Long Island Lighting Company
Shoreham Nuclear Power Station
Emergency Response Capability
Program Plan (NUREG -0737 , Supp. 1)

- Objectives and Methodology
- Management Responsibility
- Review Team Selection
- Scheduling
- Data Management

NOVEMBER 1984

Prepared for
Division of Human Factors Safety
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

PREFACE

This document was prepared by the Long Island Lighting Company in response to the "Requirements for Emergency Response Capability" (herein, ERC) published by the U.S. Nuclear Regulatory Commission as Supplement 1 to NUREG-0737 in Generic Letter 82-33, dated December 17, 1982.

The Emergency Response Capability Program Plan contained herein addresses, in addition to the design of SPDS, Reg. Guide 1.97 instrumentation, plant-specific EOPs, training and staffing, the requirements for Detailed Control Room Design Review (DCRDR) and, as such, supersedes the requirements for the latter contained in NUREG-0700.

The scope of this document fulfills the detailed planning requirements for the preliminary proposal that was submitted to the NRC Office of Nuclear Reactor Regulation on April 14, 1983 in LILCO Letter SNRC-863. That proposal was entitled "DCRDR" and will henceforth be called ERC.

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REPORTING REQUIREMENTS
ADDRESSED BY THIS PLAN

NUREG-0737, Supplement 1 contains several reporting requirements, listed below by technical category:

- SPDS: A written safety analysis on SPDS parameter selection (par. 4.2.a);
- CRDR: A program plan addressing the review team, task analysis, identification of missing displays and controls, control room survey, HED assessment, and verification of improvements (par. 5.2.a);

  A summary report of the completed review outlining proposed control room changes, including proposed schedules for implementation. The report will also provide a summary justification for human engineering discrepancies with safety significance to be left uncorrected or partially corrected (par. 5.2.b);
- Reg. Guide 1.97: A report on technical justification of Reg. Guide 1.97 instruments contained in the control room, TSC and EOF (par. 6.2);
- EOPs: Submittal of a Procedures Generation Package to NRC for review (par. 7.2.b);
- ERFs: Submittal of conceptual design of Emergency Response Facilities (TSC, OSC, and EOF) to NRC for review (par. 8.4.2);
- TRAINING: Submittal date for completion of training plan addressing training analysis and design, trainee performance evaluation and training program revision. (Supp. 1 follow-up meeting "Agenda," p. 42).

This ERC Program Plan addresses each of these reporting requirements to the extent that each is involved in the integrated analysis and design effort aimed at "enhancement of operator ability to comprehend plant conditions and cope with emergencies."

LILCO

GLOSSARY

Function(al) Allocation Review: An analysis of the functions that must be performed by a system in achieving its mission objectives to determine how those functions are actually allocated among personnel, equipment and software. In this context, functional allocation review is used to define tasks assigned to operators in achieving mission objectives.

Function(al) Analysis: An analysis of the functions that must be performed by a system in achieving its mission objectives to determine how those functions are best allocated among personnel, equipment and software. In this context, "system" is understood as a complex of hardware (i.e., pumps, valves, instruments, controls, etc.), personnel, and software (i.e., procedures, computer aids, etc.).

Levels of Analysis: In accordance with the terminology of NUREG-0899, Criteria for the Development of Emergency Operating Procedures, levels of analysis proceed from broad based "Objectives," e.g. 'Power Generation' to "High Level Functions," e.g., 'reactivity control' to "Low Level Functions, "e.g. 'slow insertion of negative reactivity' to "Tasks," e.g., 'manually scram reactor' to "Procedural Steps," e.g. 'hit manual scram push button.' In this taxonomy, functions may include combined activities of the plant's automatic protective circuits and operator tasks.

System: In human engineering terminology, "system" is a complex of hardware, personnel and software that act together to achieve some functional objective. In power plant terminology, system is a complex of hardware elements (i.e., pumps, valves, controllers, instruments, and controls, etc.) that are grouped together by virtue of some physical interrelationship.

Systematic Review: In engineering terminology, "systematic review" refers to a design review methodology in which objectives and design assumptions are clearly stated, physical design criteria are derived therefrom, and in which performance testing is conducted against the design criteria. This methodology is also referred to as the "top down approach."

Systems Review: In power engineering terminology, "systems review" is a review of the functions that are accomplished by a plant system. A systems review may or may not address the changes to system function that occur in various operating events.

Task Analysis: An analysis of tasks assigned to operators to determine the information, decision, and action requirements involved when the tasks are performed in a specific power plant using specific instruments and controls. Further information on task analysis is available in MIL-H-46855B.

Task Definition: The process by which tasks associated with a certain function are defined. Task definition generally defines machine tasks, operator tasks, and combinations thereof. Task definition is the output of the functional allocation review process defined above.

Taxonomy: The study of the general principles of scientific classification.

Workload/Workstation Task Analysis: An analysis of tasks assigned to operators to determine the logistic problems associated with the real-time performance of those tasks in a specific power plant, using specific instruments and controls. Workload/Workstation task analysis is also referred to as "Link Analysis." Workload/Workstation Task Analysis is the preferred usage for this document because of its prior use in NRC documents.

LIST OF ACRONYMS

ANS	American Nuclear Society
ANSI	American National Standards Institute
AOA	Advanced Operator Aids (System)
ATWS	Anticipated Transient Without Scram
BWR	Boiling Water Reactor
BWROG	BWR Owners Group
CFR	Code of Federal Regulations
CRDR	Control Room Design Review
CRGR	Committee to Review Generic Requirements
DASS	Disturbance Analysis Surveiliance System
DCRDR	Detailed Control Room Design Review
EOP	Emergency Operating Procedure
EPG	Emergency Procedure Guideline
EPRI	Electric Power Research Institute
ERC	Emergency Response Capability
ERF	Emergency Response Facility
FSAR	Final Safety Analysis Report
GE	General Electric
HED	Human Engineering Discrepancy
HEO	Human Engineering Observation
HF	Human Factors
HFE	Human Factors Engineering
LER	Licensee Event Report
LILCO	Long Island Lighting Company
LOCA	Loss of Coolant Accident
NOSD	Nuclear Operations Support Department
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NTOL	Near Term Operating License(e)
NUREG	Nuclear Regulation
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Assessment
PSTG	Plant Specific Technical Guideline(s)
PWR	Pressurized Water Reactor
QA	Quality Assurance
RPS	Reactor Protection System
RPV	Reactor Pressure Vessel
SER	Safety Evaluation Report
SLC	Standby Liquid Control (System)
SNPS	Shoreham Nuclear Power Station
SPDS	Safety Parameter Display System
SRO	Senior Reactor Operator
TMI	Three Mile Island
VTR	Video Tape Recorder

LIST OF ILLUSTRATIONS

CHAPTER I: OBJECTIVES AND METHODOLOGY

1.0 INTRODUCTION

NUREG-0737, Supplement 1 is a product of the NRC Committee to Review Generic Requirements (CRGR). The significance of CRGR's efforts is seen, among other places, in Chapter 3 of Supplement 1 under the heading of coordination and integration of initiatives in which:

> The design of SPDS, design of instrument displays based on Reg. Guide 1.97 guidance, CRDR, development of function oriented EOPs, and operating staff training should be integrated with respect to the overall enhancement of operator ability to comprehend plant conditions and cope with emergencies. (par. 3.1, p. 4, emphasis added)

Based on this regulatory language, LILCO has concluded that the key to a successful Supplement 1 ERC effort is the proper integration of the design bases of those hardware and software elements that affect operator ability to comprehend plant conditions and cope with emergencies. Accordingly, LILCO places great emphasis in this ERC Program Plan on (a) a sound data base for analysis and (b) proper analytical methods.

Since the publication of the key TMI Reports: the Report of the President's Commission on the Accident at Three Mile Island (The Kemeny Report) and NUREG/CR-1270, Human Factors Evaluation of Control Room Design and Operator Performance at Three Mile Island-2 (The Rogovin Report), both "analytical methods" and "analytical data bases" have been the subject of much discussion and development. For this reason, LILCO has conducted an extensive regulatory review to ensure that this ERC Program Plan addresses the important TMI technical issues using a sound data base and proper analytical tools. A synopsis of that regulatory review is presented in Appendix A which addresses those regulatory documents that shed some light on the issues of data base (including scope) and methodology.

2.0 OBJECTIVES

2.1 Major Objective

Based on the requirements found in NUREG-0737, Supplement 1, the major objective of the Emergency Response Capability Program outlined in this Program Plan is that

> The design of the SPDS, design of instrument displays based on Reg. Guide 1.97 - Rev. 2 guidance, modifications of the design of the control room, design of plant-specific EOPs, design of operating staff training, and the design of operating crew structure shall be integrated with respect to the overall enhancement of operating crew ability to comprehend plant conditions and cope with emergencies.

The boundary of the Major Objective is the integration of operational elements that come into play when the EOPs are exercised by an appropriate set of events. An overview of the Shoreham ERC Program Plan is shown in figure I-1.

2.2 Related Objectives

The design of other operational elements is included in NUREG-0737, Supplement 1, but is outside the scope of the real-time analysis. These other operational elements are considered to be Related Objectives and are defined below:

2.2.1 Unresolved HEDs from the 1981 Control Room Survey that are not emergency event specific, (i.e., habitability, acoustics, illumination) will be resolved.

2.2.2 A program for on-going operating experience assessment (LERs and plant specific, non-reportable items) will be developed.

