CONTROL ROOM REVIEW PLAN

for

OCONEE, McGUIRE & CATAWBA

NUCLEAR STATIONS

DUKE POWER COMPANY

Revision Log

Revision No.	Date	Description	Pages Affected
0	4-19-82	Original issue	All
1	5-4-82	Revised to include comments from Consultants and others	All
2	6-17-82	Revised as noted	i, ii, 1, 2, 4 5, 6, 9-13
3	2-15-83	Revised as noted	All

FOREWORD

This Control Room Review Plan was explicitly developed for use on Duke nuclear units and structured to complement related nuclear unit activities while optimizing use of our resources.

As a matter of background, Duke Power Company has utilized "in-house" architect/engineering for many years. It is the Company's philosophy to develop and utilize in-house resources for the design, construction and operation of our units. Additionally, we have sought out external expertise to complement this in-house capability where appropriate. This overall approach has been used in placing some 58 units in service over the past thirty years. All these units included in-house control room design. Practical applications of human factors engineering have been in place over this entire process. In fact, full scale control board mock-ups using direct operator feedback have been in use since the mid-fifties.

With this overall approach we have developed an admirable record for safe, reliable, and efficient power plant operation. While we are proud of that record, we do see benefit in conducting control room reviews for our nuclear units. The basis for this review is: (1) increasing plant complexity, (2) frequency of process functional changes, (3) advancing human factors technology, and finally (4) related regulatory activities.

In addition to our long past experience in power plant design, we have been involved in many recent activities which are in support of control room review programs. More specifically, we have been involved in:

(1) Participation in AIF, INPO and IEEE related activities,
(2) McGuire Preliminary Control Room Review (began January 1980, completed June 1980),
(3) Various human factors training of Duke Staff (EPRI, MIT, and In-House Short Courses by J.L. Seminara, T.B. Sheridan and H.E. Price).

With the above background, Duke has set out to conduct control room reviews with the objective of identifying cost effective improvements to strengthen the man-machine interface. We have approached this review with the formation of an interdisciplinary Steering Committee which was established in October, 1981. It is this Committee's charter to provide management oversight to fulfill the above objective by:

(1) Formulating the review program concept,
(2) Assembling the required expertise,
(3) Ensuring coordination with related activities,
(4) Review and approval of the project report, and
(5) Ensuring implementation of the cost effective improvements.

The Steering Committee agreed upon a review program concept in January 1982 which served as the basis for this plan. In addition to stating objectives and approach, the program concept emphasized the utilization of a full time review team reporting to the Steering Committee. This team is responsible for the development of the detailed plan and the execution of that plan. Further, it was emphasized that the plan is to be executed utilizing our most qualified

resources. These resources include the well established line organizations, the Review Team, and external consultants as appropriate.

With the above program, we will:

(1) Ensure we fulfill our responsibility (as owner and operator of the units) to make cost effective improvements,
(2) Ensure an expeditious review, and
(3) Enhance our long term experience base.

By further enhancing our long term experience base we can not only feed improvements forward to new designs, but also ensure consistent review and application of modifications to existing design.

The full time Review Team was assigned in February, 1982 and has developed the attached Control Room Review Plan which has been approved by the Steering Committee.

T. C. McMeekin
Principal Engineer
Control Room Review Steering Committee Chairman

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I. OVERVIEW

A. Introduction

The control room design review is part of a larger effort within Duke Power to upgrade control rooms, emergency facilities, and procedures. While the scope of this plan for the control room review is directed toward a human factors review of the design adequacy and operability of the existing control room, it is recognized and intended that other areas of concern such as upgraded emergency procedures, the design of an SPDS, and the inclusion of post accident monitoring instrumentation will be coordinated with the control room review to ensure that an integrated, operable control room will result (refer to Figure 1).

Guidance for the control room review has been under development by the NRC and other industry groups. We concur with the basic objectives of these activities. Subsequently, this review plan will be structured to fulfill the basic objectives or intent of this guidance.

This plan shall be applicable to the control room reviews performed for the Oconee, McGuire, and Catawba Nuclear Stations. A separate review will be performed for each individual unit at each station. However, generic reviews will be performed wherever applicable, such as a review of the environment in a two unit control room. Full advantage will be taken of previous work in such areas.

B. Objective

The primary objective of the Control Room Review is to identify cost effective improvements which will strengthen the man-machine interface. Although primary emphasis will be placed on improving our emergency response capability, problem areas in normal operations will also be examined.

The objective will be accomplished by identifying HED's in the man-machine interfaces in the control room, determining the extent and importance of the HED's, developing and implementing modifications and training as necessary to resolve significant discrepancies, and establishing a working interface with the SPDS, Emergency Procedure Upgrade and Post Accident Monitoring Assessment efforts.

The term HED (Human Engineering Discrepancy) has been "defined" as "a departure from some benchmark in system design suitability for the roles and capabilities of the human operator." This review will refer to discrepancies as HED's.

C. Definition of the Physical Review Area

The physical area for control room review activities will be as shown in Figures 2, 3, 4 and 5, and will include all of the identified

control panels. Also included in the review will be the Auxiliary Shutdown Panels at all three stations.

D. Description of the Control Room Review

The control room review will be conducted in three distinct phases:

- o Review Phase
- o Assessment Phase
- o Implementation Phase

1. Review Phase

The Review Phase will constitute the investigative portion of the control room review. During this phase, plant specific mock-ups will be built for use during the review. Task analyses will identify the task steps which the operator must accomplish during selected emergency and normal operations, and will evaluate the human engineering suitability of controls and displays to support those steps. An examination of operating experience, both generic and specific to each plant, will be conducted by a review of operating history, i.e. plant records, LER experience, etc., and by a survey of operating personnel through structured interviews and questionnaires. A survey of the control room components and environment will also be performed to determine conformance with applicable human factors guidelines.

2. Assessment Phase

During the Assessment Phase all discrepancies identified in the Review Phase will be analyzed, and the importance of each discrepancy to plant operation from the control room will be determined. Discrepancies will be ranked according to importance and significant discrepancies will be selected for resolution through modifications, additional training, etc. Modifications and other actions proposed to resolve significant discrepancies will be analyzed for impact and effect upon operation.

3. Implementation Phase

A plan will be developed to ensure the integration of approved modifications with other enhancement programs, as well as plant operating status, and an installation schedule will be determined. A follow-up procedure will be instituted to ensure successful completion of modifications.

During the control room review, close coordination for technical interchange will be maintained with simultaneous programs for the development of an SPDS, the upgrade of emergency procedures, and the assessment of post accident monitoring instrumentation.

II. MANAGEMENT AND STAFFING

A. Management Approach

1. Introduction

Duke's approach to management of the control room review effort is outlined in Figure 6. The primary elements include the Steering Committee, the Review Team, the Duke line organizations, and Consultants.

The primary responsibility of the Steering Committee is to provide management oversight to assure integration of the project objectives for meaningful control room improvement.

The Review Team reports to the Steering Committee through the Steering Committee Chairman and is responsible for planning, scheduling and coordination of the total integrated control room review including the assignment of particular technical activities to existing line organization and obtaining consultants as necessary.

The line organizations will carry out many of the technical activities associated with the review and will work closely with the Review Team in developing procedures and reports.

2. Responsibilities

a. The Steering Committee provides the necessary and critical link between company departments, such as Nuclear Production or Design Engineering, and the Review Team. Its primary responsibility is to provide management oversight to assure integration of the project objectives of meaningful control room improvement as well as fulfilling regulatory intent for the Oconee, McGuire and Catawba Nuclear Stations in a cost effective manner. The Steering Committee is responsible for assembling the required expertise to carry on the project, the formulation of the overall program and its scope, and assuring coordination to accomplish the job on a timely basis. The Steering Committee is also responsible for review and approval of the final report and its recommendations.

b. The Review Team is responsible for planning, scheduling and coordinating the total integrated control room review. Work activities will be performed by Duke line organizations, consultants, and the Review Team. The Review Team will be responsible for assigning specific activities.

Review Team activities include developing the methodologies for the review and for the assessment of discrepancies, establishing the overall plan and schedule for the control room review, acting as a resource for the line organi-

zations and integrating all action items. Human factors specialists will be used as necessary to develop, review or otherwise support review and assessment activities. In addition, the Review Team will develop or have developed all reports relating to the control room review and assure that appropriate reports are submitted to the Steering Committee for review and approval.

c. The line organizations are responsible for performing assigned portions of the control room review which are related to their normal activities. For example, the control room survey will be performed by the line organization in Design Engineering that is responsible for control room engineering activities.

d. Human factors consultants will be obtained to develop, review, conduct, or otherwise support Review and Assessment activities. In some activities the consultant will have lead responsibility, for example, operator interviews will be conducted and the data analyzed by the consultant. In other activities the consultant will perform a supporting role.

