CONTROL ROOM DESIGN REVIEW

DETAILED PROGRAM PLAN AND

IMPLEMENTATION GUIDELINES

FOR

CAROLINA POWER AND LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT

UNITS 1 AND 2

DECEMBER, 1984

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SECTION 1.0 REVIEW PLAN

1.1 INTRODUCTION

This Program Plan has been prepared in response to NUREG-0737, Clarification of TMI Action Plan Requirements, para. I.D. 1, and paragraph 5.2.a of NUREG-0737 Supplement 1, Requirements for Emergency Response Capability (Generic Letter No. 82-33). This program plan describes the Control Room Design Review (CRDR) that will be conducted for the Brunswick Steam Electric Plant (BSEP), Units 1 and 2, owned and operated by Carolina Power and Light Company (CP&L). The format of this report follows that recommended by NUREG-0700, Guidelines for Control Room Design Reviews, published September 1981, paragraph 5.1, as follows:

1. Review Plan

2. Management and Staffing

3. Documentation and Document Control

4. Technical Approach (Review Procedures)

5. Assessment and Design Solutions

This program plan addresses the acceptance guidelines stated in Section 2 of the October 1981 Draft of NUREG-0801, Evaluation Criteria for Detailed Control Room Design Review, and in Section 2.0 "Planning Phase" of NUREG-0700. The BSEP CRDR Program Plan also recognizes and is responsive to each of the nine criteria by which the NRC evaluates CRDR Program Plan submittal by licensees. Table 1 identifies each of these evaluation criteria, and the specific section(s) of this Program Plan that describes compliance with each criterion for the BSEP CRDR.

TABLE 1
COMPLIANCE WITH CRDR PROGRAM PLAN EVALUATION CRITERIA

Criteria	BSEP CRDR Program Plan Section Demonstrating Compliance
1. Establishment of a qualified multidisciplinary review team.	Section 2.0
2. Function and task analyses to identify control room operator tasks and information and control requirements during emergency operations.	Section 3.4
3. Comparison of display and control requirements with a control room inventory.	Section 3.5
4. Control room survey to identify deviations from accepted human factors principles.	Section 4.3
5. Assessment of HEDs to determine which HEDs are significant and should be corrected.	Section 4.0
6. Selection of design improvements.	Section 4.3
7. Verification that selected design improvements will provide necessary correction.	Section 4.2
8. Verification that improvements will not introduce new HEDs.	Section 4.2
9. Coordination of control room improvements with changes from other programs such as SPDS, operator training, Reg. Guide 1.97 instrumentation, and upgraded EOPs.	Section 1.2

1.2 BACKGROUND

1.2.1 General

This Program Plan report describes how CP&L plans to complete a Control Room Design Review (CRDR) for Brunswick, Units 1 and 2. The CRDR is part of a broad effort within the nuclear industry to evaluate the adequacy of control rooms to support safe and effective operations. Guidance for the CRDR has been provided by the Nuclear Regulatory Commission (NRC) in the form of various NUREGs and regulatory guides. CP&L has used all relevant guidance in developing this Program Plan and has dedicated the necessary resources to this CRDR to ensure success of the project.

1.2.2 Integration

Although the CRDR is specifically directed toward evaluating the control room (CR) (including the remote shutdown panel), CP&L recognizes interfaces between the CRDR and other related activities, such as the design of a Safety Parameter Display System (SPDS), implementation of Reg. Guide 1.97 requirements, development of Emergency Operating Procedures, operator training, implementation of Emergency Response Facilities and the inclusion of post-accident monitoring (PAM) instrumentation. The organization of this plan considers coordination of the CRDR with these related efforts and reflects the balanced and orderly approach CP&L has followed to implement all NUREG-0737 requirements.

1.2.3 Brunswick

The Brunswick Steam Electric Plant, consist of two General Electric boiling Water Reactors (BWR-4) which are located in Southport, North Carolina. Unit 2 began commercial operation in November of 1975 and Unit 1 in March of 1977.

1.2.4 CR-1580 Review

CP&L conducted a review of the Brunswick Units 1 and 2 control rooms in 1981, in accordance with the guidance provided in NUREG/CR-1580. In the current effort, the earlier review will be updated to the current NUREG-0700 standards.

1.2.5 Program Plan Objectives

This Program Plan provides a means to ensure that an adequate CRDR will be conducted. It will also clearly define the roles and responsibilities of the review team members as defined in NUREG-0737.

1.3 CRDR PROGRAM STRUCTURE

1.3.1 CRDR Phases

The CRDR is to be conducted in three phases as follows:

a. Phase I - Project Planning

The objective of this first phase was to develop a plan for conducting the review that describes project milestones, schedules, review methods, personnel responsibilities, and project interfaces. Submission of this Program Plan to the NRC completes the planning phase.

NRC staff comments upon review of this Program Plan will be taken into account in implementing the plan. Any requirements or changes to the plan will be documented in the final summary report on the CRDR.

b. Phase II - Review and Assessment

The second phase of the CRDR will involve collection, reduction and analysis of data pertaining to the adequacy of the CR design from a human factors perspective, and assessment of any human engineering discrepancies (HEDs) identified during this process. This assessment procedure will include:

1) A determination of the error potential and consequences of each HED

2) Identification of HED resolutions

3) Assurance that no additional HEDs will be introduced as a result of these resolutions.

At the conclusion of Phase II, a Final Summary Report describing the methods, results and implications of the CRDR will be submitted to the NRC. This report will also describe CP&L's plans and schedules for correction of the HEDs at Brunswick.

c. Phase III - Implementation

The final phase in the CRDR will be to implement the resolutions, or backfits, for the HEDs. Backfit specifications will be reviewed prior to implementation to ensure that they fulfill the CRDR recommendations. Correct implementation will also be verified.

Figure 1-1 outlines, in general, the phases, and task flow for conducting the CRDR. A brief discussion of the activities conducted in each phase of the review is described below. For more detailed descriptions of the objectives, approach, data collection methodology, and specific evaluation methods, refer to Section 3.0, Technical Approach of this plan.

1.3.2 Project Planning

This plan is the output of the Project Planning Phase. Acceptance of this document essentially concludes Project Planning. The guidelines provided in NUREG-0700 and draft NUREG-0801 form the primary basis of this document.

1.3.3 Control Room Review

The CR review and assessment phase is subdivided into the following six tasks:

- o Operating Experience Review
- o Conduct Surveys
- o System Functions and Task Analysis
- o Control Room Inventory
- o Verification of Task Performance
- o Validation of Control Room Functions

The six tasks are described below:

1.3.3.1 Operating Experience Review - This task is composed of operator interviews where a significant number of operators will be interviewed. Interviews consist of general and detail questions on plant operations.

1.3.3.2 Conduct Control Room Surveys - Much of the detailed assessment of the control room is conducted via a total of 14 surveys. The surveys to be conducted are:

- o Ambient Noise - Direct measurements of noise levels are taken and compared to individual guidelines items.

- o Illumination - Measurements are taken under various ambient conditions (e.g., emergency lighting) and are compared to individual guidelines items.

- o CR Environment (HVAC) - Assessments are made by direct measurement of the parameters listed below and comparison of the data to the NUREG-0700 guidelines:
  - Temperature
  - Humidity
  - Ventilation

- o Workspace - The CR workspace is evaluated by checklist survey and direct measurements which address the following:
  - Workspace Arrangement
  - Document Organization, Use and Storage
  - CR Access

- o Conventions - The CR is evaluated by survey for the conventions listed below and data are subsequently compared to NUREG-0700 guidelines:
  - Coding methods (color, shape, pattern, etc.)
  - Standardization of abbreviations and acronyms
  - Consistency of control use
  - Consistency of display movement or indication

- Controls - Controls are evaluated by measurements, observations and other assessment methods.

- Displays - Displays are evaluated by measurements, observations or other assessment methods.

- Computer System - Computer systems are assessed by measurements, observations or other assessment methods.

- Emergency Equipment - Data are collected by walk-throughs, emergency garment use, and speech intelligibility analysis.

- Labels and Location Aids - Labels and location aids are evaluated by measurements, observations and other assessment methods.

- Annunciator System - The annunciator system is evaluated by measurements, observations or other assessment methods.

- Anthropometrics - Reach and visual access to CR components are analyzed, given physical configuration of boards, panels, layout, etc. The data are subsequently compared to checklist item requirements.

- Communications - Communications systems are evaluated by guidelines and speech intelligibility of communications modes is analyzed.

- Maintainability - Checklist and questionnaire data concerning operator-maintained components (trend recorders, bulbs, etc.) are collected.

Survey data are collected from preconstructed task plans which contain checklists, interview forms, and methods for direct measurements of CR parameters, such as noise levels, light levels, etc. The guidance for the conduct of the survey is found in NUREG-0700.

