CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN

FEBRUARY 1984

WNP-2

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN

February 1984

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Washington Public Power Supply System

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1.0 INTRODUCTION

The Supply System concurs with the intent of performing a Control Room Design Review Program and has undertaken a program to complete a review of the WNP-2 control room in accordance with NUREG-0660 and NUREG-0737, Supplement 1.

The Supply System methodology has been to provide a dual program approach:

- Participate as an active member in the Boiling Water Reactor Owners' Group (BWROG) Control Room Design Review Program.
- Establish a WNP-2 Task Force for detailed assessment and resolution of control room human factor concerns and to provide configuration control for on-going changes to the WNP-2 control room.

This report constitutes the Control Room Design Review Program Plan as specified in NUREG-0737, Supplement 1, for conduct of the WNP-2 Control Room Design Review (CRDR).

2.0 OVERVIEW

The following is a description of the purpose, objectives, and activities of the Control Room Design Review (CRDR).

2.1 Purpose

The purpose of the control room design review, as defined in the guidance in NUREG-0700, "Guidelines for Control Room Design Reviews," is to:

- Review and evaluate the control room workspace, instrumentation, controls, and other equipment from a human factors engineering viewpoint, taking into account both system demands and operator capabilities.

- To identify, assess, and implement control room design modifications to correct inadequate or unsuitable items.

2.2 Objectives

The objectives for the control room design review are:

- Improve the ability of control room operators to function more effectively during normal and off-normal conditions by improving information provided to them and strategically locating that information.

- Identify any modifications of the control room configuration that would contribute to a significant reduction of risk and to enhance safety of operation.

2.3 Description of CRDR Program

The CRDR Program consists of four phases:

- Planning

- Review

- Assessment and Implementation

- Reporting

To achieve the objectives of the CRDR, a number of activities must be completed within these phases. The diversity of these activities requires a multidisciplinary review team. A flow chart of these phases and activities is presented in Figure 2-1.

2.3.1 Planning Phase

A Project Action Plan for initiating a CRDR Program was approved in April 1980. The Action Plan chartered a WNP-2 Control Room Task Force to monitor various industrial approaches to the program, define the objectives of the control room design review, define the resources, schedule, and methodology required to initiate the program, and implement the program through to completion of corrective actions and reporting requirements.

The planning phase of the WNP-2 Control Room Task Force CRDR Program is represented in this Program Plan report.

2.3.2 Review Phase

The review phase constitutes the investigative, data-gathering portion of the CRDR. Six processes are defined for the review phase:

- A review of operating experience and a survey of control room operators.
- A review and analysis of system functions and control room operator tasks, to establish the instrumentation and equipment requirements for the tasks operators are expected to accomplish.
- An inventory to identify existing instrumentation and equipment.
- A survey in which the instrumentation, controls, ambient conditions, and other features are checked against human engineering guidelines.
- Verification of task performance capabilities, in which the instrument and equipment requirements derived from task analysis are compared to the items presently in the control room inventory.
- Validation of the control room functions, in which the relationships and dependencies in operating crew activities and between the operators and plant processes are examined.

2.3.3 Assessment and Implementation Phase

During the assessment and implementation phase, all discrepancies identified are analyzed, and the potential

impact of each discrepancy on plant operation is determined. Discrepancies are classified according to their safety and reliability consequence.

Human Engineering Discrepancies (HED) are evaluated for significance and prioritized for corrective action. Corrective resolution may use such methods as enhancement techniques, design modifications, procedure changes, or training improvements. Improvements that are introduced are coordinated with changes resulting from other improvement programs, such as new instrumentation (RG-1.97), upgraded emergency procedures, and new Graphic Display Systems.

2.3.4 Reporting Phase

The reporting phase consists of two sections:

- A Preliminary Control Room Design Reviews Report was submitted in April 1983 for licensing of WNP-2.
- At the conclusion of the CRDR, a summary report will be submitted to NRC in accordance with the WNP-2 Operating License, six months prior to the first refueling outage. The summary report will include:
  - Significant changes made to the program plan, if any.
  - HEDs which were identified as requiring correction.
  - HEDs identified with safety significance that will not be corrected or only partially corrected and justification for doing so.
  - Proposed schedule for correcting HEDs.

FLOW CHART OF CRDR ACTIVITIES

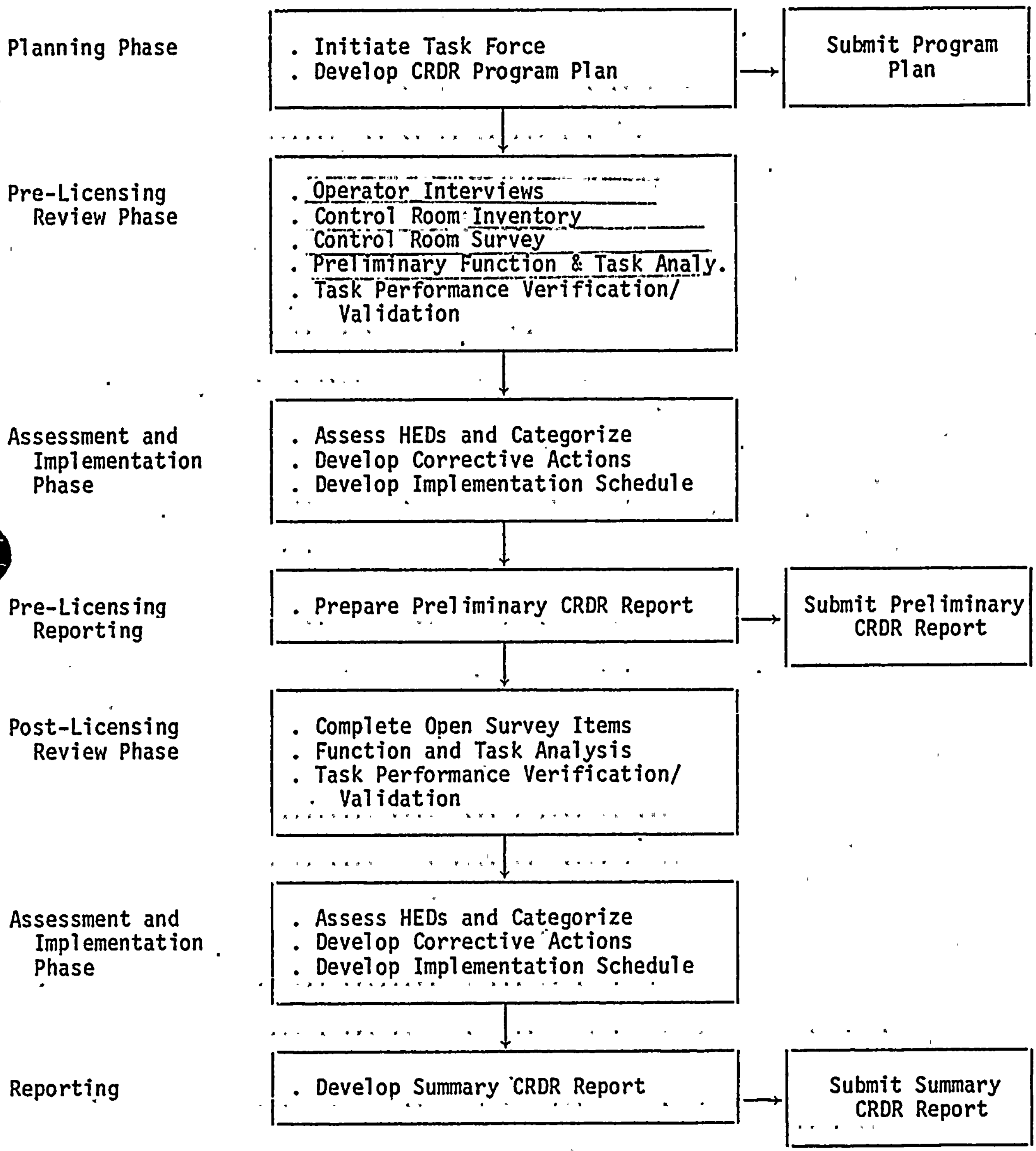


Figure 2-1

3.0 STAFFING AND QUALIFICATIONS OF REVIEW TEAM

3.1 Review Team Management and Organization

WNP-2 Management has retained responsibility and functional control of the CRDR Program to ensure overall support to the control room review process and integration with other studies, design changes, and related construction and plant modification activities.

A Control Room CRDR Task Coordinator was assigned to develop and implement the CRDR program, coordinate required control room changes, and monitor other control room affecting activities to ensure human factor integration.

A Task Force Review Team was formed to ensure integration of control room-related engineering design activities, plant operability, and construction. To augment the Task Force, General Physics Corporation was contracted for human factors consultant services.

WNP-2 supports the BWROG Program. The WNP-2 Task Force Coordinator is a member of the Owners' Group working committee and has participated in the development of the Control Room Design Review Program and Survey Checklists. WNP-2 Task Force members were trained on human factor concerns and the Owners' Group Program at an Owners' Group-sponsored workshop. The Task Force has supported the program as members of Owners' Group Survey Teams at Nine-Mile Point, Peach Bottom 2/3, and Pilgram Nuclear Power Stations and was, in turn, surveyed by an Owners' Group Survey Team.

Project scheduling assigned full time personnel to develop and integrate control room engineering and construction schedules. The Control Room Human Factors Program was integrated into the project schedule for visibility, management tracking, and integration with other control room activities.

Supply System Engineering and Startup organizations identified personnel to coordinate and manage control room activities. A Project Control Room Program Manager was assigned to monitor, coordinate, and expedite engineering and construction management-related activities. A Startup Control Room Coordinator was assigned to monitor, coordinate, and expedite startup and construction activities related to the control room.

These management levels provided direct management support for the CRDR Task Force, integration of activities affecting control room design reviews, ensured support from other organizations or personnel as required and provided the review and approval authority for

Task Force Human Engineering Discrepancy (HED) reports and corrective recommendations [see Figure 3-1, Management and Organization Structure].

3.2 Review Team Composition

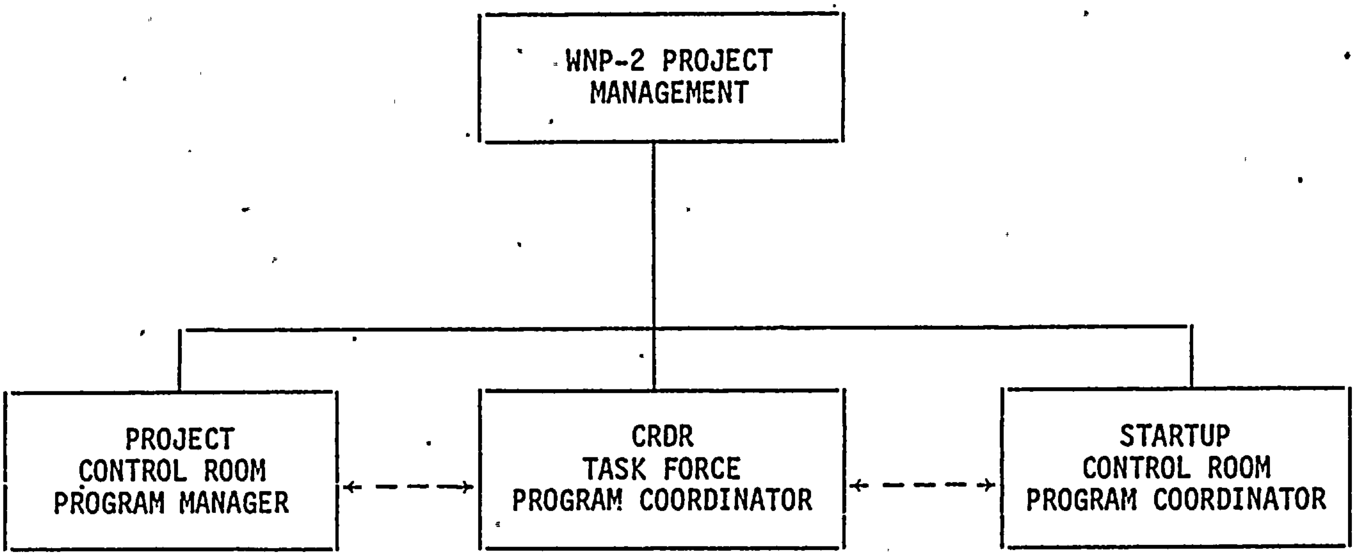
The Task Force review team and the Owners' Group survey team provide for both an inhouse and an independent multidisciple team of individuals with the wide range of skills necessary to perform the design review. Review team members consisted of personnel from the following companies:

- Supply System
- General Electric (NSSS vendor)
- Burns and Roe (Architect-Engineer)
- General Physics Corporation (human factors)
- Massachusetts Institute of Technology (human factors)
- Boston Edison Company
- Niagara Mohawk Company
- Yankee Atomic Electric Company

During the course of the review, additional specialists required for specific tasks will be made available to the review team as needed.