3. Interfaces

In order to perform the control room review expeditiously while at the same time utilizing and broadening experience in our existing organizations, specific tasks within the course of the control room review will be delegated to the line organization and consultants where necessary. The relationship between the Control Room Review Team and these technical lead organizations will be established as follows:

- Based upon the objectives defined by the Review Team, the technical lead organization will submit a procedure for each assigned activity to the Review Team for review to assure the activities are coordinated with and support the overall effort. These procedures will address the major steps required to perform assigned activities as well as the interfaces with the Review Team, especially with regard to the level of detail of information exchanged, schedules, etc.

- Elements of the lead organization will be responsible for producing a final report for each assigned activity in a format approved by the Review Team.

- The Review Team Leader will have the authority to contact the appropriate manager of the technical lead organization to establish a cooperative working relationship with the line organization.

To ensure technical continuity of the total project, the Review Team Leader will:

- Clearly communicate to the technical lead organization the relationship of each task product to the total project.
- Establish a specific Review Team member to serve as technical liaison with the lead organization.
- Review with the technical lead organizations the integration of the individual task products as appropriate to resolve questions, seek clarification, etc.

Qualified consultants will work with the Review Team and the line organizations to meet the objectives of the Control Room Review. These consultants will play a key role in the review, and will be given the opportunity to express independent judgements.

B. Steering Committee Composition and Qualifications

The Steering Committee is composed of eleven members representing the following areas within the company:

NUCLEAR PRODUCTION DEPARTMENT
- Nuclear Maintenance
- Nuclear Engineering (Licensing)
- Oconee Nuclear Station
- McGuire Nuclear Station
- Catawba Nuclear Station
- Nuclear Operation

PRODUCTION SUPPORT DEPARTMENT
- Production Technical Services

DESIGN ENGINEERING DEPARTMENT
- Electrical Division - Control Systems Engineering
- Safety Review, Analysis and Licensing Division
- Mechanical/Nuclear Division - Systems Engineering

A summary of the qualifications of the Steering Committee members is provided in Apendix A.

C. Review Team Composition and Qualifications

The Review Team is composed of a core team of six full-time members. Additional members from the line organization will be added during certain planned activities, such as Task Analysis and the Assessment Phase. The core team members include three Senior Reactor Operators (from Oconee, McGuire, and Catawba) and three Instrumentation and Control Engineers (from Design Engineering). The qualifications for core team members are shown in Appendix B.

D. Reporting Relationships

The Review Team Leader will functionally report to the Control Room Review Steering Committee Chairman. Review Team members and consultants will functionally report to the Review Team Leader. Liaisons will be established with the line organizations for each major activity. Although these relationships are important for effective management of the review, recourse for unresolved differences and other concerns among the Review Team members and consultants is through the Review Team leader. If still unresolved, the Chairman of the Steering Committee and higher levels of management as necessary will resolve the difference or concern. Such differences and concerns will be documented.

E. Orientation and Training

1. Human Factors

Training will be provided for the review team and participating line organizations to familiarize personnel with principles of human factors engineering and their application to the control room review. In addition, specific activities associated with the review will warrant additional training for the Review Team and others. For example, task analysis and control room survey teams will be trained by a human factors consultant prior to beginning the review activities. The importance of proper preparation and training for all review activities is recognized.

2. Simulator/Procedure Familiarization

Training in basic plant operation fundamentals and the use of operating and emergency procedures will be provided for Review Team members.

3. Other Training

During the course of the review other areas requiring training may be identified and appropriate training or orientation will be obtained to meet the needs. In addition, human factors consultants will be provided orientation training to familiarize them with nuclear power plant fundamentals and operation.

III. DOCUMENTATION AND CONTROLS

A. Introduction

It is recognized that maintaining an efficient means of documenting all phases of the review effort is necessary to support a meaningful Control Room Review. The Review Teams' approach to Documentation is further discussed under the headings of References, Correspondence and Documents Generated by Review Team.

B. References

During the Control Room Review, a substantial amount of reference material will be used for guidance. Following is a list of the types of material that will be necessary:

1. Final Safety Analysis Reports (FSAR) for all plants
2. Regulatory Guides (e.g., RG 1.97, 1.47, etc.) and Duke Nuclear Guides
3. NUREG's (e.g., NUREG 0700, 0899, 0737, 0801, etc.)
4. Control Room Design (e.g., Control room floor plans, layout drawings, photographs, etc.)
5. Human Factors Information (e.g., Human Engineering Guide to Equipment Design, MIL-STD-1472B Human Engineering Design for Military Systems, Equipment and Facilities, etc.)
6. Westinghouse and B & W Emergency Procedure Guidelines (EPG's)
7. Results of previous control room review activities
8. INPO/NUTAC guideline documents

C. Correspondence

All correspondence generated or received by the Review Team will be filed in the Review Team files. In addition, files have been established in the Nuclear Production and the Design Engineering Departments which will contain all correspondence related to the Review. Existing filing and document control systems will be utilized.

D. Documents Generated by Review Team

Various procedures, forms, reports and other documents will be generated as necessary to

1. Document the basis or criteria used for each review activity
2. Record the results of the Control Room Survey, Operating Experience Review, and Task Analysis

3. Compile and assemble HED's and associated data for review and assessment

Consultants will assist Duke in the above areas as necessary. In addition, a data base management system will be developed to assist in sorting, comparing and analyzing HED's generated during the review.

IV. REVIEW PHASE

A. Objective

The primary objective of the Review Phase is to identify HED's in the man-machine interface in the control room. The Review Phase will provide an examination of the design of the control room and the characteristics of the man/machine interface to determine whether operator tasks can be accomplished effectively. The examination will be conducted in three major areas (refer to Figure 7):

- Control Room Survey
- Operating Experience Review
- Task Analysis

B. Activities

1. Control Room Survey

A survey of each control room and control panel as defined in Section I.C. will be conducted to determine conformance with applicable human engineering design guidelines. The guidelines and the survey results will be documented. The survey will be divided into a physical survey, an engineering survey, and an environmental survey. The physical survey will assess the suitability of individual components, labels, workspace, and communication and protective equipment through the use of mock-ups and on-site inspections. The engineering survey will address the guidelines that can be reviewed by examination of design engineering drawings and documentation. The environmental survey will study control room conditions such as lighting, noise, and temperature. Discrepancies (HED's) will be documented for review during the Assessment Phase of the Control Room Review. Consultants will be used to support these activities as mentioned in Section II.

2. Operating Experience Review

The objective of the Operating Experience Review is to identify features in control room operation or design which could degrade effective control of the plant. The review will focus on two primary areas, (1) an operator survey, and (2) a review of operating history.

The operator survey will consist of questionnaires and follow-up interviews conducted by consultants with a representative sample (approximately 50%) of licensed operators and those operators in license training. In addition, Duke operations training instructors and/or simulator instructors may be interviewed to ascertain their perspective on problem areas in control room operation. Control board photographs will be used for reference and detailed problem identification. Control Room Problem/Suggestion forms will be placed in each control room for

additional operator input after the interviews have been completed.

The operator survey will provide the Review Team with practical information on problems in control room operation and design which may not be identified during the other review activities. HED's will document the problem areas identified in this survey. While both normal and emergency operations will be covered, it is expected that problems encountered during normal operation will be most prevalent. This information will be used to determine if events other than those covered by the NSSS vendor emergency procedure guidelines should be addressed in the Task Analysis.

The operating history review will examine selected documents (i.e., Station Incident Reports, LER's, etc.) to determine Control Room design problem areas which are applicable to Duke Nuclear Stations. Such problem areas will be documented by HED's.

3. Task Analysis

The primary objective of Task Analysis is to evaluate the human engineering suitability of controls and displays to support the effective accomplishment of operator actions required during certain normal and emergency operating conditions. The Task Analysis activity will identify operator tasks, determine the controls and displays required to perform those tasks, and evaluate the suitability of the required controls and displays during a walk-through of each task analyzed.

Thorough systems analyses of transients and accident conditions have been performed by the NSSS vendors in their development of emergency procedure guidelines (EPG's). These generic guidelines define the functions allocated to the control room operating crew to provide effective operation and control of the plant under a variety of abnormal and emergency conditions. As such, the EPG's form a sound technical basis for the development of plant-specific emergency procedures as well as the Task Analysis. The Review Team will select a representative combination of EPG's which collectively include operation of most emergency systems. These EPG's will be used as the basis for the determination of operating tasks during the task analysis activity.