1.3.3.3 System Functions and Task Analysis (SFTA) - The task analysis procedure is a descriptive process which extracts generic operator action and information requirements from systems function data, converts these requirements to a plant-specific level, and documents the results in a tabular format for use as an input into the Verification of Task Performance Capabilities and the Validation of Control Room Functions.

These procedures are organized into three major activities which are:

1. Generate a list of plant-specific actions and information requirements for each task, organized by task.

2. Reorganize the listing so that all action requirements of a given type and all information requirements of a given type are collected together. Type refers to a group of action or information requirements which all have the same system, subsystem, plant component, and parameter.

3. Summarize each action type and each information type in list form such that required ranges, values and precisions or other parameteric information is summarized for each parameter.

1.3.3.4 Control Room Inventory - A comprehensive inventory of control room instrumentation, controls, and other equipment will be developed. The inventory will include the necessary information (e.g. type of component, application/function, range, divisions, location) required to verify the availability of the required displays and controls (see paragraph 1.3.3.5). The inventory process is described in detail in paragraph 3.5 of this plan.

1.3.3.5 Verification of Task Performance Capabilities - This analysis is composed of two subtasks: Verification of instrument/control availability, and verification of human engineering suitability. The first, verification of availability, determines whether the instrumentation and controls required by the control room operator are actually available to the operator for completion of the tasks identified in the task analysis. The control room inventory and the task action and information requirements from the SFTA are the two major inputs to this task. The SFTA documentation describes the instruments and controls and their main characteristics which are necessary for the required tasks, whereas the control room inventory lists the components which are actually available. A comparison of these lists will determine if a required instrument or control is not available.

The second subtask, verification of human engineering suitability, will examine the components for characteristics which may degrade operator task performance, and which are not necessarily apparent in a control room survey. This analysis will focus on practical suitability considerations such as task required ranges, values, precisions or response times.

The primary products of the verification phase are the documentation of missing task related instrumentation and/or controls and the identification of problems regarding component suitability.

1.3.3.6 Validate Control Room Functions - This involves analysis of workload and distribution of workload for operators for specific tasks and event sequences. The primary means of analysis are traffic analysis and walk and talk-through simulation of task sequences. Checklists will be used to aid in the validation of CR functions.

1.3.4 Assessment and Design Solutions

The basic procedure to be employed in assessment and in identifying and selecting enhancements and design solutions is based on NUREG-0700, exhibit 4-2, and the process discussed in NUREG-0801 (draft-Oct. 1981).

1.3.4.1 Assess Discrepancies - Assessment is discussed in Section 4.0 of this plan. In general, the assessment process is outlined below:

- o Assess extent of deviation from NUREG-0700 guidelines
- o Estimate increase in human error for the discrepancy
- o Determine if discrepant component is safety function related
- o Determine if errors in using discrepant component(s) could lead to violation of tech specs or unsafe operation
- o Assignment of category and priority, based on the above.

1.3.4.2 Analysis of Correction by Enhancement - Discrepancies selected for correction are first examined for possible correction by enhancement (labeling, demarcation, procedure aids, etc.). Where it is determined that correction by enhancement is not possible, the discrepancy is analyzed for correction by design alternatives.

1.3.4.3 Analysis of Correction by Design Alternative - Design alternatives will be identified by examining the HED, referring to task analysis data, and identifying potential constraints (e.g., availability of equipment, Reg. Guide 1.97, etc.). The acceptability of design alternatives will be verified by reapplication of NUREG-0700 Guidelines and task analysis.

1.3.4.4 Assessment of Extent of Correction - For all HEDs selected for correction, the extent of correction (by enhancement or redesign) will undergo evaluation. In addition, the correction will be reviewed to ensure that no new HEDs are introduced into the control room as a result of the change.

1.3.5 Implementation

The final phase in the CRDR will be to implement the corrective actions for the HEDs. As suggested in NUREG-0801, the implementation of corrective actions will be scheduled according to the respective priorities of the HEDs (see paragraph 4.2). Since the implementation process is expected to extend beyond the CRDR, CP&L intends to maintain an ongoing review activity to ensure that all HED resolutions are properly implemented.

As part of this ongoing activity, all HED resolutions will be evaluated to ensure that each resolution is completed and adequate. This activity will also ensure that no new HEDs will have been introduced into the control room as a result of the resolution. If, for some reason an HED cannot be fully corrected, CP&L will assess the potential impact on operator performance. This assessment will be documented and submitted as an amendment to the Final Summary Report.

The implementation process is discussed in Section 7.0 of this plan.

1.4 GLOSSARY OF TERMS

Since there are differences in usages of terms (even among practitioners within the same field), the following definitions are provided to reduce ambiguity.

CONTROL ROOM: For the purpose of this plan, the control room is defined to include the primary operating area of the main control room and the remote shutdown panel.

CONTROL ROOM DESIGN REVIEW: The control room design review as required by NUREG-0660, Item I.D.1 and implemented in accordance with NUREG-0700.

CRDR PROGRAM PLAN: A work plan designed to provide high-level guidance on the scheduling and performance of the CRDR.

ENHANCEMENTS: Surface modifications that do not involve major physical changes, for example, demarcation, labeling changes and painting.

FINAL SUMMARY REPORT: Final summary report of the results of the CRDR as required by NUREG-0660, Item I.D.1 and in accordance with Generic Letter 82-3.

FUNCTION: An activity performed by one or more system constituents (people, mechanisms, structures) to contribute to a goal.

FUNCTIONAL ALLOCATION: The distribution of functions among the human and machine constituents of a system.

FUNCTIONAL ALLOCATION REVIEW: The examination of system goals to determine what function they require; also, examination of the required functions to determine how the functions may be allocated and executed; primarily, the identification of established functions and examination of how they are allocated and executed.

HUMAN ENGINEERING DISCREPANCY (HED): A departure from some benchmark of system design suitability for the roles and capabilities of the human operator.

HED ASSESSMENT TEAM (HEDAT): Those individuals of the CRDR Team who have the responsibility for review and assessment of all HED reports.

HUMAN FACTORS ENGINEERING: The science of optimizing the performance of human beings, especially in industry; also, the science of designing equipment for efficient use by human beings.

OBJECTIVE (MISSION, GOAL): The end-product as a result of a coordinated group of activities.

LICENSED OPERATOR: Any individual currently licensed by the NRC who manipulates a control or directs another to manipulate a control that directly affects reactivity (SRO or RO).

SIGNIFICANT HEDs: Those HEDs which, alone or in combination with other HEDs, may (in the judgement of the HEDAT) increase the potential for operator error to an unacceptable level and/or may have serious impact on system performance.

SUBTASK: An activity (action step) performed by a person (or machine) directed toward achieving a single task.

SYSTEM: A whole which functions as a whole by virtue of the interdependence of its parts: an organization of interdependent constituents that work together in a patterned manner to accomplish some purpose.

SYSTEM ANALYSIS: Examination of a complex organization and its constituents to define (usually, but not necessarily, in mathematical terms) their relationships, and the means by which their actions and interactions are regulated to achieve goal states.

TASK: A specific action, performed by a single system constituent -- person or equipment -- that contributes to the accomplishment of a function. In NUREG-0700, only tasks allocated to people, in particular to control room operators, are addressed in detail. Moreover, in accordance with Generic Letter 83-22, only tasks associated with emergency systems will be evaluated.

VALIDATION: The process of determining if the physical and organizational design for operations is adequate to support effective integrated performance of the functions of the control room operating crew.

VERIFICATION: The process of determining if instrumentation, controls, and other equipment meet the specific requirements of the tasks performed by operators.