AN OVERVIEW OF THE SHOREHAM ERC PLAN

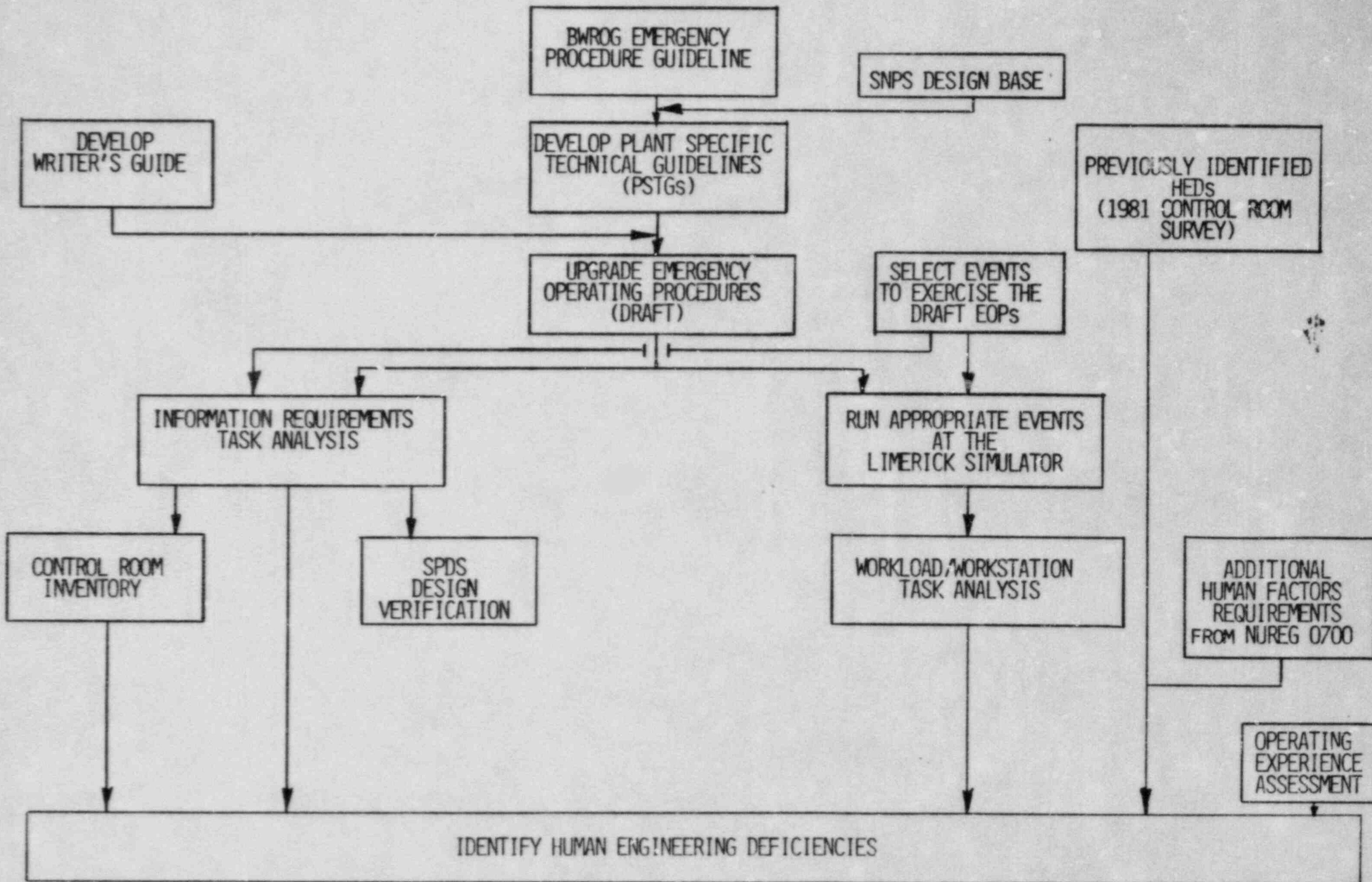


FIGURE I-1

2.0 Related Objectives (cont'd)

2.2.3 The role of the plant process computer in emergency operational support will be defined and if necessary, integrated into the task analysis.

3.0 METHODOLOGY

3.1 Preparation for Task Analysis

3.1.1 Develop Plant Specific Technical Guidelines (PSTGs)

The first step in preparation for task analysis is the (re)development of the Shoreham Plant Specific Technical Guidelines (PSTGs) based on Revision 3 of the BWR Owner's Group Emergency Procedure Guidelines (EPGs). The PSTGs will serve as the technical basis for the EOPs. The PSTGs present Shoreham plant engineering data in such a way that it can be used to write EOPs. These function oriented technical guidelines will produce symptom based EOPs which will allow an operator to respond correctly to an emergency situation without having to diagnose the event causing the emergency.

The current Shoreham-specific EOPs are based on Revision 1b of the EPGs, amended to include the concerns of Revisions 2 and 3 of the EPGs. LILCO has committed to the Staff to produce an upgraded Procedures Generation Package in accordance with the requirements of NUREG-0899, Chapter 7 and has communicated same to the staff in its April 14, 1983 submittal, SNRC-863, Attachment D.

LILCO Nuclear Systems Engineering is responsible for the development of the Shoreham Plant Specific Technical Guidelines. The baseline documents for the PSTGs will be Appendices B and C of the BWROG Emergency Procedure Guidelines. These appendices will be modified based on Shoreham-specific equipment and operating characteristics. This will be a QA document in accordance with the requirements of NUREG-0899, Chapter 4.

3.1.1 Develop Plant Specific Technical Guidelines, (cont'd.)

The PSTG development process will begin with the establishment of a methodological document that describes the ". . . process used to develop the technical guidelines... in sufficient detail to show the flow of information from its analytical base to its use in the development of the technical guidelines, thereby providing an audit trail." (Cf.: NUREG-0899, par. 4.3). Since the "analytical base" is found in SNPS design information, the developers of the PSTGs will establish in the methodological document how the information they use for PSTG development can be traced back to the plant design base through the LILCO Nuclear Engineering Department. This methodological document will be reviewed and approved by the Nuclear Engineering Department (NED), Nuclear Operations and Support Department (NOSD) and the Operations Department (Plant Staff).

The PSTGs will be reviewed and approved by NED before being used for the development of plant-specific, human-factored EOPs.

3.1.2 Develop Plant Specific Writer's Guide

In accordance with the requirements for the Procedures Generation Package, LILCO will also submit a Shoreham-specific Writer's Guide. The Writer's Guide will be prepared, reviewed and approved by the Shoreham Operations Section.

3.1.2. <u>Develop Plant Specific Writer's Guide, (cont'd.)</u>

The Writer's Guide will "provide detailed instructions on how to prepare text and visual aids for the Emergency Operating Procedures so that they are complete, accurate, convenient, readable and acceptable to control room personnel." (NUREG 0899, Section 2.7) It will be written from a human factors standpoint using the guidance of Chapter 5, NUREG 0899, and address items such as sequencing, time-dependent steps, division of responsibility and staffing. After the Task Analysis, the Writer's Guide may require revision to correct any deficiencies discovered in the Operating Procedures format.

3.1.3 <u>Develop Upgraded Emergency Operating Procedures</u>

The Shoreham Operations Section will be responsible for upgrading the SNPS Emergency Operating Procedures based on Revision 3 of the Emergency Procedures Guidelines.

The EOPs will be drafted using the approved PSTGs, Writer's Guide and the guidance of NUREG-0899 to achieve its purpose of directing "operators' actions necessary to mitigate the consequences of transients and accidents that have caused plant parameters to exceed reactor protection system set points or engineered safety feature setpoints, or other established limits" (NUREG-0899, par. 2.2).

3.1.3 Develop Upgraded Emergency Operating Procedures (Cont'd.)

Initially, the EOPs will be upgraded as a draft. These draft EOPs will provide the steps required to be taken by the operators which are needed to drive the Task Analysis. At the completion of the Task Analysis, any Human Engineering Discrepancies (HEDs) identified within the draft EOPs will be addressed. The end result will be human factored, function oriented Emergency Operating Procedures.

3.1.4 Select Events to Exercise the Draft EOPs

The BWROG EPGs were designed to cover the full range of precipitating accident events that can be managed by BWR plant systems; i.e., the procedural guideline structure is designed not to be event sensitive. LILCO concurs that the EPG structure is not event sensitive. (See Appendix A, par. 10.0 of this document). However, the actual use of the plant-specific EOPs derived from the EPGs is event sensitive. This event sensitivity is derived from the fact that the procedural documents (a) are used by multiple operators, (b) require "tracking" through entry guidelines and related contingencies in real time, and (c) are used in a large control room that requires considerable operator movement. These are some of the "human-factors" issues that will affect plant-specific procedure content, format and division of responsibility.

3.1.4 Select Events to Exercise the Draft EOPs (cont'd)

Accordingly, LILCO will select operating events on the following basis:

1. The personnel involved in Plant Specific Technical Guidelines (PSTG) development will select a set of operating events designed to exercise the draft EOPs to the maximum extent. This will be a reiteration of the process initially used by GE to develop the EPGs, but in this case, the process will be specific to Shoreham.

2. Personnel involved in the Shoreham Probabilistic Risk Assessment (PRA) effort will develop a set of events based on the most probable contributors to risk without being confined to the EPG structure. The PRA-based event selection process will consider the SALEM ATWS event and ATWS events with simultaneous and consequential failures.

3. The personnel involved in selecting events will also review available documentation of operating difficulties and incidents. Because Shoreham is not yet an operating plant, this will include applicable industry-wide reports such as LERs.

4. The experience-based and PRA-based event selections will be blended into a list of Events for Analysis. Regulatory Guide 1.70 and the Shoreham FSAR, Chapter 15, also will be referenced during the event selection.

3.1.4 Select Events to Exercise the Draft EOPs (cont'd.)

Personnel, manpower loading, and schedule information for this effort are discussed in this document at Chapters IV and V. In general, event selection follows a traceable course as evidenced by (a) the establishment of a selection methodology, (b) review and approval of this methodology, (c) actual event selection, and (d) final review and approval of the selected events.

3.1.5 Event Data Acquisition

After the events have been selected, the Limerick Simulator will be utilized, as appropriate, to obtain real-time plant responses. The simulator exercise is not in itself an analysis to identify control room deficiencies; it is a means to generate real-time event data to be used to analyze the Shoreham control room response capability.

When the selected events are run at the Limerick simulator, the simulator operators responding to the events will be prepared to provide correct operator action so that operator errors will not be included in the resulting real-time task data. Accordingly, the task analysis that is driven by this data will reflect correct operator response, insuring that the Shoreham Control Room design, draft EOPs, SPDS and training are designed to produce correct operator response at Shoreham. For this reason, the simulator operators will be supervised by the personnel involved in the development of the draft EOPs. The developers of the draft EOPs will be responsible for training three (3) SNPS

3.1.5 Event Data Acquisition (Cont'd.)

operators (SROs) to manipulate the Limerick simulator in response to the selected events within the framework of the SNPS draft EOPs. Since the design differences between the Shoreham and Limerick plants will have to be "factored-out" at this point, an operator training program will be given to address differences between the Shoreham and Limerick plants (especially response times) and control rooms. Since the instructional personnel involved will have developed the draft EOPs and are themselves licensed operators, no curriculum approval requirement has been established by LILCO for this training effort. However, the schedule has been designed so that operator training cannot begin until LILCO has reviewed and provisionally approved the draft EOPs and the selected events. Figure I-2 illustrates the Preparation for Task Analysis. Details on personnel, manpower and scheduling for the operator training effort are found in this document at Chapter IV, par. 2.21.

3.1.6 SPDS Validation by Limerick Simulator

In order to integrate SPDS during the Simulator run, LILCO will install two colorgraphic terminals, (Chromatics CGC-7900), at Limerick. These terminals will communicate with the Shoreham on-site Emergency Response Facility Computer System (ERFCS). Data tapes will be necessary to update the ERFCS to match the responses of the Limerick Simulator.

Some selected events will be run on the Simulator both with and without SPDS such that the effect of SPDS can be evaluated.