While the emphasis of the task analysis activity will be on emergency operations, problem areas in normal operations identified in the Operating Experience Review will be selected for analysis.

Task Analysis will be conducted by a team for each plant, consisting of a Senior Reactor Operator and a systems engineer. In addition, a human factors consultant, experienced in the application of task analysis, will be utilized to help define

and develop a usable, cost-effective methodology using proven task analysis techniques and to provide on-going human factors assurance.

V. ASSESSMENT PHASE

A. Objectives

The objectives of the control room review Assessment Phase are to evaluate the significance of the human engineering discrepancies (HED's) which represent the end products of the Review Phase, to identify and justify those discrepancies which should be corrected, and to evaluate the extent of any proposed control room modifications. The Assessment Phase will begin after the HED's are generated.

B. Description

In general, it is expected that three broad classes of HED's will be identified during the review phase: HED's with a safety significance to emergency response, HED's whose correction would contribute to improved normal operation, and HED's whose correction would provide a general human factors enhancement of the control room. A categorization method will be developed to facilitate the retrieval of HED's from the data base in a format consistent with the manner in which HED assessment will be performed.

In addition, assessment criteria and guidelines will be developed to aid the Review Team in the analysis and prioritization of HED's. The guidelines will be designed to assess the potential for causing or contributing to operator error, the plant safety consequences of such error, solution costs, and feasibility. The significance of the HED will be defined as some combined "score" resulting from evaluations in these areas. Human factors consultants will participate as necessary in this phase.

Some HED's may be corrected by simple surface enhancement techniques, such as changing labels, adding demarcation lines or mimic lines, etc. In some cases, training may be the only technique needed to resolve HEDs. Correction of other HED's may require more extensive measures. If it is determined that the correction must involve movement, modification, or addition/deletion of controls and/or displays, then these corrections will be evaluated with other alternatives and with consideration of how the corrections will impact the existing control room (consistency and compatibility), plant availability, and operator training, performance, and procedures. Proposed modifications may be made on the mock-ups and evaluated with procedures to determine their overall effectiveness. Experienced operators will be used to evaluate alternative approaches. Established human factors guidelines will also be used to review proposed modifications.

C. Report

A final report will be prepared containing Review Phase methodologies, generated HED's, the assessment criteria, and the results of the Assessment Phase including priorities, proposed changes, etc. Additionally, this report will document

recommendations for implementation of criteria and procedures to be utilized in evaluation of future changes. This report will be submitted to the Steering Committee for review and approval. An executive summary will be provided to aid upper management and others in their review.

VI. IMPLEMENTATION PHASE

A. Objective

The primary objective of the Implementation Phase is to implement modifications, procedures and training as necessary to resolve significant human engineering discrepancies (HED's) identified in the Assessment Phase.

B. Description

Modifications required to resolve significant HED's will be implemented through the existing station modification process. The station modification process is described by the Administrative Policy Manual for Nuclear Stations in the Nuclear Production Department and by the Quality Assurance Program of the Design Engineering Department.

Since the completion of all selected corrections through the station modification process may take a considerable amount of time, the implementation and follow-up activities will rely upon normal line organizations both at the station and in the General Office. Therefore, the HED(s) and the resulting modification request(s) must be very explicit as to what is to be done.

An organized transition will be made between the Review Team and the line organizations to assure effective implementation of the results of the Control Room Review. The Steering Committee will be responsible for defining and implementing this transition.

C. Future Control Room Modifications

In order to ensure adequate human factors considerations for all modifications that are considered after the Control Room Review Team has completed its activities, the line organizations responsible for station modifications will implement the necessary criteria and procedures to evaluate the human factors aspects of all future control room modifications. Proposed solutions should be reviewed by those responsible for operating the plant. The mock-ups used during the Control Room Review will be an excellent tool for all future modification activities and, therefore, consideration should be given to maintaining the mock-ups in some form for future use.

VII. PROGRAM INTERFACES

Several other programs are to be coordinated with the Control Room Review Program. These programs are the following:

1. Emergency Procedures Upgrade Program

2. Safety Parameter Display System (SPDS) Program

3. Post-Accident Monitoring Assessment Program

Coordination of these programs is necessary because the approaches taken and items implemented in one program may directly or indirectly affect the other programs.

The relationship of one program and its activities to other programs and their activities is shown in Figure 8. As shown, the following relationships can be determined:

- SPDS completed relatively early
- Emergency procedures upgrade completed prior to the implementation of control board changes
- Control Room Review, which includes the implementation of control board changes, will take the longest time
- SPDS and post-accident monitoring assessment should be completed prior to the completion of the Control Room Review.
- Special training will be provided for upgraded emergency procedures
- Training on procedure revisions and plant modifications will be provided per existing training programs.
- Other programs will be revised as necessary after the Control Room Review is completed.