1.5 ACRONYMS

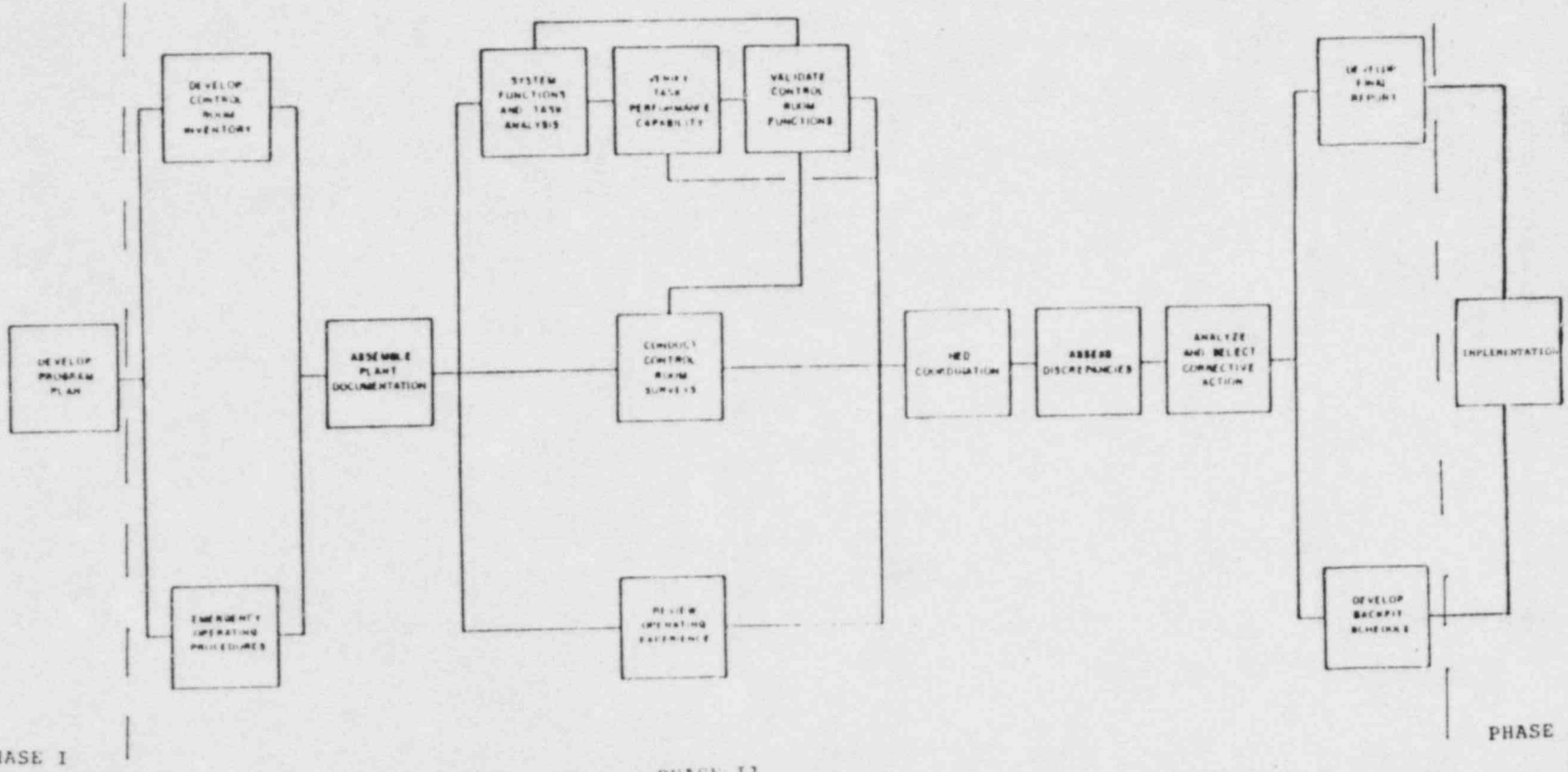
A number of acronyms have been used in this report. They are presented to facilitate the reader's use and comprehension of the report.

BSEP	Brunswick Steam Electric Plant
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owner's Group
CR	Control Room
CRDR	Control Room Design Review
EOP	Emergency Operating Procedure
EPGs	Emergency Procedure Guidelines
EPRI	Electric Power Research Institute
HE	Human Engineering
HED	Human Engineering Discrepancy
HEDAT	Human Engineering Discrepancy Assessment Team
HF	Human Factors
HFS	Human Factors Specialist
I&C	Instrument and Control
INPO	Institute for Nuclear Power Operation
LDE	Lead Discipline Engineer
LHFS	Lead Human Factors Specialist
NRC	Nuclear Regulatory Commission
OER	Operating Experience Review
PSTG	Plant-Specific Technical Guideline

RO	Reactor Operator
RTL	Review Team Leader
SFTA	System Function Task Analysis
SPDS	Safety Parameter Display System
SRO	Senior Reactor Operator
STA	Shift Technical Advisor

THE TASK FLOW/RELATIONSHIPS OF THE CONTROL ROOM DESIGN REVIEW

FIGURE 1-1



SECTION 2.0 MANAGEMENT AND STAFFING

2.1 INTRODUCTION

a. The quality of the review effort and the results of the CRDR depend upon the composition, balance, and management of the review team. The CP&L CRDR team has been assembled to include representatives from the various human factors, operations and engineering disciplines necessary to insure optimum performance of the review team. The structure and functions of the team have been established to allow for maximum flexibility and interaction between team members and station personnel, yet retain a rational organizational structure.

b. The management and staffing is most easily described in terms of the CP&L structure that is responsible for initiating and supporting this project, the review team composition and the functional responsibilities.

c. Subsequent paragraphs of this section describe the:

1) CP&L Management Support Structure
2) CRDR Team Composition and Responsibilities
3) CRDR Team Task Responsibilities

2.2 CP&L MANAGEMENT SUPPORT

Establishment of the CP&L CRDR project and the development of the project team was initiated by the Vice President of the Brunswick Nuclear project and the General Manager of BSEP. Directly below this level of management is the Manager of Operations. It is this level of management that has the direct responsibility for the review team and its on-going support. Figure 2-1 illustrates this upper management organization.

2.3 CRDR TEAM

2.3.1 General

a. The CRDR team and structure of the dedicated core team is shown in Figure 2-2. This core group will be supplemented on an as-required basis by the remaining individuals. This support group is composed of representatives from all required disciplines such as operations, mechanical, nuclear, electrical, industrial, and human factors engineering. Key personnel from these departments will provide technical input and review throughout the project.

b. Within the core CRDR team, individuals have been designated as members of the Human Engineering Discrepancy Assessment Team (HEDAT). Principle responsibilities of the HEDAT will be to review and assess all HED reports as described in Section 4.0 and, to develop recommended resolutions, and establish preliminary scheduling of all backfit activities.

2.3.2 CRDR Core Team

2.3.2.1 Structure and Function - The core team is structured as illustrated in Figure 2.2. As can be seen, the primary management structure is comprised of the HEDAT members. This, as stated earlier, enhances the review team's ability to rapidly respond at a competent technical level to the broad spectrum of review activities on a day-to-day basis. Core team resumes will be provided in the summary report to document the proven track record of this team as managers, administrators, supervisors and technical experts.

2.3.2.2 Lead Discipline Engineer - The Lead Discipline Engineer (LDE) for the CRDR is the Manager of Operations and has the overall responsibility for insuring that the review is conducted as planned and scheduled. The LDE will also serve as the director for the coordination between the CRDR and other programs such as the SPDS and Post-Accident Monitoring requirements, etc.

2.3.2.3 Review Team Leader - The Review Team Leader (RTL) for the CRDR is a member of operations and will work closely with the LDE to insure the review is conducted as planned and scheduled. As the team manager, the RTL will review the project's progress, identify any problems concerning schedules and planning and, with the aid of the team coordinators, he will resolve any coordination problems. The RTL will also chair all project meetings required during the course of the review and will be responsible for reporting project status and progress to CP&L/Brunswick Management. As the review team's technical leader he will insure that adequate technical resources are applied to all review activities. As a member of HEDAT, the RTL will be responsible for insuring strict adherence to HEDAT review procedures.

2.3.2.4 System Integration Team Leader - The System Integration Team Leader (SITL) has the overall responsibility for implementing the CRDR as planned and scheduled. The SITL will work directly for the RTL and direct the CRDR Tasks.

2.3.2.5 Lead Human Factors Specialists - The Lead Human Factors Specialist (LHFS) for the CRDR (human factors consultant) will be primarily responsible for insuring the technical quality of human factors work and the availability of appropriate human factors specialists as required throughout this project. The LHFS will work closely with the RTLs and will coordinate all HF activities with the SITL. The LHFS will be directly responsible to the RTL for the progress of the HF areas of the project and will report any deviations from planned activities, methods or procedures in a timely manner. The LHFS will also be responsible for technical justifications related to any proposed methodological or procedural changes. As a member of the HEDAT, the LHFS will establish accurate and realistic statements on the human performance aspects for all identified problems and will also suggest resolutions to HEDs that will not create other HF problems.

2.3.2.6 Operations Support - The Operations Support personnel, as indicated in Figure 2-2, are committed to the CRDR for direct support in the System Function Task Analysis and the Verification and Validation Tasks. They will also be available on an as-needed basis for engineering support throughout the project.

2.3.2.7 Human Factors Specialists - Human Factors support personnel, human factors consultants, are committed to this project for direct support of all data collection; data reduction and analysis; and HED generation, analysis, and resolution. Also, in support of this project is a pool of human factors support personnel that represent diverse and current specialized experience backgrounds in human factors. The support group will be directed by the HF Project Manager, and will be available on an as-needed basis throughout the review.

