PROGRAM PLAN FOR THE

IMPLEMENTATION OF THE CONTROL ROOM DESIGN REVIEW

OF THE BEAVER VALLEY NUCLEAR POWER STATION

UNIT 1 NUCLEAR PLANT

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1. Introduction

1.1 Goals, Scope and Guidance

The control room design review (CRDR) is part of an extensive effort within the nuclear industry and the Nuclear Regulatory Commission (NRC) to evaluate control rooms, and emergency operation procedures (EOPs). The goals of the CRDR effort for nuclear power plants currently in operation is to identify human engineering discrepancies within the context of the existing control rooms, evaluate the human engineering disrepancies for their possible impact on the safe operation of the plant, assess whether or not the impact is significant and provide for adequate disposition of the human engineering discrepancies that are identified. In achieving these goals, while care must be taken to avoid negating the safety characterisitics of the existing control room design, practical considerations require that action be taken to upgrade the control room using accepted human factors principles.

Although the CRDR is directed toward the existing control room, it is recognized that other areas of concern, such as the design of a Safety Parameter Display System (SPDS) and the development of new Emergency Operating Procedures, will be coordinated with the CRDR. Also, in parallel with the CRDR as presented in this program plan, an evaluation will be performed to assure effective integration of the review of accident monitoring instrumentation (Regulatory Guide 1.97) with the CRDR and EOP's. A final report on the evaluation of

Regulatory Guide 1.97 instrumentation will be provided with the CRDR Summary Report.

This program plan describes the manner in which Duquesne Light Company (DLC) intends to conduct the review of its Beaver Valley Nuclear Power Station Unit 1 Nuclear Plant (BV-1) control room. DLC has proceeded to work on certain elements of its program plan prior to NRC review. However, DLC anticipates that any major deficiencies in its plan noted by the NRC staff will be brought to DLC's attention in a timely manner.

The DLC program plan provides a basis upon which to judge that an adequate BV-1 CRDR has indeed been conducted. It is intended that any audit of DLC's CRDR by NRC personnel or contractors will use this program plan as its reference document and that the criteria for completeness and adequacy will be taken from this document.

Guidance for the DLC CRDR and related activities has been provided by the NRC in the form of various NUREGs and Regulatory Guides. While there are differences between the utility industry and NRC positions on some of the specific criteria in these documents, the basic objectives are the same. However, a CRDR program plan oriented only toward meeting the detailed criteria of NRC guidance documents does not ensure an adequate or coordinated approach to improving control room operability and plant safety. Therefore, DLC intends to use the guidance documents provided by the Nuclear Utility Task Action Committee (NUTAC) on CRDR, chartered under the Institute of Nuclear

Power Operations (INPO) in developing its program plan. DLC actively participates in CRDR NUTACs and considers that NRC guidance has been adequately considered and properly incorporated in the NUTAC documents.

1.2 Overall Schedule

The expected overall schedule is provided below for the BV-1 CRDR. It is within the framework of this overall schedule that the CRDR tasks will be performed. Those tasks identified in Supplement 1 to NUREG-0737 are included to show how the CRDR schedule integrates with these activities for the BV-1 Plant.

1.	SPDS Safety Analysis	- contingent upon NRC issuance of SER on Westinghouse designed SPDS
2.	Full Implementation of the SPDS	- following the fifth refueling outage tentatively scheduled for July of 1986.
3.	CRDR Program Plan	- submittal to NRC in September 1983
4.	CRDR Summary Report	- submittal to NRC in November 1985
5.	R. G. 1.97 Report	- submittal to NRC in November 1985
6	EOP Technical Guidelines (Generic)	- previously submitted by the Westinghouse Owner's Group

7.	EOP Procedures Generation Package	- submittal to NRC in June 1984
8.	Full implementation of the EOPs	- following the fifth refueling outage tentatively scheduled for July of 1986
9.	ERF fully functional	- following fourth refueling outage (without SPDS)

This schedule lends itself to efficient staff use for the integration of the many related tasks contained in Supplement 1 to NUREG-0737. DLC anticipates that the review of BV-1 operating experience and the control room human factors survey will be completed by the first half of 1984. Performance of the CRDR verification and validation portions of the task analysis will depend on the completion of the draft EOPs and the BV-1 simulator expected by the end of the second quarter of 1984 and first quarter of 1985, respectively. Upon completion of the execution and assessment phases of the CRDR, DLC will be in a position to complete the preparation of the CRDR summary report and submit it to the NRC. At that time, sufficient information should be available for the planning of the CRDR correction phase.

2. Overview

2.1 PURPOSE

The purpose of the DLC CRDR is to ensure that the BV-1 control room and remote shutdown panels will support operation during emergency conditions. The operator tasks required during emergencies will be based on the new Emergency Response Guidelines (ERGs) developed by the Westinghouse Owners Group and currently being reviewed by the NRC staff.

2.2 OBJECTIVES

To ensure that the CRDR fulfills its stated purpose, several objectives will be met during the review. The following specific objectives are defined for the CRDR:

- to perform a control room survey that compares the existing control room design with accepted human engineering criteria
- to identify human engineering discrepancies (HEDs)
- to review relevant plant operational experience using appropriate documentation and an operator questionnaire
- to determine the input and output requirements of control room operator tasks during emergency conditions
- to determine the extent and importance of any identified discrepancies

- to formulate and implement resolutions for significant discrepancies (as judged above)
- to ensure that the proposed resolutions do, in fact, eliminate or mitigate the discrepancies for which they are formulated
- to ensure that the task analysis can serve as a basis for developing and implementing training so that control room operators can adequately function with any proposed control room modification and the new EOPs.
- To improve the operator/control board interface through improved labeling and mimicking to the extent practicable.

2.3 DESCRIPTION OF CRDR ACTIVITIES

To achieve the stated objectives of the CRDR, several activities will be completed during the review. A flow chart of these activities is presented in Figure 1. This flow chart is not intended to show the start and stop times for each activity, but rather, the inter-relationships of the information needed and obtained by each activity. Note that the CRDR has been split into six nominal phases: planning, execution, assessment, correction, effectiveness, and documentation. The planning phase of the CRDR is represented by this program plan.

The activities within each phase will be described in more detail later, but a brief synopsis of these activities will help give a general picture of the review process.

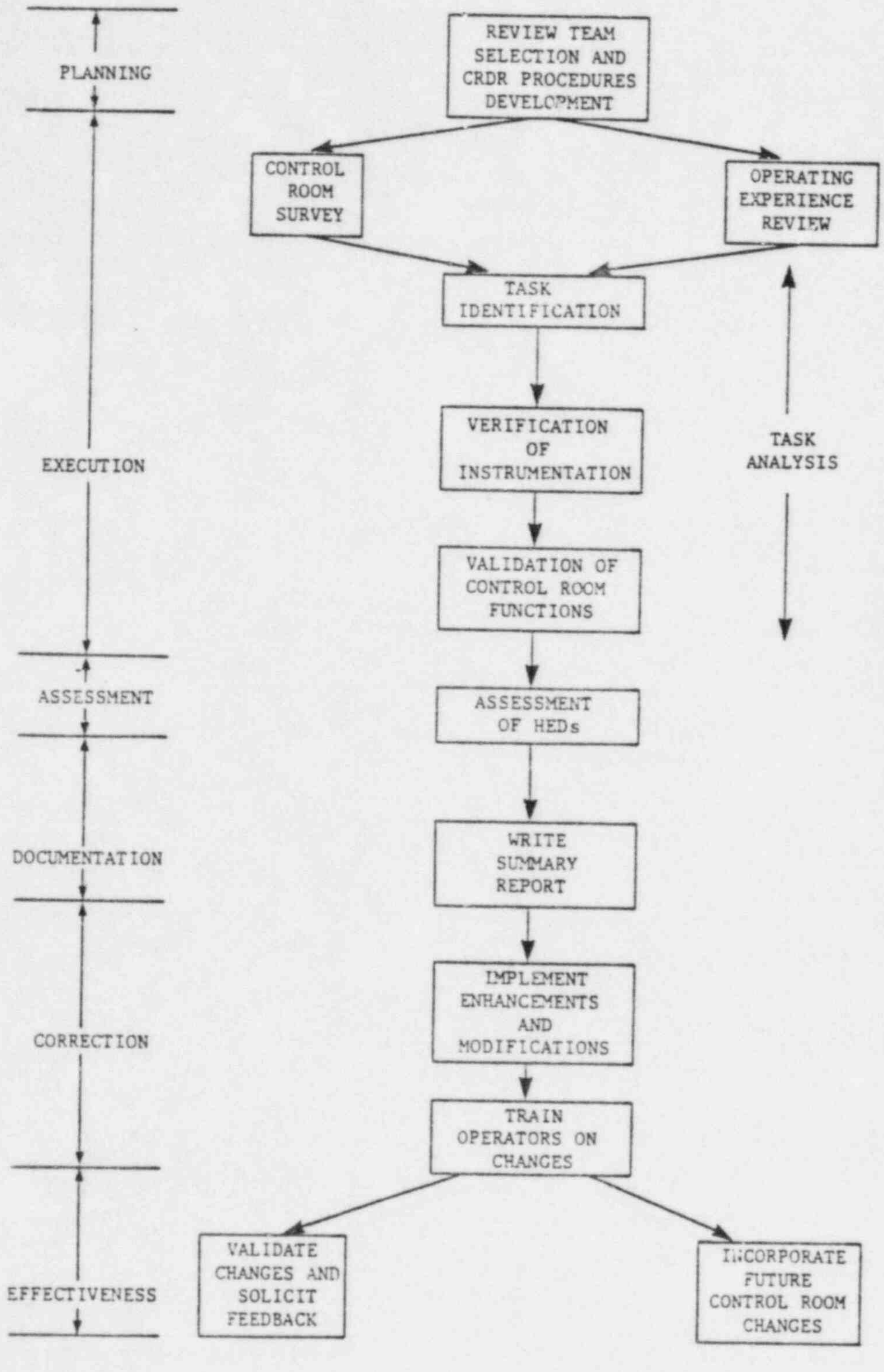

Figure 1. Schematic of Control Room Design Review Activities

2.3.1 Execution Phase

The execution phase will constitute the investigative, data gathering portion of the CRDR. During this phase, a control room survey will compare the characteristics of the existing control room with appropriate human engineering design guidelines. An examination of BV-1 operating experience will be conducted by a review of incident reports (IRs) and licensee event reports (LERs) and through a control room operator questionnaire. During the task analysis, the new ERGs will be evaluated to determine the tasks required of operators during emergencies. The instrumentation and control requirements for those tasks will be established, and the adequacy and completeness of existing instrumentation and controls will be determined. In addition, the guidance provided in Regulatory Guide 1.97 will be used to evaluate the appropriate instrumentation.

