to clarify the objectives and advantages of program coordination. It was mentioned that IMECo is early enough in the process to connect the various programs successfully. The licensee showed an understanding and the intention of achieving this requirement.

In conclusion, the in-progress meeting provided the licensee with the opportunity to more fully describe the process they intend to employ to complete the DCRDR activities. NRC staff believe that the licensee has shown a strong commitment, with a fairly complete and organized planning effort, to conduct a successful DCRDR.

However, to assure that the licensee has fully addressed some of the concerns raised during the course of the meeting it was requested that they submit in writing the following items:

- Functions of each team, personnel tasks and responsibilities and how the teams interact with one another. This is particularly

important for the Assessment and Implementation phase as discussed above.

- The process the licensee will use to address items 2 and 4 in the summary letter from the WOG/NRC meeting (March 29, 1984) on the task analysis requirement.

- Plan for achieving integration and coordination with other Emergency Response Capability efforts.

Attachment 1

D.C. COOK DCRDR MEETING
May 8, 1984

Name	Organization
D.L. Wigginton	NRR/DL/ORBI
J.J. Kramer	NRR/DAFS/HFEB
C. Kain	SAI/NRC
Ralph Surman	Westinghouse
Robert G. Orendi	Westinghouse
John D. Young	Westinghouse
Bill Johnson	Westinghouse
Ray Ramirez	NRC/DHFS/HFEB
Ray Roland	SAI/NRC
Phuoc Le	SAI/NRC
T.R. Stephens	D.C. Cook/AEP
R. Shoemaker	AEPSC
A.S. Grimes	AEPSC
K. Toth	AEPSC
T.J. Voss	Essex
G. Allen Elliff	Essex

APPENDIX D

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

. LETTER AEP:NRC:0773H

INDIANA & MICHIGAN ELECTRIC COMPANY

P.O. BOX 16631
COLUMBUS, OHIO 43216

August 6, 1984
AEP:NRC:0773H

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
MAY 8, 1984 REQUEST FOR ADDITIONAL INFORMATION
ON DETAILED CONTROL ROOM DESIGN REVIEW (DCRDR)

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

This letter is in response to your staff's request for additional information made during the the DCRDR meeting held on May 8, 1984. The minutes of the May 8, 1984 meeting are contained in Mr. D. Wigginton's May 22, 1984 letter to Indiana & Michigan Electric Company (I&MECO). Your staff requested information concerning the following:

1. Functions of each DCRDR team, personnel tasks and responsibilities and how the teams interact with one another.

This information is provided in Attachment 1 to this letter. We are adding a full-time Human Factors Professional as a member of the Assessment Team and the Project Review Team. We believe this will insure that categorization, prioritization, design, and implementation of solutions to Human Engineering Descrepancies (HED) will receive appropriate attention.

2. The process the licensee will use to address items 2 and 4 in the summary letter from the WOG/NRC meeting (March 29, 1984) on the task analysis requirement. A copy of this letter is included as Attachment 2 to this letter.

Attachment 2A of this letter outlines a methodology for determining the operator information and control needs (that is not available from the Emergency Response Guide and background documentation), and the process to derive the needed characteristics of the instrumentation and controls. To the extent possible, the operator information and control needs will be identified and documented concurrently with the identification and documentation of the operator instrumentation control requirement. We

believe this approach will evaluate what exists in the D. C. Cook control rooms against a predetermined set of information and control needs and their characteristics.

3. Plan for achieving integration and coordination with other Emergency Response Capability efforts.

The key personnel responsible for the integration and coordination of the various Emergency Response Capability efforts are identified in Attachment 3. The integration and coordination plan provided in Attachment 3 was adapted from the NUTAC on Emergency Response Capabilities. We believe the Plan adequately describes the interfaces between the separate portions of the program.

This letter has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President

MPA/dew

Attachments

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Charnoff
E. R. Swanson, NRC Resident Inspector - Bridgman

LIST OF ATTACHMENTS

to

AEP:NRC:0773H

Attachment 1 - D. C. Cook DCRDR Project Review, Assessment, and Design Review Teams Interface.

Attachment 2 - NRC April 5, 1984, Memorandum for Dennis L. Ziemann from H. Brent Clayton

Attachment 2A - D. C. Cook Control Room Instrumentation and Control Characteristics Identification and Documentation

Attachment 3 - D. C. Cook Emergency Response Capability Integration Plan

Attachment 4 - D. C. Cook DCRDR Acronymns/Abbreviations

COOK DCRDR
Project Review, Assessment and Design
Review Teams Interface

(1) The Project Review Team performs the management functions of review, approval and coordination of the DCRDR Program, program phases and reports. It reviews/approves the other teams work and documentation. It generates, initiates, reviews and approves plans and strategies to accomplish the overall program objectives.

Its primary interfaces with the Assessment and Design Review Teams are the positions common to all three teams, the Program Administrator, the Lead Engineer and the Human Factors Specialist, and the review/approval of the teams output.

The expertise of the team personnel as currently staffed to accomplish these tasks is as follows:

The Program Administrator - presently a consulting engineer to the AEPSC Mechanical Engineering Division. Past experience involves assistant division manager responsibilities and Instrumentation & Control Section Manager throughout the design, construction and startup of the D. C. Cook Plant.

The Lead Engineer, has both I&C and operator supervision experience in control rooms. He has both designed and put into service control and instrumentation systems. He has written both control and operation startup procedures.

Human Factors Specialist expertise is provided by Dr. T. A. Sheridan, a widely known industrial consultant, MIT Professor, researcher, author and editor.

The Plant Coordinator provides the D. C. Cook Nuclear Plant operations department representation. He is a Senior Performance engineer on the Operations Dept. staff with five years nuclear plant experience.

The Program Manager of Westinghouse provides the team with NSSS vendor expertise with 14 years of nuclear control board layout and design, reactor protection, safeguards and testing systems.

The Project Engineer provides the team overall expertise of project coordination and scheduling, D. C. Cook Nuclear Plant engineering design change projects planning and scheduling and construction project planning, scheduling and coordination.

(2) The Assessment Team is responsible for identifying CLOs and HEDs, categorizing the HEDs to establish the significance of their

deviation from the NUREG-0700 Guidelines, and the assessing of the probability of operator error and the consequences of operator error in order to determine the priority rating for implementation of corrective actions.
They assess corrective action design alternatives to determine that the required correction is provided and no new departures from NUREG-0700 are created. They select which design alternative will be implemented, schedule its implementation, assess the corrective action for full, partial or no fix, justify and document less than full fixes.

These considerable responsibilities which can involve significant company resources, require a team of depth, knowledge and experience. Nuclear plant systems expertise is provided by the various engineering manager's and plant management. Human factors specialist input will be provided by Dr. T. A. Sheridan and another human factors specialist or company as yet not named.

The expertise of the team personnel to accomplish its tasks is as follows:

The Program Administrator and Lead Engineer, already described under the PRT. Instrumentation, control, safety and interlock systems engineering management experience is supplied by the I & C and Electrical Generation Section Managers.

D. C. Cook Nuclear Plant management expertise is provided by the Assistant Plant Manager. Operations expertise is supplied by both the Assistant Plant Manager and the Operations Superintendent.

Independent nuclear safety analysis and expertise is provided by the NS&L Manager.

Overall program and company quality assurance expertise and company procedures and practice expertise is provided by the Manager of Quality Assurance.

One of its primary interfaces with the Project Review and Design Review Teams are the two persons common to all three teams, the Program Administrator and Lead Engineer. A primary interface with the Project Review Team is the Assessment and Implementation Reports of the Assessment Team which requires the review/approval of the PRT. Another is the PRT review/approval of the DRT member Design Study results and comments for each HED that the Assessment Team requested corrective action proposals on.

The Assessment Team interface with the DRT is the DRT primary output of CLO's and the DRT assistance in evaluating HED's in the Assessment Phase and DRT assistance with the Implementation Report during the Implement-tion Phase.

(3) The Design Review Team is essentially the "working" team. Westinghouse and ESSEX are part of the DRT and perform the bulk of all Review Phase tasks and provide the human factors specialist expertise required for

these tasks. The AEP members of the DRT are responsible for reviewing LERs, assembling the Control Room Inventory, assisting Westinghouse & ESSEX in their tasks as required, and furnishing reference materials and documentation to Westinghouse and ESSEX. The DRT will assist the AT with the evaluation of HEDs and the Assessment Report during the Assessment Phase and Implementation Report during the Implementation Phase.

The DRT Develops the Program Plan Report & the Program Summary Report.

Its primary interfaces with the Project Review Team and the Assessment Team are the two persons common to all three teams, (the Program Administrator and the Lead Engineer), its primary output of CLOs to the Assessment Team, and its output of Task Summary Reports reviewed/approved by the PRT. It interfaces with the AT in assisting with the evaluation of HED's, development of the Assessment & Implementation Reports.

The expertise of the team personnel to accomplish these design review tasks is as follows:

> Westinghouse and ESSEX provide extensive human factors specialist talent, NSSS and balance of plant vendor knowledge, I & C control board design, and training expertise.
>
> AEP provides the Program Administrator & Lead Engineer qualities defined under the PRT, mechanical and electrical instrumentation and control system engineering, D. C. Cook Nuclear Plant licensed reactor operator and operator staff and training staff personnel, nuclear safety & licensing engineering, quality assurance engineering and project engineering.

COOK DCRDR
Personnel Job Description

Title: DCRDR Program Administrator

Name: A. S. Grimes

Team: Assessment, Project Review, Design Review

Responsibilities:

* Communication between Management & DCRDR Teams
* Over all program scheduling
* Over all program coordination with related projects
* Over all program Quality Assurance procedures & practice
* Over all program reporting & documentation
* HED review process
* Obtaining Technical & Administrative support as necessary

Level of effort: As required. Estimated Manhours:

* Phase II, Task 1, 24; Task 2, 8; Task 3, 4; Task 4, 8, Task 5, 8; Task 6, 8;
* Phase III, Assessment, 160; Implementation, 80.
* Phase IV, Reporting, 60.

COOK DCRDR
Personnel Job Description

Title: DCRDR Program Lead Engineer

Name: R. F. Shoemaker

Team: Assessment, Project Review, Design Review

Responsible to DCRDR Program Administrator

Responsibilities:

* Communications between Program Administrator & Teams
* Communications between Teams & AEPSC Engineering
* Over all program Engineering Documentation Files & Reference
* Design improvements implementation coordination
* Develop control room inventory
* Advise Program Administrator on HED Disposition

Level of effort: As required. Estimated Manhours:

* Phase II, Task 1, 48; Task 2, 80; Task 3, 320; Task 4,8; Task 5, 8; Task 6, 8.
* Phase III, Assessment, 400; Implementation, 200
* Phase IV, Reporting, 80.

Estimated Manhours for I & C Personnel under Lead Engineer's Supervision:

* Phase II, Task 3, 120
* Phase III, Assessment, 2000; Implementation, 2000

COOK DCRDR
Personnel Job Description

Title: DCRDR Program Manager (Westinghouse)

Name: John D. Young

Team: Design Review, Project Review

Responsible to DCRDR Program Administrator

Responsibilities:

* Over all Review Phase Coordination & Documentation
* Program Plan Report Development & Documentation
* Program Summary Report Development & Documentation
* Control Room Human Engineering Criteria Report Development & Documentation
* Documentation & Compilation of Checklist Observation Forms

Level of Effort: As Required. Estimated Manhours by Manager and People Under his supervision:

* Phase II, Task 1, 48; Task 2, 20; Task 3, 20; Task 5, 696; Task 6, 348,
* Phase IV, Reporting, 348.

COOK DCRDR
Personnel Job Description

Title: AEPSC Human Factor Consultant

Name: Dr. T. Sheridan

Team: Assessment, Project Review

Responsible to DCRDR Program Administrator

Responsibilities:

* Over all Human Factors Support to Project Review & Assessment Teams
* HED Identification Verification
* HED Correction Verification
* Approve Design Review Team Review Phase Output
* HED Categorization Verification

Level of Effort: As Required

COOK DCRDR
Personnel Job Description

Title: DCRDR Human Factors Consultant (ESSEX)

Name: Dr. G. A. Elliff

Team: Design Review

Responsible to DCRDR Program Manager

Responsibilities

* Checklist Observation Form Documentation
* Control Room operating Personnel Survey Interviews, Questionaires, Documentation & Reports
* Control Room Human Factors Survey Measurements, Documentation, & Reports
* Over all Review Phase human factors support
* Review Phase task plans development

Level of Effort: Estimated. Estimated Manhours, by consultant or people under his supervision:

* Phase II, Task 1, Crops, 166; Task 4, Crops, 1446; Task 6, 332.

Cook DCRDR Program
Job Position Description

Title: AEPSC Manager of Quality Assurance

Name: R. F. Kroeger

Team: Assessment

Responsible to: DCRDR Program Administrator

Responsibilities:

* Evaluate observed departures from the CRHEC Report
* Identify HED's
* HED review
* Validation of HED priority
* Review & Approval of HED correction recommendations
* Overall Quality Assurance Engineering support for Assessment Team.

Level of Effort: As Required. Estimate 96 manhours through 1984. Estimate 96 manhours through 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: AEPSC Nuclear Safety & Licensing Section Manager

Name: J. G. Feinstein

Team: Assessment

Responsible to: DCRDR Program Administrator

Responsibilities:

* Evaluate observed departures from CRHEC Report
* Identify HED's
* HED review
* Validation of HED Priority
* Review & approval of HED correction recommendations
* Overall Nuclear Safety and Licensing Engineering support to Assessment Team.

Level of Effort: As required. Estimate 96 manhours through 1984. Estimate 96 manhours through 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: AEPSC I & C Section Manager

Name: J. C. Jeffrey

Team: Assessment

Responsible to: DCRDR Program Administrator

Responsibilities:

* Evaluate observed departures from CRHEC Rerport
* Identify HED's
* HED review
* Validation of HED Priority
* Review & approval of HED correction recommendations
* Overall Instrumentation and Control Engineering support for Assessment Team.

Level of Effort: As Required. Estimate 160 manhours through 1984. Estimate 320 manhours through 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: I&MECo. Senior Reactor Operator

Team: Assessment

Responsible to: DCRDR Program Administrator

Responsibilities:

* Evaluate observed departures from CRHEC Report
* Identify HED's
* HED review
* Validation of HED priority
* Review & approval of HED correction recommendations
* Overall Cook Plant Licensed Senior Reactor Operator support to Assessment Team.

Level of Effort: As Required. Estimate 144 manhours through 1984. Estimate 144 manhours through 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: D. C. Cook Management

Team: Assessment

Responsible to: DCRDR Program Administrator

Responsibilities:

* Evaluate observed departures from CRHEC Report
* Identify HED's
* HED review
* Validation of HED priority
* Review & approval of HED correction recommendations
* Overall Cook Plant Management support to Assessment Team.

Level of Effort: As Required. Estimate 144 manhours thru 1984. Estimate144 manhours thru 1985.

Cook DCRDR Program
Job Position Description

Title: AEPSC Electrical Generation Section Manager

Name: R. C. Carruth

Team: Assessment

Responsible to: DCRDR Program Adminsitrator

Responsibilities:

* Evaluate observed departures from the CRHEC Report
* Identify HED's
* HED review
* Validation of HED priority
* Review & approval of HED correction recommendations
* Overall Electrical Engineering suppirt for Assessment Team.

Level of Effort; As Required. Estimate 96 manhours thru 1984. Estimate 96 manhours through 1985.

Cook DCRDR Program
Job Position Description

Title: DCRDR Program Plant Coordinator

Name: T. R. Stephens

Team: Design Review, Project Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* AEPSC and plant liaison & communications
* CROPS & CRHFS coordination and scheduling
* Monitoring program progress
* Reporting program status
* Providing overall support to program process
* Ensuring program is performed in accordance with AEPSC-Cook Plant Quality Assurance Program
* Ensuring program objectives & tasks are coordinated with other NUREG-0660 efforts
* Coordination of all tasks involving Cook Plant Operations Department

Level of Effort: As Required. Estimate 80 manhours in 1984. Estimate 160 manhours in 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: DCRDR Program Project Engineer

Name: F. Van Pelt, Jr.

Team: Project Review, Design Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* Monitoring program progress.
* Reporting program status.
* Providing overall support to program process.
* Ensuring program is performed in accordance with AEPSC QA Program.
* Ensuring program objectives & tasks are coordinated with other NUREG-0660 efforts.
* Overall project engineering and coordination support for Project Review and Design Review Teams.

Level of Effort: As required. Estimate 40 man hours 1984 Estimate 160 man hours thru 1985.

Cook DCRDR Program
Job Position Description

Title: AEPSC Electrical Engineer

Name: L. P. DeMarco

Team: Design Review

Responsible to DCRDR Program Administrator

Responsibilities:

* Technical support to Assessment Team
* Develop HED corrections and implementation plans
* Help develop Program Plan Report and Program Summary Report
* Planning, Review, Assessment and Implementation Phase assignments as directed
* Overall Electrical Engineering support to Design Review Team

Level of Effort: As required. Estimate 40 manhours in 1984. Estimate 160 manhours in 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: I&MECo. Training Personnel

Team: Design Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* Technical support to Assessment Team, with plant training and operation procedures speciality.

Level of Effort: As Required. Estimate 100 manhours in 1984. Estimate 200 manhours in 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: AEPSC I & C Engineer

Name: R. F. Shoemaker

Team: Design Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* Technical support to Assessment Team
* Develop HED corrections and implementation plans
* Help develop Program Plant Report and Program Summary Report
* Planning, Review, Assessment and Implementation Phase assignments as directed
* Overall Instrumentation & Control Engineering support to Design Review Team

Level of Effort: As Required. Estimate 80 manhours through 1984. Estimate 320 manhours in 1985.

Cook DCRDR Program
Job Position Description

Title: Westinghouse Training Personnel

Team: Design Review

Responsible to: DCRDR Program Manager

Responsibilities:

* Over all Operating Procedures and Training Support for Westinghouse Review Phase tasks

Level of Effort: As Required

Cook DCRDR Program
Job Position Description

Title: AEPSC Quality Assurance Engineer

Name: J. B. Brittan

Team: Design Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* Technical support to Assessment Team
* Develop HED corrections and implementation plans
* Help develop Program Plan Report and Program Summary Report
* Planning, Review, Assessment and Implementation Phase assignments as directed
* Overall quality assurance engineering support for Design Review Team

Level of Effort: As Required. Estimate 40 manhours in 1984. Estimate 160 manhours in 1985.

Attachment 1 to AEP:NRC:0773H

Cook DCRDR Program
Job Position Description

Title: AEPSC Nuclear Safety & Licensing Engineer

Name: K. J. Toth

Team: Design Review

Responsible to: DCRDR Program Administrator

Responsibilities:

* Technical support to Assessment Team
* Develop HED corrections and implementation plans
* Help develop Program Plan Report and Program Summary Report
* Planning, Review, Assessment and Implemenation Phase assignments as directed
* Overall nuclear safety analysis engineering support for Design Review Team

Level of Effort: As Required. Estimate 200 manhours in 1984. Estimate 200 manhours in 1985.

Attachment 2

to

AEP:NRC:0773H

Attachment 1 to WOG-84-164

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 12 1984
R. C. SURMAN

April 5, 1984

MEMORANDUM FOR: Dennis L. Ziemann, Chief
Procedures and Systems Review Branch
Division of Human Factors Safety

FROM: H. Brent Clayton, Section Leader
Section A - Procedures
Procedures and Systems Review Branch
Division of Human Factors Safety

SUBJECT: MEETING SUMMARY - TASK ANALYSIS REQUIREMENTS OF SUPPLEMENT 1 TO NUREG-0737
MARCH 29, 1984 MEETING WITH WESTINGHOUSE OWNERS GROUP (WOG) PROCEDURES SUBCOMMITTEE AND OTHER INTERESTED PERSONS

Staff representatives met with representatives of the WOG Procedures Subcommittee and others on March 29, 1984, to discuss the task analysis requirements of Supplement 1 to NUREG-0737 (Generic Letter 82-33). The purposes of the meeting were (1) for the Subcommittee to discuss how operator information and control needs have been addressed by the Emergency Response Guideline (ERG) development effort, and (2) for the staff to identify any additional analysis or documentation needed for review.

Mr. Doug McKinney, Subcommittee Chairman, made a brief presentation on the background of the ERG development program as it relates to the issue of task analysis. His presentation included a description of the ERG background documents, development of Revision 1 to the ERG, interactions with NRC, Supplement 1 to NUREG-0737 requirements, and an overview of how the WOG had responded to the requirements. A copy of Mr. McKinney's transparencies is enclosed (Enclosure 1).

Mr. Ralph Surman of Westinghouse made a presentation which described in some detail the development of the ERG and the accompanying background documentation for both the Basic version and Revision 1. He emphasized that one of the main objectives of the ERG is to identify the operator tasks necessary to perform functions which are identified in the background documentation. A copy of Mr. Surman's transparencies is enclosed as Enclosure 2.

After a caucus, the staff made the following comments to the meeting attendees:

(1) Based on the presentations by Mr. McKinney and Mr. Surman, it appears that Revision 1 of the ERG and background documents do provide an adequate basis for generically identifying information and control needs.

(2) Each licensee and applicant, on a plant-specific basis, must describe the process for using the generic guidelines and background documentation to identify the characteristics of needed instrumentation and controls. For the information of this type that is not available from the ERG and background documentation, licensees and applicants must describe the process to be used to generate this information (e.g., from transient and accident analyses) to derive instrumentation and control characteristics. This process can be described in either the PGP or DCRDR Program Plan with appropriate cross-referencing.

(3) For potentially safety-significant plant-specific deviations from the ERG instrumentation and controls, each licensee and applicant must provide in the PGP a list of the deviations and their justification. These should be submitted in the plant-specific technical guideline portion of the PGP, along with other technical deviations.

(4) For each instrument and control used to implement the emergency operating procedures, there should be an auditable record of how the needed characteristics of the instruments and controls were determined. These needed characteristics should be derived from the information and control needs identified in the background documentation of Revision 1 of the ERG or from plant-specific information.

(5) It appears that the Basic version of the ERG and background documentation provide an adequate basis for generically deriving information and control needs. However, because of the differences in the organziation of the material in the background documents between Basic and Revision 1, it is apparent that it would be easier to extract the needed information from the Revision 1 background documents.

At the conclusion of the meeting, there was general agreement with the staff's comments among the owners' representatives present.

Enclosure 3 is a list of attendees.

H. Brent Clayton, Section Leader
Section A - Procedures
Procedures and Systems Review Branch
Division of Human Factors Safety

Enclosures:
As stated.

cc w/enclosures:
[redacted]
D. McKinney

Attachment 2A

to

AEP:NRC:0773H

D. C. COOK CONTROL ROOM INSTRUMENTATION AND CONTROL CHARACTERISTICS IDENTIFICATION AND DOCUMENTATION

The following will define the instrumentation and control characteristics that are necessary for proper operator response to emergency transients. Supporting basis documentation will also be developed.

The documentation developed as part of this program will complement the documentation being developed as part of the existing D. C. Cook Task Analysis Program in satisfying the needs of the CRDR review team and the requirements of the NRC.

Scope

The program scope includes the definition of a process and the development of documentation to identify instrumentation and control characteristics based on operator information and control needs during emergency operations. The process and documentation will be based on the same representative event sequences (Table 2A-1) and emergency operating procedures (Table 2A-2) that the present D. C. Cook Task Analysis Program is based.

Process

The process for identification of instrumentation and control characteristics will be as follows:

1. The set of operator functions for response to emergency transients will be reviewed and finalized.

2. The selected subset of D. C. Cook Emergency Operating Procedures (EOP's) will then be reviewed and procedure steps will be mapped into the operator functions in a manner similar to that shown in Figure 2A-1.

3. For each operator function, the generic background documentation (Step Description Tables) will be reviewed to identify:

   - Operator information and control needs necessary to support the operator functions.

   - Plant systems necessary to provide information and control needs.

   - Plant instrumentation and controls necessary to provide information and control needs.

4. For each operator function, instrumentation and control characteristics will be identified based on the required information and control needs.

   a. Characteristics for instrumentation will include:

      - Units
      - Range
      - Resolution/Sensitivity
      - Accuracy
      - Response Time
      - Type - Discreet values and/or continuous (trending)

   b. Characteristics for indications and controls will include:

      - Type - Discreet (on-off) and/or continuous (variable)

Documentation

The results of the evaluation process will be provided in an INSTRUMENTATION AND CONTROL CHARACTERISTICS FOR EMERGENCY RESPONSE document. This document

will consist of the following major sections:

1. Introduction
2. Description of Operator Function Evaluation Process
3. Description of Operator Function Information and Control Needs
   For each operator function, summary documentation will be provided to describe:

   a. information and control needs.
   b. plant systems required to provide information and control needs.
   c. instrumentation and controls required to provide information and control needs.
   d. characteristics of instrumentation and controls required to provide information and control needs.

4. Description of Instrumentation and Control Characteristics

   For each instrument and control, summary documentation will be provided to identify the required characteristics. The basis for the identified characteristics will be established by referencing appropriate discussion in Section 3 above, and/or the appropriate information in the generic ERG Revision 1 background documentation or appropriate D. C. Cook documentation.

The instrumentation and control characteristics will also be included on the Instrument Requirements Tables and Control Requirements Tables being developed as part of the present task analysis documentation.

Development of the INSTRUMENTATION AND CONTROL CHARACTERISTICS FOR EMERGENCY RESPONSE document may result in the redefinition of the change on the CRDR results. Although such changes are possible, a significant number of such changes are not expected.

TABLE 2A-1

EVENT SEQUENCES SELECTED FOR D. C. COOK TASK ANALYSIS PROGRAM

- Spurious Safety Injection
- Loss of reactor coolant (small break - 1 inch diameter)
- Loss of reactor coolant (small break - 4 inch diameter)*
- Loss of reactor coolant (large break)
- Loss of secondary coolant
- Combined loss of reactor and secondary coolant
- Steam generator tube rupture (design basis)
- Steam generator tube rupture (multiple ruptures in one steam generator)*
- Steam generator tube rupture (ruptures in more than one steam generator)*
- Anticipated Transient without Scram*
- Inadequate core cooling (resulting from failures in emergency core cooling system)*
- Inadequate core cooling (resulting from loss of secondary heat sink)
- Pressurized thermal shock

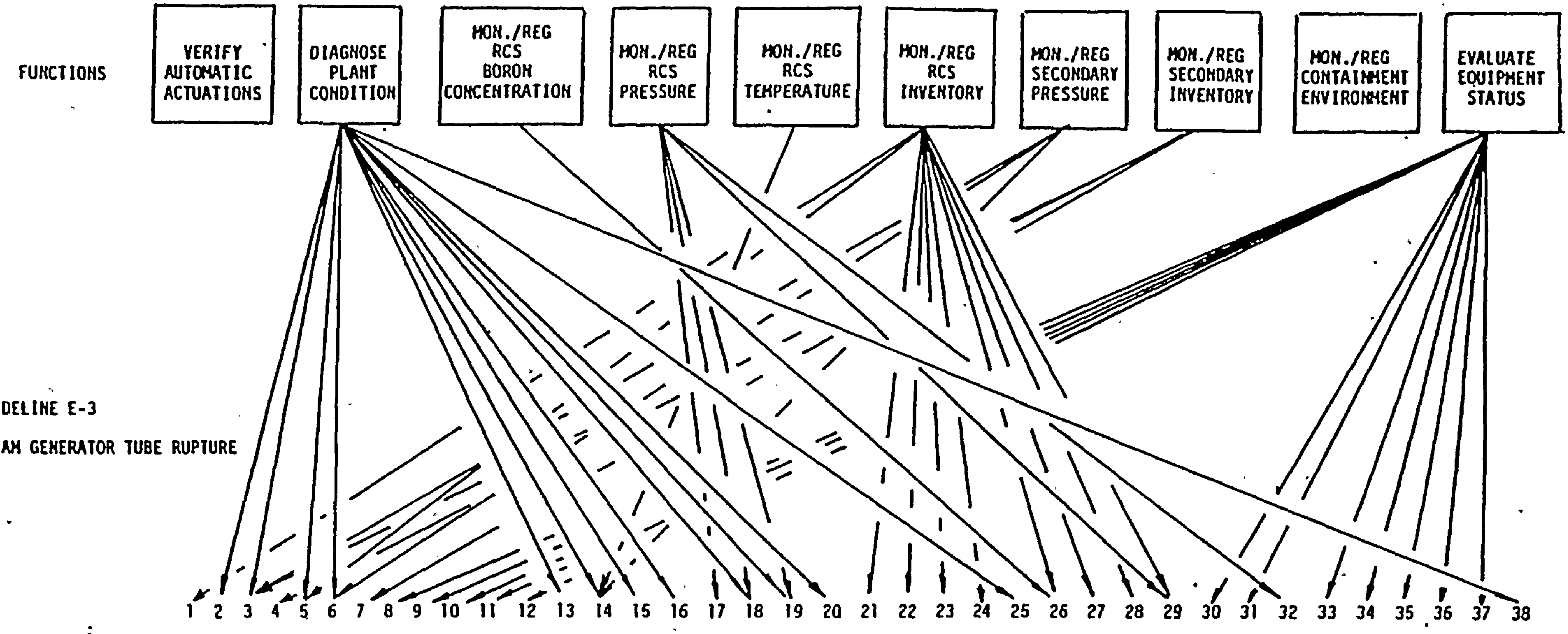
*Event sequences recommended in NUREG-0700

TABLE 2A-2

EMERGENCY OPERATING PROCEDURES SELECTED
FOR D. C. COOK TASK ANALYSIS PROGRAM

- Reactor Trip or Safety Injection
- SI Termination
- Loss of Reactor or Secondary Coolant
- Post-LOCA Cooldown and Depressurization
- Transfer to Cold Leg Recirculation
- Transfer to Hot Leg Recirculation
- Faulted Steam Generator Isolation
- Steam Generator Tube Rupture
- Post-SGTR Cooldown Using Steam Pump
- Critical Safety Function Status Trees
- Response to Nuclear Power Generation/ATWS
- Response to Inadequate Core Cooling
- Response to Loss of Secondary Heat Sink
- Response to Iminent Pressurized Thermal Shock Conditions

FIGURE 2A-1



NOTE: The blocks along the top are the various Functions a control room operator would be expected to perform during a Steam Generator Tube Rupture transient condition. The numbers at the bottom indicate the various steps in the Generic Guideline E-3 for a Steam Generator Tube Rupture. In order to perform the Functions along the top, monitor/regulate RCS Boron Concentration for example, the operator will use information various Emergency Operating Procedures, in this case from step 26 in the Generic Guideline E-3 for a Steam Generator Tube Rupture.

FIGURE 2A-1

Attachment 3

to

AEP:NRC:0773H

D. C. COOK EMERGENCY RESPONSE CAPABILITY INTEGRATION PLAN

In accordance with NUREG-0737, Supplement 1, American Electric Power Service Corporation (AEPSC) proposes to integrate the overall Emergency Response Capabilities in the following manner.

K. J. Toth, of the Nuclear Engineering Division, has been appointed as the overall project coordinator (indicated on Figure 3-1). As overall coordinator, K. J. Toth is responsible for the integration of all the NUREG-0737, Supplement 1 elements designed to enhance the control room operators ability to comprehend plant conditions and cope with emergencies. These elements, the Safety Parameter Display System (SPDS), Detailed Control Room Design Review (DCRDR), Emergency Operating Procedures (EOPs), Regulatory Guide 1.97 (RG 1.97), and the Emergency Operating Facilities (EOF) including the Technical Support Center (TSC), all have appointed Lead Engineers (also indicated in Figure 3-1). These Lead Engineers, or their designated alternates, form the Emergency Response Capabilities Council which will meet at periodic intervals and according to need. Plans and schedules have been developed for each of the elements (Figure 3-2). Functions of each element have been established and discussions held to determine how each of the elements relate to each other and how they must interface to provide Emergency Response Capability. Each Lead Engineer is responsible for the scheduling and coordination of activities within his project, and the coordination of his project as it interfaces the other emergency response capabilities projects.

Figure 3-3 shows the interfaces that will be considered between the basic elements of the emergency response capability implementation plan. Each element and its relation to previous and succeeding elements is discussed in the following plan descriptions.

CRDR ELEMENT

The AEP/I&MEC Detailed Control Room Design Review Program Plan Report provides the method for performing the entire review.

The Control Room Inventory task has been accomplished. The Operating Experience Review has been performed and has identified and documented some operational problems. The Control Room Human Factors Survey is almost complete and has also identified and documented some problems.

The Systems Function and Operator Task Analysis Review is being conducted by a Consultant. The required instruments and controls determined by this review will be compared with the Control Room Inventory in the Verification of Task Capabilities Review to determine availability and human engineering suitability. The control room information and control functions will be validated by the upgraded EOP walk-through-talk-through process using selected EOP's.

Control Room additions associated with the SPDS and incorporation of RG 1.97 recommendations will be given human factors evaluation.

The Control Room improvements will be coordinated with changes resulting from other programs such as EOP, RG 1.97, SPDS, and ERF.

EOP ELEMENT

The Cook Plant EOPs are being developed for the purpose of mitigating the consequences of a broad range of initiating events, and subsequent multiple failures or operator errors, without the need to diagnose a specific event. These procedures are function-oriented and are being written with human factors considerations to improve human reliability. These EOPs are being developed based upon a writer's guide, NSSS generic technical guidelines and a plant specific analysis.

The adequacy of these procedures are dependent upon the trained operator's needs. EOPs will be checked for completeness, understandability, technical correctness, usability, and compatability with the control room. In

order for operators to have confidence in the EOPs, all of these criteria must be met. A walk-through of the initial EOPs has been scheduled for the purpose of evaluating these criteria. The EOP walk-through will be conducted in the control room and by using a full-sized photographic mock-up of the control room. Although Figure 3-3 shows only one EOP walk-through, we intend to repeat the process as necessary.