2.3.3 Review Team Support Members

2.3.3.1 General - Review Team Support members have been assigned support roles from the various required disciplines to insure an appropriate level of technical quality for the project. Although not assigned full-time, their availability has been assured by CP&L management directive and has been pre-planned to the degree possible during the initial planning and implementation phases of the project. Individual disciplines represented in this support group include but will not be limited to:

1) Operations
2) Training
3) I&C Engineering
4) Maintenance

2.3.3.2 Operations - Experienced operators participate in various phases and activities of this project. Of particular concern will be their contribution to the Operating Experience Review (OER) described in paragraph 3.2. They will also furnish additional assistance during the verification of task performance activities, validation of CR functions processes, and the clarification of HEDs as

required. Each operator will have specific, unique experiential information that, when required, can contribute significantly to appropriate HED resolutions.

2.3.3.3 I&C Engineering - The instrumentation and control (I&C) engineer will be primarily involved in the control room inventory process and HED assessment tasks. Intimate knowledge of plant instrumentation from the I&C viewpoint will also utilize during the verification of availability of CR functions.

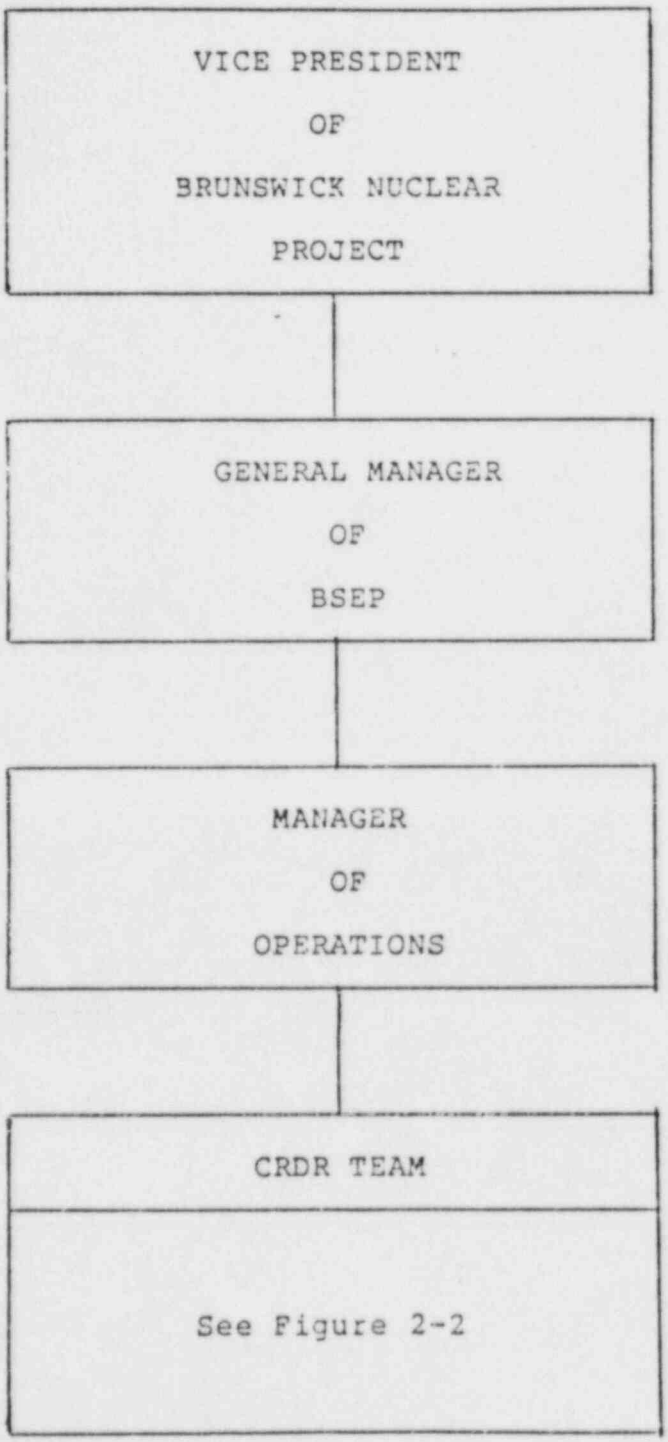
2.3.3.4 Training Representatives - The training representatives will be primarily involved in the System function task analysis and will contribute adjunct information on operational scenarios and cognitive task elements.

2.3.3.5 Maintenance - The maintenance engineer will be primarily involved in the resolution of HEDs and the implementation of backfits.

2.3.4 CRDR Team Task Responsibilities

a. Figure 2-3 illustrates, in matrix format, the task responsibility by team member. It should be recognized that the dynamic aspects of the CRDR will probably introduce requirements to adjust or supplement these anticipated assignments with additional team members. Any such changes of a significant nature will be documented and explained in the CRDR Final Summary Report.

CP&L MANAGEMENT ORGANIZATION



CP&L CRDR PROJECT MANAGEMENT SUPPORT
FIGURE 2-1

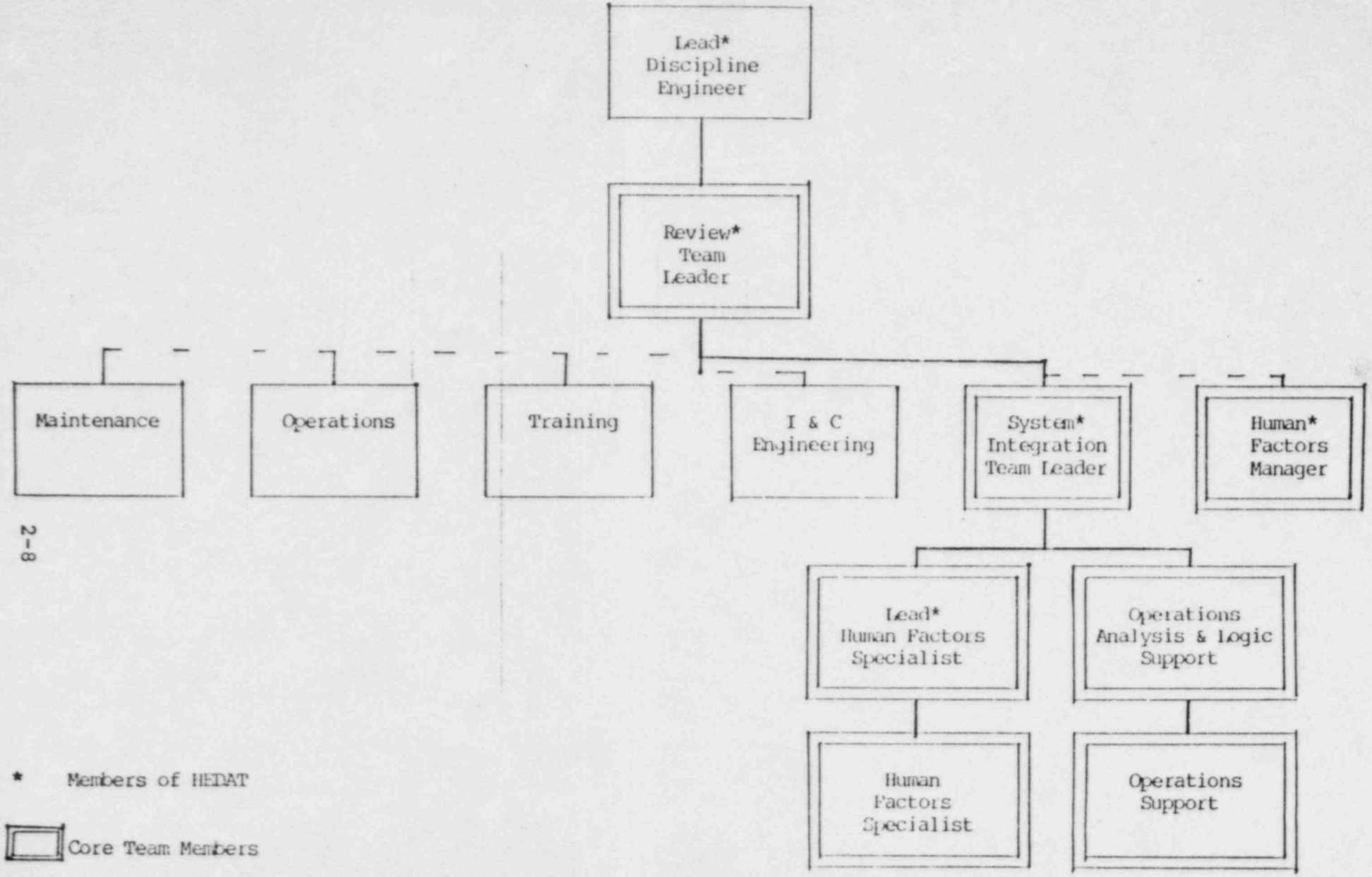

Lead*
Discipline
Engineer
Review*
Team
Leader
Maintenance
Operations
Training
I & C
Engineering
System*
Integration
Team Leader
Human*
Factors
Manager
Lead*
Human Factors
Specialist
Operations
Analysis & Logic
Support
Human
Factors
Specialist
Operations
Support
* Members of HEDAT
Core Team Members