DUKE POWER COMPANY
CONTROL ROOM REVIEW PROCESS

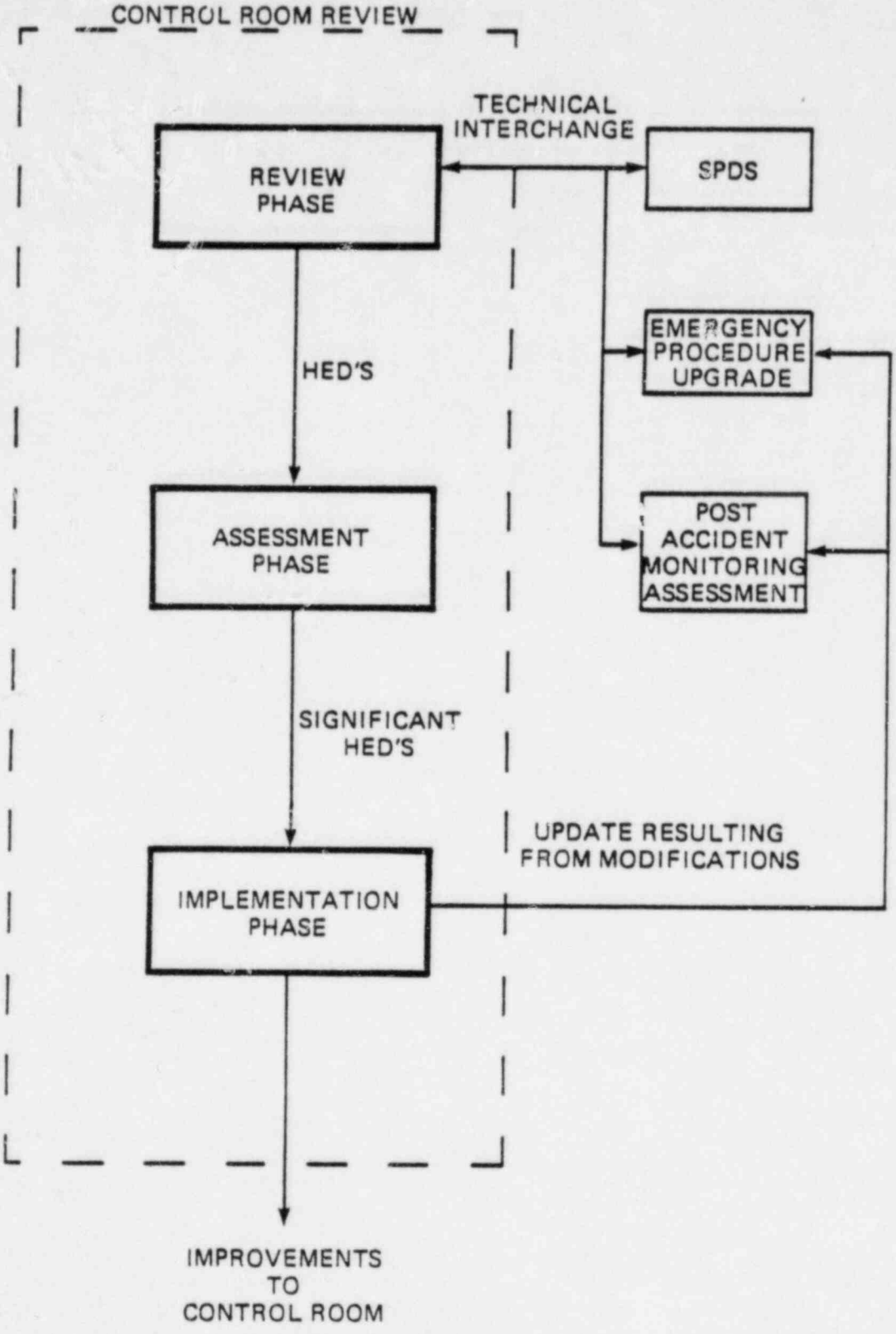

FIGURE 1

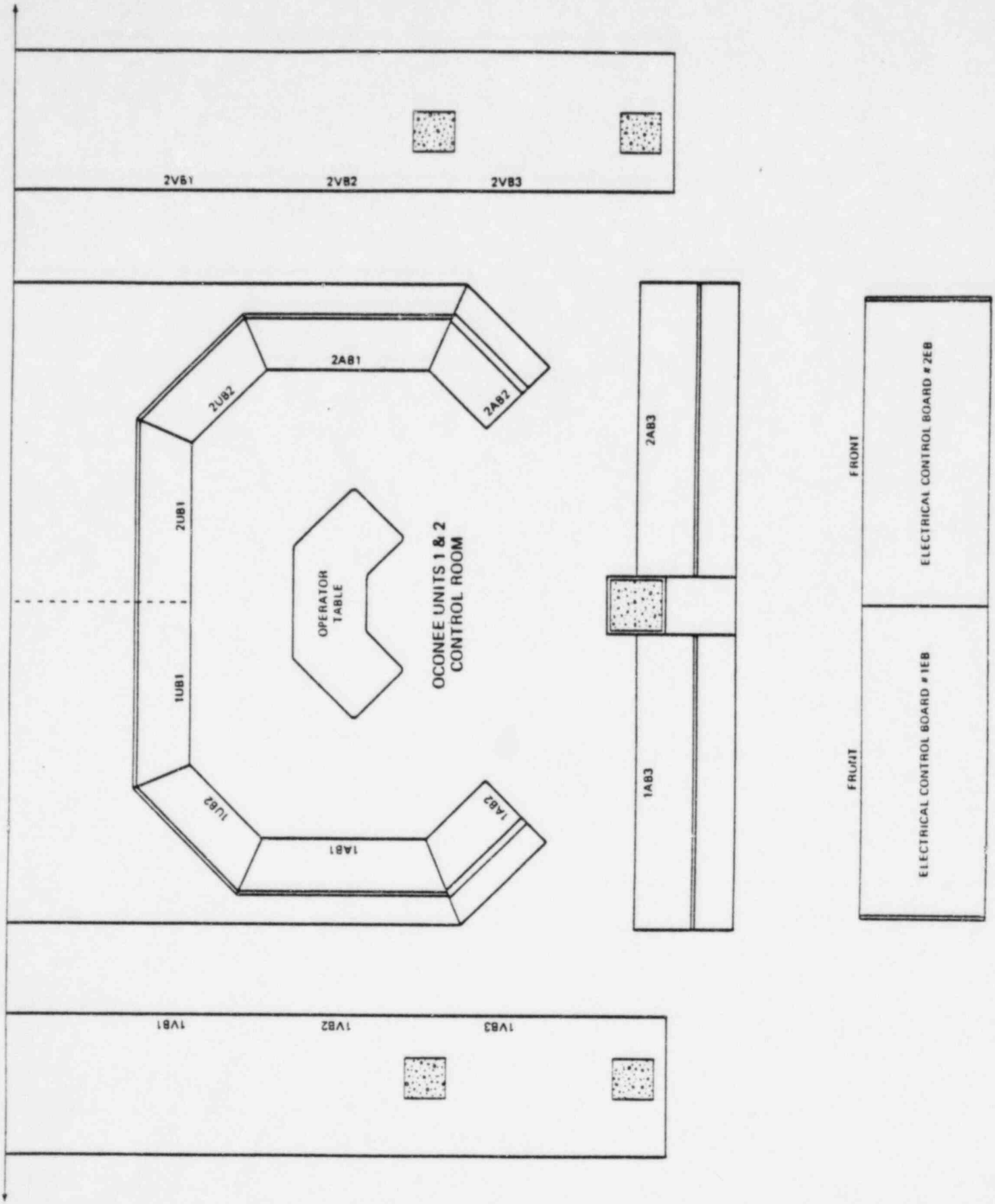
2VB1
2VB2
2VB3
2AB1
2AB2
2UB2
2UB1
OPERATOR TABLE
OCONEE UNITS 1 & 2 CONTROL ROOM
1UB1
1UB2
1AB1
1AB2
1VB1
1VB2
1VB3
2AB3
1AB3
FRONT
ELECTRICAL CONTROL BOARD # 2EB
FRONT
ELECTRICAL CONTROL BOARD # 1EB

FIGURE 2

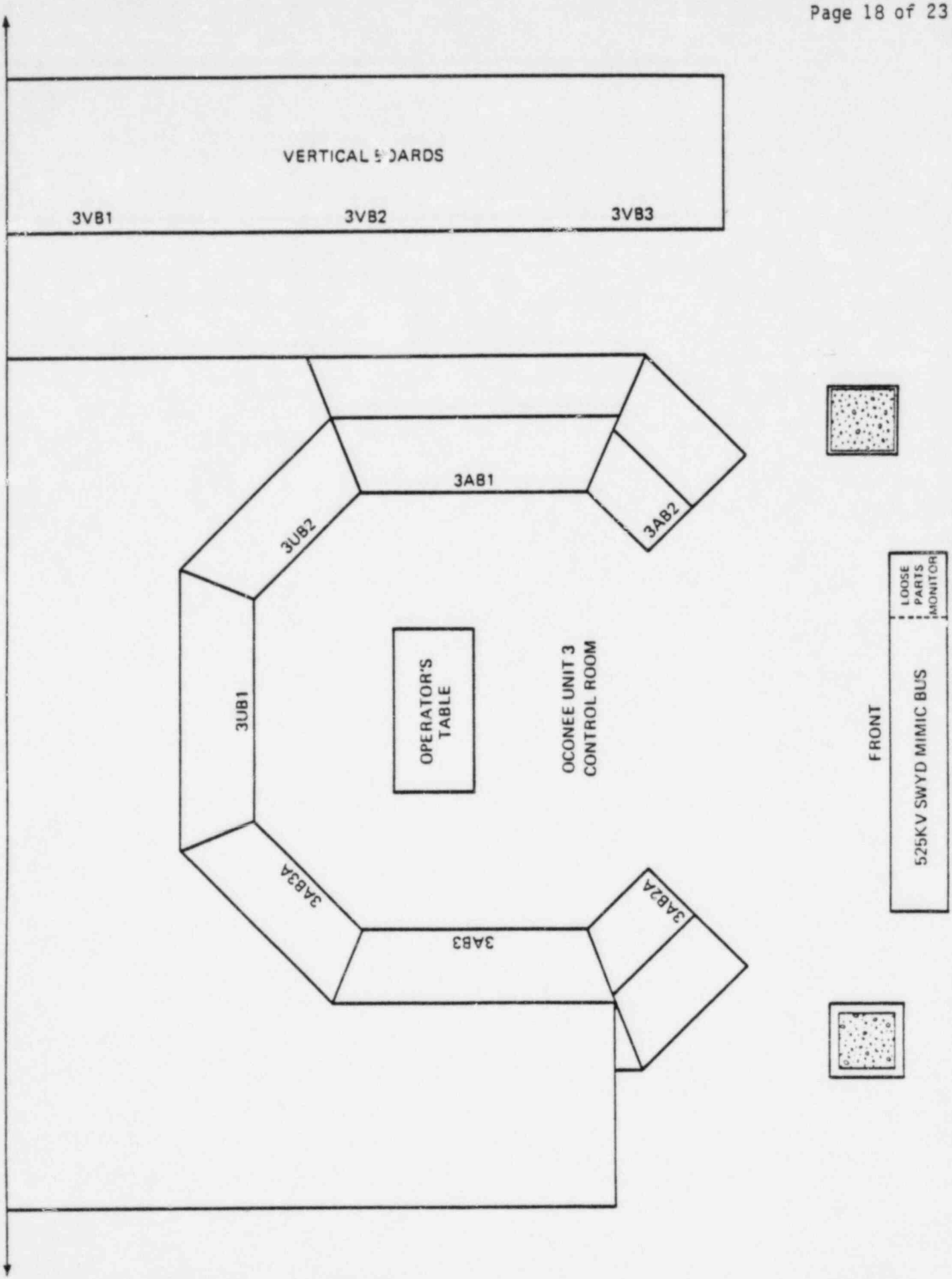
VERTICAL BOARDS
3VB1
3VB2
3VB3
3AB1
3AB2
3UB2
3UB1
OPERATOR'S TABLE
OCONEE UNIT 3 CONTROL ROOM
3AB3A
3AB2A
3AB3
FRONT
525KV SWYD MIMIC BUS
LOOSE PARTS MONITOR

