DMB 016

June 7, 1984

Docket No. 50-313
50-368

LICENSEE: Arkansas Power and Light Company (AP&L)

FACILITY: Arkansas Nuclear One, Units Nos. 1 & 2 (ANO-1&2)

SUBJECT: SUMMARY OF MEETING WITH ARKANSAS POWER & LIGHT COMPANY (AP&L) ON MAY 2, 1984, CONCERNING THE DETAILED CONTROL ROOM DESIGN REVIEW (DCRDR) PROGRAM PLAN FOR ARKANSAS NUCLEAR ONE, UNITS NOS. 1 & 2 (AN)-1&2)

INTRODUCTION

By letter dated March 26, 1984, we transmitted our comments concerning the ANO-1&2 DCRDR Program Plan and requested the licensee to meet with us to review their plan. A meeting was held in Bethesda, Maryland on May 2, 1984 with AP&L in response to the staff's request to discuss the licensee's DCRDR Program Plan for ANO-1&2. The meeting followed the adgenda provided in Enclosure 1. The attendees at the meeting are identified in Enclosure 2. The material presented by the licensee is included as Enclosures 3 and 4.

DISCUSSION

The licensee's discussion included in Enclosure 3 very well presented the essence of the meeting and the view graphs are self explanatory. The staff indicated a favorable response in that the licensee has a well planned program with the proper emphasis on human factors engineering.

"ORIGINAL SIGNED BY:"

Guy S. Vissing, Project Manager
Operating Reactors Branch #4, DL

Enclosures:
As Stated

cc w/enclosures:
See next page

ORB#4:DL
GVissing;cf
6/7 /84

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PDR ADOCK 05000313
F PDR

MEETING SUMMARY DISTRIBUTION

Licensee: Arkansas Power and Light Company (AP&L)

*Copies also sent to those people on service (cc) list for subject plant(s).

Docket File
NRC PDR
L PDR
ORB#4 Rdg
Project Manager - GVissing
JStolz
BGrimes (Emerg. Preparedness only)
OELD
NSIC
EJordan, IE
JNGrace, IE
ACRS-10

NRC Meeting Participants:

REckenrode
RLee
DTondi

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Enclosure 1

A G E N D A

- INTRODUCTION — Dale James
- CRDR PROGRAM PLAN OVERVIEW — Steve McKissack
- QUALIFICATIONS AND STRUCTURE OF THE CRDR TEAM — Steve McKissack
  - Selection & Role of the Human Factors Consultant
  - Level of Involvement of the CRDR Team
  - Qualifications & Role of AP&L Support Organizations
  - Nature of Training Received by the Review Team
- FUNCTION AND TASK ANALYSIS — Dan Williams
  - Function Review Methods & Comprehensiveness
  - Task Analysis Methods, Comprehensiveness, & Selection Procedures for Task Analysis
  - Task Analysis Data Forms
- CONTROL ROOM INVENTORY & VERIFICATION — Dan Williams
  - Inventory & Task Analysis Comparison Process
  - Inventory Forms
- CONTROL ROOM SURVEY — Robert Kershner
  - Purpose & Objectives
  - Procedure for Checklist Survey (Methods)
  - Plans for Integration of Task Analysis Data
  - Non-Environmental Survey & Checklist Forms

- ASSESSMENT OF HEDs & SELECTION OF DESIGN IMPROVEMENTS — Steve McKissack
  - Methods & Integration of the Assessment, Resolution, & Implementation Process
  - Assessment Criteria, Guidelines & Category
  - Development of Proposed Design Improvements
  - Review of Alternatives
  - Design Solution Selection
- VERIFICATION THAT IMPROVEMENTS WILL PROVIDE THE NECESSARY CORRECTIONS & THAT CONTROL ROOM MODIFICATIONS DO NOT INTRODUCE NEW HEDs — Steve McKissack
- COORDINATION OF THE CRDR PROGRAM WITH OTHER IMPROVEMENT PROGRAMS — John Marshall
  - Qualifications & Level of Involvement of Management in the CRDR
  - Integrated Implementation Plan
  - Rap Up

Enclosure 2

Attendance List to
Meeting with AP&L Concerning
Detailed Control Room Design Review for
ANO 1/2
May 2, 1984

Name	Affilation
Guy Vissing	NRR/DL
Richard Eckenrode	NRR/DHFS
Timothy O'Donoghue	Science Applications, Inc.
Trisha Filipek	AP&L
Don Taylor	ARD Corporation
Dan Williams	AP&L
Brian Steeen-Larsen	Lousiana Power & Light
Ronald V. Siedl	Lousiana Power & Light
Douglas Sikes	AP&L
Herbert "Sandy" Kook, Jr.	Mississippi Power & Light
Bill Garrison	AP&L
Larry Young	Sacramento Municipal Utility District
Jeffery Jones	" "
John Marshall	AP&L
Gene Silverman	ARD Corporation
Bob Kershner	ARD Corporation
Steve McKissack	AP&L
Dale James	AP&L
Steve Bennett	Mississippi Power & Light
Garry Young	United Energy Services Corp./AP&L
Robert Lee	NRR/DL
Dom Tondi	NRR/DHFS

INTRODUCTION

The purpose of our presentation this morning is to specifically address the comments provided in your letter of March 26. The major points we want to emphasize throughout this presentation are:

(Overhead)

- AP&L is providing competent and qualified CRDR Team Members.
- The Human Factors Consultant, Advanced Resource Development, Corp., is:
  - Trained and competent in Human Factors Engineering.
  - Experienced in Performing Control Room Design Reviews.
- The CRDR Team has been and will be involved in every phase of the CRDR.
  - Planning Phase
  - Review Phase
  - Assessment Phase
  - Implementation Phase
- The CRDR Team has been and will be conducting the CRDR with respect to NRC Regulations and Guidelines.
- The Program Plan is complete and summarizes AP&L's selected approach to the CRDR process and is supported by the necessary documentation and resources to achieve a very successful CRDR.
- The Final Summary Report will summarize the overall CRDR process. However, the details of the review will be documented and maintained for future use or review.

With this in mind, let me proceed further and briefly describe the history and the progress made to date. (Overhead) The ANO CRDR process began with early meetings of AP&L management in January, 1984 and progressed to the selection of ARD in September, 1983. The NRC was advised of this decision in October, 1983.

From there, the Program Plan was submitted in November, 1983. Later in February, 1984, AP&L contacted with ARD Corporation for the Review Phase and implemented the Program Plan.

Since February 1984, the following major tasks are complete or nearing completion:

Historical Document Review

Operator Questionnaire

Operator Interviews

Task Analysis

Thus, the AP&L Organizational Structure proposed in the Program Plan is in place and functional.

The Organizational Structure chosen by AP&L was not selected by chance, but by design. AP&L has supported the multidisciplined organizational concept recommended by the NRC. AP&L could see that the combined talents of a multidisciplined team were needed to achieve a meaningful CRDR.

Selection of the Human Factors Consultant

Consequently, AP&L has provided experienced engineers and licensed operators as members of the CRDR Team. Also, AP&L recognized very early that an experienced and qualified Human Factors Consultant was needed as a key member of the CRDR Team.

Therefore, in September 1983, AP&L selected Advanced Resource Development Corporation of Columbia, Maryland, as the Human Factors Consultant for the Planning Phase. ARD's selection was the direct result of several months of intensive review and evaluation.

AP&L advised the NRC of ARD's selection in our Supplement 1 update dated October 20, 1983. The selection of ARD completed the CRDR Team and included (Overhead).

- Outside Specialists
- AP&L Headquarters Personnel
- Plant Staff

The CRDR Team has been and will continue to be substantially involved in every aspect of the CRDR.

Role of the Human Factors Consultant

Though detailed planning continues, the Planning Phase ended with the submittal of the Program Plan to the NRC. ARD's involvement in this initial planning can be summarized as follows:
(Overhead)

- Undergo an Orientation to obtain a working knowledge of the:
  - Layout and environment of ANO Unit 1 and 2 control rooms
  - Interface with the control room design review team
- Participated in the development and review of the program plan by:
  - Contributing knowledge of:
    - Human factors engineering principles and practices
    - NRC regulations and guidelines
  - Providing guidance from previous CRDR experiences to ensure:
    - Conformance to NRC regulations and guidelines
    - Familiarize the CRDR team with reference materials, equipment and forms necessary to conduct the CRDR
  - Participated in the development of a detailed project plan that:
    - Identifies and schedules major CRDR tasks
    - Considers the status of plant activities: outages, control room access, etc.
    - Considers the availability of both ARD Corporation and AP&L personnel

Thus, the role of the Human Factors Consultant was well defined during the Planning Phase. This role would be carried forward into the review phase. During the review phase ARD's role can generally be defined as follows: (Overhead)

- Participate as an active CRDR team member
- Continue to contribute knowledge of:
  - Human factor engineering principles and practices
  - NRC regulations and guideliness
- Ensure conformance to:
  - Accepted human engineering standards
  - NRC regulations and guidelines

- Directly perform specific CRDR tasks or acceptance with the:
  - CRDR program plan
  - CRDR project schedule
- Identify and document positive control room features as well as human engineering discrepancies

ARD is involved in every aspect of the CRDR. This involvement may be defined further by the specific tasks which ARD has been asked to perform. (Overhead)

As evidenced by these tasks, ARD is substantially involved in all phases of the review and all tasks performed.

I would like to summarize this portion of the presentation by saying that AP&L is concerned about the contribution of human factors engineering. The CRDR team has made and will continue to make the necessary provision for ARD to be directly involved.

In addition to the involvement of ARD, AP&L management has committed experienced engineers and licensed operators. The CRDR team is (Overhead) multidisciplined as evidenced by this comparison to the disciplines recommended by the draft to NUREG-0801. Each AP&L team member is involved individually, and collectively with the team. On an individual basis a team member is involved by:

- Having each team member assigned respnosibilities for major activities.

  These assignments were made with consideration given to the individuals training and experience. These assignments are indicated on the following chart:

(Overhead)

Each team member is assigned to at least one major activity and every process in NUREG-0700 is covered.

Regarding these major activities, the team member is responsible for the following:

(Overhead)

- Serving as a Technical Liaison: For the major activity the CRDR team member serves as a focal point for coordination with ARD, general office and plant organizations. This involvement includes support of technical aspects as well as administrative support.
- Monitoring the Progress and Performance of the Major Activity
  - The team member monitors progress and performance in accordance with the program plan. Thus, the team member must

be technically aware of the activity and maintain contact to review the progress and results.

- Ensure consistency with the operating philosophy of ANO.
- Identify existing or potential problems by direct involvement and provide guidance in problem solving.
- Utilize CRDR team member's overall project involvement in the successful performance of specific tasks.

CRDR team members are involved in every task utilizing their knowledge and experience directly in the successful completion of these tasks.

In addition, each individual is included as a collective part of the team. For instance, each team member participates in team meetings. CRDR team meetings are held atleast once a week where all team members, including ARD, participate in atleast the following major topics:
(Overhead)

- Status of all activities in progress
- Progress and performance of activities
- Identified or potential problem areas and suggested solutions
- Schedule and discussion of the following week's activities
- Overall project schedule

The intent of these weekly meetings is to keep every team member advised of the status of the CRDR. Communication on a project this important and complex is essential to achieve meaningful and timely results.

The excellent progress made to date is a direct result of the project communication and coordination achieved by the CRDR team members through the forum established by these meetings. Every CRDR team member is given an opportunity to ask pertinent questions and provide input about any aspect of the CRDR.

Therefore, CRDR team members contribute individually and as a group. This involvement encompasses every phase and every task. Together these team members provide the expertise and experience necessary to successfully accomplish the CRDR, both technically and administratively.

AP&L Support Organizations

However, early in the planning phase AP&L anticipated that a project of this importance duration and complexity could at times place a significant workload on these experienced resources. AP&L could see that the success and timely completion of the CRDR would be dependent on the availability of qualified resources.