FIGURE 2-2

CRDR (PROJECT MANAGEME T) TASK RESPONSIBILITIES

Figure 2-3

	TASK	LDE	RTL	SITL	LHFS	HFS	OS
1.	Program Definition	*	*	X	*		
2.	Master Schedule Preparati n and Revisions	*	*	X	*		
3.	Sub-schedule Preparation nd Revisions	o	*	*	X	*	
4.	Detail Schedule for Plant Specific CRDR Preparation and Revi ions		o	X	*	*	
5.	Periodic Update Reports	o	o	*	X	*	
6.	Define CRDR Human Factors Requirements	*	*	*	X	*	
7.	Conduct Plant-Specific Re iew (CRDR)		*	*	X	*	*
8.	Review HEDs and Determine Corrective Actions	X	X	X	X	*	*
9.	Present Recommended Corr. Actions to Management and Assess rogram	o	o	o	X	*	*
10.	Final Summary Report Prep ration				X	*	
11.	Final Summary Report Revi w	X	*	*			
12.	Final Summary Report Appr val	o	o	o			
13.	Final Summary Report Deli ery	*	X				
14.	Implementation of Correct ve Actions (Phase III)	X	*	*	*		*
15.	Review of Corrective Acti ns (Phase III)	X	*	o	.o		

X = Primary Responsibility

* = Support Responsibility

o = Approval Authority

LDE = Lead Discipline Engineer

RTL = Review Team Leader

SITL = System Integration Team Leader

LHFS = Lead Human Factors Specialist

HFS = Human Factors Specialist

OS = Operations Support

SECTION 3.0 TECHNICAL APPROACH

3.1 INTRODUCTION

3.1.1 General

This section of the Program Plan describes the procedures to be used by CP&L to review the completeness and suitability of the Brunswick Units 1 and 2 Control Rooms. As suggested in NUREG-0700, the specific objectives of the review effort will be:

a. To determine whether the control room provides the system status information, control capabilities, feedback, and performance aids necessary for the control room operators to accomplish their functions and tasks effectively.

b. To identify characteristics of the existing room instrumentation, controls, other equipment, and physical arrangement that may detract from operator performance.

Throughout the review process, CP&L will focus on ensuring that the functions and tasks assigned to the operators can be accomplished in an effective manner within the existing control rooms.

3.1.2 Method

The review process planned by CP&L will be conducted in six activities that parallel those described in Section 3 of NUREG-0700. Each of these activities is described below.

3.1.2.1 Operating Experience Review - The objective of the Operating Experience Review (OER) is to identify any characteristics in the design, layout or operation of the Control Room that may contribute to or alleviate operator performance problems. The focus during this activity is on control room characteristics of concern that are reflected by the experience of the control room operators. This activity will be conducted by interviews with licensed plant operating personnel.

Any problems identified during the OER will be reviewed to determine their causes and effects. Where appropriate, HEDs will be written and scheduled for assessment.

3.1.2.2 Control Room Surveys - The objective of the control room surveys is to ensure that the Control Room conforms to established principles of human engineering as contained in Section 6 of NUREG-0700. Surveys will be conducted through the application of methods and procedures which use the Section 6 guidelines as criteria. Any deviation from the guidelines will be noted. HEDs will then be written and scheduled for assessment.

3.1.2.3 System Functions and Task Analysis - A System Functions and Task Analysis (SFTA) will be conducted to identify information and control requirements associated with operator tasks performed during emergency conditions. These requirements will serve as evaluation criteria during the Verification of the Control Room Functions.

Any problems in the design or layout of the control room identified during the SFTA will be noted, and HEDs will be written and scheduled for assessment.

3.1.2.4 Control Room Inventory - In order to ensure the availability of required instrumentation and controls, a comprehensive inventory of all control room components will be prepared. The inventory will be organized by major control room panels, and will serve as a reference document during the Verification of Task Performance Capabilities activity.

3.1.2.5 Verification of Task Performance Capabilities - Task performance capabilities will be verified by ensuring that all operator information and control requirements identified during the SFTA are met both in terms of the availability of the components and human factors suitability of the components. Any requirements not met will be identified, and HEDs will be written and scheduled for assessment.

In addition, any control room components that are identified as unnecessary will be subject to consideration for relocation outside the primary operating area.

3.1.2.6 Validation of Control Room Functions - The final activity in the review process will be to ensure that all operator functions can be performed within the existing control room. This activity will employ walk-through, talk-through exercises using selected event sequences identified during the SFTA. Any problems identified in performing control room functions will be documented and HEDs will be written and scheduled for assessment.

3.1.3 Products

The product of the review process will be a set of human engineering discrepancies identified in the control room. These HEDs will specify the type and extent of the problem, the potential impact on operator performance in relation to plant operation, and a suggestion for corrective action.

A detailed description of the review process is presented in the following sections.

3.2 OPERATING EXPERIENCE REVIEW

3.2.1 Introduction

The Operating Experience Review (OER) will identify CR design attributes and procedural activities that may contribute to or alleviate operator performance problems.

3.2.2 Operations Personnel Survey

3.2.2.1 General - The Operations Personnel Survey (OPS) will focus on the analysis of experiential information to identify potential problems that may have contributed to degraded operator performance. Additionally, information will be solicited which identifies possible outstanding design features which appear to enhance operator performance.

3.2.2.2 Structured Interviews - A stratified sample of operators will be selected for structured interviews. This sample will include a representative sample of licensed operators (SROs and ROs). The format of the interview will systematically address and document details concerning the following areas from NUREG-0700:

1) Workspace
2) Anthropometrics
3) Emergency Equipment
4) Heating, Ventilation and Air Conditioning
5) Illumination
6) Ambient Noise
7) Maintainability (Operator Performed)
8) Communications
9) Annunciator System
10) Controls
11) Displays
12) Labels and Location Aids
13) Computer System
14) Conventions

In addition, operators will be encouraged to provide any other comments or concerns they may have regarding the design or operation of the control room.

3.2.2.4 Response Analysis - All response data will be reviewed and tabulated. Questionnaire/Interview checklists constructed from specific guidelines contained in Section 6.0 of NUREG-0700 will be used to aid in the analysis of all responses. A negative response which identifies a deviation from guidelines or a potential human performance problem will result in the generation of an HED report. All HED reports will be assessed by the HEDAT during the assessment and implementation phase.

3.3 CONTROL ROOM SURVEYS

3.3.1 Introduction

a. The CR surveys are planned to follow the guidance of NUREG-0700. Human factors specialists, in concert with experienced operations and engineering personnel, will measure and observe a number of CR design features. Central to this survey effort are the HF guidelines contained in Section 6.0 of NUREG-0700. These guidelines will be used as the criteria to which the survey data will be compared.

b. The surveys have been organized, and methodology has been developed which parallels the structure of Section 6.0 of NUREG-0700. Fourteen specific surveys are planned which are:

1) Workspace
2) Anthropometrics
3) Emergency Equipment
4) HVAC
5) Illumination
6) Ambient Noise
7) Maintainability
8) Communications
9) Annunciator Systems
10) Controls
11) Displays
12) Labels and Location Aids
13) Computer System
14) Conventions

c. In order to facilitate data collection, reduction, and analysis and to support the review documentation requirements, task plans have been developed for each of the above 14 survey areas. Each of these tasks plans direct the data collection, data analysis and HED report generation based upon a mix of four basic data collection procedures. These are:

1) Measurements
2) Observations
3) Questionnaires/Interviews
4) Document Reviews

Each of these task plans uses one or more of these procedures to collect the data needed to evaluate the task plan-designated area of CR design. Task plan organization, and these procedures are explained in more detail in paragraph 3.3.2. (A sample task plan is provided in Appendix A.)