Plant specific EOPs will be incorporated in an iterative process with Control Room HEDs, the application of RG 1.97 recommendations, SPDS design bases, and Emergency Response Facility criteria. This interactive process will be used to determine what changes can be made to the EOPs to accommodate deficiencies in other areas without impacting the effectiveness of the EOPs. Because all of the elements that impact EOPs will not be available at the same time, the interaction process between EOPs and the other impacting elements will be conducted as each element is developed.

Both the upgraded plant specific EOP's and the SFTA of selected EOPs are being performed by W and, except for refinements, are complete. The EOP group at Cook will begin the verification of those upgraded procedures and the DCRDR Design Review Team will begin the verification of operator task capability with the SFTA and CRI. Control Room operator walk-through/talk-through of plant specific upgraded EOPs for validation of the procedures will also involve DCRDR human factors specialists on selected procedures to satisfy the DCRDR validation of control room function review task.

RG 1.97 ELEMENT

A complete set of design criteria is being developed to form a basis for the plant instrument selection. Utilizing the design criteria, as well as the post-accident instrumentation requirements identified from the CRDR task analysis and EOPS's, a specific list of accident monitoring instrumentation, including qualification criteria and locations will be developed. The list will also provide feedback to the control room design review. ERF design

criteria will provide additional input to the RG 1.97 list. Once the list is finalized in design, an iterative process will be conducted to consider changes associated with EOPs, Control Room improvements, SPDS design and ERF design.

Regulatory Guide 1.97 Type A instrumentation, which is critical to the emergency response capability of the Control Room, will be identified when the upgraded EOPs are available in July, 1984. Evaluation of the Type B through E Categories 1 through 3 will begin approximately August 1, 1984. Any new instrument that is added to the Control Room to satisfy RG 1.97 requirements will undergo human engineering analysis by the DCRDR Design Review Team or will be verified for acceptable human engineering practice by reviewing the guidelines established by the DCRDR Program.

SPDS ELEMENT

The SPDS installation is well under way and was developed with cognizance of current NRC and other generic guidelines. Interfaces with other NUREG-0737, Supplement 1 elements are defined and understood, which will enhance integration.

To ensure an effective SPDS, the design specified hardware, inputs, software, and identified SPDS user(s), locations, and availability were evaluated. The SPDS at the Cook Plant is designed to serve as an operator aid in monitoring and analyzing the critical safety functions. The SPDS design considers operator usability and compatibility with plant-specific EOPs.

SPDS usability is essential to the effectiveness of the system. The human factors engineering for the SPDS, as well as guidance for other factors that influence usability, have been provided by the vendor, Westinghouse.

Iteration is an ongoing process, as long as significant HEDs exist or any changes that could impact the SPDS or any of the other NUREG-0737, Supplement 1 elements. Coordination is essential to effectively determine modifications to the SPDS (or any of the other elements) without creating additional discrepancies.

ERF ELEMENT

The D. C. Cook Emergency Response Facilities and the Emergency Response Plan have been completed/developed in cognizance of current NRC guidelines. The facilities and plan have been tested and satisfactorily demonstrated functionality. However, the ERF and the Emergency Response Plan will continue to be included in an iterative process with other elements of NUREG-0737, Supplement 1. These include Control Room improvements, plant-specific EOPs, specific RG 1.97 application and SPDS design. This iterative process will continue as an ongoing commitment. The AEP/I&MEC DCRDR Program has been conceptually promulgated as a living program, whereby all future additions or revisions to the Control Room will be subjected to a review process established by the DCRDR. All functional requirements of each of the elements of the Emergency Response Capabilities will be reviewed by as many of the DCRDR - Design Review and/or Assessment Teams as necessary to assure Human Factors engineering evaluation and assessment of any given improvement.

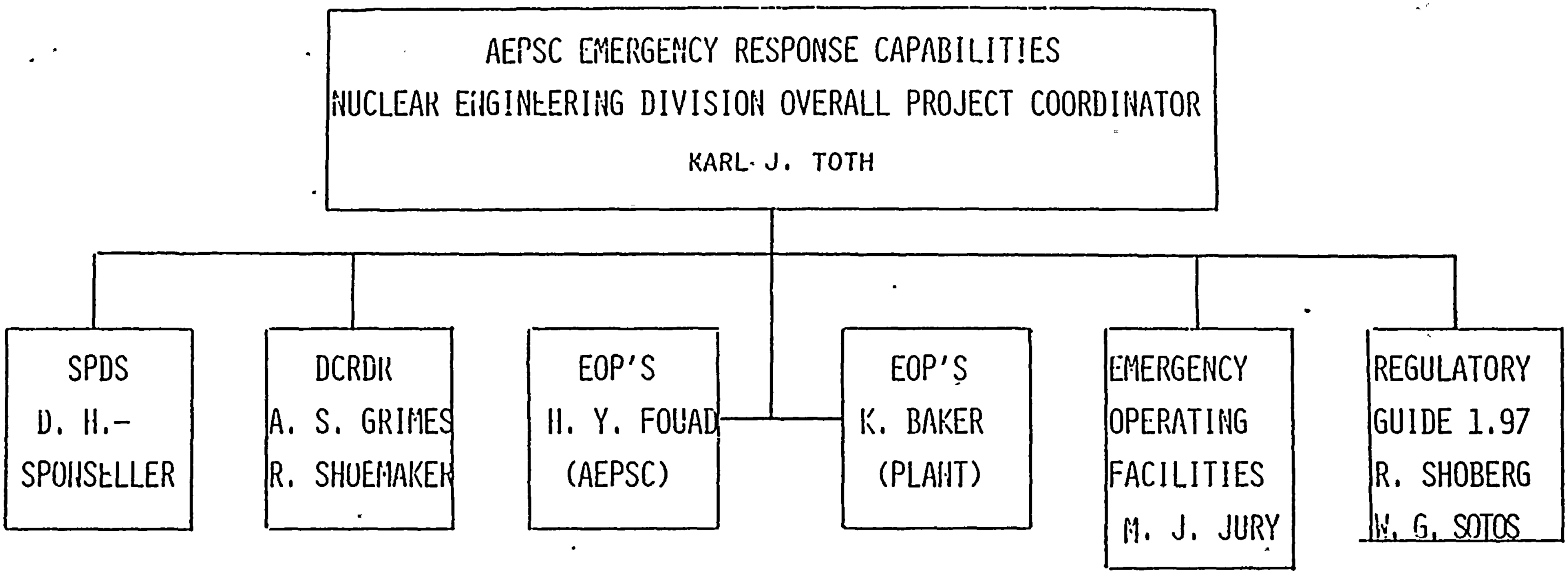

AEPSC EMERGENCY RESPONSE CAPABILITIES
NUCLEAR ENGINEERING DIVISION OVERALL PROJECT COORDINATOR
KARL J. TOTH
SPDS
D. H. SPONSELLER
DCRDR
A. S. GRIMES
R. SHOEMAKER
EOP'S
H. Y. FOUAD
(AEPSC)
EOP'S
K. BAKER
(PLANT)
EMERGENCY
OPERATING
FACILITIES
M. J. JURY
REGULATORY
GUIDE 1.97
R. SHOBERG
W. G. SOTOS

FIGURE 3-1

AEPSC – D.C. COOK EMERGENCY RESPONSE CAPABILITIES FLOW CHART

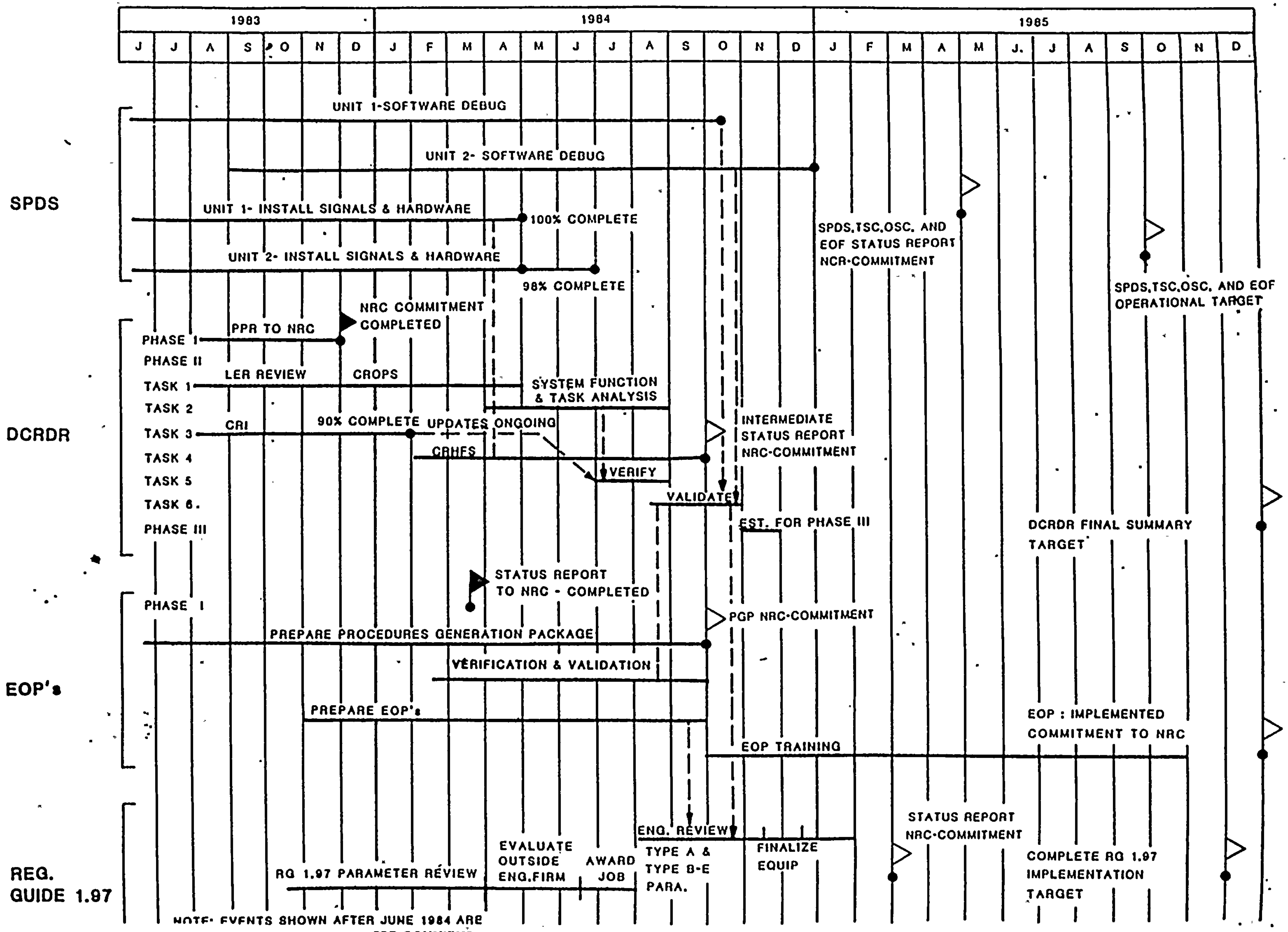
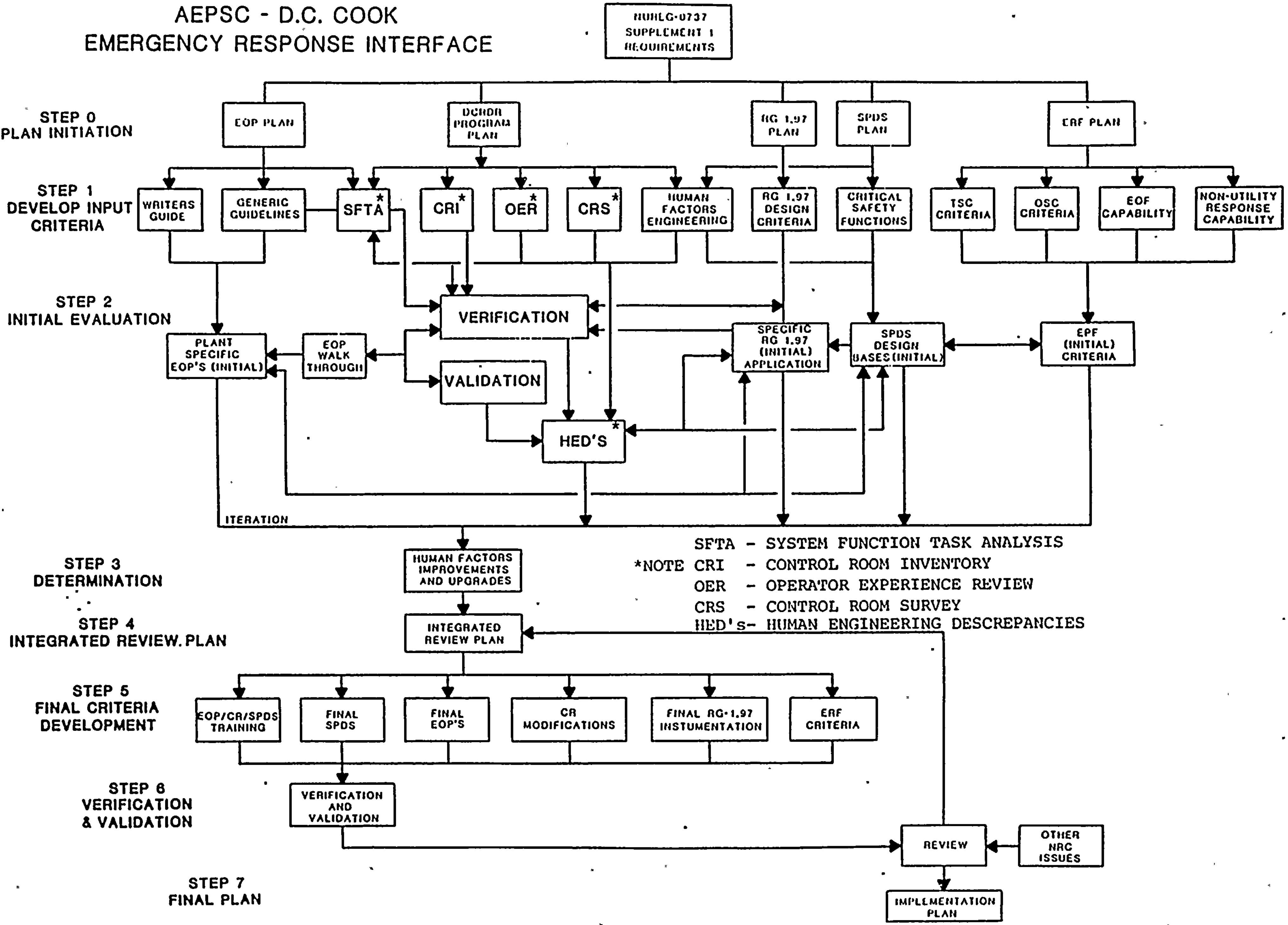


FIGURE 3

AEPSC - D.C. COOK
EMERGENCY RESPONSE INTERFACE



Attachment 4 to AEP:NRC:0773H

COOK DCRDR ACRONYMNS/ABBREVIATIONS

AEPSC	AMERICAN ELECTRIC POWER SERVICE CORPORATION
AIT	ACTION ITEM TRACKING
ASST. MGR.	ASSISTANT MANAGER
AT	ASSESSMENT TEAM
CLO	CHECKLIST OBERSERVATION
COOR.	COORDINATOR
CRHEC	CONTROL ROOM HUMAN ENGINEERING CRITERIA
CRHFS	CONTROL ROOM HUMAN FACTORS SURVEY
CRI	CONTROL ROOM INVENTORY
CROPS	CONTROL ROOM OPERATING PERSONNEL SURVEY
CRS	CONTROL ROOM SURVEY
CTF	COMMITMENT TRAVELER FORM
DCRDR	DETAILED CONTROL ROOM DESIGN REVIEW
DRT	DESIGN REVIEW TEAM
DWGS	DRAWINGS
EED	ELECTRICAL ENGINEERING DIVISION
ENG	ENGINEER
ENGG	ENGINEERING
EOP	EMERGENCY OPERATING PROCEDURES
GEN. PROC. NO.	GENERAL PROCEDURE NUMBER
HED	HUMAN ENGINEERING DIVISION
MCR	MATERIAL CONTROL RECORD
MED	MECHANICAL ENGINEERING DIVISION
MGR	MANAGER
NED	NUCLEAR ENGINEERING DIVISION
NRC	NUCLEAR REGULATORY COMMISSION
NS&L	NUCLEAR SAFETY & LICENSING
OER	OPERATIONAL EXPERIENCE REVIEW
PPR	PROGRAM PLAN REPORT
PRT	PROJECT REVIEW TEAM
QA	QUALITY ASSURANCE
RFC	REQUEST FOR CHANGE
SECT	SECTION
SECTR	SECRETARY
SFTA	SYSTEM FUNCTION AND TASK ANALYSIS
SPDS	SAFETY PARAMENTER DISPLAY SYSTEM
W	WESTINGHOUSE
WOG/ERG	WESTINGHOUSE OWNERS GROUP/EMERGENCY RESPONSE GUIDELINES

APPENDIX E

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

CONTROL ROOM OPERATING PERSONNEL SURVEY

INTERVIEW QUESTIONS

DONALD C. COOK NUCLEAR PLANT
UNITS 1 AND 2

OPERATOR INTERVIEW/QUESTIONNAIRE

D.C. COOK NUCLEAR PLANT

OPERATOR INTERVIEW/QUESTIONNAIRE

INSTRUCTIONS

1. The following are questions concerning the general layout, functional organization, and operational considerations in your control room. Most of the questions will require a YES or NO answer, with some additional information.

2. When you have comments or suggestions, use the space provided below each question. If you need additional room, use the backs of the sheets.

3. If you do not understand a question, please ask the monitor for clarification.

4. Please answer all of the questions as completely as possible.

5. If any question does not apply to your control room, please mark it as N/A.

6. Take as much time as you need to complete the questionnaire.

7. All of your answers and your biographical information will be kept in the strictest confidence and will be used to aid in the performance of the detailed control room design review.

PLEASE BEGIN

D.C. COOK NUCLEAR PLANT

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

BIOGRAPHICAL DATA:

Name: ______________________ Age: __________

Sex: __________ Height: __________ Weight: __________

Current Position/Title: ______________________

1. Do you have a current reactor operator's license? YES ______ NO ______
2. Amount of licensed experience at this plant: ______________
3. Total amount licensed experience: ______________
4. Related experience and amount (example: operator-trainee, Hodge NPP Unit 1, 1 yr.):

5. Education:

   a. Highest level attained: ______________

   b. Specialized Schools or courses (list):

6. Military experience:

WORKSPACE

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Have you experienced any problems in viewing control and display panels (including annunciator panels) from desks and consoles placed in the primary operating area? YES NO

2.(3) Are you able to perform task actions in a convenient position at any work station? YES NO

3.(6) Is the access and movement of nonessential but authorized personnel limited to prescribed areas within the control room? YES NO

4.(7) Are provisions made for easy access to procedure manuals and other reference materials while task sequences are peformed at consoles? YES NO

5.(10) Are you able to work comfortably at desks, with proper surface height and area, and adequate knee room and chair height? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(12) Are there suitable, out-of-the-way but secure places for storage of the personal belongings of control room personnel, with adequate space? YES NO

7.(13) Do you consider the control room environment generally cheerful in terms of color and lighting? YES NO

8.(16) Does the carpeting or other floor covering in the control room lessen the fatigue of standing and walking? YES NO

9.(17) Do control room personnel have unlimited access to a restroom and kitchen that are dedicated to their use? YES NO

10.(18) Do these facilities have communication links to the control room, if they are out of voice contact range? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Have you ever had any problems operating a control because it was too high? YES NO

If yes, please explain:

2.(2) Have you ever had any problems operating a control because it was too low? YES NO

If yes, please explain:

3.(3) Are there any controls that are located in such a way that it makes operating the control awkward (i.e., resting hand on panel, leaning on rail, etc.)? YES NO

If yes, please explain:

4.(4) Are there any controls that are inconveniently located? YES NO

If yes, please give examples:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

5.(5) Have you ever had any problems reading a display because it was too low? YES NO

If yes, please give examples:

6.(6) Have you ever had any problems reading a display because it was too high? YES NO

If yes, please give examples:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Is all emergency equipment that is needed by control room personnel in the control room area? YES NO

2.(5) Are all operators well practiced in donning protective equipment? YES NO

3.(8) Is there protective clothing available that is compatible with your size? YES NO

4.(9) Is there breathing equipment available that is compatible with your size? YES NO

5.(12) Do you have any problem performing your general control room duties while wearing protective equipment? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(13) Do you have any problems communicating with others while wearing protective equipment, specifically breathing equipment? YES NO

7.(18) Is all fire, radiation, and rescue equipment easily and readily accessible? YES NO

8.(25) Are provisions available to assure complete internal and external communications capabilities during emergencies? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Are there any specific areas within the control room boundary that are not comfortable because of the temperature or humidity? YES NO

2.(2) Do you ever notice any perceptible air motion or drafts? YES NO

3.(3) While in the control room, does your throat or skin often become dry? YES NO

4.(8) Are there noticeable fluctuations in control room climate conditions? YES NO

5.(10) Can the control room HVAC system be adjusted as necessary? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(3) Are there areas in the primary operating area where illumination is not sufficient for the task performed? YES NO

2.(4) Do shadows ever interfere with reading labels, instructions, and other written information? YES NO

3.(5) Does glare ever interfere with the readability of displays, labels, or indicators? YES NO

4.(6) Are colors used on panel surfaces, controls, and displays recognizable under both normal and emergency lighting conditions? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Have you noticed any difficulty with verbal communications between any two points in the control room? YES NO

2.(2) Have you noticed any particular noise distractions originating inside the control room? YES NO

3.(3) Have you noticed any particular noise districtions originating outside the control room? YES NO

4.(4) Are there any particular time periods when noise levels are either too high or too low? YES NO

5.(5) Do you feel that general background noise is too high? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Do you have an adequate supply of expendable items such as ink, pens, printer paper, etc.? If NO, please list the expendables and the amounts you feel you need. YES NO

2.(2) Do you have an adequate supply of spare parts such as fuses, bulbs, etc.? If NO, please list the spare parts and amounts you feel you need. YES NO

3.(3) Do you have all necessary and special replacement tools that are needed to install expendables and spare parts available in the control room? If NO, please list the tools you need. YES NO

4.(7) Is there ample storage space available in the control room for expendables, spare parts, and tools? YES NO

5.(8) When different types, sizes, or styles of expendables are required, are they clearly visible? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(9) When different types, sizes, or styles of spare parts are required, are they clearly marked? YES NO

7.(13) If bulbs are replaced in annunciator panels that require legend tiles to be removed, are the tiles marked to ensure that they will be replaced in the correct position? YES NO

8.(15) Are the legend pushbuttons in your control room provided with either dual filaments, dual lamps, or lamp test function? YES NO

9.(16) Can you replace bulbs in legend pushbuttons from the front of the panel? YES NO

10.(19) Are legend covers keyed or marked in some way to prevent you from interchanging the covers? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

11.(20) Do all indicator lights have either dual filaments, dual bulbs, or bulb test function? YES NO

12.(21) Can you replace indicator light bulbs easily, with the power on, and without danger to yourself or the equipment? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(3) Are there any conditions under which the conventional-powered telephone system is difficult to use because of noise or some other factor? YES NO

If yes, please explain:

2.(4) Are there any conditions under which the sound-powered telephone system is difficult to use because of noise or other factors? YES NO

If yes, please explain:

3.(5) Are there any conditions under which the walkie-talkie system is difficult to use because of noise or other factors? YES NO

If yes, please explain:

4.(6) Are there any conditions under which the fixed-base UHF system is difficult to use because of noise or other factors? YES NO

If yes, please explain:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

5.(7) Have you ever had any problems transmitting or receiving messages over the PA system? YES NO

If yes, please explain:

6.(8) Does the PA system ever interfere with reception of incoming alarms? YES NO

If yes, please explain:

7.(9) Are emergency backup communications equipment adequate for all anticipated operating modes? YES NO

If no, please explain:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Do you have a first out annunciator panel where only the tile associated with the reactor trip event illuminates and all subsequent alarms on that panel are "locked out"? YES NO

2.(5) Is the annunciator system priority coded by color, position, shape, or symbolic coding of the tiles? YES NO

3.(13) Are auditory signals priority coded by pulse, frequency change (warbling), intensity, or different frequencies for different signals? YES NO

4.(17) Do any of the alarm horns startle or irritate you? YES NO

5.(28) Are all tiles dark on annunciator panels when no alarm is indicated? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(29) Can you easily tell if a tile is normally on for an extended duration during normal operating conditions? YES NO

7.(30) Are you immediately aware if an annunciator tile is out of service? YES NO

8.(32) Do you know of any alarms that occur so frequently that you consider them a nuisance? YES NO

9.(33) Do you know of any alarms that do not give you ample time to respond to a warning condition? YES NO

10.(34) When responding to an alarm tile, can you readily locate the controls and displays required for corrective or diagnostic action? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

11.(38) If alarms are used that require information outside the control room, do they allow you ample time to respond? YES NO

12.(41) Do you have any tiles with dual messages such as HIGH-LOW? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Do you know of any controls that activate a critical function that do not have a movable cover or guard? YES NO

2.(3) Do you know of any areas on the board where toggle, lever, or pushbutton controls should be replaced with rotary controls because of accidental activation? YES NO

3.(5) Have you ever had difficulty activating a control because an adjacent control was in the way? YES NO

4.(6) Do you know of any controls that interlock unnecessarily? YES NO

5.(8) When a strict sequential activation is necessary, do you know of any controls which are not provided with some type of interlock? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(10) Can you recall any controls that you are never required to use? YES NO

7.(11) Are there any controls that are duplicated unnecessarily? YES NO

8.(13) Are there any controls that you would expect to be of a certain type or size, and they are not? YES NO

9.(24) Can you recall any knobs or handles of control switches that slip or are loose on their shafts? YES NO

10.(25) Are there any controls that move so easily that you can't tell when you've activated them? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

11.(30) Do you know of any small J-handles that should be larger because of the torque required to operate them? YES NO

12.(34) Are there any controls that are difficult to adjust to the precise level you need? YES NO

13.(35) Do you get immediate feedback that a pushbutton has been activated? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(2) Is system/equipment status inferred by any indicator light being off instead of illuminated? YES NO

2.(13) Do you know of any scale ranges which are too wide for the maximum displayed values (i.e., meter never indicates over half scale)? YES NO

3.(14) Do you know of any scales where maximum values are too large for the scale (i.e., pointer reaches maximum, then stops) and supporting wide-range instruments are not provided? YES NO

4.(15) Do all meters fail off-scale? YES NO

5.(17) Do you know of any multiscale displays (i.e., single pointer, multiple scales) that should be single scale displays? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(18) Are any of the multiscale displays confusing to read? YES NO

7.(19) Are any displays difficult to read because of poor contrast between the pointer and the background? YES NO

8.(21) Are all recorders that you are required to use located within your primary work area? YES NO

9.(22) Do you know of any recorders that are used for a purpose other than to record trend information and material for later reference? YES NO

10.(25) Can you easily read all the data through the window of the recorder without opening it? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(26) Do you know of any graphic recorders in which the ink clogs the pens or smudges the paper? YES NO

12.(29) Do you know of any strip chart or impact recorders in which the pens or the printing heads are frequently driven to their maximum, then tend to mechanically or electrically hang up? YES NO

3.(30) Where multiple channel inputs are control- or switch-selectable for display on a strip chart recorder, do you know of any case where after input selection, there is an appreciable delay before the parameter is actually displayed? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(7) Are controls, displays, and other equipment items appropriately and clearly labeled to enable rapid and accurate location, identification, and manipulation (if applicable)? YES NO

2.(8) Are labels pertinent to control actuation visible during actuation? YES NO

3.(10) Do labels describe the primary function of equipment items? YES NO

4.(11) Do the words employed in the label express exactly what action is intended, if action is necessary? YES NO

5.(12) Are instructions on labels clear and direct? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

6.(13) Do words have a commonly accepted meaning for all users? YES NO

7.(14) Are there any unusual technical terms used in labels? YES NO

8.(15) Are there any symbols (e.g., abstract symbols like %) which have uncommon meanings? YES NO

9.(18) Does the method used for "tagging-out" a control prevent actuation of the control? YES NO

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

1.(1) Have you ever experienced any problems with the computer system such as accessing a file or locating information? YES NO

If yes, please explain:

2.(2) Have you ever experienced any problems with the computer system printers? YES NO

If yes, please explain:

3.(3) Have you ever experienced problems with the computer system CRTs? YES NO

If yes, please explain:

4.(4) Have you ever experienced any problems with the computer system keyboards? YES NO

If yes, please explain:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

5.(6) Is the computer dialogue logical? YES NO

If not, please explain:

6.(7) Is the computer dialogue vocabulary and syntax common to the operators who use the system? YES NO

If not, please give examples:

7.(8) Is the data presented on the CRT screen in a readily usable format? YES NO

If not, please explain:

8.(9) Are urgent messages requiring an imemdiate response highlighted to attract the operator's attention? YES NO

If not, please give examples:

APPENDIX B2
OPERATOR INTERVIEW/QUESTIONNAIRE

9.(11) Do general messages displayed on a CRT provide the information necessary to complete a specific action or decision sequence? YES NO

If not, please explain:

10.(12) Are alarm messages readily distinguishable from other messages? YES NO

If not, please give examples:

11.(13) Does the wording of alarm messages clearly relate to the specific annunciator tile that is illuminated? YES NO

If not, please explain:

12.(16) Are graphs and tables displayed on CRTs easy to read or interpret? YES NO

If not, please give examples:

APPENDIX F

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

SUMMARY SHEETS FOR CONTROL ROOM

OPERATING PERSONNEL INTERVIEWS

Workspace

1.(8) Have you experienced any problems viewing control & display panels from desks....?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n= 2	57% n= 8	29% n= 4
RO n= 20	10% n= 2	90% n= 18	0% n= 0
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	12% n= 6	80% n= 39	8% n= 4

Major Concern(s) - CRTs on consoles block view to front and rear.

Workspace

2.(3) Are you able to perform task actions in a convenient position at any . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	30% n= 4	35% n= 5	35% n= 5
RO n= 20	80% n= 16	20% n= 4	0% n= 0
SRO/SS n= 15	67% n= 10	33% n= 5	0% n= 0
TOTAL n= 49	61% n= 30	29% n= 14	10% n= 5

Major Concern(s) - Instances in which displays are up high and controls are down low, such as:

Main Feed pumps
TD Aux Feed pumps
Condensate, Heater Panels (MSR controls)

Workspace

3.(6) Are nonessential but authorized personnel limited to prescribed areas...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n= 2	72% n= 10	14% n= 2
RO n= 20	25% n= 5	75% n= 15	0% n= 0
SRO/SS n= 15	33% n= 5	67% n= 10	0% n= 0
TOTAL n= 49	24% n= 12	72% n= 35	4% n= 2

Major Concern(s) - Too many non-essential people in the way during startups, transients, day shifts (especially C+I techs.)

Workspace.

4.(7) Are provisions made for easy access to procedure manuals & other references ... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n=10	21% n= 3	8% n= 1
RO n= 20	85% n= 17	15% n= 3	0% n= 0
SRO/SS n= 15	100% n= 15	0% n= 0	0% n= 0
TOTAL n= 49	86% n= 42	12% n= 6	2% n= 1

Major Concern(s) - none

Workspace

5.(10) Are you able to work comfortably at desks, with proper surface height . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	21% n= 3	15% n= 2
RO n= 20	90% n= 18	10% n= 2	0% n= 0
SRO/SS n= 15	100% n= 15	0% n= 0	0% n= 0
TOTAL n= 49	86% n= 42	10% n= 5	4% n= 2

Major Concern(s) - none

Workspace

6.(12) Are there suitable, out-of-the-way but secure places for storage of personal . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n=10	22% n= 3	7% n=1
RO n= 20	90% n=18	10% n= 2	0% n=0
SRO/SS n= 15	53% n= 8	47% n= 7	0% n=0
TOTAL n= 49	73% n= 36	25% n= 12	2% n= 1

Major Concern(s) - Not enough space; coats not secure.

Workspace

7.(13) Do you consider the control room environment generally cheerful... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	43% n= 6	0% n= 0
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	67% n= 33	33% n= 16	0% n= 0

Major Concern(s) – Dislike green color of board; harsh lighting.

Workspace

8.(16) Does the floor covering in the CR lessen the fatigue of standing . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	22% n= 3	71% n= 10	7% n= 1
RO n= 20	55% n= 11	45% n= 9	0% n= 0
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	33% n= 16	65% n= 32	2% n= 1

Major Concern(s) – Floor is too hard, mats don't help enough. Eleven operators specifically requested carpeting. Four requested mats (interlocking to prevent present tripping hazards).

Workspace

9. (17) Do control room personnel have unlimited access to restroom &.... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	36% n= 5	0% n= 0
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	60% n= 9	40% n= 6	0% n= 0
TOTAL n= 49	63% n= 31	37% n= 18	0% n= 0

Major Concern(s) R.O.s have to be relieved to use restroom. Women have to go downstairs.

Workspace.

10.(18) Do these facilities have communication links to the CR, if they . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	21% n= 3	79% n= 11	0% n= 0
RO n= 20	10% n= 2	90% n= 18	0% n=0
SRO/SS n= 15	0% n=0	100% n= 15	0% n=0
TOTAL n= 49	10% n=5	90% n= 44	0% n=0

Major Concern(s) - Can't hear PA.