FIGURE 3

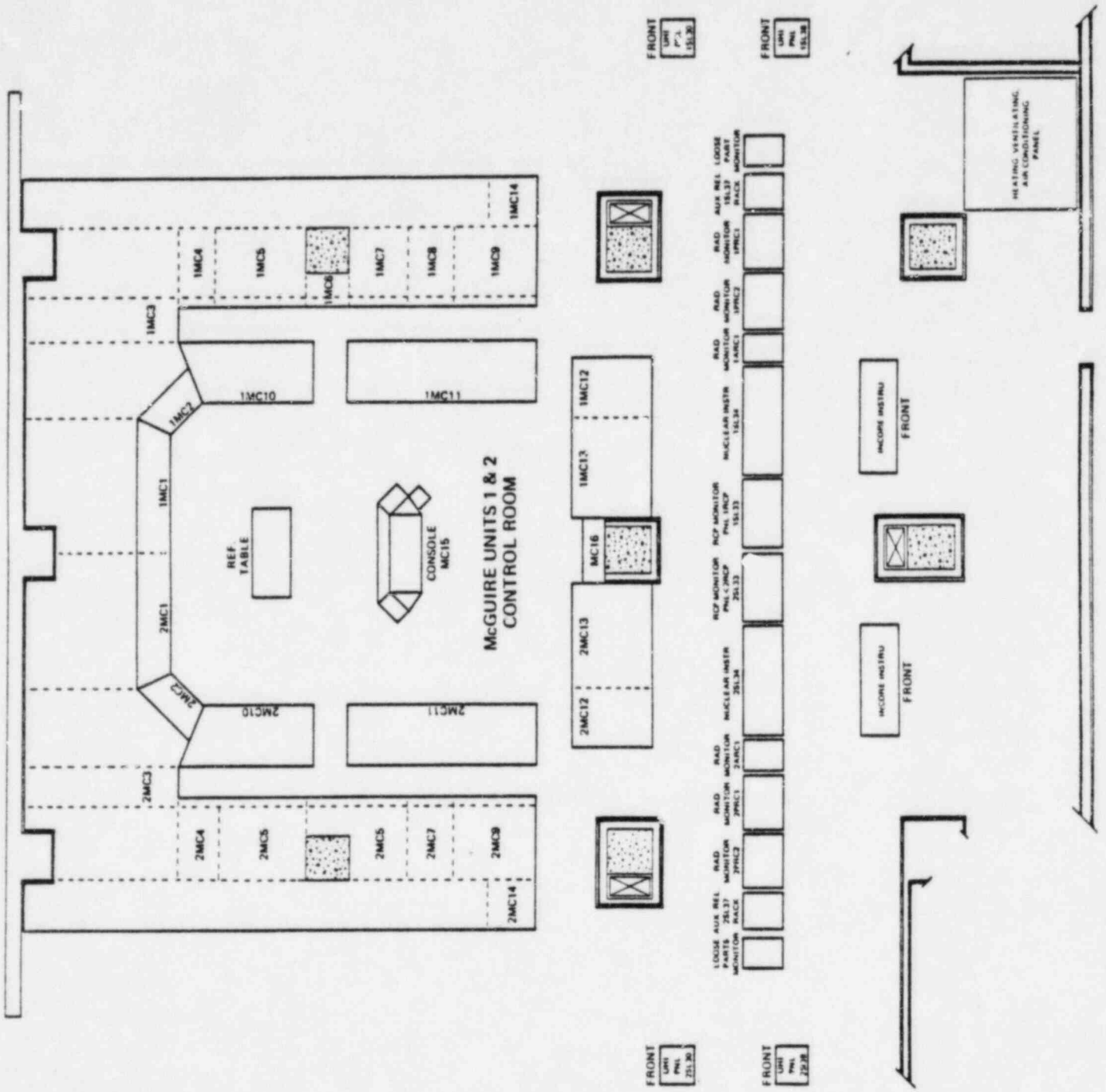
McGUIRE UNITS 1 & 2
CONTROL ROOM
REF. TABLE
CONSOLE MC15
1MC1
1MC2
1MC3
1MC4
1MC5
1MC6
1MC7
1MC8
1MC9
1MC10
1MC11
1MC12
1MC13
MC16
2MC1
2MC2
2MC3
2MC4
2MC5
2MC6
2MC7
2MC9
2MC10
2MC11
2MC12
2MC13
2MC14
FRONT
HEATING VENTILATING AIR CONDITIONING PANEL

FIGURE 4

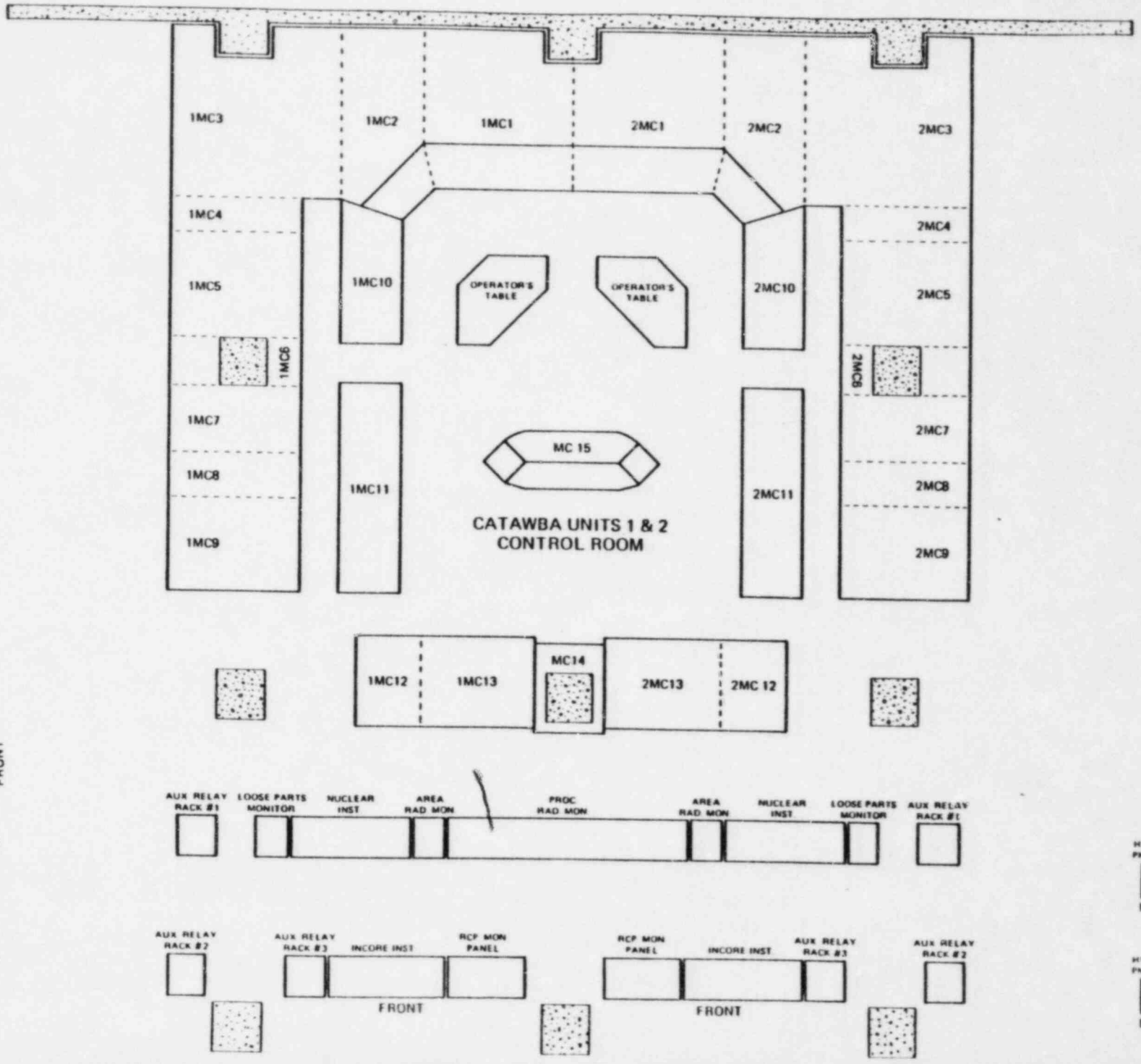
1MC3
1MC2
1MC1
2MC1
2MC2
2MC3
1MC4
2MC4
1MC5
1MC10
OPERATOR'S TABLE
OPERATOR'S TABLE
2MC10
2MC5
1MC6
2MC6
1MC7
2MC7
1MC8
1MC11
MC 15
2MC11
2MC8
1MC9
2MC9
CATAWBA UNITS 1 & 2
CONTROL ROOM
1MC12
1MC13
MC14
2MC13
2MC 12
EEB MON CAB
FRONT
AUX RELAY RACK #1
LOOSE PARTS MONITOR
NUCLEAR INST
AREA RAD MON
PROC RAD MON
AREA RAD MON
NUCLEAR INST
LOOSE PARTS MONITOR
AUX RELAY RACK #1
HYD SERV PNL TRN A
FRONT
AUX RELAY RACK #2
AUX RELAY RACK #3
INCORE INST
RCP MON PANEL
FRONT
RCP MON PANEL
INCORE INST
AUX RELAY RACK #3
AUX RELAY RACK #2
FRONT
HYD SERV PNL TRN A
FRONT
HYD SERV PNL TRN B
FRONT
HYD SERV PNL TRN B
FRONT