3.3.2 Task Plan Procedures

a. Each task plan contains an identical format and outline. Content is varied only where necessary for the particular design area discussed. A typical task plan outline is as follows:

1.0 Objectives
2.0 Review Team
3.0 Criteria Summary
4.0 Procedures
5.0 Equipment/Facility Requirements
6.0 Inputs and Data Forms Listing
7.0 Required Outputs/Expected Results
8.0 Figures and Tables (if required)
9.0 Procedure Exceptions (if any)

Appendix A - Detailed Criteria (from NUREG-0700)
Appendix B - Data Collection/Analysis Forms
Appendix C - Criteria-to-Procedure Matrix
Appendix D - Task Plan Critique

b. Sections 1.0 through 8.0 of the text are brief summaries intended primarily to familiarize the task conductor with the overall task requirements. Upon completion of the task, the task conductor completes Section 9.0, if necessary, and submits a completed Task Plan Critique from Appendix D to the CP&L technical reviewer. The critique is to identify any difficulties or problems with the task plan and is not a central part of the review process. The important and detailed criteria and procedural information are contained in Appendix A and B of each task plan.

c. Appendix A contains a subset of the guidelines from NUREG-0700, Section 6.0. Each guideline is worded identical to the NUREG-0700 guideline and the NUREG-0700 guideline paragraph number is preserved for ease of cross-referencing. When taken in total, all 14 of the Task Plan criteria sets represent subsections 6.1 through 6.7 of NUREG-0700.

The last two subsections, 6.8 and 6.9 of NUREG-0700 Section 6.0, are used as criteria for the SFTA and the verification and validation activities. The task plans, themselves, occur in the same order as the Section 6.0 subsections of NUREG-0700 and, with one main exception, are titled similar to the Section 6.0 subsection titles. For example, the Annunciator System Review Task Plan (TP-3.1) incorporates as criteria the guidelines contained in NUREG-0700 Section 6.3. The main exception to this approach is that Section 6.1 - Workspace, of NUREG-0700, was further subdivided into seven task plans that, in general, follow the additional breakdown of Section 6.1. Thus, General Layout - 6.1.1 becomes the Workspace Task Plan, Workstation Design - 6.1.2 becomes the Anthropometrics Task

Plan, Emergency Equipment - 6.1.4 becomes the Emergency Equipment Task Plan, and Environment - 6.1.5 becomes HVAC, Illumination, Ambient Noise, and Maintainability Task Plans. The guidelines in Section 6.1.3 - Multi-Unit Control Rooms, was integrated into all other task plans as appropriate.

d. Some minor exceptions to this general classification scheme for the evaluation criteria occurred that was caused, primarily, by individual interpretations of specific guideline statements. As an example, 6.1.1.6b of NUREG-0700, while appropriately in subsection 6.1 - Control Room Workspace, explains the need for dedicated communication links between the supervisor's office and the control room (note that it also refers to guideline 6.2.1.7 - Point-to-Point Intercom Systems).

   It was felt that the evaluation of that design would be easier to accomplish if 6.1.1.6b appeared as a criterion in the Communications Task Plan.

e. Appendix B in each task plan is subdivided into as many subappendices (e.g., B1, B2, B3, etc.) as is necessary to describe the detailed data collection and analysis procedures used for that plan. Appendix B1 is always measurements data forms and directions, B2 is always an Operator Interview/Questionnaire, B3 is always an Observations Checklist, and B4 is always a Document Review Checklist. B5 through B9 are additional analyses directions and supplement forms as required. To preserve consistency from task plan to task plan, Appendices B1 through B4 always exist. As an example, if measurements are not required data for the Conventions Survey Task Plan, an Appendix B1 - Measurements sheet is inserted, in place, with the notation of "not required". In this way,

it is possible to conduct any or all of a given type of procedure across one or more task plans during a review. This flexibility allows for optimizing the review data collection and analysis activities to fit the review scheduling, personnel availability constraints, and equipment access constraints, all without adversely impacting data quality or review comprehensiveness.

Of special interest here, is that the Interview/-Questionnaire sections of each of the 14 task plans (with the addition of operationally related criteria from Sections 6.8 and 6.9 of NUREG-0700) constitute the prepared structured interview that is described in paragraph 4.2.3.

f. Appendix C provides a criteria matrix for all the guidelines contained in Appendix A. The Criteria Matrix provides a crosswalk for the guidelines and defines the data collection methods and the suggested data sources required for evaluation of each guideline.

g. The various data types are determined by the NUREG-0700 criteria. Measurement data are those data which must be numerically compared to the NUREG-0700 guidelines for evaluation. These consist of such design features as display height, noise levels, or illumination levels. Observation data are those data that a trained human factors specialist can adequately evaluate by observing the design feature. These consist of such features as procedure and document storage, office locations, and restroom facilities. Questionnaire/Interview data are data that require a knowledge of the equipment, frequently operational, before such data can be adequately or realistically evaluated. These consist of such features as the possible

meaning attached to color codes, identification of degraded illumination characteristics in certain indicator lights, or controls that are extremely difficult to operate. Documentation Review data are data that must (or may) be obtained by reviewing available documents that pertain to the design and/or operation of the plant. These consist of such design features as the availability and adequacy of a dictionary of standard terms, abbreviations, and acronyms, or an administrative procedure for the control of temporary labels.

h. As each data type collection procedure is complete, the task conductor may choose to proceed to the next data collection procedure, or may choose to reduce, analyze, and generate HED reports (if any) on the just-completed data collection step. This additional flexibility allows for involving plant personnel (who are members of the CRDR Project Team) in a manner in which they are either frequently but moderately involved, or infrequently but heavily involved in reviewing HED reports and furnishing needed plant information into the review process.

i. All task plan procedures require that, before an HED report can be generated, the collected data must be compared to one or more referenced criterion. In comparing the data to the criteria, the task conductor will annotate the checklist column next to the criterion guideline as either yes, no, or N/A. For all "no" check marks, an HED report is then generated and the HED report number is entered in the criterion comments column. As a cross-reference, the data collection appendix number and the guideline paragraph number are entered on the HED report form. Once this process is complete for each data point within a task plan, and all task plans are complete, the surveys and

reviews of the human factors suitability of the evaluated design (independent of the task requirements) are completed and documented.

j. Copies of all completed task plans are filed in the Review Data File.

3.4 SYSTEM FUNCTION AND TASK ANALYSIS (SFTA)

3.4.1 Introduction

The objective of this activity is to establish the information and control requirements for the tasks which operators are required to accomplish under emergency conditions. These requirements will serve as benchmarks for the examination of the adequacy of control room instrumentation, controls and other equipment.

3.4.2 Method

a. The starting point for the SFTA will be the Emergency Procedure Guidelines (EPGs) and associated background documentation developed by the BWR Owners Group(BWROG). This documentation defines the generic plant systems and functions for emergency response, including the primary actions, information requirements and criteria, and allocates the functions between human and machine.

An additional generic source will be the functional analysis performed to develop information requirements for a graphic display system to support the EPG's. In this analysis, sponsored by EPRI with BWROG participation, a comprehensive set of parameter tables was developed, pertinent to each EPG step.

b. The following procedure will be used to develop a plant-specific task analysis data base, starting from the generic baseline documentation identified above:

1. The first step is to examine the requirements in the EPGs and identify departures necessary because of plant-specific engineering differences. The plant-specific EOP technical guidelines will be used for this purpose. These guidelines document the bases for departure from the generic guidelines represented by the EPGs. This process will yield a set of primary, plant-specific operator actions for each emergency response function and contingency represented by the EPGs.

2. The next step is to break out these high level requirements into specific tasks and behavioral elements necessary to accomplish each task. The behavioral elements define both control actions and information requirements. The description of a behavioral element includes a verb which identifies the operator action, and the plant system, component and/or parameter addressed by the action. The description also includes identification of specific control action and information characteristics/criteria such as permissible bands, limits, and timing requirements.

   This information will be tabulated on the ACTION-INFORMATION REQUIREMENTS DETAILS (AIRD) forms, (see figure 3-1). The column headings on the AIRD form specify the item of information that will be used to define each behavioral element.

The specification of behavioral elements is done by detailed consideration of plant system engineering and operating criteria in relation to the functional objectives of the tasks. The EPRI-BWROG generic information requirements analysis for emergency response, previously discussed will be used to help ensure complete identification of parameters as applicable to Brunswick. Other sources to be used in identification of detailed information and control characteristics/criteria include the plant-specific technical guidelines for the EOPs, system descriptive data, Technical Specifications, and associated analyses.

c When all AIRD forms are complete the forms are sorted by task name, so that all the forms with the same task name are together. Within each of these stacks the forms are ordered by step within the EPG.

d The next step is to summarize the information and control requirements associated with a given type of behavioral element. Behavioral element types that are the same are defined as having the following characteristics:

1. Their verbs agree as to class, i.e.., they refer either to control actions or to information gathering verbs such as observe, monitor, start, stop etc.

2. Their system/subsystem, component, and parameter are all the same.

The ACTION-INFORMATION REQUIREMENTS SUMMARY (AIRS) form will be used to summarize information and control requirements across tasks and elements. See Figure 3-2.