Anthropometrics

1.(1) Have you ever had any problems operating a control . . . . Too high?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	72% n= 10	14% n= 2	14% n= 2
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	84% n= 41	12% n= 6	4% n= 2

Major Concern(s) - Heater Drn Pumps start & Stop (Panel C-Unit 2); Charcoal Filter Dampers Selector switch (AES Panel).

Anthropometrics

2.(2) Have you ever had a problem operating a control . . . too close?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	29% n= 4	14% n= 2
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	69% n= 34	27% n= 13	4% n= 2

Major Concern(s) - Aux Feed Flow Control valves and various other valves in which operator must get down on knees to operate while looking at displays located high on panels.

Note: Question 3.(3) eliminated since it does not apply to vertical panels.

Anthropometrics

4.(4) Are there any controls that are inconveniently located?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	43% n= 6	36% n= 5	21% n= 3
RO n= 20	20% n= 4	80% n=16	0% n=0
SRO/SS n= 15	40% n= 6	60% n= 9	0% n= 0
TOTAL n= 49	33% n= 16	61% n= 30	6% n= 3

Major Concern(s) - RHR Letdown Controls located on different panel from displays. Several other control-display or control-control dislocation problems.

Anthropometrics

5.(5) Have you ever had any problems reading a display . . . Too low?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	36% n= 5	0% n= 0
RO n= 20	75% n= 15	25% n= 5	0% n= 0
SRO/SS n= 15	67% n= 10	33% n= 5	0% n= 0
TOTAL n= 49	69% n= 34	31% n= 15	0% n= 0

Major Concern(s) – Indicators for Main Feed Pump, Main Turb. valve position and vacuum. Various indicators on SV, T, G, C+NIS Panels.

Anthropometrics

6.(6) Have you ever had any problems reading a display . . . too high?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n= 2	86% n= 12	0% n= 0
RO n= 20	15% n= 3	85% n= 17	0% n= 0
SRO/SS n= 15	20% n= 3	80% n= 12	0% n= 0
TOTAL n= 49	16% n= [illegible]	84% n= 41	0% n= 0

Major Concern(s) — Top Row of indicators on most panels requires use of a stool for accurate readings. Due to parallax and operators being of different heights (or not using stools) readings will often be inaccurate.

Emergency Equip

1.(1) Is all emerg equip that is needed by CR personnel in the CR ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 11 79%	n= 2 14%	n= 1 7%
RO n= 20	n= 14 70%	n= 6 30%	n= 0 0%
SRO/SS n= 15	n= 8 53%	n= 7 47%	n= 0 0%
TOTAL n= 49	n= 33 67%	n= 15 31%	n= 1 2%

Major Concerns - Equipment is not actually in Control Room which may be a problem. Someone would have bring equipment in to RO and CR doors fail closed. Some equipment in SS office.

Emergency Equip

2.(5) Are all operators well practiced donning protective equip?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n= 14	0% n=0	0% n=0
RO n= 20	100% n=20	0% n=0	0% n=0
SRO/SS n= 15	93% n=14	7% n=1	0% n=0
TOTAL n= 49	98% n= 48	2% n=1	0% n=0

Major Concerns - none

Emergency Equip

3.(8) Is there protective clothing available that is compatible with your size?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 6 43%	n= 8 57%	n= 0 0%
RO n= 20	n= 16 80%	n= 4 20%	n= 0 0%
SRO/SS n= 15	n= 12 80%	n= 2 13%	n= 1 7%
TOTAL n= 49	n= 34 69%	n= 14 29%	n= 1 2%

Major Concern(s) - Fire equipment sizes are limited; boots - sizes too large (too small in one instance); shoe covers and gloves need more sizes.

Emergency Equip

4.(9) Is there breathing equip available that is compatible with your size?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n=14	0% n= 0	0% n= 0
RO n= 20	100% n=20	0% n= 0	0% n= 0
SRO/SS n= 15	100% n=15	0% n= 0	0% n= 0
TOTAL n= 49	100% n=49	0% n= 0	0% n= 0

No concerns

Emergency Equip

5. (12) Do you have any problems performing your general CR duties while wearing . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n=0	7% n=1	93% n=13
RO n= 20	5% n=1	0% n=0	95% n=19
SRO/SS n= 15	20% n=3	7% n=1	73% n=11
TOTAL n= 49	8% n=4	4% n=2	88% n=43

Majority of operators responded that they have never tried performing general control room duties while wearing protective equipment.

Emergency Equip

6.(13) Do you have any problems communicating with others.... specifically breathing equip?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	7% n= 1	86% n= 12	7% n= 1
RO n= 20	15% n= 3	75% n= 15	10% n= 2
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	12% n= 6	82% n= 40	6% n= 3

Major Concerns - No mouthpieces, can't communicate verbally.

Emergency Equip

7. (1P) Is all fire, radiation, and rescue equip. easily & readily accessible?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n=12	14% n= 2	0% n= 0
RO n= 20	85% n=17	15% n= 3	0% n= 0
SRO/SS n= 15	80% n=12	20% n= 3	0% n= 0
TOTAL n= 49	84% n=41	16% n=8	0% n=0

Major Concern(s) - Have to get radiation equipment from RP.

Emergency Equip

8.(25) are provisions available to assure complete communications during emergencies?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n= 11	14% n= 2	7% n= 1
RO n= 20	85% n=17	15% n= 3	0% n= 0
SRO/SS n= 15	80% n=12	20% n= 3	0% n= 0
TOTAL n= 49	82% n=40	16% n= 8	2% n= 1

Major Concern(s) - PA often unusable and radios don't work in many areas.

HVAC

1.(1) Are there any specific areas within the CR that are not comfortable ... temp or humidity?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n= 14	0% n= 0	0% n= 0
RO n= 20	90% n= 18	10% n= 2	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	92% n= 45	8% n= 4	0% n= 0

Major Concern(s) - none

HVAC

2.(a) Do you ever notice any perceptible air motion or drafts?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	93% n=13	7% n=1	0% n=0
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	93% n=14	7% n= 1	0% n= 0
TOTAL n= 49	96% n=47	4% n= 2	0% n= 0

Major Concern(s) - none

HVAC

3.(3) While in the CR, does your throat or skin often become dry?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n= 11	21% n= 3	0% n= 0
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	88% n= 43	12% n= 6	0% n= 0

Major concern(s) - none

HVAC

4.(8) are there noticeable fluctuations in control room climate conditions?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n=14	0% n= 0	0% n=0
RO n= 20	90% n= 18	10% n=2	0% n=0
SRO/SS n= 15	87% n= 13	13% n=2	0% n= 0
TOTAL n= 49	92% n=45	8% n=4	0% n= 0

Major concerns: none

HVAC

5.(10) Can the control room HVAC Systems be adjusted as necessary?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	93% n= 13	0% n= 0	7% n=1
RO n= 20	90% n= 18	10% n= 2	0% n= 0
SRO/SS n= 15	60% n= 9	40% n= 6	0% n=0
TOTAL n= 49	82% n=40	16% n= 8	2% n= 1

Major Concern(s) - none

Illumination

1.(3) Are there areas in the primary operating area where illumination is not sufficient...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 10 71%	n= 3 21%	n= 1 7%
RO n= 20	n= 19 95%	n= 1 5%	n= 0 0%
SRO/SS n= 15	n= 13 87%	n= 2 13%	n= 0 0%
TOTAL n= 49	n= 42 86%	n= 6 12%	n= 1 2%

Major Concern(s) - Bulb replacement, ceiling fixtures dirty, lighting behind panels too dim (don't replace burnt out bulbs)

Illumination

2.(4) Do shadows ever interfere with reading labels, instructions . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	72% n= 10	14% n= 2	14% n= 2
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	88% n= 43	8% n= 4	4% n= 2

Major Concerns: none

Illumination

3.(5) Does glare ever interfere with readability of displays, lables or indicators?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	21% n=3	72% n=10	7% n= 1
RO n= 20	10% n=2	90% n= 18	0% n= 0
SRO/SS n= 15	0% n= 0	100% n= 15	0% n= 0
TOTAL n= 49	10% n= 5	88% n= 43	2% n= 1

Major Concern(s)-Meters with curved faces-high on panels, especially: Feedwater, SG press/level, Front Panels (upper row) NIS Instrumentation, Upper row on Vertical Panels.

Illumination

4.(6) Are colors used on panel surfaces, controls & displays visible ... emergency lighting?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	14% n= 2	29% n= 4
RO n= 20	75% n= 17	0% n= 0	15% n= 3
SRO/SS n= 15	70% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	76% n= 37	10% n= 5	14% n= 7

Major Concerns - Poor light placement - many dark areas

Ambient Noise

1.(1) Have you noticed any difficulty with verbal communications between any two points in CR

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n=9	36% n=5	0% n=0
RO n= 20	85% n=17	15% n=3	0% n=0
SRO/SS n= 15	80% n=12	20% n=3	0% n=0
TOTAL n= 49	78% n=38	22% n=11	0% n=0

Major Concern(s) - Front to back in control room, have to shout sometimes (if crowded).

Ambient Noise

2.(2) Have you ever noticed any particular noise distractions orginating inside the CR?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	50% n= 7	50% n= 7	0% n= 0
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	60% n= 9	40% n= 6	0% n= 0
TOTAL n= 49	59% n= 29	41% n= 20	0% n= 0

Major Concerns) - PA system (stuffed with cotton), RMS Printer & Alarm (taped to muffle sound), One telephone has an annoying ~~two~~-tone buzz.

Ambient Noise

3.(3) Have you noticed any particular noise distractions originating outside the CR?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	14% n= 2	0% n= 0
RO n= 20	85% n= 17	15% n= 3	0% n= 0
SRO/SS n= 15	93% n= 14	7% n= 1	0% n= 0
TOTAL n= 49	88% n= 43	12% n= 6	0% n= 0

Major Concern(s) - none

Ambient Noise

4.(4) Are there any particular time periods when noise levels are too high or low?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	43% n= 6	57% n= 8	0% n= 0
RO n= 20	60% n= 12	40% n= 8	0% n= 0
SRO/SS n= 15	20% n= 3	80% n= 12	0% n=0
TOTAL n= 49	43% n=21	57% n=28	0% n= 0

Major Concern(s): Due to too many people in CR, especially during shift change, day shift (C+I techs), around meal and break times.

Ambient Noise

5.(5') Do you feel that general background noise is too high?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n=14	0% n= 0	0% n= 0
RO n= 20	95% n=19	5% n=1	0% n= 0
SRO/SS n= 15	93% n=14	7% n=1	0% n= 0
TOTAL n= 49	96% n=47	4% n= 2	0% n= 0

Major Concern(s) - none

Maintainability

1.(1) Do you have an adequate supply of expendable items such as ink, pens...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	14% n= 2	0% n=0
RO n= 20	100% n=20	0% n= 0	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	92% n=45	8% n= 4	0% n= 0

Major Concerns: none

Maintainability

2.(2) Do you have an adequate supply of spare parts such as fuses, bulbs...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	29% n= 4	0% n= 0
RO n= 20	80% n= 16	20% n= 4	0% n= 0
SRO/SS n= 15	73% n= 11	27% n= 4	0% n= 0
TOTAL n= 49	76% n= 37	24% n= 12	0% n= 0

Major Concern(s) - Storeroom closed on backshifts, need more resistors, fuses, + bulbs.

Maintainability

3.(3) Do you have all necessary and special replacement tools . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	21% n= 3	8% n= 1
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	67% n= 10	20% n= 3	13% n= 2
TOTAL n= 49	80% n= 39	14% n= 7	6% n= 3

Major Concern(s) - Need bulb and resistor pullers.

Maintainability

4.(7) Is there ample storage space available in CR for expendables... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n= 14	0% n= 0	0% n= 0
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	94% n= 46	6% n= 3	0% n= 0

Major Concern(s) - none

Maintainability

5.(8) When different types, sizes or styles of expendables are required . . . clearly visible?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 9 64%	n= 5 36%	n= 0 0%
RO n= 20	n= 18 90%	n= 2 10%	n= 0 0%
SRO/SS n= 15	n= 10 67%	n= 5 33%	n= 0 0%
TOTAL n= 49	n= 37 76%	n= 12 24%	n= 0 0%

Major Concern(s) - Bulbs, fuses, ink cartridges could be better organized and located consistently in one drawer.

Maintainability

6.(9) When different types, sizes or styles of spare parts are required, ... clearly marked?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n=14	0% n= 0	0% n= 0
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	73% n=11	20% n=3	7% n= 1
TOTAL n= 49	90% n=44	8% n= 4	2% n= 1

Major Concern(s) - none

Maintainability

7. (13) If bulbs are replaced in annun. panels that require Tiles To be removed. . Tiles marked?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	7% n= 1	79% n= 11	14% n= 2
RO n= 20	0% n= 0	100% n= 20	0% n= 0
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	6% n= 3	90% n= 44	4% n= 2

Major Concerns(s) - Administrative control necessary so that only one tile at a time removed.

Maintainability

8.(15) Are the legend pushbuttons in your CR provided with either dual fil, dual lamps or . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	100% n=14	0% n= 0	0% n=0
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	93% n= 14	0% n= 0	7% n= 1
TOTAL n= 49	96% n= 47	2% n= 1	2% n= 1

Major Concern(s) - All have test, but bulbs not changed until both burnt out.

Maintainability

9. (16) Can you replace bulbs in legend pushbutton from the front of the panel?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	0% n= 0	14% n= 2
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	100% n= 15	0% n= 0	0% n= 0
TOTAL n= 49	96% n= 47	0% n= 0	4% n= 2

No concerns

Maintainability

11. (20) Do all indicator lights have either dual filament, dual bulbs, or bulb-test function?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	7% n= 1	93% n= 13	0% n= 0
RO n= 20	0% n= 0	100% n= 20	0% n= 0
SRO/SS n= 15	7% n= 1	86% n= 13	7% n= 1
TOTAL n= 49	4% n= 2	94% n= 46	2% n= 1

Major Concern(s) - Simple indicator lights for pumps and valves do not comply with guideline. Should determine which need to comply with guideline and whether reliability would be effected by installing bulb test.

Note: Question 10(19) deleted [redundant to 7(13)].

Maintainability

12. (21) Can you replace indicator light bulbs easily, with the power on. . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	14% n= 2	0% n= 0
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	73% n= 14	7% n= 1	0% n= 0
TOTAL n= 49	94% n= 46	6% n= 3	0% n= 0

Major concern(s) — none (But resistors are a problem).

Communications

1.(3) Are there any conditions under which the conventional-powered Telephone.. diff to use?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n=11 79%	n=2 14%	n=1 7%
RO n= 20	n=8 40%	n=12 60%	n=0 0%
SRO/SS n= 15	n=6 40%	n=9 60%	n=0 0%
TOTAL n= 49	n=25 51%	n=23 47%	n=1 2%

Major concern(s) - Noisey areas in plant - Hear Here boxes help.

Communications

2. (4) Are there any conditions under which the head sets with mikes are diff to use. . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	22% n= 3	7% n= 1
RO n= 20	50% n= 10	50% n= 10	0% n= 0
SRO/SS n= 15	40% n= 6	60% n= 9	0% n= 0
TOTAL n= 49	53% n= 26	45% n= 22	2% n= 1

Major concern(s) - Broken sets, not enough jacks, only one channel.

Communications

3.(5) are there any conditions under which The walkie-Talkie system is diff to use...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 3 21%	n= 11 79%	n= 0 0%
RO n= 20	n= 1 5%	n= 19 95%	n= 0 0%
SRO/SS n= 15	n= 1 7%	n= 14 93%	n= 0 0%
TOTAL n= 49	n= 5 10%	n= 44 90%	n= 0 0%

Major Concern(s) - Don't work in some areas, better repair program needed.

Communications

4.(6) Are there any conditions under which the field-based UHF system is diff To use...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 11 79%	n= 0 0%	n= 3 21%
RO n= 20	n= 16 80%	n= 3 15%	n= 1 5%
SRO/SS n= 15	n= 12 80%	n= 2 13%	n= 1 7%
TOTAL n= 49	n= 39 80%	n= 5 10%	n= 5 10%

Major concern(s)-none

Communications

5.(7) Have you ever had any problems Transmitting or receiving ... PA systems?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n= 0	100% n= 14	0% n= 0
RO n= 20	5% n= 1	95% n= 19	0% n= 0
SRO/SS n= 15	0% n= 0	100% n= 15	0% n= 0
TOTAL n= 49	2% n= 1	98% n= 48	0% n= 0

Major concern(s) - Crossover, malfunctions, poor maintenance, can't hear in high noise areas, humming + buzzing, some speakers too loud + some dont work at all, some stations have one or more line not working.

Communications

6.(8) Does the PA system ever interfere with reception of incoming alarms?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	93% n= 13	7% n= 1	0% n= 0
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	94% n= 46	6% n= 3	0% n= 0

Not a problem because PA station in CR is stuffed with paper or cotton.

Communications

7. (9) Is emergency backup communications equipment adequate for all . . . modes ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 6 43%	n= 7 50%	n= 1 7%
RO n= 20	n= 14 70%	n= 5 25%	n= 1 5%
SRO/SS n= 15	n= 12 80%	n= 3 20%	n= 0 0%
TOTAL n= 49	n= 32 65%	n= 15 31%	n= 2 4%

Major Concern(s) - walkie-talkies and PA system are inadequate.

Annunciator System

6(1) Do you have a first out panel ...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n=0	79% n= 11	21% n= 3
RO n= 20	0% n= 0	100% n= 20	0% n= 0
SRO/SS n= 15	0% n= 0	100% n= 15	0% n= 0
TOTAL n= 49	0% n=0	94% n= 46	6% n= 3

No first-out panel, but P250 prints out alarm sequence and also have sequence monitor (which is turned off sometimes because its noisey).

Annun System

2.(5) Is the annunciator system priority coded by color, position, ...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n= 2	64% n= 9	22% n= 3
RO n= 20	45% n= 9	55% n= 11	0% n= 0
SRO/SS n= 15	26% n= 4	74% n= 11	0% n= 0
TOTAL n= 49	31% n= 15	63% n= 31	6% n= 3

Major Concern(s) - Only annunciator color coding is on DG panel which has some red tiles.

Annun System

3.(13) Are auditory signals priority coded by pulse, frequency....?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n=9	21% n= 3	15% n= 2
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	53% n= 8	47% n= 7	0% n= 0
TOTAL n= 49	61% n=30	35% n= 17	4% n= 2

Major Concern(s) - Not priority coded, rather coded by location in CR.

Annun System

4.(17) Do any of the alarm horns startle or irritate you?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n=11	21% n=3	0% n=0
RO n= 20	50% n=10	50% n=10	0% n=0
SRO/SS n= 15	40% n=6	60% n=9	0% n=0
TOTAL n= 49	55% n=27	45% n=22	0% n=0

Major Concern(s) - Nuisance alarms, Fire Detector Panel alarms (turned off most of time), RMS (too high pitched), Computer Alarm, Plant Battery Under Voltage: TSC Air Cond. Temp; Almost all alarms are too loud (have paper towels stuffed in them).

Annun System

5.(28) are all tiles on annun panels dark when no alarm is indicated?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	43% n=6	57% n= 8	0% n=0
RO n= 20	60% n=12	40% n= 8	0% n= 0
SRO/SS n= 15	47% n=7	53% n= 8	0% n= 0
TOTAL n= 49	51% n=25	49% n= 24	0% n= 0

Major Concern(s) - Nuisance alarms marked with "Rs" (these are, however, being worked on).

Annun. Systems

6.(29) Can you easily tell if a tile is normally on for an extended duration... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n= 5	50% n= 7	14% n= 2
RO n= 20	20% n= 4	80% n= 16	0% n= 0
SRO/SS n= 15	20% n= 3	80% n= 12	0% n= 0
TOTAL n= 49	24% n= 12	71% n= 35	5% n= 2

Major Concern(s) - only know which ones by experience, have to walk down panels each shift and look at log to know which ones.

Annun System

7.(30) are you immediately aware if an annun tile is out of service?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	21% n= 3	79% n= 11	0% n= 0
RO n= 20	20% n= 4	80% n= 16	0% n= 0
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	18% n= 9	82% n= 40	0% n= 0

Major Concern(s) - Only find out by testing at shift change or when alarm comes in. Only replace dual burnt-out bulbs.

Annunciator System

8.(32) Do you know of any alarms that occur so freq. ... nuisance?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n= 0	100% n= 14	0% n= 0
RO n= 20	0% n= 0	100% n= 20	0% n= 0
SRO/SS n= 15	7% n= 1	93% n= 14	0% n= 0
TOTAL n= 49	2% n= 1	98% n= 48	0% n= 0

Major Concern(s) - Many nuisance alarms such as ESW + NESW Flow Mismatch, many marked with "Ps". Peg and log nuisance alarms.

Annun System

9.(33) Do you know of any alarms that do not give you ample time...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n=12	7% n= 1	7% n= 1
RO n= 20	75% n= 15	20% n= 4	5% n= 1
SRO/SS n= 15	73% n= 11	27% n= 4	0% n=0
TOTAL n= 49	78% n=38	18% n= 9	4% n= 2

Major Concern(s) - Lo PZR pressure, Hi Tave Alarm, Drains on MSRs, Air Header Alarms, + Seismic Monitor ("Alarm stops before we can reach it.")

Annun System

13. (34) When responding to an alarm tile, can you readily locate the controls & displays...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	58% n= 8	21% n= 3	21% n= 3
RO n= 20	80% n= 16	20% n= 4	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	73% n= 36	20% n= 10	7% n= 3

Major concern(s) - WDS alarms (have to go to WDS panel), Some alarms on different panels than controls, e.g. Steam Gen. Blowdown on RCP, RHR alarms on RHR Panel while RHR Heat Exchange Controls on SIS Panel.

Annun System

11. (38) If alarms are used that require information outside the CR, . . . ample time . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	29% n= 4	7% n= 1
RO n= 20	70% n= 14	30% n= 6	0% n= 0
SRO/SS n= 15	67% n= 10	26% n= 4	7% n= 1
TOTAL n= 49	67% n= 33	29% n= 14	4% n= 2

Major Concern(s) - CAS alarm; WDS Evaporator alarms; containment; Fire Detection Strings.

Annun System

12. (41) Do you have any Tiles with dual messages such as HIGH-LOW?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n= 0	100% n= 14	0% n= 0
RO n= 20	10% n= 2	90% n= 18	0% n= 0
SRO/SS n= 15	13% n= 2	87% n= 13	0% n= 0
TOTAL n= 49	8% n= 4	92% n= 45	0% n= 0

Major Concern(s) - There are many. Some may be a problem, needs investigation.

Controls

1.(1) Do you know of any controls that activate a critical function . . . needs cover. . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	29% n= 4	14% n= 2
RO n= 20	30% n= 6	70% n= 14	0% n= 0
SRO/SS n= 15	40% n= 6	60% n= 9	0% n= 0
TOTAL n= 49	41% n= 20	55% n= 27	4% n= 2

Major Concern(s) - SI, Reactor Trip, RCP control switches (low on panel - could be hit by broom), Turb trip controls, PZR SI Reset + Actuate, Gen. Output Breakers.

Controls

2.(3) Do you know of any areas on the board where toggle, . . . controls should be replaced . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n= 11	21% n= 3	0% n= 0
RO n= 20	75% n= 15	25% n= 5	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	80% n= 39	20% n= 10	0% n= 0

Major Concern(s) - Beach Evacuation Alarm, Nuclear Emergency Alarm, Vacuum Breaker on OTU Panel.

Controls

3. (5) Have you ever had difficulty activating a control because an adjacent ... in the way?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	0% n= 0	14% n= 2
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	100% n= 15	0% n= 0	0% n= 0
TOTAL n= 49	96% n= 47	0% n= 0	4% n= 2

No concerns

Controls

4.(6) Do you know of any controls that interlock unnecessarily?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	0% n= 0	29% n= 4
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	100% n= 15	0% n= 0	0% n= 0
TOTAL n= 49	90% n= 44	2% n= 1	8% n= 4

Major Concern(s) - none

Controls

5. (8) When a strict sequential activation is necessary, any controls. . . . some type of interlock?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	0% n= 0	36% n= 5
RO n= 20	95% n= 19	5% n= 1	0% n= 0
SRO/SS n= 15	80% n= 12	13% n= 2	7% n= 1
TOTAL n= 49	82% n= 40	6% n= 3	12% n= 6

Major Concern(s) - Purge supply + exhaust, Charging Pump Recirc + Suction, RHR Pumps + suction flow path.

Controls

6. (10) Can you recall any controls that you are never required to use?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n=8	14% n=2	29% n=4
RO n= 20	45% n=9	50% n=10	5% n=1
SRO/SS n= 15	53% n=8	40% n=6	7% n=1
TOTAL n= 49	51% n=25	37% n=18	12% n=6

Major concern(s) - RV water level indicators, Part length rod controls and other controls including Feedwater PH recorder.

Controls

7. (11) Are there any controls that are duplicated unnecessarily?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n= 11	0% n= 0	21% n= 3
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	93% n= 14	7% n= 1	0% n= 0
TOTAL n= 49	92% n= 45	2% n= 1	6% n= 3

Major concern(s) - none

Controls

·8. (13) Are there any controls that you would expect to be of a certain type... they are not?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	7% n= 1	29% n= 4
RO n= 20	85% n= 17	15% n= 3	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	78% n= 38	14% n= 7	8% n= 4

Major Concern(s) - Some two position return to center switches would be better as separate pushbuttons (esp. Block/Reset ones).

Controls

9. (24) Can you recall any knobs or handles of control switches that slip .... on their shafts?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	0% n= 0	29% n= 4
RO n= 20	90% n= 18	10% n= 2	0% n= 0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n= 0
TOTAL n= 49	82% n= 40	10% n= 5	8% n= 4

Major Concern(s) - none

Controls

10. (25) Are there any controls that move so easily that you can't tell ... activated them?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n=9	7% n= 1	29% n=4
RO n= 20	85% n= 17	15% n= 3	0% n= 0
SRO/SS n= 15	73% n= 11	27% n= 4	0% n= 0
TOTAL n= 49	76% n=37	16% n= 8	8% n= 4

Major Concern(s) - Turb. adj. pot, lube oil temp on main turbine, SG + PRZ SI Block switches.

Controls

11. (30) Do you know of any controls that should be larger because of the torque required...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	14% n= 2	22% n= 3
RO n= 20	75% n= 15	25% n= 5	0% n= 0
SRO/SS n= 15	73% n= 11	27% n= 4	0% n= 0
TOTAL n= 49	71% n=35	22% n= 11	7% n= 3

Major Concern(s) - Some J-handles in pull-to-lock and knurled knobs on electrical panel (lubrication may help).

Controls

12. (34) Are there any controls that are difficult to adjust to precise level you need?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 2 14%	n= 9 64%	n= 3 22%
RO n= 20	n= 5 25%	n= 15 75%	n= 0 0%
SRO/SS n= 15	n= 7 47%	n= 8 53%	n= 0 0%
TOTAL n= 49	n= 14 29%	n= 32 65%	n= 3 6%

Major concern(s): AUX FEEDWATER REG VALVES (majority mentioned these). Others include: NIS pots, Condensate Makeup & Letdown, RHR flow control valves, CCW Heat Exchanger Valves, & Hotwell Level Control.

Controls

13. (35) Do you get immediate feedback that a pushbutton has been activated?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	7% n= 1	29% n= 4
RO n= 20	65% n= 13	35% n= 7	0% n= 0
SRO/SS n= 15	53% n= 8	40% n= 6	7% n= 1
TOTAL n= 49	61% n=30	29% n= 14	10% n= 5

No, but have associated indicator lights or annunciators.

Display

1.(2) Is system/equip status inferred by an indicator light being off instead of on?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	72% n=10	14% n= 2	14% n= 2
RO n= 20	50% n= 10	50% n= 10	0% n= 0
SRO/SS n= 15	47% n= 7	40% n= 6	13% n=2
TOTAL n= 49	55% n=27	37% n=18	8% n= 4

Major Concern(s) - RHR Channel Pressurization; AES fan charcoal filters; FIX Panel + Reactor Protect. Panel - some status lights go on and some off.

Display

2.(13) Do you know of any scale ranges that are too wide for maximum displayed values?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	7% n= 1	36% n= 5
RO n= 20	35% n= 7	65% n= 13	0% n= 0
SRO/SS n= 15	73% n= 11	27% n= 4	0% n= 0
TOTAL n= 49	53% n= 26	37% n= 18	10% n= 5

Major Concern(s) - Steam Packing Exhaust Pressure Guage; BIT Flow; SI Flow to loops; Steam + Feed Flows, Aux Feed during startup.

Displays

3.(14) Do you know of any displays where maximum are too large... not provided?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	50% n= 7	14% n= 2	36% n=5
RO n= 20	60% n= 12	40% n= 8	0% n= 0
SRO/SS n= 15	60% n= 9	40% n= 6	0% n= 0
TOTAL n= 49	57% n=28	33% n= 16	10% n= 5

Major Concern(s) - Containment Spray Eductor Flow, SG Steam Flow + Feed Flow, Aux Feed Flow, Letdown Makeup Flow trend recorders, CCW Reactor Support Cooling Flow, + CCW to + from Excess Letdown Heat Exchangers, Main Steam Flow, RHR total flow. RCS Pressure on Hot Shutdown Panel.

Display

4. (15) Do all meters fail off-scale?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n=5	21% n=3	43% n=6
RO n= 20	30% n=6	45% n=9	25% n=5
SRO/SS n= 15	48% n=7	26% n=4	26% n=4
TOTAL n= 49	37% n=18	33% n=16	30% n=15

Major Concern(s) - Need verification that all meters designed to fail off scale.

Displays

5. (17) Do you know of any multiscale displays that should be single scale...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	42% n= 6	29% n= 4	29% n= 4
RO n= 20	80% n= 16	20% n= 4	0% n= 0
SRO/SS n= 15	67% n= 10	33% n= 5	0% n= 0
TOTAL n= 49	65% n= 32	27% n= 13	8% n= 4

Major Concern(s) - SRV 400/402, Lube Oil Bearing Temp. Recorders, Vent Flow Recorders, Holdup Tk Hdr. Press, Aux Bldg Sump, Air Flow Recorders.

Displays

6. (18) Are any of the multiscale displays confusing to read?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n= 2	64% n= 9	22% n= 3
RO n= 20	40% n= 8	60% n= 12	0% n= 0
SRO/SS n= 15	40% n= 6	60% n= 9	0% n= 0
TOTAL n= 49	33% n= 16	61% n= 30	6% n= 3

Major Concern(s) - Ice Condenser, Generator Auxillaries; about twenty scales in all (especially those with handwritten paper scales).

Displays

7. (19) Are any displays difficult to read because of contrast bet pointer & background?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	29% n= 4	7% n= 1
RO n= 20	30% n= 6	70% n= 14	0% n= 0
SRO/SS n= 15	40% n= 6	60% n= 9	0% n= 0
TOTAL n= 49	43% n= 21	55% n= 27	2% n= 1

Major Concern(s) - Indicators with red or purple scales and black pointers.

Displays

8.(21) Are all recorders that you are required to use located within your primary...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n= 11	14% n= 2	7% n= 1
RO n= 20	60% n= 12	40% n= 8	0% n= 0
SRO/SS n= 15	20% n= 3	80% n= 12	0% n= 0
TOTAL n= 49	53% n= 26	45% n= 22	2% n= 1

Major Concern(s) - Containment Sump Recorder (mentioned by sixteen operators), Weather Recorder, SG Wide Range on back panels.

Display

9.(22) Do you know of any recorders that are used for a purpose other than trend info...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	36% n= 5	7% n= 1
RO n= 20	25% n= 5	75% n= 15	0% n= 0
SRO/SS n= 15	47% n= 7	53% n= 8	0% n= 0
TOTAL n= 49	41% n= 20	57% n= 28	2% n= 1

Major Concerns - none

Traplaup

10. (25) Can you easily read all the data through the window of the recorder . . . ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n= 5	64% n= 9	0% n= 0
RO n= 20	55% n= 11	45% n= 9	0% n= 0
SRO/SS n= 15	20% n= 3	80% n= 12	0% n= 0
TOTAL n= 49	39% n= 19	61% n= 30	0% n= 0

Major Concern(s) - Several, especially Westronics, NR-45.

Displays

11. (26) Do you know of any graphic recorders in which ink clogs the pens...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 0	93% n= 13	7% n= 1
RO n= 20	10% n= 2	90% n= 18	0% n= 0
SRO/SS n= 15	7% n= 1	93% n= 14	0% n= 0
TOTAL n= 49	6% n= 3	92% n= 45	2% n= 1

Major Concern(s) - Recorders need better clean up and maintenance to prevent this.

Display

12. (29) Do you know of any recorders which pens or heads are freq driven to max, then hang up?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n= 5	28% n= 4	36% n= 5
RO n= 20	20% n= 4	80% n= 16	0% n= 0
SRO/SS n= 15	33% n= 5	67% n= 10	0% n= 0
TOTAL n= 49	27% n= 14	61% n= 30	10% n= 5

Major Concern(s) - CST, RWST, Hotwell Makeup & Flow Control, Seal Flows to RCPs, Letdown & Makeup Flow, Air Ejector Flow, Containment Humidity, SG Chemistry, Turbine Vib. Recorder.

Display

13. (30) When multiple channel inputs are switch selectable, is there an appreciable delay...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n= 5	28% n= 4	36% n= 5
RO n= 20	70% n= 14	25% n= 5	5% n= 1
SRO/SS n= 15	60% n= 9	40% n= 6	0% n= 0
TOTAL n= 49	57% n= 28	31% n= 15	12% n= 6

Major Concern(s) - P250 controlled recorders, & RMS recorders.