Thus, the program plan made a provision for the CRDR team, at its discretion, to potentially call upon AP&L support organizations. These support organizations would perform tasks assigned by the CRDR team only when necessary. The intent of this provision is not to add to the core of CRDR team members, but to provide staff support routinely provided by AP&L organizations knowledge.

AP&L support organizations include two sources. First, the AP&L support organizations include the organizations represented by CRDR team members, such as, instrument and control engineering or ANO operations. Also, AP&L support organizations include associated groups capable of performing specialized, but necessary tasks. Examples of these groups include training, planning and scheduling and drafting.

The discretionary use of AP&L support organizations or consultants provides the CRDR team with the flexibility for additional support.

It must be emphasized that these organizations will be used with the cognizance of the CRDR team. In all cases support organizations will perform tasks associated with their normal work activities.

In summary, the focus of the CRDR is ARD's human factors review. The CRDR team is interacting directly in support. Finally, AP&L support organizations will be used for support, when necessary.

The NRC mentioned training received by the CRDR team in the agenda. However, this area was not mentioned in the specific comments. Relevant qualifications of CRDR team members are provided in Appendix A of the program plan. The experience and associated training of the multidisciplined CRDR team can be summarized by the following: (Overhead)

- Utility experience - 48 years
  This represents an average of about five years per person

- Nuclear related experience - 71 years
  Have the average or 10 years per person

- ANO operations experience - 25 years
  This represents an average of 3½ years per person

- ARD Human Factors - 39 years
  This represents an average of 6½ years per person

The assessment phase proposed by AP&L will be organized, systematic, structured, and designed to achieve effective results. The objectives of the assessment phase are:

(Overhead)

- Evaluate problems that could arise from identified HEDs
- Determine significance of HEDs identified
- Develop action plan for HEDs to be corrected

AP&L's approach to the assessment phase is summarized as follows:

(Overhead)

- All HEDs will be evaluated.
- HEDs will be classified into three broad classifications
  - HEDs with safety significance to emergency response

    These are HEDs which would be specifically identified relative to the emergency operating procedures.
  - HEDs whose correction would improve non-emergency operations.

    These are HEDs associated with the abnormal operating procedures.
  - HEDs contributing to overall control room improvement but not related to emergency or non-emergency operation.

    These are HEDs associated with normal plant conditions. These corrections could have an impact on operator efficiency or performance.
- HEDs will be prioritized and ranked according to assessment criteria and guidelines.

  Qualitative criteria to be used by the CRDR team during the assessment phase will be developed prior to assessing the HEDs. These criteria developed in conjunction with ARD will consider such factors as:
  - The potential for causing or contributing to operator error
  - Operator performance and task
  - Plant operation
  - Cost/Benefit
- Final priority will be the combined assessment of the CRDR team and the human factors consultant

The result of the assessment phase will be a prioritized list of HEDs which the CRDR team recommends for corrective action. During the assessment phase

there will likely be some HEDs that upon close examination may not proceed with corrective action. This may be due to such factors as unacceptable cost/benefit or potential degradation of plant performance. These will be appropriately documented.

HEDs recommended for corrective action that involve changes to ANO design documents will proceed through AP&L's established design change process. The AP&L Energy Supply Engineering Services Department, as a part of its normal responsibilities, will be responsible for evaluating and developing design solutions.

The AP&L Design Change Process begins with the submittal of an Engineering Action Request (EAR) to the Engineering Services Department. The EAR summarizes the problem and asks for engineering assistance. EARs are then assigned to responsible engineers whose first responsibility is to develop Project Scoping Reports (PSRs). Project Scoping Reports combine into one document the following considerations:
(Overhead)

- Description of the problem
- Developments and description of design alternatives
- Development of cost estimates
- Selection of design alternative
- Documents to be prepared or revised to implement design
- Division of responsibility

Thus, the Project Scoping Report, which in a part of the existing AP&L design process is the mechanism for the development of design alternatives, schedules and the selected design. The Project Scoping Report upon completion must be reviewed and approved by all engineering disciplines and also by ANO Plant Operations. (Overhead) Approved Project Scoping Reports will then initiate the development of engineering Design Change Packages. The AP&L Design Change Package process is an established AP&L procedure for developing and documenting engineering designs. The CRDR Team, as appropriate, will be utilized during the design phase and later in the implementation phase to provide a human factors review to ensure the design improvements provide the necessary corrections. Also, the CRDR team will verify that improvements will not introduce new HEDs.

Enclosure 4

AGENDA

- INTRODUCTION
- CRDR PROGRAM PLAN OVERVIEW
- QUALIFICATIONS AND STRUCTURE OF THE CRDR TEAM
- FUNCTION AND TASK ANALYSIS
- CONTROL ROOM INVENTORY AND VERIFICATION
- CONTROL ROOM SURVEY
- ASSESSMENT OF HEDS AND SELECTION OF DESIGN IMPROVEMENTS
- VERIFICATION THAT IMPROVEMENTS WILL PROVIDE THE NECESSARY CORRECTIONS AND WILL NOT INTRODUCE NEW HEDS
- COORDINATION OF THE CRDR PROGRAM WITH OTHER IMPROVEMENT PROGRAMS

INTRODUCTION

CONTROL ROOM DESIGN REVIEW

- AP&L IS PROVIDING COMPETENT AND QUALIFIED CRDR TEAM MEMBERS
- THE HUMAN FACTORS CONSULTANT, ADVANCED RESOURCE DEVELOPMENT (ARD) CORPORATION, IS:
  - -- TRAINED AND COMPETENT IN HUMAN FACTORS ENGINEERING
  - -- EXPERIENCED IN PERFORMING CONTROL ROOM DESIGN REVIEWS
- THE CRDR TEAM HAS BEEN AND WILL BE INVOLVED IN EVERY PHASE OF THE CRDR
  - -- PLANNING PHASE
  - -- REVIEW PHASE
  - -- ASSESSMENT PHASE
  - -- IMPLEMENTATION PHASE
- THE CRDR TEAM HAS BEEN AND WILL BE CONDUCTING THE CRDR WITH RESPECT TO NRC REGULATIONS AND GUIDELINES
- THE PROGRAM PLAN IS COMPLETE AND SUMMARIZES AP&L'S SELECTED APPROACH TO THE CRDR PROCESS AND IS SUPPORTED BY THE NECESSARY DOCUMENTATION AND RESOURCES TO ACHIEVE A SUCCESSFUL CRDR.
- THE FINAL SUMMARY REPORT WILL SUMMARIZE THE OVERALL CRDR PROCESS. HOWEVER, THE DETAILS OF THE REVIEW WILL BE DOCUMENTED AND MAINTAINED FOR FUTURE USE OR REVIEW.

INTRODUCTION

CONTROL ROOM DESIGN REVIEW

SIGNIFICANT PROJECT DATES

JANUARY 1983	INITIAL AP&L MANAGEMENT MEETINGS TO ASSESS THE CRDR PROJECT
FEBRUARY 1983	CONDUCTED "QUALIFICATION" CONFERENCES WITH POTENTIAL HUMAN FACTORS CONSULTANTS
MARCH 1983	INITIATED DEVELOPMENT OF REQUEST FOR PROPOSAL (RFP) FOR HUMAN FACTORS CONSULTING SERVICES
APRIL 15, 1983	SUBMITTED RESPONSE TO SUPPLEMENT 1 TO NUREG-0737
JUNE 1983	COMPLETED RFP FOR HUMAN FACTORS CONSULTING SERVICES
AUGUST 1983	ISSUED RFP TO SELECTED BIDDERS
SEPTEMBER 1983	EXECUTED CONTRACT WITH ADVANCED RESOURCE DEVELOPMENT (ARD) CORPORATION FOR THE PLANNING PHASE OF THE CRDR
OCTOBER 20, 1983	NUREG-0737, SUPPLEMENT 1 UPDATE ADVISED THE NRC OF THE SELECTION OF ARD CORPORATION
NOVEMBER 25, 1983	SUBMITTED PROGRAM PLAN TO THE NRC
DECEMBER 1983	INITIATED NEGOTIATIONS WITH ARD CORPORATION FOR HUMAN FACTORS CONSULTING SERVICES DURING THE REVIEW PHASE
FEBRUARY 1984	EXECUTED CONTRACT WITH ARD CORPORATION FOR THE REVIEW PHASE AND INITIATED IMPLEMENTATION OF THE CRDR PROGRAM PLAN

SELECTION - HUMAN FACTORS CONSULTANT

CONTROL ROOM DESIGN REVIEW

TEAM COMPOSITION

- OUTSIDE SPECIALISTS
  - -- HUMAN FACTORS CONSULTANT
- AP&L HEADQUARTERS PERSONNEL
  - -- NUCLEAR SYSTEMS
  - -- INSTRUMENTATION AND CONTROLS
  - -- ELECTRICAL ENGINEERING
- PLANT STAFF
  - -- LICENSED AND QUALIFIED OPERATIONS PERSONNEL

ARD CORPORATION'S ROLE

CRDR PLANNING PHASE

- UNDERGO AN ORIENTATION TO OBTAIN A WORKING KNOWLEDGE OF THE
  - -- LAYOUT AND ENVIRONMENT OF THE ANO-UNITS 1 AND 2 CONTROL ROOM
  - -- INTERFACE WITH THE CONTROL ROOM DESIGN REVIEW TEAM

- PARTICIPATE IN THE DEVELOPMENT AND REVIEW OF THE CRDR PROGRAM PLAN
  - -- CONTRIBUTING KNOWLEDGE OF:
    - ◊ HUMAN FACTORS ENGINEERING PRINCIPLES AND PRACTICES
    - ◊ NRC REGULATIONS AND GUIDELINES
  - -- PROVIDING GUIDANCE FROM PREVIOUS CRDR EXPERIENCE TO ENSURE:
    - ◊ CONFORMANCE TO NRC REGULATIONS AND GUIDELINES
    - ◊ FAMILIARIZE THE CRDR TEAM WITH REFERENCE MATERIALS, EQUIPMENT, AND FORMS NECESSARY TO CONDUCT THE CRDR
  - -- PARTICIPATE IN THE DEVELOPMENT OF A PROJECT PLAN THAT:
    - ◊ IDENTIFIES AND SCHEDULE MAJOR CRDR TASKS
    - ◊ CONSIDERS THE STATUS OF THE PLANT (I.E., OUTAGES, CONTROL ROOM ACCESS)
    - ◊ CONSIDERS THE AVAILABILITY OF HUMAN FACTORS CONSULTANTS AND AP&L PERSONNEL

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ARD CORPORATION'S ROLE

CRDR REVIEW PHASE

- PARTICIPATE AS AN ACTIVE CRDR TEAM MEMBER

- CONTINUE CONTRIBUTING KNOWLEDGE OF:
  - -- HUMAN FACTORS ENGINEERING PRINCIPLES AND PRACTICES
  - -- NRC REGULATIONS AND GUIDELINES

- ENSURE CONFORMANCE TO:
  - -- ACCEPTED HUMAN FACTORS ENGINEERING PRINCIPLES AND PRACTICES
  - -- NRC REGULATIONS AND GUIDELINES

- DIRECTLY PERFORM SPECIFIC CRDR TASKS IN ACCORDANCE WITH THE:
  - -- CRDR PROGRAM PLAN
  - -- CRDR PROJECT SCHEDULE

- IDENTIFY AND DOCUMENT POSITIVE CONTROL ROOM FEATURES AS WELL AS HUMAN FACTORS ENGINEERING DISCREPANCIES

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ROLE OF THE HUMAN FACTORS CONSULTANT

ARD CORPORATION TASKS

- HISTORICAL DOCUMENT REVIEW
  - -- DEVELOP AND COLLECT LIST OF INDUSTRY DOCUMENTS
  - -- DETERMINE INDUSTRY DOCUMENTS APPLICABLE TO AND AID TO HUMAN FACTORS ENGINEERING
  - -- DETERMINE PLANT SPECIFIC DOCUMENTS APPLICABLE TO HUMAN FACTORS ENGINEERING
  - -- ANALYZE INDUSTRY AND PLANT DOCUMENTS
  - -- COMPILE NOTEBOOK OF HISTORICAL DOCUMENT REVIEW