Figures 3-2, 3-3, and 3-4 provide information as to Supply System Task Force and BWROG Survey Team composition and assignments and career experience levels. Resume briefs are noted in Attachment A.

MANAGEMENT AND ORGANIZATION STRUCTURE



Monitor and coordinate engineering and construction management activities	Monitor and coordinate CRDR Program activities	Monitor and coordinate startup and control room change activities

Figure 3-1

TEAM COMPOSITION AND ASSIGNMENT

CRDR PROGRAM
TASK FORCE COORDINATOR
RG DaValle

SUPPLY SYSTEM TASK FORCE MEMBERS		BWROG SURVEY TEAM MEMBERS
RG DaValle	Administration	W. Babcock
DC Burgy/RJ Little	Human Factors Engineer	MD Field
RE Green	Nuclear Systems Engineer	RM Fairfield
CH McGilton/RG DaValle	Nuclear Safety Assurance	RG DaValle
BJ Van Erem/GJ Freeman/ DC Burgy	Systems Analysis Engineer	A. Miller/MD Field
Van Erem/RE Green	I&C Engineer	RM Fairfield/A. Miller/ W. Babcock/A. Vierling
CH McGilton/RG DaValle	Reactor Operations	KC Ross/RM Fairfield/ RG DaValle
--	Training Engineer	KC Ross/RM Fairfield

SUPPORT SPECIALISTS

RA Call	Computer	MD Field/KC Ross
RJ Little	Communications	MD Field/RM Fairfield
RJ Little	Lighting	KC Ross
RJ Little	Accoustic	KC Ross

Figure 3-2

SUPPLY SYSTEM TASK FORCE PERSONNEL

CAREER EXPERIENCE LEVEL

RG DaValle	17 years
RE Green	19 years
CH McGilton	20 years
GJ Freeman	23 years
BJ Van Erem	22 years
DC Burgy	19 years
RJ Little	17 years
RA Call	21 years
Total years of experience:	158 years

Figure 3-3

BWROG SURVEY TEAM PERSONNEL

CAREER EXPERIENCE LEVEL

W. Babcock	15 years
A. Miller	15 years
A. Vierling	7 years
RM Fairfield	17 years
KC Ross	9 years
RG DaValle	17 years
MD Field	28 years
Total years of experience:	108 years

Figure 3-4

4.0 DOCUMENTATION AND DOCUMENT CONTROL

The Control Room Design Review Program involves the systematic use of a substantial number of existing documents and the preparation of new materials to record and document reviews. Reference materials, review reports, Human Engineering Deficiency (HED) forms, and other working documents are used. These enable the Task Force to record review results, provide a design data base, identify and track HEDs and resulting recommendations, and provide a document trail for traceability.

4.1 Reference Documentation

A data base reference library or access to reference material was established. Material included those noted in NUREG-0700 and, in addition, industrial reports on Control Room Human Factor Studies, Preliminary Plant Control Room Human Factor Reviews and audit reports from other plants, WNP-2 outstanding design changes, BWROG emergency procedure guidelines and procedures, standard technical specifications, and related NUREGs, regulatory guides, and TMI-related reports.

4.2 Review Documentation

Documents and forms are being prepared as each phase of the WNP-2 Control Room Review Program is identified and implemented. Standard HED forms have been prepared to identify the location of discrepancies, describe their nature and priority, and provide a record of recommended corrective actions. Initial data base review report formats, prepared prior to HED Report preparation, vary depending on the review process and data requirements.

Attachment B provides representative samples of different review report formats and provides a sample of a standard HED report form.

BWROG Survey Team Program checklists, operator interview forms, task analysis and procedure walkthrough forms, and assessment methodology are not included in this document. These are included in the BWROG Program Plan which was submitted to the U.S. Nuclear Regulatory Commission on August 25, 1981.

4.3 Document Control

Control and traceability of HED Reports and their review and approval are maintained through Task Force HED correspondence, Supply System HED Directives to the A-E, and a Task Force-controlled HED Status and Tracking Log. All correspondence is forwarded to the WNP-2 Controlled Site Files, and a working file is maintained in the Task Force Coordinator's Office.

5.0 REVIEW PHASE

The Supply System methodology has been to provide a dual program approach:

- Participate as an active member in the BWROG Control Room Design Review Program.
- Establish a WNP-2 Task Force for detailed assessment and resolution of control room human factor concerns and to provide configuration control for on-going changes to the WNP-2 control room.

The "review" phase is divided into six processes:

- Operating experience and operator interviews.
- Function and task analysis.
- Control room inventory.
- Control room survey.
- Verification of task performance capabilities.
- Validation of control room functions.

The BWROG Survey Program will be used to satisfy sections of the review phase requirements and/or augment or provide verification and validation for Task Force reviews.

The BWROG review methodology includes analysis of plant LERs and scram reports, operator interviews, checklist evaluations, task analyses, and walkthroughs of emergency procedures. The LER and scram report analysis and operator interviews together correspond to Process 1 of NUREG-0700. The task analyses and walkthroughs correspond to Processes 2, 3, 5, and 6. The survey checklist evaluations correspond to Process 4.

5.1 Operating Experience and Operator Interviews

5.1.1 Operating Experience Reviews

WNP-2 has no operating history. Therefore, a review of LERs and scram reports could not be performed under the BWROG Program. However, during the WNP-2 Task Force reviews, considerable input was obtained from experienced operators and from operational experience and CRDR reports from other plants. Also, WNP-2 has established an onsite Nuclear Safety Assurance Group (NSAG), as required by NUREG-0737 and WNP-2 Technical Specifications, to provide formal

operational experience reviews relative to WNP-2, which include LER and scram reports. Two of the WNP-2 Human Factors Task Force members are part of the WNP-2 NSAG to ensure continuation of human factors input into WNP-2 plant operations. Per plant technical specifications, NSAG is responsible for maintaining surveillance of unit activities to provide independent verification that activities are performed correctly and that human errors are reduced as much as practical.

5.1.2 Operator Interviews

Operator interviews were conducted by the BWROG survey team to obtain information concerning plant design directly from the user population. Written questionnaires were administered to operators, including equipment operators, control room operators, shift supervisors, and shift managers. In addition, oral interviews were conducted with approximately one-third of the total operating staff. A representative group of operators was selected for the oral interviews covering a range of experience, education, ability, and physical size.

Interviews were conducted by utility personnel and survey team members with background or experience in operations and engineering or design with a position conducive to a free flow of information. Following the interviews, the survey team consolidated the information obtained and analyze it to help identify specific areas of concern for detailed analysis during the control room review.

5.2 Function and Task Analysis

NUREG-0737 Action Plan Item I.C.1 requires reanalysis of transients and accidents and preparation of technical guidelines. Technical guidelines are defined in NUREG-0899 as documents that identify the equipment or systems to be operated and list the steps necessary to mitigate the consequences of transients and accidents and restore safety functions. Technical guidelines represent the translation of engineering data derived from transient and accident analyses into information presented in such a way that it can be used to write EOPs. Generic Emergency Procedure Guidelines have been prepared by BWROG in response to Item I.C.1 of NUREG-0737. These guidelines contain technical information and guidance for dealing with unanticipated accidents. The functionally oriented guidelines, along with supporting information on their development, will be used as the starting point for the Function and Task Analysis.

Function and task analysis is used in the CRDR to accomplish the following objectives:

- Define operator emergency response functions and tasks.
- Establish operator control and information requirements.
- Assess the adequacy of existing controls and instrumentation.
- Evaluate the effectiveness of the control room in supporting the integrated accomplishment of the emergency response functions.

The results of the function and task analysis will be organized to clearly present the following information:

- The functions that need to be performed.
- The systems to be used in performing those functions.
- Tasks to be performed by the operator.
- The information that must be available to the operators to carry out their tasks.
- The control functions the operator will be required to perform.
- The anticipated sequence of operator actions.

The specific events to be reviewed under Function and Task Analysis include the following emergency procedures:

RPV CONTROL

PPM 5.1.1	RPV Level Control (RPV/L)
PPM 5.1.2	RPV Pressure Control (RPV/P)
PPM 5.1.3	Reactor Power Control (RPV/Q)

CONTAINMENT CONTROL

PPM 5.2.1	Suppression Pool Temperature Control (SP/T)
PPM 5.2.2	Drywell Temperature Control (DW/T)
PPM 5.2.3	Primary Containment Pressure Control (PC/P)
PPM 5.2.4	Suppression Pool Level Control (SP/L)

EMERGENCY PROCEDURE CONTINGENCIES

PPM 5.3.1	Level Restoration (Contingency)
PPM 5.3.2	Emergency RPV Depressurization (Contingency)
PPM 5.3.3	Steam Cooling (Contingency)
PPM 5.3.4	Core Cooling Without Level Restoration (Contingency)
PPM 5.3.5	Alternate Shutdown Cooling (Contingency)
PPM 5.3.6	RPV Flooding (Contingency)
PPM 5.3.7	Level/Power Control (Contingency)

The WNP-2 CRDR function and task analysis is being implemented in two phases. First, a preliminary analysis was performed during the BWROG CRDR completed in January 1983. Second, a more detailed analysis will be performed based upon the latest revision of the WNP-2 plant-specific Emergency Operating Procedures (EOP). The methodology applied in each phase is outlined in sections 5.2.1 and 5.2.2, below.

5.2.1 BWROG Task Analysis Program

The BWROG Survey Program was implemented at WNP-2. Function and Task Analysis was performed based on the BWROG Emergency Procedures Guidelines and draft WNP-2 Plant Specific Guidelines to augment the Task Force and BWROG Control Room Surveys, to provide input for the assessment of HEDs and development of corrective recommendations, and to help verify and validate control room modifications during the plant construction phase.

The BWROG function and task analysis included the following elements:

- Operator emergency response functions and tasks were identified.
- Control and instrumentation requirements were specified for each identified operator task.
- The adequacy of existing and proposed controls and instrumentation was evaluated against the control and information requirements specified.
- The validity of the task sequences and the overall effectiveness of the control room were evaluated using talk and walkthroughs.
- During the performance of elements third and fourth, above, each task was analyzed in terms of the following considerations:

- Is the task sequence valid and complete?

- Is sufficient information immediately available to the operator to enable him to complete the task?

- Do critical controls and displays identified for each task conform to human factor design criteria?

- Is direct feedback used to verify control functions?

- Is available manpower adequate to perform the task?

The results of the BWROG Function and Task Analysis were forwarded to NRC in the WNP-2 Preliminary CRDR Report, April 1983.

