PUBLIC SERVICE COMPANY OF COLORADO
FORT ST. VRAIN NUCLEAR GENERATING STATION

CONTROL ROOM DESIGN REVIEW
PROGRAM PLAN

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1.0 INTRODUCTION AND PURPOSE

The Control Room Design Review (CRDR) is one element of several interrelated efforts designed to improve control rooms, emergency response capabilities and procedures. Regulatory requirements for conducting this review are based in NUREG-0737 and NRC generic letter 82-33.

Guidance for the CRDR and related activities is derived from NUREG-0700 and an industry sponsored CRDR Nuclear Utility Task Action Committee (NUTAC) document entitled "Control Room Design Review - Implementation Guideline". Methodology developed within this plan takes into account the unique characteristics of the Fort St. Vrain (FSV) High Temperature Gas-cooled Reactor (HTGR).

The Purpose of this program plan is to describe the manner in which Public Service Co. (PSC) intends to conduct a review of the Fort St. Vrain (FSV) Control Room. Additionally, the plan developed herein will provide the basis upon which to judge that an adequate CRDR has been conducted.

This Implementation Plan includes a proposed schedule, however it is recognized that any final schedule is contingent upon negotiations and agreement between PSC and the assigned NRC Project Manager.

2.0 OVERVIEW

2.1 FUNCTIONAL PURPOSE

The purpose of the PSC CRDR is to ensure that the FSV Control Room and any required auxiliary panels will support operation during emergency conditions. The operator tasks required during emergencies will be based on certain emergency procedures.

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 operator interviews
- 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 resolutions for significant discrepancies (as judged above)
- To ensure that the implemented resolutions do, in fact, eliminate or mitigate the discrepancies for which they are formulated
- To provide input to the FSV Training Department as necessary to ensure that operators can function adequately with any control room changes

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 4.1. Note that the CRDR has been split into five phases: Planning, Execution, Assessment, Correction, and Post Review Phases corresponding to the four CRDR phases described in NUREG-0700.

The planning aspect of the CRDR is represented by this implementation plan.

The post planning 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.

2.3.1 Execution Phase

The Execution Phase will constitute the investigative, data gathering portion of the CRDR. Certain select EP's and the plant systems called for in those EP's will be analyzed 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.

2.3.2 Assessment Phase

During the Assessment Phase, the required operator actions as determined by the Execution Phase will be evaluated as an integrated part of control room operations. Major inputs to this integrated assessment will include human factors considerations, operating history, personnel surveys, and current modifications. HED's will be identified as a result of this assessment, and will be classified according to their potential impact on plant emergency operation.

2.3.3 Correction Phase

Human Engineering Discrepancies (HEDs) that are identified as Significant or Problem discrepancies will be resolved by either modification, enhancements, training, or staffing.

A plant-specific plan will be developed to ensure the integration of proposed control room changes with other NUREG-0737 items, as well as plant operating status. A schedule will be developed for the orderly introduction of proposed changes. Existing change control procedures will be utilized to ensure the successful completion and integration of all Control Room changes.

Operating procedures affected by Control Room modifications or other CRDR activities

will be revised following the correction phase, by the responsible operating department.

If any HEDs are to be resolved by additional training, that input will be provided to the FSV Training Department to allow integration with other NUREG-0737 activities.

2.3.4 Post Review Phase

The Post Review Phase is necessary because several unique activities that are to be completed following the CRDR.

- Validation of Changes - This activity will make certain that changes resulting from the CRDR are evaluated for their effectiveness.

- Reporting - A summary report will be submitted at the conclusion of the CRDR that will summarize the overall review process, summarize the identified human engineering discrepancies, describe the disposition of discrepancies for which no changes were made, describe control room design improvements implemented during the course of the review, identify existing design characteristics that are beneficial, and identify the proposed design improvements implemented during the course of the review, identify existing design characteristics that are beneficial, and identify the proposed design improvements and their schedules for implementation. The final report will be submitted to the NRC upon completion of the CRDR.

- Design Control - A set of guidelines and/or standards will be developed and included in the existing change control process, to assure that future control room changes conform to the criteria established during this CRDR.

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 Acccident," 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 almost led 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 program plan and schedule.

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

Human Engineering Discrepancy (HED) - A characteristic of the existing control room that does not comply with 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 operational experience review screens plant operating documents and operator experience to discover human engineering shortcomings that have caused actual operating problems or potential problem situations in the past.

Review Team - A group of individuals responsible for directing 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, symptom-action EPs.

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

Survey Team - A group of individuals responsible for conducting a control room survey.

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

Task Analysis - A tool used to delineate system functions and the specific actions that must take place to accomplish those functions. In the CRDR context, task analysis is used to determine the individual tasks that must be completed to allow successful emergency operation. This activity checks the control room match to the emergency operating procedures.

Validation - The process of determining whether the control room operating crew can perform their functions effectively given the control room instrumentation, 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. The control room survey is a verification activity which checks the control room match to the human operator. In the CRDR context, verification implies a static check of instrumentation against human engineering criteria.

2.5 Acronyms

AVS - Air Velocity Survey Record (used to identify a specific form)
BS - Bachelor of Science
CN - Change Notice
CRDR - Control Room Design Review
CRPV - Control Room Plan View (used to identify a specific form)
EPs - Emergency Procedures
FSV - Fort St. Vrain
HED - Human Engineering Discrepancy
HEDE-1 - Human Engineering Discrepancy Evaluation (used to identify a specific form)
HFS - Human Factors Specialist
HTGR - High Temperature Gas-Cooled Reactor
HTR-1 - Humidity/Temperature Record (used to identify a specific form)
IDR-1 - Instrument Data Record (used to identify a specific form)
LSI-1 - Lighting Survey (used to identify a specific form)
NUTAC - Nuclear Utility Task Action Committee
OER-1 - Operating Experience Review Problem Analysis (used to identify a specific form)
PDS-1 - Personnel Demographic Summary Form
PEM-1 - Panel Elevation Map - Front Panel (used to identify a specific form)
PEM-2 - Panel Elevation Map - Rear Panel (used to identify a specific form)
PL-1 - Photographic Log (used to identify a specific form)
PSC - Public Service Company (of Colorado)
PTL - Paint, Tape, and Label
QIS-1 - Questionnaire Item Summary Form
SME - Subject Matter Expert
SPDS - Safety Parameter Display System
SRO - Senior Reactor Operator
SSR-1 - Sound Survey Record (used to identify a specific form)
TMI - Three Mile Island

2.6 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.

- FSV Nuclear Plant Final Safety Analysis Report
- Symptom Action Emergency Procedures
- Regulatory Guides (e.g., RG 1.97 and RG 1.47)
- NRC Guidance Documents (e.g., NUREG-0700)
- Control Room Drawings (floor plan, panel layout, etc.)
- Control Room Photographs (panel photographs, etc.)
- Human Factors Design Information
  - -- Van Cott & Kinkade
  - -- McCormick
  - -- MIL-STD-1472C
- Existing System Descriptions
- Piping and Instrumentation Diagrams (P&IDs)
- Operating Training Materials
- Computer Software Descriptions
- Schematic and Loop Diagrams
- Instrument Lists and Data Sheets
- Alarm Schematics and Elevation Drawings (legends)
- CRDR NUTAC Documents

3.0 MANAGEMENT AND STAFFING

3.1 CRDR MANAGEMENT REVIEW TEAM

The ultimate responsibility for the FSV CRDR will reside with the PSC Manager of the Nuclear Engineering Division. The day-to-day conduct of the review, will be the responsibility of a review team established specifically for this 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. The review team will include members from PSC's Engineering Division and from the FSV Operating staff.