- OPERATOR SURVEY
  - -- DEVELOP AND DISTRIBUTE OPERATOR QUESTIONNAIRE
  - -- COMPILE AND ANALYZE RESULTS
  - -- DEVELOP LIST OF OPERATORS FOR FOLLOW-UP INTERVIEWS
  - -- CONDUCT FOLLOW-UP INTERVIEWS
  - -- COMPILE AND ANALYZE RESULTS
  - -- REPORT RESULTS TO CRDR TEAM

- CONTROL ROOM INVENTORY
  - -- DEVELOP INVENTORY FOR THE DATABASE MANAGEMENT SYSTEM (DBMS)
  - -- LOOK UP DATA SHEETS AND DRAWINGS
  - -- EXTRACT RELEVANT INFORMATION FROM ANNUNCIATORS
  - -- ENTER INTO THE DBMS

- CONTROL ROOM ENHANCEMENTS
  - -- RESEARCH PREVIOUS CONTROL ROOM ENHANCEMENTS
  - -- DEVELOPMENT REPORT OF PREVIOUS CONTROL ROOM ENHANCEMENTS

- TASK ANALYSIS
  - -- REVIEW RELEVANT TASK ANALYSIS INFORMATION
  - -- REVIEW PROCEDURES AND DETERMINE SYSTEM FUNCTION
  - -- PERFORM TASK ANALYSIS
  - -- DETERMINE COMPONENT FUNCTIONS
  - -- IDENTIFY COMPONENT RELATED OPERATOR TASKS
  - -- PERFORM TASK ANALYSIS FOR RELATED INSTRUMENTATION
  - -- ENTER DATA INTO THE DBMS

ROLE OF THE HUMAN FACTORS CONSULTANT

ARD CORPORATION TASKS

- CONTROL ROOM SURVEY
  - -- DOCUMENT CONTROL ROOM CONVENTIONS
  - -- DOCUMENT STANDARD ABBREVIATIONS
  - -- DEVELOP CHECKLIST ENVIRONMENTAL MEASURES
  - -- DEVELOP SCHEDULE FOR PERFORMING SURVEY
  - -- PERFORM CHECKLIST SURVEY PER NUREG-0700, SECTION 6
  - -- DELIVER CHECKLIST SURVEY RESULTS TO CRDR TEAM

- VERIFICATION
  - -- DEVELOP DBMS SORTING ALGORITHMS
  - -- PERFORM COMPARISONS TO DETERMINE INSTRUMENT AVAILABILITY
  - -- FOLLOW-UP AND CONFIRM ANY MISSING INSTRUMENTS
  - -- PERFORM COMPARISONS TO DETERMINE INSTRUMENT SUITABILITY
  - -- REPORT RESULTS TO CRDR TEAM

- VALIDATION
  - -- SET UP TEST AND EVALUATION PROCEDURE
  - -- PERFORM CONTROL ROOM WALK THROUGHS AND RECORD RESULTS
  - -- ACCUMULATE AND ANALYZE RESULTS
  - -- REPORT RESULTS TO CRDR TEAM

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ARD CORPORATION'S ROLE

CRDR ASSESSMENT PHASE

- ANALYZING AND EVALUATING PROBLEMS THAT COULD ARISE FROM THE IDENTIFIED HUMAN ENGINEERING DISCREPANCIES (HEDS)

- DETERMINING THE SIGNIFICANCE OF IDENTIFIED HEDS

- DEFINING AND IMPLEMENTING A CORRECTIVE ACTION PLAN THAT APPLIES HUMAN FACTORS PRINCIPLES

- INTERFACE WITH OTHER CONTROL ROOM RELATED PROJECTS THAT MAY IMPACT THE CORRECTIVE ACTION OR NEED HUMAN FACTORS REVIEW

- INTEGRATE THE IMPLEMENTATION PROCESS TO ENSURE THAT HUMAN FACTORS ENGINEERING PRINCIPLES ARE MAINTAINED

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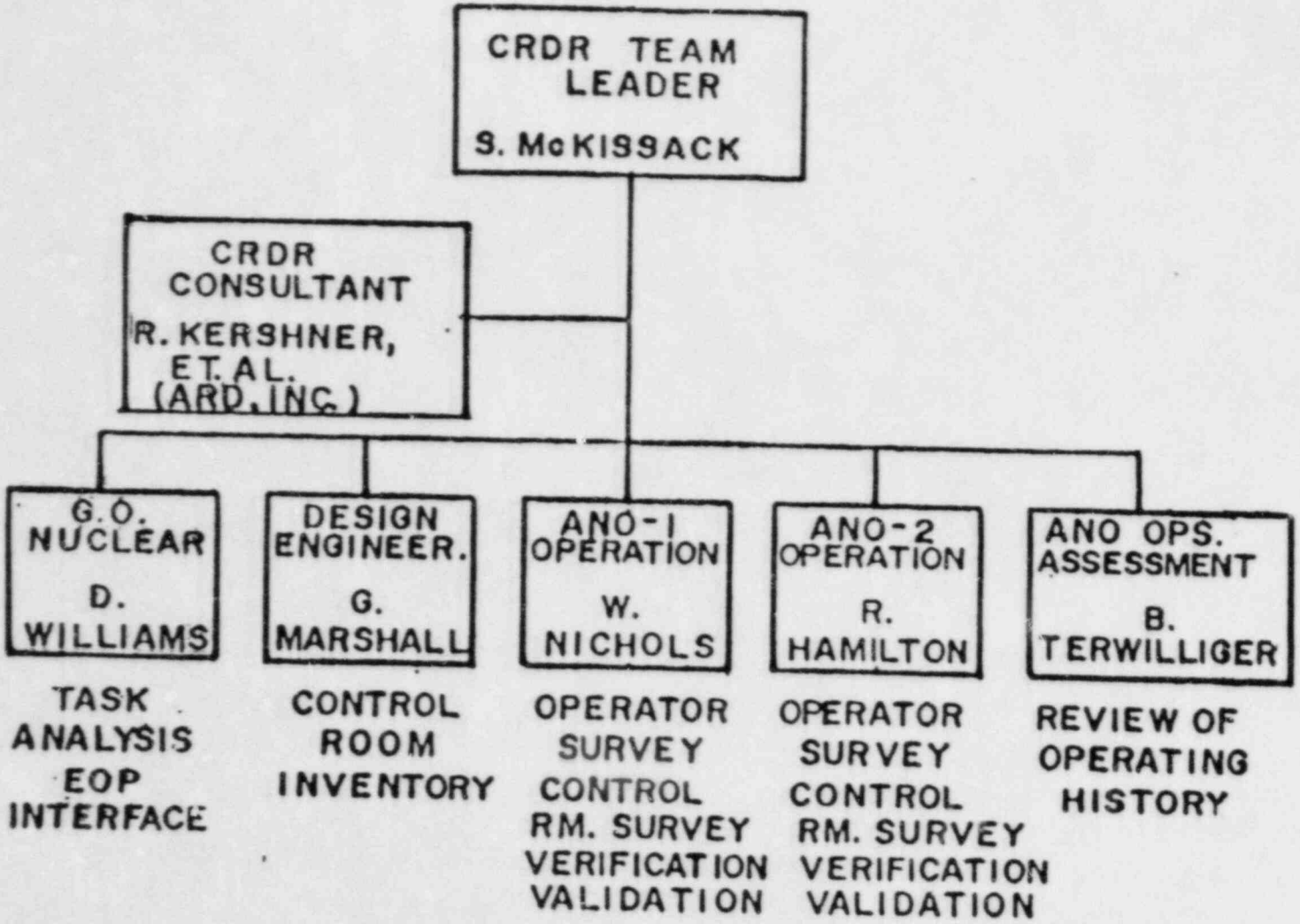
COMPARISON OF CRDR TEAM MEMBERS' QUALIFICATIONS

WITH GUIDELINES OF NUREG-0801

TEAM MEMBER	NUREG 0801 CLASSIFICATION
S. MCKISSACK	INSTRUMENTATION AND CONTROLS ENGINEERING
R. KERSHNER	HUMAN FACTORS SPECIALIST
D. WILLIAMS	NUCLEAR SYSTEMS ENGINEERING
G. MARSHALL	OTHER DISCIPLINE - ELECTRICAL ENGINEERING
W. NICHOLS	REACTOR OPERATIONS
R. HAMILTON	REACTOR OPERATIONS
B. TERWILLÍGER	REACTOR OPERATIONS SYSTEMS ANALYSIS


CRDR TEAM LEADER
S. McKISSACK
CRDR CONSULTANT
R. KERSHNER, ET. AL. (ARD, INC.)
G.O. NUCLEAR
D. WILLIAMS
DESIGN ENGINEER.
G. MARSHALL
ANO-1 OPERATION
W. NICHOLS
ANO-2 OPERATION
R. HAMILTON
ANO OPS. ASSESSMENT
B. TERWILLIGER
TASK ANALYSIS
EOP INTERFACE
CONTROL ROOM INVENTORY
OPERATOR SURVEY
CONTROL RM. SURVEY
VERIFICATION
VALIDATION
OPERATOR SURVEY
CONTROL RM. SURVEY
VERIFICATION
VALIDATION
REVIEW OF OPERATING HISTORY

LEVEL OF INVOLVEMENT - CRDR TEAM

RESPONSIBILITIES

- SERVING AS A TECHNICAL LIAISON
- MONITOR PROGRESS AND PERFORMANCE
- ENSURE CONSISTENCY WITH THE OPERATING PHILOSOPHY OF ANO
- IDENTIFY EXISTING OR POTENTIAL PROBLEMS BY DIRECT INVOLVEMENT TO PERMIT TIMELY CORRECTION
- UTILIZE KNOWLEDGE OF OVERALL CRDR PROJECT INTO THE SUCCESSFUL PERFORMANCE OF SPECIFIC TASKS

LEVEL OF INVOLVEMENT - CRDR TEAM

WEEKLY MEETINGS

- STATUS OF ALL ACTIVITIES IN PROGRESS
  - -- PROGRESS AND PERFORMANCE OF ACTIVITIES
- IDENTIFIED OR POTENTIAL PROBLEM AREAS AND SUGGESTED SOLUTIONS
- SCHEDULE AND DISCUSSION OF THE FOLLOWING WEEK'S ACTIVITIES
- OVERALL PROJECT SCHEDULE

CRDR TEAM TRAINING

COMBINED EXPERIENCE

UTILITY EXPERIENCE (ARKANSAS POWER & LIGHT COMPANY)	48 YEARS
NUCLEAR RELATED EXPERIENCE	71 YEARS
ANO OPERATIONS EXPERIENCE	25 YEARS
ARD HUMAN FACTORS EXPERIENCE	39 YEARS

ibject
2.13

NUREG-0737 SUPPLEMENT 1

§5.1.B.ii

THE REVIEW SHALL CONSIST OF:

THE USE OF FUNCTION AND TASK ANALYSIS (THAT HAD BEEN USED AS THE BASIS FOR DEVELOPING EMERGENCY OPERATING PROCEDURES TECHNICAL GUIDELINES AND PLANT SPECIFIC EMERGENCY OPERATING PROCEDURES) TO IDENTIFY CONTROL ROOM OPERATOR TASKS AND INFORMATION AND CONTROL REQUIREMENTS DURING EMERGENCY OPERATIONS.

NUREG-0700

§3.4.2.3

IT IS EXPECTED THAT THE ANALYSES PERFORMED FOR TASKS I.C.1 AND I.C.9 WILL PROVIDE MUCH, IF NOT ALL, OF THE FUNCTION DOCUMENTATION NEEDED FOR TRANSIENT AND POTENTIAL ACCIDENT EVENTS, EVEN IF THE REVISION OF PROCEDURES BASED ON THOSE ANALYSES IS NOT COMPLETE.