Labels & Location Aids

1. (7) Are controls, displays & other equip items appropriately & clearly labeled...?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	57% n= 8	36% n= 5	7% n= 1
RO n= 20	40% n= 8	60% n= 12	0% n= 0
SRO/SS n= 15	47% n= 7	53% n= 8	0% n= 0
TOTAL n= 49	47% n= 23	51% n= 25	2% n= 1

Major Concern(s) - Much dymotape, some unlabelled components.

Labels & Location Aid

2.(8) are labels pertinent to control activation visible during actuation?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	0% n= 0	29% n=4
RO n= 20	75% n= 15	25% n= 5	0% n=0
SRO/SS n= 15	80% n= 12	20% n= 3	0% n=0
TOTAL n= 49	76% n= 37	16% n=8	8% n= 4

Major Concern(s)- Containment Vent. Isol. Reset, Boration Control, Steam Flow + Feed Flow switches.

Labels & Location Aids

7.(10) Do labels describe the primary function of equipment items?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n=10	21% n=3	8% n=1
RO n= 20	75% n=15	25% n=5	0% n=0
SRO/SS n= 15	53% n=8	47% n=7	0% n=0
TOTAL n= 49	67%. n=33	31% n=15	2% n=1

Major Concern(s) - Some labels contain only valve numbers, some need to be clearer. Some incorrect such as RHR Heater Exchanger Bypass Valves which are really RHR Discharge Cross Tie's.

Labels & Location Aids

4(11) Do the words employed in the label express exactly what action is intended ... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	29% n= 4	0% n= 0
RO n= 20	70% n= 14	30% n= 6	0% n= 0
SRO/SS n= 15	53% n= 8	47% n= 7	0% n= 0
TOTAL n= 49	65% n= 32	35% n= 17	0% n= 0

Major Concern(s) - Neutral can have different meanings, not all positions on multi-function switches labelled.

Labels & Location Aids

5. (12) Are instructions on labels clear and direct?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	50% n= 7	43% n=6	7% n=1
RO n= 20	80% n=16	20% n=4	0% n=0
SRO/SS n= 15	73% n=11	26% n=4	0% n=0
TOTAL n= 49	69% n=34	29% n=14	2% n=1

Major Concern(s) - Use information tags and dymotape as solutions" Challenges to the PZR PORVs shall be logged in the CR log."

Labels & Location Aids

6. (13) Do words have a commonly accepted meaning for all users?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	64% n= 9	36% n=5	0% n=0
RO n= 20	75% n= 15	25% n= 5	0% n= 0
SRO/SS n= 15	73% n= 11	27% n=4	0% n= 0
TOTAL n= 49	71% n=35	29% n= 14	0% n= 0

Major Concern(s) - Lack of Standardization in terminology and abbreviations (overcome with experience).

Labels & Location Aids

7.(14) Are there any unusual Technical Terms used in labels?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n=10	21% n=3	8% n=1
RO n= 20	100% n=20	0% n=0	0% n=0
SRO/SS n= 15	93% n=14	7% n=1	0% n=0
TOTAL n= 49	90% n=44	8% n=4	2% n=1

Major Concern(s): none

Label & Location Aids

8. (15) Are there any symbols . . . which have uncommon meanings?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	86% n= 12	0% n= 0	14% n= 2
RO n= 20	100% n= 20	0% n= 0	0% n= 0
SRO/SS n= 15	87% n= 13	13% n= 2	0% n= 0
TOTAL n= 49	92% n= 45	4% n= 2	4% n= 2

Major Concern(s) - none

Labels & Location Aids

9. (18) Does the method used for "Tagging out" a control prevent actuation of the control?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n=11	14% n= 2	7% n=1
RO n= 20	85% n=17	15% n= 3	0% n= 0
SRO/SS n= 15	87% n=13	13% n=2	0% n=0
TOTAL n= 49	84% n=41	14% n= 7	2% n= 1

No problem if done correctly.

Computer System

1.(1) Have you ever experienced any problems in accessing a file or locating info?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	14% n=2	43% n=6	43% n=6
RO n= 20	25% n=5	75% n=15	0% n=0
SRO/SS n= 15	26% n=4	74% n=11	0% n=0
TOTAL n= 49	22% n=11	65% n=32	13% n=6

Major Concern(s) - Poor response time, need simplified index and instruction books, need more training.

Computer System

2.(2) Have you experienced any problems with the computer system printers?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	50% n= 7	21% n= 3	29% n= 4
RO n= 20	70% n= 14	25% n= 5	5% n= 1
SRO/SS n= 15	47% n= 7	53% n= 8	0% n= 0
TOTAL n= 49	57% n= 28	33% n= 16	10% n= 5

Major Concern(s) - paper jams

Computer Systems

3.(3) Have you ever experienced problems with the computer system CRTs? RMS

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	0% n= 0	50% n= 7	50% n= 7
RO n= 20	15% n= 3	55% n= 11	30% n= 6
SRO/SS n= 15	13% n= 2	73% n= 11	14% n= 2
TOTAL n= 49	10% n= 5	59% n=29	31% n= 15

Major Concern(s) - RMS: not enough training or information available to operators, if using Unit 2 - can't use Unit 1, fails too often, slow response time, error messages hard to understand.

Computer Systems

4.(4) Have you ever experienced any problems with the comp sys keyboards?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	36% n= 5	28% n= 4	36% n= 5
RO n= 20	70% n=14	30% n= 6	0% n= 0
SRO/SS n= 15	73% n=11	20% n= 3	7% n= 1
TOTAL n= 49	61% n=30	27% n= 13	12% n=6

Major concern(s) - Too slow, have to repeat input, function lights don't stay lit, non-standard functions + symbols.

Computer System

5.(6) Is the computer dialogue logical?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	79% n=11	0% n= 0	21% n=3
RO n= 20	60% n=12	35% n= 7	5% n= 1
SRO/SS n= 15	93% n=14	0% n=0	7% n=1
TOTAL n= 49	76% n=37	14% n= 7	10% n= 5

Major concern(s) - none

Computer Systems

6.(7) Is the computer dialogue vocabulary & syntax common to the operators who use... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	72% n=10	14% n=2	14% n=2
RO n= 20	60% n=12	35% n=7	5% n=1
SRO/SS n= 15	80% n=12	20% n=3	0% n=0
TOTAL n= 49	69% n=34	24% n=12	7% n=3

Major Concern(s): Somewhat difficult to learn.

Computer Systems

8.(9) are urgent messages requiring an immediate response highlighted to attract... ?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	58% n= 8	21% n= 3	21% n= 3
RO n= 20	75% n= 15	20% n= 4	5% n= 1
SRO/SS n= 15	86% n= 13	7% n= 1	7% n= 1
TOTAL n= 49	73% n= 36	16% n= 8	11% n= 5

Major Concern(s) - Alarm not used because it's annoying.

Note: 7.(8) deleted because there are no CRTs associated with the P250.

Computer Systems

10.(12) Are alarm messages readily distinguishable from other messages?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	71% n= 10	7% n= 1	22% n= 3
RO n= 20	90% n= 18	5% n= 1	5% n= 1
SRO/SS n= 15	87% n= 13	0% n= 0	13% n= 2
TOTAL n= 49	84% n= 41	4% n= 2	12% n= 6

Major concern(s) - none

Note: 9(11) deleted because there are no CRTs associated with the P250.

Computer Systems

11. (13) Does the wording of alarm messages clearly relate to the annun tile ... illuminated?

EXPERIENCE LEVEL	F	U	NR
AEO n= 14	n= 2 14%	n= 3 21%	n= 9 65%
RO n= 20	n= 11 55%	n=6 30%	n= 3 15%
SRO/SS n= 15	n= 11 74%	n= 2 13%	n= 2 13%
TOTAL n= 49	n= 24 49%	n= 11 22%	n= 14 29%

Major concern(s) - Difficult to know which annunciator since wording differs.

Note: 12. (16) Deleted because there are no CRTs associated with the P250.

APPENDIX G

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

LETTER AEP:NRC:0773I AND NRC RESPONSE

INDIANA & MICHIGAN ELECTRIC COMPANY
P.O. BOX 16631
COLUMBUS, OHIO 43216

September 28, 1984
AEP:NRC:0773I

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
JUNE 12, 1984 CONFIRMATORY ORDER - STATUS REPORT ON
DETAILED CONTROL ROOM DESIGN REVIEW (DCRDR) AND UPGRADED
EMERGENCY OPERATING PROCEDURES (EOPs)

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Dear Mr. Denton:

This letter is submitted in compliance with your June 12, 1984 Licensing Order to the Donald C. Cook Nuclear Plant Unit Nos. 1 and 2. The order specifically obligated the American Electric Power Service Corporation to submit to the NRC by September 30, 1984 the following:

1. A Detailed Control Room Design Review (DCRDR) status report which will include the current project status and a completion date for the DCRDR Summary Report which will include a proposed schedule for implementation, and

2. The Upgrade Emergency Operating Procedures (EOPs) - Procedures Generation Package.

DETAILED CONTROL ROOM DESIGN REVIEW

The attached table shows the status of the DCRDR as of September 1, 1984. As the table indicates (Attachment 1), Phase I (Planning) of the DCRDR is essentially complete. This statement is predicated on the anticipated acceptance by your staff of the information provided in our August 6, 1984 submittal. Phase II tasks (Identification and Review) are progressing satisfactorily with several complete. See Attachment 1 for status of the various subtasks. Estimated start and completion dates are shown for those subtasks that are not yet completed. Please note that our previous estimated completion dates for the EOPs in the DCRDR validation task (6) have slipped from November 1984 to December 28, 1984 due to events and/or circumstances as noted below. The EOP delay will in turn affect the Phase III assessment task. Although we have started a preliminary assessment of the existing information, an estimated completion date cannot be accurately predicted.

In our February 10, 1984 AEP:NRC:0773E letter we established a target date of December 1985 for the DCRDR Summary Report and implementation schedule. Because of the previously referred to series of events and/or circumstances, we now estimate that a December 1986 date is more realistic for the DCRDR Summary Report and implementation schedule.

Due to these unanticipated events and to keep your staff apprised of our progress, we will provide you with an additional progress report during March 1985 and semi-annually thereafter until submission of the DCRDR Summary Report.

The series of events and/or circumstances which will cause this delay are as follows:

1. The D. C. Cook Control Room Instrumentation & Control Characteristics Identification & Justification Documentation Program outlined in Attachment 2A of our August 6, 1984 AEP:NRC:0773H letter is in the process of being contracted to a consultant. However, the additional work required by the April 5, 1984 NRC letter/memorandum (Attachment 2 of our August 6, 1984 letter) will cause delays in the DCRDR validation task as well as the Phase III assessment task. The Instrumentation & Control Characteristics Identification & Justification Documentation Program, which is now part of the DCRDR Summary Report in accordance with that April 5, 1984 letter, will delay our submittal of the DCRDR Report. The extent of the delay has not been fully evaluated as of this date.

2. The Appendix R commitments which require plant procedure changes, and which must be integrated with the DCRDR Program, were inadequately estimated previously. While the integration of the procedures is not anticipated to cause great difficulty, the Appendix R changes, including the procedures, is not scheduled for implementation until late 1985.

3. Recently, several D. C. Cook control room operators failed their annual requalification examinations. As a result, a more intensified training program has been established for these operators which reduces the staff of control room operators available to perform EOP verification and validation tasks. This additional training commitment was not anticipated and will also result in delaying the completion of our DCRDR planned schedule.

UPGRADED EMERGENCY OPERATING PROCEDURES

Attachment 2 of this letter contains the entire EOP's Procedures Generation Package (PGP). In summary, the PGP contains the Writers Guide, and the Plant Specific Technical Guidelines, that were used in developing the D. C. cook EOPs. The PGP also contains the D. C. Cook EOP's Verification/Validation and Training Program descriptions which we believe will enable us to successfully validate, train, and implement our Upgraded Emergency Operating Procedures.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President

th

Attachment

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Charnoff
E. R. Swanson, NRC Resident Inspector - Bridgman

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 3 1 1985

Docket Nos.: 50-315
and 50-316

Mr. John Dolan, Vice President
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

Dear Mr. Dolan:

Subject: Supplement 1 to NUREG-0737, Request for Modification of Commission Order Dated July 12, 1985

Re: Donald C. Cook Nuclear Plant, Unit Nos. 1 and 2

The July 12, 1985, Order, established December 1985 completion dates for the Safety Parameter Display Systems (SPDS), the Emergency Operating Procedures (EOPs), and the Emergency Response Facilities. The December 1985 date corresponded to the planned 1985 Unit 2 outage for fuel reload. The Order also established December 1986 as a completion date for the Detailed Control Room Design Review. By letter dated November 27, 1985, the Indiana and Michigan Electric Company requested a modification of the dates corresponding to the 1985 refueling outage and provided new completion dates for the SPDS, EOPs, and the Emergency Response Facilities.

In July and August 1985, the Unit 2 experienced three unplanned outages due to steam generator tube leaks. As a result of the steam generator repair outages, the refueling outage has been delayed until no later than February 28, 1986. The original completion date, December 1985, corresponded to 1 month after the original planned refueling outage. Therefore, the new proposed completion date based on the February 1986 refueling date is March 1986. The one completion date of December 1986 for the Detailed Control Room Design Review remains unchanged.

In your earlier submittals, you based the completion schedules for the SPDS, EOPs, and Emergency Response Facilities on the implementation of the EOPs in Unit Nos. 1 and 2 at the same time. The SPDS is included in the new EOPs and both are to be located in the Emergency Response Facilities. For Unit 1, the implementation of the EOPs and SPDS in March 1986 is appropriate; however, since the SPDS in Unit 2 will not be required before startup following the refueling outage, we agree that the SPDS completion date for Unit 2 (and operability) may correspond to the startup following the refueling. The Emergency Response Facilities which are shared by both units are to be complete in March 1986 with the exception that the Unit 2 SPDS be installed and operational as planned but at the startup following the Unit 2 refueling outage. A revised chart of the acceptable dates is enclosed.

Based on your submittals, which were addressed above, we find that you have shown good cause for the requested extensions; that the extensions are in response to staff concerns or were otherwise unavoidable; that the extensions appear reasonable; and that you have made a good faith effort to comply with the schedule contained in the Commission's Order of July 12, 1985. Therefore, in accordance with the terms of Section V of the July 12, 1985, Commission Order, we conclude that there is adequate justification for modification of the Commission's Order and, hereby, grant the requested extensions.

Sincerely,

Thomas M. Novak, Acting Director
Division of PWR Licensing-A, NRR

Enclosure: Licensee's Additional Comments on Supplement 1 to NUREG-0737

cc: See next page

DONALD C. COOK NUCLEAR PLANT

LICENSEE'S ADDITIONAL COMMITMENTS ON SUPPLEMENT 1 TO NUREG-0737

TITLE	REQUIREMENTS	LICENSEE'S COMPLETION SCHEDULE (OR STATUS)
1. Safety Parameter Display System (SPDS)	1b. SPDS fully operational and operators trained	March 1986*
2. Detailed Control Room Design Review (DCRDR)	2b. Submit a summary report to the NRC including a proposed schedule for implementation.	December 1986
4. Upgrade Emergency Operating Procedures (EOPs)	4b. Implement the upgraded EOPs	March 1986
5. Emergency Response Facilities Fully Functional	5a. Technical Support Center 5b. Operations Staging Area 5c. Emergency Response Facility	Complete* Complete Complete*

* SPDS to be installed and operational March 1986 for Unit 1 and at the startup following the 1986 refueling outage for Unit 2.

APPENDIX H

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

HUMAN ENGINEERING DISCREPANCY ASSESSMENT METHODOLOGY AND CRITERIA

HUMAN ENGINEERING DISCREPANCY ASSESSMENT

METHODOLOGY AND CRITERIA

This section gives a detailed discussion of the methodology and criteria of the assessment process as discussed in the May 8, 1984 meeting with the NRC staff.

Figure 1

This simplified flow chart shows the CLO (Checklist Observation) in the Review Phase advancing to a HED (Human Engineering Discrepancy) in the Assessment Phase and on to a full or partial correction in the Implementation Phase of the DCRDR (Detailed Control Room Design Review). Westinghouse and ESSEX are contracted by AEP to perform the bulk of the DCRDR Review Phase work, including the CROPS (Control Room Operating Personnel Survey) interviews and questionnaires, the CRHFS (Control Room Human Factors Survey), the SRTA (System Function Review & Task Analysis) of selected Upgraded EOPs (Emergency Operating Procedures) to be used in the Verification of Task Performance Capabilities Review, and the Validation of Control Room Functions. The primary output of the Westinghouse - ESSEX Review Phase work are the CLOs which document the observed departures from the NUREG-0700 guidelines.

These CLOs of the Review Phase from Westinghouse & ESSEX efforts are transferred to the Assessment Team in the Assessment Phase of the DCRDR Program. Those CLOs determined to be HED's by the AT then leave the DCRDR Program and go to AEPSC Engineering Design Study Process to identify HED corrections.

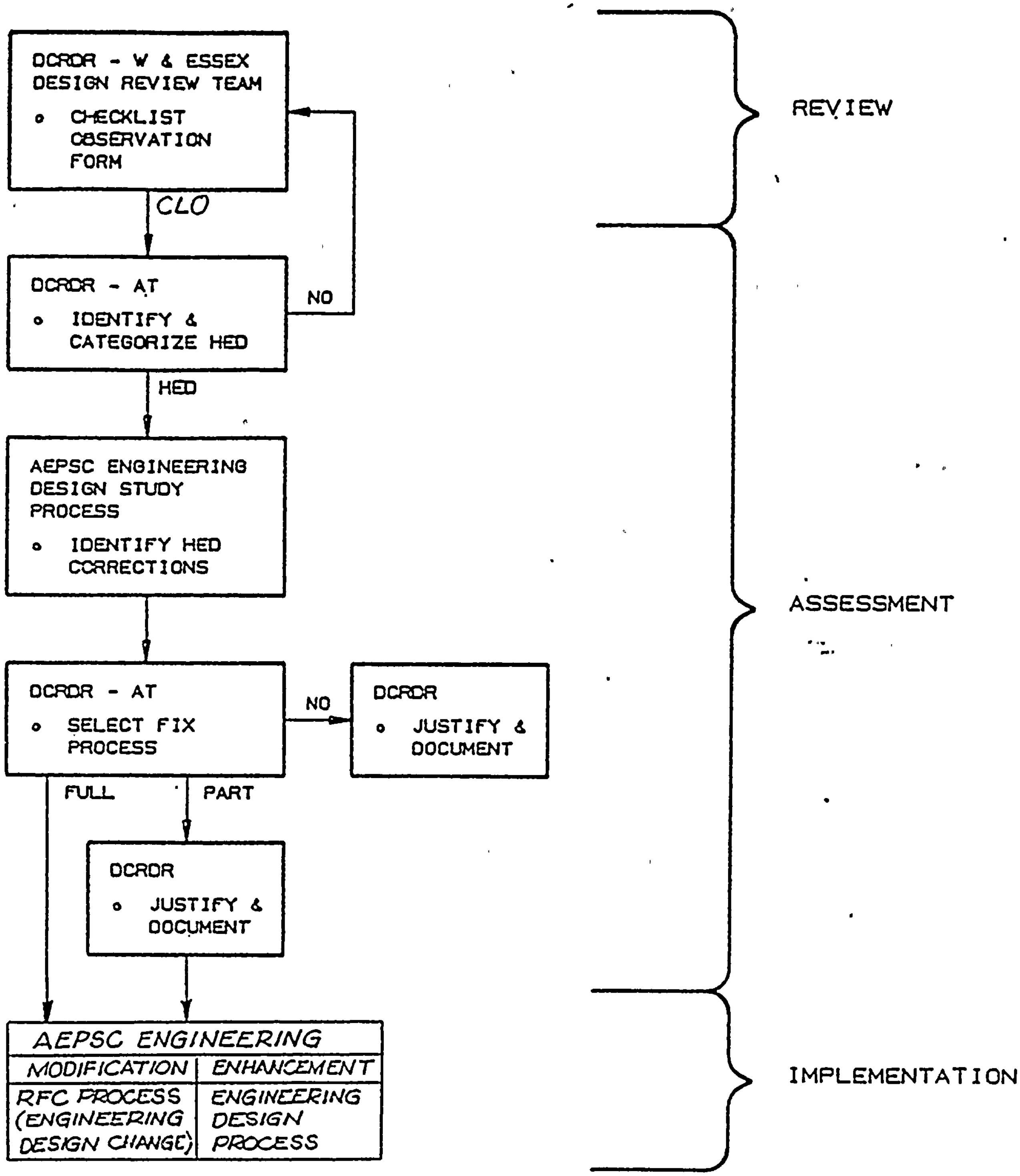
The product of the Design Study Process leave AEPSC Engg. and returns to the DCRDR - AT for the Fix Selection Process.

Where the AT chooses full or partial fixes for implementation, the HED again leaves the DCRDR - AT and enters AEPSC Engineering during the Implementation Phase.

In summary, the Simplified Flow Chart demonstrates that the CLO to HED conversion crosses corporation boundaries of Westinghouse and ESSEX to AEP, and within AEP will cross several boundaries, leaving and entering the DCRDR Program more than once. Later figures will show this process in more detail.

COOK DCRDR SIMPLIFIED FLOW CHART

CLO-HED THROUGH ASSESSMENT & IMPLEMENTATION



1/050784.

FIGURE 1

Figure 2

This figure is the first of several which explain the CLO/Review Phase to HED/Assessment & Implementation Phase methodology and criteria in more detail.

The Design Review Team (specifically, Westinghouse and ESSEX within the DRT) generates the Checklist Observation Forms for the Assessment Team. The AT identifies the CLO as a HED or sends it back to the DRT for a one time reassessment or explanation. The probability of a CLO not being accepted as a HED is low, since the only criteria is for the AT to determine that the CLO has the potential to increase operator error. If so, the CLO becomes a HED.

Figure 3

The first step in the HED categorization process is to determine if it possesses a Safety Consequence. The criteria for determining a Safety Consequence are shown on Figure 3.

A "yes" answer to any one of the five criteria shown on Figure 3 constitutes a safety consequence.

The HED is then evaluated for High Probability of Operational Error/Significant Deviation whose criteria is again shown on Figure 3.

COOK DCRDR HED EVALUATION FLOW CHART

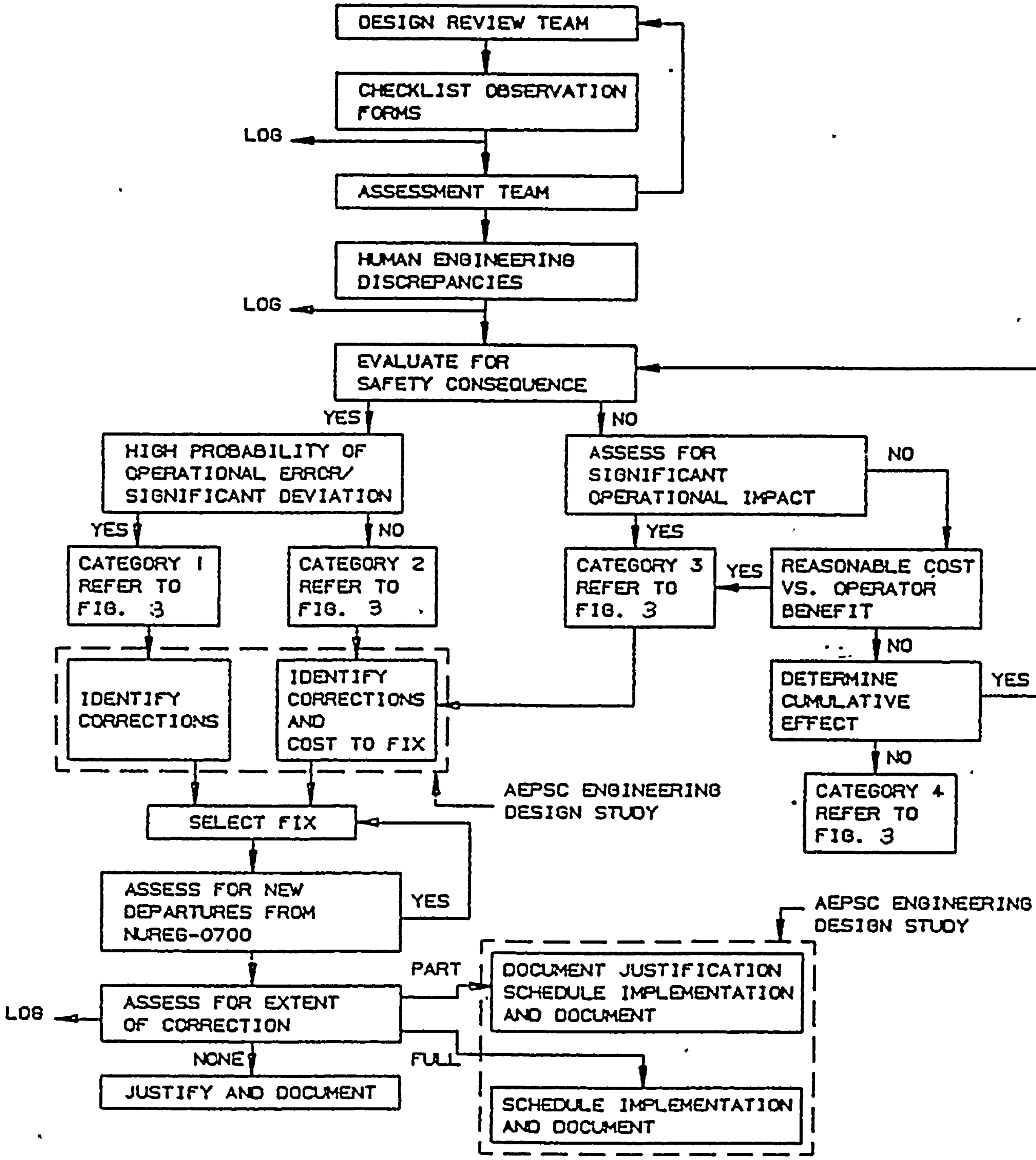


FIGURE 2

HED CATEGORY GUIDELINES

CHECKLIST OBSERVATIONS FROM REVIEW PROCESS

↓

HED ASSESSMENT - HAS POTENTIAL FOR INCREASING OPERATOR ERROR

↓

ASSESSMENT CRITERIA

CATEGORY	ASSESSMENT FACTOR	IMPLEMENTATION (RATING)
1	SAFETY CONSEQUENCE: o ASSOCIATED WITH SAFETY FUNCTION NECESSARY TO SHUT DOWN PLANT o COULD LEAD TO VIOLATION OF TECH. SPECS. o ANY FUNCTION NECESSARY TO MITIGATE THE CONSEQUENCES OF AN ACCIDENT o NON-SAFETY FUNCTION THAT AFFECTS SAFETY OBJECTIVES o LEADS TO TRANSIENTS THAT UNNECESSARILY TEST OR EXERCISE THE SAFETY FUNCTIONS HIGH PROBABILITY OF OPERATIONAL ERROR/ SIGNIFICANT DEVIATION: o DOCUMENTED OPERATOR ERROR o EXTENT OR DEGREE OF DEVIATION FROM NUREG-0700	EARLIEST OPPORTUNITY (MANDATORY)
2	SAFETY CONSEQUENCE NOT POTENTIAL HIGH PROBABILITY OF OPERATOR ERROR NOT LARGE DEVIATION FROM NUREG-0700	EARLIEST OPPORTUNITY (NEXT HIGHEST PRIORITY)
3	LOW PROBABILITY OF SAFETY CONSEQUENCE SIGNIFICANT OPERATIONAL IMPACT o AFFECTS OPERATOR EFFICIENCY o AFFECTS OPERATOR PERFORMANCE o AFFECTS PLANT PERFORMANCE o AFFECTS PLANT AVAILABILITY o AFFECTS OPERABILITY, INCLUDING MAINTENANCE COSTS REASONABLE COST VS. OPERATOR BENEFIT	CONVENIENT SCHEDULED OUTAGE
4	INSIGNIFICANT PROBABILITY OF ERROR NO SAFETY CONSEQUENCE OPERATIONAL IMPACT NOT SIGNIFICANT MAY IMPROVE OPERATOR MORALE	MAY OR MAY NOT BE REQUIRED

Category 1 → HEDS I, II, III → ANALYSIS FOR CORRECTION

CAT IV ↓

RECOMMEND CORRECTION — NO → DOCUMENT

RECOMMEND CORRECTION — YES → ANALYSIS FOR CORRECTION

FIGURE 3

High Probability of Operational Error is defined as a documented operator error from past operating history such a LER's, technical specification violation reports, operator interview, questionnaires, etc. Significant Deviation relates to the extent or degree of deviation from the NUREG-0700 guidelines and is a noticeable or measured large amount or considered to be important.

If a HED has any one of the five safety consequence criteria, and documentation shows it has caused operator error in the past or its deviation from the NUREG-0700 Guidelines is significant, then the HED is Category 1. As shown on Figure 3, it is mandatory to implement a correction at the earliest opportunity that the engineering design, expedited cost scoping, review, approval and material delivery can be achieved coinciding with a scheduled outage, where necessary.

If a HED possesses a safety consequence, but no past operator error is documented and its deviation of NUREG-0700 is not significant, it becomes a Category 2.

Category 2, as shown on Figure 3, must have its correction implemented at the earliest opportunity after thorough and complete engineering analysis, design, review, approval, cost evaluation and study, and material acquisition contingent with a scheduled unit outage, where necessary.

Category 3 and 4 HEDs have no or insignificant safety consequence. None of the five safety criteria are affected by these HEDs.

These HEDs would then be evaluated for Significant Operational Impact. The criteria for significant Operational Impact are shown on Figure 3.

Even though the HED has no or low probability of safety consequence, if it possesses any of the five Operational Impact criteria in a significant amount, it is categorized as Category 3 and will be scheduled for implementation during a convenient scheduled unit outage.

Even if the HED possesses no operational impact of significance, it will be evaluated for being of some operator benefit and if this benefit can be implemented at a reasonable cost, it is also categorized Category 3.

Those HEDs that possess insignificant safety consequence, insignificant operational impact and operator benefit cannot be achieved except at a high cost, will be further analyzed for any effect they may have on any other HED. Should it be determined that this effect is cumulative, or tends to upgrade the category of this or any other HED, these HEDs will be routed back through the entire categorization process. It is possible, therefore, that this HED which by itself is a lowly Category 4, can through cumulative effect become part of a Category 1, 2, or 3 HED.

Those HEDs that are left become Category 4. They would contain no safety consequence and insignificant probability error. But because they may have some aesthetic value or could affect operator morale, they will be further assessed for possible implementation, even though implementation is not required.

In summary, if a CLO is assessed to have the potential for increasing operator error, it becomes a HED. If a HED involves a safety consequence, it becomes a Category 1 or 2, the two highest implementation ratings. Past documented errors or a significant deviation from NUREG-0700 Guidelines with a safety consequence is Category 1.

A HED that possesses insignificant probability of a safety consequence is categorized 3 or 4. Anything that has a significant effect on operator or plant performance and efficiency is Category 3. If some operator benefit can be visualized at a reasonable cost then it is also categorized 3. Category 3 HEDs will be implemented during convenient scheduled outages. Even though a HED possess no significant effect on the reactor or balance or plant, and is not associated with a significant probability of operator error, it may still be chosen for implementation for no other reason than it may raise operator morale.

Figure 4

The Category 1, 2, or 3 HED is chosen for correction by the Assessment Team. The DCRDR Lead Engineer will then assign a DRT member the responsibility of getting an AEPSC Engg. Design Study to identify corrections and/or propose fixes.

The DRT member will assign the HED to an appropriate AEPSC Engg. Division and Section. The majority of all HED corrections will rest primarily with the Mechanical Engg. Division, Instrumentation & Control Section or the Electrical Engg. Division, Electrical Generation Section. The DRT member will also develop a schedule for completion of the design study based upon HED category and unit outage schedules.

The DRT member sends the HED to the appropriate Section Manager who assigns a Section Lead Engineer to review the HED and the NUREG-0700 Guidelines propose fixes, examine the proposals for new departures from the guidelines and determine costs of each proposal. Depending on unit outage schedules, Category 1 HED costs may only be scoped in an expedited manner to speed up the process.

The Section Manager sends the approved Design Study results back to the DRT member who reviews/approves the fixes/costs and looks for new departures. The DRT member determines the strengths and weaknesses of each proposal, that the proposal provides the necessary correction, and on any new NUREG-0700 Guidelines departures.

The DRT member sends the Design Study-HED packet to the DCRDR Lead Engineer who submits it to the PRT.

The Project REview Team reviews/approves the Design Study and the DRT member comments for submittal to the Assessment Team.