3.2 REVIEW TEAM STRUCTURE

The review team is a multi-disciplined team of individuals with the wide range of skills necessary to perform the design review. The team will include the following personnel:

- Team Manager
- Task Coordinator
- A Senior Reactor Operator
- A Human Factors Specialist
- An Engineering Technician

The core team will be supplemented, as required, by other disciplines such as: mechanical engineering, electrical engineering, technical services, training, computer operations, procedures, licensing, health physics, and emergency preparedness. During the course of the review, any additional specialists (e.g., lighting, acoustics) required for specific tasks will be made available to the review team, as needed.

3.2.1 Review Team Manager

The Review Team Manager selected for the FSV CRDR is the Nuclear Site Engineering Manager within the Nuclear Engineering Division. This individual holds a BS degree in Electrical Engineering and has nine (9) years in design functions, eight (8) of

which are plant specific experience, with the last three (3) years as a design group supervisor. This individual's extensive plant specific experience and the present management role provides the review team with a direct management interface, information on current and proposed plant changes and a source of information regarding the actions being taken on other elements of NUREG-0737 Supplement 1.

The Review Team Manager will not be physically involved in the day-to-day conduct of the CRDR, however, he will serve as an active team member in; (1) any determination of methology or technique, (2) the review of findings, (3) assessments, and (4) HED corrective actions.

The Review Team Manager has delegated the responsibility for the routine conduct of the CRDR to a Task Coordinator.

3.2.2 CRDR Task Coordinator

The Task Coordinator selected for the FSV CRDR will be responsible for the daily conduct of the CRDR and will also provide controls and instrumentation expertise. This individual is technically trained and has worked in Electrical, Electronic and Electro-Mechanical fields a total of twenty-seven (27) years filling Instructor, Technician, and Design Engineering positions. Eleven (11) years of FSV plant specific experience includes nine (9) years of Control, Instrument and Electrical design experience for the FSV Nuclear Steam Supplier, with the remaining two (2) years spent in an identical position within the Nuclear Engineering Division of Public Service Company.

The CRDR Task Coordinator will coordinate the review team's activities, arrange access to information, facilities and individuals providing input to the team.

3.2.3 Human Factors Specialist (HFS)

The Human Factors Specialist selected for the FSV CRDR will be an individual from outside the utility and will provide : (1) Human Factors Engineering considerations during he planning phase, (2) guidance and training of team members in human engineering factors during the execution phase; and (3) human factors technical direction during the assessment phase.

Minimum qualifications for Senior Human Factors Specialist includes:

- 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 closely related systems:

3.2.4 Senior Reactor Operator (SRO)

The Senior Reactor Operator (SRO) selected for the FSV CRDR holds a Senior Reactor Operator's license and is currently an Operations Shift Supervisor. This individual has thirty (30) years operating experience of which thirteen (13) years is FSV plant specific, ten (10) years as an SRO.

3.2.5 Engineering Technician

The Engineering Technician chosen to serve as a member of the FSV CRDR Team is a technically trained individual with nine (9) years of nuclear related experience. Six (6) years of which was naval operating and maintenance experience. The remaining (3) years is FSV plant specific design experience as a member of the PSC Nuclear Engineering Department. This individual is currently in the junior year of curriculum for an Electrical Engineering degree and has training in Human Performance relating to Power Plant Operation.

3.3 REVIEW TEAM ACTIVITIES

Review team activities will include the following:

a. establishing the overall plan and schedule for the CRDR,

b. developing the methodologies for the review,

c. determination of HED's

d. assessment and recommended disposition of HED's

e. integration of all activities required to complete the CRDR

f. development and submittal to management reports relating to the CRDR.

3.4 REVIEW TEAM/ORGANIZATIONAL INTERFACE

The Review Team will exist as a function of the Nuclear Engineering Division with reporting responsibility thru the Division Management.

3.5 REVIEW TEAM ORIENTATION

3.5.1 Resources. Each team member will bring their own in-depth knowledge of specific topics to the team. These individual resources will be utilized in providing each team member with a common understanding from which to conduct the CRDR. Where specific expertise is required, and not available within the team structure, auxiliary resources will be utilized.

3.5.2 Orientation Syllabus

Team members will become familiar with the following:

a. CRDR requirements, resources, and goals.

b. Plant Operations, emergency procedures, and plant records

c. Human factors principles and their application to the control room review.

3.5.3 Miscellaneous

During the course of the review, other areas requiring training may be identified and the appropriate training obtained to meet these needs.

3.6 USE OF CONSULTANTS

Consultants will be used in areas where the necessary skills and/or expertise does not exist within the PSC's organization at this time.

A human factors specialist will be retained to provide the following:

a. human factors engineering considerations during the planning phase,

b. guidance and training of team members in human engineering factors during the execution phase.

c. human factors technical direction during the assessment phase.

4.0 PROCEDURES FOR THE CRDR

This section of the program plan describes the procedures that will be applied to accomplish the overall objectives of the CRDR. Figure 4.1 depicits the various steps and the sequence of the steps required to accomplish the CRDR. The following explanations and summaries generally follow the sequence of steps shown by Figure 4.1.

PSC plans to construct a full size photographic mock-up of the FSV control room panels. Photographs taken and data gathered during the mock-up construction will generally be utilized during and as part of the CRDR, however, certain data and photographs may be collected for purposes other than the CRDR.

4.1 CONTROL ROOM SURVEY

A survey of the existing FSV control room will be conducted during the CRDR. The purpose of the survey will be to compare the design features of