PREPARATION FOR TASK ANALYSIS

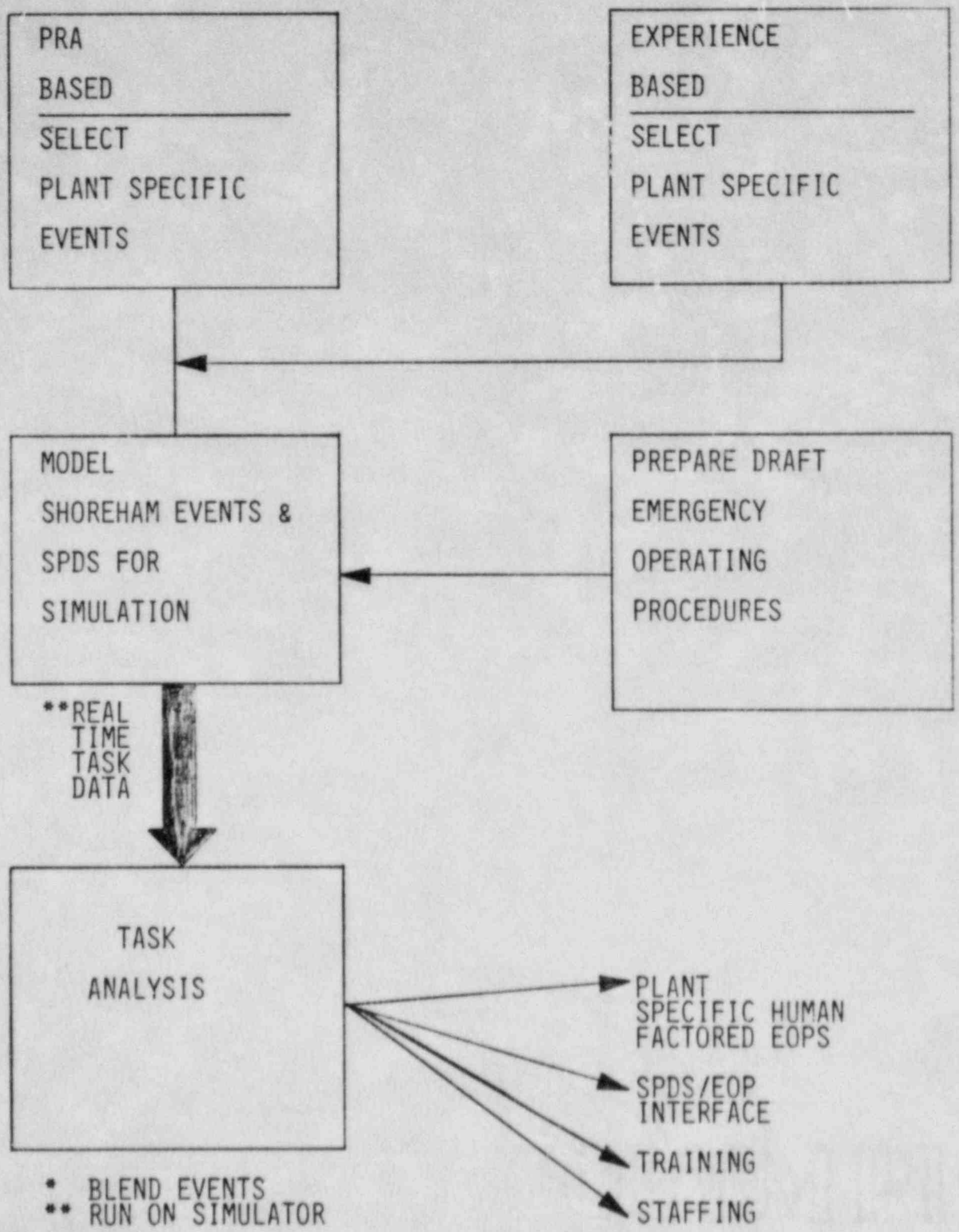


FIGURE I - 2

3.1.7 Videotaping of Simulator Exercise

All events exercised on the Limerick Simulator will be videotaped. This will serve as the basis for performing workload/work station Task Analysis. The videotape will enable the Operators and Task Analysts to review the process and to generate real time task data, such as response time and procedural callouts for operator action and the resulting operator tasks.

3.2 Task Analysis in Terms of Information Requirements, Decision Requirements and Action Requirements (Major Objective)

3.2.1 Introduction:

The purpose of this portion of the task analysis is to determine the adequacy of information presentations relative to the tasks that the operators are asked to perform. In LILCO's opinion, Three Mile Island raised, among other issues, that of parameter selection. For example, was indirect PORV indication suitable for the task "check PORV closure?" Was a strap-on thermocouple an adequate instrument to indicate flow downstream of the PORV? Was the thermocouple appropriate in light of the indirect PORV indication? Were separate temperature and pressure indicators a suitable information input to the task "insure adequate margin of saturation?"

3.2.2 Display, Procedures and Training Integration

In LILCO's judgement, the answers to these and other information questions cannot be made outside the context of the total integration of Displays/Procedures/Training, inasmuch as these three elements either individually or collectively contain all the explicit and implicit information needed to support operator decisions and actions in the EOPs. Operator information requirements will be determined by performing a "desk top" Operator Requirements Task Analysis on the selected events using the Task Analysis Form in figure I-3.

3.2.3 Task Analysis (Using Task Analysis Form)

Using the Shoreham-specific draft EOPs as a basis, the Task Analysis will identify and document the discrete tasks that the operators must perform during the selected emergency events. Correspondingly, the specific instrumentation, controls and equipment that are required to successfully perform the emergency operations will be identified and documented.

Using the Task Analysis Form shown in Figure I-3, the EOPs will be analyzed and documented in the following manner:

1. The identification of discrete steps in the draft EOPs in order of performance. These steps will be recorded in the "Procedure No. 1 Step No." column of the Task Analysis Form and branching points noted, depending on the plant transient being analyzed in the "Scenario Response" column.

2. A brief description of the operator's tasks for each procedural step will be recorded in the "Task/Subtask" column of the Task Analysis Form. Note that there may be more tasks described than are explicity called out in the procedural step. All tasks, both implicit and explicit, will be documented by the personnel performing the task analysis.

3. The operator decisions and/or actions that are linked to task performance are then noted in the "Decision and/or Contingent Action Requirements" column. System functional response is described when appropriate in this column. This set of data also includes

TASK ANALYSIS FORM

ROCEDURE NO. STEP NO.	Task/Subtask	Scen. Resp.	Crew Memb.	Loc.	Decision and/or Contingent Action Requirements	Information & Control Req.	Means	I&C Ident		CR Inventory		SPDS		Comments HEO Description
								Panel	No.	Av.	Suit	Y	N	

FIGURE I-3

3.2.3 Task Analysis (Using Task Analysis Form (Cont'd.)

branching points in the EOPs that determine the outcome of the operating sequence.

4. The input and output requirements for successful task performance are documented in the "Information and Control Requirements" column. These would be in the form of parameters necessary to determine the need to perform the task, and the parameters necessary to determine that the task has been performed successfully (e.g., reactor vessel water level, reactor coolant system flow). Specific values for requisite parameters will also be documented.

5. Operator tasks will be analyzed to determine the characteristics of the information and control capability required to perform the task. Information characteristics include parameter type, range, units and accuracy. Control characteristics include type (discrete or continuous), discrete functions (e.g., On, Off, Auto, Manual) criticality, and frequency of use. This information will be entered in the "Means" column of the Task Analysis Worksheet.

6. The SPDS column will be used to identify the operator's use of the aid.

7. The crew member performing the EOP step and the location will be specified in the appropriate columns.

3.2.3 Task Analysis (Using Task Analysis Form (cont'd)

The remainder of the Task Analysis Form will be used during the Control Room Inventory.

3.3 Use of Task Analysis Information

Figure I-4, "Use of Task Analysis Information," illustrates the flow of information from the task analysis to the end products. The output of the task analysis is the total information requirement for the EOPs.

The following are the specific end uses of the task analysis information:

- Control Room Inventory: After the task analysis information is generated all informational and instrument requirements identified become the basis for the control room inventory and the basis for verification that the control room has the required parameter displays appropriate for the operator tasks. Additional information on control room inventory is found below in this Chapter at par. 3.5.3.

- SPDS Design Verification: After the task analysis information is generated and analyzed, it will become the basis for the SPDS parameter verification process to insure that the SPDS has the required parameter and exclusion plots appropriate to operator tasks. However, final SPDS parameter verification is not complete until SPDS information displays are compared against all control room, EOP and training requirements.

- EOP Design: After the task analysis, any Human Engineering Observations (HEOs) that are determined to be HEDs will be addressed by the final EOPs, as appropriate. The task analysis serves as a verification of the Shoreham human factored EOPs.