COOK DCRDR HED FIX PROPOSALS THROUGH DESIGN STUDY

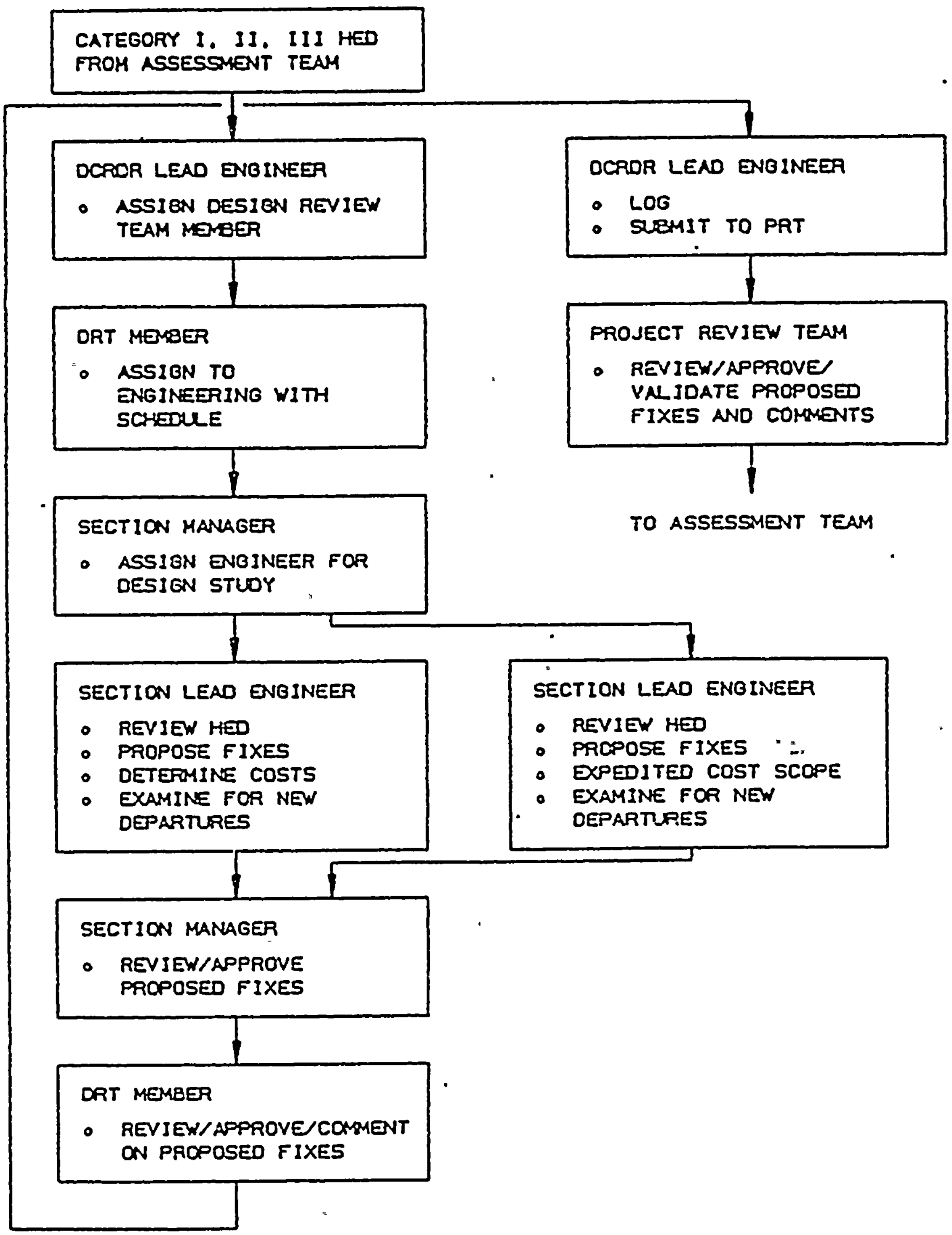


FIGURE 4

Figure 5

The next step after identifying fixes is for the Assessment Team to select a fix.

The AT analyzes any enhancement fix proposal first. They verify the enhancement proposal will provide the necessary correction and will not interfere with other future corrections. If it passes this assessment it will be implemented on a timely schedule.

If no enhancement fixes are proposed or acceptable, the AT selects the preferred design alternative, verifying that the necessary correction is achieved and the method, references, materials, schedules, costs, etc. are acceptable. It validates the design with drawings, sketches, photographs, models, sample, mock-ups or actual control room visitation.

The next step is the AT assessment for new departures from the NUREG-0700 Guidelines by reviewing the fix, the DRT member comments and the guidelines criterion.

The next step is the AT assessment of the extent of correction to determine that the fix will be a full or partial fix, or no fix will be implemented.

Full and partial fixes that require control board modification enter the AEPSC Engg. RFC Process for engineering design change. This process is outlined on Figure 6.

Figure 6

As can be seen in this figure there are numerous steps and working groups involved in this procedure. To summarize, a RFC Lead Eng. is appointed, generally the same individual/section that was responsible for the original Design Study. The RFC Lead Eng. is the primary responsible individual who follows the RFC from inception to closeout. The RFC Process involves correction, design conception and/or refinement, supervisory/management (both in AEPSC and Plant) review/approval process, AEPSC Design Division design work and drawing revision, required word document revisions by responsible sections, independent safety review/approvals, final cost estimates, procurement of materials, installation scheduling and coordination, inspection and testing, quality assurance review and documentation control. There are several levels of review/approval process involved, as shown on Figure 6.

Once approved it passes from the RFC Lead Engineer through the Design Division to the Plant for implementation and closeout.

This is an in place system and procedure for Cook plant revisions and additions.

COOK DCRDR SELECT FIX PROCESS

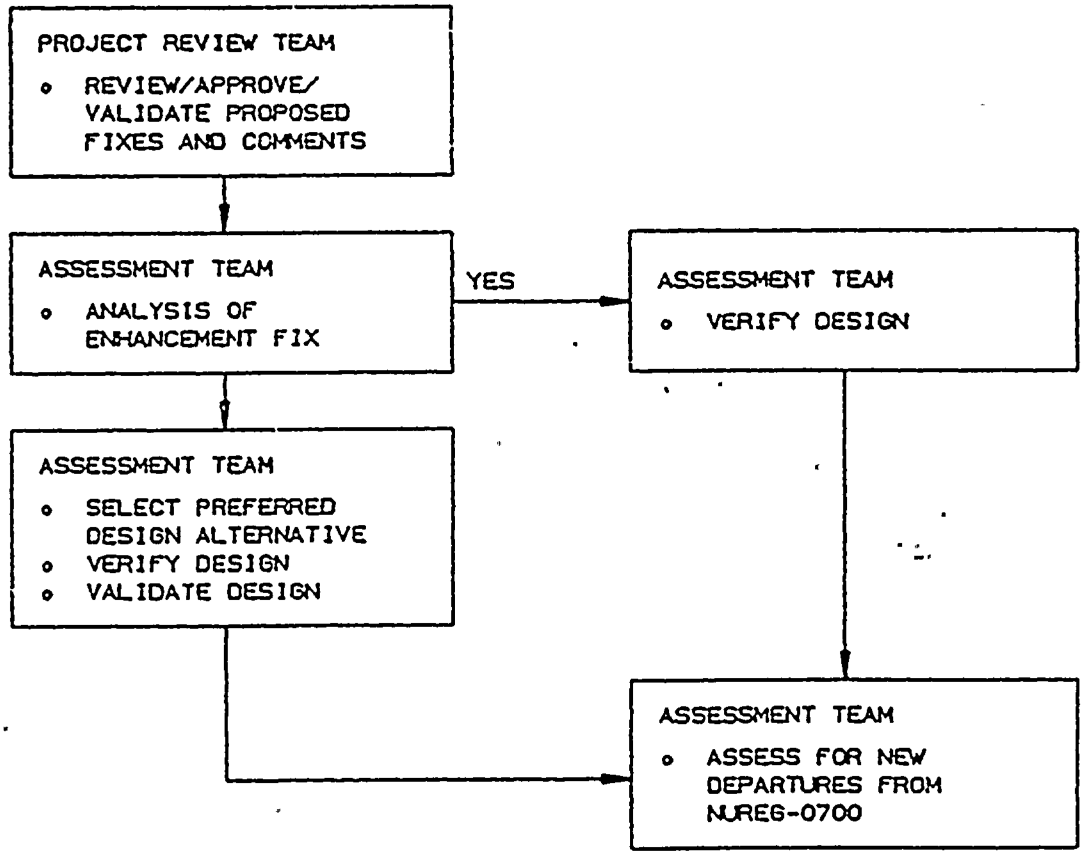
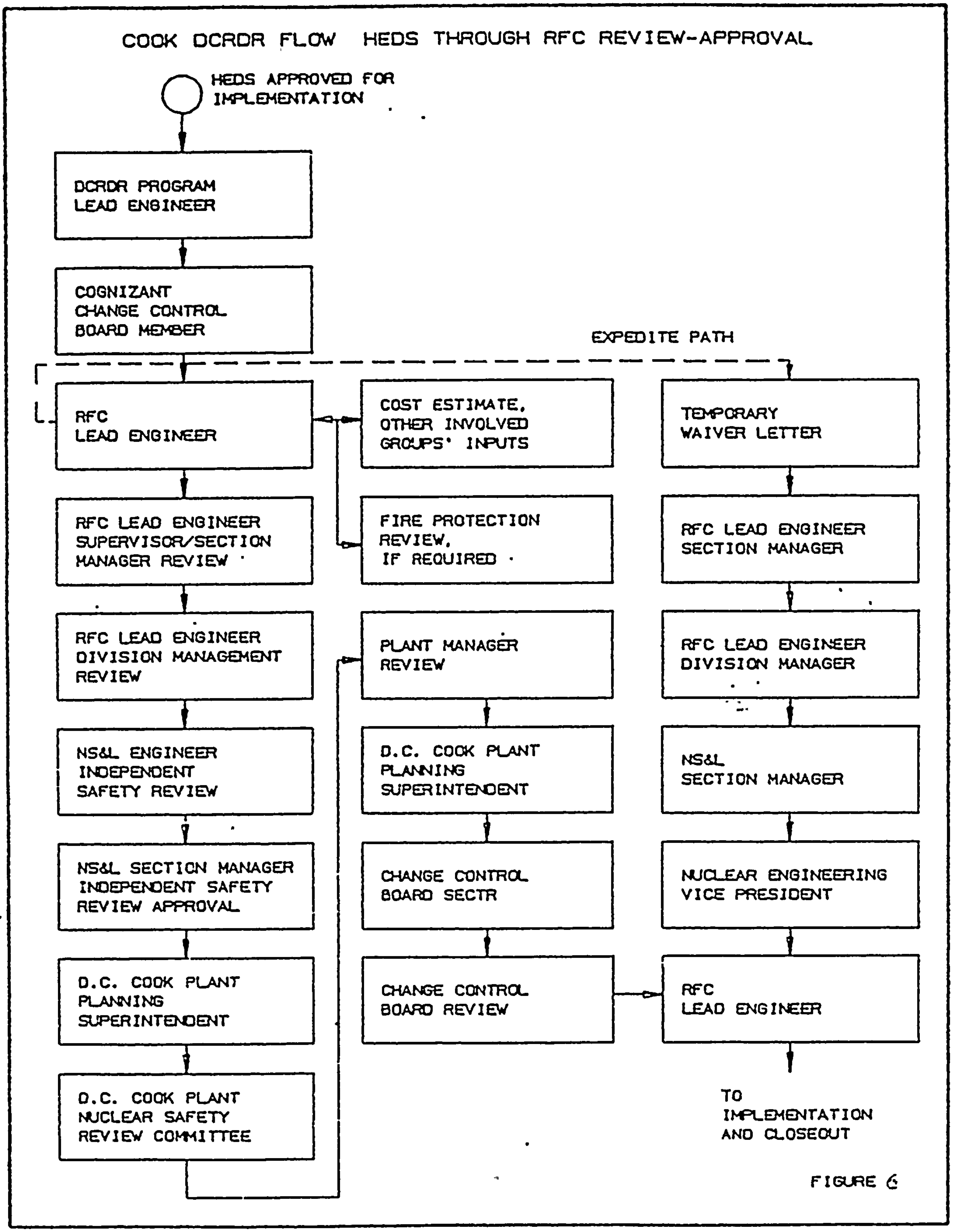


FIGURE 5



COOK DCRDR FLOW HEDS THROUGH RFC REVIEW-APPROVAL
HEDS APPROVED FOR IMPLEMENTATION
DCRDR PROGRAM LEAD ENGINEER
COGNIZANT CHANGE CONTROL BOARD MEMBER
EXPEDITE PATH
RFC LEAD ENGINEER
COST ESTIMATE, OTHER INVOLVED GROUPS' INPUTS
TEMPORARY WAIVER LETTER
RFC LEAD ENGINEER SUPERVISOR/SECTION MANAGER REVIEW
FIRE PROTECTION REVIEW, IF REQUIRED
RFC LEAD ENGINEER SECTION MANAGER
RFC LEAD ENGINEER DIVISION MANAGEMENT REVIEW
PLANT MANAGER REVIEW
RFC LEAD ENGINEER DIVISION MANAGER
NS&L ENGINEER INDEPENDENT SAFETY REVIEW
D.C. COOK PLANT PLANNING SUPERINTENDENT
NS&L SECTION MANAGER
NS&L SECTION MANAGER INDEPENDENT SAFETY REVIEW APPROVAL
CHANGE CONTROL BOARD SECTR
NUCLEAR ENGINEERING VICE PRESIDENT
D.C. COOK PLANT PLANNING SUPERINTENDENT
CHANGE CONTROL BOARD REVIEW
RFC LEAD ENGINEER
D.C. COOK PLANT NUCLEAR SAFETY REVIEW COMMITTEE
TO IMPLEMENTATION AND CLOSEOUT

FIGURE 6

Figure 7

The CLO from the Review Phase to the HED through the Assessment and Implementation Phase is a relatively complex operation which can span a considerable time period and can involve numerous HEDs. Clearly, a HED Tracking method is required.

This simplified flow chart shows two tracking methods. First, the DCRDR - HED Log will be the responsibility of the DCRDR Lead Eng. and will be used by the Assessment TEam and the DCRDR Program Administrator to determine HED and corrective action disposition.

All CLO's received from Westinghouse and ESSEX will be logged. When identified as a HED it will be logged. Final rejection of a CLO will be logged and no further entries required.

The conclusion of the Design Study Process will be logged.

The corrective action selection of the AT will be logged. This includes enhancement modification or no fix corrective action. The No Fix selection would closeout the DCRDR - HED Log entries.

When a modification fix requiring the RFC process is approved, the Action Item Tracking (AIT) process is initiated. The AIT process is an in place company procedure for action items, in particular, commitments are monitored by AEP management. It is also monitored by the AEPSC Quality Assurance group for past due commitment dates.

There is an in place AEPSC RFC Status Summary Report Process which generates periodic status reports to further enhance our ability to keep track of HEDs.

COOK DCRDR SIMPLIFIED FLOW CHART HED TRACKING SYSTEM

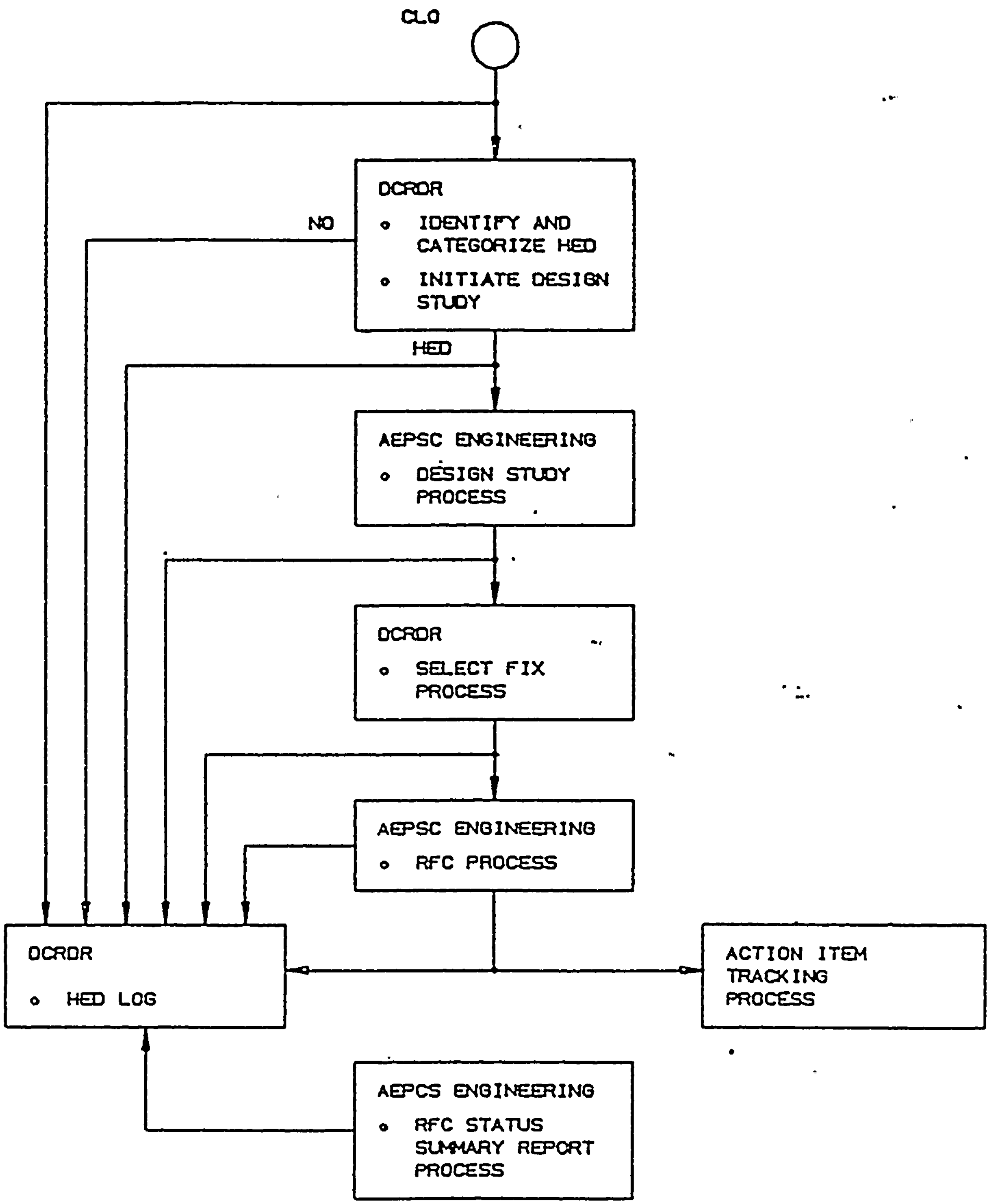


FIGURE 7

APPENDIX I

DONALD C. COOK NUCLEAR PLANT

UNITS 1 AND 2

CONTROL ROOM OPERATOR QUESTIONNAIRE

FOR THE COLUMBUS MOCKUP

COOK DCRDR PROGRAM

CONTROL ROOM OPERATOR QUESTIONNAIRE

FOR

COLUMBUS MOCKUP

Cook DCRDR
Cook Control Room Mockup
Operator Questionaire

Several enhancements/minor modifications have been simulated on the NESW, ESW, CCW, SPY, SIS and RHR Panels. Your comments and suggestions are needed to determine the benefits to the control room operator and to finalize the design. Please answer the following questions. Comment where you wish.

Please answer the questions considering other factors besides your own personal opinion. For example, even though you may be an experienced operator thoroughly familiar with the Cook main control room panels, would the enhancement help a newer operator? Will it help under high stress conditions, such as emergency operating conditions?

Please read all of the questions before answering first question. Answer questions with asterix first, then those questions you feel most important. Try to answer as many questions as time allows. You are encouraged to write comments on any aspect of a question you desire.

(dd)

Cook DCRDR
Operator Questionaire
Weschler Indicators

The scale graduations and numerals will be black on a white background. This allows operating zone coding with transparent red, yellow and green tape. The flow, pressure and level indicators will be color coded on the noun name portion of the scale.

1. Does the color coding scheme help you find and recognize the indicators more easily?

   Yes______ No______ Uncertain______

   Comments:____

1a. We are considering adding a fourth color code for the horizontal flux indicators, to help distinquish them from the horizontal temperature indicators, which are white. Would this be worthwhile?

   Yes______ No______ Uncertain______

   Comments:____

2. Is it easier to read values from the white and black scales graduations and numerals, particularly when compared to old dark red flow indicators?

   Yes______ No______ Uncertain______

   Comments:____

* 3. Where applicable, system/subsystem hierarchial labels have been used with the edgewise indicators. This reduces the number of words required vertically on the vertical indicators. Bigger characters can be employed. Is it easier to read noun names?

   Yes______ No______ Uncertain______

   Comments:____

* 3a. Look at the vertical indicators on the ESW Panel. Note the top label "HEAT EXCHANGER FLOW", and the next lower labels "DIESEL GEN", "CNTMT SPRAY", "CCW COOLER" and "CONT RM AC", now notice all that is on the vertical indicator scales now is "DGIAB, DGICD, EAST and WEST". Does this present any problem to you in determining that, for example, WFI-715 is ESW flow to the west containment spray heat exchanger?

Yes______ No______ Uncertain______

Comments:______________________________

____

* 3b. On panels where heirarchial labeling has been done, is it obvious as to which devices the labels apply?

Yes______ No______ Uncertain______

Comments:______________________________

____

4. Operating zone coding color bands are shown on applicable indicators. The red and yellow zone coding criteria is the same as the first and second priority coding for the annunciators, see attached criteria. Are these Operating Zone color coded bands on indicators useful information?

Yes______ No______ Uncertain______

Comments:______________________________

____

4a. On the electrical meters for motor amps, the third color orange is employed. The narrow orange band designates a precautionary operating zone above 115% motor nameplate rating, while the wider band shows motor overload protective relay settings.

1) Is this useful?

Yes______ No______ Uncertain______

2) Does the orange color help separate the higher priority red and yellow zones from electrical equipment protection zones?

Yes______ No______ Uncertain______

Comments:______________________________

____

4b. Ammeters associated with pumps could also employ a orange band on the low end of the scale. This band would run from zero to 40 or 50 percent of the full load name plate rating value, and would represent a pump not delivering flow to the system (unloaded). Would you consider this useful?

Yes______ No______ Uncertain______

Comments:____

____

5. Overall, do you consider the Weschler indicator enhancements beneficial?

Yes______ No______ Uncertain______

Comments:____

____

6. Is it beneficial to use the same color code on the Bailey indicators?

Yes______ No______ Uncertain______

Comments:____

____

7. Certain indicators are shown with a live zero so that you might recognize either indicator or input failure more readily. These indicators would normally indicate zero during normal service, but would come into service during emergency conditions. Hopefully, you would recognize a failure before the meter was required for service. Look at IFI-51 thru 54. Would you be able to readily spot the pointer at the bottom of one of these indicators, versus at zero scale?

Yes______ No______ Uncertain______

Comments:____

____

8. In order to reduce the number of words written vertically on these indicators, the words FLOW, PRESS, LEVEL have been eliminated. The Mark No. tag, units of measure such as PSIG and GPM, and the color code all signify type of indication. Is this satisfactory?

Yes______ No______ Uncertain______.

Comments:____

____

9. Do the large dial indicators at the top of the Panels need the pressure color code shown on the NESW Panel?

Yes______ No______ Uncertain______

Comments:____

____

Cook DCRDR
Operator Questionaire
Hierarchial Labels & Lines

1. Recently the Main Control Room boards had panel boundary lines and labels installed. Since the panel equipment is generally arranged by system function and sequence of operation, these large panel name labels describe a system function. Is this beneficial in helping you find control panel equipment?

   Yes_________ No_________ Uncertain_________

   Comments____

   ____

*2. In addition to the above labels and boundary lines, we are considering further subdividing the panels and labeling. Please read the attached rules for hierarchial labeling. Look at the examples on panels NESW thru RHR. Note the effect on component nameplates. Please answer the following questions on a per panel basis.

   *a. Overall, is the hierarchial labeling scheme beneficial in locating or finding individual pieces of equipment?

   NESW: Yes___ No___ Uncertain___

   Comments____

   ____

   ESW: Yes___ No___ Uncertain___

   Comments____

   ____

   CCW: Yes___ No___ Uncertain___

   Comments____

   ____

   SPY: Yes___ No___ Uncertain___

   Comments____

   ____

(a con't)

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

* b. Overall, does the panel now look more congested or too "busy"?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

*c. Does the system/subsystem lines within the panel boundary lines help you visualize/associate common/shared functions among the controls and displays?

Yes__________ No__________ Uncertain__________

Comments____

*d. The component nameplates don't repeat words in the higher level subsystem/system labels. Does this improve your ability to determine the function of an individual piece of equipment?

NESW: Yes___ No___ Uncertain___

Comments____

ESW: Yes___ No___ Uncertain___

Comments____

CCW: Yes___ No___ Uncertain___

Comments____

SPY: Yes___ No___ Uncertain___

Comments____

SIS: Yes___ No___ Uncertain___

Comments____

RHR: Yes___ No___ Uncertain___

Comments____

*e. Are the hierarchial labels associated with the edgewise indicators beneficial?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

*f. Stand at the middle of the room, look at the component labels. In many cases, they have fewer words than present labels. In conjunction with the larger system/subsystem labels, can you find individual components more easily?

NESW: Yes___ No___ Uncertain___

Comments____

____

(f con't)

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

*g. Stand at arms length from each panel. Can you readily identify each control switch function, even though you may have to read more than one label?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

(g con't)

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

h. Note that some pump control switch nameplates contain only the motor breaker Mark No. Is this satisfactory?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

* i. Do you recommend hierarchial labeling and demarcation lines for this panel?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

j. On RHR Panel the system/subsystem lines are shown with champhered corners or junctions. This takes more time to install on panels? Is this feature worthwhile compared to the square corners/junctions shown on other panels?

NESW: Yes___ No___ Uncertain___

Comments____

____

ESW: Yes___ No___ Uncertain___

Comments____

____

CCW: Yes___ No___ Uncertain___

Comments____

____

SPY: Yes___ No___ Uncertain___

Comments____

____

SIS: Yes___ No___ Uncertain___

Comments____

____

RHR: Yes___ No___ Uncertain___

Comments____

____

K. Xerox copies of the control panel front views are provided for your use if you have suggestions as to the system/subsystem demarcation lines or hierarchial labels.

Cook DCRDR
Operator Questionaire
Annunciator Enhancements

1. Only three lines of text are used on the new engraved tiles to reduce congestion and improve readability. Is this beneficial?

   Yes______ No______ Uncertain______

   Comments____

   ____

2. Note the old drop labeled "ANNUNCIATOR CONTROL VOLTAGE FAILURE" is now labeled "ANNUNCIATOR VOLTAGE AVAILABLE" because this drop is normally lit. Does this help improve your recognition or understanding of what this window means when lit or out?

   Yes______ No______ Uncertain______

   Comments____

   ____

3. Color coded filters are shown to represent alarm priority. See attached annunciator priority coding criteria. Do these color coded annunciator drops help improve ready recognition of high priority alarms?

   Yes______ No______ Uncertain______

   Comments____

   ____

Cook DCRDR
Operator Questionaire
Status/Monitor Lights Engraving

1. Only three lines of text are used on the new engraved tiles. The largest, boldest characters that will fit are used (they are slightly larger than what is used on the annunciators). Is this beneficial?

   Yes______ No______ Uncertain______

   Comments:____

   ____

2. The proposed character size in combination with only three lines of text means the windows no longer have room for the red triangles. Note the proposed black borders around the tiles to replace the red triangle coding. Any problem with this method?

   Yes______ No______ Uncertain______

   Comments:____

   ____

3. The red triangles have to be replaced because they are red. At the very least, we would have made them black. Does slightly bigger lettering to make the writing easier to read worthwhile enough to offset the extra trouble of the black borders for coding?

   Yes______ No______ Uncertain______

   Comments:____

   ____

Cook DCRDR
Operator Questionaire
H/A Station Enhancements

The Foxboro stations have several enhancements; new Mark No. and Noun Name Labels, new open, close and knob rotation stickers.

1. Are the Open, Close stickers beneficial?

   Yes______ No______ Uncertain______

   Comments:____

   ____

2. Are the Inc Set Point or Open Valve stickers beneficial?

   Yes______ No______ Uncertain______

   Comments:____

   ____

3. The Bailey Stations on the Condensate Panel also have similar enhancements. Is this beneficial?

   Yes______ No______ Uncertain______

   Comments:____

   ____

4. Overall, how do the stickers and labels look?

   Bad______ Good______ Uncertain______

   Comments:____

   ____

Cook DCRDR
Operator Questionaire
Engraved White Lamp Caps

1. All unlabeled white lamp caps that cannot be labeled externally, will get a new engraved cap. The engraving will describe what the lamp represents when lit. Does the engraving help you determine the function?

   Yes______ No______ Uncertain______

   Comments:____

   ____

2. The fire detector lamps at the top of the EF Panel presently have dymotape labels. We plan on replacing with engraved white lamp caps and external labels. Please review this on Mockup.

   Comments:____

   ____

Cook DCRDR
Operator Questionaire
General Questions

* 1. Foxboro Stations for IRV-310 & 320 are used primarily to control RHR flow during cooldowns, yet they are located on the Containment Spray Panel. One of the modifications being considered is to relocate these stations to the RHR, where the flow and temperature indication and alarms are. Do you consider this worthwhile? See SPY-RHR Panel drawing and change description.

Yes______ No______ Uncertain______

Comments:____

____

* 2. On the DTU Panel, the RCS wide range T_H and T_C recorders are arranged Loop 1 top left, Loop 2 top right, Loop 3 bottom left, Loop 4 bottom right. The T and Tavg indicators at the top of the panel are arranged differently, Loop 1 top left, Loop 3 top right, Loop 2 bottom left, Loop 4 bottom right. One of the modifications being considered is to interchange the Loop 2 and 3 T & Tavg indicators to make their arrangement the same as the recorders. Do you consider this worthwhile?

Yes______ No______ Uncertain______

Comments:____

____

* 3. The Steam Generation Panel is being considered for extensive rearrangement. Basically, the TDAFP control switches for FMO-211,221, 231 & 241 would be moved to the present locations for control switches MRV-210,220,230 & 240. The MRV control switches would move straight down the panels to the old FMO elevation. Control switches for the feedwater isolation valves FMO 201 and 202 would be interchanged, and FMO-203 with 204. This basically lines up all equipment for each steam generator in vertical groups. The No. 1 MDAFP controls in the middle of the panel would be moved to where the TDAFP controls are now on the left side of the panel, and arranged similar to the No. 2 MDAFP controls on the right side of the panel. This gives six vertical groups of equipment, the two outside groups alike, the four inside groups alike. The seventh group, the oddball, the TDAFP controls, are put in the middle where the No. 1 MDAFP controls vacated. See SG Panel Mod drawing and change description. The controls rearrangement has been simulated on the Mockup. Please examine the simulated arrangement and answer the following questions:

* Is this arrangement an improvement for operation of the aux feedpumps and valves during emergency conditions?

Yes______ No______ Uncertain______

Comments:____

____

* Is this arrangement satisfactory during normal operation, including startups?

Yes______ No______ Uncertain______

Comments:____

____

* Do you consider this rearrangement of equipment so extensive that you would have difficulty learning the new configuration?

Yes______ No______ Uncertain______

Comments:____

____

* Overall, do you consider this modification worthwhile?

Yes______ No______ Uncertain______

Comments:____

____

* 4. There are four control switches on the VS Panel that control two fans apiece. Refer to the attached sketch for details. Note the advantage of the proposed switch position configuration. Do you consider this worthwhile?

Yes______ No______ Uncertain______

Comments:____

____

* 5. The control switches for the E&W feedpump emergency leakoff valves FRV-252 & 254 are wired such that turning the switch clockwise has the opposite effect of all other control switches in the control room. That is, it goes from OPEN to AUTO to CLOSE in the clockwise direction. These switches are being considered for rewire to get CLOSE to AUTO to OPEN in the clockwise direction. Do you consider this worthwhile?

Yes______ No______ Uncertain______

Comments:____

____

* 6. The valve test control switch positions and position indicators for the Unit 1 E&W feedpump turbines are not arranged in the same sequence. That is, if you throw the switch to the left to test the valve, the indicator on the right moves. Vice versa when you throw the switch to the right. We are considering interchanging the left and right hand indicators. Do you consider this worthwhile?

Yes______ No______ Uncertain______

Comments:____

____

* 7. The IV Panel has several control switch arrangement problems. The EOP Attachment A & B to E-0 has been revised to be more compatible with the panel arrangement. A set of status lights being considered for this panel showing Phase A and B Isolation Valves. One of the proposals being considered is to add status lights for the valves that are not located on the IV Panel. That way, all isolation valves are indicated on the IV Panel, either by status lights or the red and green indicating lamps associated with the control switches. The status lights would be wired in such a way as to be de-energized unless a Phase A or B Isolation signal were present. In order for the operator to quickly assess the red and green indicating lamps associated with the control switches on the IV Panel, the operator would start at the top left hand control switch and go straight down the vertical row of switches, left to right, looking only for the small labels with A above the indicating lamp during Phase A Isolation, and B during Phase B Isolation. At each A label, he merely verifies that lamp is on, the opposite lamp is off. Because the operator is not reading labels or looking for particular valves, he can quickly go through all of the indicating lamp sets on the IV Panel, if all of the valves are stroked to the proper position.

If, however, a valve did not fully stroke, the operator would stop at that control switch and manually throw the switch to close the valve. If that works, he continues on as before. If that does not work, we propose the attachment A and B valve lists show the opposite safety

train valve on the same line with a grid coordinate number. A drawing would be added to Attachment A and B showing what each row and column of switches are designated for the grid coordinates. The operator then has a ready reference to enable him to find sister valves quickly.

He verifies the sister valve has stroked. If so, he continues on with the process until all the IV Panel is canvassed. He notes the valve or valves that are not fully stroked, and initiates local operator action if applicable. The point is, the valve closed-open lamps can be quickly and reliably canvassed using the A and B labels only, and the valves not on IV Panel would have status lights on the IV Panel. Do you think this is a practical method for you to use?

Yes______ No______ Uncertain______

Comments:____

____

8. Is it worthwhile, or even detrimental, to demarcate and hierarchial label the present arrangements on panels SPY, RHR and SG when we plan on rearranging them within three years?