EOP FUNCTION REVIEW TOOLS

ANO-1 (ALL PLANT SPECIFIC)

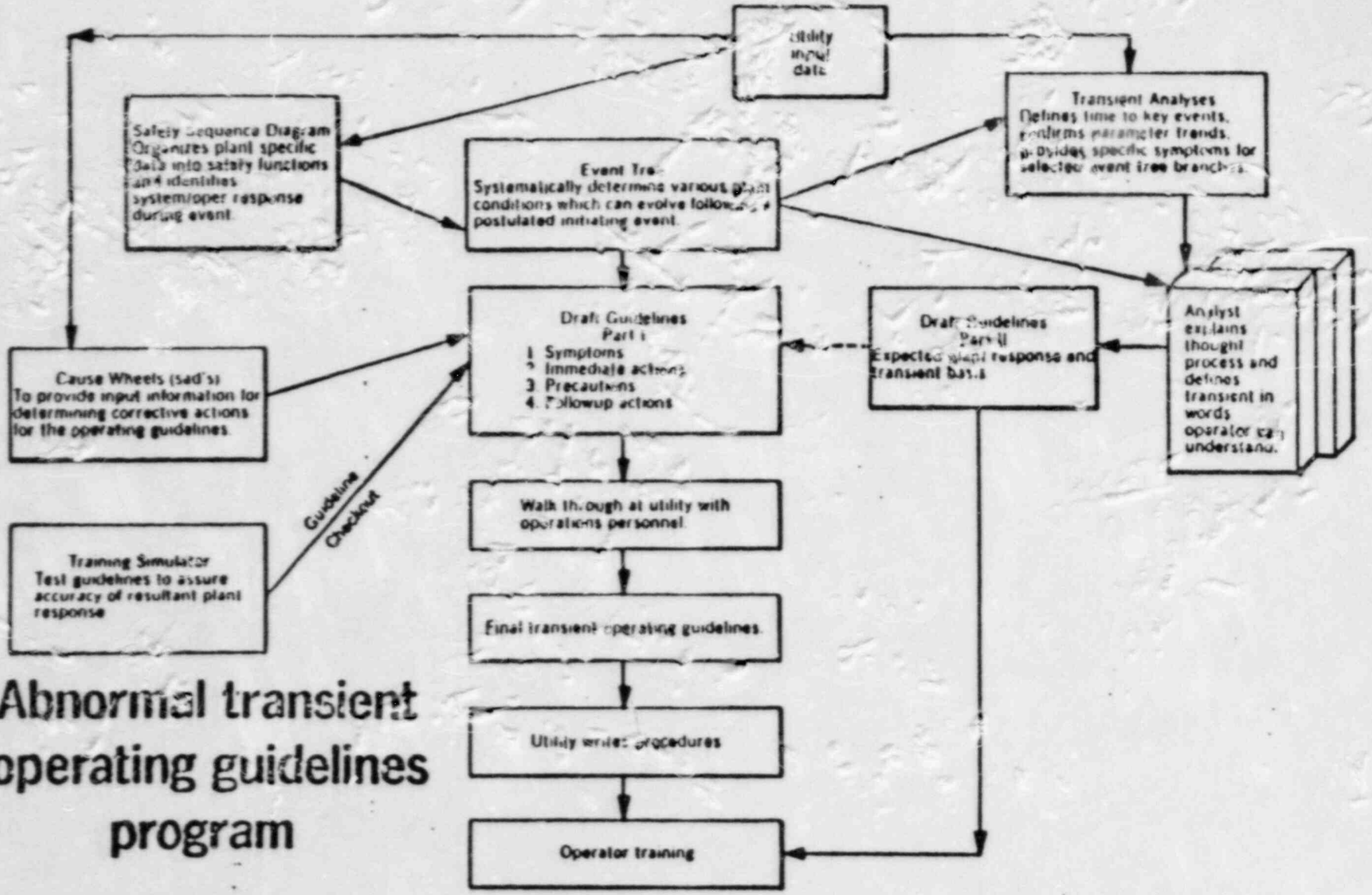
SAFETY SEQUENCE DIAGRAMS

SYSTEM AUXILIARY DIAGRAMS

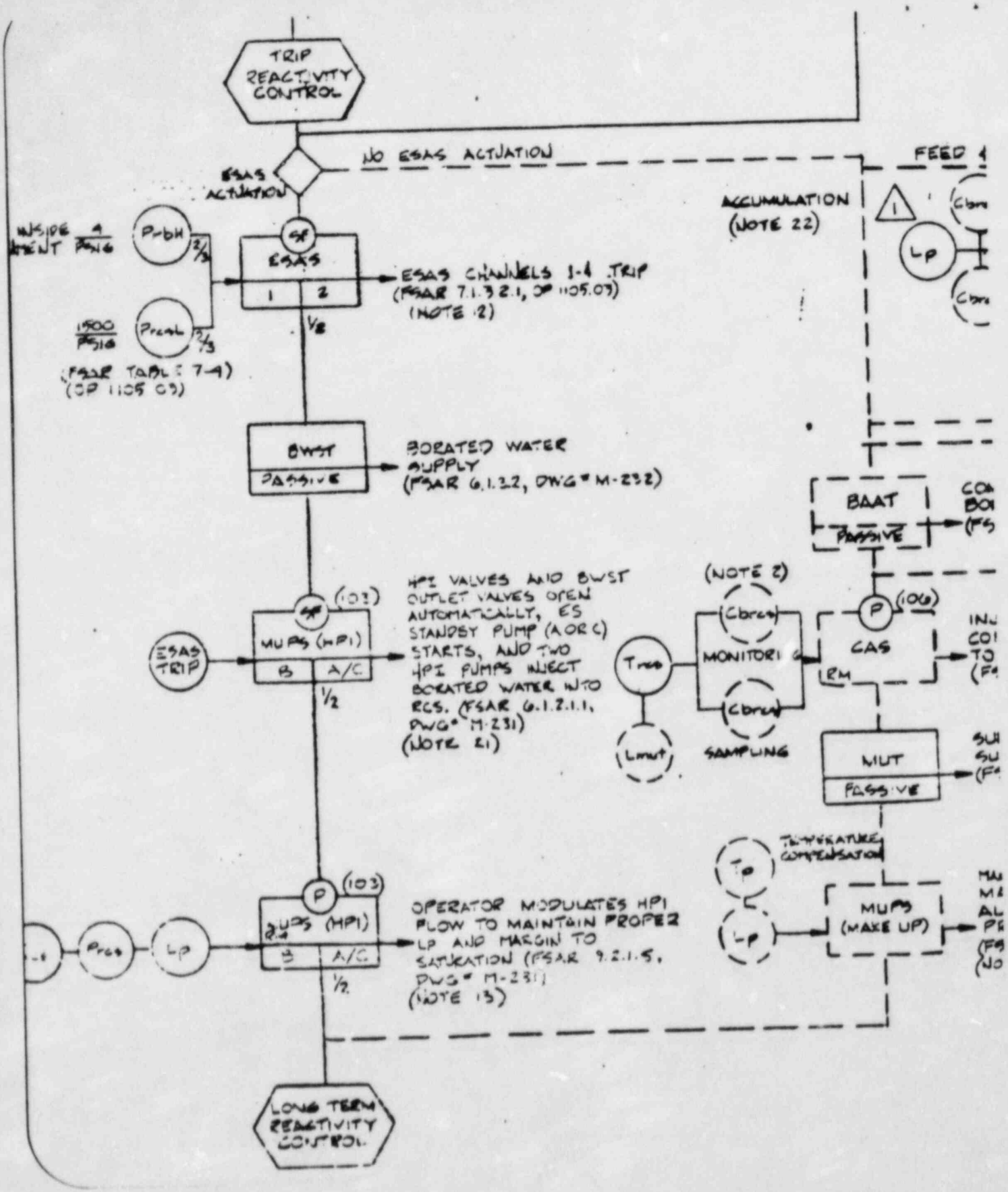
EVENT TREES

ANO-2

EOP's STILL UNDER DEVELOPMENT



Abnormal transient operating guidelines program



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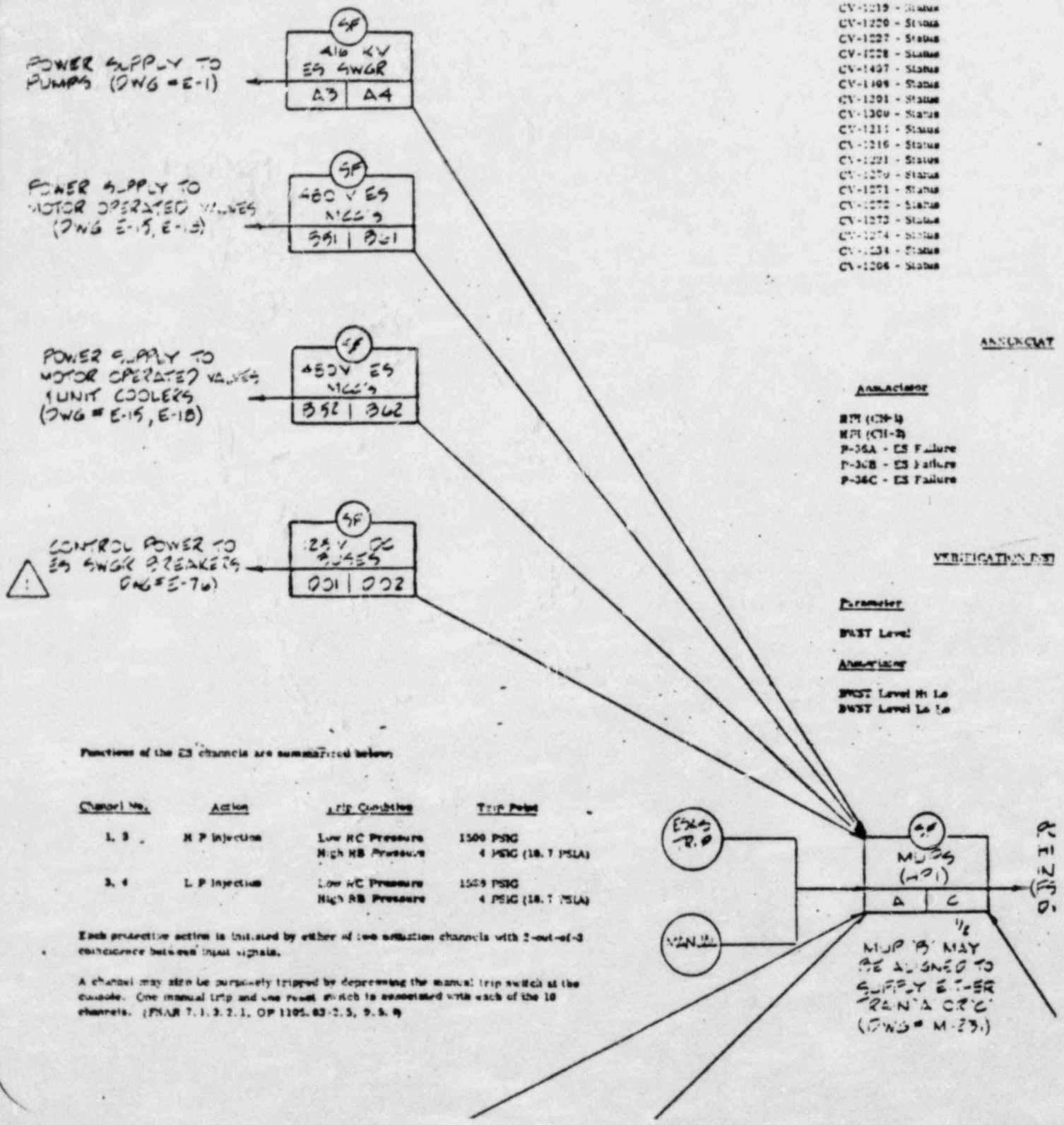