<u>THE USE OF TASK ANALYSIS INFORMATION</u>

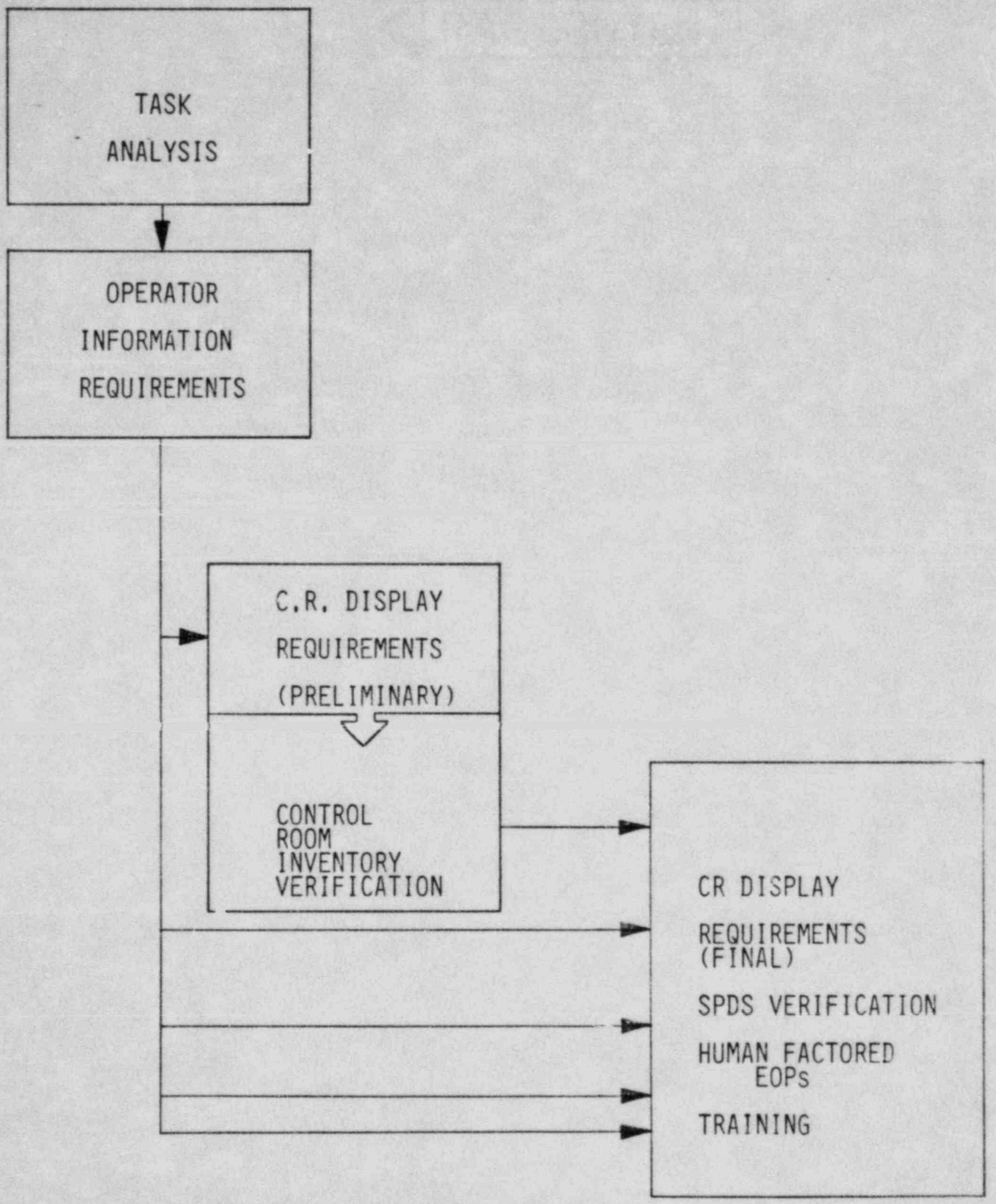


FIGURE I-4

3.3 Use of Task Analysis Information (cont'd)

- Training Design: After the task analysis information is generated appropriate training requirements (e.g. significance of parameters, trends, operational strategies, etc.) will be fed into training design to insure that the training program properly supports the overall cognitive process of the operators over the full range of procedures and events under analysis.

3.4 Task Analysis in Terms of Workstation and Manning Requirements (Major Objective)

3.4.1 Introduction:

The purpose of this portion of the task analysis is to determine the adequacy of the control room layout and staffing relative to the sequence and duration of the tasks that the operators are asked to perform. It will determine the control room crew and layout that is physically needed to perform the operator tasks from the draft EOPs in real-time. In LILCO's opinion, Three Mile Island raised the issue of control room layout. For example, was the location of the PORV tailpipe thermocouple readout logical relative to its required use, especially in a situation of information overload? In cases where the operators were required to compute a derived variable, were the input instruments logically juxtaposed?

In LILCO's judgement, the answers to these and other layout and crew structure questions cannot be answered outside the context of how the operators are "driven" around the control room by the real-time course of the postulated emergency events within the framework of the EOPs. Accordingly the methodology for assessing the adequacy of the control room layout and crew structure will be to conduct a layout and workload analysis.

3.4.2 Input to the Workload/Workstation Task Analysis

The Task Analysis described in 3.2 identifies control room instrumentation and control requirements and thereby serves as the basis for the control room inventory. However, the control room inventory is a static analysis, i.e. it cannot reveal the desirability of juxtaposing certain instruments and controls according to a logic determined by the event scenarios in which the instruments and controls are used. Accordingly, the event

3.4.2 Input to the Workload/Workstation Task Analysis, (cont'd.)

mapping is designed to serve a second purpose, i.e., a workload/workstation analysis. However, for the event maps to achieve this purpose, real-time usage of the instruments and controls must be analyzed as discussed below.

3.4.3 Workload/Workstation Methodology

Figure I-5 is an event map of the Shoreham Control Room that allows the operations analysts to review the instrumentation and control locations relating to required tasks. It also contains a table of tasks by event with real-time event information for both the human operator and the plant. Information on methods of generating operator and plant response data is discussed above in this Chapter at par. 3.1.5. During event mapping, the I&C Engineer will locate the required instrument or control for each emergency task directly from the EOPs.

The first purpose of the event map is an off-line analysis of task clustering. If, for example, the map graphically illustrates two distinct clusters of instrument and control tasks for a given event, each cluster is subjected to real-time analysis to determine if the cluster of tasks is within the workload capability of a single operator. Looking at the real-time sequence and task duration within a cluster, the analyst can identify overlapping control requirements.

When an overlapping control requirement is identified, one of several solutions can be indicated to correct the overlapping control requirement:

- o the control requirement can be removed from the task cluster by allocating the undesirable task to another control room operator

EVENT MAP

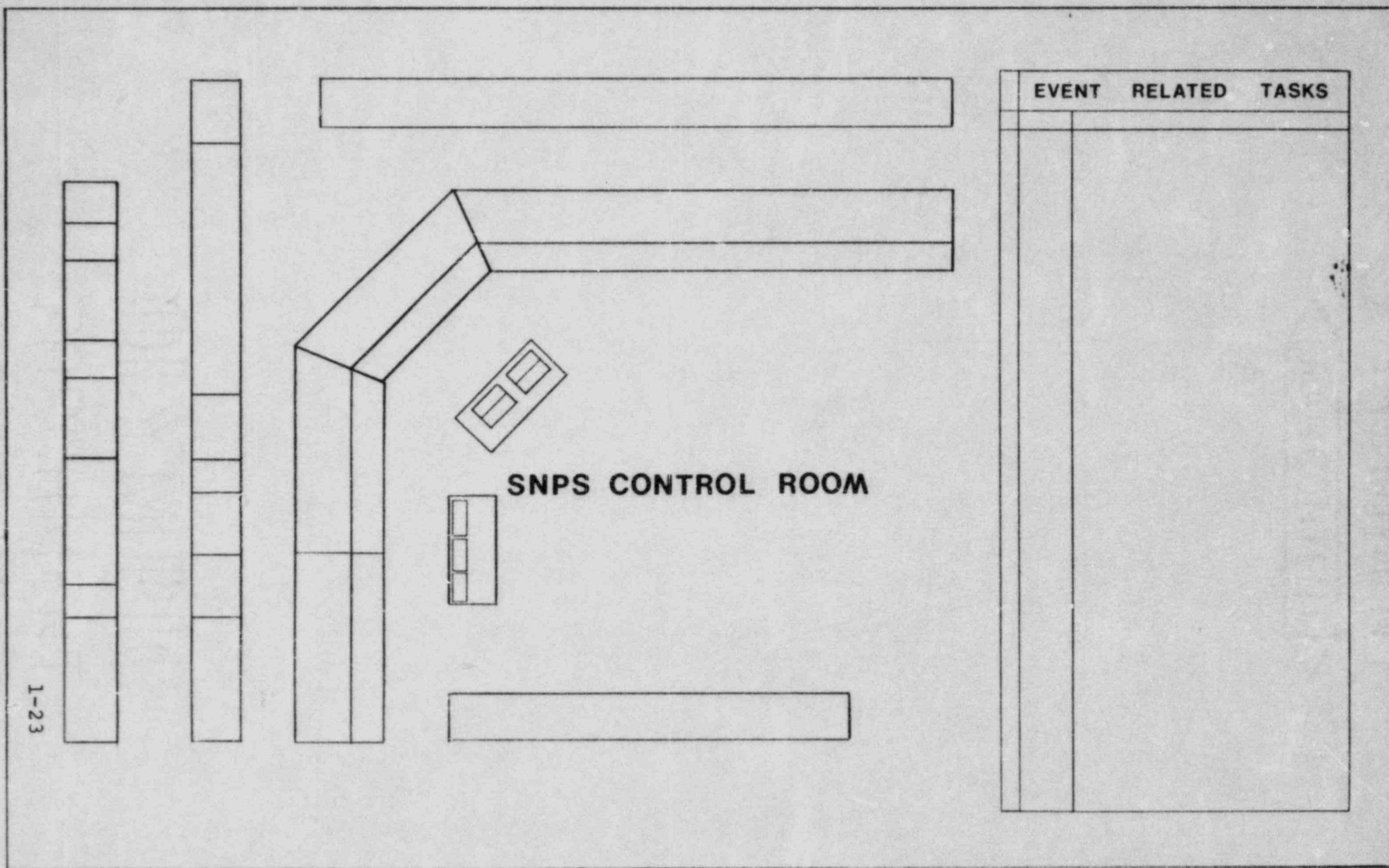


FIGURE 1-5

3.4.3 Workload/Workstation Methodology, (cont'd.)

- the control requirement can be removed from the task cluster by physical reconfiguration of the control room

- the undesirable task can remain in the original task cluster with compensatory training or procedural format modifications, or

- the undesirable control task can be reallocated to automatic control.

3.4.4 Uses of Workload/Workstation Analysis

The control room layout/operator workload portion of the task analysis will be performed to a standard of operator workload that attempts to (a) minimize operator crossover, (b) minimize single operator parallel control responsibility and (c) allow operators sufficient time to perform required tasks within the real-time framework of each emergency event. The implementation of this standard is empirical, i.e. it relies on the combined judgment of the operations personnel, human factors specialist, plant engineers, and the other members of the review team.

Information on personnel, manpower and scheduling for the Workload/Workstation Task Analysis is found in this document at Chapter IV, par. 2.24.

3.5 Detailed Control Room Design Review (DCRDR)

3.5.1 Introduction

LILCO will meet the requirements of NUREG 0737, Supplement 1, Chapter 5, Detailed Control Room Design Review by performing the specific tasks defined in this section and will achieve the integration required by implementing the entire ERC Program Plan.

The Review Team will be defined in Chapter III, the Task Analysis was described in sections 3.2 and 3.3 above, and HEO Assessment/HED Categorization will be described in Section 3.7 below.

3.5.2 Control Room Survey

A preliminary human factors control room review was performed on the Shoreham Control Room following the guidance given in NUREG/CR-1580 in March 1981.

Since the 1580/Chapter 6 review, the Human Engineering Discrepancies (HEDs) generated therein have been under resolution by LILCO and the NRC Human Factors Branch. Many of the HEDs identified in that review and in a similar review conducted at the site by the NRC are pending resolution on the basis of whether or not they are included in the emergency-event based review required by NUREG-0737, Supplement 1.

LILCO shall compare the requirements of NUREG-0700, Chapter 6 with the requirements of NUREG/CR-1580 and develop a list of additional human factors requirements to which the Shoreham Control Room should be subjected over and above the March 1981 preliminary review. This activity will, at a minimum, address the NRC Staff concerns on annunciators and the use of

3.5.2 Control Room Survey (cont'd)

the process computer. (CF.: A. Schwencer to M. S. Pollock, December 12, 1983, p. 5). In addition, a human factors specialist will perform a review of all modifications or additions to the control room since the last survey.