2.3.2 Assessment Phase

During the assessment phase, all discrepancies identified in the execution phase will be analyzed, and the potential impact of each discrepancy on emergency plant operation will be determined. Discrepancies will be classified according to their potential impact on emergency plant operation. Significant discrepancies will be resolved through enhancement, modification, or other means, such as changes

to procedures and training and utilization of the SPDS. Any actions proposed to resolve significant discrepancies will be analyzed for their effects on control room operations, operators, and operator training.

2.3.3 Documentation Phase

A summary report will be submitted to the NRC at the conclusion of the CRDR. It will summarize the overall review process, summarize the identified human engineering discrepancies, provide a summary justification for human engineering discrepancies with safety significance to be left uncorrected or partially corrected, describe control room design improvements implemented during the course of the review, and outline proposed control room improvements and their proposed schedules for implementation if those schedules are known at the time the report is written. For convenience, documentation is shown in Figure 1 as only occuring during the writing of the summary report. In reality, documentation will occur throughout the CRDR to provide supporting data and information for the summary report and for auditability of CRDR activities.

2.3.4 Correction Phase

A BV-1 plant-specific plan will be developed to ensure the integration of proposed control room modifications with the

other programs included in Supplement 1 to NUREG-0737 as well as scheduled plant outages. A schedule will be developed for the derly introduction of proposed modifications. The schedule will take into account the required training of operators on pending modifications. Administrative follow-up will ensure the successful completion and integration of all control room modifications.

2.3.5 Effectiveness Phase

This phase will be accomplished by using two different procedures. The first procedure will validate, as installed, changes resulting from the Assessment Phase during the CRDR. The second procedure will consider control room changes that are proposed after the CRDR is completed. These are discussed further in Section 8.

2.4 DEFINITION OF TERMS

Control Room Design Review (CRDR) - A post-TMI task listed in NUREG-0660, "Task Action Plan Developed as a Result of the TMI-2 Accident," and NUREG-0737, the staff supplement to NUREG-0660, as Task I.D.1.

Control Room Survey - One of the activities that constitute a CRDR. The control room survey is a static verification of the

control room performed by comparing the existing control room instrumentation and layout with selected human engineering design criteria, i.e., checking the control room match to the human operator.

Critical Incident Technique - An interview technique in which job incumbents and subject matter experts (SMEs) are asked to describe situations they have witnessed where either they or someone else committed an error that led or could lead to an abnormal or unsafe operational status.

Elements of a Utility CRDR Implementation Process - Necessary parts of a cohesive CRDR implementation process that a utility should consider in developing and reviewing their implementation plan and schedule.

Emergency Operation Procedures (EOPs) - Plant procedures directing the operator actions necessary to mitigate the consequences of transients and accidents that cause plant parameters to exceed reactor protection setpoints, engineered safety feature setpoint, or other appropriate technical limits.

Emergency Response Guidelines (ERGs) - Guidelines, developed from system analysis of transients and accidents, that provide sound technical bases for plant-specified EOPs.

Human Engineering Discrepancy (HED) - A characteristic of the existing control room that does not comply with accepted conventional human engineering criteria.

Human Engineering Suitability - An attribute of a system, component, or procedure that determines its compliance with the human engineering requirements of its users and the job in which it is used.

Nuclear Utility Task Action Committee (NUTAC) for CRDR - Representatives from various nuclear utilities and INPO organized to define areas of CRDR implementation for which an overall industry effort can provide assistance to individual utilities in completing Task I.D.1, NUREG-0737.

Operational Experience Review - One of the activities that constitute a CRDR. The operating experience review screens plant operating documents and operator experience to discover human engineering shortcomings that have caused actual operating problems.

Review Team - A group of individuals responsible for performing the CRDR of a specific control room.

Safety Parameter Display Systems (SPDS) - An aid to the control room operating crew for use in monitoring the status of critical

safety functions (CSFs) that constitute the basis for plant-specific EOPs.

Subject Matter Expert (SME) - An individual who, by virtue of training and experience, possesses in-depth knowledge in a specific subject area.

System Function Analysis - The determination of system functions required to meet system goals.

Task Analysis - The systematic process of identifying and examining tasks in order to identify conditions, standards, instrumentation, skills, and knowledge associated with the performance of a task. In the CRDR context, task analysis is used to determine the individual tasks that must be completed to allow successful emergency system operation. In addition, this activity can verify and validate the match of information available in the control room to the information requirements of emergency operating tasks.

Validation - The process of determining whether the control room operating crew can perform their tasks effectively given the control room instrumentation and controls, procedures, and training. In the CRDR context, validation implies a dynamic performance evaluation.

Verification - The process of determining whether instrumentation, controls, and other equipment exist to meet the specific requirements of the emergency tasks performed by operators. In the CRDR context, verification implies a static check of instrumentation against human engineering criteria.

3. MANAGEMENT AND STAFFING

3.1 CRDR Management Review Team

The ultimate responsibility for the BV-1 CRDR will reside with the DLC Licensing Section. The day-to-day conduct of the review, however, will be the responsibility of a review team established specifically for the CRDR. The review team will provide the management oversight to ensure the integration of the project objectives and to fulfill the intent of the review. The review team is responsible for planning, scheduling, and coordinating the total, integrated CRDR. This overall responsibility makes the review team function unique within each individual utility. DLC considers that the control of such a function be maintained within the utility itself which has the ultimate responsibility for adequate performance of the CRDR. The review team will, therefore, consist of members from departments within the Nuclear and Engineering and Construction Divisions of DLC.

3.2 REVIEW TEAM STRUCTURE

The review team is a multidisciplined team of individuals with the wide range of skills necessary to perform the design review. The team will consist of the following DLC personnel:

- review team leader
- senior reactor operator
- instrument and controls specialist
- engineering

The resumes of the DLC review team members are included in Appendix A of the Program Plan. The following provides, in general, the intended function and duties of a Human Factors Specialist (HFS), of supplemental personnel, and of the individual team members. Minimum qualifications for the HFS and team members are also provided. DLC recognizes that the purpose of the CRDR is to assess the control room in terms of human engineering design characterisitics. However, many aspects of the physical control room layout are not easily analyzed without input from fields other than human factors. Emergency plant operations itself, on which the CRDR focuses, is supported by many disciplines within the DLC organizations. Human factors engineering must be incorporated as an additional discipline for the CRDR. Guidelines, such as found in NUREG-0700 and NUREG-0801, based on accepted human factors engineering principles and/or advice from Human Factors Specialists have been generated from many sources providing extensive criteria for reviewing specific human factors design elements in nuclear power plant

control rooms. DLC intends to imploy these guidelines in its methodology for performing the review. To ensure that human factors principles are adequately considered in its CRDR, provisions for a Human Factors Specialist to assist the review team are being made by DLC. Because of this unique role, the Human Factors Specialist will be considered a review team member in the capacity of a subject matter expert (SME) as described below.

A subject matter expert (SME) may be designated by the review team as a technical team leader if the scope of specific technical review task(s) warrants this action. In such a case, the SME will assist in coordinating the activities directly involved in the task and work with and report findings to the review team directly or through the review team leader. During the course of the review any additional specialists (eg. lighting, acoustics) required for specific tasks will be made available to the review team, as needed.

The team will be supplemented, as required, by personnel in disciplines such as: operations, mechanical, electrical, and industrial engineering, training, procedures, licensing, health physics, and emergency preparedness. Supplementary personnel can serve as limited duration team members with responsibility for a particular aspect of the CRDR as the situation dictates and/or to provide coordination between team activities and other NUREG-0737 task activities.

3.2.1 Review Team Leader

The review team has the review team leader as its key person. This individual provides the administrative and technical direction for the project and has responsibility for the project. Access to information, facilities, and individuals providing useful or necessary input to the team is coordinated by the review team leader. This individual provides a cohesive force for the various DLC department personnel and any vendor organization involved with this project. Plant operations personnel provide input to the review team through contact with the review team leader.

It will be the responsibility of the review team leader to resolve human factors opinions on methodology, technique, review findings, assessment and HED corrective actions that dissent with the majority opinion of the CRDR Review Team. The minimum qualifications for the review team leader will include:

- bachelors level degree (or equivalent) in an engineering discipline or
- SRO-certification and
- five years' experience in nuclear plant operations or engineering

3.2.2 Human Factors Specialist (HFS)

The human factors specialist will work closely with the review team throughout phases of the control room review as indicated herein and provide the team with human factors technical expertise for a valid and comprehensive review.

Minimum qualifications for human factors specialist include the following:

- M.A. or M.S. in human engineering or related discipline
- five years' experience in human factors, one of which is in nuclear control room review or a closely related systems area

3.2.3 Instrument and Controls (I&C) Specialist

The I&C specialist will assist in the identification of plant system design features and will serve as the review team expert on the capabilities and limitations of controls and instruments. The I&C specialist will also provide input to the team during the assessment phase of the review, especially when the review team considers proposals for mitigating HEDs.

The minimum qualifications for the I&C specialist include the following:

- B.S. degree (or equivalent) in engineering or applied science field
- five years' of I&C experience, at least two of which are in the nuclear design area

3.2.4 Senior Reactor Operator (SRO)

At least one SRO from BV-1 will serve as a member of the review team. The SRO will assist in identifying operator tasks and will serve as the review team expert on the operational constraints for manipulations of plant systems.

The minimum qualifications for the SRO include the following:

- an SRO license at BV-1
- at least (five) years' experience as a licensed nuclear operator

3.2.5 Engineering Personnel

Four engineers have been selected from DLC organizations who will bring to the review team varied experiences directly applicable to the type of evaluations anticipated during the CRDR. The disciplines represented are Electrical and Nuclear engineering. These engineers hold responsible positions with DLC and will provide valuable assistance in

the identification of plant system design goals and functions and the factors affecting design decisions at the BV-1 plant. As a group they have expertice in current design concepts, test procedures, operating procedures, nuclear safety analysis, and simulator design and procurement, and represent more than twenty-four years of nuclear related experience.

The minimum qualifications for the design engineer include:

- B.S. degree in engineering
- five years' of experience, at least two of which are in nuclear

3.3 REVIEW TEAM ACTIVITIES

Review team activities will include developing the methodologies for the review and assessment of discrepancies, establishing the overall plan and schedule for the CRDR, acting as a resource for the departmental organizations, and integrating all action items. The review team will develop, or have developed, all reports relating to the CRDR and submit the appropriate reports to the Licensing Section, the Onsite Safety Committee, the Offsite Review Committee, and the Vice-President of the Nuclear Division for review and approval. The review team will ensure that adequate documentation is maintained throughout the CRDR.