5.2.2 Task Force Task Analysis Program

WNP-2 plant specific emergency procedure guidelines and procedure generation package were forwarded to NRC in March 1983. WNP-2 will perform a function and task analysis on the WNP-2 plant specific emergency procedure guidelines to satisfy the requirements of Supplement 1 to NUREG-0737 and the CRDR program. This information will be used for verification of task performance capabilities and for validation of control room functions as noted in sections 5.5 and 5.6 of this Program Plan.

The methodology to be employed in the detailed function and task analysis is modeled upon the functional analysis of the BWROG EPGs performed for the Display/Procedures Integration Committee of the BWROG. This process described in the Supply System submittal, Function and Task Analysis of the WNP-2 Emergency Operating Procedures, February 1984, will identify a) all operator control, decision, and action functions contained in the EOPs and b) control and information requirements to support these functions. The method by which the functional analysis will be applied in the CRDR is detailed in Attachment C to this report. In general, the evaluation will include the following elements:

- Operator emergency response decision and action functions will be identified through functional analysis.

- Each operator decision and action function will be subjected to task and decision analysis to identify related control and information requirements.

- Existing control room instrumentation will be assessed against the identified control and information requirements. Each control and indication will be evaluated in terms of availability, usability, and location.

- The effectiveness of the control room in supporting the integrated accomplishment of the emergency response functions will be evaluated using talk and walkthroughs.

The results of the Function and Task Analysis will be reported in the WNP-2 CRDR Summary Report.

5.3 Control Room Inventory

A reference set of data for control room instrumentation and controls is available on computerized instrument and equipment lists, panel arrangement and engraving drawings, and other reference documents, such as panel photographs, engineering drawings, vendor files, and other inventory documents.

During the Control Room Survey Phase, an independent inventory survey was conducted to identify controls, switches, alarms, displays, and components available to the control room operators. The survey inventory was documented in Review Reports, as noted in Attachment B, and compared with engineering data, noted above, to assure consistency and accuracy of inventory data. The control room panels, which had an inventory review performed, are noted in Table 5-1.

5.4 Control Room Survey

The purpose of the Control Room Survey is to review and assess the adequacy of the arrangement and identification of important controls and displays, the usefulness of audio and visual alarm systems, plant status information provided, procedures and training with respect to limitations of existing instrumentation, information recording and recall capability, the control room layout and environment, and other areas of human factor engineering that potentially impact operator effectiveness. The ultimate objective is to identify potential modifications of the operator-control room interface which will reduce the potential for human error.

The control panels evaluated by both the WNP-2 Task Force and the BWROG survey team are listed in Table 5-1. The Remote Shutdown panels were included in the scope of the review. Figure 5-1 provides a layout arrangement of the WNP-2 Control Room panels. Table 5-2 provides a listing of the major survey areas with which human factor principles will be compared.

In performing the survey, particular attention was given to items

identified as potential problem areas noted in Operator Interviews, Audit Reports from other utilities, and industry human factor documents.

5.4.1 BWROG Survey Program

A BWROG Survey Team performed an independent survey of the WNP-2 Control Room. The BWROG CRDR Program Plan and Survey Checklists are not documented within this report. The BWROG program was submitted to NRC on August 25, 1981. Deviations from the BWROG program consisted of not completing the Licensee Event Report analysis section of the survey. Rational and methodology for bringing this portion of the program into compliance are noted in section 5.1.1 of this Program Plan.

The results of the BWROG Survey were reported in the Preliminary Control Room Design Review Report submitted in April 1983 to NRC. BWROG Survey checklist items not completed, due to the plant construction status, and the BWROG Supplemental Survey checklists will be completed during the plant operating phase by the WNP-2 Task Force and reported in the WNP-2 CRDR Summary Report.

5.4.2 Supply System Task Force

The Supply System WNP-2 Task Force survey included use of the BWROG Program Survey checklist and appropriate sections of NUREG-0700 and augmented by additional input from audits and findings from control room reviews performed in the industry and other human factor documents. Task Force surveys were documented in accordance to section 4.0 of this Program Plan and was included in the WNP-2 Preliminary CRDR Report noted in section 5.4.1 of this Program Plan.

General Physics Corporation assisted the Task Force and augmented the Task Force Survey by completing an independent survey of the WNP-2 control room using methodology and checklists developed by General Physics Corporation. Included in their survey was a review of the WNP-2 Task Force program methodology, documentation control and methods, and HED Reports with recommended corrective actions.

5.5 Verification of Task Performance Capabilities

Verification is accomplished by comparing the inventory of existing control room instrumentation and controls with the instrumentation

and control requirements identified in the Function and Task Analysis. Specifically, the results of this comparison identifies instrumentation and controls required by the control room operator for task performance but not provided in the control room.

Additionally, control room instrumentation and control design is evaluated to assure that selected design improvements, both individually and collectively, adequately correct discrepancies and do not create other safety problems. Verification is accomplished by performing the following:

- Comparison of the modified control room design with the control room human factors design conventions.
- Comparison of the modified control room design with the instrumentation and controls requirements identified during the Function and Task Analysis.
- Comparison of the modified control room design with approved project design criteria (e.g., electrical separation criteria).

The BWROG Program was used to provide verification of control room instrumentation and control adequacy and provided information as to the need for control room improvements during plant construction. [See section 5.2.1 of this Program Plan.] Subsequent verification to be performed by the Supply System Task Force will be based on the results of Function and Task Analysis performed per section 5.2.2 of this Program Plan.

5.6 Validation of Control Room Function

The validation process will utilize the upgraded EOPs and the modified control room or simulator to verify, by talk and walk-throughs of event sequences selected from those studied in the Function and Task Analysis, that the functions allocated to the control room operators can be accomplished in an effective manner. The modified control room will include changes resulting from the CRDR and other improvement programs, such as SPDS and RG 1.97 Rev. 2.

Any potential HEDs resulting from the validation process will be processed as described in section 6.0, Assessment and Implementation.

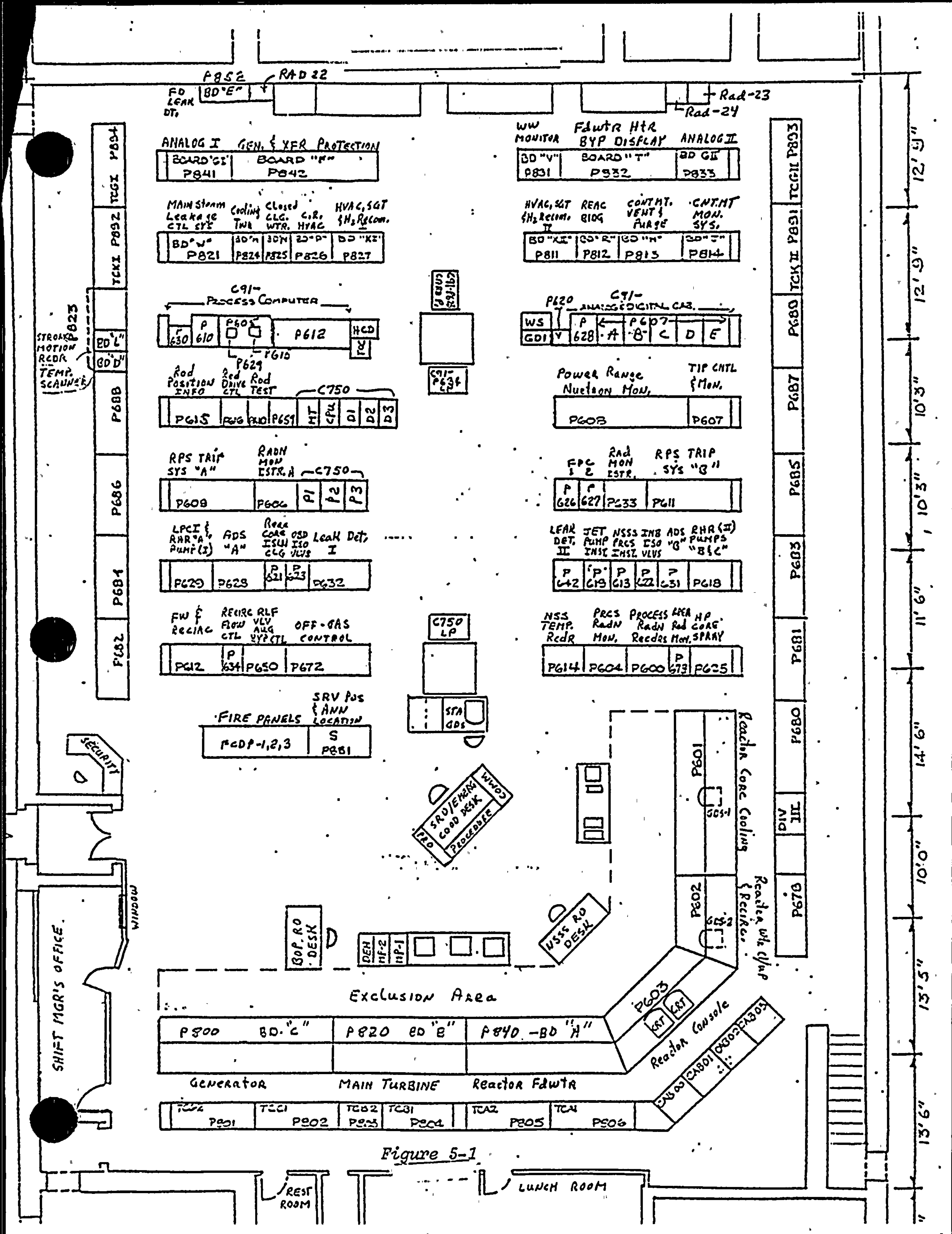

P852
RAD 22
FD LEAK DT.
BD "E"
Rad-23
Rad-24
ANALOG I
GEN. & XFR PROTECTION
BOARD 'GI'
P841
BOARD "F"
P842
WW MONITOR
Fdwtr Htr BYP DISPLAY
ANALOG II
BD "V"
P831
BOARD "T"
P832
BD GII
P833
Main Steam Leakage CTL SYS
Cooling Twr
Closed CLG. WTR.
C.R. HVAC
HVAC, SGT & H2 Recom.
P821
P824
P825
P826
P827
HVAC, SGT & H2 Recom. II
REAC BLDG
CONT MT. VENT & PURGE
CNT MT MON. SYS.
P811
P812
P813
P814
C91- Process Computer
P630
P610
P605
P612
HCD
P629
P616
P620
C91- ANALOG DIGITAL CAB.
WS
GDI
P628
P607
A B C D E
STRONG MOTION RCDR
TEMP. SCANNER
P823
BD "L"
BD "D"
Rod Position INFO
Rod Drive CTL
Rod TEST
C750
P615
P651
MT
CPU
D1 D2 D3
Power Range Nucleon Mon.
TIP CNTL & Mon.
P608
P607
RPS TRIP SYS "A"
RADN MON ESTR. A
P609
P606
P1 P2 P3
FPC 1 2
Rad MON ESTR.
RPS TRIP SYS "B"
P626
P627
P633
P611
LPCI & RHR "A" PUMP (I)
ADS "A"
Recirc Core ISLN CLG
OSD ISO VLVS
Leak Det. I
P629
P628
P621
P623
P632
LEAK DET. II
JET PUMP INST
NSSS PRCS INST.
INB ISO VLVS
ADS "B"
RHR (II) PUMPS "B & C"
P642
P619
P613
P622
P631
P618
FW & RECIRC
RECIRC FLOW CTL
RLF VLV AUG SYS CTL
OFF-GAS CONTROL
P612
P634
P650
P672
C750 LP
NSS TEMP. Rcdr
PRCS RadN MON.
PROCESS RadN Recdrs
AREA Rad MON.
HP CORE SPRAY
P614
P604
P600
P673
P625
FIRE PANELS
SRV Pos & ANN LOCATION
FCDP-1,2,3
P881
SECURITY
SRO/EMERG COOD DESK
COMM
PROCEDURE
P601
Reactor Core Cooling
GDS-1
P602
GDS-2
Reactor W/C C/UP & Recirc.
NSSS RO DESK
BOP RO DESK
DEH
MF-2
MP-1
Exclusion Area
P603
CRT
Reactor Console
P800 BD. "C"
P820 BD "B"
P840 -BD "A"
Generator
MAIN TURBINE
Reactor Fdwtr
P801
P802
P803
P804
P805
P806
SHIFT MGR'S OFFICE
WINDOW
REST ROOM
LUNCH ROOM
P894
P892
P893
P891
P880
P687
P688
P686
P685
P684
P683
P682
P681
P680
P678
DIV III
12' 3"
12' 9"
10' 3"
10' 3"
11' 6"
14' 6"
10' 0"
13' 5"
13' 6"