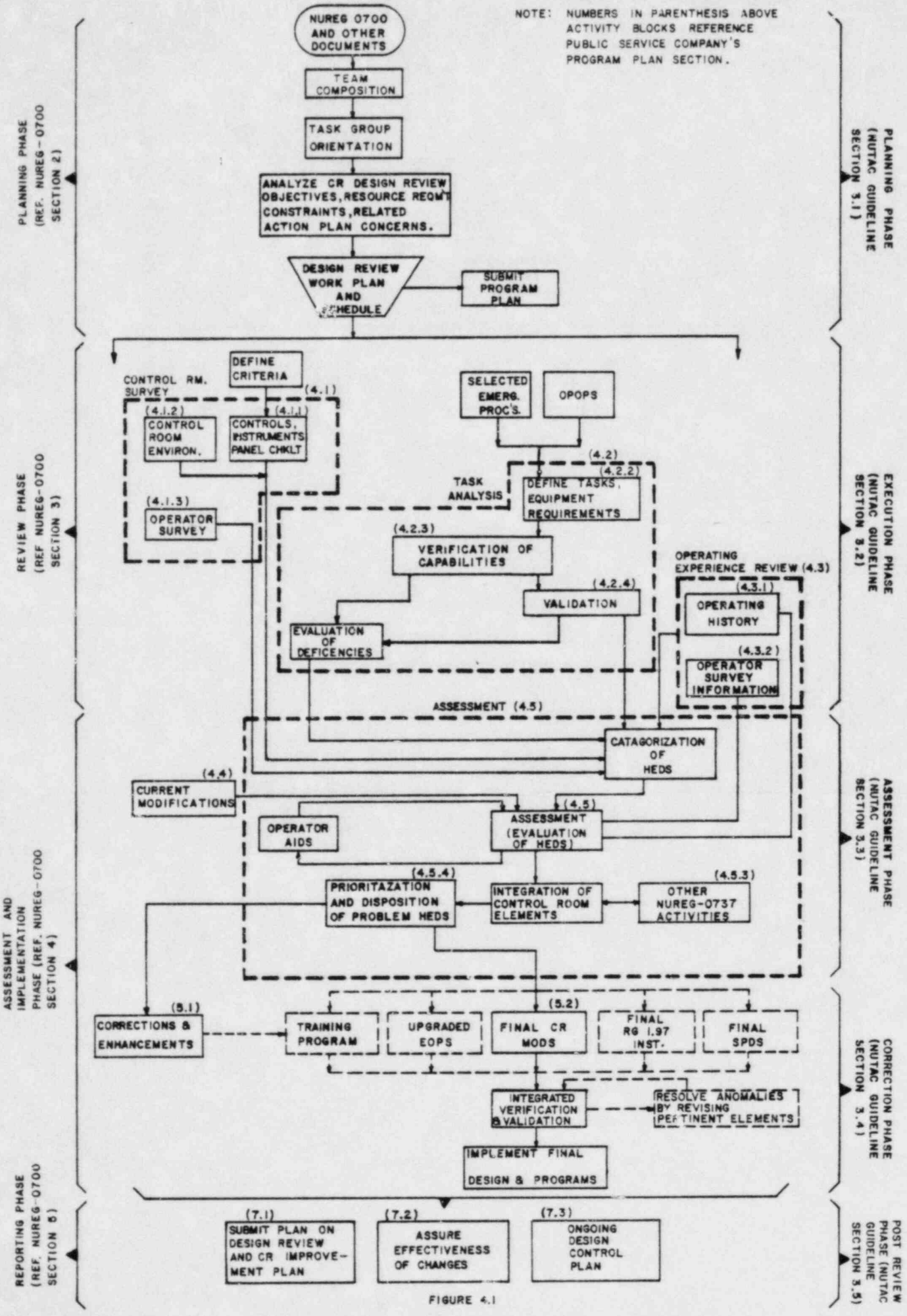

NOTE: NUMBERS IN PARENTHESIS ABOVE ACTIVITY BLOCKS REFERENCE PUBLIC SERVICE COMPANY'S PROGRAM PLAN SECTION.
NUREG 0700 AND OTHER DOCUMENTS
TEAM COMPOSITION
TASK GROUP ORIENTATION
ANALYZE CR DESIGN REVIEW OBJECTIVES, RESOURCE REQMT CONSTRAINTS, RELATED ACTION PLAN CONCERNS.
DESIGN REVIEW WORK PLAN AND SCHEDULE
SUBMIT PROGRAM PLAN
PLANNING PHASE (REF. NUREG-0700 SECTION 2)
PLANNING PHASE (NUTAC GUIDELINE SECTION 3.1)
REVIEW PHASE (REF NUREG-0700 SECTION 3)
EXECUTION PHASE (NUTAC GUIDELINE SECTION 3.2)
CONTROL RM. SURVEY
DEFINE CRITERIA
(4.1)
(4.1.2) CONTROL ROOM ENVIRON.
(4.1.1) CONTROLS, INSTRUMENTS PANEL CHKLT
(4.1.3) OPERATOR SURVEY
SELECTED EMERG. PROC'S.
OPOPS
(4.2)
TASK ANALYSIS
(4.2.2) DEFINE TASKS, EQUIPMENT REQUIREMENTS
(4.2.3) VERIFICATION OF CAPABILITIES
(4.2.4) VALIDATION
EVALUATION OF DEFICENCIES
OPERATING EXPERIENCE REVIEW (4.3)
(4.3.1) OPERATING HISTORY
(4.3.2) OPERATOR SURVEY INFORMATION
ASSESSMENT (4.5)
CATAGORIZATION OF HEDS
(4.4) CURRENT MODIFICATIONS
OPERATOR AIDS
(4.5) ASSESSMENT (EVALUATION OF HEDS)
(4.5.4) PRIORITAZATION AND DISPOSITION OF PROBLEM HEDS
INTEGRATION OF CONTROL ROOM ELEMENTS
(4.5.3) OTHER NUREG-0737 ACTIVITIES
ASSESSMENT AND IMPLEMENTATION PHASE (REF. NUREG-0700 SECTION 4)
ASSESSMENT PHASE (NUTAC GUIDELINE SECTION 3.3)
(5.1) CORRECTIONS & ENHANCEMENTS
TRAINING PROGRAM
UPGRADED EOPS
(5.2) FINAL CR MODS
FINAL RG 1.97 INST.
FINAL SPDS
INTEGRATED VERIFICATION & VALIDATION
RESOLVE ANOMALIES BY REVISING PERTINENT ELEMENTS
IMPLEMENT FINAL DESIGN & PROGRAMS
CORRECTION PHASE (NUTAC GUIDELINE SECTION 3.4)
REPORTING PHASE (REF. NUREG-0700 SECTION 5)
(7.1) SUBMIT PLAN ON DESIGN REVIEW AND CR IMPROVEMENT PLAN
(7.2) ASSURE EFFECTIVENESS OF CHANGES
(7.3) ONGOING DESIGN CONTROL PLAN
POST REVIEW PHASE (NUTAC GUIDELINE SECTION 3.5)

FIGURE 4.1

the existing control room with applicable human engineering design guidelines.

4.1.1 Checklists

The checklists will be developed using the NUTAC Control Room Design Review Development Guidelines and other appropriate reference documents. The review team will extract the necessary information from the reference documents and reformat that information for the FSV survey. The checklists will organize guideline items under the broad categories listed in subsection 4.3.3. In the control room survey, checklists will be used to evaluate each panel and component represented in the control room.

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 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 will be modeled on those contained in the "CRDR Survey Development Guideline" draft developed by the NUTAC on CRDR.

Checklist 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 HED will be described in greater detail on a separate record cross-referenced to the checklist. Photographic evidence of at least one example of each type of HED will also be provided, if feasible, for review during the assessment phase of the CRDR. When HEDs are mitigated by physical changes, the post-fix configuration will also be photographed.

4.1.2 Environmental Data

An environmental survey will be conducted in the FSV control room to determine acceptability of the environment for operator comfort, visual acuity, and optimum auditory reception. The following measurements will be taken and recorded:

- Humidity and Temperature
- Air Velocity
- Sound Level
- Illuminance
- Luminance

Reading locations, times and frequencies will be in accordance with the respective forms included in Appendix A of this report and with the Guidelines presented by the NUTAC CRDR document.

4.1.3 Operating Personnel Survey

The intent of the operating personnel survey is twofold. The primary purpose is to gain as much firsthand information from the operators as to the useability of the control room, control instrumentation and supporting equipment. The secondary purpose will be to gain operating history as related to operating incidents.

The survey will consist of a self-administered survey document and follow-up structured interviews as required.

4.1.4 Survey Document Construction

An open-ended, self-administered approach will be adopted. This method will enable a high percentage of operators to be questioned and ensures effective use of their time and that of the human factors specialists. The survey will cover the following topics.

- workspace layout and environment
- panel and controls design
- annunciator warning system
- communications
- process computers
- corrective and preventive maintenance
- procedures
- staffing and job design
- training
- other areas for operator comment
- biographical data

For each topic area, the following will be accomplished:

- A set of survey topics will be assembled. The survey document will be structured in the imperative sense to ensure that responses are as objective as possible.
- Statements will be written using the following criteria:

  Simplicity - Statements will be direct, employ common everyday language, and be as brief as possible.

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

Objectivity - Statements will be 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. Selected items will be those that have the minimum tendency toward these error types.

- The survey document contains an introductory section which will: (1) explain the purpose, (2) describe the document, (3) convey what will be done with the results, and (4) request biographical information.

4.1.5 Survey Document Distribution

Survey Documents will be given to non-licensed operations personnel, licensed operations personnel, and licensed non-operations personnel early in the CRDR process. At the time of distribution, the survey document recipients will receive a briefing by a review team member. The briefing will emphasize the major elements discussed in the cover letter. Respondents will be instructed to return the completed survey document in the envelope provided, within two weeks after distribution.

As each envelope containing a survey document is distributed, 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.