Parameter

HPI Header Flow - Train "A"
HPI Header Flow - Train "B"
P-36A - Status
P-36B - Status
P-36C - Status
CV-1219 - Status
CV-1220 - Status
CV-1227 - Status
CV-1228 - Status
CV-1407 - Status
CV-1409 - Status
CV-1201 - Status
CV-1209 - Status
CV-1211 - Status
CV-1216 - Status
CV-1221 - Status
CV-1229 - Status
CV-1271 - Status
CV-1272 - Status
CV-1273 - Status
CV-1274 - Status
CV-1234 - Status
CV-1206 - Status

Annunciator

RCP (CH-4)
RCP (CH-8)
P-36A - ES Failure
P-36B - ES Failure
P-36C - ES Failure

Parameter

BWST Level

Annunciator

BWST Level Hi Lo
BWST Level Lo Lo

Functions of the ES channels are summarized below:

Channel No.	Action	Trip Condition	Trip Point
1, 3	H P Injection	Low HC Pressure	1500 PSIG
		High NB Pressure	4 PSIG (18.7 PSIA)
2, 4	L P Injection	Low HC Pressure	1500 PSIG
		High NB Pressure	4 PSIG (18.7 PSIA)

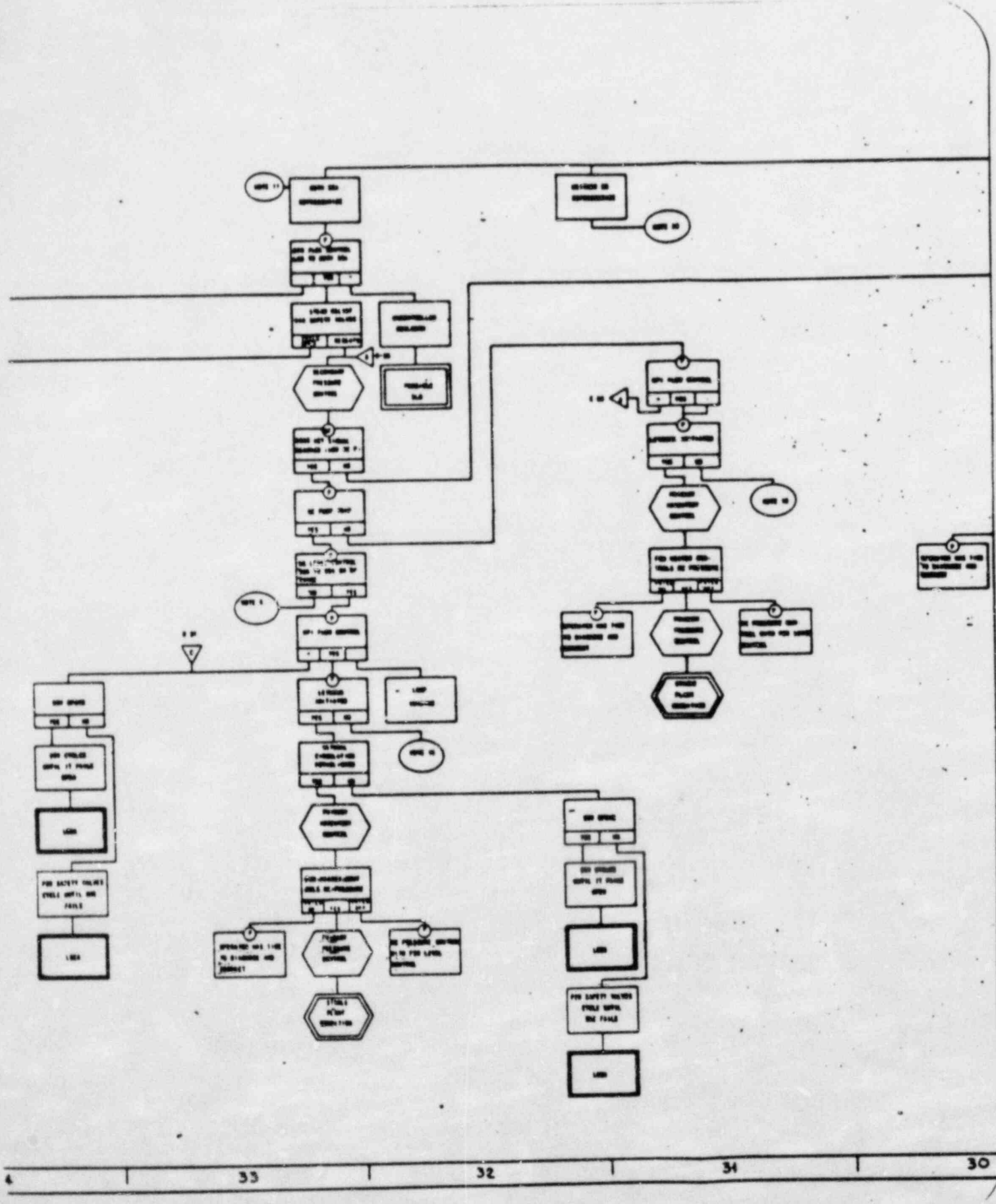
Each protective action is initiated by either of two actuation channels with 2-out-of-3 coincidence between input signals.

A channel may also be purposely tripped by depressing the manual trip switch at the console. One manual trip and one reset switch is associated with each of the 10 channels. (FSAR 7.1.3.2.1, OP 1105.03-2.5, 9.5.9)

subject no.

ubject

o.



Procedure Section: 4.0 Overheating

Date 3/20/84
Analyst ALL/KW

STEP	OPERATOR FUNCTION	OPERATOR TASK
4.0	Identify overheating cond'n	4.1 Observe temperatures and RCS temp. >560°
4.1.A	Verify secondary system	4.2 Verify feedwater supplied to both OTSGs
	response	
4.1.B	Verify secondary system	4.3 Verify both OTSGs at low limit
	response	
4.1.C	Verify secondary system	4.4 Verify OTSGs pressures at 1050 PSIG
	response	
4.1.C	(Overheating cause unknown)	4.5 Acknowledge Pressurizer Lvl may be offscale
	- Start HPI	high
4.1.C	Start HPI	4.6 Open CV-1407 and CV-1408 BWST Suction Vlvs
4.1.C	Start HPI	4.7 Start ES STDBY or Make-up PP Oil PP and ES
		STDBY M/U PP
4.1.C	Start HPI	4.8 Verify ERV block Vlv open
4.1.C	Start HPI	4.9 Allow ERV to cycle in auto
4.1.C	Start HPI	4.10 Fully open all four HPI Vlvs
		4.11 Open Th High Point Vents and RX Vessel Head
4.1.C	Start HPI	Vents
		4.12 Close M/U PP Recirc. Vlvs, and verify M/U
		Tank floating on BWST
4.1.C	Start HPI	4.13 Stop RB Sump draining and isolate RE-2400
4.2	Reduce heat load	4.14 Stop all but one RCPs
4.2	Reduce heat load	4.15 Stop all RCPs if subcooling margin is lost
4.3.A	Maintain RC pressure -	4.16 Establish maximum letdown flow
	natural circulation	
4.3.B	Maintain RC pressure -	4.17 Establish make-up flow in manual and full
	natural circulation	open
4.3.B	Maintain RC pressure -	4.18 Observe RCS level, pressure and temp.
	forced circulation	
4.3.B	Maintain RC pressure -	4.19 Open ERV
	forced circulation	
4.3.B	Control RC pressure	4.20 Close Th High Point Vents on RX Vessel Head
		Vents to maintain 60°-70° subcooling margin
4.3.B	Control RC pressure	4.21 Throttle HPI valves when >50° subcooled.
4.3.B	Control RC pressure	4.22 Stop HPI pump when >50° subcooled

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Transients Selected for Guideline Preparation

- Increase in heat removal by secondary system
  - Small steam leaks
  - Excessive feedwater flow
- Decrease in heat removal by secondary system
  - Loss of feedwater
  - Loss of station power
- Decrease in reactor coolant inventory
  - Steam generator tube rupture
  - Inadequate core cooling
  - Loss of coolant

TASK ANALYSIS INSTRUMENTATION REQUIREMENT FORM

Same as

Page 3 of 56

Date 3/20/84

Analyst ALL/MG

4.0 OPERATION
Procedure Section

Task Number

4.1A
Step Number

Verify Secondary System Response
Function/Activity

Alt. to:

4.2
Task Number

Verify Feedwater Supplied to both OTSGs
Task Title

Task Number

OP	WRAB	OBJECT																OTHER PERFORMANCE REQUIREMENTS	EXIT OR COMMENTS
		CONTROL								INDICATOR/FEEDBACK									
		PARAMETER	EQUIPMENT	POSITION	STATUS	ID	TYPE	MODE	OTHER	PARAMETER	STATE	TYPE	ID	UNITS	RANGE	DIV	OTHER		
1	1.1	EMERG FW PP STATUS (STEAM) P7A	STM SUPPLY VLV	OPEN	OPEN		J	D		STM SUPPLY VLV STATUS	LIT RED	CSL							
1	1.1	EMERG FW PP STATUS (STEAM) P7A	STM SUPPLY VLV							EMERG FW PP DISCH PRESS P7A	V	M		PSIG	500-1500	100			
1	1.1	TURBINE SPEED	STEAM DRIVEN FW TURBINE							STEAM DRIVEN FW TURBINE	V	M		RPM	0-5000	500			

KEY
DISCRETE
CONTINUOUS
CALCULATED
PUSH
TURN

3.3 LOCK-OUT
3.4 TOUCH
3.5 ADJUSTS
3.6 TYPES
3.7 PULL

4.1 INFORMS
4.2 RECOMMENDS
4.3 RECEIVES

CONTROL TYPE KEY
J J HANDLE
JS JOYSTICK
K KEY OPERATED
LP LIGHTED PUSHBUTTON
NP NON-LIGHTED PUSHBUTTON

B BADGER SWITCH
BS ROTARY SWITCH
S SLIDE SWITCH
T T HANDLE
TG TOGGLE SWITCH

TW THUMBWHEEL
TS TOUCHSCREEN
KB KEYBOARD
C CONTROLLER
A AUTO

M MAN
A/M AUTO W/MAN OVERRIDE
M/A MANUAL W/AUTO OVERRIDE

CONTROL MODE
D DISCRETE
C CONTINUOUS

SWITCH BINDING KEY
SA SPRING RETURN
I IMMOBILE
B BACKLIT

DISPLAY TYPE KEY
A ANNUNCIATOR
C DRUM COUNTER
EC ELECTRONIC COUNTER
M METER
R RECORDER

D DIGITAL DISPLAY
CSL CONTROL STATUS LIGHT
LL LEGEND LIGHT
NL NON LIGHTED LIGHT
CRT CATHODE RAY TUBE

G GRAPHIC

Unit 1
Page 1 of 2
Date 4 / 9 / 84
Analyst PG

Panel:

ID TI2223
Loc
Sys
Param
Label ICW TEMP^NON-NUC; NUC
Type VM
Manuf.
Model
Range 0-20
Div 1
Units °F
Markings °F X 10
Pens
No. Recorded Pts.
Other Label
Notes DM7

ID TI2225
Loc
Sys
Param
Label ICW TEMP^NON-NUC; NUC
Type VM
Manuf.
Model
Range 0-20
Div 1
Units °F
Markings °F X 10
Pens
No. Recorded Pts.
Other Label
Notes DM7

ID FI2888A
Loc
Sys
Param
Label EFW TEST LOOP^FLOW;PRESS
Type VM
Manuf.
Model
Range 0-10
Div .2
Units GPM
Markings GPM X 100
Pens
No. Recorded Pts.
Other Label FI 2888A
Notes DM8

ID PI2888A
Loc
Sys
Param
Label EFW TEST LOOP^FLOW;PRESS
Type VM
Manuf.
Model
Range 0-14
Div .2
Units PSIG
Markings PSIG X 100
Pens
No. Recorded Pts.
Other Label PI 2888A
Notes DM8

ID PIS2811
Loc
Sys
Param
Label P7A DISCH PRESSURE
Type VM
Manuf.
Model
Range 0-14
Div 2
Units PSIG
Markings PSIG X 100
Pens
No. Recorded Pts.
Other Label
Notes DM9

ID
Loc
Sys
Param
Label P7A DISCH^PRESSURE
Type VM
Manuf.
Model
Range 0-14
Div 2
Units PSIG
Markings PSIG X 100
Pens
No. Recorded Pts.
Other Label
Notes This side is a setpoint

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ARKANSAS NUCLEAR ONE
CONTROL ROOM SURVEY

- CONTROL ROOM WORKSPACE
- COMMUNICATIONS
- ANNUNCIATOR WARNING SYSTEM
- CONTROLS
- VISUAL DISPLAYS
- LABELS AND LOCATION AIDS
- PROCESS COMPUTERS
- PANEL LAYOUT
- CONTROL-DISPLAY INTEGRATION

CONTROL ROOM SURVEY

OBJECTIVE: TO CONSIDER THE EXTENT TO WHICH HUMAN PERFORMANCE CHARACTERISTICS ARE CONSIDERED WITHIN THE CONTROL ROOM.