Figure 5-1

CONTROL ROOM PANELS REVIEW

Main Benchboards

P601	P800
P602	P820
P603	P840

Remote Shutdown Panels

P001	P100

Vertical Panels

P614	P824
P672	P825
P811	P826
P812	P827
P813	P831
P814	P832
P821	P851

Fire Control Panels

Table 5-1

CONTROL ROOM SURVEY SUBJECT AREAS

A. PANEL LAYOUT AND DESIGN

Anthropometrics and control room layout
Demarcation lines and mimics
Control/display grouping
Color codes
Labels
Temporary modifications
Traffic patterns and panel arrangement

B. INSTRUMENTATION AND HARDWARE

Controllers
Indicators
Recorders
Indicating lights
Switches
Emergency switches
Key-lock switches

C. ANNUNCIATORS

Grouping
Window design
Visual alarm
Audible alarm
Acknowledgement
Visual alarm
Procedures
Maintenance
Nuisance alarms

D. COMPUTERS

Console
Capability
CRTs
Typers

E. PROCEDURES

Availability
Access and recognition
Format
Content
References
Revision
Logkeeping

F. CONTROL ROOM ENVIRONMENT

Communications
Auditory displays
Lighting
Heating and ventilation
Fire control
Emergency situations

G. MAINTENANCE AND SURVEILLANCE

Operator functions
Jumpers and lifted leads
Permanent modifications
Tags
Spare parts
Procedures

H. TRAINING AND MANNING

Training
Control room manning
Shift change

Table 5-2

6.0 HED ASSESSMENT AND IMPLEMENTATION

During the Assessment and Implementation phase, all discrepancies identified will be analyzed, and the potential impact of each discrepancy on safe plant operation will be determined. Discrepancies will then be categorized according to their safety and reliability consequence. Corrective recommendation will then be selected and a schedule for implementation developed.

The HEDs identified by the review process are considered potential HEDs until assessed and dispositioned according to this program.

6.1 Review Process

A review report is prepared by the assigned Task Force member. The review report identifies the area of review and concerns/problems noted during the review and provides selected corrective recommendations. The review report is distributed to all Task Force members.

Each Task Force member reviews the report to ensure completeness and accuracy in their area of expertise. The Task Force Coordinator overviews to ensure each area of review is adequate prior to preparation of the HED Report. Each member is free to review the reports in each others area of expertise as the need arises.

Human Factor affecting activities within the control room are reviewed by the Task Force to ensure configuration control and integration between related activities. Specific design and layout reviews include such areas as RG-1.97, RG-1.47, Safety Parameter Display System, new BWR Emergency Procedure Guidelines and Procedures, TMI-related tasks, and other engineering changes.

A Task Force meeting is held to discuss the Review Reports and resulting concerns and recommendations. Review Report changes, additions and deletions are agreed to, and the report subsequently revised. All resulting concerns are reviewed against the HED Prioritization Criteria. Prioritization coding requires the unanimous agreement by the Task Force Team for each item of concern. All concerns are noted on the HED Report for document completeness and traceability. The HED Report is prepared, concurred with by each Task Force member, and forwarded to Management.

Prior to plant licensing, Project Management has authorized the startup organization's Control Room Coordinator, responsible for coordinating control room startup and construction activities, to review and approve Task Force HED Reports and corrective recommendations. Upon review of the HED Report, the Startup Control Room

Coordinator meets with the Task Force to resolve areas of startup or construction impacting concern. All changes from the HED Report are unanimously agreed to and documented by Project Management Directives to the Architect-Engineer for implementation [see Figures 6-1 and 6-2].

Upon plant licensing, the Plant Operating Committee provides the review and approval of CRDR corrective recommendations which affect safety. Other CRDR corrective recommendations, such as panel enhancements, are implemented using plant administrative control procedures upon approval of the Task Force [see Figure 6-3].

6.2 Corrective Recommendations

Corrective reommendations are developed to bring the HEDs into agreement with acceptable human factors guidelines. The specific corrective actions chosen may be enhancements, design modifications, improved training, revised procedures, or any of the above either individually or in combination. The recommended corrective action is documented on the HED Report form.

Many potential HEDs are the result of minor human engineering violations or incongruent design efforts (e.g., improper abbreviations and tagging, indicator wording and scale marking, system identifications) and can usually be corrected by enhancement. Potential HEDs selected for correction by enhancement techniques do not require categorization relative to safety or reliability consequences. However, the enhancements themselves are considered in the evaluation of aggregate HEDs as well as their effect on the entire control room. Also, enhancements are not viewed as solutions to serious human factor design problems. All HEDs not correctable by enhancement techniques are evaluated for design corrections.

6.3 Assessment of Human Engineering Discrepancies

Each HED is assessed for its seriousness using the following considerations:

- The extent or degree the HED deviates from the guidelines of the BWROG checklists, NUREG-0700, NUREG-0801, or other applicable human engineering guidelines.
- The impact of each HED on operator performance.
- The probability that the HED will degrade operating crew performance, thereby increasing the potential for operator error.

- Industry operational and design concerns as noted in operating experience reports, control room audits of other utilities, and other industry documents.

For each potential HED, the Task Force determines 1) the safety and/or reliability consequences that could result consistent with the seriousness of the deficiency and 2) the likelihood of operator error and/or the operator's opportunity to correct the error. A ranking factor, Category I (highest) through Category V (lowest), is assigned to each potential HED.

The Task Force also reviews the potential HED based on industry assessment of the specific deficiency type irrespective of the WNP-2 design. A risk factor is assigned based on deviation significance from human factor guidelines, operating experience information from other utilities, control room audit reports from other utilities, and other applicable documents. A risk factor of high, medium, or minimal is assigned.

6.4 Prioritization and Implementation

The need to correct an identified HED is based on its assigned assessment category and licensing risk category. The Prioritization Guideline Table, noted below, provides guidance for the Task Force in determining HED corrective priority and implementation schedule. Deviations from the guideline table may occur based on individual assessment.

Prioritization Guideline Table

Category	Risk: High	Risk: Medium	Risk: Low
Safety I	1	1	1 or 2
Safety II	1	1	1 or 2
Reliability III	1	2	2 or 3
Reliability IV	2	2 or 3	3
Neither V	2 or 3	2 or 3	3

Priority Rating	Schedule
1	Prompt/Prior to Fuel Load
2	Near Term/After Fuel Load
3	Correction Optional

HEDs, identified for "prompt" or "near term" correction, are evaluated against system completion, contractor turnover, and plant operating schedules to determine the exact timing for the correction. In general, the corrections necessary are formed as soon as practical to allow for subsequent training, procedures, verification, and validation. The actual schedule for corrections depends on availability of instrumentation, procurement scheduling, status of procedures, training and retraining, and other related concerns.

PROJECT CONSTRUCTION PHASE

SUPPLY SYSTEM TASK FORCE REVIEW PROCESS

Task Force Member	Perform Review Prepare Review Report	Assess Human Factor Concerns; Develop Recommendations
Task Force Team	Review Report Findings	Assess Review Completeness; Assess Operational Impact; Assess Engineering Impact
Task Force Team	Prepare HED Report	Assess HED Discrepancies; Prioritize HEDs; Approve HED Corrective Recommendations
Startup Control Room Coordinator	Review HED Report	Assess HED Recommendations; Assess Construction/Startup Impact
Task Force Team/ Startup Control Room Coordinator	Resolve Conflicts	
Startup Control Room Coordinator	Project Directive to the A-E	
Architect-Engineer (A-E)	Prepare Detail Design Changes	

Figure 6-1

PROJECT CONSTRUCTION PHASE

BWR OWNERS' GROUP SURVEY REVIEW PROCESS

BWR Owners' Group Survey Team	Perform Review Prepare Review Report	Assess Human Factor Concerns; Develop Recommendations
(Supply System) Task Force Team	Review Report Findings	Assess Review Completeness; Assess Operational Impact; Assess Engineering Impact
Task Force Team	Prepare HED Report	Assess HED Discrepancies; Prioritize HEDs; Approve HED Corrective Recommendations
Startup Control Room Coordinator	Review HED Report	Assess HED Recommendations; Assess Construction/Startup Impact
Task Force Team/ Startup Control Room Coordinator	Resolve Conflicts	
Startup Control Room Coordinator	Project Directive to the A-E	
Architect-Engineer (A-E)	Prepare Detail Design Changes	

Figure 6-2

PLANT OPERATION PHASE

SUPPLY SYSTEM REVIEW PROCESS

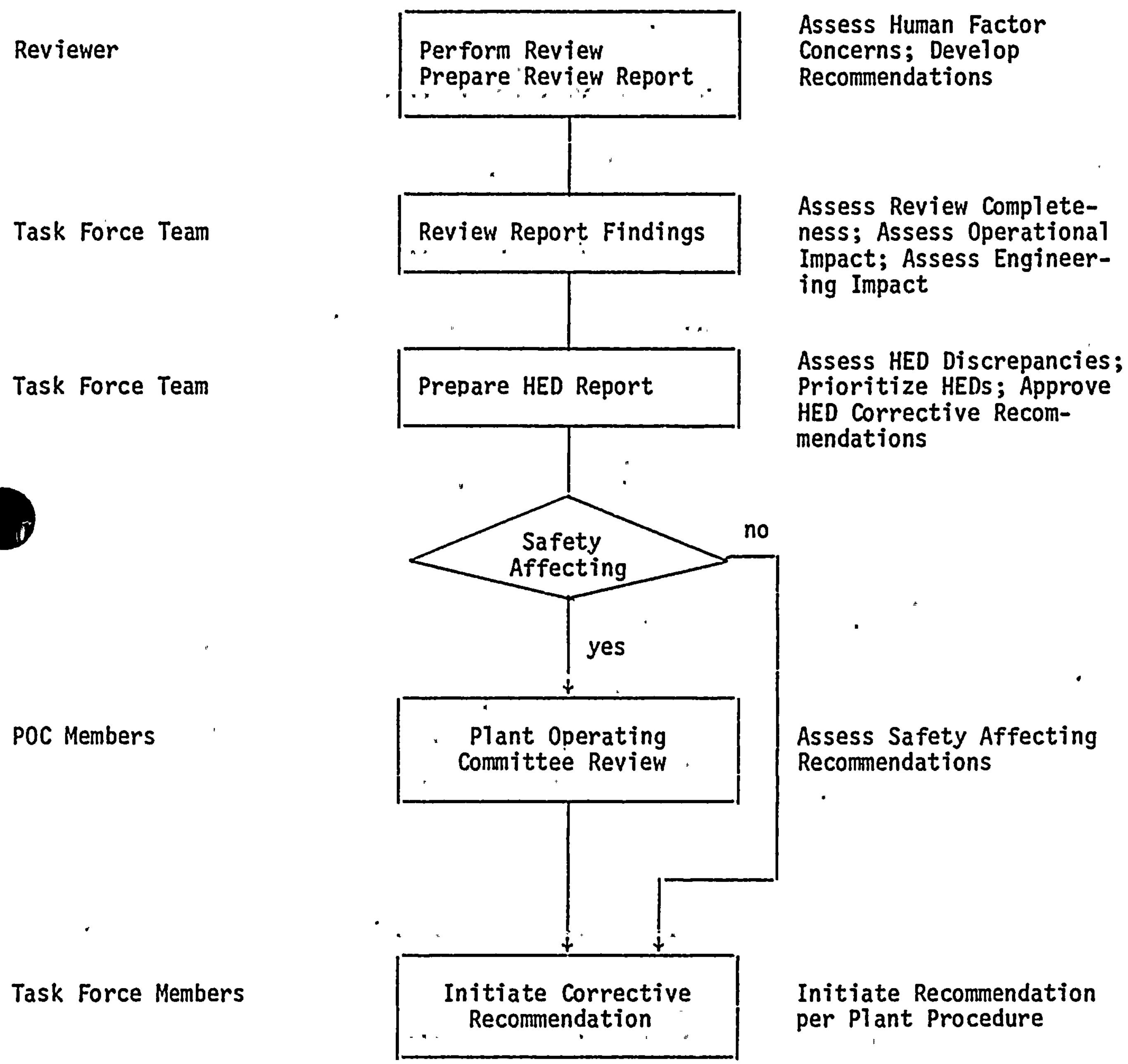


Figure 6-3

HED PRIORITIZATION CRITERIA STANDARD

1) Categorization Code

Category I - Safety Related, Minimum Opportunity to Correct Error

Category II - Safety Related, Some Opportunity to Correct Error

Category III - Reliability Related, Minimum Opportunity to Correct Error

Category IV - Reliability Related, Some Opportunity to Correct Error

Category V - No Impact on Safety or Reliability

In Terms of Need:

Category I - To enhance safe operation, the change should be made.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category II - To enhance safe operation, the change should be made.