3.5.3 Control Room Inventory

Introduction:

NUREG-0700, at par. 3.5.1 indicates the need to ". . . identify all instrumentation, controls and equipment within the control room for comparison with the requirements identified through the analysis of operator tasks." LILCO intends to first identify control room instrumentation and control requirements for all emergency events within the framework of the EOPs by performing the Operator Requirements Task Analysis and compare those required controls and instruments identified on the Task Analysis Forms with the as-found control room.

NUREG-0700, at par. 3.5.2 recommends that the control room inventory be prepared ". . . on a panel by panel or other work station basis." However, due to the task-by-task nature of the LILCO analysis, the control room inventory discrepancies will be generated on a similar task-by-task basis. Admittedly, this inverse procedure does not identify "unnecessary controls and instruments." However, since NUREG-0737, Supplement 1 supersedes NUREG-0700, LILCO is of the opinion that an examination of unnecessary controls and instruments is no longer within the scope of its efforts.

3.5.3 Control Room Inventory (cont'd)

Use of Task Analysis Forms

The two subcolumns on the Task Analysis Form "Availability" and "Suitability", will be used for control room inventory verification.

The presence or absence of required Instrumentation and Controls will be noted in the "Availability" column of the Task Analysis Form. If it is discovered that required Instrumentation and Controls are not available to the operator it will be identified as an HEO and documented in the "Comments/HEO Description" column of the Task Analysis Form.

The second column, "Suitability," will indicate the human engineering suitability of the required Instrumentation and Controls. For example, if a meter utilized in a particular procedure step exists in the control room, it will be examined to determine whether or not the meter has the appropriate range, scaling and accuracy to support the operator in the corresponding procedural step. If the range, scaling and accuracy are appropriate, it will be so noted in the "Suitability" column of the Task Analysis Form. Conversely, if the meter range, scaling or accuracy is not appropriate for the parameter of interest to the operator it will be noted on the form, defined as an HEO and documented accordingly.

For each Information and Control requirement that is met by a particular piece of equipment in the control room, the panel on which the equipment is located and the equipment identifying number will be noted in the "Panel" and "No." (Number) subcolumns of the Task Analysis Form.

3.6 On-Going Abnormal or Emergency Operating Experience Assessment

Operating experience affects (1) the structure and content of the EOPs and (2) the selection of events used to exercise the EOPs. LILCO's program for on-going operating experience assessment will use a similar methodology as follows:

(A) Plant-specific abnormal or emergency operating events will be analyzed relative to the structure and content of the EOPs. For example, if an operating event indicates that the Shoreham plant response characteristics are different than the postulated responses that form the basis for the PSTGs, the plant response curves will be altered. Also, if an operating event indicates a missing or out-of-sequence step within the EOPs, the operator tasks within the EOPs will be revised. It is important to note that operating events will be initially and directly compared to the PSTGs rather than to the plant-specific, human factored EOPs. In this manner, engineering assumptions that directly affect the PSTGs and indirectly, the EOPs, will be properly challenged.

(B) After an operating event has been used to challenge the structure and content of the EOPs, that same event will be task analyzed by exercising it through the PSTG or EOP structure as appropriate. For example, if an event has challenged the plant response curves, it will first be necessary to redesign the appropriate PSTG based on the new plant response information, then analyze the resulting changes to operator tasks. If an event has not challenged the plant response curves or the PSTG structure, it may only be necessary to re-analyze the cognitive impact of the affected operator tasks.

Whether A or B above applies, it will first be necessary for the Review Team to justify the level of re-analysis required by the event, and then for them to conduct the analysis and alter the outputs, i.e., plant-specific EOPs, training, staffing, control room instruments, etc.

3.6 <u>On-Going Abnormal or Emergency Operating Experience Assessment (cont'd)</u>

(C) Control room operating personnel can provide valuable information on the suitability of instruments and controls and the suitability of the control room atmosphere. LILCO encourages operators to use the "Man-Machine Interface Log" to express any comments they have on the Shoreham Control Room. The Log is indexed by panel and there is also a section for General Control Room Comments. Figure I-6 is a page from the log. The Log will always be present in the Control Room.

The purpose of this log is to record man-machine interface problems found in the Control Room. Minimizing or eliminating interface problems will ensure control room operations both normal and abnormal are conducted in a timely, precise and efficient manner.

Recording each problem as it is identified will ensure proper documentation, review and disposition.

The Watch Engineer is responsible for placing the items in the log book. Anyone may bring to the Watch Engineer's attention potential interface problems at which time he, at his discretion, will record the item in the log indicating the date problem identified, name of person identifying the problem, description of the problem, whether or not any Inter-office Correspondence (IOC) was issued and to whom the IOC was issued. An IOC need not be issued if the responsibility for close out of the item is within the Operations Section.

The Operating Engineer or designee will ensure each item placed in the log is dispositioned in a timely manner.

Examples of man-machine interface problems are as follows:

MAN MACHINE INTERFACE LOG

ITEM NO.	DATE	IDENTIFIED BY	SYSTEM	PANEL BOARD	DESCRIPTION OF PROBLEM	IOC	TO WHOM	CLOSE OUT DATE/SIGN	REMARKS

FIGURE 1-6

3.6 On-Going Abnormal or Emergency Operating Experience Assessment (cont'd.)

1. Improper or ambiguous positioning of switches, annunciators and displays.

2. Incorrect, ambiguous or misplaced labels or nameplates.

3. Improper or confusing mimics.

4. Inability to interpret or read displays close up and/or at a distance (ie. visual acuity).

5. Indicating lights not in the proper position or wrong color.

6. Meter faces with improper or confusing increments.

7. Improper or inconsistent color coding.

8. Improper or confusing annunciator labels.

9. Controls or displays not logically sequenced (ie. ABCD, ACBD, AC, BD, 3, 1, 2 etc.).

10. Annunciator back lighting improper (ie. not properly prioritized).

11. Switches not operating according to design.

12. Insufficient indication available on critical parameters or components.

13. Lack of special caution or instruction labels.

3.6 On-Going Abnormal or Emergency Operating Experience Assessment (cont'd.)

D) The operators will be periodically interviewed to provide valuable insight into problems or positive system features that have been noted in the course of operations. The interviewer will be an experienced operations engineer whose familiarity with the Shoreham Control Room and operating procedures will be an advantage in exploring the problem areas. A full range of the operating staff will be interviewed. The interview content and procedure will be developed based on NUREG-0700, section 3.3.2. Areas it shall address include:

- Workspace
- Panel design
- Annunciator warning system
- Communications
- Process Computers
- Corrective and Preventive Maintenance
- Procedures
- Staffing and job design
- Training

Further information on the Operator Interview will be provided in the Summary Report.

3.7 HEO Assessment and HED Categorization

Human Engineering Observations (HEOs) will be identified through the following processes:

1. Control room survey
2. Control room inventory
3. Task analysis
4. Operating experience review
5. Simulator experience

The Review Team will assess each HEO using the guidance of NUREG-0801, par. 4.2.1. Any HEO that results in an increase in the potential impact on safety will be designated as a Human Engineering Deficiency (HED).

HEDs will be categorized as follows:

Category I - HEDs Associated with Documented Errors. Category I includes all HEDs which are known to have previously caused or contributed to an operating crew error, as documented in an LER or other historical record.

Category II - HEDs Associated with Potential Errors. Category II includes all HEDs which have been assessed and determined to increase the potential for causing or contributing to an operating crew error, but for which there has been no previous documentation.

Category III- HEDs Associated with Low Probability Errors of Serious Consequences. Category III includes all HEDs that are associated with low probability errors of serious consequence. HEDs in this category are those associated with errors which are intolerable because of their possible adverse consequences.

3.7 HED Assessment, (Cont'd.)

Category IV - HEDs Not Associated with Errors. Category IV includes any discrepancy that has been evaluated and determined neither to increase the potential for causing or contributing to operating crew error nor to have adverse safety consequences. All discrepancies in this category should be examined for their cumulative or interactive effects. This is necessary because in some instances a single HED may not increase the potential for operating crew error but may pose significant error potential in conjunction with other HEDs.

All HEDs so identified will be subjected to "Analysis for Correction by Enhancement" and if necessary, to "Analysis to Identify Design Improvement Alternatives and Select Recommended Solution" according to the logic illustrated in NUREG-0700, Exhibit 4-2, page 4.4.

All other HEDs will be subjected to analysis in accordance with the recommendations found in par. 4.2.1 of NUREG-0801. It should be noted that the significance of these HEDs will depend largely on the experience of the interdisciplinary review team (including the human factors specialists) selected to review the HEDs. Refer to Chapter III of this Plan for a discussion of the Review Team.

When an HED is verified by the review team, the HED form shown in Figure I-7 will be filled out. The HED records will be stored in a Computer Database Tracking System. Once HEDs are identified within these categories, they will be prioritized on a cost/benefit basis. Information on final HED prioritization will be available in the final report.

HUMAN ENGINEERING DISCREPANCY RECORD FORMAT

HUMAN ENGINEERING DISCREPANCY RECORD # PLANT: PAGE:

HEO REVIEWER: DATE: NO.

PANEL IDENTIFIER : COMPONENT IDENTIFIER

REVIEW SECTION CODE: C/D INTEGRATION GUIDELINE NO:

DESCRIPTION OF DEFICIENCY:

HED CATEGORY CODE: 1__ 2__ 3__ 4__

IMPLEMENTATION SCHEDULE:

RECOMMENDATIONS:

COMMENTS/JUSTIFICATION FOR NON-CONFORMANCE:

FIGURE I-7

3.8 Final Report and Future Applications

3.8.1 Final Report

At the completion of the ERC Project, a final report will be generated to document, in summary form, the procedures utilized in the ERC Program Plan. Any departures from the methodologies described in this Program Plan will be noted and justified.

The final report will also describe the results of the review process. The HEDs that were identified will be included along with the recommendations for correction and/or resolution for each HED. A schedule for the correction of the HEDs, based upon their assessment categorization, will be included.

The results of the ERC Project will be incorporated into Shoreham training programs as applicable. This will ensure that any implemented changes will be brought to operators' attention with regard to physical modifications or procedural alterations.

3.8.2 Future Applications

To provide a mechanism for an integrated type of analysis for any HEDs identified throughout the operational life of the Shoreham Nuclear Power Station, the following tasks will be undertaken:

- Personnel Survey - an operator questionnaire will be distributed periodically. Problems identified will be investigated, assessed as HEDs, and recommendations for correction or resolution will be made.

3.8.2 Future Applications (Cont'd.)

- o Design Change Evaluation - any design change, modification (addition or deletion of instrumentation) will be examined prior to implementation and the human factors aspect of the change will be evaluated. The examination will attempt to identify any HEDs that are associated with the proposed design change. The resulting HEDs, if any are discovered, will be assessed, and recommendations for correction or resolution will be made.