3.4 REVIEW TEAM ORGANIZATIONAL INTERFACES

3.4.1 Departmental Organization Interface

In order to perform the CRDR expeditiously while utilizing and broadening the experience in our existing organizations, specific control room review tasks will be delegated to departmental organizations supplemented as necessary with technical specialists. The relationships between the review team and departmental organizations will be established as follows:

- Based upon the objectives defined by the review team, the departmental organization will submit a plan to the review team for each assigned activity. The review team will ensure that the departmental activities are coordinated with and support overall effort. This plan will address the major steps required to perform assigned activities as well as the interfaces between the departmental personnel and the review team, especially with regard to the level of detail of information exchanged, schedules, etc.

- Personnel of the departmental 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 each department to establish a cooperative working relationship with the manager's organization.

3.4.2 Company Interface

The review team will exist as a distinct entity within the DLC organizational structure. The review team leader will report to the BV-1 Superintendent of Safety and Licensing. The work of the review team will not be arbitrarily restricted in any area without written justification that will be made a part of the auditable review documentation.

It is essential that the CRDR be coordinated with other ongoing activities that involve potential physical changes to the plant, such as implementation and manning of emergency response facilities (ERFs). The BV-1 Nuclear Division has an established procedure, Nuclear Engineering Management Procedures (NEMPs), that document activities involving potential physical changes to the plant ie. Design Change Packages (DCPs). The Safety and Licensing Department is part of the review effort on all design changes which affect Nuclear Safety. In process and future DCPs will be provided to the review team for their review if the CRDR effort is impacted. Team members, through their association with their individual departments will also be made aware of

policy and software changes affecting operations and control room personnel. Members will be responsible for ensuring that the CRDR is coordinated with ongoing activities and that documentation of changes be maintained fcr team use and NRC audits.

3.5 REVIEW TEAM ORIENTATION

Each member of the review team will bring his or her own in-depth knowledge of specific topics to the team. It is important, however, that the review team be able to conduct the CRDR from a common basis of understanding. During its initial meetings, the review team will discuss the need and extent of an orientation program designed to provide each team member with certain basic knowledge requirements. The purpose of the orientation is to acquaint each team member with the other disciplines represented on the team, not to make each team member an expert in all specialties.

The following minimum instructional areas will be addresed in the orientation program as indicated.

- Human Factors - Orientation will be provided for the review team to familiarize the team with principles of human factors and their application to the control room review. Included in this area will be a brief synopsis of the history of the CRDR requirement and its ultimate goals. This orientation area

will be slanted toward those review team members with little or no background in human engineering.

- NUREGs-0700 and 0801 and Supplement 1 to NUREG-0737 - Familiarization with the methods and contents of these NUREGs will be provided for the review team.

- Plant Familiarization - The review team members will evaluate their need for supplemental plant familiarization. The team will consider its familiarization with normal plant operation and the use of emergency procedures. It is assumed that portions of this orientation will take place at the plant or the training facilities of BV-1 or the simulator when it becomes available.

3.6 USE OF CONSULTANTS

DLC personnel will be used for CRDR activities as much as possible. A high degree of involvement will enhance personnel development overall, increase awareness of human engineering methodology, and provide for a better understanding and acceptance of any proposed corrective actions. Therefore, consultant services will be retained during CRDR activities when it is necessary to provide skills not represented within DLC.

At this time, DLC recognizes the need for a human factors specialist to assist the review team. The human factors specialist will be retained as indicated in this plan. During the CRDR, the review team will be responsible for identifying any additional assistance required. In general, consultant services will be used to insure that human factors principles and methodology are adhered to and properly implemented in the CRDR.

4. PROCEDURES FOR THE CRDR

The objective of the DLC CRDR is to determine the extent which the BV-1 control room provides the operators with sufficient information to complete their required functions and task responsibilities efficiently under emergency conditions. The review will also determine the human engineering suitability of the designs of the instrumentation and equipment in the BV-1 control room. This section of the program plan describes the procedures that will be applied to accomplish those overall objectives.

4.1 OPERATING EXPERIENCE REVIEW

The Beaver Valley Nuclear Power Station is a two unit Westinghouse pressurized water reactor (PWR). The BV-1 plant has been operating commercially since September, 1976. The BV-2 plant is under construction. The BV-1 unit is a 3-loop, high-head design with a net unit electrical output of 851.9 MWe. With

such a relatively long operating history, the experience of operational personnel and data from plant operation documents is an appropriate source of information for the CRDR.

The review of operating experience will provide information on potential problem areas in the control room by studying actual occurrences in the plant. Two separate steps are involved in reviewing operating experience. The first is to review available and applicable historical documentation pertaining to plant-specific occurrences. The second step is to survey operating personnel. Operating personnel surveys will identify specific problem areas related to the BV-1 control room and point out problems that occur during normal plant operation or that could occur during emergency operations.

4.1.1 Historical Documentation Review

Since DLC is most concerned with events that have occurred at BV-1, the documentation review will involve plant-specific documents. Applicable plant documents that will be examined are the plant incident reports (IRs) and licensee event reports (LERs). They will be examined for instances of incorrect control room operation that may have led to a plant trip or turbine trip.

LERs are required whenever personnel injury, test failure, radiation exposure, or equipment damage is caused by an

operating event. LERs are also required when an error is committed that, in the opinion of the shift supervisor or plant manager, might have led to personnel injury, exposure, or equipment damage.

4.1.2 Screening the Documents

The CRDR team with the assistance of a human factors specialist will review all IRs and LERs. Copies of those involving control room operator, procedural, and/or control board equipment failure and/or design arrangements errors will be obtained. The reports obtained will be screened by a human factors specialist with the assistance of an operations subject matter expert (SME) if required to determine if the report describes and documents a control room problem. A control room problem is defined as one that meets one or more of the following criteria:

- Equipment referenced (valve/pump controls, displays, indicators, etc.) must be in the physical confines of the control room or remote shutdown panel.

- Procedure steps referenced should be accomplished within the physical confines of the control room or remote shutdown panel.
- Personnel error referenced must have occurred in the control room on equipment in the control room or remote shutdown panel or entailed a deviation from procedures

that were to be accomplished in the control room or remote shutdown panel.

Reports that pass the above selection criteria will be retained for further analysis.

4.1.3 Operating Personnel Survey

The most valuable source of data on operational problems are the personnel that have operated the plant. The intent of the operating personnel survey is to gain as much firsthand information as possible on actual and potential operational errors. The survey will consist of a self-administered questionnaire and follow-up structured interviews if clarification or additional information for questionnaire responses is required by the review team. A copy of the Survey Questionnaire is provided in Appendix B of this Program Plan.

4.1.4 Questionnaire Construction

An open-ended, confidential, self-administered questionnaire approach has been adopted. DLC feels that by employing this method, the majority of the operating personnel can be questioned thereby maximizing the use of their time and insures an open response. The survey covers 10 content-topics. Specifically, the areas covered are as follows:

- workspace layout and environment

- panel design
- annunciator warning system
- communciations
- process computers
- corrective and preventive maintenance
- procedures
- staffing and job design
- training
- other areas for operator comment

For each topic area, the following has been accomplished:

- The question orientation is predominantly along the lines ofthe Critical Incident Technique to ensure that responses are as objective as possible.
- The questions written have been evaluated for inclusion in the questionnaire using the following criteria:

Simplicity - Questions are direct, employ common everyday language, and are as brief as possible.

Clarity - Questions are unambiguous so that the response received will be unbiased and accurate.

Objectivity - Questions are free of emotionally charged words such as good/bad, strong/weak, etc.

Error Free - Surveys are susceptible to social desirability, leniency, central tendency, and halo-type errors. The questions are those that have the minimum tendency toward these error types.

- The Safety and Licensing Department assembled questions

for each topic area of the questionnaire so that the area is sampled completely in item content. Each topic area contains sections in which suggestions for improvements are solicited.

A cover letter attached to each questionnaire was prepared. The cover letter (1) explains the purpose and gives background information, (2) describes the questionnaire and provides instructions, (3) ensures respondent confidentiality, (4) conveys what will be done with the results, and (5) requests biographical information.

4.1.5 Questionnaire Distribution

Questionnaires were given to the control room shift supervisors, foremen, and licensed on-shift operations personnel. Respondents were instructed to return the completed questionnaire within eight weeks after the issuance date stated on the cover letter.

4.1.6 Questionnaire Data Analysis

As each questionnaire is retrieved, it will be assigned a code number. These code numbers will be used to trace item responses to individual respondents should it become necessary to do follow-up interviewing.

After the questionnaires have been completed, retrieved, and logged in, they will be examined and reviewed on an item-by-item basis. Responses will be summarized on a Questionnaire Item Summary Form.

It is anticipated that both positive and negative control room features will be identified by the respondents. Further investigation will therefore be carried out for each item on the responses to determine whether they are in accordance with sound human engineering conventions and practices. Positive responses that are in accordance with sound human engineering conventions and practices will be recorded and disseminated to every member of the CRDR team for consideration in subsequent review processess (e.g., as possible recommendations for corrective action to HEDs). Negative responses will be investigated further in the interviews and in other phases of the CRDR as judged appropriate by the review team.

The biographical data information collected by the Personnel and Biographical Data Sheets will be summed and averaged to provide the review team with an indication upon which the survey response is predicated. This information will be recorded on the Personnel Demographic Summary Form and will be submitted as part of the final CRDR report.

4.1.7 Follow-up Interviews

If required, structured interviews will be used as a follow-up to the questionnaire. As the name suggests, structured interviews are conducted according to a pre-designed outline. The outline may even have specific questions that should be answered during the interview. A structured interview helps to reduce the variability of interview results caused by asking different questions of each interviewee or by allowing the interview topics to appear more or less randomly during the interview. Structured interviews will be developed to obtain more detailed information where required in areas of control room design that prompted negative questionnaire responses or need further explanation. The interview outline will also allow detailed follow-up in areas of general interest to the review team.

This particular activity depending on the scope will be assigned to a contracted individual instead of a DLC review team or departmental personnel. There are two principal reasons for contracting this activity. First, DLC does not maintain a staff of individuals proficient in interview techniques. Although some departments within the company do use interviews, e.g. personnel, the particular techniques used in operator interviewing are sufficiently unique to warrant using outside help.