Worthwhile______ Not Worthwhile______ Uncertain______

Comments:____

____

9. Any comment or suggestion suggestion you may wish to make on any of the following, please do so:

Safety Train Tape______________________________________

____

____

Panel Labels/Lines_____________________________________

____

____

Electrical Mimic Lines_________________________________

____

____

Engraved White Lamp Caps ____________________

____

____

H/A Station Stickers/Labels ____________________

____

____

Control Room Rug ____________________

____

____

Recorder Labels ____________________

____

____

Control Switch Handle Color/Shape Codes ____________________

____

____

Annunciator Windows ____________________

____

____

Status/Monitor Lights ____________________

____

____

Operating Zone Coding ____________________

____

____

RG 1.97 Stickers____

____

____

Indicators____

____

____

Other____

____

____

✳ 10. In your opinion, which of the enhancements or modifications simulated on the Mockup or discussed in the Questionaire would be the most useful and helpful to the control room operator. List as many as you like, particularily if you feel they have cumulative effects with each other.

Most beneficial____

____

____

Beneficial____

____

____

Least beneficial____

____

____

*11. Examine Mockup panels from the Reactor Coolant Pumps around to the Turbine Auxiliaries Panel. System/subsystem labels and demarcation lines have been simulated. Although the component nameplates have not been simulated yet, the non-repetition of words already in the system/subsystem labels, similiar to that shown on the NESW thru RHR Panels, would be followed where applicable. Please comment on a panel by panel basis on demarcation lines grouping of equipment and the system/subsystem names used on the labels. If you wish to rearrange the equipment groupings (demarcation lines) and change names, etc, a drawing is provided for you to mark up as you please.

* Reactor Coolant Pumps Panel

(a) Are groupings (demarc lines) satisfactory?____________________

____

____

(b) Are system/subsystem labels satisfactory?____________________

____

____

(c) Any Suggestions?______________________________________

____

____

* Pressurizer Panel

(a) Are groupings (demarc lines) satisfactory?____________________

____

____

(b) Are system/subsystem labels satisfactory?____________________

____

____

(c) Any Suggestions?______________________________________

____

____

* Flux/Rod Control Panel

(a) Are groupings (demarc lines) satisfactory? ____________________

____

____

(b) Are system/subsystem labels satisfactory? ____________________

____

____

(c) Any Suggestions? ______________________________

____

____

* Delta Temp/Steam Dump/Unit Panel

(a) Are groupings (demarc lines) satisfactory? ____________________

____

____

(b) Are system/subsystem labels satisfactory? ____________________

____

____

(c) Any Suggestions? ______________________________

____

____

* Steam Generator/Aux Feedwater Panel

(a) Are groupings (demarc lines) satisfactory? ____________________

____

____

(b) Are system/subsystem labels satisfactory? ____________________

____

____

(c) Any Suggestions?____

* Main Feedpumps Panel

(a) Are groupings (demarc lines) satisfactory?

(b) Are system/subsystem labels satisfactory?

(c) Any Suggestions?

* Condensate Pumps/Heater Panel

(a) Are groupings (demarc lines) satisfactory?

(b) Are system/subsystem labels satisfactory?

(c) Any Suggestions?

* Feedwater Heater/MSR Panel

(a) Are groupings (demarc lines) satisfactory?

(b) Are system/subsystem labels satisfactory?

(c) Any Suggestions?

* Turbine Auxiliaries Panel

(a) Are groupings (demarc lines) satisfactory?

(b) Are system/subsystem labels satisfactory?

(c) Any Suggestions?

*12. Examine the proposed VS Panel modification drawings. Would these changes be beneficial?

Yes________ No________ Uncertain______________

Comments____

____

____

*13. NRV-152 & 153 controls on Pressurizer Panel each have two sets of switches. One is the control switch with Close, Auto, Open positions, the second switch is the Cold Overpressure selectro switch with Block - Unblock positions. The selector switch is mounted low on the panel where there is concern for accidental operation. Also, recent panel revisions have placed these switches immediately below electrical meters, where there is concern for mistaken operation (it looks like its part of heater controls).

The function of both the control switch and selector switch can be incorporated into the control switch only. See attached description.

Do you think this would be beneficial?

Yes__________ No__________ Uncertain_______________

Would accidental or mistaken operation possibilities be reduced?

Yes__________ No__________ Uncertain_______________

Can you think of any condition where you would need the present two switch control configurations over the single switch proposal?

Yes__________ No__________ Uncertain_______________

Comments____

____

____

✳ 14. One of the modifications being considered for annunciators is to rearrange them to correspond to the relative location of related controls and displays, where applicable. For example, if the East Motor Driven Aux Feedpump controls/displays were to the left of the Turbine Driven Aux Feedpump controls/displays, so should its annunciator drops be to the left. Do you consider this important or beneficial?

Important_________ Beneficial_________ Not Necessary_________

Comments____

____

✳ 15. One of the modifications being considered for the ECCS Monitor Lights is to rearrange them to correspond to the arrangement of the control switches where applicable. That is, if a particular valves control switch is to the left or above another valves control switch, the monitor light will be to the left or above, etc. Do you consider this important or beneficial?

Important_________ Beneficial_________ Not Necessary_________

Comments____

____

Station Auxiliary Panel

1. The SA Panel has been demarcated into three section: Diesel Generator 1AB, Auxiliary Buses, and Diesel Generator 1CD. Do you find this helpful?

   Yes ____ No ____ Uncertain ____

   Comments ____

   ____

2. The left half of the SA Panel has been labeled using hierarchial labeling criteria. The right half was labeled using standard component labels.

   a. Overall, is the hierarchial labeling beneficial in locating or finding individual pieces of equipment?

      Yes ____ No ____ Uncertain ____

      Comments ____

      ____

   b. Overall, does the panel now look more congested or too "busy"?

      Yes ____ No ____ Uncertain ____

      Comments ____

      ____

   c. Do you find hierarchial labeling of the panel meters helpful?

      Yes ____ No ____ Uncertain ____

      Comments ____

      ____

   d. Would it be confusing to use hierarchial labeling on the panel meters and components labels on control switches.

      Yes ____ No ____ Uncertain ____

      Comments ____

      ____

3. Recently new mimic lines were installed on the SA Panels at Cook Plant. The new mimic lines are all one color, black, with voltage designations printed on the lines to enable the operators to distinguish between different bus voltages.

a. Are the new mimic lines easy to follow.

Yes ____ No ____ Uncertain ____

Comments ____
____

b. Throughout each control room there are as many as six (6) different voltage levels shown on mimic lines. The old mimic lines used a color code scheme to distinguish between the different voltage levels. Due to the number of colors needed to distinguish between the different voltage levels it was thought confusion could occur over which color meant which voltage. Are the new mimic lines less confusing.

Yes ____ No ____ Uncertain ____

Comments ____
____

4. Any general comments concerning the SA Panel.

a. Hierarchial labeling of the entire panel.

Comments ____
____
____

b. Partial Hierarchial labeling - Hierarchial labeling of panel meters, component labeling of controls on other information.

Comments ____
____
____

c. Mimic lines

Comments ____
____
____

d. Anything in general concerning the SA Panel.

Comments ____
____
____
____
____
____

COOK DCRDR PROGRAM

CONTROL ROOM OPERATOR QUESTIONNAIRE

ATTACHMENTS

I. Red Zone

A. Plant Shutdown
B. Reactor Trip
C. Main Turbine Trip, F.P.T. Trip
D. Radiation Release
E. Plant conditions which, if not corrected immediately, will result in automatic shutdown or radiation release or will require manual plant shutdown.
F. Fire Alarm
G. Diesel Generator Emergency Power Bus (NRC Requirement)
Any alarm condition that would not allow the Diesel Generators to operate or deliver required power to their Respective Busses.

II. Yellow Zone

A. Plant condition which, if not corrected, may lead to a plant shutdown or radiation release.
B. Forewarning of or can lead to a first priority alarm condition.
C. Technical Specification related, may require plant shutdown or curtailment, may require verification or testing of equipment, data acquisitioning and logging.

III. Green Zone

Limited application, normally associated with a parameter that is controlled automatically at a constant set point. Band is only wide enough to show normal variations from set point, width not to exceed 10% of absolute value of set point.

IV. Orange Zone (Electrical Meters)

A. Wide Orange Zone represents values where electrical protection logic will tripout equipment. Includes overload current protection, which is a time delay function.

B. Narrow Orange Zone represents values where equipment precautionary measures should be taken and the equipment should not be operated at unless necessary.

1. <u>First Priority</u>
   Red (Pink) Lens Color

   A. Plant Shutdown
   B. Reactor Trip
   C. Main Turbine Trip, F.P.T. Trip
   D. Radiation Release
   E. Plant conditions which, if not corrected immediately, will result in automatic shutdown or radiation release or will require manual plant shutdown.
   F. Fire Alarm
   G. Diesel Generator Emergency Power Bus (NRC Requirement)
      Any alarm condition that would not allow the Diesel Generators to operate or deliver required power to their Respective Busses.

II. <u>Second Priority</u>
   Yellow (Amber) Lens Color

   A. Plant condition which, if not corrected, may lead to a plant shutdown or radiation release.
   B. Forewarning of or can lead to a first priority alarm condition.
   C. Technical Specification related, may require plant shutdown or curtailment, may require verification or testing of equipment, data acquisitioning and logging.

III. <u>Third Priority</u>
   White Lens Color

   A. Plant conditions representing problems & system degradation which affect plant operability but which should not lead to plant shutdown, radiation release, or violation of Technical Specifications.
   B. Information that is useful to the operator but may or may not require operator response, depending on equipment status.

COOK DCRDR

Hierarchial Labeling Criteria

Hierarchial Labeling will be employed when:

(1) Majority of controls within a individual panel boundary lines can be outlined with orderly system/subsystem demarcation lines.

(2) The system/subsystem labels can be located without interference in a prominent place in the middle top half of the group.

(3) All labels required to identify the most familiar noun name or function description of a component can be read by the operator without head movement at arms distance from the component. This includes all components within the group.

(4) The addition of the system/subsystem demarcation lines and labels shall not significantly increase the visual clutter of the panel.

(5) Operators consider the system/subsystem demarcation and labeling on a panel beneficial

The reasoning behind the above criteria are dictated by the nature of the vertical panels in the Cook control rooms.

While all panel, system, subsystem and component nameplates can be read easily from the center of the room (6 to 13 feet distance from panel) without head movement, at arms distance it cannot be done on several panels. That is, you cannot read a component nameplate that is 34 inches above the floor from arms distance, and read a system/subsystem label that is above 5 feet 6 inches from the floor, much less a panel label that is 8 feet plus above floor, without head movement. Head movement can cause an operator to lose his place, or increase the potential for operator error, or at least cause undue delay while the operator finds the required panel component again.

While hierarchial labeling would be adequate while standing or approaching the panel from 6 to 13 feet away, the operator must verify he is on the correct control after reaching the component on the panel before actuating said control. This verification would be more difficult if the operator must look at a panel nameplate 8 feet plus above floor, then a system/subsystem label 4 to 7 feet above floor, then the component label 24 inches above floor.

Further, the operator may have to actuate multiple controls on the same panel, which may cross system/subsystem boundaries. While working at a given panel, he should not be required to read multiple labels separated by appreciable distances to verify a single components identity.

Hierarchial labeling, that is, lower level labels do not repeat information from higher level labels, can be applied to groups in the upper regions of the panel where the panel name is necessary to determine the components function; or to groups lower on the panel where the system/subsystem label is in close proximity to the component label, and the panel label contents are not necessary in the component function description.

Where the above criteria cannot be met, modified hierarchial labeling will be applied, if it meets all above criteria except (3). Modified hierarchial labeling is defined the same as hierarchial, except the component nameplate shall contain the most familiar complete noun name (function description).

Modified and hierarchial labeling may be applied to dissimiliar groups on the same panel, but one or the other must be applied to all components within a group where applicable.

Cook DCRDR 12/27/85

Proposed Arrangement - SG Panel Including Plant Operations Review

(1) Move East MDAFP controls to left side of panel similar to West MDAFP now on right side of panel.

(2) Move TDAFP controls to middle of panel

(3) Move FMO-211, 221, 231 and 241 up to where MRV-210, 220, 230 & 240 are now. Move MRV-210, 220, 230 & 240 to where FMO-211, 221, 231 & 241 are now.

(4) Interchange FMO-201 with FMO-202, and FMO-203 with 204.

(5) Relocate FW Isolation Alarm Reset pushbutton to center of panel

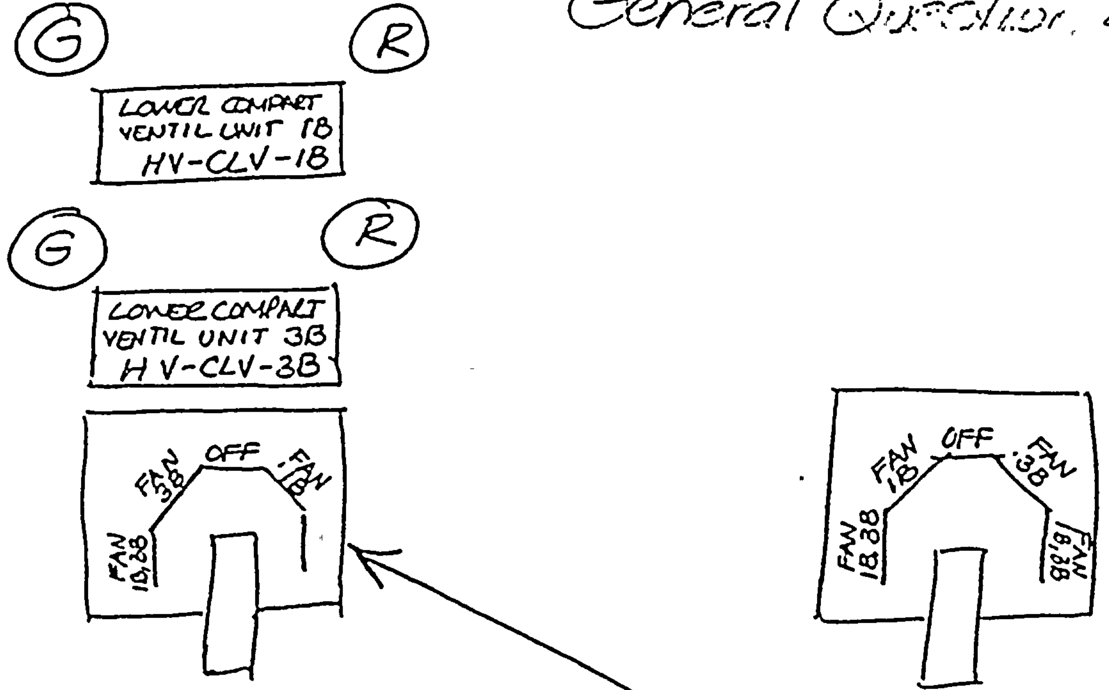
(6) Rearrange vertical indicators
(a) Move WR SG Level up with NR Levels
(b) Move AFP disch press to beside AFWF and in group nearest associated controls

(c) Group both FFCs and MFCs per SG side by side on bottom row

(7) Interchange Steam Line SI Block Switch and FW Isolation Reset pushbutton on left side of panel with ones on right side to line up with their respective safety trains.

Typical VS Panel Fan Control

Ref to Operator Questionnaire
General Question 4



Change from this   to this

Reasons: Need to be able to turn on either fan from OFF position

Need to be able to go to 2 fan operation from either fan

Fan 3 should be CW from Fan 1

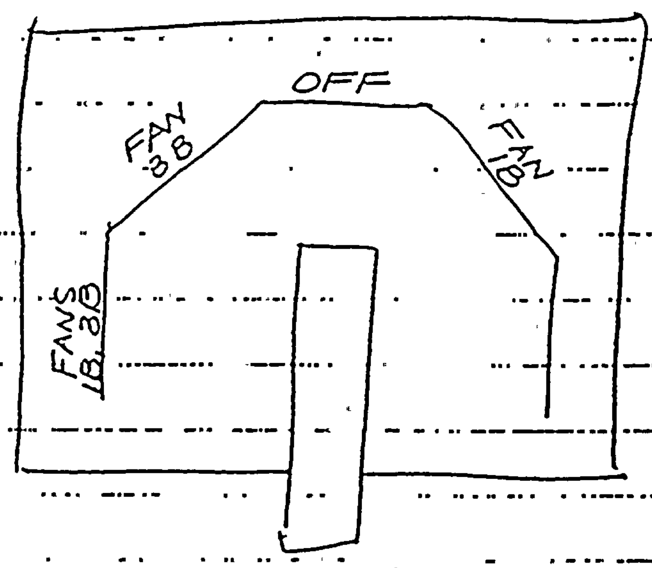
Similar Application to
HV-CLV-2A & 4A ; HV-CLV-2B & 4B
HV-CLV-1A & 3A ; HV-AFS-2 & 4
HV-AFS-1 & 3 ; HV-CUV-1 & 3,
HV-CUV-2 & 4

Cook DCRDR CLO 4.1-16817

Problem Description: Human factors problems with control switch position, do not increase in service condition in clockwise direction or does not increase numerically in clockwise direction. Control switches with problem on VS Panel:

HV-CLV - 1A & 3A
" - " - 2A & 4A
" " - 1B & 3B
" " - 2B & 4B
" CUV - 1 & 3
" " 2 & 4
" AFS 1 & 3
" " 2 & 4

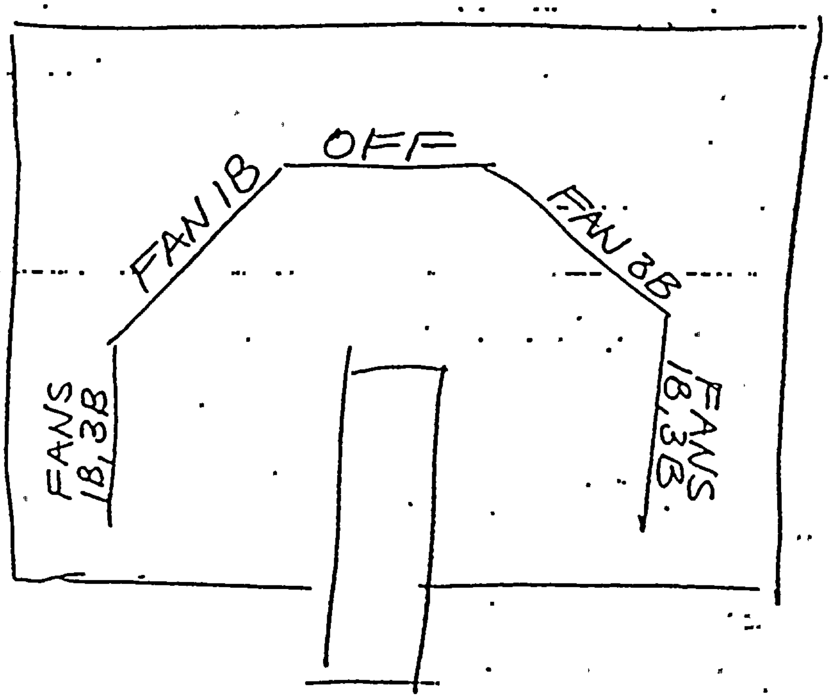
Example of present control switch positions!



CONT'D →

Cook DCRDR CLO 4.1-16&17

Proposed Solution: Rewire and relabel control switches per below example:



Can start either fan from OFF position and can go to two fan operation from either single fan operation without shutting down fan.

Fan 3B and clockwise, fan 1B is counterwise, which may console human engineers.

The human factors problems with present arrangement is 3B is counterclockwise from OFF while 1B is clockwise and 1B, 3B is furthest counterclockwise position.

The engineering problem with the present switch is that two fan operation cannot be selected if fan 1B is running without shutting down 1B, starting 3B and then finally restarting 1B.

Cook DCRDR
NRV-152 & 153 Control Switch Proposal
Description:

Five position switch, blank unlabeled position at 12 O'Clock is functionally same as AUTO-NORMAL OVERPRESSURE. This reduces inadvertent transfer to COLD OVERPRESSURE if operator should overtravel going from CLOSE to AUTO/NORM OP position.

Clockwise movement of switch positions functionally puts the relief valve more in service. Operator would be instructed to never leave switch in 12 O'Clock position, this position is a safety feature. Should operator want to employ AUTO-COLD OVERPRESS, he must move the switch thru the unlabeled 12 O'Clock position. COLD OVERPRESS is functionally more in service than NORMAL OVERPRESS because the automatic control has a

on the control panels where BLOCK
is clockwise. They are:

Pressurizer Pressure SI Block	on	PRZ	
Steamline Break	"	"	on SG
Source Range Trip	"	"	FLX

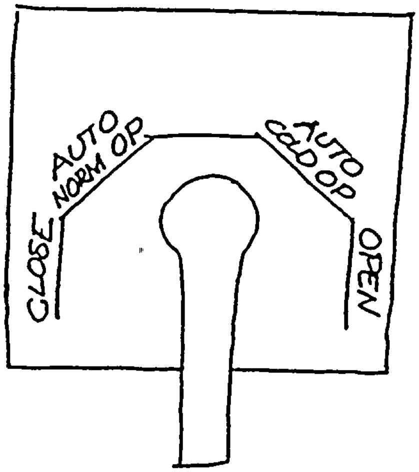
Cook DCRDR

NRV-152&153 Control Switches Proposal

(Reference Question 13)

Rewire PRZ-38&39 for following positions:

Blank 12 O'Clock Position same as AUTO-NORM OP



Remove PRZ-47&48 from panel, no longer required.

AUTO-NORM OP is the same as old PRZ-38 & 39 in AUTO and PRZ-47 & 48 in BLOCK

AUTO-COLD OP is the same as old PRZ-38 & 39 in AUTO and PRZ-47 & 48 in UNBLOCK

Proposed RHR & SPY & BA Panels Modification

(1) Move Foxboro stations RS-16&17 for IRV-310&320 from SPY to RHR Panel. Move MR-14&15 on RHR Panel.

(2) Move the containment relief controls for VCR-107&207 from bottom of SPY panel up to area vacated by RS-16&17.

(3) Move IMO-330&331 down to where VCR-107&207 presently located.

(4) Move HV-CPR-1(SPY-21, containment pressure relief system fan) up to present location of IMO-331.

(5) Interchange vertical indicators 1F1-200, 1P1-210, PPP-301&302, 1F1-331, 1P1-200&220 on panel SPY. This gives more logical left to right order and eliminates mirror image.

(6) Interchange vertical indicators 1F1-310&311 and 1PA-320 and NPS-121, move 1PA-320 to above 1F1-320 on panel RHR. This eliminates mirror image and improves relative locations of flow and pressure indicators.

(7) Interchange SPY 144 & 167

(8) Move IRV-300 Station from RHR to BA Panel @ present QRV-170 Station location, move QRV-170 station and QRV-112, 62 & 113 switches down as necessary

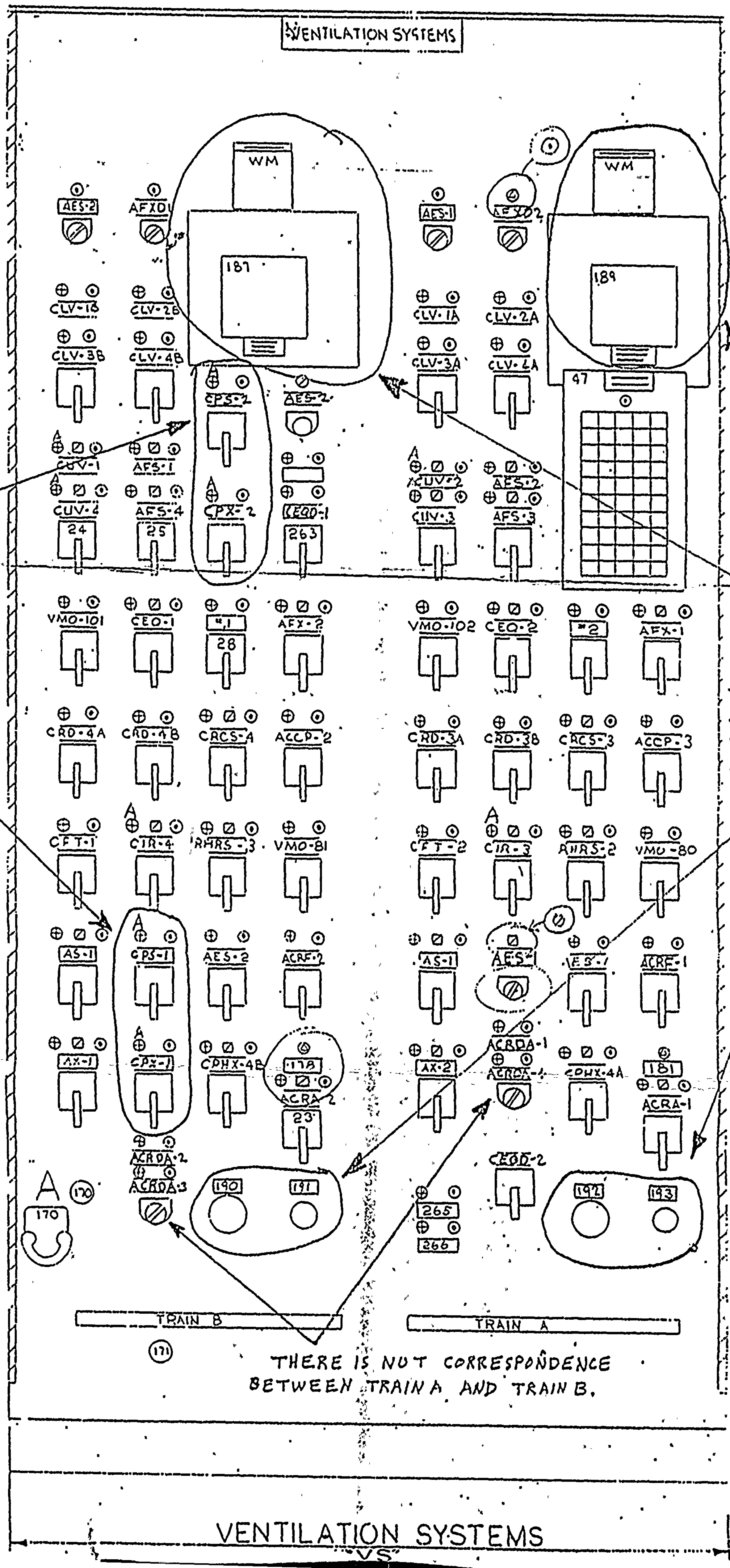
RFS/dkh (8-s)

D.A. PURVIS
5/20/86

VS PANEL

PROBLEMS WITH PRESENT ARRANGEMENT

NOTE: SHOWN FOR UNIT 1. UNIT 2 HAS THE SAME PROBLEMS BUT THE ARRANGEMENT DIFFERS SLIGHTLY



CPS-1 AND CPS-2 ARE NOT BY EACH OTHER.
CPX-1 AND CPX-2 ARE NOT BY EACH OTHER.

H2 RECOMBINER POTENTIOMETER AND TEMPERATURE SELECTOR SWITCH NOT LOCATED CLOSE TO TEMPERATURE AND WATTS INDICATORS

THERE IS NOT CORRESPONDENCE BETWEEN TRAIN A AND TRAIN B.