  Proposed design changes will also be examined with regard to their impact on the SPDS, EOPs, Regulatory Guide 1.97 instrumentation requirements and other related emergency response capabilities.

CHAPTER II: MANAGEMENT RESPONSIBILITY

1.0 INTRODUCTION

NUREG-0737, Supplement 1 in its planning submittal requirements does not specifically contain a planning requirement titled "Management Responsibility." Nevertheless, Management Responsibility is addressed in several places throughout the regulatory documents applicable to the ERC effort. Management Responsibility, as derived from the regulatory requirements is presented in this Chapter as follows:

- o Regulatory Guidance for Management Involvement in the ERC Program;
- o Technical Requirements for Management Involvement in the ERC Program;
- o Criteria for Management Involvement.

2.0 REGULATORY GUIDANCE FOR MANAGEMENT INVOLVEMENT IN THE ERC PROGRAM

2.1 NUREG-0700, Guidelines for Control Room Design Reviews

Chapter 2 of NUREG-0700, "Planning Phase," identifies the need to identify Management Responsibility:

> Management attention to the planning process is important. Management tasks include overall support of the control room design review process, and integration of the design review with other studies and analyses involving human factors concerns. This will involve careful review of NUREG-0700 along with other NRC communications/guidelines which address the overall human factors review program. NUREG-0660 states that all measures considered for correcting discrepancies in control room design be considered in conjunction with other design measures to improve control room human engineering. Two such measures are the development of a safety parameter display system and upgrading of emergency support facilities. The control room design review will also have a bearing on other NUREG-0660 tasks with human factors implications. Examples include assessment of shift manning, training and qualifications of personnel, and procedures upgrading. Management attention to the coordination of all these tasks within the human factors engineering framework is recommended (op. cit., par. 2.2).

LILCO considers that since this language reveals a sensitivity on the part of the Commission relative to the total scope of the human engineering effort (note the correspondence between the technical issues cited above and the scope of this ERC Plan), the Commission's concern with "management attention to coordination" is a legitimate criterion for development of management responsibility for the ERC effort.

2.2 NUREG-0801, Evaluation Criteria for Detailed Control Room Design Review

Chapter 2 of NUREG-0801, "Program Plan," identifies the authoritative support that should be given to the Review Team by management:

> To clarify the role of the DCRDR team and its relationship to other licensee/applicant organizational elements, the Program Plan should specify the authority given to the team to carry out its mission. This statement should include types of support to be given the team, e.g.:
>
> o Access to information (records, documents, plans, procedures, drawings, etc.)
>
> o Freedom to document dissenting opinion
>
> o Access to required facilities (control room, computer, word processing, cameras/VTR, etc.)
>
> o Access to people with useful or necessary information (reactor operators, equipment designers or planners, or utility management).
>
> (op. cit., par. 2.1.3).

2.3 NUREG-1000, Generic Implications of ATWS Events at the Salem Nuclear Power Plant

Appendix A, paragraph 12.0 of this Program Plan addresses the technical issues related to the Salem ATWS events. Since the Salem ATWS has been incorporated into this Program Plan, it is appropriate that NUREG-1000 guidelines on the topic of management also be included in this Program Plan.

> The Salem events emphasize the importance of extending the reach of management responsibility down into the details of plant design and operation. That is not a simple task; the commitment to safety must permeate the

2.3 NUREG-1000, Generic Implications of ATWS Events at the Salem Nuclear Power Plant (Cont'd.)

> organization even though the ultimate responsibility for safety cannot be delegated. It is not sufficient for management to set the policies and establish the goals for safe nuclear plant operation. Management must also provide the resources necessary to assure that the goals can be met, and it must exercise continuing, diligent oversight to assure that these goals are pursued.
>
> There is no magic formula or easy solution to the overall management problem that was found at Salem, no silver bullet. No single error led to the ATWS events; rather, it was a combination of failures. Diligence, attention to detail, an intuitively questioning attitude, and the clear assignment of duties are the only ways to avoid such problems. (op. cit., p. 2-1).

It should be noted that the commission's recommendation that management "provide the resources necessary to assure that the goals can be met," corresponds with similar language in NUREG-0801, cited above. LILCO will comply with this recommendation as discussed below. Additionally, the "clear assignment of duties and accountability" corresponds to similar recommendations in ANSI/ANS-3.2:

> Lines of authority, responsibility and communication shall be established and well defined from the highest management level through intermediate levels to and including all onsite operating organization positions with involvement in activities affecting the safety of the nuclear power plant (including those offsite organizational units assigned responsibility for procurement, design and construction, quality assurance, and technical support activities). These relationships shall be documented and updated, as appropriate, in the form of organizational charts, functional descriptions of departmental responsibilities and relationships and job descriptions for key personnel positions or in equivalent forms of documentation. (op. cit., par. 3.2).

2.4 Regulatory Quality Assurance Requirements

- NUREG-0899, Guidelines for the Preparation of Emergency Operating Procedures:

  NUREG-0899 indicates that the portion of the ERC Program involving the preparation of Plant Specific Technical Guidelines be subject to examination under the plant's overall QA Program in accordance with the requirements of Reg. Guide 1.33.

- Regulatory Guide 1.33 (ANSI/ANS-3.2-1982):

  The administrative controls and quality assurance program shall provide measures to control and coordinate the approval and issuance of documents, including changes thereto, which prescribe all activities affecting quality. Such documents include those which describe organizational interfaces, or which prescribe, activities affecting safety-related structures, systems and components. These documents also include operating and special orders, operating procedures, emergency and off-normal procedures, test procedures, equipment control procedures, maintenance or modification procedures, refueling procedures, and material control procedures. These measures shall assure that documents, including revisions or changes, are reviewed for adequacy by appropriately qualified personnel and approved for release by authorized personnel; and are distributed in accordance with current distribution lists and used by the personnel performing the prescribed activity, and that procedures are provided to avoid the misuse of outdated or inappropriate documents. (op. cit., par. 5.2.15).

3.0 TECHNICAL REQUIREMENTS FOR MANAGEMENT INVOLVEMENT IN THE ERC PROGRAM

3.1 LILCO Organization: Structural Requirements

Chapters III and IV of this document contain the detailed requirements for LILCO discipline support of the ERC Program. As illustrated in Fig. II-1, those discipline support requirements are dispersed among the three major departments of the LILCO Nuclear Organization: the Nuclear Operations Support Department, the Operations Department (Plant Staff) and the Nuclear Engineering Department.

Fig. II-1 illustrates that the Vice-President, Nuclear Operations is the single point in the Nuclear Organization that is common to all the required LILCO ERC disciplines. Accordingly, the responsibility for the ERC Program rests ultimately with the Vice-President, Nuclear Operations who has the organizational authority to bring together and integrate the required disciplines.

The degree of involvement of the Vice-President, Nuclear Operations has been designed to respond to the intent of NUREG-1000.

Lilco Nuclear Organization

(Abbreviated To Locate ERC Disciplines)

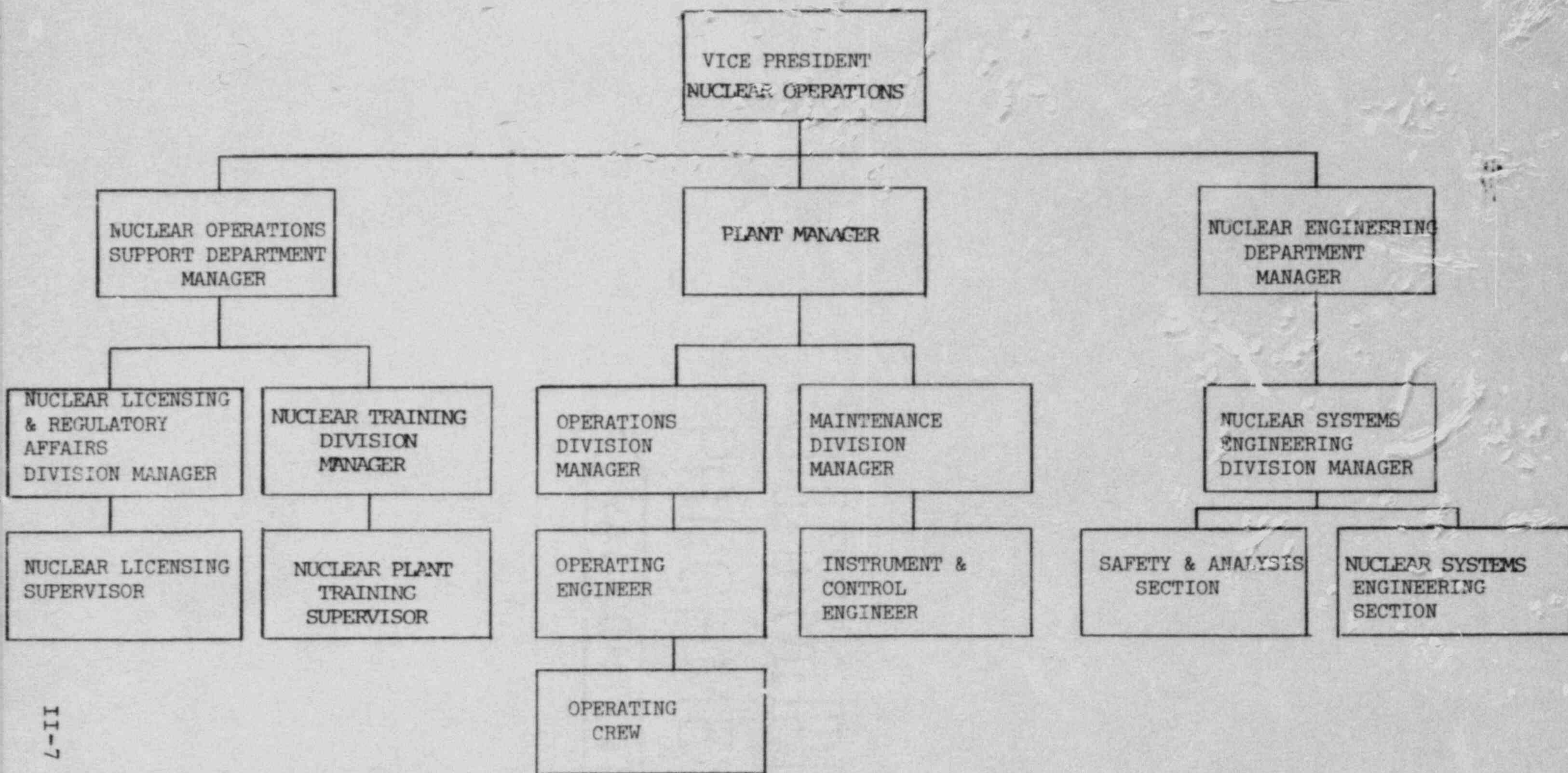


FIGURE II-1

4.0 CRITERIA FOR MANAGEMENT INVOLVEMENT

4.1 Management Involvement Criteria

- Management shall give its attention to the coordination of all tasks within the human factors engineering framework (NUREG-0700);
- Management shall specify the authority given to the review team to carry out its responsibilities (NUREG-0801);
- Management shall provide the resources necessary to assure that the goals can be met (NUREG-1000);
- Management shall exercise continuing, diligent oversight to assure that ERC Program goals are met (NUREG-1000);
- Management shall articulate lines of authority, responsibility and communication for the ERC Team (NUREG-1000 and ANSI/ANS-3.2);
- Management shall apply QA requirements to "documents which describe organizational interfaces," and the Plant Specific Technical Guidelines (NUREG-0899 and ANSI/ANS-3.2).