4.1.6 Survey Document Data Analysis

After the survey documents 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 Survey Document Item Summary Form (QIS-1).

It is anticipated that both positive and negative control room features will be identifed 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 menber of the CRDR team for consideration in subsequent review processes (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.

The biographical data information collected by the survey document will be summed and averaged to provide the review team with an indication of the demographics of the population upon which the survey response data is predicated. This information will be recorded on the Personnel Demographic Summary Form (PDS-1) (see Appendix) and will be submitted as part of the final CRDR report.

4.1.7 Operator Interviews

In order to evaluate the survey document as a psychometric instrument and probe areas in which negative responses are prevalent, follow-up interviews will be done for selected potential problem areas.

Structured interviews will be developed to obtain more detailed information in areas of control room design that prompted negative survey document responses. The interview outline will also allow detailed follow-up in areas of general interest to the review team. Interviews will be conducted using a structured technique that helps ensure all important 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 on a random basis from each shift.

4.1.8 Personnel Assignments

It is not necessary that the total review team be involved in the day-to-day conduct of the control room survey. The review team will be responsible for developing the checklists for the survey and ensuring that the checklists are adequate and soundly based.

The leader of the survey team will be the CRDR Task Coordinator. Other members will be drawn from Engineering and Operations. Personnel selected to conduct the survey will be designated as members of the survey team and trained to use the survey checklists properly.

4.2 TASK ANALYSIS

The objective of the task analysis is to identify the instrumentation and control requirements of the control room crew for emergency operation and to ensure that required systems can be efficiently and reliably operated under the conditions of emergency operation by available personnel. The presence or absence of instruments and equipment to support emergency operation will be determined and the human engineering suitability of available instrumentation will be determined.

The desired output of task analysis as a CRDR activity is a list of controls and displays used by control room operators to accomplish all the required steps in an emergency procedure. This information is necessary to determine if all controls and displays required for emergency operation are, in fact, present in the control room. Additionally, instrument and controls locations are required for evaluating the operator's ability to perform the procedural steps in the sequential and time frame requirements.

The task analysis described will be performed by members of the review team with additional support solicited from other specialties as required.

The general characteristics of the task analysis to be utilized in accomplishing the FSV CRDR as follows:

4.2.1 Methodology

Task analyses will be conducted by the following steps:

- Determine the tasks to be analyzed,
- Analyze each operator task identified above to determine required actions, aids, instruments and controls,
- Verify that the aids, instruments and controls identified above are present in the control room,
- Determine the suitability of the control room aids, instruments and controls for function and required operator tasks.

4.2.2 Task Definition and Equipment Requirements

The purpose of this activity is to determine specific operator tasks required for response to certain select Emergency Procedures. This activity will consist of reviewing each symptom-action matrix included as part of the Emergency procedures and selecting those tasks to be evaluated.

Additionally, this activity will consist of verbally dissecting selected tasks into component steps and listing sequentially the required actions, along with the instrument and controls required. A location mapping of manual actions, diagnostic and analytical action steps will be keyed to the respective sequential listing.

4.2.3 Verification of Capabilities

The objective of the verification process is to ensure that the required instrumentation and controls exist so operator tasks can be performed in the existing control room with minimum potential for human error. This activity will verify the presence (or absence) of instruments and equipment that provide the information and control capabilities necessary to implement each task.

Personnel knowledgeable in plant systems, instrumentation and controls engineering, and operations will participate in the verification process.

The information needed for this process will come primarily from the task definition and allocation of functions.

4.2.4 Validation of Control Room Functions

The objective of the validation is to determine if the functions allocated to the control room operating crew during emergencies can be accomplished effectively within both the structure of the established operating and emergency procedures and the design of the control room as it exists. The purpose of this section of the implementation plan is to provide and describe the processes that will be used to perform the validation review. Specifically, this section delineates:

- the selection of specific plant events to be evaluated,
- the procedure that will be followed for the evaluations
- the method to be used to record data
- the method of data analysis
- the way in which the results will be reported

4.2.5 Plant Events to be Evaluated

Selection of the actual events to be evaluated is contingent upon the completion of task analysis. Those tasks requiring maximum manipulation of controls, use of analytical and diagnostic instrumentation, operator interface and operator mobility will be prime candidates for evaluation. The selection of events will be made by the review team considering the following:

- Complexity of task,
- Location of required aids, instrumentation and controls,
- Communication requirements
- East and west end operator interface
- Operator traffic patterns

4.2.6 Validation Approach

A walk-through talk-through method using the FSV mock-up will be used to validate the selected events.

If in the opinion of the review team more realistic simulation of controls or control functions is required, the plant Superintendent of Operations will be approached to determine the availability of the control room for validating specific tasks. Control room and system availability is dependent upon plant status. While access to the control room may be granted, actual manipulation of specific controls may be prohibited.

4.2.7 Implementation of the Validation Procedure

The walk-throughs will be performed according to the following procedural steps:

- The CRDR team will select an event for validation from the list and obtain the appropriate procedure(s).

- The selected operator(s) will then walk-through what he/she/they would do while following the appropriate procedure(s). During the walk-through, the operator(s) will describe what they are doing.

The operator(s) will be instructed to simulate actions they would take if the event was real. The operator(s) will be cautioned NOT to activitate any live equipment on the control board.

- The operator(s) will be accompanied by an HFS during the walk-through of each event. The HFS will take observational notes on a procedural, step-by-step basis, utilizing the "task analysis" worksheets, attending to the relation between operator performance and control board/control room design. In particular, the HFS will evaluate and critique the walk-through on the following criteria:

  -- The indications and annunciators listed in the "Task Analysis" worksheets,

  -- The units or measurement displayed should be appropriate and consistent with the required diagnosis as defined during task analysis,

  -- The labels associated with the various controls, displays, and annunciators referenced or used should be readily identifiable.

- A second review team member will observe the walk-through to verify and record station work flow information using the unit floor diagram (map) developed during "task analysis". The information recorded will include the following:

  -- direction of movement

-- sequence of movement

-- frequency of movement

-- estimated time criticality of the movement

-- real-time estimate of the time that the operator(s) spends at each work station

° An SRO will observe the validation process to verify that operator actions are consistent with accomplishing the required task. (This information may also be utilized for further validation of operational and training procedures). The SRO will take observational notes on a procedural, step-by-step basis, atttending to the relation between operator actions and system operational requirements. The SRO will record the following:

-- difference between task analysis and operator sequences,

--omitted steps

--steps performed where not defined by task analysis.

° If, in the opinion of the review team, the information recorded during the control room validation procedure is inadequate, the event may be repeated for evaluation.

4.2.8 Data Analysis

A number of methods will be used to analyze and process the information obtained in the Validation Process. The methods will vary according to the type of data collected and the manner in which it was collected. The review team will review the comments recorded during the Validation, and determine if the comment requires further action or response. For those comments requiring further disposition, the review team shall resolve each comment into either an HED, procedure, or training concern.

Diagrammatical and/or mathematical link analyses techniques will be employed on the observational data collected by the HFS on work station and work flow.

HEDs not previously recorded will be recorded on a HED evaluation form. Procedure or training concerns not directly affecting or being affected by a HED will be recorded for later disposition outside the CRDR activity.

4.3 OPERATING EXPERIENCE REVIEW

The Fort St. Vrain Nuclear Generating Plant is a High Temperature Gas-Cooled Reactor (HTGR) designed in the late 1960's. First commercial operation occurred in December of 1976. Subsequent testing and commercial production operation has resulted in Electrical Production in excess of 3.5 million megawatt hours. This period of operation provides considerable plant history and operator experience as a source of information for the CRDR.