TI
APERTURE
CARD

Also Available On
Aperture Card

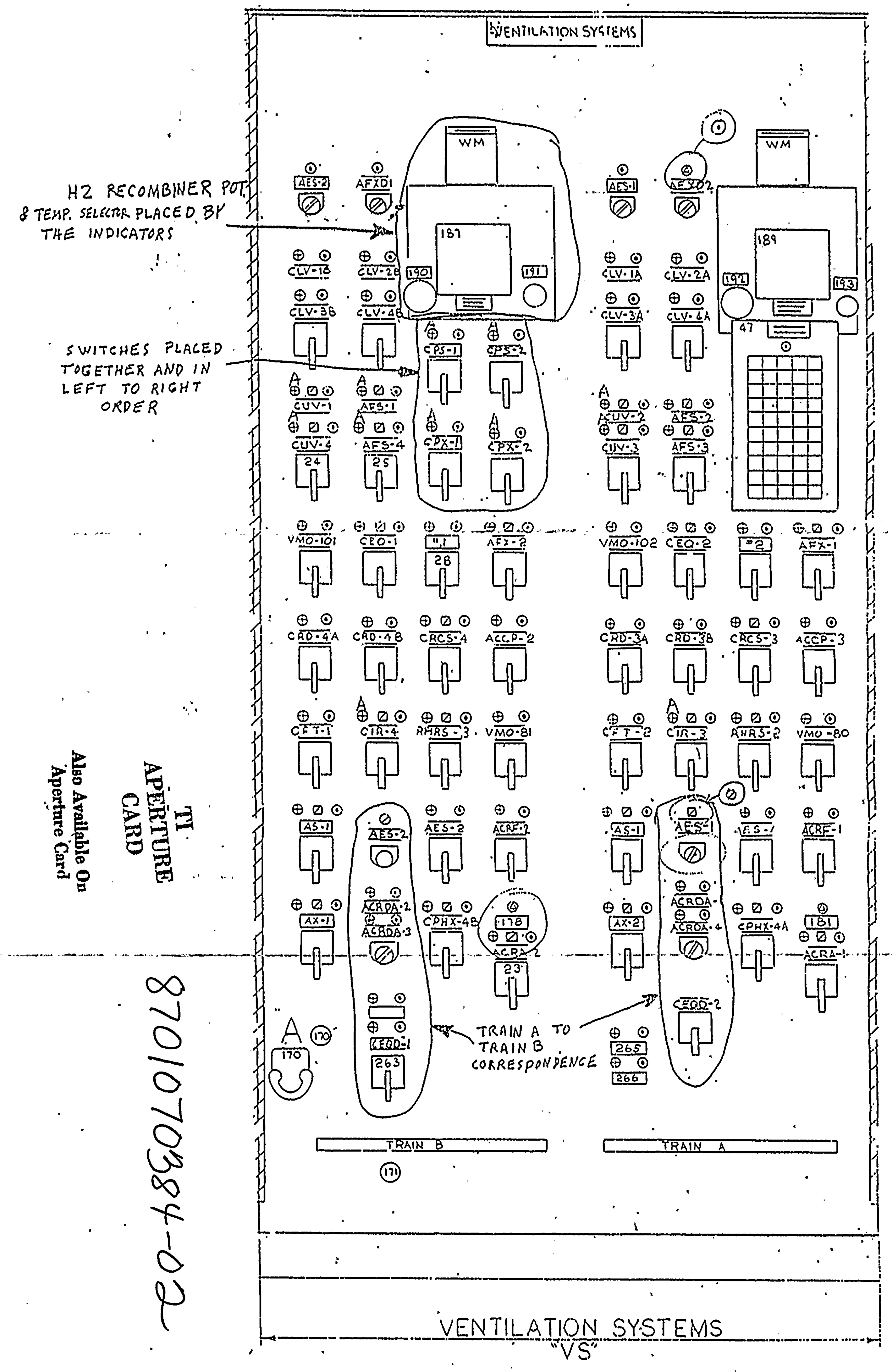
8701070384-01

PURVIS
30/86

VS PANEL

PROPOSED ARRANGEMENT

NOTE: SHOWN FOR UNIT 1. UNIT 2 HAS THE SAME CHANGES EXCEPT CEQD-1 & 2 ARE LOCATED WHERE THEY DO NOT NEED TO BE MOVED



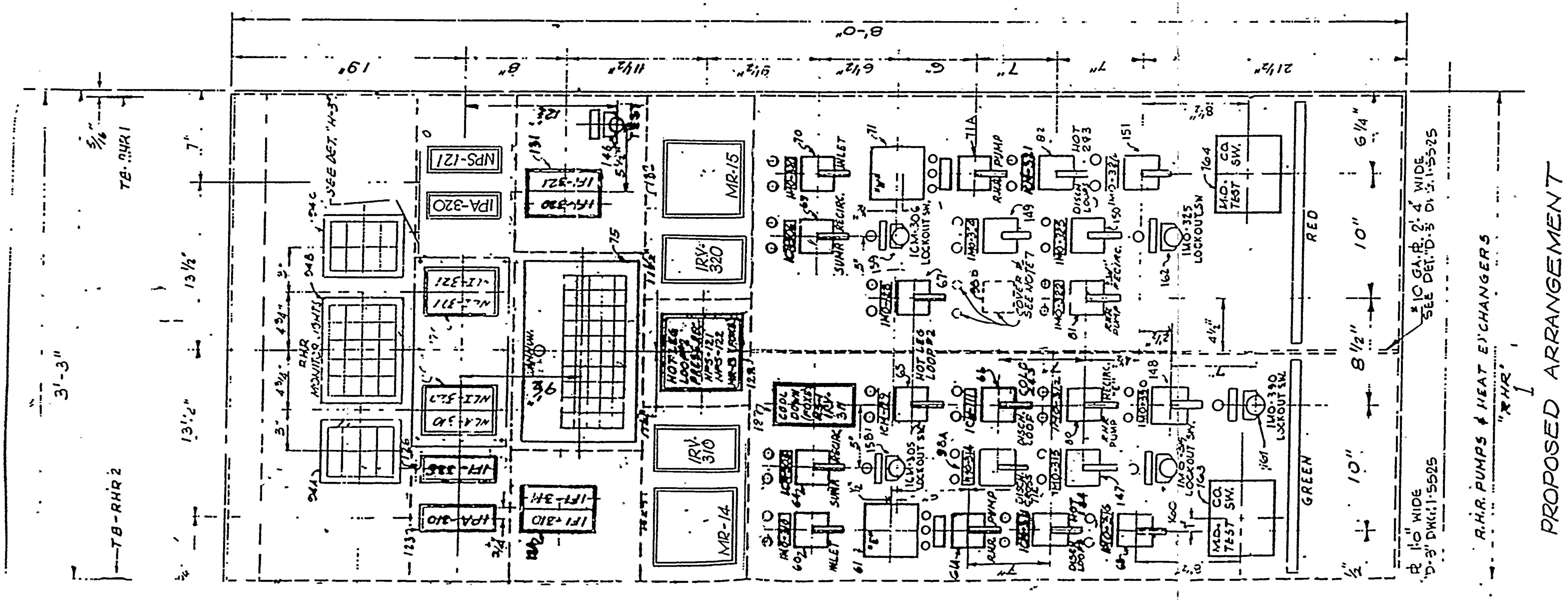
TI APERTURE CARD

Also Available On Aperture Card

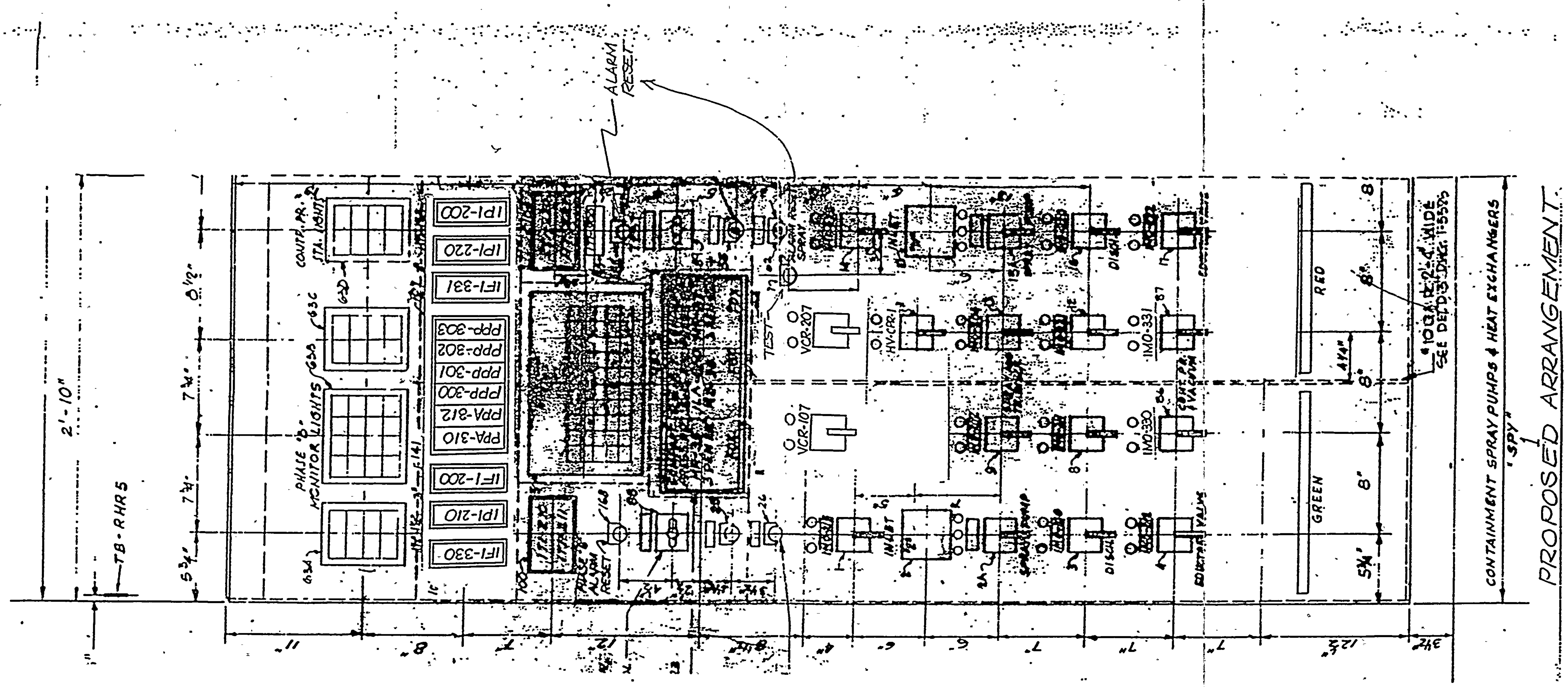
8701070384-02

TI
APERTURE
CARD

Also Available On
Aperture Card



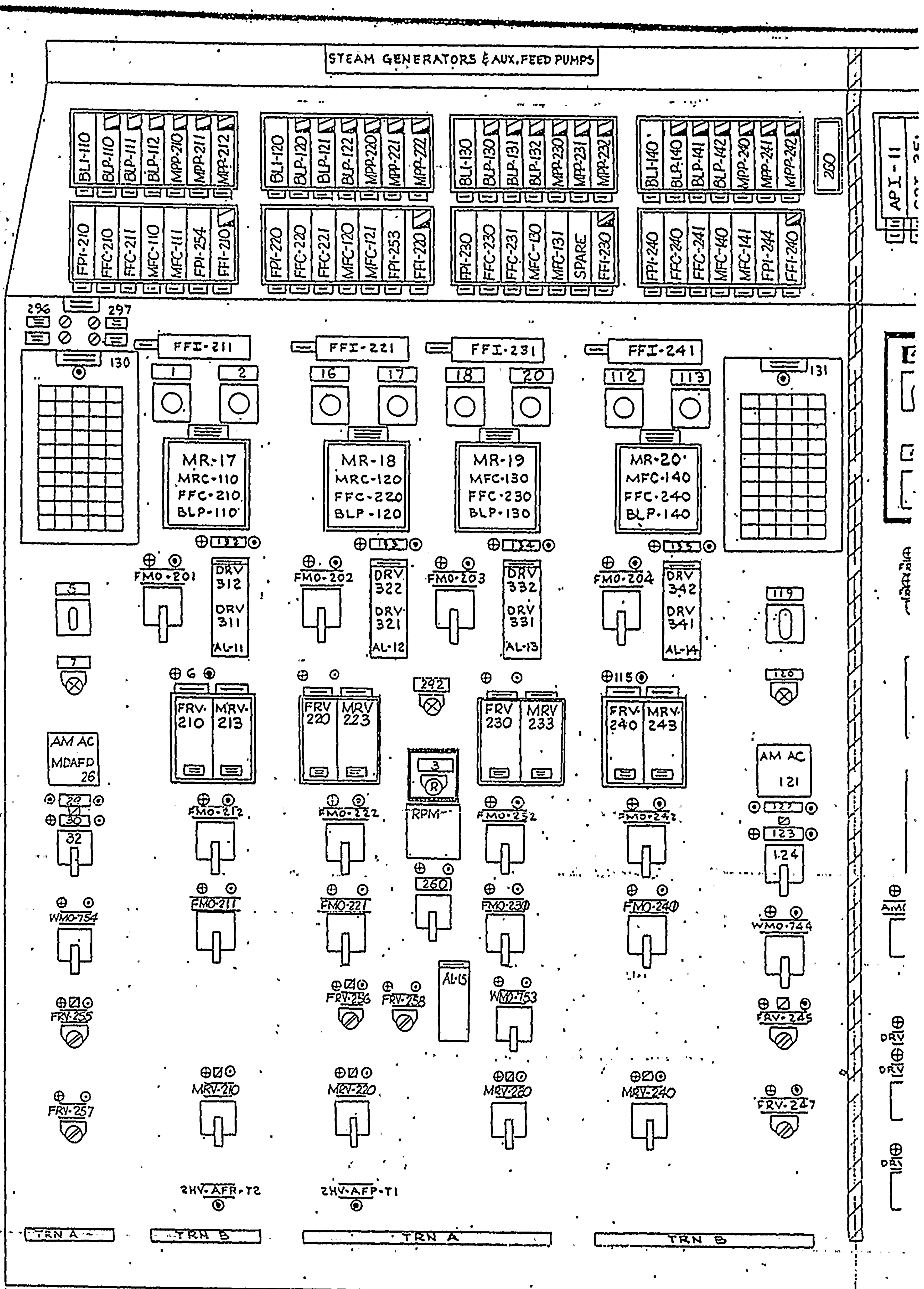
8701070384-03



TI
APERTURE
CARD

Also Available On
Aperture Card

8701070384-04



FLOOR EL. 633'-0"

MATCH LINE WITH "DTU" DWG 2-5531B

STEAM GENERATORS & AUX FEED PUMPS

("S G")

PANEL SEAM & BEND LINE

PROPOSED MODIFICATION

6-86

A B C D

TI
APERTURE
CARD

Also Available On
Aperture Card

8701070384-05

SAFETY TRAIN TAPE SAMPLES

TRAIN N

TRAIN A

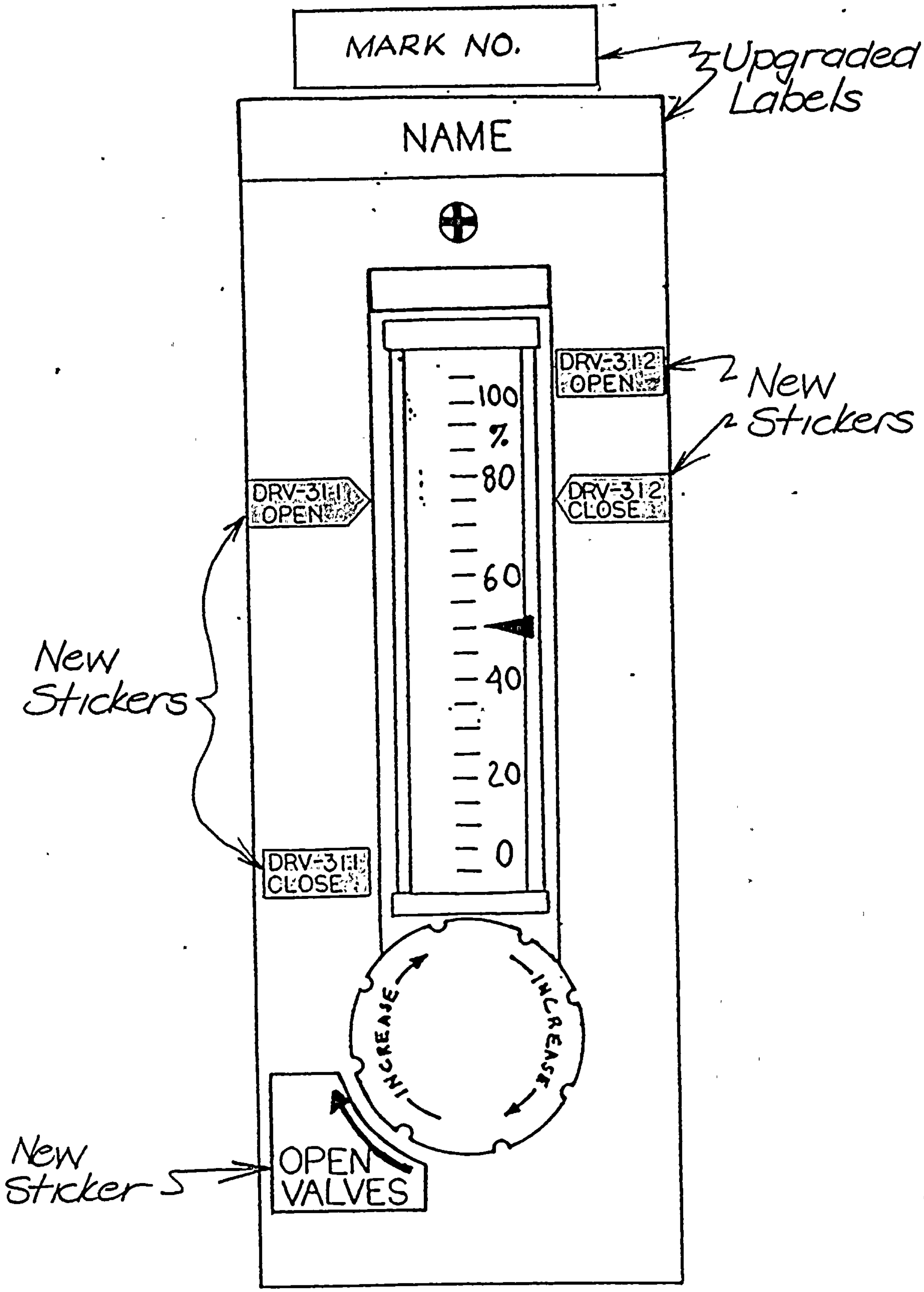
TRAIN B

Note: Train N Tape = Brown
" A " = Green
" B " = Red

RG1.97 STICKER SAMPLE

SEISMIC. QUAL. NOT REQ'D

NOT E.Q. BUT SHOULD BE

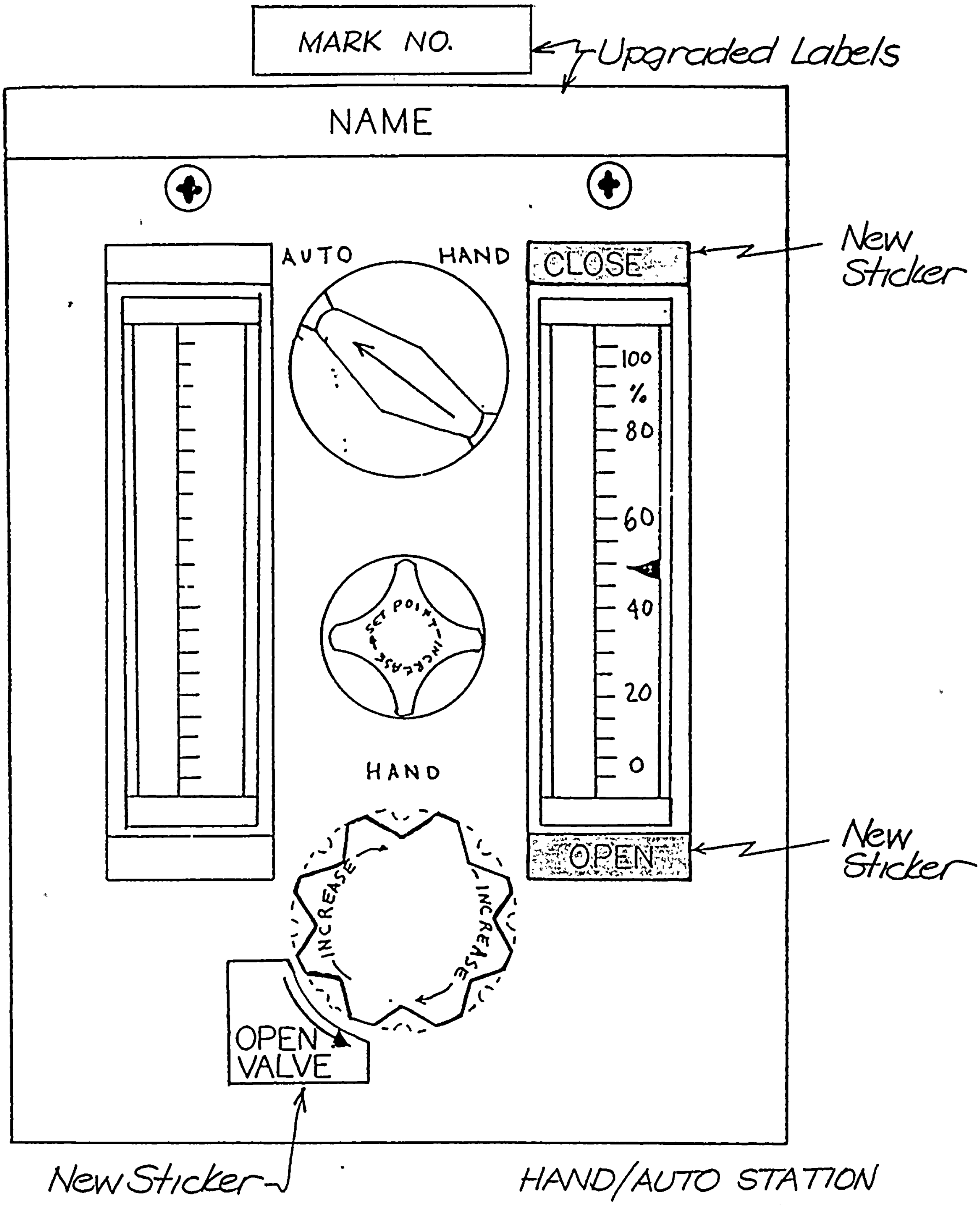


MANUAL STATION LABELING EXAMPLE

FULL SIZE

REF. DWG.

AEPSC - MED - I & C SECTION	BAILEY MANUAL STATION DIRECT ACTION	
PLANT D.C. COOK DCRDR	BY: EKL	DWG REV.

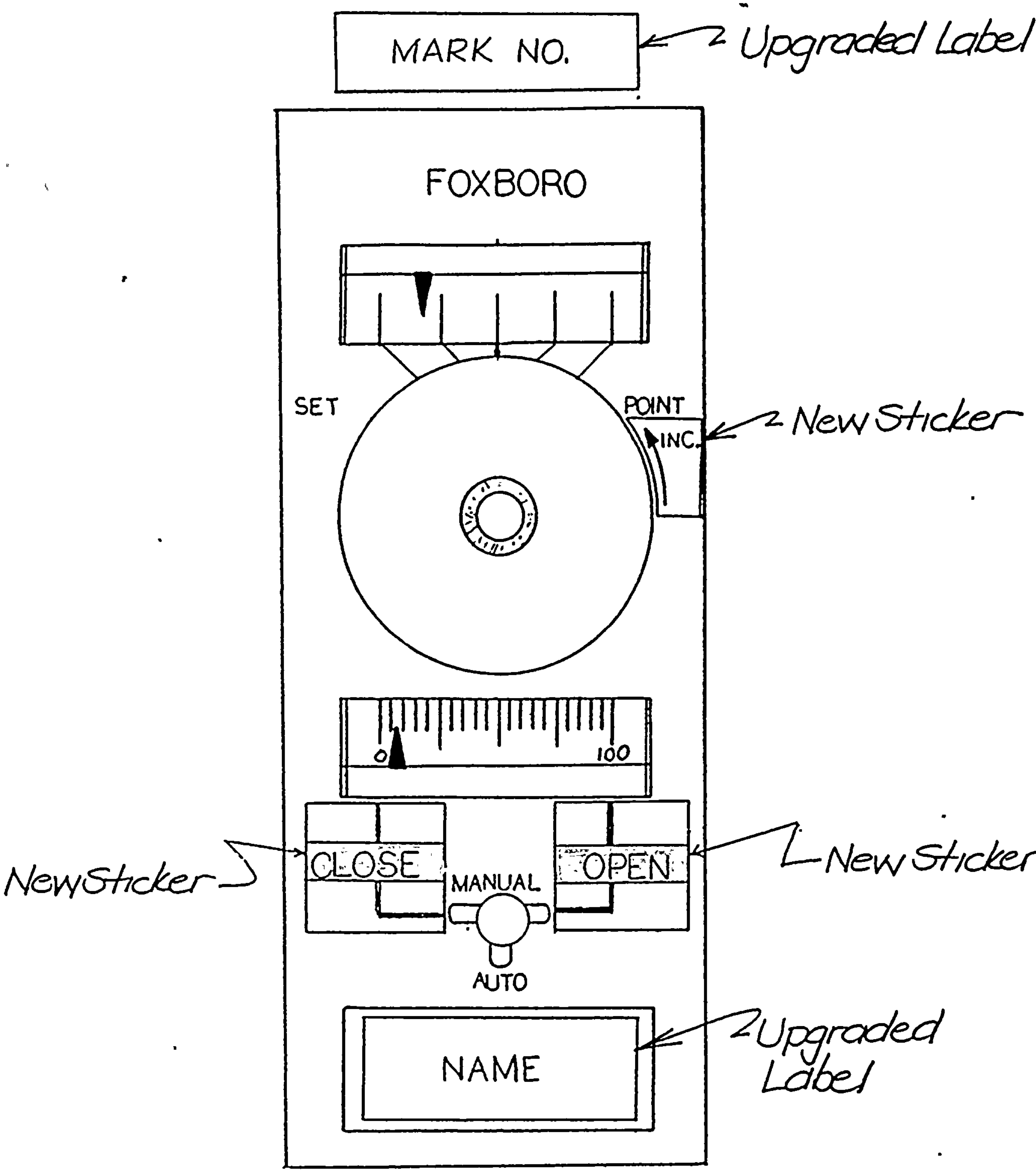


FULL SIZE

HAND/AUTO STATION LABELING EXAMPLE

REF DWG.

AEPSC - MED - I & C SECTION	BAILEY H/A STATION REVERSE ACTION		
PLANT D.C. COOK - DCRDR	BY: EKL	DWG	REV.



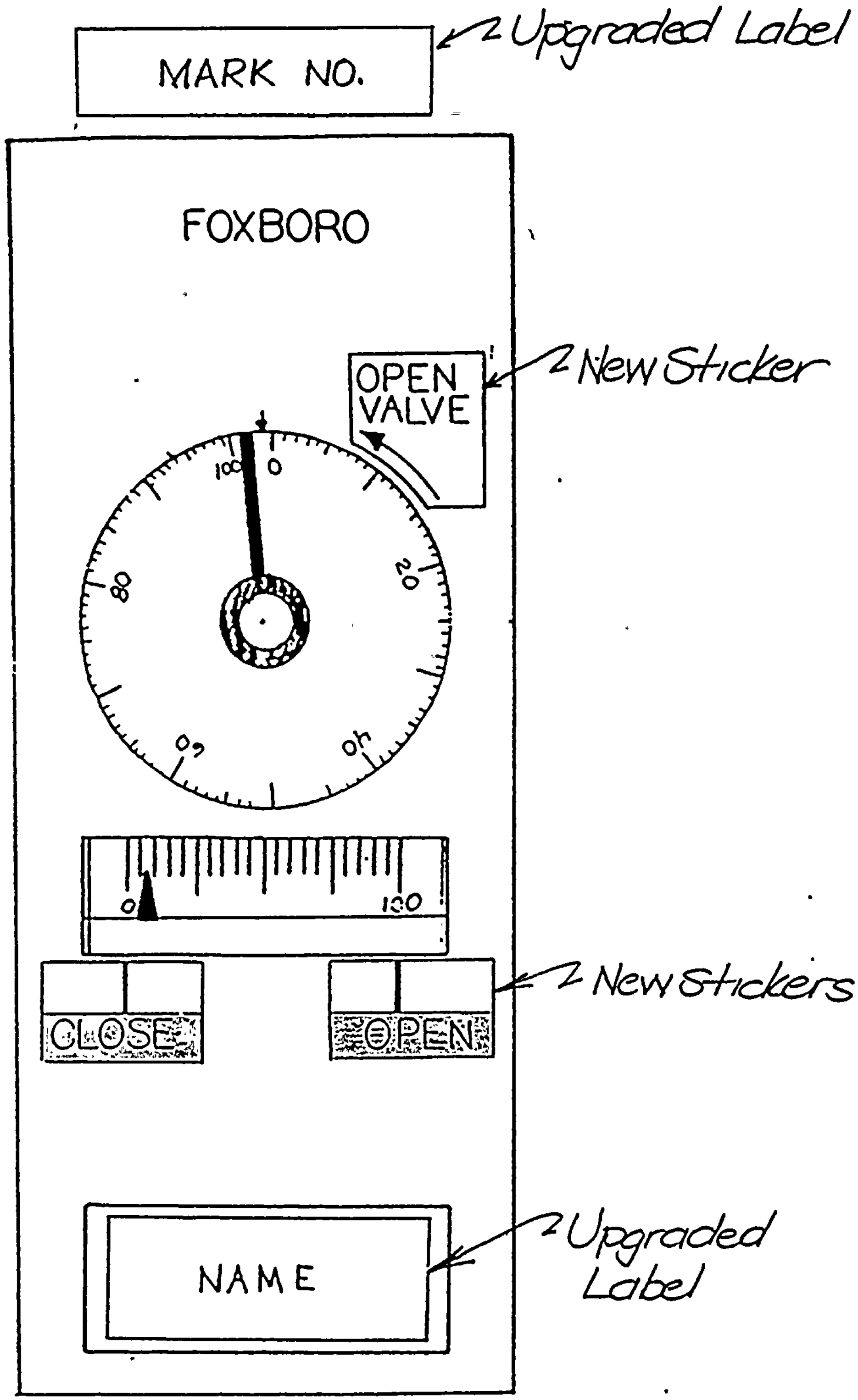
FULL SIZE

HAND/AUTO STATION LABELING EXAMPLE

REF. DWG.

* PANEL ITEM NUMBER

AEPSC - MED - I & C SECTION	FOXBORO H/A STATION DIRECT ACTION
PLANT D.C. COOK DCRDR	BY: EKL DATE: | DWG REV. SHEET 14 OF 20



FULL SIZE

MANUAL STATION LABELING EXAMPLE

REF. DWG.

AEPSC - MED - I & C SECTION	FOXBORO MANUAL STATION DIRECT ACTION	
PLANT D.C. COOK DCRDR	BY: EKL	DWG REV.

LABELING SAMPLE

3-Pen. Continuous Recorder

1-MR-70

REACTOR VESSEL LEVEL TRN B

RED	1-NLI-121	UPPER PLENUM	(68-120%)
GRN	1-NLI-111	NARROW RANGE	(0-120%)
BLU	1-NLI-131	WIDE RANGE	(0-120%)

VIBRATION & ECCENTRICITY *Nameplate*

LEFT ZONE	MIDDLE ZONE	RIGHT ZONE
0 E FPT BRG 1 VIB	4 W FPT BRG 1 VIB	8 E FPT ECCENTRICITY
1 E FPT BRG 2 VIB	5 W FPT BRG 2 VIB	9 W FPT ECCENTRICITY
2 E FEED PUMP BRG 1 VIB	6 W FEED PUMP BRG 1 VIB	10 SPARE
3 E FEED PUMP BRG 2 VIB	7 W FEED PUMP BRG 2 VIB	11 SPARE

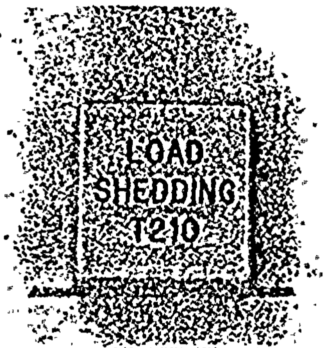
Points Description Label

1-SG-23 *Recorder Mark No.*

545143 *Chart Paper No.*

RECORDER LABELING SAMPLE

ENGRAVED WHITE LAMP CAP SAMPLE



USE: WHITE LAMP CAP - 3 LINES

FILE NAME TEMP: WHITECAPLINE3L/1B

FILE NAME PERM:

CUTTER: 0.020" **PLATE SIZE:** 0.9" X 0.9" **CHARACTER HT:** 1/8"

FORMAT DATE: 6-3-86

OTHER INFO: MACHINE SETUP: CENTER HOME, SPEED 64%, FEED: 11:00

DWELL 9:30 FILL W/ BLACK PAINT NOTCHES GO LEFT & RIGHT

TILE ENGRAVING SAMPLES

RHR PUMPS
MOTOR
INSTANT TRIP

USE: ANNUNCIATOR TILE 3 LINES WITH SEAL-IN-MARK

FILE NAME TEMP: 3LINEANN/ JOBSAVE7

FILE NAME PERM:

CUTTER: 0.010" PLATE SIZE: 0.725 X 1.03" CHARACTER HT: 1/10"

FORMAT DATE: 8-6-86

OTHER INFO: SET DEPTH TO CUT 0.016" STROKE. SPEED = 100%; FEED = A
FILL WITH BLACK PAINT. NOTCH UP. SHINY SIDE UP

RCP BUS 3
UNDERVOLT
CHANNEL 4

USE: STATUS & MONITOR LITE TILE 3 LINES TEXT CENTERED

FILE NAME TEMP: 3LINESTATCENTERED JOBSAVE7

FILE NAME PERM:

CUTTER: 0.015" PLATE SIZE: 0.725 X 1.03" CHARACTER HT.: 1/8"

FORMAT DATE: 7-22-86

OTHER INFO.: SET DEPTH TO CUT 0.020" STROKE; SPEED 100%; FEED = A
FILL WITH BLACK PAINT. NOTCH UP, SHINY SIDE UP

LABELING SAMPLES

FEEDWATER ANNUNCIATOR
NO. 215   30P-PAP

USE: ANNUNCIATOR, STATUS LITE, & MONITOR LITE NAME & NUMBER

FILE NAME TEMP: ANNNAME1X4.75

FILE NAME PERM:

CUTTER: 0.040" PLATE SIZE: 1" X 1 3/4" CHAR HT.= 0.25"

FORMAT DATE: 6-23-86

OTHER INFO: ADD 6 SPACES BETWEEN 2 GROUPS OF CHARACTERS ON BOTTOM LINE

CCW SURGE TANK
VENT VALVE
2-CRV-412

USE: CONTROL SWITCH NAMEPLATE - 3 Lines

FILE NAME TEMP: 3LINEC/SPLATE

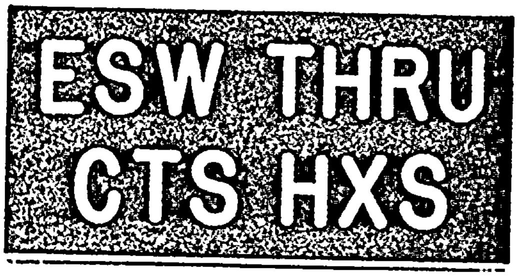
FILE NAME PERM:

CUTTER: 0.040" PLATE SIZE: 1 1/4" X 3" CHARACTER HT.: 1/4"

FORMAT DATE: 6-24-86

OTHER INFO.:

LABELING SAMPLES



USE: SYSTEM/SUBSYSTEM LABEL 2 LINES OF TEXT

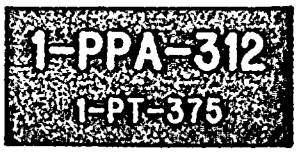
FILE NAME TEMP: 3/8CHAR.1&5/16HI JOBSAVE7

FILE NAME PERM:

CUTTER: 0.060 PLATE SIZE: 1 5/16 HI CHARACTER HT: 3/8

FORMAT DATE: 6-15-86

OTHER INFO: VARIABLE LENGTH LABEL. LABEL LENGTH DEPENDENT ON TEXT LENGTH.