CHAPTER III: REVIEW TEAM SELECTION

1.0 INTRODUCTION

The scope of the ERC Program detailed in this Program Plan is greater than the scope of work currently associated with a DCRDR. The ERC Program includes all the work associated with front-end development of Plant Specific Technical Guidelines (including PRA and experience based event generation) and the ultimate generation of plant-specific, human-factored EOPs, SPDS design, training design and crew structure design in addition to the DCRDR. Accordingly, the organizational needs for this program are greater than those normally associated with a DCRDR. LILCO has reviewed the organizational needs for this program and has developed a two-tier organizational structure. First, it has assembled an ERC Project Team that will be responsible for the direction of the entire project. Secondly, it has assembled an ERC Review Team to perform the required task analyses - the Review Team resembling the DCRDR team envisioned by the NRC. The structure, management and composition of each of these teams will be addressed in this Chapter as follows:

- o ERC PROJECT TEAM: Responsibilities, Management, and Orientation (par. 2.0)
- o ERC PROJECT TEAM ORGANIZATIONAL DESCRIPTION: Regulatory Background, Structure and Composition, and Accountability (par. 3.0)
- o ERC REVIEW TEAM: Regulatory Background, Structure and Management, Accountability, and Technical Services Support (par. 4.0)

2.0 ERC PROJECT TEAM

2.1 ERC Project Team Responsibilities

- The ERC Project Team will coordinate all tasks within the ERC review framework and report back to management as discussed in par. 3.3, below (NUREG-0700);

- The ERC Project Team will specify its program goals and report back to management on their implementation (NUREG-0801, NUREG-1000, and NUREG-0737, Supplement 1);

- The ERC Project Team will identify the resources necessary to assure that its goals can be met (NUREG-1000 and NUREG-0737, Supplement 1); those resources are identified in this Program Plan in this Chapter at par. 5.0 and in Chapter IV;

- The ERC Project Team will ensure that QA requirements specified by management are applied and report back to management (NUREG-0899 and ANSI/ANS-3.2);

2.2 Management of the Project Team

NUREG-0801, "Evaluation Criteria for DCRDR," in its Acceptance Guidelines for the Licensee's DCRDR Team, asks licensees to address the issue of team management in terms of "An Administrator" and "Technical Review Leaders." Relative to the position of "Administrator," NUREG-0801, at par. 2.1.2, specifically recommends that ". . . because the ultimate responsibility for the review lies with the licensee/applicant, the individual with the overall administrative lead and responsibility should be a licensee/applicant employee." The "Technical Review Leader," on the other hand, apparently need not be a licensee/applicant employee. In this regard, NUREG-0801 indicates that a human factors specialist should ". . . be involved in the project planning phase," and ". . . should also share overall technical leadership of the entire project." Generic Letter 83-18 adds that the qualifications of such individuals should be documented.

2.2 Management of the Project Team (Cont'd.)

For these reasons LILCO has created three Project Co-Administrators and has assigned key personnel to these positions. Relative to the position of Technical Review Leader, LILCO will utilize the services of a human factors specialist to be assigned as the Technical Review Leader. Additionally, LILCO has placed its Co-Administrators and the Technical Review Leader responsible for the entire ERC Program rather than over the DCRDR component because of the total integration required between the DCRDR and other program elements.

Specific assignments to these positions are as follows:

Co-Administrators:

- Mr. Eric Dean: Mr. Dean, a member of the SNPS Operations Section, is responsible for the overall technical review and administration of the project including methodology and planning. Additionally, Mr. Dean provides access to key operations personnel and facilities.
- Mr. John Valente: Mr. Valente, a member of the Nuclear Engineering Department, provides technical input on matters relating to SPDS design and its integration with other operational elements. He also provides access to personnel within NED.
- Mr. Robert Grunseich: Mr. Grunseich, a member of the Nuclear Operations Support Department (NOSD), provides licensing support to the project.

Technical Review Leader:

This position will be filled by a human factors consultant experienced in emergency response capabilities, control room design and Operations Engineering. The Commission will be notified when LILCO fills this position.

3.0 ERC PROJECT TEAM ORGANIZATIONAL DESCRIPTION

3.1 Introduction

The following functional organizational description is based upon the ERC Project Team Responsibility Criteria contained in paragraph 2.1, above. The organizational description is that of an Independent Review Body in accordance with the guidance of ANSI/ANS 3.2-1982 based on the Project Team's involvement with proposed changes in procedures and other matter(s) involving safe operation of the nuclear power plant. (Cf.: ANSI/ANS 3.2-1982, par. 4.3.3, "Organizational Units Functioning as Independent Review Bodies," subpar's. 2 and 5)

The functional responsibilities delineated herein are also in accordance with LILCO Nuclear Operations Corporate Policy No. 2, "Corporate Interfaces for Safety Related Activities."

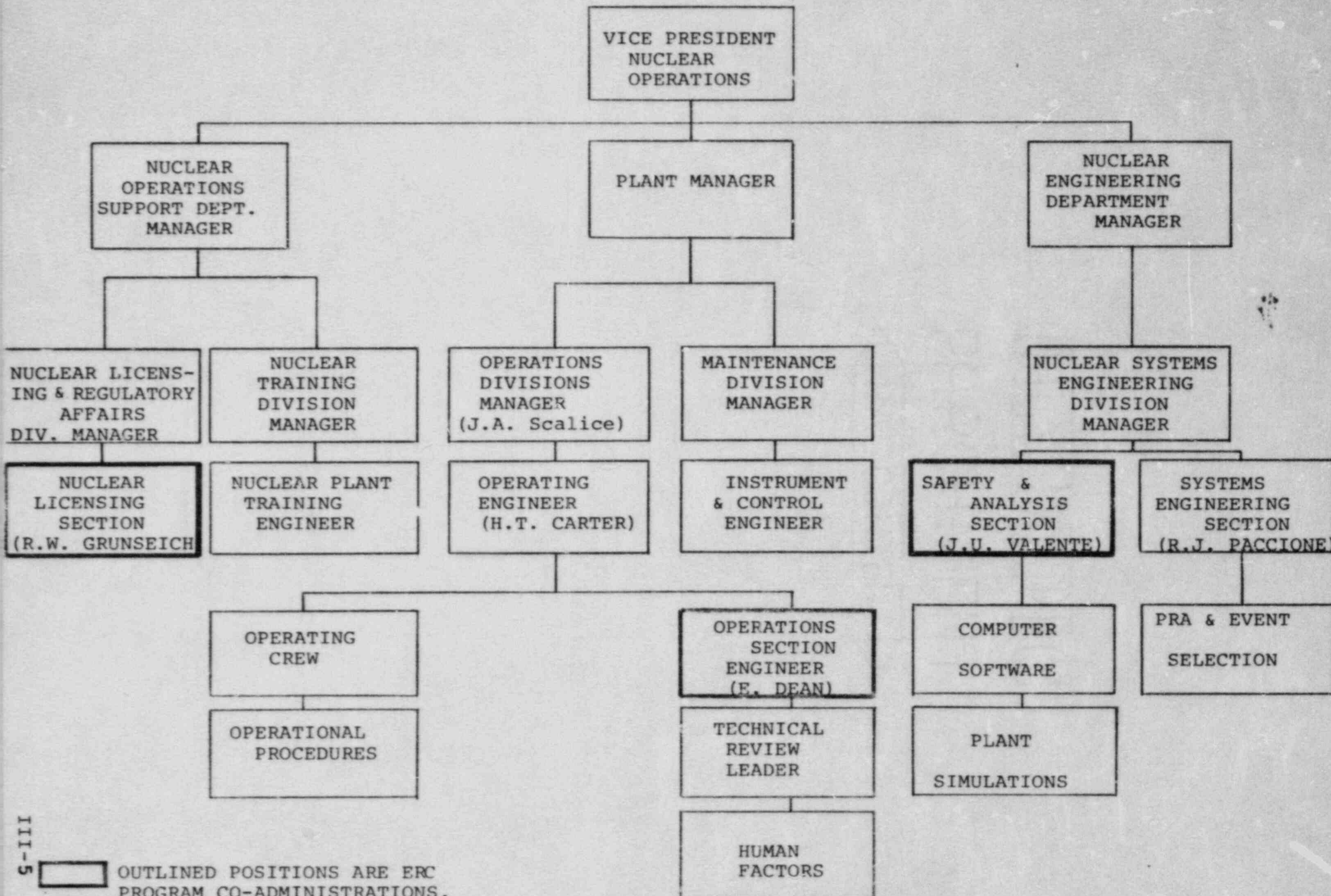
3.2 Structure and Composition of the ERC Project Team

Figure III-1, LILCO Nuclear Organization (supplemented with outside support) illustrates the structure and composition of the ERC Project Team as it operates within the LILCO Nuclear Organization.

3.2.1 ERC Project Team Co-Administrators: The Co-Administrators represent each of the major departments within the Nuclear Organization: Nuclear Operations Support Department, Operations Department (Plant Staff), and the Nuclear Engineering Department. The ERC Team Co-Administrators, as a group, direct the ERC Program and report to the Operations Manager, who in turn, reports to the Plant Manager and the Vice President, Nuclear Operations.

The Lilco Nuclear Organization

(Abbreviated To Locate The ERC Review Team)



OUTLINED POSITIONS ARE ERC PROGRAM CO-ADMINISTRATIONS.

FIGURE III-1

3.2 Structure and Composition of the ERC Project Team, (cont'd.)

3.2.1 Co-Administrators, (cont'd.)

The Co-Administrators are responsible for the major and minor objectives of the ERC Program. The assignment of three Co-Administrators serves two functions: (a) each of the major departments within the LILCO Nuclear Organization is represented to insure proper technical integration, and (b) an appropriate division of responsibilities is effected as follows:

- Operations Department Co-Administrator: As indicated in Figure III-1, the Plant Staff Co-Administrator is responsible for the technical liason with the Technical Review Leader/Human Factors Specialist. The Plant Staff Co-Administrator is also responsible for the overall administration of the program and functions to provide access to those Plant Staff personnel with useful or necessary information, i.e. reactor operators, access to required facilities, i.e., control room, and access to information, i.e. procedures (cf. NUREG-0801, par. 2.1.3).