The second reason for using contract people for the operator interviews is the common belief that information will be more candidly provided during an interview if no company personnel are present. Since it is the intent of DLC to gain as much useful information as possible by encouraging control room operators to be completely frank and open, no DLC personnel will be present during the interviews.

While a contractor will be used to conduct these operator inverviews, it is essential that the interviewer be familiar with control room environment. Unless such familiarity is present, the importance of certain responses might be missed by the interviewer. Also, responses might lead an experienced interviewer to probe deeper in specific areas, seemingly unrelated to the response.

Interviews will be conducted using a structured technique that helps ensure all pertinent areas will be addressed. The structure will be flexible enough to allow added emphasis on certain topics if necessary. The operating personnel to be interviewed will be selected by the review team on the basis of the questionnaire evaluation. Responses requiring further investigation will subsequently identify interview topics and the respondents to be interviewed.

4.2 CONTROL ROOM SURVEY

A human factors survey of the existing BV-1 control room will be conducted during the CRDR. The purpose of the survey will be to compare the design features of the existing control room with applicable human engineering design guidelines. To facilitate the human factors survey, checklists and survey lists will be compiled for which direct observation and measurement of control room human factors features can be undertaken. The CRDR Survey Development Guideline published by the INPO NUTAC on CRDR will be used in developing specific BV-1 methods. The NUTAC method provides screening criteria for the proper dispositioning of the survey items contained in Section 6 of NUREG-0700. NUREG-0700 items found not to be directly applicable to the Control Room Survey are identified in the NUTAC Guideline for use, where possible, elsewhere in the CRDR.

4.2.1 Checklists and Survey Lists

The checklists and survey lists will be developed using Section 6 of NUREG-0700 and information from some of the documents listed in Section 6 of this program plan. The review team will extract the necessary information from the reference documents and, if ncessary, reformat that information for the BV-1 specific survey. The lists will organize guideline items under the broad categories listed in subsection 4.1.4 and will be used to evaluate the

adequacy of the appropriate control room design features. Along with the lists a photograph will be made of at least one instance of each type of discrepancy.

While most of the checklist items are applicable at the component level, some guidelines apply to the specific use of instruments and equipment, task sequence requirements, communications requirements or other aspects of dynamic operation. These dynamically oriented guidelines are most appropriately addressed from the task or function perspective described in Section 4.3.

Some guidelines will be addressed in survey lists primarily on a control room-wide basis, such as those that fall in the categories of communications, process computer, control room layout, and environmental factors. Others will be approached on a control room-wide basis first, and then panel-by-panel, such as the annunciator system and layout. Still other guidelines will be evaluated element-by-element, and then for general control room consistency, such as controls, displays, labels, and location aids. The checklists and survey lists will be modeled after those contained in the "CRDR Survey Development Guideline" published by the NUTAC on CRDR.

Listed items will be organized for easy reference and will provide space for an indication of compliance or

noncompliance to each guideline. When lack of compliance is found, the specific reason or reasons will be clearly described in an adjacent space. Items that require further documentation of the human engineering discrepancy will be described in greater detail on a separate record cross-referenced to the checklist or survey list.

4.2.2 Personnel Assignments

It is not necessary that the review team carry out the actual performance of the control room survey. The members of the review team will be responsible for developing the checklists and survey lists for the overall control room survey and ensuring that the lists are adequate and soundly based. The actual survey with its extensive documentation requirements will be performed by members of DLC departments assisted by a human factors professional. Personnel selected to conduct the survey will be designated as part-time members of the survey team and trained to use the lists properly. The survey team will include a control room operator (CRO) for BV-1 Operations who will be assisted by the review team leader.

At least one member of the survey team will be an outside human factors professional. The survey team human factors person need not be a senior level professional, nor is it

necessary for this individual to have long project-related experience.

The survey team will interact with the review team on a daily basis through the review team leader to ensure proper conductance of the survey. Thus, any clarification of listed items will be immediate and interactive. A procedure will be developed to allow any Survey Team member to document opinions concerning the potential classification of control room features he or she feels strongly about, but that may be in conflict with the opinion of the majority of the survey team. These documents will be available during the assessment phase and during any audit of the CRDR.

4.3 TASK ANALYSIS

The operating experience review and the control room survey will identify as HEDs control room characteristics that have caused, or nearly caused, problems during normal operations or HEDs that do not conform to human engineering design criteria. The final activity in the CRDR execution phase, the task analysis, will identify the tasks which operators must perform during emergency operations, determine whether the instrumentation, controls, and equipment are available and suitable to perform those tasks, and validate that the emergency tasks identified can be performed under simulated emergency conditions. More details on task

analysis are provided below and in the "CRDR Task Analysis Guideline" developed by the CRDR NUTAC.

The task analysis will use as its technical basis the Emergency Response Guidelines (ERGs) developed by the Westinghouse Owners Group (WOG). These ERGs have been designed to generate plant-specific emergency operating procedures (EOPs) for Westinghouse supplied nuclear steam supply systems. The first draft of the new BV-1 EOPs is currently being developed. DLC intends to use the draft EOPs when performing the verification and validation portions of the task analysis.

4.3.1 Task Identification

Starting with specific WOG ERGs all tasks within the ERGs will be identified and analyzed to determine the instrumentation required. Beyond the tasks to be analyzed certain plant systems are referenced in the ERGs as resources to be used during emergency operation. As part of the task analysis, the tasks necessary to use the plant systems or interpret data, as they are required to be used in the ERGs, will be delineated. Any instruments and controls necessary to complete these tasks will be determined. Some of the operator tasks required for specific system operation can be determined using existing BV-1 EOPs and the WOG ERGs. Where this is not the case, any

additional analysis required to determine system-specific tasks will be performed and documented.

After the required tasks are delineated and the necessary instruments and controls identified, a two-step process will be undertaken that will (1) verify that the required instruments and controls are present in the control room and are of the appropriate range with the appropriate scales and labels and (2) validate, with dynamic walk-through-talk-throughs, that all EOP and system-specific steps can be completed in the BV-1 control room by the normal complement of operating personnel.

The methodology contained in the Emergency Response Capability (ERC) Nuclear Utility Task Action Committee (NUTAC) Component Verification and System Validation Guideline will be used to develop the actual validation procedures.

4.3.2 Verification of Instrumentation

The process of verifying that the BV-1 control room contains appropriate instruments and controls will be completed in two somewhat over-lapping steps. These steps will check the correspondence between the procedures and control room hardware. First a determination will be made as to whether the instrumentation and controls necessary to make the

decisions and implement the tasks identified previously are, in fact, present in the control room. If not, any such instance will be defined as an HED and documented accordingly.

The second step of the verification process consists of an examination of the instrumentation and controls located in the first step, above, to determine their human engineering suitability for the task or decision it is supposed to support. Although the control room survey examined all control room instrumentation for conformance with human engineering design criteria, this verification step is required to determine if a meter, for example uses the same units of measurement and has the appropriate range and scale gradations to support a particular EOP task or system-specific task step.

In conjunction with the above verification steps, the Post Accident Monitoring Systems (PAMS) as described in the FSAR will be evaluated. Information on the instruments and instrument components as presently installed at BV-1 will be listed and compared against the design criteria of Regulatory Guide 1.97 (see data sheets in Appendix C). Deviations from the guidance in Regulatory Guide 1.97 will be shown and justifications where possible for non-conformances will be presented with the CRDR Summary Report.

4.3.3 Validation of Control Room Functions

The final analytical step in the task analysis is to evaluate the tasks delineated in the new EOPs that must be performed to carry out emergency functions and to validate that those tasks can be completed in the existing BV-1 control room by the normal operating crew. This evaluation will be accomplished in two phases. Both phases will use the BV-1 simulator. First, the BV-1 simulator will be used as a static control room mockup to determine if the instrumentation and controls operate as called for in the EOPs and are spatially located such that they can be used with the number of individuals normally on shift. Secondly, specific transients that require operators to use the EOPs will be selected and run on the BV-1 simulator. A BV-1 operating crew will walk-through-talk-through the actions that are required by the EOPs. The objective of the dynamic simulation is to provide a high level of assurance that the procedures will work, i.e. the procedures guide the operator in mitigating transients and accidents.

In the event that the BV-1 Simulator will not be operational in time to support the EOP validation, then a suitable alternate plan will be developed. A static mock-up of the control room would be considered for such an alternate plan.

4.3.3.1 Walk-through Using BV-1 Simulator - Phase 1

For each EOP the walk-through procedure will be the same. A complete operating crew will be assembled at the simulator and the crew members will take their normal positions relative to the control boards. An observation team will be assigned to lead the crew through the specific instructions in the EOP and to record crew comments and movements in response to those instructions. The crew will be encouraged to move about the simulator just as they would move about the control room and to verbalize what they are doing, why they are doing it, and which instruments and controls they are using for each activity.

This phase is not a dynamic check of the adequacy of the control room layout, but it will indicate whether or not appropriate instrumentation is available in the primary control area to carry out the tasks called for in the EOPs. In addition, the instruments and controls used to operate specific plant systems can be recorded. The activities of observational personnel are described in Section 4.3.5.

4.3.3.2 Walk-through Using BV-1 Simulator - Phase 2

Upon completion of the preceding phase 1 of validation, dynamic validation of an EOP set of transients will be performed on the BV-1 simulator. The following lists the transients selected for simulator validation:

- SIS Actuation
- Reactor Trip
- Loss of Reactor Coolant
- Loss of Secondary Coolant
- S/G Tube Rupture with and without offsite power
- Total Loss of Feedwater
- Loss of all A/C Power (Station Blackout)

The selected set of transients are intended to provide a high level of assurance that the new BV-1 EOPs will properly direct the operators in mitigating accident conditions. Any deficiencies noted during validation of these transients will be reviewed for their possible occurrence in the other EOPs.

A complete operating crew will be assembled at the BV-1 simulator. The crew members will take their normal positions relative to the control boards. An observation team will be assigned to record the crew's movements and to note any deviations from the appropriate EOPs. Two runs will be made for each

transient. The first run will be made at real time so that the events on the simulator will occur in the same time frame as in the actual plant. If needed, the second run will be made in slow time so the operating crew members can describe their actions to the observation crew and tell the observation crew which instruments are being used at any given time.

It appears that it will require about two eight-hour shifts to complete two runs for each transient. At least two crews will be run through all the selected scenarios. The simulator walk-throughs will not be video-taped or sound recorded. This decision is based on the experience of other utilities that have used videotape for simulator walk-throughs and have found that the tapes serve mostly an archival purpose, and do not impart adequate detail for fine-grained analysis.