Category III - To enhance reliable operation, the change may be desirable.

- Remove or mitigate discrepancy
- Provide error feedback to the operator
- Increase time to respond to error

Category IV - To enhance reliable operation, the change may be desirable.

Category V - Change may improve operations.

2) Risk Assessment

a. High
b. Medium
c. Minimal

Risk Assignment Based on:
- Guidance in draft NUREG-1580, 0659, and 0700
- Audits of other control rooms
- BWR Owners' Group decisions
- Operating Experience Reports

3) Prioritization/Schedule to Complete

1. Prior to fuel load/prompt
2. After fuel load/near term
3. Correction optional

Figure 6-4

ATTACHMENT A

CRDR PROGRAM PERSONNEL

RESUME BRIEFS

SUPPLY SYSTEM TASK FORCE

R. G. DaValle, Task Force Coordinator

Bachelor of Science in General Engineering. Experience includes seventeen years in the nuclear industry: Five years as a certified control room supervisor, three years in project design engineering of FFTF, and ten years with the Supply System in plant operations holding positions of Senior Operation Engineer, Supervisor Generation Administrative Services, and Nuclear Safety Specialist.

Member of BWROG Committee on Control Room Design Review Program. Attended ten-day Owners' Group Human Factors Workshop Program. Participated in the Owners' Group Survey of the Peach Bottom 2 and 3 Nuclear Power Station Control Rooms.

Responsibility to WNP-2 Program Management for NUREG-0660, Item I.D.1/ NUREG-0700 Program Implementation. Provide administrative and document control for the program; maintain working files and HED Log; ensure adequacy of Control Room reviews; coordinate license and A-E engineering changes affecting the control room; perform assigned areas of review; and provide detailed overviews of Review Reports and HED Reports.

C. H. McGilton, Plant Operations Representative

Bachelor of Science in Metallurgical Engineering, Graduate of Oak Ridge School of Reactor Technology, and NRC Licensed Senior Reactor Operator. Experience includes twenty years in the nuclear industry: Four years with the U.S. AEC, three years as Shift Supervisor in the U.S. Navy Nuclear Program, two years in engineering assignments involving BWR startup, operation, and refueling, and ten years at WNP-2, consisting of seven years as WNP-2 Plant Operations Supervisor and presently as Manager of the WNP-2 Nuclear Safety Assurance Group.

Attended ten-day Owners' Group Human Factors Workshop Program.

Responsible for performing assigned areas of Control Room Reviews, providing operational reviews of Review Reports and HED Reports against available operational procedures and technical specification, interfaces with experienced plant operation personnel, and integrates human factors input into plant operations organization.

B. J. Van Erem, Architect Engineer Representative

Graduate of U.S. Naval Nuclear Power School, Westinghouse Reactor Design School, and U.S. Navy Electronics and Advanced Electronics Schools.

Experience includes twenty-two years in the nuclear field: Eight years in the U.S. Navy either aboard nuclear submarines or at naval nuclear test facilities, five years with the U.S. Atomic Energy Commission as Senior Inspector, Naval Reactors Division, two years as Assistant Chief Nuclear Fueling Engineer with Morrison-Knudsen Company, one year with Burns & Roe, Inc., as Senior Operations/Test Engineer on Nuclear and Fossil Station Test Programs, four years as Senior A-E Construction Superintendent at WNP-2, one year as Engineering Manager for the WNP-1 Instrumentation Contractor, and presently Senior Instrumentation and Control Engineer for the WNP-2 Architect-Engineer, Burns and Roe, Inc.

Participated in the Owners' Group Control Room Survey of Nine-Mile Point Nuclear Power Station.

Responsible for performing assigned areas of control room reviews, integrating ongoing engineering changes between the Task Force and the A-E and providing detailed engineering reviews of Review Reports and HED Reports against plant design and engineering criteria.

R. E. Green, NSSS Vendor/Engineering Representative

Bachelor of Arts in Business Administration and Bachelor of Science in Industrial Technology. Experience includes nineteen years in the nuclear industry: Two years as a Journeyman Electrician with the U.S. Atomic Energy Commission, nine years with General Electric Company as an Instrumentation and Control Safety System Design Engineer, which included design work on the WNP-2 Control Room panels, and eight years with the Supply System as a Project Instrumentation Design Engineer and Senior Instrumentation Engineer.

Attended ten-day Owners' Group Human Factors Workshop Program. Participated in Owners' Group Survey of the Pilgrim Nuclear Power Station Control Room.

Responsible for performing assigned areas of control room reviews, providing NSSS design and instrumentation review of Review Reports and HED Reports and interfacing with licensee's engineering staff and integrating engineering changes with the task force reviews.

G. J. Freeman, Startup Control Room Program Coordinator

Bachelor of Science in Electrical Engineering. Experience includes sixteen years in the nuclear industry and twenty-one years in Industrial Control Systems. Experience includes checkout, startup, and operating assistance on complex instrument and electrical control systems, such as Recirculation and Feedwater Systems, BWR NSSS experience with General Electric as a troubleshooting specialist in instrument and electrical control systems, and presently Startup Control Room Manager responsible

for coordinating WNP-2 Control Room-related Startup and Construction activities. Holds professional license in Control Systems.

Authorized by Project Management to review and approve Task Force HED corrective recommendations. Provides Startup and Construction Impact Reviews and Design Coordination.

D. C. Burgy, Human Factors Consultant

Manager, Human Factors Engineering, General Physics Corporation; Ph.D Candidate, Applied Experimental Psychology. Nineteen years of experience in Human Factors Engineering and Man-Machine System Design and Evaluation. Areas of human factors expertise include systems analysis, information processing, man-computer interactions, performance evaluation, training systems, and speech/nonspeech communications. Applied research background includes an emphasis in experimental design and methods, multivariate statistical analysis, mini/micro computer applications, and software psychology.

Experience in nuclear power plant control room reviews includes onsite field evaluations at North Anna, Surry, Zion, LaSalle, Susquehanna (Advanced Control Room Design), and Zimmer Stations. Evaluations have included the application of current NRC Human Factors Guidelines and existing military standards to control room designs as well as field and laboratory experimentation to validate criteria used in design tradeoff analyses.

R. J. Little, Human Factors Consultant

Staff Scientist, General Physics Corporation; M.S., Industrial Engineering and Operations Research. Seventeen years of experience included conducting and teaching human factors seminars, Lead Human Factors Engineer for review of Georgia Power Company's Plant Vogtle Control Room, and Project Manager of the Human Factors Review for Long Island Lighting Company's Shoreham Nuclear Power Station.

Responsible for the review of assigned control room areas, review WNP-2 Program Methodology and Documentation Control, and review Task Force Review Reports and HED Reports for adequacy of human factor concerns and recommended corrective action.

R. A. Call, Computer Support Specialist

A.A. Degree in Electronics Engineering Technology. Experience includes twenty-one years in the nuclear industry: Thirteen years as Operations Staff Specialist with Argonne National Laboratory, eight years as Senior Instrument and Control Engineer and Senior Computer Engineer, and

presently Senior Engineer, Nuclear Safety Assurance. Past experience includes responsibility for plant computer design criteria and specifications, instrument rack and control board specifications, and security system design requirements.

Participated in the Supply System CRDR review of WNP-3/5 Control Room. Responsible for providing support and performing reviews in the area of WNP-2 computer design and operability.

BWROG SURVEY TEAM

Warran Babcock, Boston Edison Company

WNP-2 BWROG Survey Team Leader.

Bachelor of Science in Electrical Engineering. Experience includes fifteen years in the nuclear industry, four years with Boston Edison Company as a Senior Electronics Engineer, two years with Burns and Roe as a Senior Instrumentation and Control Engineer, two years with Ebasco as a Senior Instrumentation and Control Engineer, three years with Stone and Webster as a Control Engineer, and four years with Babcox and Wilcox as a Plant Electrical Engineer. Experience includes control board design and layout with several of the above companies.

Member of the BWROG Committee on Control Room Design Review Program. Attended ten-day Owners' Group Human Factors Workshop Program and a two-week MIT course on Control Room Improvements. Team Leader for BWROG surveys of Limerick 1 and 2, Peach Bottom 2/3, Pilgrim, Nine-Mile Point 1 and 2, Brown's Ferry 1/2/3, Duane Arnold, and WNP-2 nuclear power stations.

Art Vierling, Niagara Mohawk Company

Bachelor of Science in Mechanical Engineering. Experience includes seven years in the nuclear industry with Niagara Mohawk, two years as a Site Quality Control Engineer, and five years as an Instrumentation and Control Engineer. Experience includes three years at Nine-Mile Point 1 nuclear power station. Presently Lead PGCC Engineer responsible for the preliminary testing, startup, and human factors review of the Nine-Mile Point 2 nuclear power stations control room Power Generation Control Complex (PGCC).

Member of the BWROG Committee on the Control Room Design Review Program, member of the INPO Committee on Control Room Design Review, attended ten-day Owners' Group Human Factors Workshop Program, attended three-day Stone and Webster Control Room Human Factors seminar, coordinated the BWROG survey of Nine-Mile Point 1, and participated as a member of the BWROG survey team for Brown's Ferry 1, 2, and 3, Nine-Mile Point 2, and WNP-2 nuclear power stations.

Al Miller, Yankee Atomic Electric Company

Bachelor of Science in Electrical Engineering. Experience includes fifteen years in the nuclear industry with Yankee Atomic Electric Company

and eight years with Foxburrow, Inc., in instrumentation and panel design. Experience includes new plant design and design backfitting at Main Yankee, Vermont Yankee, and Yankee Rowe nuclear power stations and presently Senior Instrumentation and Control Engineer in the Human Factors Engineering section at Yankee Atomic Electric Company.

Attended two-week MIT course on control room improvements and several seminars, member of utilities Human Factors Engineering section, and participated as a member of thw BWROG survey team at Seabrook and WNP nuclear power stations.

R. M. Fairfield, General Electric Company

Bachelor of Science in Electrical Engineering, Professional Engineer, Nuclear Engineering. Experience includes seventeen years in the nuclear industry: One year in control and instrumentation, eight years in startup and operations, two years as an operator certification instructor at the Morris, Illinois, simulator, and six years in program management.