FIGURE 5

DUKE POWER COMPANY
CONTROL ROOM REVIEW

MANAGEMENT APPROACH

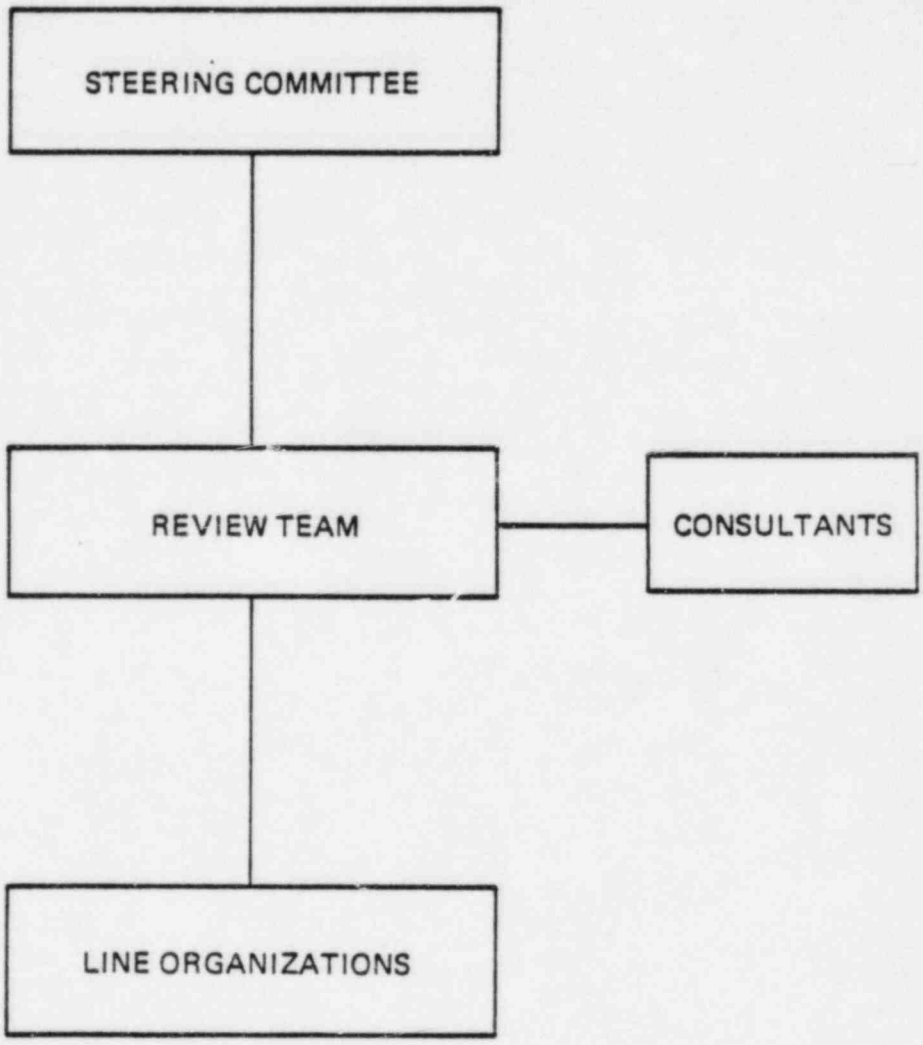

FIGURE 6

CONTROL ROOM REVIEW

REVIEW PHASE ACTIVITIES

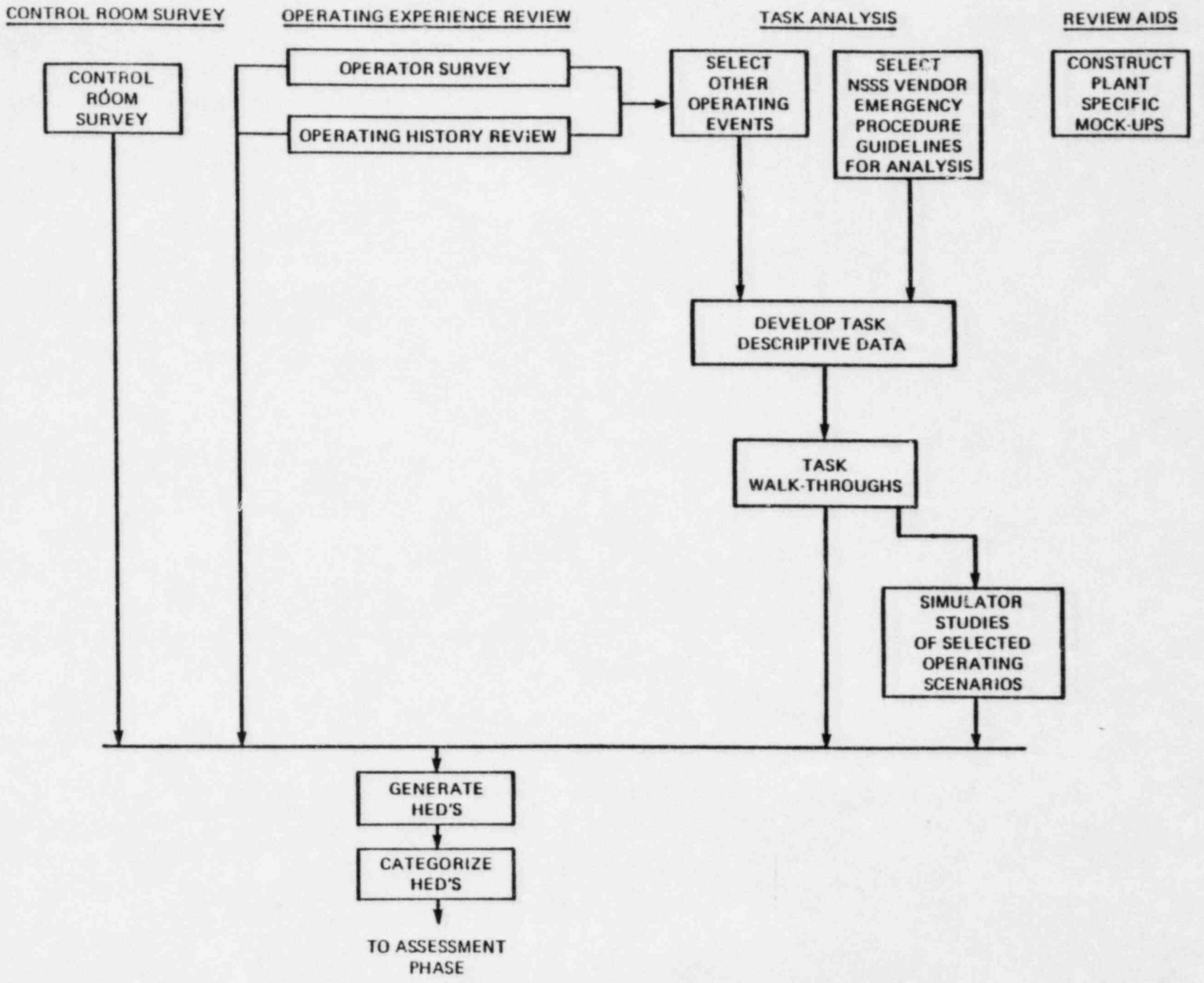

FIGURE 7

DUKE POWER COMPANY
CONTROL ROOM REVIEW

PROGRAM INTERFACES

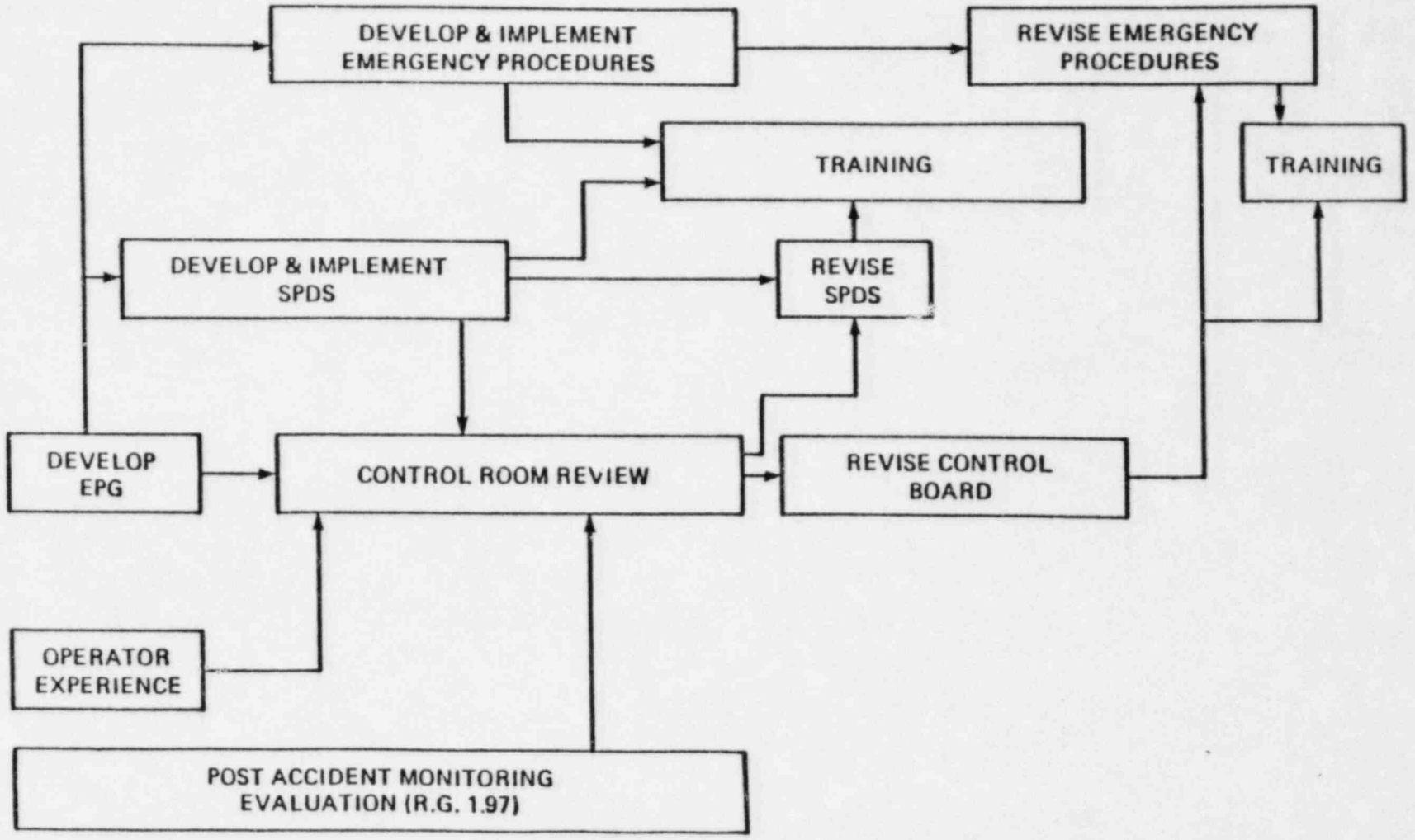

FIGURE 8

Appendix A

Revision Log

Rev. 0	3-1-82
Rev. 1	4-1-82
Rev. 2	6-17-82
Rev. 3	2-15-83

CONTROL ROOM REVIEW STEERING COMMITTEE
MEMBER QUALIFICATION SUMMARY

STEERING COMMITTEE MEMBER	CURRENT			EDUCATION			LICENSES	EXPERIENCE							TECH SOC. MBR.	MISCELLANEOUS (Stds., Task Forces, Work Grps. and Related Activities)
	POS'N	LOC'N DIV'N or GRP	DEPT	LEVEL	FIELD	OTHER		TOTAL YRS	PLANT OP	PLANT ENG	OTHER C/R	OTHER I/C	OTHER SYST	OTHER SUPP'T		
S. L. BROWN	System I&C Engr	Prod. Tech. Serv.	Prod. Sup-port	BS	ME		P.E. (NC-SC)	14	1	6		7			ISA	Paper "Enhanced FW Htr Level Control" Mbr-EPRI/DOE - B&W DASS Project Mbr-AIF C.R. Considerations Subcom
C. A. LITTLE	System I&E Engr.	Nuc. Maint.	NPD	BS	EE		P.E. (NC)	10	1			5	4			Mbr. IEEE SC7, WG 7.1
K. S. DAWE	Consultant	Elec Con. Sys.	D/E	BS	ME	AFDA-FERMI	P.E. (Ill)	43		5	10	18	10		IEEE HFS	Mbr IEEE SC6 - Safety Systems and WG 1.2 Control Room Std. Papers-Several on CR/CB's (IEEE, IAEA, JEAC)
G. D. GILBERT	Operating Engr	MNS	Stn	BS	ME		SRO P.E. (NC)	11	11							
R. E. HALL	Supervs'ng Les.Engr	Mech	D/E	BS	ME		P.E. (NC)	13		2			11		ASME	CE Owners Grp -Systems Oper'ns Subcom Chmn, DPC Metric Conversion Comm.
J. W. HAMPTON	Mgr. Catawba Nuc. Sta.	CNS	Stn	BS	ME	W Prototype Reactor	SRO ONS	24	16	8						EPRI - Eng'g & Operations Task Force INPO - Evaluation & Assistance Div'n, Industry Group
H. R. LOWERY	Operating Engr	OMS	Stn	H.S.	Gen		SRO	18	18							
T.C. MIMISH	Principal Engr	Elect. Con. Sys.	D/E	BS	EE	USN-Nucl. Pwr & Sub. Schools	P.E. (NC -SC)	17	5			12			ANS IEEE ASNE	Mbr - NSRB