APPROACH: A COMPARISON OF THE INSTRUMENT AND CONTROL FEATURES TO HUMAN ENGINEERING GUIDELINES USING DATA FROM:

- HISTORICAL EVENT REVIEW
- OPERATOR SURVEY
- TASK ANALYSIS
- OBSERVATION

ARKANSAS NUCLEAR ONE
PROCEDURE FOR CHECKLIST SURVEY

1. ITEMS NEEDING OPERATOR ASSISTANCE IN ACTIVATING INSTRUMENTS.

2. ITEMS HUMAN FACTORS SPECIALIST CAN PERFORM INDEPENDENTLY.

3. ITEMS DERIVED FROM OTHER CRDR ACTIVITIES.

4. ENVIRONMENTAL.

GUIDELINE

COMPLIANCE CHECKLIST

N/A	Yes	No	Reference/Comment

6.1.2.2 STAND-UP CONSOLE DIMENSIONS

a. CONSOLE HEIGHT TO SEE OVER–When it is necessary for a standing operator to see over the top, console height (with or without annunciator panels) should not exceed 58 inches.

b. CONTROL HEIGHT–The range of suitable control height on stand-up consoles is defined by the reach radius of the 5th and 95th percentiles (as defined in Exhibit 6.1-5). Measurements should be made using shoulder height and functional reach with the shoulder in line with the leading edge of the benchboard, as shown in Exhibit 6.1-6. The exhibit shows the results of two console designs with differing benchboard slope and depth. Controls may be placed somewhat higher on consoles with shallower and/or more steeply angled benchboards, which allow the shoulder reference point to be closer to the back of the benchboard and to the vertical panel.

(1) The highest control on a stand-up console should be within the highest reach of the 5th percentile female without stretching or using a stool, ladder, etc.

(2) The lowest controls on a stand-up console should be within the lowest reach of the 95th percentile male without bending or stooping.

c. BENCHBOARD SLOPE – The benchboard slope, in conjunction with its depth, should result in all controls being within the reach radius of the 5th percentile female, as illustrated in Exhibit 6.1-6.

d. CONTROL DISTANCE FROM THE FRONT EDGE OF THE CONSOLE

(1) Controls should be set back a minimum of 3 inches from the front edge to protect against accidental activation.

HISTORICAL DOCUMENT REPORT
ARKANSAS POWER & LIGHT
ANO-1

- LICENSEE EVENT REPORT (LER) - ALL REPORTABLE OCCURRENCES
- SIGNIFICANT EVENT REPORT (SER) - COMPILATION OF SIMILAR LERS
- SIGNIFICANT OPERATING EVENT REPORT (SOER) - COMPILATION OF SIGNIFICANT SERS
- UNIT TRANSIENT REPORT - ARKANSAS NUCLEAR ONE-1 TRIPS
- TRANSIENT ASSESSMENT PROGRAM (TAP) - B AND W PLANT TRIPS

HISTORICAL DOCUMENT REVIEW

ARKANSAS NUCLEAR ONE

ANO-1

- COLLECT LERs, SERs, AND SOERs FOR ALL B&W PLANTS.
- COLLECT ALL TAP AND UNIT TRANSIENT REPORTS.
- SORT REPORTS FOR HUMAN FACTORS APPLICABLE.
- SORT REPORTS FOR CONTROL ROOM SPECIFIC.
- SORT REPORTS FOR ANO-1 APPLICABLE.
- ASSESS IF PROBLEM HAS BEEN CORRECTED AT ANO-1.
- WRITE HEDs.

Arkansas Nuclear One - 1
Historical Document Review

	Summary of Results of Sorts					
	LER	SER	SOER	TAP	Transient Report	Total
Not Applicable to HFE	277	36	12	89	23	437
Not Control Room Related	23	3	4	1	0	31
Not Applicable to ANO-1	8	0	0	11	0	19
Problem Corrected at ANO-1	10	2	4	14	6	36
HED Written	1	0	0	2	1	4
Total	319	41	20	117	30	527

Arkansas Nuclear One - 1
Historical Document Review

The following problems were responsible for many of the events found in the reports reviewed:

- Equipment failure, wires crossed, improper connections
- Equipment not positioned correctly
- Alarm malfunction
- Incorrect breaker alignment
- Inaccurate or incorrect calibration
- Use of non-qualified equipment
- Installation of improper spare parts
- Failure to properly follow a procedure
- Inadequate (deficient or inconsistency) procedure
- Misinterpretation of procedure, instructions
- Inadequate training (especially with new employees)
- Lack of administrative controls
- Inadequate monitoring
- Failure to complete surveillance tests on time
- Missed samples
- Acceptance criteria of procedure not met
- Creation of event contrary to Technical Specifications
- Exceeding Technical Specification limits
- Improperly completed records
- Fire protection deficiencies (removal of fire barriers, fire door blocked open, fire penetrations not sealed, fire pumps out of service)
- Actions/errors by contractors or maintenance personnel
- Inadequate maintenance

Arkansas Nuclear One - 1
Historical Document Review
Problem Analysis Report (PAR)

Name of Investigator(s): _____
Report Type and Number: _____
Station: _____ Unit: _____
Event Date: _____ Operating Status: _____

Circumstances and Events Leading to the Problem: _____

_____

_____

Nature of the Problem: _____

_____

_____

Steps Taken to Correct or Alleviate the Problem _____

_____

_____

Outcome: _____

_____

_____

Corrective Measures Undertaken: _____

_____

_____

Human Performance Problems Associated With Event: _____

_____

_____

Arkansas Nuclear One - 1
Historical Document Review
Problem Analysis Report (PAR) (Cont.)

Applicable to Plant Under Review? Yes _____ No _____
(If no, end form here.)

In Which Areas: _____

_____

_____

Corrective Actions Taken: _____

_____

_____

Unresolved Discrepancies: _____
(If none, end form here.)

_____

_____

HED Number: _____

ARKANSAS NUCLEAR ONE
OPERATOR SURVEY

	NUMBER	PERCENTAGE
QUESTIONNAIRES DISTRIBUTED	48	100%
QUESTIONNAIRES COMPLETED	27	56%
FOLLOW-UP INTERVIEWS	20	42%

PERSONNEL SURVEY SUMMARY FORM

1. HFS Analyst: _____
2. Station: _____

Population Demographics and Statistics

Frequency

MEAN STATISTICS

Group	N	Sex M	Sex F	Height	Age	Nuclear Oper Exp.	Control Board Oper Exp.	#Yrs RO	#Yrs SRO
Non-Licensed Operator	3	0		72.33"	28.33	9.00	2.00	0	0
Reactor Operator	11	0		72.59"	33.35	9.91	3.11	1.98	0
Senior Reactor Operator	13	0		70.00"	36.00	14.46	6.12	3.26	3.38
Overall	27	0		71.31"	34.11	12.00	4.44	2.38	1.63

MEDIAN STATISTICS

Frequency

Group	N	Sex M	Sex F	Height	Age	Nuclear Oper Exp.	Control Board Oper Exp.	#Yrs RO	#Yrs SRO
Non-Licensed Operator	3	0		73.00"	28.75	8.50	0.25	0	0
Reactor Operator	11	0		73.67"	30.00	9.33	1.75	1.42	0
Senior Reactor Operator	13	0		70.00"	35.75	14.00	5.75	2.67	2.00
Overall	27	0		71.67"	32.33	10.50	3.50	1.81	0.40

Arkansas Nuclear One - 1

Control Room Design Review Operator Survey

A. Workspace Layout and Environment

A.1. Are additional controls needed in the control room? Your response should consider the controls needed to respond to potential emergency or abnormal situations in addition to the various modes of normal operations.

a. None
b. 1 or 2
c. Several
d. Many

Please identify any needed controls and your reasons for wanting them. Also identify any systems in which the controls are particularly well designed, i.e. you would not like to see them changed.

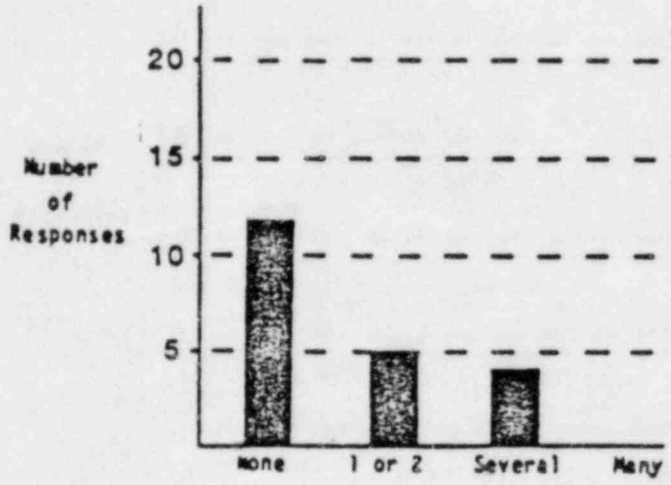
A.2 Are any of the controls that are presently in the control room unnecessary? That is, are there controls that are not used in any mode of plant operation?

a. None
b. 1 or 2
c. Several
d. Many

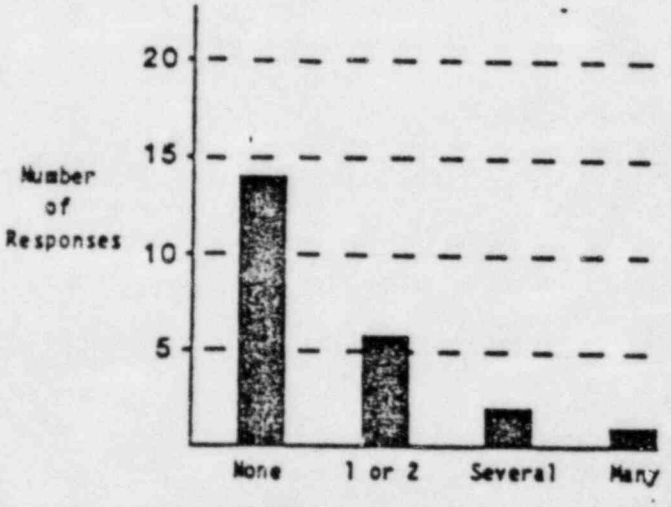
Please identify any extraneous controls.