Member of BWROG survey team for three plants and author of two Control Room Design Review Summary Reports.

K. C. Ross, General Electric Company

Experience includes nine years in the nuclear industry: Four years as an instructor in the U.S. Navy nuclear power program, two years as an instructor at the Morris, Illinois, simulator, and three years as a Program Manager for General Electric in the BWROG Control Room Improvements program. Holds Senior Reactor Operators license and certified by NRC to teach all phases of BWR operation.

Program Manager for the BWROG Control Room Design Review Program. Provided management support for eighteen BWR control room reviews, principal author of nine Control Room Design Review Summary Reports, coauthor of an additional seven. Developed, organized, and presented the BWROG Control Room Survey Program Workshop, attended MIT summer program on human factors engineering, and INPO workshop on control room evaluations. Coauthor of BWROG Emergency Procedure Guideline Training appendices.

Dr. Melvin D. Field, Massachusetts Institute of Technology, Human Factors Consultant

Degree in Electrical Engineering, with professional engineers license. Twenty-eight years experience in Systems Engineering, analysis, and design, communications technology and information science, computer program planning and management, man-machine interfaces, and graphic displays. Member of the BWROG survey team for WNP-2 nuclear power station.

ATTACHMENT B

TASK FORCE

REVIEW DOCUMENTATION SAMPLES

CONTROL ROOM PANEL LAYOUT DESIGN REVIEW
PANEL P602

RWCU and RRC Control Panel

Concern

Panel P602 provides controls for the Reactor Water Cleanup (RWCU) and Reactor Recirculation Control (RRC) systems, with several miscellaneous groupings of Main Steam Line (MSL) drain valves, radwaste equipment drains, and Reactor Feedwater (RFW) isolation valves. Except for the lack of contrast between systems or groups of controls, which in general, applies to all the control room panels, specific concerns noted are:

1. The RFW isolation valves are not grouped with the feedwater system controls on P840, and are essential equipment whose controls are located on a non-essential panel. No functional need exists for the controls on P602.

2. The MSL drain grouping of controls can be arranged into four basic flow paths or control groupings; RPV head vent, MSL drains, and drains from main steam isolation valves MS-V-28 (A, B, C, D) and from MS-V-22 (A, B, C, D). There is a lack of contrast between the four groups, and some controls are not arranged with their respective drain groups or consistent in operating sequence. Specific conserns noted are:

   a) MD-V-73 drain control is not grouped with its respective bypass valve or operationally sequenced with the other main steam line drain controls, and is mixed with the MS-V-28 isolation valve drain controls.

   b) MD-V-60 drain control for isolation valves MS-V-28 (A, B, C, D) is not grouped with the respective bypass valve, and is mixed with the main steam line drain controls.

   c) MS-V-21 and MS-V-156 drain controls for isolation valves MS-V-22 (A, B, C, D) are not consistent in arrangement with the other drain groups. This section of P602 has the drain controls arranged in a horizontal sequence, except for these two controls, which are in a vertical sequence.

3. The RWCU system lack visibility as to flow path or operating sequence. The arrangement requires increased operator knowledge and awareness of the system flow path to function. Specific concerns noted are:

   a) The RPV vessel reject controller is separated from its respective valve controls, and should be grouped together to facilitate operation.

b) The RWCU system controls are not arranged to facilitate ease of operation. The two system bypass valve controls are not grouped together, the system suction controls are reverse of normal sequence convention (BA rather than AB) and control operating sequence jumps both vertically and horizontally rather than a smooth sequence from left to right.

c) RWCU-V-40 is an essential control valve whose control is located on P602, a non-essential panel. Per engineering, RWCU-V-40 should be moved off of P602.

d) The two RWCU system conductivity recorders are reverse of normal convention (outlet before inlet).

4. RRC system reviews noted the following concerns:

a) RRC Loop A and B isolation valve controls blend too well into the panel arrangement. Contrast is needed to improve their visibility for access and to prevent inadvertent operation.

b) RRC two pen recorders R650 and R614 are inconsistent in use of pen color code. R650 has Loop A and B temperatures as red and black, respectively, while R614 has Loop A and B flows as black and red, respectively. Color coding is not consistent.

c) A design change (FDI-TCHI) has located controls and indicating lamps for the flux discriminator master controller (located on P603) with RRC Loop B displays on P602. This needs to be reviewed with respect to system grouping and demarcation application before installation.

d) Flow control valves RRC-V-60 (A, B) are hydraulically operated. PED 218-E-5079 specifies that the hydraulic system isolation valve controls HY-V-17, 18, 19, 20 (A/B) be located on P602. Per engineering, the PED must be changed to relocate the essential hydraulic isolation valve controls from P602, which is a "non-essential" panel. A new location is required.

5. Two CRT's will be used for the Safety Parameter Display System (SPDS). A location is required for the CRT's.

Recommendations

1. Relocate RFW-V-32 (A, B) and RFW-V-65 (A, B) to Panel P840. The four feedwater controls are for manually isolating the RFW system. Since these are not automatic isolation valves, placing them on P601 NS^4 area would be inconsistent with the present controls at the NS^4 area. The RFW controls were therefore, relocated to P840 and grouped with the other RFW system controls. See P840 for details.

2. Rearrange the MSL drain controls to improve grouping and visibility of the four groups of drain controls. The air operated valve controls were located to the right of their respective bypass controls for consistency of arrangement, and demarcation lines applied to provide contrast.

3. Rearrange the RWCU system.

   a) The RPV vessel reject controls were grouped together in an operational sequence, and the RWCU system flow path arranged in a smooth operating sequence from left to right. With the addition of mimicing demarcation lines and a system flow diagram legend plate, operability of the system is significantly enhanced.

   b) Retain the control for RWCU-V-40 on P602. On review of RWCU-V-40 isolation valve control, a more appropriate operational location could not be identified than with the RWCU system on P602. Upgrade Panel P602 to an "essential" panel.

4. The RRC system arrangement was found to be satisfactorily arranged and grouped by Loop A and Loop B. The concerns noted earlier were resolved as follows:

   a) Install mimicing on RRC Loop A and B per the configuration drawing. The added mimicing provides contrast and visibility as to the relationship between the isolation valves, flow control valve controller, and pump controls.

   b) Modify recorders R650 and R614 such that the red pen in each recorder is used for Loop A readout. This is consistent with other two pen recorders.

   c) Relocate controls S122 and S123, and lamps FEL-1, 2, and 3 per the configuration drawing. This removes the controls from the RRC Loop B area of the panel, placing them in a general area close to its associated master flux controller on P603.

   d) Retain the HYD-V-17, 18, 19, 20 (A/B) hydraulic line isolation valve controls on Panel P602. Lockup of the RRC loop flow control valves is required under certain operational conditions. Access near the flow valve controllers is needed. The hydraulic isolation valves were therefore kept on P602. Upgrade Panel P602 to an "essential" panel.

5. Locate the two SPDS CRT's on P601 and P602. Tentative locations have been identified and reserved for the CRT's. The planned location on P602 appears to provide ready access and clear visibility to the operator from the feedwater and reactivity control area of the control room. Final layout approval is pending engineering design, hardware selection and operational review of the Emergency Procedures.

EQUIPMENT AFFECTED BY RECOMMENDATIONS

RWCU AND RRC PANEL - P602

A. RFW System

1. Remove to Panel P840:

RFW-V-32A	RFW-V-65A
RFW-V-32B	RFW-V-65B

B. Main Steam Line Drain System

1. Rearrange per configuration drawing:

MS-V-20	MS-V-71
MS-V-21	MS-V-72
MS-V-69	MS-V-73
MS-V-156	

C. RWCU System

1. Rearrange per configuration drawing:

RWCU-V-31	RWCU-V-40
RWCU-V-34	RWCU-V-42
	RWCU-V-44
RWCU-V-1A	RWCU-V-100
RWCU-V-1B	RWCU-V-104
	RWCU-V-106

D. RRC System

1. Modify recorders R614 and R650 such that the red pens are used for Loop A, and black pens for Loop B.

2. Modify FDI-TCHI rearrangement per configuration drawing:

B35-S122	FEL-1
B35-S123	FEL-2
	FEL-3

3. Change PED 218-E-5079 to locate HY-V-17, 18, 19, 20 (A/B) controls on Panel P602 per recommendations.

E. SPDS

1. Install SPDS CRT per configuration drawing.

WNP-2 CONTROL ROOM PANEL ANNUNCIATOR REVIEW

PANEL P602 — Date: October 30, 1981

Rev.: 1

I. PURPOSE

The purpose of this review was to evaluate the annunciators on P602 for the following:

- Annunciator Grouping
- Annunciator Window (Tile) Color Prioritization
- Annunciator Window Wording
- Annunciators that have multiple actuation inputs which are independent and can exist at the same time.
- Need for Addition and/or Deletion of Annunciators

II. SCOPE

The scope covers all the annunciators for the systems controlled from P602. There are no R.G.-1.47 changes to the P602 annunciators.

III. FINDINGS

A. Annunciator Grouping

1. Annunciator grouping on panel P602 is good. The only discrepancy noted was that the Radwaste System annunciators were unnecessarily on both annunciators A5 and A13. Attachment 4 of this review shows the existing P602 annunciator grouping.

B. Annunciator Window Color Prioritization

1. In general, the window color prioritization is good. Some inconsistancies were, however, noted and are detailed in Attachment 1 of this review.
2. There are eight (8) windows on annunciator A13 which are white. GE drawing 761E791AD specifies amber color for these windows. See Attachment 5 of this review for the specific windows.

C. Annunciator Window Wording

1. Annunciator window wording on panel P602 is good. Some minor discrepancies were noted, however, and are detailed in Attachment 2 of this review.

D. Annunciators Having Multiple Actuation Inputs

1. Eight (8) annunciators have multiple actuation inputs which are independent and can exist at the same time, which prevents the operator of being alerted to additional alarm conditions after one alarm comes in and remains in the alarm state. Attachment 3 contains a listing of the above annunciators. Annunciators with multiple inputs from redundant channels monitoring the same parameter are not listed in Attachment 3.

E. Need for Addition and/or Deletion of Annunciators

1. There are four (4) RHR/RCIC annunciators on P602 which should be relocated to P601.

IV. RECOMMENDATIONS

A. Annunciator Grouping

1. Relocate three (3) annunciator windows as shown in Attachment 5. Attachment 4 shows "as-is" grouping. The proposed grouping locates all RadWaste system windows on annunciator A13.

2. Correct GE drawing 807E174TC, Rev. 9 to show that annunciator A13-1.2 is actually installed in A13-1.1.

NOTE: Proposed Annunciator Wording Changes are not shown in Attachment 5.

B. Annunciator Window Color Prioritization

1. Make annunciator window color changes proposed in Attachment 1. Justification is stated in Attachment 1. Attachment 5 also shows the proposed colors.

2. Change the color of eight (8) windows on annunciator A13 from white to amber to conform to GE drawing 761E791AD. See Attachment 5 for specific annunciator windows.

C. Annunciator Window Wording

1. Review annunciator window wording as shown in Attachment 2.

2. All acronyms and abbreviations shall be in accordance with the "WNP-2 Standard List of Acronyms and Abbreviations for Control Room Labels and Legend Plates".

3. Correct any wrong spelling.

4. Change all GE MPL Numbers to B&R Tag Number.

D. Annunciators Having Multiple Actuation Inputs

1. A determination should be made concerning the need for an annunciator "Reflash" capability or an acceptable alternative, such as administrative procedures. Attachment 3 lists the annunciators having multiple and independent actuation inputs.

E. Need for Addition or Deletion of Annunciators

1. Relocate the four (4) RHR/RCIC annunciators on annunciator A13 to P601. See Panel P601 annunciator review for the specific locations on P601.