4.3.4 Data Recording and Analysis

Various data will be recorded by the members of the observation team (see 4.3.5) during the simulator walk-throughs. During the real time run, the movements of each crew member will be traced on a control room outline drawing by an observer. This information will be analyzed to determine the main paths between panels and panel sections and also to identify any significant need to access back

panel indications or controls. In addition to crew movements, observers will trace the path of the crew through the appropriate EOPs and plant systems. Notations will be made of significant communication links used during each tran ient and any instances of crew member conflict (either physical access problems or communication problems) will be noted.

During the slow time run of each transient, if performed, the observation team will question the operating crew concerning the instrumentation they are using at any point in time and their strategy for dealing with the particular transient. This information will be cross-checked with similar information from the first phase walk-throughs and any obvious discrepancies noted.

The review team will use the output from the simulator walk-throughs to determine if HEDs were manifested due to the layout of the control room and the dynamic interaction of the operating crew during emergency operation.

4.3.5 Personnel Assignments

The task identification described in Subsection 4.3.1 is characterized by extensive evaluation of the ERGs before any walk-through validation is done. Prior to the validation, the CRDR team, with the assistance of a Human Factors

Specialist, will review and evaluate the operator tasks for the set of transients identified in Subsection 4.3.3.2. The primary objective of this review and evaluation will be to develop the methods and procedures which will be used in validating the operator tasks and the corresponding man-machine interfaces. This is just the type of multidisciplinary activity that the review team is designed to handle.

After this review and pre-evaluation is complete, the simulator walk-throughs will require the intermittent participation of certain review team members. The CRDR team leader will be responsible for scheduling crews to run through the selected EOPs and for scheduling both crew and simulator time for transient runs on the BV-1 simulator.

A group of trained observers will be required for the walk-through activities, although the number of people in this group will change, depending on the phase of validation. For the dynamic simulator validation, each crew member will be tracked by a separate observer whereas the first phase walk-throughs will not be as time-critical. A Human Factors Specialist will be required to determine the human factors suitability of instruments and controls used by the operators during the walk-throughs.

5. ASSESSMENT OF HEDs

5.1 OBJECTIVES

The objectives of this phase of the CRDR are as follows:

- Evaluate the significance of the HEDs defined in the previous phases of the CRDR.
- Where HEDs are found to be of minor significance, describe the technical and operational basis for such a finding.
- Where HEDs are found to be of potentially major significance, formulate changes to the control room, procedures, operator training, or any combination thereof to mitigate those HEDs.

Of these objectives, the most conceptually difficult is to evaluate HED significance. A fairly straightforward method for HED evaluation is described in the next section.

5.2 EVALUATION CRITERIA

Human engineering discrepancies found during the control room survey, the operating experience review, and the task analysis will be evaluated according to their potential to affect emergency operation adversely. A categorization scheme will be used that requires each HED to be assessed by the review team and prioritized for resolution. The following four categories are designed to be unique so a consensus can be obtained from the review team as to which category each HED should be assigned.

Category 1 (Highest Priority) - HEDs that are judged likely to adversely affect the management of emergency conditions by control room operators. Most of the HEDs placed in this category will probably be found during the task analysis and may be supported by the results of the survey and operating experience review.

Category 2 - HEDs that are known to have caused problems during normal operation. The HEDs placed in this category will emerge from responses to the operator questionnaires and reviews of IRs. Some support may come from the control room survey.

Category 3 - HEDs that can be "fixed" with simple and inexpensive enhancements, so-called "paint, tape, and label" (PTL) fixes. This may seem to be an implementation rather than an assessment category. However, there will probably be HEDs that the review team finds are easy to fix, but difficult to assess as to effect on emergency operation. This category is for such HEDs.

Category 4 (Lowest Priority) - HEDs that do not fit into Categories 1 through 3. These HEDs are evaluated and judged by the review team as not likely to affect emergency operation, not documented as causing problems during normal operation, and involving significant redesign and cost to fix.

The precise method to be used to put HEDs into these categories has not been delineated. It is envisioned that comparing HEDs to

higher level principles, such as those listed in the CRDR NUTAC document "Human Factors Principles for CRDR," will help determine which HEDs are likely to result in actual performance problems. Those HEDs that are likely to affect performance will be further categorized as described above. A HFS will assist the review team, as required, to further develop and refine the methodology and to apply the principles for HED categorization.

Any review team member who feels strongly that an HED has been assessed with a too low priority will be able to put that opinion in writing and have the written statement included in the permanent record of the CRDR.

5.3 RESOLUTION OF HEDS

One of the final responsibilities of the review team will be to propose solutions to the HEDs that have been identified and categorized. There are, in general, many ways to solve specific human engineering problems. In some cases, a simple change in training or procedures may suffice, although this solution is sometimes over-used and inadequate to address the root causes of a particular problem. Some HEDs, such as Category 3, may be corrected by simple surface enhancement techniques. Correction of other HEDs may require more extensive measures.

If it is determined that the correction must involve movement, modification, addition, or deletion of instrumentation, then these corrections will be evaluated with respect to their impact on the existing control room, including operator performance, training, and procedures. Before any large-scale changes are approved proposed modifications will be evaluated to determine their effectiveness. Before any changes are made, even small-scale changes, a review by operations personnel will be obtained.

Several criteria will be used by the review team when evaluating candidate proposals for HED correction. The following characteristics of each proposal will be considered:

- impact on operating effectiveness
- system safety
- magnitude of cost and redesign
- impact on plant availability
- consistency with existing features
- compliance with regulatory design requirements
- impact on control room staffing
- impact on operator training programs
- consistency with implementation and integration of other emergency response activities
- creation of new HEDs

6. DOCUMENTATION PHASE

The importance of data management before, during, and after the CRDR cannot be overemphasized. Adequate documentation and document control creates a traceable and systematic translation of information from one phase of the CRDR to the next. It is mandatory that the CRDR team have immediate access to a complete, up-to-date library of documents to:

- provide a support base to manage and execute the various steps and phases of the control room reviews
- provide a design data base from which future control room modifications may draw

Therefore, a data base library will be established to ensure the success of the CRDR process.

This section describes the documentation system and documentation management procedures that DLC will use to support its control room design review.

6.1 GENERAL DOCUMENTATION REQUIREMENTS

Many documents will be referenced and produced during the CRDR project.

The documentation system will meet the following requirements:

- provide a record of all documents used by the Review Team as references during various phases of the CRDR

- provide a record of all correspondence generated or received by the review team during the review
- provide a record of all documents produced by the review team as project output
- allow an audit path to be generated through the project documentation
- retain project files in a manner that allows future access to help determine the effects of control room changes proposed in the future

6.2 REFERENCES

The following documents have been identified as possible reference material to be used during the review project. As the review progresses, it is anticipated that additional material and references will be identified.

- BV-1 Final Safety Analysis Report
- Westinghouse Emergency Response Guidelines (ERGs)
- Regulatory Guides
- NRC guidance documents (e.g., NUREG-0700)
- control room drawings (floor plan, panel layout, etc.)
- control room photographs (panel photographs, etc.)
- Operating Manuals
- piping and instrumentation diagrams (P&IDs)
- results of preliminary control room review activities

- instrument and control tabulations
- annunciator and label engraving lists
- CRDR NUTAC documents

6.3 REVIEW DOCUMENTATION

Throughout the review process, documents will be processed to record data, analyses, and findings. Whenever practical and appropriate, standard forms will be developed and used. The bulk of the documentation generated by the review process will be necessary to do the following:

- document the criteria used for each review activity
- record the results of the survey, operating experience review, and task analysis
- compile HEDs and associated data for review and assessment
- document disposition of HEDs

In order to facilitate systematizing and recording control room design review, DLC will develop a series of standard forms. The instrumentation and control data sheets have already been developed and appear in Appendix C. Listed below is a minimum set of forms which will be used for the review.

- Human Engineering Discrepancy Record
- Questionnaire Item Summary
- Personnel Demographic Summary
- Instrumentation and Control Data Sheets
- Operational Experience Review Problem Analysis Report

Any or all of these forms may be revised based on the experience gained during the CRDR.

6.4 SUMMARY REPORT

Upon completion of the CRDR, a detailed summary of the results will be prepared and submitted to the NRC for review. The summary report will describe the results of the CRDR and will be submitted within six months after completion of the review. This report will summarize the review process, provide descriptions of the identified human engineering discrepancies (HEDs), proposed corrective actions and proposed implementation schedules. Details of the CRDR, along with complete documentation, will be available for NRC evaluation and review.

The summary report will specify the personnel who participated in the CRDR and delineate their qualifications. It will also indicate any modifications or revisions made to the implementation plan submitted to the NRC. These may become necessary periodically throughout the CRDR and will be described by the review team in the report.

A summary of the Operating Experience Review processes and results will be contained in the report. The types of historical reports reviewed and the period of time they covered will be provided. The experience levels of the surveyed operators as

well as the procedures used to conduct the survey will be summarized.

Data management procedures used to record review data and provide a data base for the system review will be described.

Samples of forms used in the control room survey will be provided. Procedures used for verification of task performance capabilities and validation of control room functions will be summarized.

Findings of the CRDR will be organized according to chapter headings that correspond to major topics in this plan. Each chapter heading will describe identified discrepancies and potential safety consequences and will identify the proposed corrective action. Details of the assessment procedure used in this process will be summarized and supporting documentation provided. Changes that do not provide a full and complete correction of an identified HED, or decisions to allow a discrepancy to remain, will be justified, and information pertinent to such decisions will be provided.

The summary report will address findings at the individual control room system level based on the control room survey or task analyses. Further discussion will be directed to review findings and solutions identified during the operating experience

review, task performance capability verification, and operating crew function validation.

Implemented or proposed design solutions and implementation schedules will be described. Such scheduling will be governed by priorities, and any departure from this priorization will be explained. This tentative implementation schedule will include a plan to ensure adequate review of planned improvement. Any deviation from the proposed CRDR methodology described herein will be discussed and appropriate explanation provided.

7. CORRECTION PHASE

The actions required to resolve significant HEDs will vary, as will the time required to complete proposed changes. It is essential, however, to set some end point for completing the proposed change for each HED category.

7.1 SCHEDULING

The following schedule will become goals for DLC when planning the activities appropriate to resolve significant HEDs.

Category	Completion
1	As soon as practical after a specific solution has been approved by DLC management. No later than 18 months after issuance of all design outputs.
2	No specific completion date. Corrective action will be based on economic judgement.
3	As soon as practical. No later than first refueling outage after the review is completed.
4	No specific completion date.

It should be recognized that these completion dates are goals and that some changes may still be pending after these dates. DLC will make all reasonable efforts to meet these goals.