A. Workspace Layout and Environment

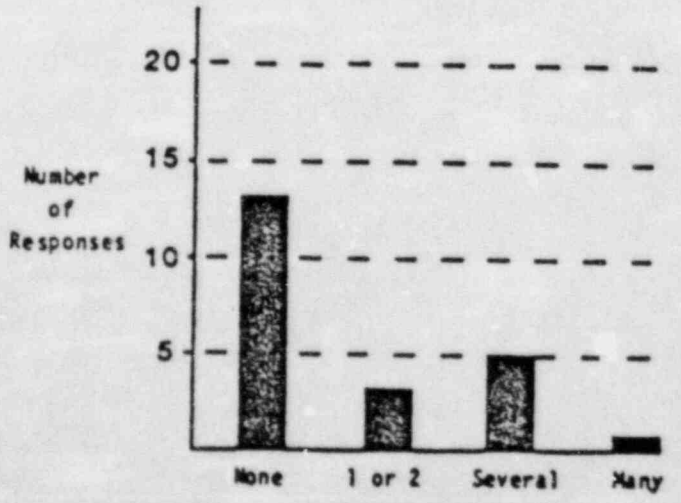
A.1. Are additional controls needed in the control room?



A.2. Are any of the controls that are presently in the control room unnecessary?



A.3. Are additional indicators (i.e. meters, status lights, chart recorders) needed in the control room?



ARKANSAS NUCLEAR ONE
ENVIRONMENTAL SURVEY

I. LIGHTING
   1. ILLUMINATION
      A. MAIN CONTROL BOARDS
      B. OPERATOR DESKS, CONSOLES
      C. EMERGENCY (STANDBY)
   2. LUMINANCE - CONTRAST RATIOS
   3. REFLECTANCE

II. SOUND
   1. AMBIENT
   2. AMBIENT WITH PRINTERS AND COMMUNICATION EQUIPMENT
   3. ANNUNCIATOR HORNS

III. VENTILATION
   1. TEMPERATURE
   2. HUMIDITY
   3. AIR VELOCITY
   4. AIR QUANTITY

6.4.5.1 THUMBWHEELS (Cont'd)

d. DISCRETE SETTING (STEPPED) THUMBWHEELS (Cont'd)

(2) Discrete thumbwheel controls should conform to the following specifications. (See Exhibit 6.4-14.)

(a) Diameter (D) (inches)
Minimum 1.5
Maximum ~~2.5~~ 3.0

(b) Trough distance (L) (inches)
Minimum 0.45
Maximum 0.75

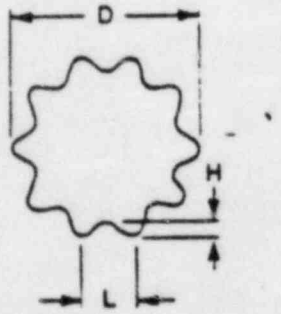
(c) Width (W) (inches)
Minimum 0.1

(d) Depth (H) (inches)
Minimum 0.125
Maximum 0.5

(e) Resistance (ounces)
Minimum 6
Maximum 20

COMPLIANCE CHECKLIST

N/A	Yes	No	Reference/Comment



	Diameter (D) (inches)	Trough Distance (L) (inches)	Width W) (inches)	Depth (H) (inches)	Resistance (ounces)
Minimum	1.5	0.45	0.1	0.125	6
Maximum	~~2.5~~ 3.0	0.75		0.5	20

Exhibit 6.4-14. Recommended dimensions for discrete thumbwheel controls.

ANO checklist uses 3.0" as a maximum, based on MIL-STD 472 C

ARKANSAS NUCLEAR ONE - 1
CONTROL ROOM HUMAN ENGINEERING DISCREPANCY RECORD

Originator: Date: No.: Page ___ of ___

Source of HED:

Panel ID#	Equipment ID#	Equipment Name

Guideline Ref.: _____ Photo Log #: _____

Description of Discrepancy

Comments/Recommendations

LIGHTING SURVEY ILLUMINANCE RECORD

Plant: _____ Date: _____ Time: _____

Measurements made by: _____ Sheet # ___ of ___

Equipment/Instrument used: _____

Serial #: _____ Calibration date: _____

Location Reference Number	Panel I.D. Number	Full AC Ambient	Full Emergency	Other Conditions (Specify)

LIGHTING SURVEY - LUMINANCE AND REFLECTANCE RECORD

Plant: _____ Date: _____ Time: _____ Sheet # ___ of ___

Measurements made by: _____ Equipment/Instrument used: _____

Serial #: _____ Calibration date: _____

Location Ref. No.	Panel # and Surfaces	Record					Calculations				
		Panel		Meter/Display			Luminance Ratio of Display: Panel		Reflectance Ratio		
		Reflect. Pad	Panel Background	Reflect. Pad	Surface w/Glare	Surface w/o Glare	w/Glare	w/o Glare	Panel: Pad	Meter/Display: Pad	
										w/Glare	w/o Glare

SOUND SURVEY RECORD

Plant: _____ Date: _____ Time: _____ Sheet # ___ of ___

Measurements made by: _____

Equipment / Instrument used: _____

Serial # : _____ Calibration Date: _____

Operator Work Station	dB(A)	Octave Band Cents. Frequency					Remarks
		250	500	1K	2K	4K	

HUMIDITY/TEMPERATURE RECORD

Plant: _____ Date: _____ Time: _____

Measurements made by: _____ Sheet # ___ of ___

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.			
	Floor			
	6 ft.			
	Floor			
	6 ft.			

AIR VELOCITY SURVEY RECORD

Plant: _____ Date: _____ Time: _____

Measurements made by: _____ Sheet # ____ of _____

Equipment/Instrument used: _____

Serial #: _____ Calibration date: _____

Location	6 ft.	4 ft.

ASSESSMENT PHASE OBJECTIVES

- EVALUATE PROBLEMS THAT COULD ARISE FROM IDENTIFIED HEDS
- DETERMINE SIGNIFICANCE OF HEDS IDENTIFIED
- DEVELOP ACTION PLAN FOR CORRECTING HEDS

Scotch
584 Transparency Mounting Frame
Commercial Tape Division 3M
St. Paul, MN 55144 Made in U.S.A.

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584 Transparency Mounting Frame
Commercial Tape Division 3M
St. Paul, MN 55144 Made in U.S.A.

ASSESSMENT PHASE SUMMARY

- ALL HEDS WILL BE EVALUATED

- HEDS WILL BE CLASSIFIED INTO THREE BROAD CLASSIFICATIONS
  - -- HEDS WITH SAFETY SIGNIFICANCE TO EMERGENCY RESPONSE
  - -- HEDS WHOSE CORRECTION WOULD IMPROVE NON-EMERGENCY OPERATIONS
  - -- HEDS CONTRIBUTING TO OVERALL CONTROL ROOM IMPROVEMENT NOT RELATED TO EMERGENCY OR NON-EMERGENCY OPERATIONS

- HEDS WILL BE PRIORITIZED AND RANKED ACCORDING TO ASSESSMENT CRITERIA AND GUIDELINES
  - -- QUALITATIVE CRITERIA WILL BE DEVELOPED IN CONJUNCTION WITH THE HUMAN FACTORS CONSULTANT TO CONSIDER SUCH FACTORS AS:
    - ◊ THE POTENTIAL FOR HED CAUSING OR CONTRIBUTING TO OPERATOR ERROR
    - ◊ OPERATOR PERFORMANCE AND TASK
    - ◊ PLANT OPERATION
    - ◊ COST BENEFITS

- FINAL PRIORITY AND RANKING WILL BE THE COMBINED ASSESSMENT OF THE CRDR TEAM

DEVELOPMENT OF DESIGN ALTERNATIVES AND SOLUTION SELECTION

PROJECT SCOPING REPORTS

CONTENTS

- DESCRIPTION OF THE PROBLEM
- DEVELOPMENT AND DESCRIPTION OF DESIGN ALTERNATIVES
- DEVELOPMENT OF COST ESTIMATES
- DEVELOPMENT OF SCHEDULES
- SELECTION OF DESIGN ALTERNATIVES
- DOCUMENTS TO BE PREPARED OR REVISED TO IMPLEMENT DESIGN
- DIVISION OF RESPONSIBILITY

Scotch
584 Transparency Mounting Frame
Commercial Tape Division 3M
St. Paul, MN 55144 Made in U.S.A.

_____

DCP NO._____

FOR INFORMATION ONLY

DCP TITLE:_____

_____

_____

_____

PREPARED BY:_____ DATE:_____
(Project Engineer)

REVIEWED BY:_____ DATE:_____
(Lead Engineering Supervisor)

_____ DATE:_____
(Lead Engineering Manager)

Civil	Mech.	I&C	Elect.

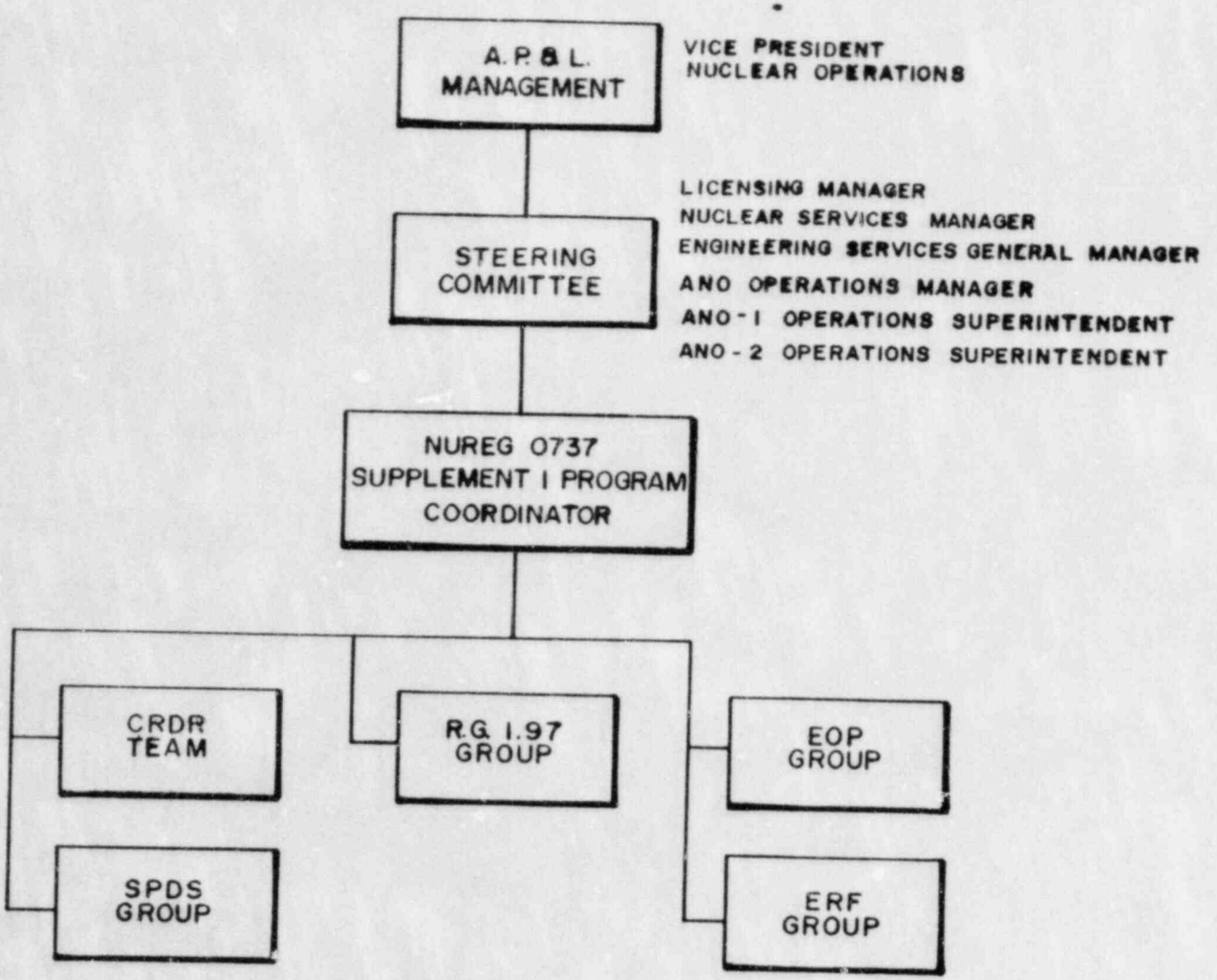
CONCURRENCE:_____ DATE:_____
(Plant Operations Supt.)