2. To allow room on P603 Annunciator Panel A7, relocate P603 annunciator A7-4.8 to P602 annunciator A13-6.1.

ATTACHMENTS

1. - Proposed Annunciator Window Color Changes

2. - Proposed Annunciator Window Wording Changes

3. - Annunciators Having Multiple Inputs

4. - As Is Annunciator Arrangement (Grouping)

5. - Proposed Annunciator Color Prioritization

WNP-2 CONTROL ROOM

Attachment 1.

PROPOSED ANNUNCIATOR WINDOW COLOR CHANGES

Panel P602

Window Number	Window Wording	Color Change	Basis for Change
A5-2.2	MS Line Monitors Downscale	Amber to White	To be consistent with all other "Downscale" annunciators which are white.
A5-3.3	Off Gas High-High Radiation	Amber to Red	Both the Off Gas "High-High" Radiation and the Off Gas "High" Radiation windows are presently amber. This change will also match the light colors on P604.
A5-3.4	Off Gas Vent Pipe High-High Radia-tion	Amber to Red	Both the "High-High" and the "High windows for this parameter are presently amber. This change will also match the light colors on P604.
A5-3.2	Off Gas Post-Treatment High-High Radiation	Amber to Red	Same as above.
A5-1.5	Reactor Building Vent High Radia-tion	Red to Amber	Both the "High-High" and the "High" windows for this parameter are presently red.
A5-2.5	Reactor Building Vent Monitors Downscale	Amber to White	To be consistent with all other "Downscale" annunciators which are white.
A6-5.1	Recirc Drywell High Press Switch A In Test	Amber to White	Is an operator information annunciator.
A6-3.4	Flow Cont Valve A Hyd Power Unit Standby Hyd Pump Operating	Amber to White	Is an operator information annunciator.

PROPOSED ANNUNCIATOR WINDOW WORDING CHANGES

Attachment 2.

Panel P602

Window Number	Existing Wording	Proposed Wording
A5-3.7	Reac Water Cleanup Pump Flow High/Low	Reac Water Cleanup Pump Flow Low.
Existing A5-1.8 Proposed A13-4.2	Radwaste Controller 1 Trouble	Radwaste Logic Controller 1 Trouble.
Existing A5-2.8 Proposed A13-5.2	Radwaste Controller 2 Trouble	Radwaste Logic Controller 2 Trouble.
Existing A5-3.8 Proposed [illegible]6.2	Radwaste Controller 3 Trouble	Radwaste Logic Controller 3 Trouble.
A6-4.1	Recirc Motor A Lockout Bus Under Voltage	Recirc Motor A Breaker Aux. Trip Circuit Under Voltage.
A6-4.5	Recirc Motor B Lockout Bus Under Voltage	Recirc Motor B Breaker Aux. Trip Circuit Under Voltage.
A6-5.5	Recirc Drywell High Press Switch In Test	Recirc Drywell High Press Switch B In Test.

WNP-2 CONTROL ROOM ANNUNCIATOR REVIEW

Attachment 3.

Panel/ Annunciator	Annunciator Meaning	Remarks
P602 / A5-4.7	Reactor Water Cleanup Pump Cooling Water High Temperature	Actuated by high temperature on either RWCU pump.
P602 / A5-3.1	Reactor Building High Radiation	Actuated by any 1 of 13 ARM's.
P602 / A5-4.1	Turbine Building High Radiation	Actuated by any 1 of 5 ARM's.
P602 / A5-5.1	Radwaste Building High Radiation	Actuated by any 1 of 9 ARM's.
P602 / A5-6.1	Area Radiation Monitors Downscale	Actuated by any 1 of 30 ARM's.

ANNUNCIATORS - BOARD P602

Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	Radwaste Controller 1 Trouble W
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale A	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale A	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	Radwaste Controller 2 Trouble W
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample Flow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	Radwaste Controller 3 Trouble W
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump Cooling Water High Temp W	SPARE
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Or Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

W - White
A - Amber
R - Red

"AS IS" ARRANGEMENT

ANNUNCI[illegible] - BOARD P602

ARM		PRM				RWCU	
Refueling Floor Area High Radiation A	Main Steam Line High Radiation R	Off Gas Post Treatment High-High-High Radiation R	Reactor Building Vent High-High Radiation R	Reactor Building Vent High Radiation R	Remote Shutdown Transfer Switch In Emergency Position A	Filter Demin Influent Conductivity High/Low W	SPARE W (1)
New Fuel Storage Area High Radiation A	Main Steam Line Monitors Downscale W	Reactor Building Vent Sample Flow High/Low A	Carbon Bed Vault High Radiation A	Reactor Building Vent Monitors Downscale A	Radwaste Effluent High Radiation A	Filter Demin Effluent Conductivity High/Low W	SPARE W (1)
Reactor Building High Radiation A	Off Gas Post Treatment High-High Radiation A	Off Gas High-High Radiation A	Off Gas Vent Pipe High-High Radiation A	Off Gas Vent Pipe Sample Flow High/Low A	Service Water Effluent High Radiation A	Reac Water Cleanup Pump Flow High/Low W	SPARE W (1)
Turbine Building High Radiation A	Off Gas Post Treatment High Radiation A	Off Gas High Radiation A	Off Gas Vent Pipe High Radiation A	Off Gas Sample Flow High/Low A	Reactor Building CC Water High Radiation. A	Reac Water Cleanup Pump A Cooling Water High Temp (2)W	Reac Water Cleanup Pump B Cooling Water High Temp W(2)
Radwaste Building High Radiation A	Off Gas Post Treatment Flow High/Low A	RHR High Radiation A	Carbon Bed Vault Monitors Downscale W	RHR Monitors Downscale Or Inoperative W	Service Water Effluent Monitors Inoperative Inoperative W	Reac Water Cleanup Pump Disch Pressure High/Low W	SPARE W
Area Radiation Monitors Downscale W	Off Gas Monitors Downscale or Inoperative W	Off Gas Post Treatment Monitors Downscale W	Off Gas Vent Pipe Monitors Downscale W	Reactor Building CC Water Monitors Downscale or Inoperative W	Radwaste Effluent Monitors Downscale or Inoperative W	Cleanup Filter Demin Failure W	Cleanup Filter Inlet High Temp W

Notes: (1) Relocated to annunciator A13-P602
(2) Existing annunciator A5-4.7 split into two (2) annunciators.

W - White
A - Amber
R - Red

PROPOSED ARRANGEMENT AND COLOR PRIORITIZATION

WNP-2 CONTROL ROOM INDICATING

LIGHT REVIEW

Date: 12/8/81

Panel H13-P602

Rev: 0

I. PURPOSE

The purpose of this review was to evaluate the indicating lights on H13-P602 for the following:

- Color conformance to WNP-2 Control Room Indicating Light Color Code Standard
- Purpose of Indicating Light
- Illuminated to Indicate Implied Condition

II. SCOPE

This review covers all the indicating lights on H13-P602.

III. FINDINGS

A. Indicating Light Color

1. The color of ten (10) indicating lights on H13-P602 is not in compliance with the "WNP-2 Control Room Indicating Light Color Code Standard".

B. Purpose of Indicating Lights

1. The indicating lights above spare switches S110A and S110B serve no purpose and should be removed. A PED to add control switches for the Hydraulic Isolation Valves will utilize these switches and replace the indicating lights.

2. White light FEL-1 above the Flux Estimater Bypass switch (S122) is lighted when the Flux Estimater bypass switch is in "normal" and goes out when the switch is placed in "Bypass".

C. Illumination Status

1. All H13-P602 indicating lights are lighted to indicate the implied status.

IV. RECOMMENDATIONS

A. Indicating Light Color

1. Make the indicating light color changes proposed in Attachment 1.

B. Purpose of Indicating Lights

1. Modify the Flux Estimater bypass circuit to have light FEL-1 light when the Normal-Bypass switch (S122) is placed in the "Bypass" position and change the color of FEL-1 to amber.

ATTACHMENT

1. Proposed Indicating Light Color Changes

Attachment 1.

WNP-2 CONTROL ROOM INDICATING LIGHT REVIEW

PANEL H13-P602

LIGHT	COLOR	MEANING	Color Change / Justification
Lights (1 ea.) above FW pump trip interlock reset switches S106A and S106B.	White	Lighted-Indicates "Rx vessel low water level and feedwater flow below minimum" interlock sealed in. Interlock initiates flow control valve partial closure.	White to Amber Abnormal condition.
Lights (1 ea.) above total FW low flow interlock reset switches S107A and S107B.	White	Lighted-Indicates "low total FW flow and RRC-V-60A(B) less than 18% open" interlocks are sealed in. Interlock initiates RRC pump transfer to slow speed.	White to Amber Abnormal condition.
Lights (1 ea.) above Main Steam Line/Pump Suction Low ΔT interlock reset switches S108A and S108B.	White	Lighted-Indicates "main steam line/RRC pump suction lowΔT" interlock sealed in. Interlock initiates RRC pump transfer to slow speed.	White to Amber Abnormal condition.
Lights (1 ea.) above Rx vessel low water level interlock reset switches S113A and S113B.	White	Lighted-Indicates "Rx vessel low water level" interlock sealed in. Interlock initiates RRC pump transfer to slow speed.	White to Amber Abnormal condition.
Light FEL-2 above switch S122 (Flux Estimater alarm reset switch).	White	Lighted-Indicates Flux Estimater needs maintenance.	White to Amber Abnormal condition.
Light FEL-3 above switch S123 (Flux Estimater Alarm reset switch).	White	Lighted-Indicates Flux Estimater failure.	White to Amber Abnormal condition.

WNP-2 CONTROL ROOM LABELS AND VISUAL DISPLAY REVIEW

Panel H13-P602

I. PURPOSE

The purpose of this review was to review the labels and visual displays on Panel H13-P602 for compliance to the requirements of NUREG 0700.

II. SCOPE

The scope of this review is as follows:

Attachment 1

NUREG 0700 Sections 6.6.1.1, 6.6.1.2.a.3, 6.6.1.2.a.4, 6.6.2.1, 6.6.2.3, 6.6.2.4.a-c, 6.6.3.1, 6.6.3.2, 6.6.3.3.b, 6.6.3.4, 6.6.3.5, 6.6.3.6, 6.6.3.8, and 6.9.1.2. In addition, derived vs direct signals for indicating lights is included in Attachment 1.

Attachment 2

NUREG 0700 Sections 6.5.1.1.e(1), 6.5.1.1.f, 6.5.1.2.a-e, 6.5.1.4.a-d, 6.5.1.4.f, 6.5.1.5.a, 6.5.1.5.c-f, 6.5.2.1, 6.5.2.4, 6.5.4.2.a, 6.5.4.2.b(2), and 6.5.4.2.b(4).

III. FINDINGS

The findings are specified in Attachments 1 and 2.