The review of operating experience is intended to provide information on potential problem areas in the control room by studying actual occurrences or potential problem areas in the control room. Two separate steps are involved in reviewing operating experience. The first is to review available and applicable historical documentation pertaining to plant-specific and generic occurrences. The second step is to survey operating personnel. Operating personnel surveys should identify specific problem

areas in the FSV control room and, in particular, should point out problems that occur in normal operation.

4.3.1 Historical Documentation Review

Since FSV is a "one-of-a-type" plant, the major portion of the documentation review will involve plant-specific documents. Applicable plant documents include:

- Reportable Occurrences
- Technical services "Flagged Log"
- Plant Trouble Reports
- EPA Violation Reports

Two of the above listed documents, "Reportable Occurrences" and "Plant Trouble Reports" are presently in PSC's computerized "STAIRS" data base. A search effort will be performed to identify those particular reports containing reference to control room operations, which may reflect operating or equipment problems relevant to the CRDR.

The remaining listed documents will be reviewed to the extent necessary to determine their relevancy to the CRDR.

Copies of those reports involving control room operator, procedural, and/or control board equipment failure and/or design arrangement errors will be obtained. The reports obtained will be screened by the review team to determine if the report describes and documents an actual 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.

- Procedure steps referenced should be accomplished within the physical confines of the control room.

- Personal error referenced must have occurred in the control room on equipment in the control room, or entailed a deviation from procedures that were to be accomplished in the control room.

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

4.3.2 Use of Operating Personnel Survey Information

Part 2 of the operator survey is designed to determine if existing control room characteristics have adversely effected operator performance. Responses indicating problems or potential problems will be reviewed and retained for evaluation during the assessment phase.

4.4 PENDING CHANGES REVIEW

The purpose of this activity is to identify any outstanding or planned changes to the control room or control boards and determine if those changes have the potential for affecting other CRDR activites.

4.4.1 Change Notices

All plant alterations and/or modifications affecting FSV safety related systems are initiated by approved Change Notices (CNs). Since approved change notices may not be implemented until some later convenient time, this activity will identify each outstanding change and determine its potential impact on the CRDR. Copies of those change notices affecting the control room or any control room equipment will be provided for team review during the assessment activity.

4.4.2 Planned Changes

NUREG-0737 contains the requirement for a Safety Parameter Display System (SPDS) and Regulatory Guide 1.97 may require instrument changes within the control room. Both of these activities will be reviewed for any potential impact on the CRDR.

4.5 ASSESSMENT

The scope of this activity includes the evaluation of all information and data collected by other CRDR activities. While the major emphasis is on determining the interrelated affects of other activities on HEDs, this activity may render information and suggestions for improvements outside the board classification of HEDs.

4.5.1 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,
- Evaluate the information collected from operating reviews, operator surveys and current modifications for affect on the operator-control room interface,
- Assess the impact of the planned SPDS, Regulatory Guide 1.97 requirements, and operator aids on the HEDs,
- 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 a potentially major significance, formulate changes to the control room, procedures, operator training,

or any combination therof to mitigate those HEDs.

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

4.5.2 Evaluation Criteria

Human engineering discrepancies found during the control room survey, the operating experience review, and the systems review 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 systems review 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 during operator surveys, interviews, and reviews of incident reports. 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 feels are very 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 judged by the review team as not likely to affect emergency operation, not documented as causing problems during normal operation, and not simple or cost effective to fix.

4.5.3 Assessment of Other Activities

Two other major NUREG-0737 activities will be in progress during the same approximate time frame as the CRDR:

(1) Regulatory Guide 1.97 - Instrumentation Review

(2) Task I.D.3 - The development and installation of an SPDS

In the event that instrument changes, additions or modifications are initiated as a result of Regulatory Guide 1.97 activities, these alterations will be reviewed utilizing the guidelines utilized during the control room survey.

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.

Should the review team not be able to reach a consensus on the categorization of particular HEDs, the majority will rule. 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.

4.5.4 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 should 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.

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

- impact on operating effectiveness,
- system safety,
- cost,
- impact on plant availability,
- consistency with existing features
- compliance with regulatory design requirements
- impact on control room staffing
- impact on operator training programs

Final Proposals for resolution of all HEDs, made by the review team will be submitted to PSC management for approval.

4.5.5 Implementation Schedule

The actions required to resolve significant HEDs will vary, as will the time required to complete changes. It is essential, however, to set some endpoint for completing the changes for each HED category. Therefore, the following schedule will become goals for Public Service Company when planning the activities appropriate to resolve significant HEDs.

Category	Completion
1	As soon as practical after approval of specific recommendations of the review team, and no later than startup following Fort St. Vrain's fourth (4th) refueling cycle.
2	No specific completion date. Corrective action will be based on economic judgment.
3	As soon as practical. No later than second refueling outage after the review.
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. Public Service Company will make all reasonable efforts to meet these dates.

5.0 CORRECTION PHASE

Modifications, corrections and/or enhancements required to resolve HEDs will be implemented through the existing station modification process. The station modification process is described by Engineering Procedure: ENG-1, FSV Administrative Procedure G9, and The Controlled Work Procedures Manual.

The use of change notice and controlled work procedures ensures that plant operation personnel will be made aware of impending changes.

5.1 CORRECTIONS & ENHANCEMENTS

Corrections or enhancements to the control boards that do not affect other NUREG-0737 activities significantly and that are determined to be a cost effective means of resolving HEDs will be implemented as "Corrections and Enhancements".

5.2 FINAL CONTROL ROOM MODIFICATIONS

Modifications required to resolve significant HEDs will be evaluated as part of an integration activity where any proposed changes are evaluated in relation to other NUREG-0737 activities.

5.3 PROCEDURAL EFFECTS

Changes implemented as a result of CRDR activities will be evaluated for possible affect on Emergency and Operating procedures. Any required changes will be initiated under existing procedure change methods.

5.4 TRAINING & STAFFING

Training procedures and staffing policies will be reviewed, revised, or restructured where CRDR activities indicate this type of action to be an effective and economical method of resolving HEDs.

6.0 DOCUMENTATION

This section describes the documentation system and documentation management procedures PSC 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,
- provide cross-referencing by file or log numbers between various CRDR documents.

6.2 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 systems review,
- compile HEDs and associated data for review and assessment.

6.3 DOCUMENT SYSTEM INTERFACE

Since the CRDR is a unique activity with specific goals and specific outputs, the documentation generated will be assigned an Engineering Evaluation File number for record and retrievability purposes.

CRDR documentation will be keyed to the existing controlled document system in two (2) locations.

- CRDR Instrument Data Records (form# IDR-1) will be entered into the computerized instrument list data base by file number.

This existing data base allows sorting of instruments by any particular "field", such as panel number (location) or tag number. The addition of a CRDR instrument data record file number will allow direct entry into the CRDR documents by instrument number in addition to the existing sorting capabilities.

- The computerized CN status log will list the initiating HED log number as a reference.

This entry will assure a review path from the change notice backwards into the CRDR documentation file via the initiating HEDE form.

7.0 POST REVIEW ACTIVITIES

7.1 FINAL SUMMARY REPORT

Upon completion of the CRDR, a summary of the results will be prepared and submitted to the NRC for review. The final report will describe the results of the CRDR and will be submitted within six months after completion of the review.

- Summarize the overall review process,
- Summarize identified HEDs
- Describe significant HEDs and summarize the disposition of these HEDs,
- Summarize alternative actions to identified discrepancies,
- Describe proposed design changes and the schedule for implementation,
- Describe the method of validating any resultant changes
- Describe a design control plan to assure consideration of human engineering principles in future changes.

Additional details of the CRDR, along with complete documentation, will be available for NRC evaluation and review.