3.4.3 Products

The product of the SFTA process will be a detailed listing of operator information and control requirements, based on summation of the specific requirements associated with each emergency response task element. This list will be used as input to the verification of task performance capabilities to assess the availability and suitability of instruments and equipment used by the control room operators. In addition, the results of the SFTA will be used to assist in the selection of event sequences to be analyzed during the validation of control room functions.

3.5 DEVELOP CONTROL ROOM INVENTORY

3.5.1 Introduction

The objective of the control room inventory is to develop a comprehensive listing of all instrumentation, controls, and equipment contained in the control room. The inventory list will be used determining the availability of CR components for supporting operator information and control requirements identified during the task analysis.

The CR inventory will also aid in integrating multiple HEDs that may be associated with a particular component or type of component. This will ensure a complete, integrated data file which will aid in the implementation of backfits.

3.5.2 Method

Project personnel will conduct a systematic review of relevant control room documentation (e.g., instrument lists, engraving lists, FSAR, etc.) to develop a preliminary inventory for each unit. The preliminary inventory will be expanded and made unit-specific through visits to the control room.

The inventory sheets will record the following information for all components:

- Component nomenclature or description
- Component labels
- Component characteristics (i.e., scale ranges)
- Panel
- Subpanel
- System
- Subsystem
- Physical location of item in CR

3.5.3 Products

The product of the CR inventory will be a comprehensive list of all instrumentation, controls and equipment contained in the control room. The CR inventory will be used to assist in the verification of available CR instrumentation (see paragraph 3.6).

3.6 VERIFICATION OF TASK PERFORMANCE CAPABILITIES

3.6.1 Introduction

The objective of this activity is to ensure the availability and suitability of required control room instrumentation and controls. As recommended in NUREG-0700, this activity will be conducted in two parts: verification of availability and verification of suitability.

3.6.2 Verification of Availability

Verification of availability will be accomplished through a comparison of the operator information and control requirements identified during the task analysis to the results of the control room inventory. The comparison will be conducted on a panel-by-panel basis to verify the presence or absence of instruments and equipment that provide each task sequence analyzed during the SFTA. Any information or control requirement that is not satisfied will be documented as an HED.

3.6.3 Verification of Suitability

Verification of suitability will involve examination of the human engineering characteristics of instrumentation and equipment identified during the verification of availability. During this process, selected guidelines from NUREG-0700 and criteria derived from the task analysis will be used to determine the suitability of CR components. This process will consider such aspects of components design as adequacy of display range, usability of displayed values, relative location of related components, and other characteristics not easily evaluated without reference to specific task sequences. Any deviations from established criteria will be noted as HEDs.

3.6.4 Products

The results of the verification of task performance capabilities will be any discrepancies noted in the availability or suitability of instrumentation, controls and other equipment required by the control room operators to perform emergency response tasks. Such discrepancies will be recorded on the standard HED form and assessed during the assessment and implementation phase. In some cases, HEDs identified during the verification process will not result directly from a Section 6.0 guideline but may result from task analysis derived criteria. Such HEDs will be properly annotated and the criteria described.

3.7 VALIDATION OF CONTROL ROOM FUNCTIONS

3.7.1 Introduction

The objective of this activity is to determine if the functions allocated to the control room operating crew during emergencies can be accomplished effectively within: 1) the structure of defined emergency procedures, and 2) the design of the control room as it exists. As with Verification of Task Performance Capabilities, Validation of Control Room Functions is an extension of the SFTA. In this case, emphasis is placed on determining the adequacy of the integrated control room design for supporting operator task sequences.

3.7.2 Method

The principal activities during this task involve observation of operators walking through selected event sequences. The following process will be employed during this task:

1) A set of scenarios will be prepared to define the emergency operating sequences to be included in the validation effort. The SFTA will be used to ensure that the sequences chosen represent all emergency interface requirements.

2) Brunswick EOPs asscciated with the selected sequences will be obtained.

3) All participants in the validation effort will be briefed concerning the objectives and procedures of the walk-throughs, including assumptions concerning the status of the plant at the onset of the sequence.

4) Control room personnel will be observed as they perform the selected sequences. The operators will be instructed to describe their actions as they perform the selected sequences, including:

   - o cues by which they initiate a tasks
   - o sources of information used (displays, procedures, knowledge, etc.)
   - o application of information, including any conversions or uncertainties
   - o controls selected and expected system response

- o methods for verifying system response and selection of alternative actions if response is not obtained

- o indications that sequence is proceeding as expected

- o indication that sequence is complete

- o other comments, as appropriate.

During this process, the observers may interrupt the operators to obtain clarification or additional information.

5) Observers will record significant operator comments, as well as any observations that relate to the performance of CR functions.

6) The results of the observations will be analyzed to identify any problems with the CR layout, location of related components, operator workload, or other human engineering concerns. Any HEDs observed during the validation process will be noted and recorded.

Observers will record: 1) any difficulties the operators had in responding to the event, 2) the impact on operator performance of any previously identified HEDs, and 3) any additional discrepancies identified during this task.

3.7.3 Products

The results of the validation process will be used by the HEDAT primarily to assess the impact of previously identified HEDs on actual operator performance. If additional HEDs are identified during the validation process they will be recorded and assessed in the same manner as other HEDs.

ACTION-INFORMATION REQUIREMENTS DETAILS (AIRD)

Sheet _____ of _____

PLANT: _____ UNIT: _____

ORIGINATOR _____ DATE: _____

REVIEWER _____ DATE _____

ERG NO: _____

STEP NO: _____

STEP OBJECTIVE: _____

REMARKS:

BEHAVIORAL ELEMENTS											
Action	Verb	Attribute	Component/ Equipment No.	Parameter	Direction	State/Value	Units/Rate	Precision	Trending Requirements	Comments	GRAS Step No.

FIGURE 3-1

ACTION INFORMATION REQUIREMENTS SUMMARY (AIRS) Sheet ____ of ____

PLANT: _____ UNIT: _____ ORIGINATOR _____ DATE _____

REVIEWER _____ DATE _____

SORT BLOCK
REQS TYPE: Act _____ Info _____
SYSTEM: _____
COMPONENT: _____
PARAMETER: _____

SUMMARY OF REQUIREMENTS BLOCK
VALUE/RANGE: _____
UNITS: _____
PRECISION: _____
RESPONSE TIME: _____

REMARKS:

VERIFICATION SUMMARY BLOCK			
DEVICE		PASS	FAIL
ID No	PANEL		

INDIVIDUAL DETAILS									
ERQ NO	Step No	Action	Verb	Direction	State/Value	Units/Rate	Precision	Trending Required?	Comments

FIGURE 3-2

SECTION 4.0 ASSESSMENT PHASE

4.1 INTRODUCTION

NUREG-0700 defines a Human Engineering Discrepancy or HED as "a departure from some benchmark of system suitability for the roles and capabilities of the human operator". Section 6 of NUREG-0700 contains these design benchmarks or guidelines. While it can be expected that the CRDR process will produce reports of Human Engineering Discrepancies, it does not follow that all discrepancies will necessarily degrade operator performance to the point that plant safety would be affected. The objective of the assessment process is for the HED Assessment Team (HEDAT) to evaluate the relative significance of the HEDs produced during the review phase. The HEDAT will separate those HEDs that are unlikely to degrade performance from those that may degrade performance.

4.2 PRIORITIZATION

a. The approach to be employed by CP&L in assessing HEDs invclves prioritization of each HED based on estimations of the potential for error and the consequence of errors resulting from the HED. Assessment of the potential for error will be based on:

- o component design factors (e.g., extent of deviation from guideline, conformance to plant design conventions),
- o task factors (e.g., difficulty, frequency, time demands), and
- o human factors (physical performance; sensory and perceptual performance; cognitive performance).

b. Once the potential for error has been established, the consequences of the error will be estimated for each HED by the HEDAT. Error consequence will be defined in terms of the potential impact on plant safety by considering the system/functions affected by the error. HEDs related to systems and functions identified as safety-related during the SFTA or which increase the probability of an error that could result in violation of technical specification or unsafe operation will receive the highest rating.

c. The HEDAT will analyze all Category I, II and III HEDs for correction (see Figure 4-1). Category IV HEDs, while considered optional for correction, will be assessed for their cumulative and interactive effects on all other HEDs. Those Category IV HEDs shown to possess the above effects will be recategorized to the appropriate category.

The next step in this procedure is for the HEDAT to identify those HEDs which can be corrected by enhancements, training of operators, and/or procedural revisions. The remaining HEDs will be analyzed to identify and provide design improvement alternatives. Since there is a limit to the number of changes which can be made as a result of this review, a cost-benefit analysis will also help determine which corrections are the most feasible and acceptable from a human engineering point of view.

d. Additionally, the CR review process will be reapplied as appropriate to ensure:

- o Any new HEDs are identified and addressed
- o That other corrections are not invalidated
- o Compliance with human engineering guidelines.