7.2 IMPLEMENTATION

Modifications required to resolve significant HEDs will be implemented through the existing BV-1 design change process. This process is described by the NEMPs and by the BV-1 Quality Assurance Program.

Since the modification process for selected HEDs may take a considerable amount of time for implementation, the implementation and follow-up activities will rely upon normal departmental organizations. Therefore, it is imperative that the HED(s) and the resulting modification request(s) are very explicit as to what is to be done.

The use of existing modification procedures ensures that plant operators will be made aware of impending changes and trained to use the modified control panels and systems.

This approach to the implementation of changes will help ensure the success of the modifications and will give the departmental organization a tool for developing their techniques for long-term support of the control room.

8. EFFECTIVENESS PHASE

During the correction phase of the CRDR, proposed modifications and enhancements were evaluated for their effectiveness in solving the deficiencies that prompted them. However, no feasible evaluation method can account beforehand for all the circumstances encountered during actual operation. Recognizing the need for operational feedback on the usability of control room changes resulting from the CRDR, DLC will further delineate an operational feedback path.

8.1 VALIDATION OF CHANGES

The validation of control room changes initiated by the CRDR team will be accomplished using the following method. After changes are installed and have been operational for approximately 60 days, the review team from the CRDR will inspect the control room to ensure that, as installed, the changes accurately reflect their original recommendations regarding particular HEDs. If the review team consensus is that any or all of the installed changes do not meet the intent of their recommendations or for some other reason do not mitigate the HEDs for which they were designed, the review team leader will report those findings. This report will be sent to the DLC Manager of Nuclear Safety and Licensing.

Each installed change will be placed in one or more of four categories by the review team. These categories are as follows:

- The change reflects the intent of the recommendation and appears to mitigate the associated HED(s).
- The change reflects the intent of the recommendation, but the problem associated with the HED(s) appears to still be present.
- The change does not reflect the intent of the recommendation.
- The change has created an HED other than the HED that prompted the change.

Any HED still present after the changes or created by the changes will be treated as a problem reported during operation and it will be evaluated by the plant engineering staff.

8.2 FUTURE CONTROL ROOM CHANGES

In order to ensure adequate human factors considerations for control room changes that are considered after the CRDR is completed, procedures will be established to integrate all such changes. To evaluate the human factors acceptability of all proposed control room modifications, the integration procedure will have criteria and controls similar to those used during the CRDR. Any proposed control room change will have to be evaluated against the criteria before such change can be implemented.

9. COORDINATION WITH OTHER ACTIVITIES

The CRDR process described in this program plan will be coordinated with other post-TMI activities in several ways. These activities include the following:

- upgrading emergency operating procedures
- development and installation of an SPDS
- evaluation of post-accident monitoring instrumentation (RG 1.97)

The task analysis portion of the CRDR will use the new Westinghouse ERGs as its starting point. Thus, the task of upgrading emergency procedures is inherently integrated into the CRDR.

The integration of the SPDS into the CRDR is a bit more problematic, since DLC has already purchased the SPDS and cathode ray tube (CRT) display. It is the intent of DLC to use the task analysis phase of

the CRDR to define the operator information requirements during conditions of emergency operation. These requirements will be a check of the plant inputs to the SPDS and the display format for the CRTs.

It is anticipated that some HEDs defined during the review and judged to be significant by the review team may be resolved by incorporating certain features into the SPDS and associated displays. This will serve to further integrate the SPDS into the CRDR.

The integration of these activities are described in more detail in the response to the NRC Generic Letter 82-33, "Supplement 1 to NUREG-0737."

10. ACCEPTANCE CRITERIA

This program plan was developed to describe the process whereby DLC will conduct the BV-1 CRDR. A sincere effort has been made by DLC to ensure that all major aspects of an effective CRDR have been considered during the development of this program plan. Since DLC is committed to perform its CRDR as described in this document, the acceptability of the CRDR should be judged against this document, supporting procedures and the Summary Report. DLC cannot guarantee that the BV-1 CRDR will meet the letter of the numerous criteria and documents generated in this regard. DLC does believe, however, that the intent of the NRC guidance, "to provide an acceptable CRDR," will be satisfied by this program plan.

APPENDIX A

RESUMES OF REVIEW TEAM MEMBERS

BEAVER VALLEY UNIT -1 CRDR

Position: Senior Compliance Engineer

Individual: Edward D. Coholich

Education and Training:

Bachelor of Arts, Mathematics and Chemistry, Duquesne University, 1959
Bachelor of Science - Chemical Engineering, Carnegie-Mellon University, 1968
Graduate School, Mathematics, Duquesne University, 1961-63

Experience:

From 1962 to 1979 he was employed by various divisions of the Westinghouse Electric Corporation. He held the positions of Associate Scientist, Engineer, Senior Licensing Engineer, and PWR Training Engineer. While with Westinghouse his responsibilities included the performance of various analyses, design and testing activities related to stress analysis of space nuclear propulsion equipment, member of a design and testing task force for Navy nuclear equipment, licensing coordinator of several projects requiring interfacing with NRC, Utilities, A/E's, and Westinghouse Projects and Safety Departments conduct, and administer PWR Training programs for power plant engineers and operators and administration of Foreign Trainees Program.

Since being employed by Duquesne Light Company in November, 1982, he has been responsible for developing the BV-1 CRDR methodology, planning and coordination of activities, and has actively participated as a member of the INPO CRDR NUTAC. He has attended the Basic Supervisory Training Program of Duquesne Light Company.

Position: Senior Instrumentation and Control Calibration Engineer, Nuclear Division, Operations Department

Individual: Francis S. Pajak

Education and Training: Bachelor of Science, Electrical Engineering, University of Pittsburgh, 1973

Experience: Since July of 1973, he has been employed by Duquesne Light Company at the Beaver Valley Power Station.

From July of 1973 to November of 1978 he held the position of Test Engineer. His responsibilities included: preparation of procedures for testing of systems and components during startup, and conducting and evaluating tests.

From November of 1978 to November of 1979, he held the position of Procedures Engineer. His responsibilities included writing and revising corrective maintenance, preventive maintenance and calibration procedures for nuclear power station components and systems.

From November of 1979 to September of 1980, he held the position of Instrument Engineer. His responsibilities included: following and supervising the maintenance and calibration of instruments and instrumentation systems; initiating and implementing design changes on various instrumentation and control systems, and documenting and controlling maintenance and surveillance testing of nuclear safety related instrumentation.

From September of 1980 to January of 1982 he held the position of Control Room Shift Technical Advisor. His responsibilities included: providing technical advice to operations personnel with regard to plant systems, particularly during accident conditions, and for evaluating surveillance testing and the performance of operations personnel.

From January of 1982 to the present he has held the position of Senior Instrumentation and Control Calibration Engineer. His responsibilities have included: writing, scheduling, implementing and evaluating the Instrumentation and Control Surveillance, Calibration and Preventive Maintenance Programs, and the supervision of Instrumentation and Control craft personnel.

Position: Nuclear Shift Supervisor, Nuclear Division, Operations Department

Individual: Albert W. Hartner

Education and Training: Bachelor of Science, Chemistry Major, Mathematics Minor, University of Pittsburgh, 1973
Nuclear Regulatory Commission Licensed, Docket No. 55-5613
Senior Reactor Operator, License No. SOP-3323, August 29, 1978.
Reactor Operator, License No. OP-4082, July 30, 1976.

Experience: Since January of 1974, he has been employed by Duquesne Light Company at the Beaver Valley Power Station.

From January of 1974 to July of 1976, he held the position of Nuclear Operator. His responsibility was in the area of preparation for Nuclear Regulatory Commission licensing and auxiliary plant operations.

From July of 1976 to March of 1979, he held the position of Nuclear Control Operator. His responsibilities included: operating all plant equipment during routine operations and normal surveillance and maintenance testing conditions, providing radiation monitoring for non-licensed operations personnel, responsibility for the safety of the reactor plant and assure proper reactor shutdown when necessary, proper execution of equipment clearances, and participation in hot functional testing.

From March of 1979 to April of 1982 he held the position of Nuclear Shift Operations Foreman. His responsibilities included: detailed personal direction of the activities of all licensed and non-licensed shift personnel during all phases of station startup, routine operations, station shutdown and emergency operating conditions, conduct training and safety programs for all shift personnel, review and assure proper preparation of all station operating logs, records and reports, coordination and direction of the emergency squad during emergency situations such as fire fighting and first aid for injured personnel, scheduling of operating crews, and assure safeguards and safe operating conditions are maintained, and that safety devices are maintained in proper operating condition. During this period, from December of 1979 to July of 1980, he also held the position of Nuclear Shift Supervisor (Temporary) which included the responsibilities below.

From April of 1982 to the present he has held the position of Nuclear Shift Supervisor and was Senior Supervisor on each operating shift. His responsibilities have included: all operational aspects of the Beaver Valley Power Station and radiological safety of shift station personnel, supervision of any special arrangements necessary for maintenance and/or testing and direct the activities of maintenance and construction personnel, prepare and supervise implementation of operating procedures, being an

alternate member of the Onsite Safety Committee, and the implementation of the Beaver Valley Emergency Plan during emergency situations and to act as the Emergency Director until relieved by higher supervision.

Position: Supervising Engineer, Nuclear Division, Nuclear Engineering Department

Individual: Stephen Alan Nass

Education and Training:

Master of Science, Nuclear Engineering
Purdue University, 1979
Bachelor of Science, Engineering,
Purdue University, 1975
Graduate Courses, Thermodynamics and Heat Transfer,
University of Tennessee, 1979-80

Experience:

As a CO-OP employee of Sargent and Lundy from 1971 to 1974, he was assigned to assist in the development of general shielding design criteria, study of radioactivity concentration in condensate storage tank, assist in preparation of PSAR, pressure drop calculations, and design of piping supports.

From 1977 to 1982 he was employed by the Tennessee Valley Authority and held the positions of Nuclear Engineer SD-2, SD-3, and SD-4. His responsibilities included: the calculation of radiation releases under normal and accident conditions, sources, and radiation doses, analysis of accident radiation environment for shielding design review and equipment qualification requirements, calculation of offsite doses and control room operator doses during accident conditions, analysis of fission product transport in the containment and leakage to the environment for probabilistic risk assessments, implementation of computer codes and computer data files, supervise engineers performing PRA studies and accident analysis.

Since coming to Duquesne Light Company in November, 1982, he has been supervising engineers performing design changes and 10 CFR 50.59 safety evaluations.