USE: WESCHLER INDICATOR AEP & WESTINGHOUSE MARK NUMBER 2-LINE LABEL

FILE NAME TEMP: 3/4X11/2LINES2B&S

FILE NAME PERM:

CUTTER: 0.030" & 0.020" PLATE SIZE: 3/4 X 1 1/2" CHAR. HEIGHT: 3/16 & 1/8"

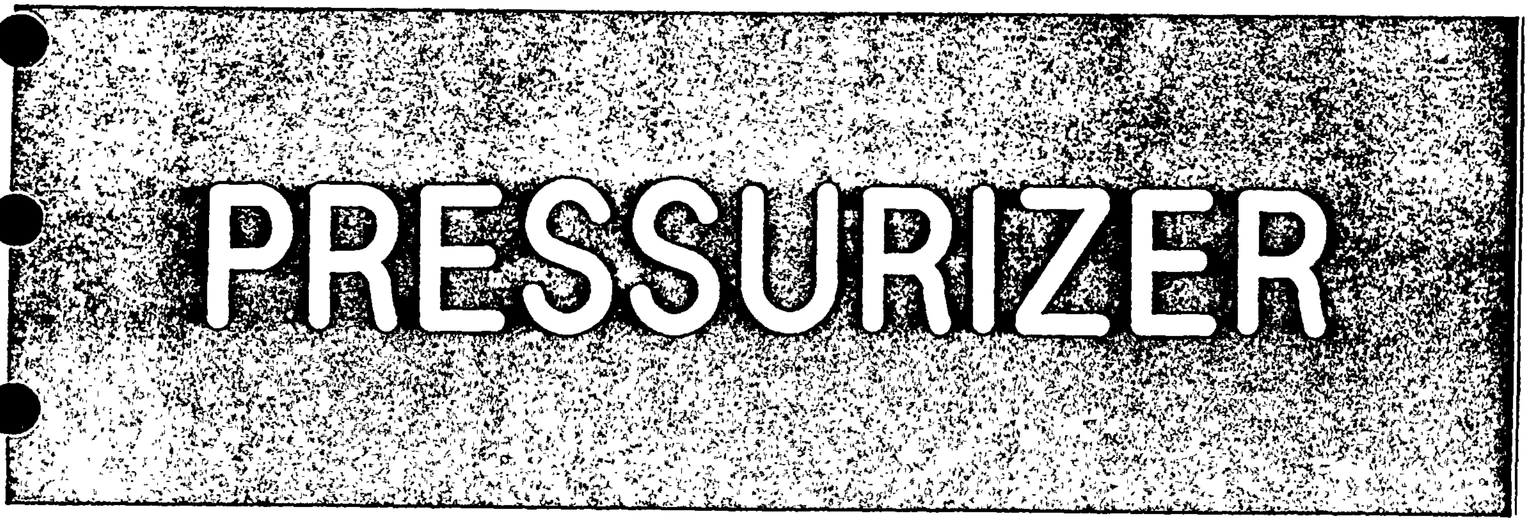
FORMAT DATE: 5-29-86

OTHER INFO: DUAL SPINDLE SETUP

GUIDELINE	N/A	Yes	No	Reference/Comment
6.6.4.2 STYLE Recommended character styles are shown in Exhibits 6.5-1 and 6.5-2.				
a. CHARACTER SELECTION (1) Labels should be prepared in capital letters.		X		
(2) The design of letters and numerals should be simple and without flourishes or serifs.		X		STYLE: UNIVERSE 55
b. CHARACTER WIDTH (1) Letter width-to-height ratio should be between 1:1 and 3:5.		X		ACTUAL: 3.03:5 WIDTH AVG. 11.7mm HEIGHT AVG 19.3mm
(2) Numeral width-to-height ratio should be 3:5 except for the numeral "4" which should be one stroke width wider and the numeral "1" which should be one stroke in width.	X			N/A
c. STROKE WIDTH—Stroke width-to-character height ratio should be between 1:6 and 1:8.		X		ACTUAL 1:7
d. SPACING (1) The minimum space between characters should be one stroke width.			X	VARIES WIDELY WITH EACH CHARACTER COMBINATION
(2) The minimum space between words should be one character width.		X		WILL BE NO PROBLEM WITH SPACING
(3) The minimum space between lines should be one-half of the character height.	X			N/A

FILE NAME: "PZRPNL"

CONTROL ROOM PANEL LABEL	REQUESTED	ACTUAL
SIGN HEIGHT/WIDTH	2 5/8" X 7 3/4"	2 5/8" X 7 3/4"
CHARACTER HEIGHT	3/4"	3/4"



LABELING SAMPLES

1-CFA-450

USE: WESCHLER INDICATOR MARK NUMBER 1-LINE LABEL

FILE NAME TEMP: STANDARD 3/4X1 1/2 SIGN

FILE NAME PERM:

CUTTER: 0.030 PLATE SIZE: 3/4 X 1 1/2" CHAR. HEIGHT: 3/16"

FORMAT DATE: 5-29-86

OTHER INFO:

1-IRV-310

USE: HAND/AUTO STATION MARK NUMBER 1-LINE LABEL

FILE NAME TEMP: 1/2X2-9

FILE NAME PERM:

CUTTER: 0.040" PLATE SIZE: 1/2 X 2" CHAR. HEIGHT: 0.25

FORMAT DATE: 5-29-86

OTHER INFO:

LABELING SAMPLES

USE: GE-AB-40 ELECTRICAL METER LABEL

FILE NAME TEMP: GEAB40METER

FILE NAME PERM:

CUTTER: 0.040" PLATE SIZE: 1/2 X 4 1/2" CHARACTER HT: 1/4"

FORMAT DATE: 8-12-86

OTHER INFO:

USE: PANEL SECTION IDENTIFIER 4 CHARACTERS ONLY

FILE NAME TEMP: PANELI.D. JOBSAVE7

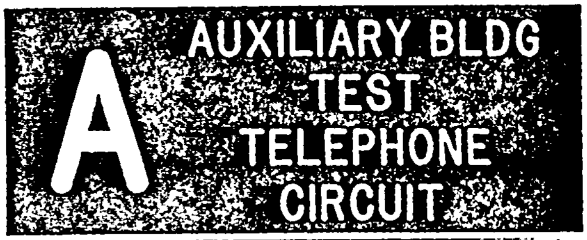
FILE NAME PERM:

CUTTER: ARROWS 0.020, TEXT 0.060 PLATE SIZE: 3/4 X 2 1/4" CHARACTER HT: 3/8"

FORMAT DATE: 8-27-86

OTHER INFO: WE SCORE

LABELING SAMPLES



USE: TEST TELEPHONE CIRCUIT IDENTIFIER

FILE NAME TEMP: TESTTELCKT JOBSAVE7

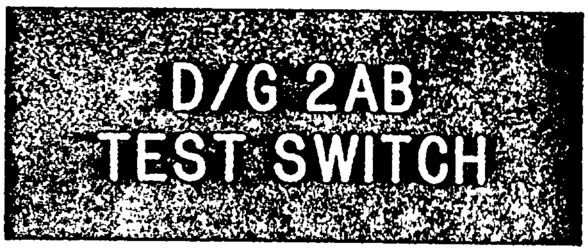
FILE NAME PERM:

CUTTER: 0.120 & 0.030 PLATE SIZE: 1 7/32 X 3" CHARACTER HT: 3/4 & 3/16

FORMAT DATE: 8-22-86

OTHER INFO: OK TO USE 1 1/4 X 3 STOCK. DUAL SPINDLE ENGRAVING

Rex



USE: CONTROL SWITCH NAMEPLATE - 2 LINES

FILE NAME TEMP: 2LINEC/SPLATE

FILE NAME PERM:

CUTTER: 0.040" PLATE SIZE: 1 1/4" X 3" CHARACTER HT: 1/4"

FORMAT DATE: 6-25-86

OTHER INFO:

COOK DCRDR - PSR PHOTOGRAPH DESCRIPTION

Photo 1:

1) Critical equipment tape - red demarcation line around Reactor Breaker control switch and indicating lamps.

2) Engraved white lamp cap between red and green lamps above Reactor Breaker control switch.

3) Safety Train Tape - horizontal green tape labeled Train A below Reactor Breaker control switch.

4) Recorder nameplate at top of recorder and immediately below safety train tape.

5) Foxboro Station labels - left side of picture, same elevation as Reactor Breaker control switch.

6) Yellow labels are information labels, yellow represents important or cautionary message.

Photo 2:

1) Panel boundary line - wide vertical olive green line on right side of picture.

2) System demarcation line - medium width vertical and horizontal olive green line on left side of picture.

3) Subsystem demarcation line - narrow width vertical olive green line at right center of picture.

4) Panel Label at top of picture.

5) Status and Monitor Lights nameplates at top left of picture.

6) Hierarchial labels on the three sets of vertical indicators and two ammeters.

Photo 3: Electrical mimic lines - black horizontal and vertical lines running between control switches and labels with voltage level designators.

Photo 4:

1) RG 1.97 Stickers - Post Accident Monitoring Instrumentation identifiers are the beige color stickers immediately adjacent to red and green indicating lamps.

2) Component nameplates immediately above control switches.

Photo 5:

1) Bailey Station labels - red and green stickers at sides of indicating scale.

2) Valve Mark No. Labels - at bottom of Bailey station and between red and green lamps above station.

Photo 6: View showing the Steam Generator/Aux Feedpumps panel at the center, with a part of the Delta Temp/Unit/Steam Dump panel on the left and the Main Feedpumps panel on the right. This overall view shows the hierarchial labeling and demarcation scheme, and the dark green border portion of the carpet at the bottom.

REX3(pd)

APPENDIX K

The attached personnel resumes are for AEP personnel shown on the DCRDR Program Organization Structure, Figure 1-5, page.1-12, Volume 1, that were not included in the original program plan.

William E. Arnold, Jr.

Senior Engineer, Instrumentation & Control Section

Fifteen years experience in instrumentation, control and protective systems, activities in fossil fuel power generation, and five years of management activity relating to the same industry.

EDUCATION:	B. S. Electrical Engineering, West Virginia Institute of Technology, 1967.
EXPERIENCE: 1984 to present	American Electric Power Service Corporation Senior Engineer, Instrumentation and Control Section - Basic responsibility is to provide support for the Cook Nuclear Plant Units 1 & 2 upgrades. Project items that make up this support are as follows: Responsible for fifteen small RFC's, performed 1984 FSAR Update for Section, prepared 1985 Budget forecast for Section, provided the I&C support for Unit 2 Cycle 6 fuel analysis, working on and directing the work of others on a multitude of problems relating to Human Engineering Deficiencies which will be solved by the DCRDR project.
1980 to 1984	Kentucky Power Company Plant Outage Coordinator in the Maintenance Department. In this capacity, I worked with the Maintenance Superintendent, Production Superintendent, and Canton Engineering Group in planning scheduled outages. During the outages, I coordinated the plant work force, contract labor, and other outside services. In between scheduled outages, I prepared the Five-Year Plan, coordinated and developed sections of the budget and assisted in outage report writing. I developed a very comprehensive Outage Preventative Maintenance Program for both units.
1977 to 1980	Performance Supervising Engineer - In this capacity, I supervised the Instrument Maintenance Supervisors and eleven technicians. Helped Instrument Maintenance Supervisors plan outage work and special help on electrical problems. Also, responsible for special project installation jobs and made design changes in process control systems.
1972 to 1977	Performance Engineer Senior - Performed the function of Instrument Maintenance Supervisor. Issued the work orders on a day-to-day basis to eight technicians and worked with the department head in planning emergency and scheduled outage work.

1967 to 1972

Performance Engineer - Worked in the New York office in The Electrical Engineering Division checking out the electrical prints for Big Sandy Plant - Unit 2, (Temporary Assignment). After prints were completed, I returned to Big Sandy Plant and worked with check-out crews on the instrumentation and controls for the Unit. Expertise developed in the following areas:

Control Systems:

250V-D.C. Control Systems - Centralized Batteries
Motor Control Centers
Valve Control Centers (Motor Operated)
600 Volt Breaker Control
4160 Volt Breaker Control
Turbine Controls (Electro Hydraulic Control)
A.C. Control Systems

Control System Indicators:

(Recorders and Panel Mounted Indicators)
L&N, Bristol, Bailey, Hagan, Foxboro, Westinghouse, General Electric, etc.

UNIVERSITY OF NOTRE DAME 1971 - 1973

Graduate Student, Teaching Assistant

Tutored undergraduates in thermodynamics and heat transfer.

Instructed experimental engineering lab for senior year mechanical engineers.

EDUCATION

NOTRE DAME UNIVERSITY BSME, 1971
NOTRE DAME UNIVERSITY MSME, 1974

Thesis: Natural Convection Mass Transfer Adjacent to Vertical and Downward Facing Inclined Surfaces.

Courses at the RPI Graduate Center, Hartford, CT

PUBLICATIONS

1. "Natural Convection Adjacent to Horizontal Surface of Various Platforms", W. R. Moran and J. R. Lloyd, ASME Journal of Heat Transfer, November 1984

2. "Natural Convection Mass Transfer Adjacent to Vertical and Downward Facing Inclined Surfaces", W. R. Moran and J. R. Lloyd, ASME Journal of Heat Transfer, August 1985

MEMBERSHIP

Professional Engineer (CT)
Tau Beta Pi (Honorary Fraternity)
Pi Tau Sigma (Honorary Fraternity)

Principal Engineer, Thermal Design Analysis Group 1975 - 1982

Provided transient and steady state thermal analyses of reactor internal components required for design and safety analyses.

Assessed and developed reactor core thermal performance limits. Included three dimensional fluid analysis combined with single and boiling heat transfer analyses to support the reload analysis for nuclear power plants.

Predicted primary system flow rate for nuclear reactors including combining system pressure losses with the pump performance to calculate expected flow rate and assessed the uncertainties associated with flow prediction using statistical analysis.

Provided thermal hydraulic analysis for a proposal to DOE for the development of a dry storage cask for nuclear fuel. Duties included material selection and natural circulation combined with radiation, convection, and conduction heat transfer analyses.

Prepared and presented a series of formal thermal hydraulic lectures to the operations and engineering staffs at six nuclear power stations.

PRATT & WHITNEY AIRCRAFT 1973 - 1975

Engineer, Power Plant Systems Group

Provided thermal analyses for rotating and static components in industrial and aircraft gas turbines. Involved use of compressible flow and convection heat transfer analyses.

[illegible]

WILLIAM R. MORAN
898 Clover Drive
Worthington, Ohio 43085

WORK EXPERIENCE

AMERICAN ELECTRIC POWER SERVICE CORPORATION 1986 - Present

Engineer, Nuclear Operations Division

Primary responsibility is interfacing with AEPSC Engineering, Design, Construction, and the D. C. Nuclear Plant on outage and long-range planning activities for both capitalized and expensed modifications and additions.

Current responsibilities include developing master service contracts, participating in human factors reviews, assisting with the development of a long-range planning program, and supporting the implementation of Requests For Change (RFCs).

COMBUSTION ENGINEERING, INC. 1975 - 1986

Project Manager, Nuclear Services Department 1985 - 1986

Developed business and managed work effort in the southeastern United States necessary to assure customer satisfaction. Identified available market and marketing strategies to penetrate the Westinghouse, Babcock and Wilcox, and General Electric Nuclear markets, placed C-E on approved bidders lists, prepared and priced proposals, managed financial and commercial aspects of contract, and reviewed final invoicing.

Consultant, Operating Reactor Support Group 1982 - 1985

As assistant Project Manager, provided general support of the initial St. Lucie Unit No. 1 Core Support Barrel (CSB) recovery program and assisted with the management of the entire program. (A $40+ million program lasting approximately 1 1/2 years.)

Coordinated formation of joint task force team between the Florida Power and Light Company and Combustion Engineering. Task force was formed to study, understand, and to reduce or eliminate the deterioration of steam generator tubes. Coordinated efforts among the engineering, chemistry, and inspection groups of both companies.

Assisted Florida Operating Reactor Project Office in the development and execution of a wide range of engineering solutions to operating, engineering, and licensing issues. Worked with Utility and C-E engineering groups to define potential solutions, formalize a proposal, and manage the commercial aspects of the task.

Assisted Project Management groups with the development and marketing of their particular project lines. Involved working with C-E engineering groups, outside vendors, and the utility.

James A. Schlunt

Electrical Engineer in Electrical Generation

Eight years of experience in engineerng electrical systems for electrical generation facilities (both coal fueled and nuclear fueled plants). One year experience in electrical substation engineering activities.

EDUCATION: BSEE, UNIVERSITY OF CINCINNATI, 1977

EXPERIENCE: American Electric Power Service Corporation
1982 to Present

1983 to Present — System Engineer in Electrical Generation as part of the engineering support for Indiana & Michigan Electric Company's D. C. Cook Nuclear Plant. Responsibilities include engineering of changes to electrical and electrical control systems, responding to IE and NRC Notices, and assisting Plant Operations.

Engineering change responsibilities include the following. Analysis and scoping of change, circuit design, specifying equipment and purchase of equipment. Coordinating project work between own section personnel, other AEPSC departments, and Plant Construction.

Response to IE and NRC Notices responsibilities include the following. Scoping of response, involving other sections if necessary, performing necessary research and/or analysis, and preparation of the response.

Assisting Plant Operations responsibilities include the following. Supporting plant personnel in the event of an emergency, answering question from plant concerning electrical systems, performing reviews of plant procedures, performing reviews of Plant Problem Reports, providing input for Plant Problem Report evaluations, and otherwise providing support to plant personnel.

1982 to 1983 — Electrical Engineering in Electrical Station Projects Section. Work involved engineering of electrical substations. Responsibilities included development of substation one-line and location plan, specification of all substation equipment, working closely with substation design group in development of substation design, and coordinating engineering for substation protection and metering. Also developed detail cost estimate for substation. Work included assisting Regional Planning on system design changes.

1977 to 1982 — <u>Indiana & Michigan Electric Company, Tanners Creek Generating Plant</u>
(Subsidiary of AEP)
Performance Engineer in Performance Department. Responsibilities included the following. Making minor design modifications to plant controls and instrumentation, including numerous control panel changes, evaluating condition of plant controls and instrumentation systems and maintenance of control and instrumentation systems. Performed and evaluated tests on plant's major equipment to determine efficiency and proper working order. Supervised instrument mechanics during unit startups and in support of instrument foreman. Provided coordination for projects originating from AEPSC offices with plant personnel.

<u>CO-OP EXPERIENCE:</u> <u>Cincinnati Gas and Electric Company Co-Op Through University of Cincinnati</u>
1973 to 1977 — Work varied from hands on experience as a helper in plant maintenance department at Beckjord Generating Station to assisting in engineering activities concerning construction of Miami Fort Generating Station Unit's #7 and 8. Also did layout work for substation protection and layout work for residential distribution.

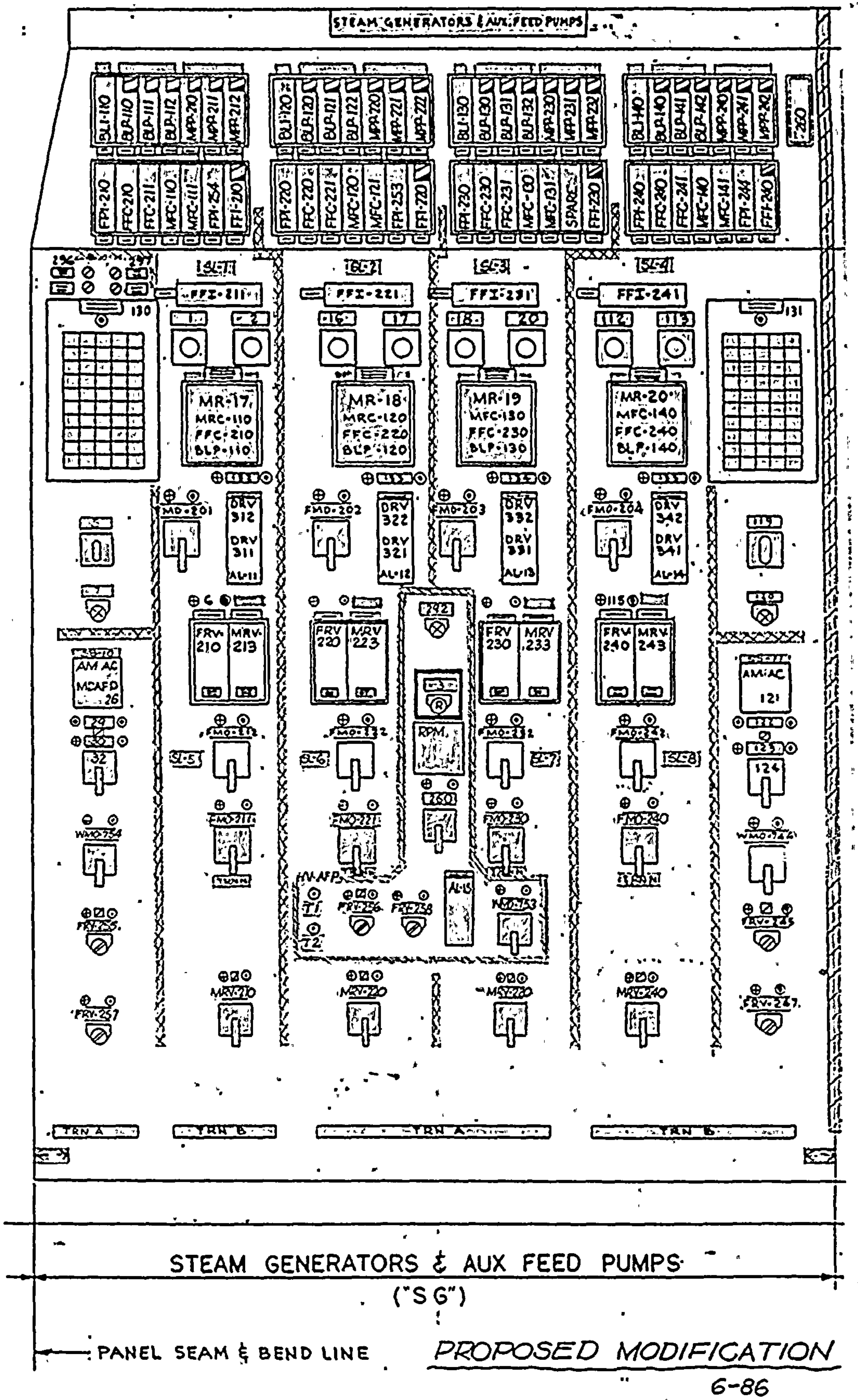
<u>PROFESSIONAL AFFILIATION</u> — Institute of Electrical and Electronic Engineers

APPENDIX J

DONALD C. COOK NUCLEAR PLANT
UNITS 1 AND 2

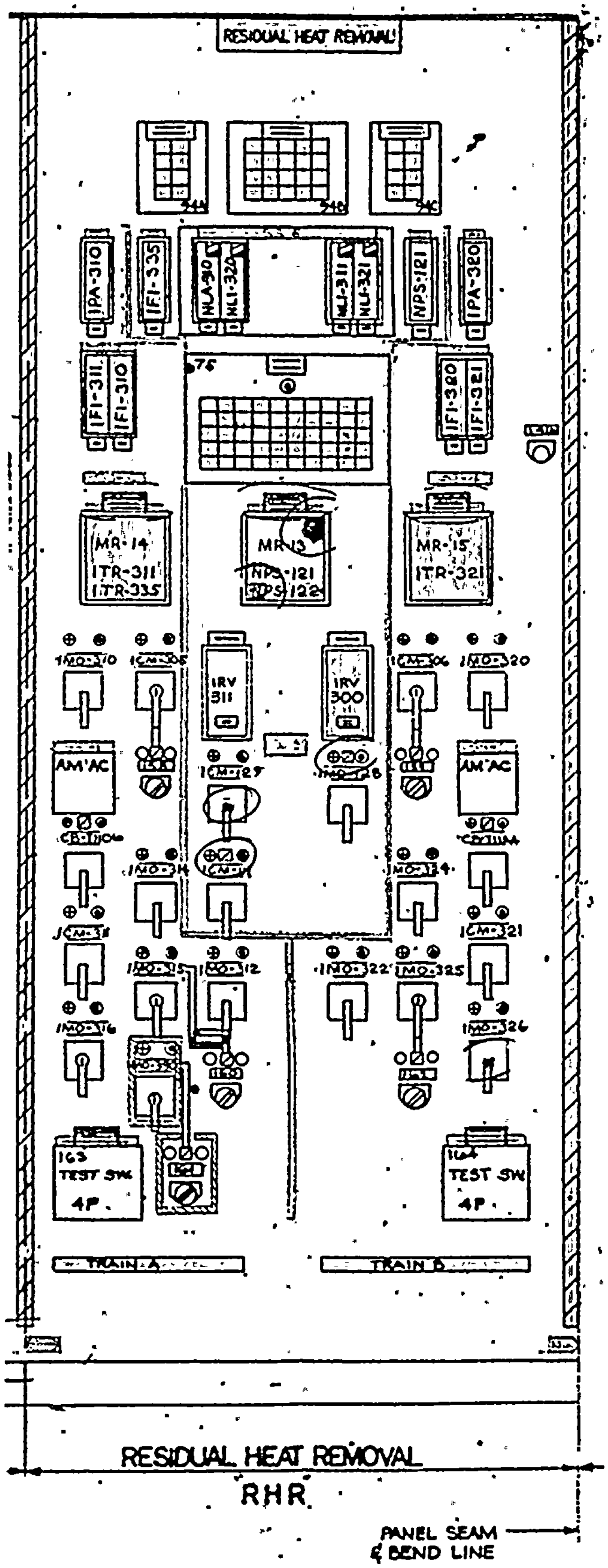
CONTROL ROOM IMPROVEMENTS
PHOTOS, SAMPLES, DRAWINGS

Cook DCRDR - Corrective Action Plan Example



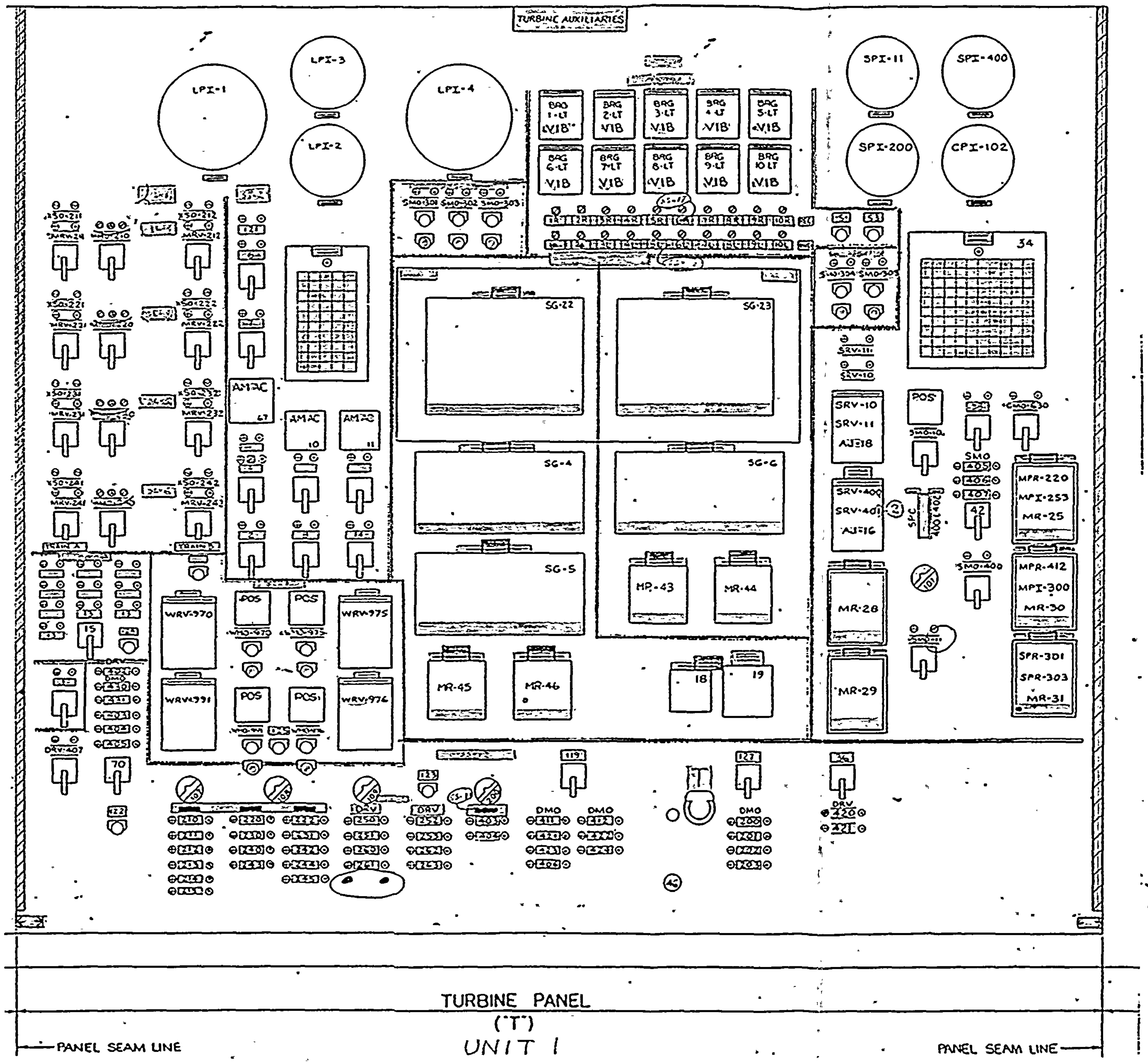
Items shown in color have received/will receive some enhancement or modification

Cook DCRDR - Corrective Action Plan Example



Items shown color have received/will receive some enhancement or modification

Cook DCRDR - Corrective Action Plan Example:



Items shown in color have received/will receive some enhancement or modification

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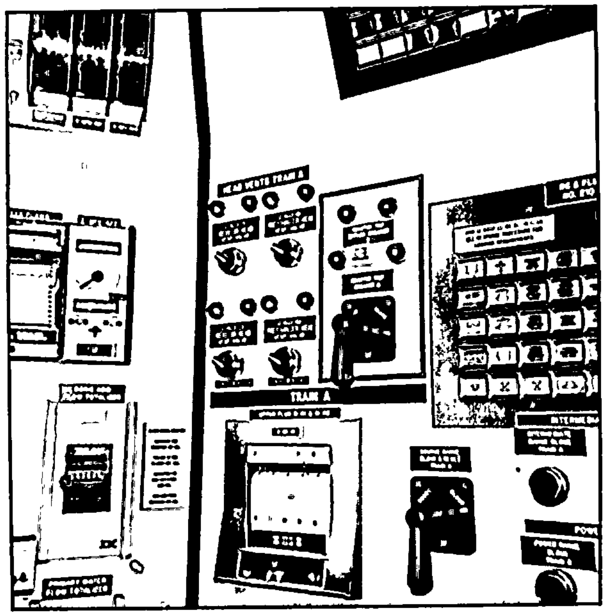
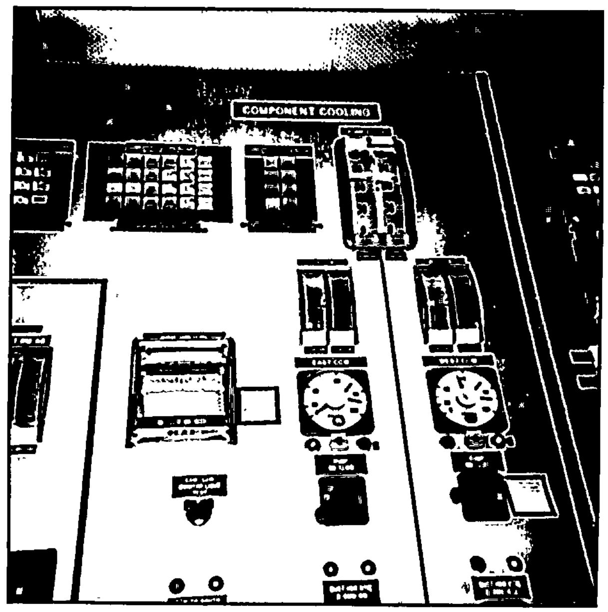
TI APERTURE CARD

Also Available On Aperture Card

UNDERSIZED
DOCUMENTS

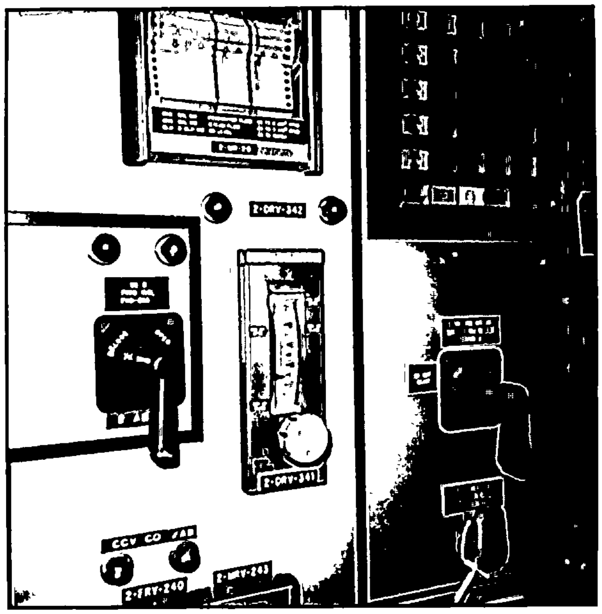


1 ①

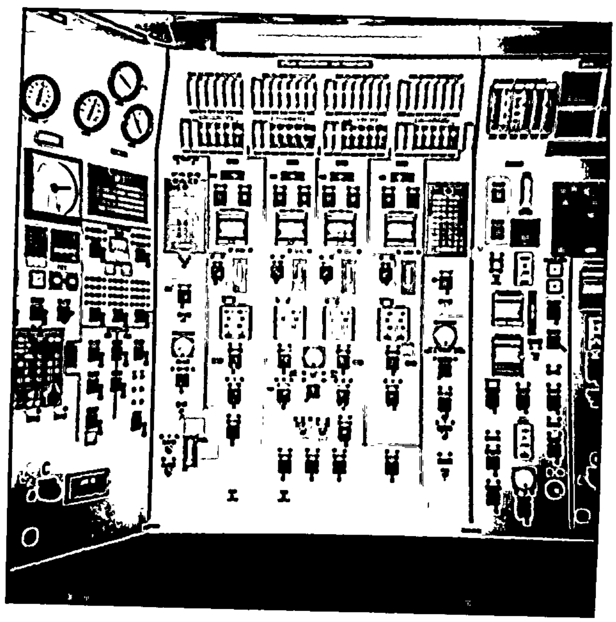


2 ②

UNDERSIZED DOCUMENTS

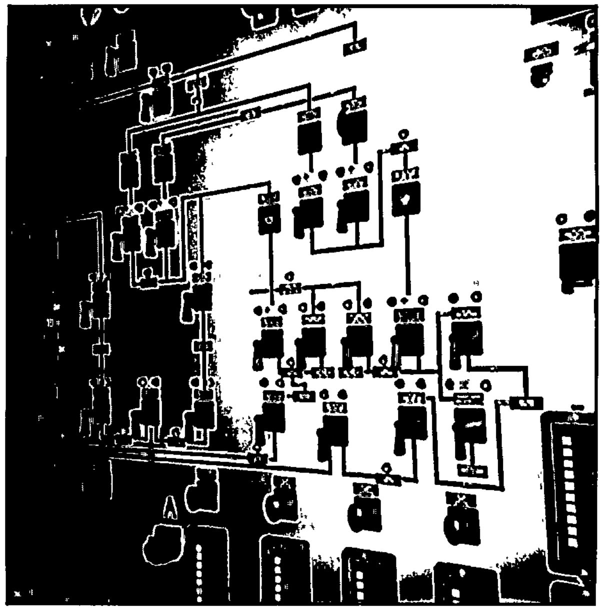


5 (5)



6 (6)

UNDERSIZED
DOCUMENTS



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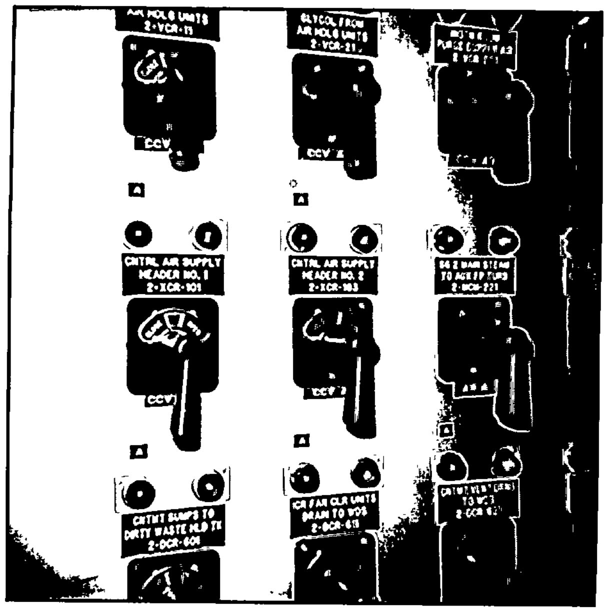

4 (4)