4.3 CORRECTION

Regardless of the HED priority ranking, potential corrective action will be identified by the HEDAT for all HEDs. The basic procedure to be employed in identifying and selecting corrective actions involves:

- o Analysis for correction by enhancements
- o Analysis for correction by design alternatives
- o Assessment of the extent of correction.

4.3.1 Analysis for Correction by Enhancement

Discrepancies selected for correction are first examined for possible correction by enhancement (labeling, demarcation, operator aids, etc.). Each HED is considered and where such correction is possible, the discrepancy is reassessed for its effect on operator performance. As appropriate, HEDs are reevaluated via checklisting and task analysis until HF suitability is verified. Where it is determined that correction by enhancement is not possible, the discrepancy is analyzed for correction by design alternatives.

4.3.2 Analysis for Correction by Design Alternative

Discrepancies not correctable by surface enhancement may require a design effort. Corrective action may involve simple modification to the communication, lighting or alarm system, or alterations to the control boards. In either case, identification of design alternatives will be achieved by examination of the HED, reference to task analysis data, and identification of potential constraints (e.g., availability of equipment, Reg. Guide 1.97). The backfit design development process, if used, will also consider the need to minimize cost of the change and its impact on the existing design. Multiple design alternatives will be considered, as appropriate. Cost and schedule estimates will also be considered for each proposed change. The impact of each proposed design change on operator training, plant maintenance and documentation will also be considered, as will the reduction in probability of operator error. The acceptability of design alternatives will be verified by further evaluation using functional analysis, task analysis, and reapplication of the NUREG-0700 guidelines.

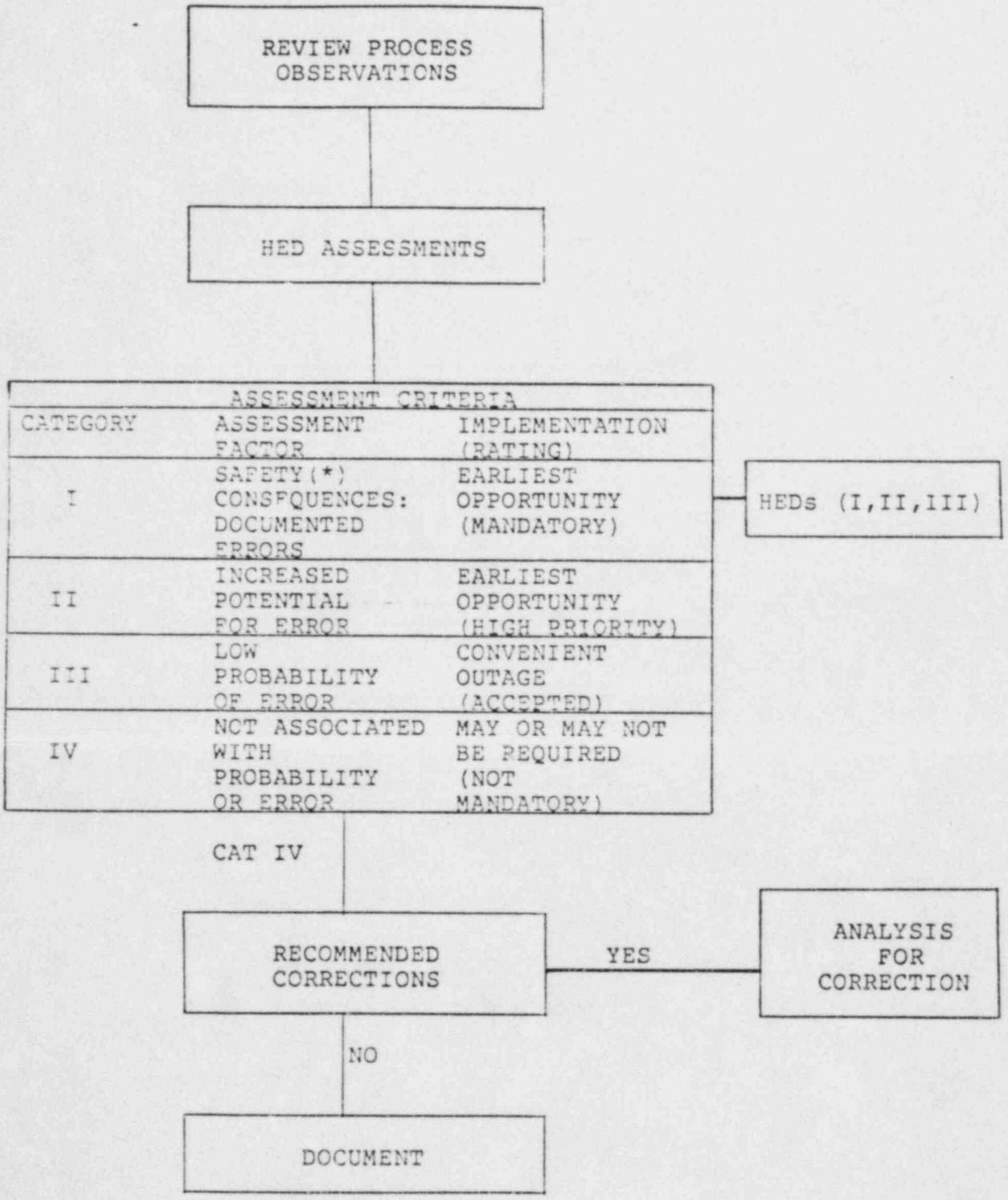
4.3.3 Assessment of the Extent of Correction

For all HEDs selected for correction, the extent to which each discrepancy will be corrected (by enhancement or redesign) will undergo HEDAT evaluation. The basis for assessment involves reapplication of the guidelines in Section 6.0 in NUREG-0700 or reference to other criteria (e.g., results of SFTA). The solutions should ideally eliminate all discrepancies and bring the control room into full compliance with the intent of the guidelines. This is accomplished by verifying the human factors suitability of all proposed changes. However, discrepancies which are not fully corrected will be identified and documented by the review team and a justification will be prepared for each one.

4.3.4 Scheduling of Corrections

HEDAT-approved solutions to HEDs will be scheduled for implementation. The category guidelines established in Paragraph 4.2 of this plan will be used as a basis for the corrective action schedule. Additional considerations in the development of the implementation schedule will be:

- Safety consequences of operator errors that could be caused by the discrepancy
- Integration with other NUREG-0737 Supplement 1 programs
- Plant operation constraints
- Operator training/retraining requirements
- Outage schedules
- Equipment procurement schedules.



(*) EXAMPLE: RESULTS IN UNSAFE OPERATION OR VIOLATION OF TECHNICAL SPECIFICATIONS

HED ASSESSMENT
FIGURE 4-1

SECTION 5.0 DOCUMENTATION AND DOCUMENT CONTROL

CP&L recognizes the critical role of document control during the CRDR process. To this end, the RTL will be responsible for controlling all project documentation, including: letters and memos, progress reports, interim reports, HED reports, and summary reports. All final versions of primary project documents will be assigned a unique designator prior to distribution, and a hard copy will be maintained in a central project file.

The primary emphasis in the documentation control system will be the control of the review project documents to ensure an accessible and fully auditable review data file. The system to be used is also compatible with the existing document control system currently in place as BSEP.

SECTION 6.0 FINAL SUMMARY REPORT

Upon completion of the CRDR, a summary of the results will be prepared and submitted to the NRC for review. The Final Summary Reports will describe the results of the CRDR and will be submitted within six months after refuel number 6 for Unit 2. These reports will summarize the CRDR process, provide summary descriptions of the identified human engineering discrepancies and their proposed corrective actions, and provide implementation schedules for each corrective action. They will also describe any modifications or revisions made to this Program Plan. Samples of control room inventory and control room survey forms and summaries of the inventory and survey procedures will be provided.

The details of the CRDR, along with complete documentation, will be maintained as part of the permanent station records.

SECTION 7.0 IMPLEMENTATION PHASE

The following general procedure will be followed to implement the recommendations:

1. The HEDs to be corrected will be ordered according to the priorities described in paragraph 4.2 of this plan.

2. The station's outage work schedule will be reviewed to arrange manpower and time, as necessary, to implement the corrective actions.

3. Upon completion of each HED's recommended correction, the responsible department will notify the RTL who will arrange for the corrections to be reviewed by an HFS.

The Implementation Phase will be described in detail as part of the Final Summary Report.

APPENDIX A
SAMPLE TASK PLAN