Position: Senior Project Engineer, Nuclear Division, Nuclear Engineering Department

Individual: Vincent Palmiero

Education and Training: Bachelor of Science, Electrical Engineering, Penn State, 1968
Registered Professional Engineer

Experience: Since coming to Duquesne Light Company in 1968, he has held the positions of Engineer in the Substation and Shops Department, Assistant Engineer in the Vice President Operations Office Staff and Senior Engineer in the Betterment Group of the Power Stations Department. His responsibilities included: specifying relay test procedures and supervisory control recommendations, supervise relay tests and service cut-ins, chairmanship and coordinator of System Rating Committee, coordination of outage and system reliability reports, and the electrical engineering related aspects of numerous equipment replacements and additions to existing power plants in the Duquesne Light Company system, including the meteorological system computer for BV.

He was a member of the BV-1 simulator bid evaluation team and since November, 1981 has been the primary responsible engineer for the BV-1 Simulator and Simulator Training Building and the coordinator for the BV-1 control room control board revisions. He is an alternate member of the Offsite Review Committee.

Position: Senior Project Engineer, Engineering and Construction Division, Mechanical Engineering Department, Nuclear Section

Individual: Ronald T. Zabowski

Education and Training: Bachelor of Science, Electrical Engineering, Gannon University, 1972
Registered Professional Engineer

Experience: Since coming to Duquesne Light Company in 1973 he has held the positions of Test Engineer, Procedures Engineer, and Technical Supervisor-Nuclear. His responsibilities included: preparation of BV-1 pre-operational and start-up test procedures involving process, instrumentation calibrations and alignments, reactor protection system checkouts, control systems alignments and response performance tests, etc., lead test engineer, preparation of BV-1 Startup Report, writing and revising operating procedures, Technical Supervisor of the Station Test Section, member of the On-Site Safety Committee, and Technical Support Center Coordinator. As of July, 1982 he has been responsible for BV-2 equipment and system design reviews, review and preparation of various BV-2 FSAR sections, and BV-1 design changes relating to the BVPS meteorological program update, radiation monitoring systems and seismic instrumentation.

Position: Project Engineer, Engineering and Construction Division, Mechanical Engineering Department, Nuclear Section

Individual: Lynn L. Waugaman

Education and Training: Bachelor of Science, Nuclear Engineering, Pennsylvania State University, 1977
Qualified Engineering Officer of the Watch, DIG Plant, KAPL Nuclear Power School, April, 1978
Qualified Nuclear Plant Engineer, DIG Plant, July, 1978
Qualified as Shift Supervisor, DIG Plant, May, 1979

Experience: From 1977 to 1982 he was employed by the General Electric Company at the Knolls Atomic Power Laboratory. He held the positions of Engineer, Nuclear Plant Engineer-Training, Nuclear Plant Engineer-Operations, Shift Test Engineer for S/G Chemical Cleaning, DIG Shift Supervisor, and Engineer, DIG Plant Materials. His responsibilities included: special assignment for S/G chemical cleaning and shipment of corrosive chemical waste, assistant for the overall operation of the power plant including during casualty and abnormal plant conditions, responsible for section production training and performance of personnel drills for radiological controls, responsible for all power plant operations in support of maintenance, testing, and training, supervisor of a Navy crew of nuclear operators, responsible for all section training of Naval officers and enlisted production students and G.E. engineers, acting Emergency Director for the Kesseling Site during backshifts and holidays, responsible for preparation organization, and control of all work documents for plant shutdown maintenance periods, and member of the Kesseling Site Emergency Control Team.

Since August of 1982, he has been Project Engineer with Duquesne Light Company. He is responsible for the preparation of design changes to BV-1, including organization of design concept, scheduling and control of detailed engineering, procurement, and documentation. He is required to perform safety evaluations of design changes in accordance with 10 CFR 50.59. In his area of expertise, he is also responsible for the review of BV-2 documents (ie. FSAR, start-up test procedures, specifications, etc.).

APPENDIX B

CONTROL ROOM QUESTIONNAIRE EXPERIENCE

QUESTIONNAIRE

BEAVER VALLEY UNIT-1 CRDR

NOTE: The following questions are listed in a format designed to minimize space requirements. The actual questionnaires contain only one question per page, single-sided.

Workspace and Environment

OQ-1 What equipment or equipment arrangement has hindered your movement about the control room in the course of normal or emergency operations?

OQ-2 What peripheral console/cabinet arrangements are ineffective and/or obstruct your movement about the control room?

OQ-3 Does your specific work location station provide adequate access to storage or desk facilities?

OQ-4 Are you required to leave the primary control boards for instruments/displays in other areas? (How often, how long?)

OQ-5 What do you dislike about the arrangement of restrooms, kitchen, place to eat and break area?

OQ-6 Is the furniture arrangement adequate and/or convenient for your use?

OQ-7 How adequate is the control room lighting and illumination control?

OQ-8 Do you have problems with glare and/or reflections in the control room?

OQ-9 Were there incidents where lighting has been ineffective and/or interfered with job performance?

OQ-10 What specific times is the noise level in the control room at an unreasonable level and the cause of annoying distractions?

OQ-11 What particular sources (equipment and/or people) of noise cause annoyance and/or distraction in the control room?

OQ-12 What problems do you have with the heating/air conditioning system, humidity, and ventilation system in the control room?

OQ-13 Has static electricity caused you any particular problems in the control room?

OQ-14 Do you have any problems controling the number of people in the control room during normal or emergency operations?

OQ-15 Do you feel there is a need for additional policies or actions to limit traffic and distractions in the control room? Identify what they could be.

OQ-16 Are there any operations in the control room where the actions of another operator interfere with your tasks?

OQ-17 What problems do you have in reaching any of the controls on the control board?

OQ-18 What important controls or displays are not easily visible to you?

OQ-19 Is the overall layout and shape of the control board/console adequate for effective monitoring and operations?

OQ-20 Is it significantly difficult to move back and forth between the vertical boards and the bench board?

OQ-21 Which major systems are not organized properly around the control boards for both normal and emergency operation?

OQ-22 Have there been incidents where you had to be in two places at once because of board layout to control and monitor a specific plant evolution?

OQ-23 Did you or would you have any problems in the operation of the emergency shutdown panel? Consider location, design and controls at the shutdown panel.

OQ-24 Describe features about the control board layout which have assisted you in job performance, ie. color codes etc.

OQ-25 Describe other features about the control room environment which have interfered with job performance.

Panel Design

OQ-26 What do you consider to be the three easiest systems to operate? Include system/panel location, why you feel they are easiest to use and any inadvertent activation of these systems.

OQ-27 What do you consider to be the three most confusing or difficult systems to operate and why? Give examples of incidents in which there was difficulty in operating the systems.

OQ-28 What systems do you operate that give you problems with a particular panel arrangement? Describe what you think is wrong with the arrangement.

OQ-28a Are there any problems in the operation, location or design of the emergency shutdown panel?

OQ-29 Which controls and indications are difficult for you to recognize as a related group?

OQ-29a It has been proposed to establish a "green is normal" convention for all control lights associated with pumps, valves and breakers. The normal arrangement would be based on 100% power operation. The intent is to provide prompt operator recognition of a change in component status. This means, however, that you will not be able to tell a component's status until you view these status lights associated with the switch, for example, if the left side is green and lit then the valve switch is closed or the pump is on. Do you consider this proposal an advantage or disadvantage to operations? Consider any problems with particular switches, status of switches, difficulty in the thought process of green being normal, red is not, etc.

OQ-30 Which types of modifications (mimics, color codes, etc.) to the boards would you consider the most useful to you?

OQ-31 Which types of modifications to the boards have created a hinderance for you?

OQ-32 Describe panel design characteristics and/or panel locations not discussed above which create particular problems for you as an operator.

OQ-33 What controls and displays of particular systems are too far away from each other for proper operation?

OQ-34 Are there any controls that are difficult to adjust as precisely as they need to be adjusted?

OQ-35 Are there any switches that are operated differently but physically are identical to other switches?

OQ-36 Are there switches that are difficult to turn?

OQ-37 Which controls do you find too large or too small to operate easily?

OQ-38 Are there meters that are scaled in different units than the procedures you have to use with them? For example, do you have to use nomographs or conversion factors other than powers of 10?

OQ-38a Are there instrument indicators that are pegged low or high during normal operation making it impossible to monitor the steady state performance of a process.

OQ-39 Are there controls and displays that work together in unusual ways? (ie. containment temperature affecting seal leak off indication)

OQ-40 Are there instruments that are diffucult to compare with backups because of differences in scale units, elevated zeros, etc.?

OQ-41 Are there instruments that are hard to use because they have to be read more precisely than the scale allows?

OQ-42 Do you have any difficulties with lamp replacement such as shock, accidental activation, or need to replace from behind panel?

OQ-43 Are there important instruments on back panels that do not have either an alarm you can hear in the control room or their own annunciator?

OQ-44 Are there labels (on controls or displays) that are unclear about what is actually being controlled or displayed, what the control does, what position a control is in, or which could cause a mistaken identity with another control?

OQ-45 Are there key switches where the key can be removed when the switch is not in its "Off" or"Safe" position?

OQ-46 Has there been any interference to instrumentation by radio or walkie-talkie signals?

OQ-47 Are there any control devices which you find confusing or difficult to operate?

OQ-48 When operating controls, do you use any of the existing coding and how important is it to you as an operating aid, ie. color, sound, shape, location, etc.? What coding schemes are most useful to you? What types of color coding would you like to see on controls or indicators? (ie. power supply coding on instruments)

OQ-49 Are there any occurrences where the wrong control has been activated or where a control was activated inadvertently or incorrectly? Do you know what caused this to happen and how and when the error was discovered?

OQ-50 What was the consequences of the occurrences asked about in the previous question?

OQ-51 Have there been recurring instances where the wrong control has been activated, or a control was activated inadvertently or incorrectly? What would you recommend to prevent recurrence of any of these problems?

OQ-52 Are there controls where it is not always apparent as to what position they are turned to (ie. pointer indicators are not obvious because of poor contrast due to design, location level or glare)?

OQ-53 Are there emergency or other critical controls which are neither coded or guarded (e.g. turbine trip push buttons, rod control startup push button)?

OQ-54 Are there controllers with inconsistent relationship between control effects and indicator (e.g. open is indicated by 0% and close by 100%)?

OQ-55 Are there multiple-position controls or speed changer controls which do not follow conventional use for right-center-left positions or clockwise movement? (ie. diesel generator ground switch deviates from normal convention)

OQ-56 Are there positive means to determine indicator light failure?

OQ-57 Are display scales adequately marked for normal operating ranges or setpoints?