7.2 EFFECTIVENESS PHASE

The effectiveness phase will be a post-CRDR activity to assure that changes resulting from the CRDR are effective. This activity will be accomplished by selective validation and operator interviews.

Due to the anticipated extended time frame required for implementing the corrective actions and possible future changes, a procedure will be implemented to assure that effectiveness evaluations will be an ongoing activity.

7.3 DESIGN CONTROL PLAN

In order to ensure adequate human factors considerations for modifications that are considered <u>after</u> the Control Room Review Team has completed its activites, the Nuclear Engineering Division will begin developing the necessary criteria, procedures, training, and controls to evaluate the human factors acceptability of future modifications. A detailed mock-up or similar tool will be available to them for evaluating proposed "solutions" <u>before</u> plant modifications are finalized.

8.0 ACCEPTANCE CRITERIA

This implementation plan was developed to describe the process whereby PSC will conduct the human factors review of the FSV control room. A sincere effort has been made by PSC to ensure that all major aspects of an effective CRDR have been considered during the development of this program plan. Since PSC is committed to perform their CRDR as described in this document, the acceptability of the CRDR should also be judged against this document. PSC cannot guarantee that the FSV CRDR will meet the letter of criteria documents other than this plan.

APPENDIX

CRDR DATA FORMS

This appendix contains sample forms to be used for the various survey and documentation efforts described by this program plan. These forms may be changed to improve useability during the CRDR. Additional forms may be developed for use when necessary.

TITLE	FORM #
Task Analysis Worksheet	TAW-1
Control Room Plan View	CRPV-1
Panel Elevation Map (Front Panel)	PEM-1
Panel Elevation Map (Rear Panel)	PEM-2
Operating Experience Review Problem Analysis Report	OER-1
Human Engineering Discrepancy	HEDE-1
Questionnaire Item Summary	QIS-1
Personnel Demographic Summary	PDS-1
Air Velocity Survey Record	AVS-1
Humidity/Temperature Record	HTR-1
Lighting Survey - Luminance and Reflectance Record	LS-1
Sound Survey Record	SSR-1
Photographic Log	PL-1
Instrument Data Record	IDR-1
Control Room Survey Checklist	CRS-__
Control Room Legend Tag Location & Lettering	None

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

TASK ANALYSIS WORKSHEET

TAW - 1

Form 344 - 22 - 4264

EMERGENCY PROCEDURE _____ OPERATIONAL TASK _____ OPERATOR _____ SHEET NO. _____ MAP NO. _____ INDEX NO. _____

TIME	ACTIVITY							EMERGENCY ACTIVITY							
	SEQ. NO.	TASK	MAP	DIAGNOSTIC	MAP	COMMUNICATION	MAP	TASK ELEMENT	MAP	DIAGNOSTIC	MAP	COMMUNICATION	MAP	REMARKS

REDUCED SIZE

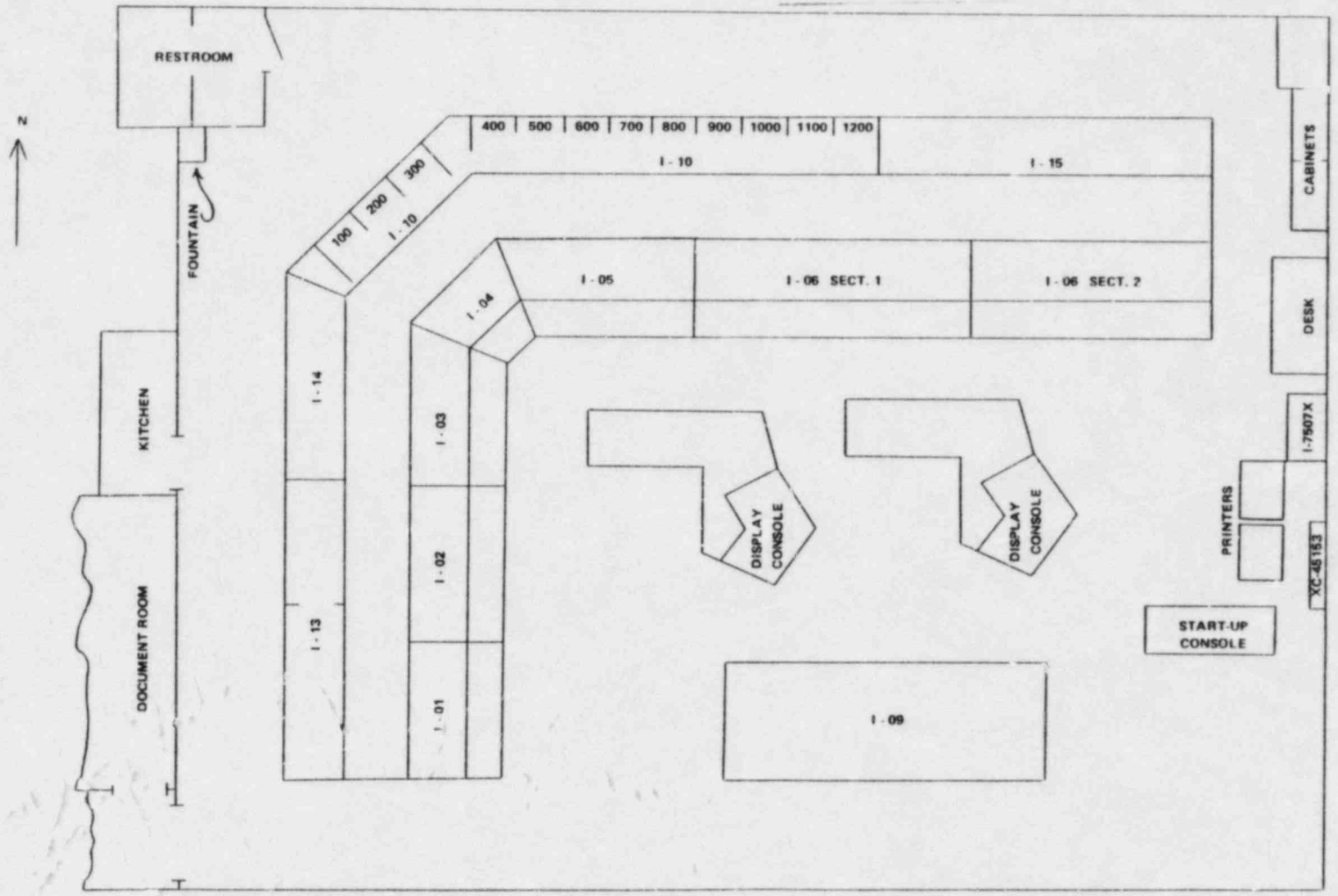
FORM# CRPV-1

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

CONTROL ROOM PLAN VIEW

REDUCED SIZE



0 6'