W. H. RASIN	Senior Engr	Mech	D/E	BS	NE	USN-Nucl. Pwr Sch	P.E. (NC-SC) SRO (U Va.)	21	14				7		ANS	EPRI - Safety and Analysis Task Force AIF-SubComm on ATWS-AMS paper Ind. Adv. Grp - TMI Site, 4/79
W. A. RUTHERFORD	Syst. Engr (Licensing)	Proj. & Lic.	Stn	BS M	NE BA			15	3	3			3	6	ANS	B&W Owners Grp, ExComm Dir NSRB '76-'79 Mbr-Equip Qual'n Grp. Mbr Nucl. Util Grp on Enforcement
B. C. MOORE	Syst. Prod. Engr	Op'n Supp	Stn	BS	ME		P.E. (SC) SRO	10	10							
TOTALS								213 Man Yrs	78 Man Yrs	30 Man Yrs	10 Man Yrs	48 Man Yrs	31 Man Yrs	6 Man Yrs	6 Societies	

Appendix B

Revision Log

Date	Pages Affected
3-23-82	All
6-1-82	All
2-15-83	All

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

	General Qualifications		Nuclear Qualifications	
Position	Academic	Experience	Academic	Experience
Instrumentation and Controls Engineer Michael R. Crews Supervising Design Engineer	B.S.E. Degree (1973) Electrical Engineering Univ. of North Carolina at Charlotte MS Degree - (1975) Electrical Engineering Ohio State University Management Training Duke Power Company 1978 and 1982 5 days - Human Factors Engineer Course (1982) (MIT)	2 years - Electrician, U.S. Navy (1967-1969)		3 years - (1975-1978) Electrical Division Special Projects in economic comparisons, nuclear plant cost estimates, mathematical and physical modeling 2 years - (1978-1980) Electrical Division Staff Engineer - staffing, annual budgets, training (engineering, administrative, QA) and licensing activities. 2 years - (1980-1982) Control Systems Equipment, Cherokee SSILS, Catawba and McGuire Isolation and Hydrogen Mitigation Systems 1/2 year - (3/1/82-9/15/82) Control Complex Engineering Group - responsible for Control Room/Control Board Engineering for Oconee, McGuire, Catawba and Cherokee Review Team Participation Review Team Leader (9/15/82 to Present)
Professional Registered Professional Engineer, N.C. & S.C. Member, IEEE and the Power Engineering Society Member, NUTAC CRDR Working Group				