OQ-58 Is it always apparent to the operator when a vital indicator fails or becomes inoperative?

OQ-58a Are there recorders that cannot be viewed from several locations on the board where equipment is routinely controlled that heavily influence changes to the recorded parameters (ie. pressurizer level, pressure and T Recorders, etc.)?

OQ-58b Do you have significant operational problems with chart recorders?

OQ-58c Are there times when chart recorders are not operational? What problems does this cause for you?

OQ-58d What additional comments do you have on controls and displays?

Annunciator Warning System

OQ-59 Are nuisance alarms a significant problem? Please describe.

OQ-60 Do you get particular recurring invalid alarms? Please describe.

OQ-61 What alarms are insignificant from an operational point of view?

OQ-62 What significant problems has the existing annunciator system design caused you?

OQ-63 Are there any problems with identifying new alarms when they come in?

OQ-64 Are there features of the annunciator warning system that have resulted in inefficient or erroneous fault identification?

OQ-65 Does the annunciator system provide an adequate amount of information to you during a major transient?

OQ-66 Are visual and auditory alarms satisfactory?

OQ-67 Are auditory signals annoying? Can you easily differentiate between different auditory signals?

OQ-68 Are any important annunciators missing or located where they should not be?

OQ-69 Do you have problems reading or identifying annunciators while you are conducting normal or emergency operations?

OQ-69a What additional comments do you have on annunciators?

Procedures

OQ-70 Do you have any problems finding or retrieving procedures that you need during emergency situations?

OQ-71 Are there adequate props for using procedures while you operate? What would be useful to you in this respect?

OQ-72 Are procedures maintained in good physical condition (e.g. are pages properly and securely inserted, are updates and changes handled properly, etc.)?

OQ-73 Do you feel there are too many procedures that operators are required to memorize? How does it effect operator performance during emergency operations?

OQ-74 Are operator comments or requested changes to written procedures satisfactorily considered and processed?

OQ-75 What plant procedures (ie. startup, shutdown) have insufficient detail or are not clearly written to the point that errors could be introduced?

OQ-76 Are there incidents whereby following procedures resulted in ineffective or erroneous performance by the operator? What was the origin of the deficiency in the procedures and how was the deficiency corrected?

OQ-77 What specific problems have you found with following routine procedures and how could they be corrected most effectively?

OQ-77a What additional comments do you have on procedures?

Communications

OQ-78 Are there nuisance problems with unauthorized communications to the control room?

OQ-79 What problems do you have with the page phones, loudspeakers, and radios? Consider equipment condition, availability of the system to the operator and outside interference (noise level, people, etc.).

OQ-80 Are the page phones and loudspeakers serviceable to you for effective communication with auxiliary operators, maintenance personnel, etc.?

OQ-81 Are there instances where control room phones have presented or interfaced with your ability to communicate with other personnel? Consider for example, delays, interference, availability of a phone, etc.?

OQ-82 Are there situations where the lack of proper communications caused operational problems?

OQ-83 What characteristics of the control room communications systems do you find most ineffective in providing you timely, intelligible contact with other personnel?

Process Center

OQ-84 Does the process computer provide inaccurate data at any time? Consider operating conditions, important system parameters, etc.

OQ-85 Is the process computer data timely? Are there emergency situations in which you would be reluctant or hesitate to use the computer for information because of its response time?

OQ-86 Is there data on the computer which you do not find useful?

OQ-87 What computer program do you feel could be better utilized or eliminated?

OQ-88 Is there data ont he computer which you find difficult to use? Consider format of printout, type of parameter trending, etc.

OQ-89 What percentage of computer printout is useful to the operator during operation? Consider normal, abnormal and emergency operations.

OQ-90 Are there other specific computer difficulties on which you would like to comment? Consider especially emergency operations but do not limit yourself to emergency operations only.

Staffing

OQ-91 Are there incidents in which the number of personnel on duty impeded your prompt response to an operational situation?

OQ-92 Are there incidents where workload requirements restricted your response to any operational situation?

OQ-92a Is the control room adequately staffed during normal, abnormal and emergency periods and during all shifts?

OQ-93 Are job responsibilities clearly defined such that a response to a transient or an emergency situation proceeds smoothly?

OQ-94 List the three most desirable characteristics of the staffing program and job assignments which provide for smooth, continuous, system operation.

OQ-95 Do your procedures provide adequate coverage for turning over a shift to incoming personnel? Consider the amount of time allowed for shift turnover, information exchange, etc.

OQ-96 Are there incidents where you were given incorrect and/or insufficient information during shift turnover?

OQ-97 Are there incidents where your efficiency was significantly degraded because of shift work or overtime?

OQ-97a Is the control room sufficiently staffed to allow for vacations and other justified reliefs?

OQ-98 To what degree does shift work impact on your homelife, social life and/or work attitudes?

OQ-99 In what ways can your job be made more interesting and your time more productively spent? Consider ways that would increase operator alertness, combat monotony, make backshifts more admissible, etc.

OQ-100 Are your duties explained to you such that you clearly understand what they are?

OQ-101 Are there incidents where it was unclear or confusing as to who was in charge and/or who should be reporting what to whom? What was the cause and was the problem corrected or did it recur.

OQ-102 Are there enough avenues open to you for resolving a personal or job related problems? Are they effective?

OQ-103 Are there other problems with staffing and/or job design on which you would like to comment?

Corrective and Preventive Maintenance

OQ-104 Are there incidents where an operator surveillance test caused an operational problem? Consider the cause, operational status, effect on operation and/or the operator, corrective action, etc.

OQ-105 Are there incidents where maintenance actions affected the safe operation of the plant? Consider the cause, operational status, effect on operation and/or the operator, corrective action, etc.

OQ-106 Are there control room preventive maintenance procedures and/or characteristics which are ineffective?

OQ-107 What is the most effective characteristic of the maintenance program?

OQ-108 What maintenance or surveillance test procedures would you like to see changed because of their negative impact on operations?

OQ-109 Are there other things in the maintenance and/or surveillance test programs on which you would like to comment?

Training

OQ-110 Are there plant control, protection, electrical, or mechanical systems on which you would like more intensive training and in what respect (simulator, class, discussion, lecture)?

OQ-111 Has your training provided you with the confidence that you could perform successfully during an emergency situation? Are there situations about which you feel inadequately prepared?

OQ-112 Are you adequately trained in the operation of the emergency shutdown panel?

OQ-113 What characteristics of your classroom training have been most effective in preparing you for control room operation?

OQ-114 Have you received training on effective communications techniques?

OQ-115 Is the use of protective gear and equipment included in your training program?

OQ-116 Are you adequately trained in using the process computer to full advantage?

OQ-117 What characteristics of your requalification training or practice sessions have been most effective in preparing you for control room operations?

OQ-118 What aspects of your training do you feel were especially ineffective or need improvement?

OQ-119 Are there other comments which you would like to make on the quality of your training?

OQ-120 What characteristics of simulator training have you found and/or do you think will be most effective in preparing you for control room operations?

Simulator Training

OQ-121 What aspects of simulator training do you feel should be eliminated or modified?

OQ-122 Are there specific operations on which more emphasis should be placed during simulator training?

OQ-123 What amount of time do you feel would be adequate for simulator training?

OQ-124 What situations, transients, etc. which have or could arise would you like to see run on the simulator?

OQ-125 Are there other aspects of simulator training and use on which you would like to comment?

Use the space below for additional comments on any of the topics covered herein or others that you may consider pertinent to this effort.

APPENDIX C

SAMPLE DATA SHEETS FOR

VERIFICATION OF EOP AND R.G. 1.97

INSTRUMENTATION AND CONTROLS

BEAVER VALLEY UNIT-1 CRDR

NO. ____________

CONTROL ROOM DESIGN REVIEW DATA SHEET

CONTROL SWITCH

(1) ______ System

______ Mark Number Instrument I.D.

(2) ______ Control Room Location

Description :		
Inscription on Control Switch :		
Switch Positions :	Redundant Yes ☐ No ☐	(3) Power Supply :
Elementary Wiring Diagram Reference :	Reg Guide 1.97 Yes ☐ No ☐	Shutdown Panel/ BIP Control : Yes ☐ No ☐
Observable Effects of Switch Misoperation at 100% Power : LOCA : ☐ Yes ☐ No Redundant Safety Systems Defeated : ☐ Yes ☐ No Mispositioning is not annunciated or no major process alarms to alert operator : ☐ Yes ☐ No		
Remote Position Indication (valves/dampers) : ☐ Yes ☐ No Alternate Means of Position Indication :		
Automatic Functions/Interlocks :		
Control Switch HED :		

Prepared by : ____________ Reviewed by : ____________

Reg. Guide 1.97 Design Criteria

NRC Required

Variable Description: ______________________________

Variable Type & Category	Indication Type	Seismic Qualif.	Single Failure Criteria	Environ-Mental Qualif.	Power Source

Presently Installed

Mark Number	Position Type	QA Cat.	Seismic Qualif.	Single Failure Criteria	Environmental Qualif.	Power Source	Indication CR	Indication TSC	Indication EOF	Comment

No. ________

CONTROL ROOM DESIGN REVIEW DATA SHEET

INDICATOR/RECORDER

(1) ______ System	______ Mark Number Instrument I.D.	(2) ______ Control Room Location

Description :	
Inscription on Device :	
Indicating Range/Units :	(3) Power Supply :
Normal Operating Range/Units at 100% Power :	Redundant : Yes ☐ No ☐
(4) Component Environmental : Qualification (79-01B) Sensor Location : inside ☐ outside ☐ Containment	Shutdown Panel/BIP : Yes ☐ Instrument No ☐
Wiring/Loop Diagram Reference :	
Indicator HED :	

Document Reference

(5)	(6)	(7)	(8)	(9)	(10)	(11)
☐	☐	☐	☐	☐	☐	☐
PVC	1.97	SPDS	OM 53	APP R	80-06	79-01B

EOPS Reference

(12)	(13)	(14)	(15)
☐	☐	☐	☐
EO	E1	E2	E3

REG GUIDE 1.97 DESIGN CRITERIA

NRC REQUIRED

Variable Type	Range	Seismic Qualif.	Single Failure Criteria	Environ-Mental Qualif.	Power Source	Display Type	Record

PRESENTLY INSTALLED

Range	QA Category	Seismic Qualif.	Single Failure Criteria	Environ-Mental Qualif.	Power Source	Display Type	CR Display	Location TSC	Location EOF	Record	Schedule	Redun-dancy

Justification for Non-Conformance :

Prepared by: ________________ Reviewed by: ________________