SCALE

MAP NO. _____

REFERENCE _____

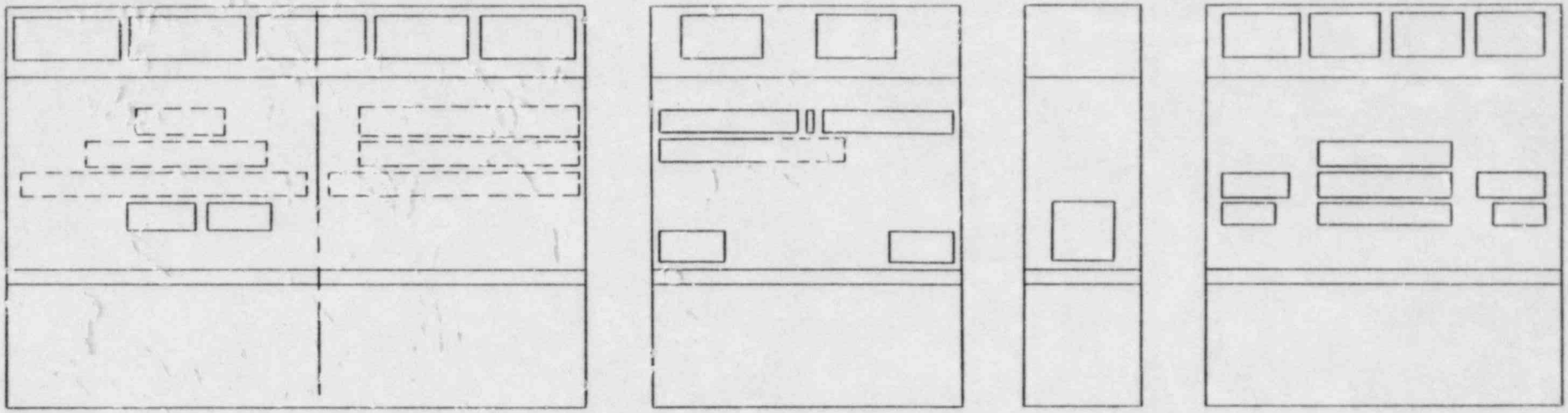
Form 344 - 24 - 4238

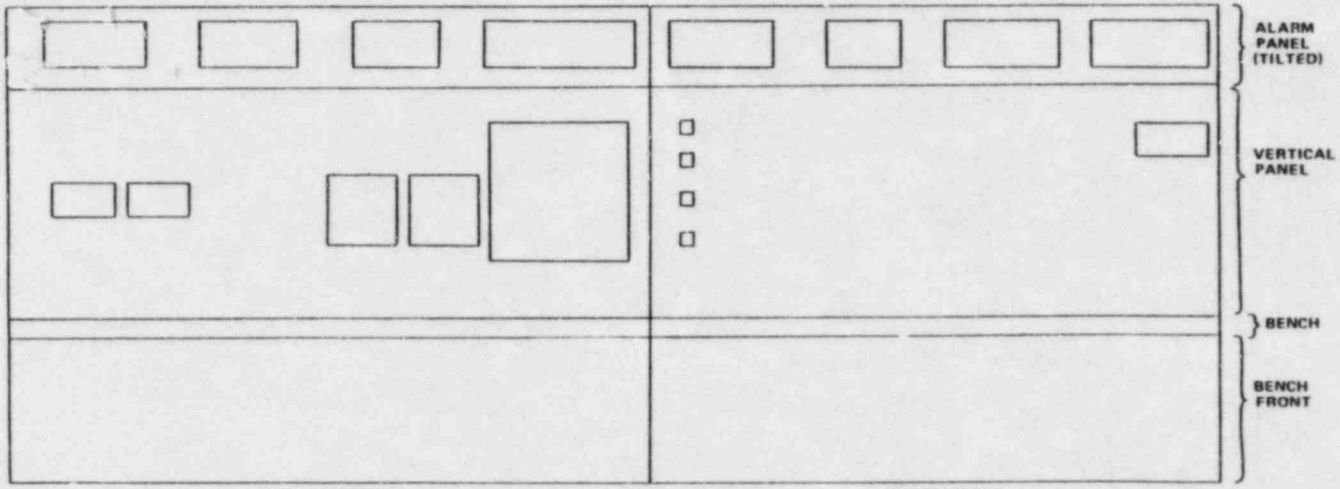
FORM# PEM-1

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

FRONT PANEL ELEVATION MAP





REDUCED SIZE

0 3'

SCALE

MAP NO. _____

REFERENCE _____

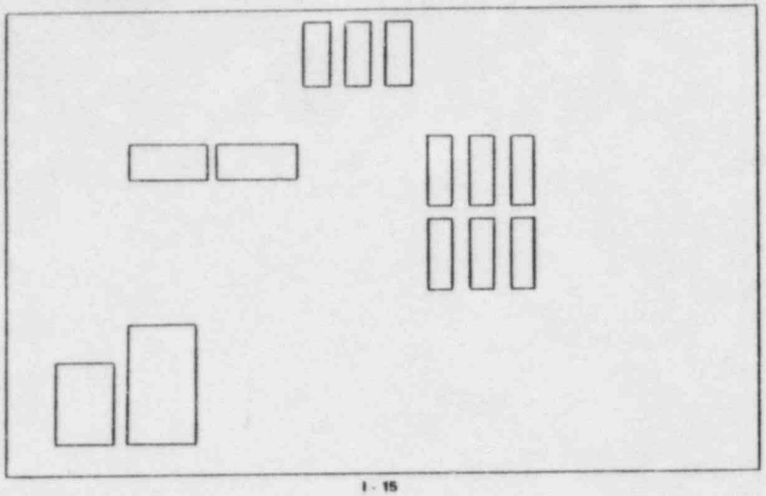
Form 344-24-4253

FORM# PEM-2

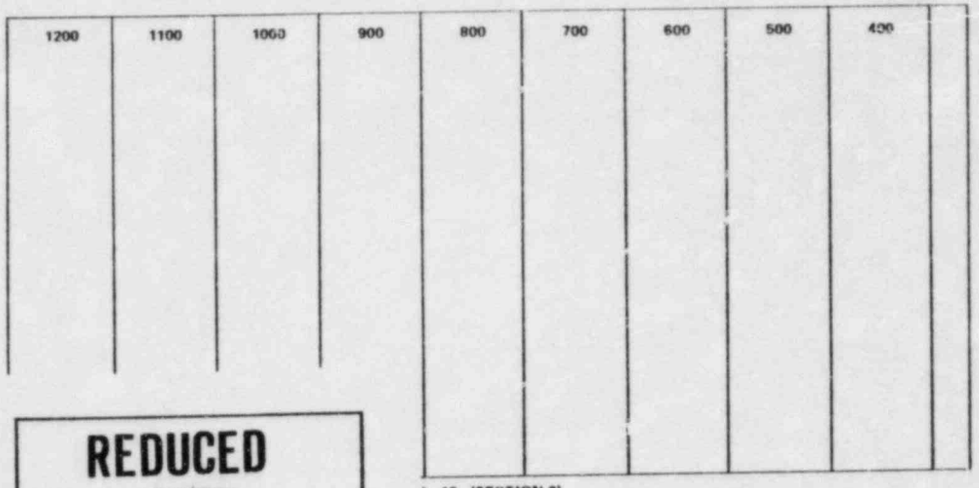
PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

REAR PANEL ELEVATION MAP

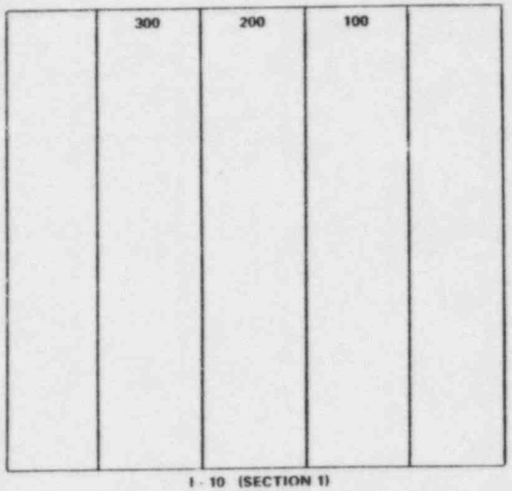


I - 15

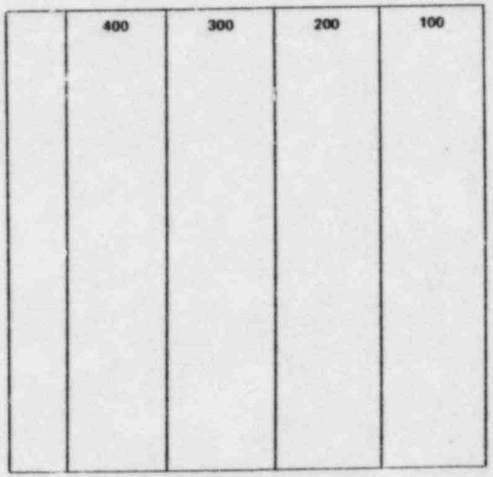


I - 10 (SECTION 2)