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

	General Qualifications		Nuclear Qualifications	
Position	Academic	Experience	Academic	Experience
Electrical Instrumentation & Controls Engineer				
R. H. White Design Engineer II	Bachelor of Electrical Engineering (1970) Georgia Institute of Technology	1 year Design Engineering - Hydro Station Design Keowee and Jocassee 1970-1971	Duke Nuclear Training Program (1970)	10 years total Design Engineering experience on Control Room/Control Board engineering and design for nuclear stations.
	3 days - Human Factors Engineering Seminar (1981) (J. L. Seminara)	1 year Design Engineering - Supervisor - Turbine Generator Controls Group, Belews Creek 1971-1972	Introduction to Nuclear Engineering NC State Univ. (NE 419) 1972	
	2 days - Human Factors Engineering Seminar (1982) (Dr. T. B. Sheridan - MIT)	1 year Design Engineering - Supervisor - Control Complex Concepts & Developments Group, Control Room/Control Board Engineering, Belews Creek & McGuire 1972-1973	2 days - Simulator/ Procedures Familiarization (1982)	6 months - Responsible Engineer, McGuire Preliminary Control Room Review Team 1980
	2 days - Human Factors Engineering Seminar (1982) - (R. H. Pope-CEGB, London)	1 1/2 years Design Engineering - Supervisor - Control Boards & Equipment Layout Group, Control Room/Control Board Design, Oconee, Belews Creek, & McGuire 1973-1975		
	1 week - Task Analysis Training Course (1982) (H. P. VanCott, Bio-Technology, Inc.)	6 mos. Design Engineering - Staff Engineer - Control & Instrumentation Section, Advanced Control, Control Room Concepts Development		Review Team Participation Core Team Member (2-18-82 to present)
	Management Training Duke Power Company 1973 and 1980	6 1/2 years Design Engineering - Control Complex Engineering Group. Responsible for Control Room/Control Board Engineering for McGuire and Cherokee Nuclear Stations. 1975 - 2/18/82		

PROFESSIONAL

Registered Professional Engineer N.C. & S.C.

Member ANS4.6 Standards Group

Member, NUTAC CRDR Working Group (INPO)

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

	General Qualifications		Nuclear Qualifications	
Position	Academic	Experience	Academic	Experience
Electrical Instrumentation & Controls Engineer				
L. T. Harbinson Design Engineer I	2 years - Lees-McRae Junior College (1964-66) A.A. Degree 1 1/2 years - Electronic Technician School U.S. Air Force 4 years - Univ. of Tennessee (1970-74) B.S. Degree Electrical Engineering Management Training Duke Power Company 1979 2 days - Human Factors Engineering Seminar (1982) (Dr. T. B. Sheridan - MIT) 2 days - Human Factors Engineering Seminar (1982) (Bio Technology) 1 week - Task Analysis Training Course (1982) (H. P. VanCott, Bio - Technology)	4 years - Electronic Technician - U.S. Air Force (1966-70)	2 days - Simulator/Procedures Familiarization (1982)	1 year - Design Engineering-I&C, Power Systems Control - McGuire 1974-75 3 years - Design Engineering I&C Turbine Generator Group-Catawba 1975-78 4 years - Design Engineering I&C Supervisor - Turbine Generator Group McGuire, P81 1978 to 2/18/82 6 months - Design Engineering - Oconee 1.97 Study 1981 Review Team Participation Core Team Member (2/18/82 to Present)

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

	General Qualifications		Nuclear Qualifications	
Position	Academic	Experience	Academic	Experience
Assistant Nuclear Control Operator				
V. G. Truesdale, Jr. (Catawba)	2 years - Furman University BS Degree - Biology (1975) Gardner-Webb College Courses in Marketing, Management and Entomology at Winthrop College (1979-1981) Gas & Arc Welding York Technical College (1980)		A.A.S. Degree (1978) Tri-County Technical College Nuclear Engineering 6 weeks - Oconee Systems Class (1978) 6 weeks - Nuclear Preparatory and Nuclear Fundamentals Technical Training Center (1979) 1 week - Research Reactor Training - N.C. State University (1980) 1 week - General Electric Turbine Generator Training Catawba Nuclear Station (1980) 1 week - De Laval Diesel Generator Training - Catawba Nuclear Station (1980) 3 months - Systems and Procedure Specific Training - Catawba Nuclear Station (1981) 3 months - Cold License Certification Classroom Training (1981) 3 months - Cold License Certification Simulator Training (1982) 1 week - Westinghouse Core Damage Mitigation Training (1982)	1 year - Co-op Student Oconee Nuclear Station (1976-1978) 1 year, 3 months - Nuclear Equipment Operator - Oconee Nuclear Station (3-7-77 to 6-1-78) 3 months - Spent Fuel Sipping, Spent Fuel Transport and New Fuel Receiving Crew - Oconee Nuclear Station (1978) 3 years, 6 months - Nuclear Equipment Operator - Catawba Nuclear Station - (7-5-78 to 8-15-82) 10 months - Procedure Development - Catawba Nuclear Station (1978-1979) 10 months - Assistant Nuclear Control Operator - Catawba Nuclear Station - (3-15-82 to 12-1-82) Review Team Participation Core Team Member (12-1-82 to Present)

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

Position	Academic	Experience	Academic	Experience
Assistant Shift Supervisor				
P. A. Thompson (McGuire)	6 months - Electrical School (1970) U.S. Navy 1 week - Westinghouse Turbine Generator Training (1975) Management Training - McGuire Nuclear Station (1982) 1 week - Task Analysis Training Course (1982) (H. P. VanCott, Bio Technology, Inc.)	6 years - Electrical Operator (EM) U.S. Navy Nuclear Program	6 months - Nuclear Power School, U.S. Navy (1971) 6 months - Prototype Training S1C Power Plant - U.S. Navy (1971) 8 months - Nuclear Fundamental and McGuire Systems Specific Training (1976) 1 week - Westinghouse NSSS Design Training (1976) 6 weeks - McGuire Systems and Procedures Training (1977) 6 months - Cold License Certification Training (1978) 4 weeks - Control Room Observation Training at Oconee Nuclear Station (1978) 2 months - License Preparatory Training (1979) 1 week - STA Training (1980) 1 day - TMI II Transient Training (1980) 1 week - Core Damage Mitigation Training (1980) 4 months - SRO License Preparatory Training (1981)	4 years - Electrical Operator (1972 75) USS Lewis & Clark SSBN-644 3 years - Utility Operator McGuire Nuclear Station (1975 78) 6 months - Procedure Development (1976) 2 years - Assistant Control Operator - McGuire Nuclear Station (1978-80) 1 1/2 years - Control Operator McGuire Nuclear Station RO Cold License - Unit 1 Startup (1980-82) 3 months - Control Board Upgrading (1980) Assistant Shift Supervisor SRO Licensed (March 1982-9-1-82) Review Team Participation Core Team Member (9-1-82 to Present)

DUKE POWER COMPANY
NUCLEAR STATION CONTROL ROOM DESIGN REVIEW

SUMMARY OF QUALIFICATIONS FOR REVIEW TEAM PERSONNEL

	General Qualifications		Nuclear Qualifications	
Position	Academic	Experience	Academic	Experience
Assistant Shift Supervisor				
G. McKendre Haynes, Jr. (Oconee)	2 years - Clemson Univ. - Chemical Engineering (1970-72) 3 days - Human Factors Engineering Seminar (J. L. Seminara) 2 days - Human Factors Engineering Seminar (1982) (Bio Technology, Inc.) 1 week - Task Analysis Training Course (1982) (H. P. VanCott, Bio-Technology, Inc.)	1 year - Whitestone Chemical Company - Maintenance & Construction - Lab Technician (1970-1972)	A.N.E. Degree (1976) - Tri-County Technical College - Nuclear Engineering 6 weeks - Oconee Systems Class - (1976) 3 months - Oconee R. O. License Class (1978) RO License Number OP 4804 (8/22/78) 6 weeks - License Requalification Class (1979) 1 week - Special Class - B&W Small Break Analysis (1979) 6 weeks - License Requalification Class (1980) 4 months - Oconee SRO License Class (1980) SRO License Number SOP 3873 (2/10/81) 1 week - Shift Technical Advisor Training Class (1981) 6 weeks - License Requalification Class (1981) 9 weeks - B&W Simulator Training - (1978-1983) 6 weeks - License Requalification Class (1982) 2 days - McGuire Simulator/ Procedures/Systems Familiarization (1982)	1 year Total as Co-op Student - Oconee Nuclear Station (1975 - 1976) 1 year - Nuclear Equipment Operator Oconee Nuclear Station (11/22/76-9/1/78) 1 year, 3 months - Assistant Control Operator - Oconee Nuclear Station (9/1/78-1/14/80) 2 years - Nuclear Control Operator - Oconee Nuclear Station (1/14/80-11/1/81) Present - Assistant Shift Supervisor (11/1/81-2/18/82) Shift Technical Advisor 11/1/81-2/18/82) Review Team Participation Core Team Member (2/18/82 - Present)
Oconee Probabilistic Risk Assessment Review Participant 5/1/82 - 12/1/82				