ATTACHMENTS

1. Legend Plate, Escutcheon Plate and Derived Signal Review
2. Indicator, Controller and Recorder Review

[illegible]

Panel H13-P602 Rev. 1

LEGEND PLATE, ESCUTCHEON PLATE AND DERIVED SIGNAL REVIEW
MSL DRAIN VALVES SECTION

Item No.	Function of Device	Existing Wording	Revised Wording	Direct Signal (yes or no)	Spring Return Switch	Remarks
496	Main steam lines (A-D) downstream drain to main condenser isolation valve B22-F071 (MD-V-71) control switch.	Legend STEAM LINE DOWNSTREAM DRAIN MOV B22-F071 Escutcheon NOR CLOSE OPEN	Legend MAIN STEAM LINES DOWNSTREAM DRAIN MD-V-71 MC-1A Escutcheon --------	Yes	To Normal	1) Add "NOR" to Authorized List of Abbreviations. Applies to 20 switches on panel.
497	Main Steam lines (A-D) downstream drain to main condenser start up drain valve B22-F072 (MD-V-72) control switch. Bypasses MD-V-73 and restruction orfice during startup.	Legend STEAM LINE DOWNSTREAM DRAIN MOV B22-F072 Escutcheon NOR CLOSE OPEN	Legend MAIN STEAM LINES STARTUP DRAIN TH MD-V-72 MC-2C Escutcheon --------	Yes	To Normal	1) Throttle valve.
443	Main steam lines (A-D) downstream drain to main condenser low power drain valve B22-F073 (MD-V-73) control switch. Will close at > 50% when in "Auto".	Legend STEAM LINE OUTBOARD DRAIN SOV B22-F073 Escutcheon AUTO CLOSE OPEN	Legend MAIN STEAM LINES LOW POWER DRAIN MD-V-73 Escutcheon ---------	No (See Remarks)	No	1) Indication only indicates solenoid pilot valve is energized or de-energized.
491	Main steam line A downstream drain to main condenser isolation valve B22-F070A (MD-V-70A) control switch.	Legend STEAM LINE DOWNSTREAM DRAIN MOV B22-F070A Escutcheon NOR CLOSE OPEN	Legend MAIN STEAM LINE A DOWNSTREAM DRAIN MD-V-70A MC-1A Escutcheon -------	Yes	To Normal	
492	Main steam line B downstream drain to main condenser isolation valve B22-F070B (MD-V-70B) control switch.	Legend STEAM LINE DOWNSTREAM DRAIN MOV B22-F070B Escutcheon NOR CLOSE OPEN	Legend MAIN STEAM LINE B DOWNSTREAM DRAIN MD-V-70B MC-2C Escutcheon -------	Yes	To Normal	

Attachment 1

Panel H13-P602

INDICATOR, CONTROLLER AND RECORDER REVIEW

RWCU SECTION

Rev. 1

Item No.	Tag No. (MPL No.)	Function	Range	Chart Paper Range	Chart Paper Type	Recorder Ink Color	Failure Apparent	Range Adequate	Scale Adequate	Remarks
448	RWCU-FI-602 (G33-R602)	RWCU discharge to main condenser or Radwaste System flow indicator.	0-300 gpm	NA	NA	NA	Yes	Yes	Yes	
449	RWCU-RMC-606 (G33-R606)	RWCU blowdown flow controller.	Set Pt 0-100% Demand 0-100%	NA	NA	NA	Yes	Yes	See Remarks	1)Need to identify as "Demand" controller (6.5.1.1.e.1). 2)No unit of measurement on setpoint scale, deviation scale or demand scale. No units on deviation scale (6.5.1.4.a)
413	(G33-R603)	RWCU demineralizer outlet conductivity recorder.	0-1.0 umho/cm	0-1.0	Bailey 6025K50-751	Red-Filter Demin A Outlet Black-Filter Demin B Outlet	No	Yes	Yes	1)FDDR-KKI-718 installs hi/lo alarm off each pen. 2)Units stated as "micromhos" vice "micromhos/cm" (6.5.1.2.b)
414	(G33-R601)	RWCU demineralizer inlet conductivity recorder.	0-10.0 umho/cm	0-10.0	Bailey 6050K60-854	Red-RRC Loop B Black-RWCU Filter Demin Inlet	No	Yes	Yes	1)FDDR-KKI-718 installs hi/lo alarm off each pen. 2)Units stated as "micromhos" vice "micromhos/cm" (6.5.1.2.b)
403	RWCU-TI-607 (G33-R607)	RWCU sys temp indicator. Reads any 1 of 5 sys temp as selected by switch below indicator.	0-600° F	NA	NA	NA	Yes	Yes	Yes	
404	RWCU-FI-609 (G33-R609)	RWCU pumps suction line flow indicator.	0-400 gpm	NA	NA	NA	Yes	Yes	Yes	
405 (left item)	RWCU-FI-605A (G33-R605A)	RWCU demineralizer A effluent flow indicator.	0-150 gpm	NA	NA	NA	Yes	Marginal-Full flow is 134gpm	See Remarks	1)14 graduations separate numerals (6.5.1.5.a). 2)Unit graduations are 30, 60 90 etc. (6.5.1.5.c).

Attachment 2

PANEL H13-P602 SYSTEM Annunciators (49.0) REPORT NO. 036 DATE 10/30/81

WNP-2 HUMAN ENGINEERING DISCREPANCY REPORT

DESCRIPTION OF HUMAN ENGINEERING DISCREPANCY	PROPOSED CHANGE	CATEGORY (1)	LIS. RISK (2)	SCHEDULE TO COMPLETE (3)	MAN-HOURS REQUIRED	REMARKS
1) Space is needed on P603 Annunciator Panel A7 for an additional annunciator.	1) Relocate the following annunciator as indicated. Existing Location — New Location P603 — P602 A7-4.8 — A13-6.1	II	c	1		1) This change must be coordinated with Item No. 2 below.
2) The following RHR/RCIC annunciators are on P602. All RHR/RCIC controls are on P601. A13-5.1 - RCIC to RHR A Steam Trap High Level A13-5.2 - RCIC to RHR B Steam Trap High Level A13-6.1 - RCIC to RHR A/B Steam Trap High Level A13-6.2 - RCIC Turbine Exh. Drain Leg High Level	2) Relocate the following annunciators as indicated. Existing Location — New Location P602 — P601 A13-5.1 -------- A4-4.1 A13-5.2 -------- A2-5.3 A13-6.1 -------- A2-6.3 A13-6.2 -------- A4-2.4	II	b	1		2) This Item is for information only. The modification is detailed in the P601 annunciator modification package. (See HED-033).
3) Several P602 annunciators have multiple inputs which are independent and can exist at the same time, which prevents the operator of being alerted to an additional alarm after one alarm comes in and remains in the alarm state. Attachment 1 contains a listing of these annunciators.	3) Separate existing annunciator A5-4.7 as follows: A5-4.7 - Reac Water Cleanup Pump A Cooling Water High Temp. A5-4.8 - Reac Water Cleanup Pump B Cooling Water High Temp. See attached drawing (page 5 of 5) for elementary diagram.	IV	b	1		3) The balance of the annunciators with multiple inputs are acceptable and meet the requirements of the "WNP-2 Annunciator Multiple Input Alarm Standard". Indication for the multiple input parameters is available in the Control Room. Administrative Procedures will be prepared to specify monitoring requirements.

ATTACHMENT C

APPLICATION OF FUNCTION AND TASK ANALYSIS TO CRDR

APPLICATION OF FUNCTION AND TASK ANALYSIS TO THE CRDR

1.0 GENERAL

The objective of the function and task analysis phase of the CRDR is to assess the effectiveness of the control room in supporting the integrated accomplishment of operator emergency response functions. This objective is achieved by evaluating existing controls and displays against the control and information requirements identified using the analysis methodology described in the Supply System submittal Function and Task Analysis of the WNP-2 Emergency Operating Procedures, February 1984. The evaluation will be performed in the following steps:

- Operator emergency response functions will be identified through analysis of the WNP-2 Emergency Operating Procedures (EOP).
- Control and information requirements will be established through task and decision analyses of the functions identified in the first step, above.
- Instrumentation requirements associated with each information requirement will be defined.
- The adequacy of existing controls and instrumentation will be evaluated against the control, information, and instrumentation requirements established in the second and third steps, above.
- The effectiveness of the control room in supporting the integrated accomplishment of the emergency response functions will be evaluated through talk and walkthroughs.

Each of the above steps is discussed in greater detail in sections 4.0 through 8.0, below.

2.0 SCOPE

In accordance with Supplement 1 to NUREG-0737, Section 5, paragraph b.(ii), and the BWROG CRDR Generic Program Plan, the function and task analysis is to emphasize emergency operations. Therefore, the analysis will be based upon the latest revision of the WNP-2 EOPs and related Generic Emergency Procedure Guidelines.

3.0 SUPPORTING DOCUMENTATION AND INFORMATION

During the function and task analysis, the following supporting documents and information will be consulted, as appropriate, to assist in the identification of control, information, and instrumentation requirements:

- System operating procedures
- Alarm response procedures
- Training manuals
- System descriptions
- System drawings
- Technical Specifications
- Operator interviews
- Data from BWROG CRDR task analysis
- Data from generic BWROG EPG functional analysis

4.0 FUNCTIONAL ANALYSIS OF THE EOPs

The functional analysis of the EOPs will be performed in accordance with the methodology described in the Supply System submittal Function and Task Analysis of the WNP-2 Emergency Operating Procedures. This analysis will identify the operator decision and action functions contained in the EOPs.

5.0 ESTABLISHING CONTROL AND INFORMATION REQUIREMENTS

The operator functions identified in the functional analysis, described above, will be subjected to task and decision analysis to identify control and information requirements. The references listed in section 3.0, above, will be consulted as appropriate.

6.0 DEFINING INSTRUMENTATION REQUIREMENTS

During the performance of the task and decision analyses, specific instrumentation requirements associated with each control and information requirement will be derived through examination of the related EOP step, system requirements, information type, and relationships to other tasks. The references listed in section 3.0, above, will be consulted as appropriate. Consideration will be given to the following:

- Definition of specific parameters
- Instrument ranges
- Instrument accuracy
- Alarm setpoints

- Display format
- Control type and characteristics
- Control and display location and organization

7.0 EVALUATING THE ADEQUACY OF EXISTING CONTROLS AND INSTRUMENTATION

The existing controls and indications will be evaluated against the control, information, and instrumentation requirements established during the task and decision analyses. The following will be considered:

- The effectiveness of existing instrumentation in satisfying information requirements.
- The effectiveness of existing controls in satisfying control requirements.
- The conformance of controls and indications to accepted human factors engineering design criteria.

The criteria used in effecting these evaluations are listed in Table C-1.

8.0 EVALUATING AND VALIDATING THE CONTROL ROOM DESIGN

The effectiveness of the overall control room design in supporting integrated plant operations will be evaluated by talk and walkthroughs. The methodology used in performing and evaluating these walkthroughs will be in accordance with that described in the BWROG CRDR Generic Program Plan. Evaluation criteria are listed in Table C-2.

CONTROL AND INSTRUMENTATION EVALUATION CRITERIA

The following evaluation criteria will be used to assess the adequacy of existing controls and instrumentation:

General Consideration	Evaluation Criteria
Is the identified information requirement satisfied by existing instrumentation?	1. Is the required instrumentation available in the control room?
	2. Does the instrumentation provide direct rather than inferential information?
	3. Is the instrumentation readily interpreted?
	4. Is the instrumentation reliable?
	5. Is the information presented in the optimum format?
	6. Are associated limits readily identifiable?
Is the identified control requirement adequately satisfied by existing controls?	1. Is the control available in the control room?
	2. Is the control of the appropriate design?
	3. Is sufficient feedback information provided?
Are the available controls and indications in conformance with accepted human factors engineering design criteria?	1. Can the controls and indications be easily identified?
	2. Are the instruments properly scaled and easily readable?
	3. Are the instrument scales of the appropriate range and accuracy?
	4. Do the controls possess the necessary sensitivity?

(cont'd)

Table C-1

General Consideration	Evaluation Criteria
Are the controls and indications optimally located?	1. Are the controls and indications convenient to related components? 2. Are the controls and indications effectively grouped and logically organized?

TALK AND WALKTHROUGH EVALUATION CRITERIA

The following criteria will be used in evaluating the effectiveness of the control room in supporting the integrated accomplishment of operator emergency response functions during the talk and walkthroughs:

- Is the task sequence valid and complete?
- Is the available manpower sufficient to accomplish the required tasks?
- Are communications adequate?
- Are traffic patterns unobstructive?
- Are controls and indications conveniently located?
- Is the control room environment compatible with the accomplishment of operator functions?

Table C-2