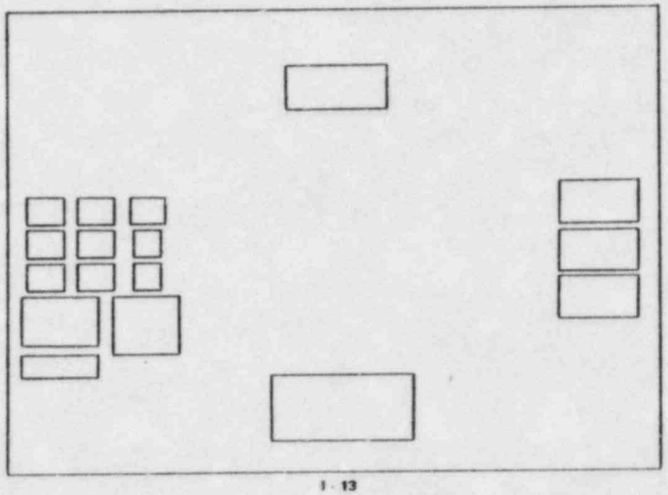
REDUCED SIZE



I - 10 (SECTION 1)



I - 14



I - 13

0 3'

SCALE

MAP NO. _____

REFERENCE _____

Form 344 24 4257

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW
OPERATING EXPERIENCE REVIEW

PROBLEM ANALYSIS REPORT

INDEX NUMBER _____

Name (s) of Investigator: _____ Date: _____

Report Type and Number: _____

Date of Incident: _____

Unit Operating Status: _____

Documented Problem: _____

_____

Sequence of Events: _____

_____

_____

_____

Effect on Unit: Unit Derated _____ hrs. Unit Shutdown _____

Unit Trip (Scram) _____ hrs.

Corrective Action Taken or Proposed: _____

_____

_____

_____

Subsequent Action Taken of a "Corrective" Nature: _____

_____

_____

_____

Problem Identified and Corrected: Yes __ __ No _____

Engineering Discrepancy Evaluation Index

Number: _____

FORM: OER-1

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

Log Number _____

HUMAN ENGINEERING DISCREPANCY EVALUATION
HEDE - 1

Form 344-22-4228

REVIEWER NAME	DATE

A. HED TITLE _____

B. ITEMS INVOLVED

ITEM TYPE	NOMENCLATURE	LOCATION	INSTRUMENT DATA FILE NO. PHOTO NO.

C. PROBLEM DESCRIPTIONS (GUIDELINES VIOLATED) _____

D. LIST THE PROCEDURES OR OPERATIONS THAT USE THE LISTED ITEMS IN A MANNER TO INDUCE THE OPERATOR ERROR _____

E. SPECIFIC OPERATOR ERROR(S) THAT COULD RESULT FROM HED

F. LIST THE CONSEQUENCES OF OPERATOR ERROR

G. CLASSIFICATION

H. CORRECTIVE ACTION OPTIONS

I. DISPOSITION

TEAM ACTION

TEAM MEMBER SIGNATURE	CONCURRENCE OR NON-CONCURRENCE	DATE
Team Manager		
CRDR Coordinator		
Human Factors Spec.		
Senior Reactor Operator		

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

INSTRUMENT DATA RECORD

IDR - 1

Form 344 - 22 - 4237

INSTRUMENT NO. _____

CRDR INSTRUMENT DATA FILE NUMBER _____

LOCATION _____

PHOTOGRAPHIC LOG NO. _____

TASK ANALYSIS WORK SHEET FILE NUMBER _____

PHOTO

PROBLEM DESCRIPTION (GUIDELINE VIOLATED) _____

_____

_____

_____

REMARKS _____

_____

_____

HED EVALUATION LOG NUMBER _____

FT ST VRAIN CONTROL ROOM
DESIGN REVIEW

QUESTIONNAIRE ITEM SUMMARY FORM

INDEX NUMBER _____

1. Analyst: _____
2. Content Area: _____
3. Question # _____
4. Question:

FREQUENCY/%	TYPE OF RESPONSE/SPECIFIC EQUIP. REF.	INVESTIGATION

FORM # QIS-1

FORM # PDS-1

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW

PERSONNEL DEMOGRAPHIC SUMMARY FORM

1. HF ANALYST: _____

2. STATION: _____

POPULATION DEMOGRAPHICS AND STATISTICS

GROUP	N	SEX		MEAN STATISTICS					
		M	F	HEIGHT	AGE	NUCLEAR OPER EXP.	CONTROL BOARD OPER EXP	#YRS RO	#YRS SRO
NON-LICENSED OPERATOR									
LICENSED OPERATORS									
LICENSED NON-OPERATORS									
SIMULATOR INSTRUCTOR									
OVERALL									

GROUP	N	SEX		MEDIAN STATISTICS					
		M	F	HEIGHT	AGE	NUCLEAR OPER EXP.	CONTROL BOARD OPER EXP	#YRS RO	#YRS SRO
NON-LICENSED OPERATOR									
LICENSED OPERATORS									
LICENSED NON-OPERATORS									
SIMULATOR INSTRUCTOR									
OVERALL									

INDEX NUMBER _____

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW

AIR VELOCITY SURVEY RECORD

INDEX # _____

Plant STATUS: _____ Date: _____ Time: _____

Measurements made by: _____

Equipment/Instrument used: _____

Serial #: _____ Calibration Date: _____

MAP #: _____

	6 ft	4 ft

FORM # AVS-1

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW

HUMIDITY/TEMPERATURE RECORD

INDEX # _____

Plant STATUS: _____ Date: _____ Time: _____

Measurements made by: _____

Equipment/Instrument Used: _____

Serial #: _____ Calibration date: _____

Time	Height	Temperature	Humidity	Remarks
	Floor			
	6 ft.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			

FORM # HTR-1

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW
LIGHTING SURVEY/ILLUMINANCE RECORD

INDEX # ____

Plant STATUS: _____ Date: _____ Time: _____

Measurements made by: _____

Equipment/Instrument used: _____

Serial #: _____ Calibration date: _____

MAP #: _____

Location	Panel I.D. No.	Full AC Ambient	Full Emergency	Other Conditions (Specify)

FORM# LS -1

FT. ST. VRAIN CONTROL ROOM
DESIGN REVIEW

SOUND SURVEY RECORD

INDEX #_____

Plant STATUS: _____ Date: _____ Time: _____

Measurements made by: _____ Sheet # ____ of ____

Equipment/Instrument used: _____

Serial #: _____ Calibration date: _____

Operator Work Station	dB(A)	Octave Band Center Frequencey					
		250	500	1K	2K	4K	Remarks

FORM# SSR-1

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

PHOTOGRAPHIC RECORD (PL - 1)

Form 344-22-4226

CAMERA	FILM TYPE	ASA	INDEX NO.	PHOTOGRAPHER	DATE

SEQ. NO.	INSTRUMENT NO.	"F" STOP	SHUTTER SPEED	DISTANCE	FOCAL LENGTH	HED INDEX NO.	REMARKS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
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26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							

FORM 344-22-4227

CONTROL ROOM SURVEY CHECKLIST

CRS - ______

File # ________ ____

Sheet ______ of ______

PRINCIPLE:

SEQ.								REMARKS
				YES	NO HED#	YES	NO HED#	