_____ DATE:_____
(Plant Engineering Supt.)

cc: Plant Engineering Superintendent
Plant Operations Superintendent
General Manager-Engineering Services
Lead Engineering Supervisor
Lead Engineering Manager

Scotch
584 Transparency Mounting Frame
D.C. Part No. 0-21268-19414
8-6969-4219-6
Commercial Tape Division 3M
St. Paul, MN 55144 Made in U.S.A.

NUREG 0737 SUPPLEMENT I ORGANIZATIONAL STRUCTURE



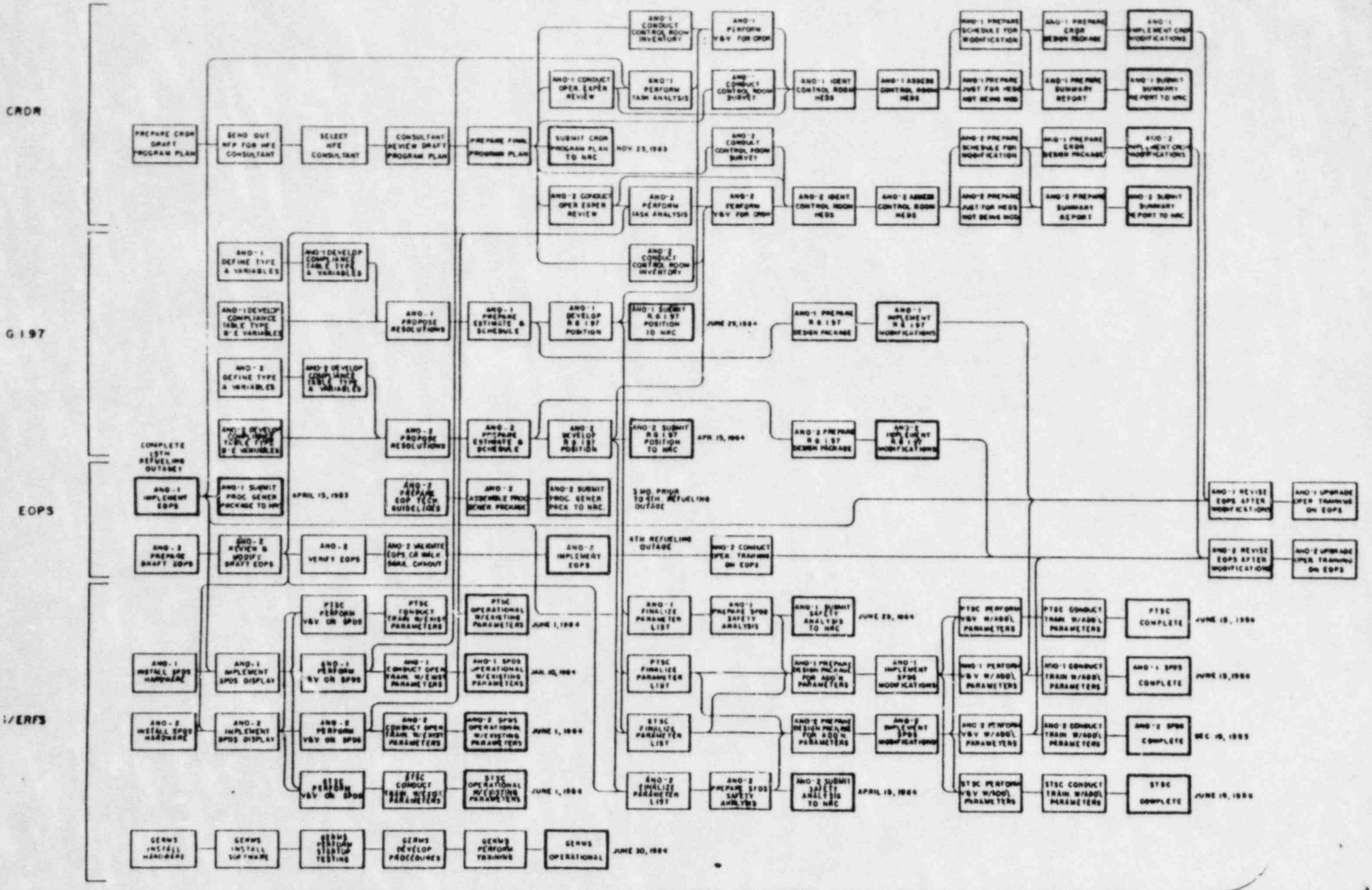

CRDR
G.1.97
EOPS
SPDS/ERFS
PREPARE CRDR DRAFT PROGRAM PLAN
SEND OUT RFP FOR HFE CONSULTANT
SELECT HFE CONSULTANT
CONSULTANT REVIEW DRAFT PROGRAM PLAN
PREPARE FINAL PROGRAM PLAN
SUBMIT CRDR PROGRAM PLAN TO NRC
NOV 23, 1983
AND-1 CONDUCT CONTROL ROOM INVENTORY
AND-1 PERFORM V&V FOR CRDR
AND-1 CONDUCT OPER EXPER REVIEW
AND-1 PERFORM TASK ANALYSIS
AND-1 CONDUCT CONTROL ROOM SURVEY
AND-1 IDENT CONTROL ROOM HEDS
AND-1 ASSESS CONTROL ROOM HEDS
AND-1 PREPARE SCHEDULE FOR MODIFICATION
AND-1 PREPARE JUST FOR HEDS NOT BEING MOD
AND-1 PREPARE CRDR DESIGN PACKAGE
AND-1 PREPARE SUMMARY REPORT
AND-1 IMPLEMENT CRDR MODIFICATIONS
AND-1 SUBMIT SUMMARY REPORT TO NRC
AND-2 CONDUCT CONTROL ROOM INVENTORY
AND-2 CONDUCT OPER EXPER REVIEW
AND-2 PERFORM TASK ANALYSIS
AND-2 CONDUCT CONTROL ROOM SURVEY
AND-2 PERFORM V&V FOR CRDR
AND-2 IDENT CONTROL ROOM HEDS
AND-2 ASSESS CONTROL ROOM HEDS
AND-2 PREPARE SCHEDULE FOR MODIFICATION
AND-2 PREPARE JUST FOR HEDS NOT BEING MOD
AND-2 PREPARE CRDR DESIGN PACKAGE
AND-2 PREPARE SUMMARY REPORT
AND-2 SUBMIT SUMMARY REPORT TO NRC
AND-1 DEFINE TYPE A VARIABLES
AND-1 DEVELOP COMPLIANCE TABLE TYPE A VARIABLES
AND-1 DEVELOP COMPLIANCE TABLE TYPE B-E VARIABLES
AND-1 PROPOSE RESOLUTIONS
AND-1 PREPARE ESTIMATE & SCHEDULE
AND-1 DEVELOP R.G. 1.97 POSITION
AND-1 SUBMIT R.G. 1.97 POSITION TO NRC
JUNE 29, 1984
AND-1 PREPARE R.G. 1.97 DESIGN PACKAGE
AND-1 IMPLEMENT R.G. 1.97 MODIFICATIONS
AND-2 DEFINE TYPE A VARIABLES
AND-2 DEVELOP COMPLIANCE TABLE TYPE A VARIABLES
AND-2 DEVELOP COMPLIANCE TABLE TYPE B-E VARIABLES
AND-2 PROPOSE RESOLUTIONS
AND-2 PREPARE ESTIMATE & SCHEDULE
AND-2 DEVELOP R.G. 1.97 POSITION
AND-2 SUBMIT R.G. 1.97 POSITION TO NRC
APR 15, 1984
AND-2 PREPARE R.G. 1.97 DESIGN PACKAGE
AND-2 IMPLEMENT R.G. 1.97 MODIFICATIONS
COMPLETE 15TH REFUELING OUTAGE
AND-1 IMPLEMENT EOPS
AND-1 SUBMIT PROC GENER PACKAGE TO NRC
APRIL 15, 1983
AND-2 PREPARE EOP TECH GUIDELINES
AND-2 ASSEMBLE PROC GENER PACKAGE
AND-2 SUBMIT PROC GENER PACK TO NRC
3 MO. PRIOR TO 4TH. REFUELING OUTAGE
AND-1 REVISE EOPS AFTER MODIFICATIONS
AND-1 UPGRADE OPER TRAINING ON EOPS
AND-2 PREPARE DRAFT EOPS
AND-2 REVIEW & MODIFY DRAFT EOPS
AND-2 VERIFY EOPS
AND-2 VALIDATE EOPS (CR WALK-THRU, SIMUL, CMOUT)
AND-2 IMPLEMENT EOPS
4TH REFUELING OUTAGE
AND-2 CONDUCT OPER TRAINING ON EOPS
AND-2 REVISE EOPS AFTER MODIFICATIONS
AND-2 UPGRADE OPER TRAINING ON EOPS
AND-1 INSTALL SPDS HARDWARE
AND-1 IMPLEMENT SPDS DISPLAY
AND-2 INSTALL SPDS HARDWARE
AND-2 IMPLEMENT SPDS DISPLAY
PTSC PERFORM V&V ON SPDS
PTSC CONDUCT TRAIN W/EXIST PARAMETERS
PTSC OPERATIONAL W/EXISTING PARAMETERS
JUNE 1, 1984
AND-1 PERFORM V&V ON SPDS
AND-1 CONDUCT OPER TRAIN W/EXIST PARAMETERS
AND-1 SPDS OPERATIONAL W/EXISTING PARAMETERS
JAN. 10, 1984
AND-2 PERFORM V&V ON SPDS
AND-2 CONDUCT OPER TRAIN W/EXIST PARAMETERS
AND-2 SPDS OPERATIONAL W/EXISTING PARAMETERS
JUNE 1, 1984
STSC PERFORM V&V ON SPDS
STSC CONDUCT TRAIN W/EXIST PARAMETERS
STSC OPERATIONAL W/EXISTING PARAMETERS
JUNE 1, 1984
AND-1 FINALIZE PARAMETER LIST
AND-1 PREPARE SPDS SAFETY ANALYSIS
AND-1 SUBMIT SAFETY ANALYSIS TO NRC
JUNE 29, 1984
PTSC FINALIZE PARAMETER LIST
AND-1 PREPARE DESIGN PACKAGE FOR ADD'N PARAMETERS
AND-1 IMPLEMENT SPDS MODIFICATIONS
AND-2 FINALIZE PARAMETER LIST
AND-2 PREPARE SPDS SAFETY ANALYSIS
AND-2 SUBMIT SAFETY ANALYSIS TO NRC
APRIL 15, 1984
AND-2 PREPARE DESIGN PACKAGE FOR ADD'N PARAMETERS
AND-2 IMPLEMENT SPDS MODIFICATIONS
PTSC PERFORM V&V W/ADD'L PARAMETERS
PTSC CONDUCT TRAIN W/ADD'L PARAMETERS
PTSC COMPLETE
JUNE 15, 1984
AND-1 PERFORM V&V W/ADD'L PARAMETERS
AND-1 CONDUCT TRAIN W/ADD'L PARAMETERS
AND-1 SPDS COMPLETE
JUNE 15, 1984
AND-2 PERFORM V&V W/ADD'L PARAMETERS
AND-2 CONDUCT TRAIN W/ADD'L PARAMETERS
AND-2 SPDS COMPLETE
DEC. 15, 1985
STSC PERFORM V&V W/ADD'L PARAMETERS
STSC CONDUCT TRAIN W/ADD'L PARAMETERS
STSC COMPLETE
JUNE 15, 1984
GERMS INSTALL HARDWARE
GERMS INSTALL SOFTWARE
GERMS PERFORM START-UP TESTING
GERMS DEVELOP PROCEDURES
GERMS PERFORM TRAINING
GERMS OPERATIONAL
JUNE 30, 1984

FIGURE 2-2