- Nuclear Engineering Department Co-Administrator: The NED Co-Administrator is specifically responsible for access to information, i.e. records, documents, plans and drawings, access to required facilities, i.e., computer, and access to people with useful or necessary information, i.e. equipment designers and planners (NUREG-0801, par. 2.1.3).

3.2 Structure and Composition of the ERC Project Team, (cont'd.)

- Nuclear Operations Support Department Co-Administrator: In addition to providing access to those NOSD personnel with useful or necessary information, the NOSD Co-Administrator is responsible for providing licensing input to the Project Team and for any contacts with the NRC.

3.2.2 Project Technical Review Leader

- The Technical Review Leader is specifically responsible for technical direction (including human factors input) and methodological guidance. This responsibility is in accordance with NUREG-0801, par. 2.1.2.

3.3 Lines of Accountability:

The ERC Project Team Co-Administrators report to the Operations Manager on a monthly basis in the following format:

- The Co-Administrators will brief the Operations Manager on the coordination of all project tasks from both a technical and logistic standpoint. Technical coordination will involve a presentation on changes to methodology that may occur during the progress of the project. Logistic coordination will involve an update of the detailed schedule contained in Chapter IV of this Program Plan.

- The Co-Administrators will specify changes to the program goals that may be necessitated over the life of the project.

3.3 Lines of Accountability, (cont'd.)

- The Co-Administrators will report to management on QA requirements including any Review Team dissenting opinions.

- The Technical Review Leader reports to the Plant Staff Co-Administrator on matters involving methodology and human factors considerations.

3.4 Other LILCO Principals within the Project Team:

Other LILCO supervisory technical personnel associated with the Project Team include the Nuclear Systems Engineering Section Head, a Plant Instrument and Control Engineer, and a Nuclear Plant Training Engineer. These individuals participate in the specific technical tasks assigned to them in Chapters III and IV of this Program Plan and also participate in the ERC Review Team.

4.0 ERC REVIEW TEAM

NUREG-0737, Supplement 1 at par. 5.1.b.i indicates that licensees and applicants should establish ". . . a qualified multidisciplinary review team and a review program incorporating established human engineering principles."

Generic Letter 83-18 expands this requirement by asking licensees and applicants to "document the qualifications of survey team members and number and extent of plant personnel participation."

The ERC Review Team operates within the ERC Project Team in areas involving the identification and resolution of HEDs.

4.1 Structure and Management of the ERC Review Team

The members of the Project Team are also members of the ERC Review Team. Further specification of Review Team members is made below.

4.1.1 ERC Review Team Chairman: The ERC Review Team Chairman is the Plant Staff Co-Administrator (an Operations Section Engineer) or his designated alternate. Designated alternates are other LILCO technical supervisory personnel who are members of the Review Team.

4.1.2 Technical Review Leader

The Technical Review Leader shall be a member of the Review Team. The Technical Review Leader will assure that the resolution of one HED does not create a new HED.

4.1.3 Other LILCO Personnel on the Review Team:

- o SPDS Designer
- o I&C Engineer
- o Nuclear Plant Training Engineer
- o Nuclear Systems Engineer
- o Operations Engineer
- o Computer Software Engineer
- o Nuclear Licensing Engineer

4.2 Lines of Accountability:

The ERC Review Team Chairman or his designated alternate is responsible for chairing sessions of the Review Team.

- o At the conclusion of each event review session, the Review Team Chairman prepares a review package for transmittal to the ERC Program Co-Administrators. The Co-Administrators review/approve the package and insure that the required technical alterations are implemented. This process insures that all Co-Administrators are integrated into the review process.

5.0 PROJECTED PARTICIPATION BY DISCIPLINE

5.1 Projected Generic Discipline Requirements:

Figure III-2 tabulates the recommended disciplines for ERC review in accordance with the requirements found in NUREG-0801, Exhibit 2-1. NUREG-0801 discipline recommendations are based on a narrower workscope than that contained in this Program Plan. Accordingly, Figure III-2 compares NUREG-0801 scope (review process) with LILCO's scope (review process) so that discipline requirements can be evaluated. This comparison illustrates that the LILCO proposed disciplines match the NUREG-0801 requirements in the areas of Systems Analysis, Reactor Operations, I&C Engineering, and Human Factors Engineering. LILCO exceeds the NUREG-0801 requirements in the areas of SPDS Design, Training Design, Graphic Design and Industrial Engineering. This is attributable to the integrated effort (SPDS, Training, Human-Factored EOPs) and real-time methodology. Note that PRA Engineering is involved in the preparatory phase but not represented on the Review Team.

5.2 Nuclear Engineering Department (NED)

- o Nuclear Engineering is responsible for the development of the Shoreham Plant Specific Technical Guidelines.
- o NED System Engineering (which includes the PRA Group) will be involved in event selection and associated software development.
- o NED Computer Engineers are responsible for SPDS design concurrent with the Operations Section parameter and display format requirements, for SPDS verification, event modeling and technical interface with the Limerick Simulator.
- o NED members will participate in the Task Analysis.
- o After the Task Analysis, NED will take the lead in developing, reviewing and implementing system design changes required to resolve HEDs.

ERC PROGRAM: DISCIPLINE REQUIREMENTS

NUREG-0801 REVIEW PROCESS (NUREG-0801, EXHIBIT 2-1)	NUREG-0801 DISCIPLINE EMPHASIS RECOMMENDATION	LILCO ERC REVIEW PROCESS (All References Are To Methodology Section In Chapter I)	LILCO PROPOSED DISCIPLINE EMPHASIS
1. Operating Experience Review Examination of Available Documents	Nuclear Systems Engineering/Reactor Operations	3.1.4	Nuclear Systems Engineering, Technical Review Leader
Control Room Operations Personnel Survey	Human Factors/Reactor Operations	3.6	Nuclear Systems Engr. Operations, Human Factors
2. Review of System Functions and Analysis of Operator Tasks Identification of Event Sequences	Nuclear Systems Engineering	Task Analysis in Sections 3.2 and 3.3	Nuclear Systems Engr. Operations, I&C Human Factors
Function Identification	Nuclear Systems Engineering		
Function Analysis	Human Factors/System Analysis		
Operator Task Identification	Nuclear Systems Engineering/Reactor Operations		
Task Analysis	Human Factors/Systems Analysis		
3. Control Room Inventory	Instrumentation and Control/Reactor Operations	3.5.3	Operations, Nuclear Systems, I&C
4. Control Room Survey	Human Factors/Subject Specialists	3.5.2	Operations, Human Factors
5. Verification of Task Performance Capabilities Verification of Availability	Instrumentation and Control/Reactor Operations	3.2, 3.3, 3.5	Nuclear Systems, Operations, I&C, Human Factors Technical Review Leader
Verification of Human Engineering Suitability	Human Factors	3.7	Human Factors
6. Validation of Control Room Functions	Instrumentation and Control/Reactor Operations/Human Factors/Systems Analysis	3.2, 3.3, 3.4, 3.5	Nuclear Systems, Operations, Tech. Review Leader

FIGURE III-2

5.2 Nuclear Engineering Department (NED) (Cont'd.)

- o NED will review and approve all NED work to ensure QA compliance.

5.3. Shoreham Operations Section

- o The Operations Section will prepare the Writers Guide, draft EOPs and conduct simulator exercises and related preparatory training.
- o Operations, working with the Human Factors Specialist, will take the lead in the CRDR.
- o Operations will recommend SPDS parameters and display formats. Operations will review all display changes to SPDS.
- o An Operations Engineer will review and approve any modifications to operations procedures or the control room.

5.4 Nuclear Operations Support Department (NOSD)

- o A NOSD Licensing Engineer will provide the interface between LILCO and the Nuclear Regulatory Commission, for the duration of the project.

5.5 Shoreham Instrument and Control Section (I&C)

- o I&C Engineering will participate in CRDR, Task Analysis and determination of control and display requirements.

5.6 Shoreham Nuclear Plant Training Section

- o Nuclear Plant Training is principally involved in developing a training program to implement the upgraded EOPs, providing input to assist in the resolution of HEDs and for training the operators.

5.7 Technical Review Leader

- The Technical Review Leader supplements the Operations Section and is consistent with the Technical Review Leader description provided in this chapter.

- As a human factors specialist he will provide overall consultation on human factors considerations through all phases of the project.

CHAPTER IV: SCHEDULING

1.0 INTRODUCTION

NUREG-0700, at par. 2.6, "Scheduling," indicates that:

> A detailed schedule for each of the review tasks and for the subsequent assessment and implementation phase tasks should be developed during the planning phase. Particular attention should be given to task dependency on the output of other tasks, and to the estimated time required to accomplish each task.

Based on this requirement, LILCO has constructed a Milestone Schedule for its Emergency Response Capability Program that indicates both task dependencies and estimated times required to accomplish each task. Additionally, it is important to note that there are discipline dependencies within each task; for example, LILCO Nuclear Engineering will be involved in the development of the Plant-Specific Technical Guidelines that will ultimately serve to drive the task analysis effort. Accordingly, this Chapter will also discuss the schedule for each task not only in terms of task dependencies and estimated times, but in terms of discipline interdependencies within each task as well.

The following paragraphs (2.1-2.29) correspond to tasks numbered 1-29 on the ERC Milestone Schedule (figure IV-1) found in the back of this Chapter.

2.0 TASK SCHEDULES AND MANPOWER LOADING

2.1 Establish PSTG Developmental Methodology

Task 1 relates to the confirmation of the methodology for the development of Plant Specific Technical Guidelines as discussed in Chapter I, par. 3.1.1. Task duration is two calendar weeks, during which time the Nuclear Engineering Department (NED) will provide the equivalent of one full-time engineer. This task will be used to establish a method whereby the PSTGs can be traced to the plant design base through NED. Accordingly, a meeting between the Operations Section, Nuclear Engineering Department, Nuclear Operations Support Department and the Technical Review Leader will be held to establish the flow and documentation of information.

2.2 Review/Approve Task No. 1 (Establish PSTG Developmental Methodology)

This review/approval task provides an opportunity for Operations Section, NOSD, the PRA Specialist and the Technical Review Leader to review and approve the methodology proposed for the development of the Plant-Specific Technical Guidelines. Task 2 is a two calendar week effort involving the Plant Staff, NOSD, NED and the Technical Review Leader. As indicated on the milestone schedule, Task 2 must be completed before work can begin on the actual development of the PSTGs (Task 3).

2.3 Develop Plant-Specific Technical Guidelines

Task 3 relates to the responsibility of Nuclear Systems Engineering for the (re)development of the PSTGs. This effort is expected to require one full-time engineer for a three calendar week period.

2.4 Review/Approve Task No. 3 (Develop Plant-Specific Technical Guidelines)

Task 4 relates to the review and approval of the PSTGs by NED. A complete review/approval cycle will take twelve weeks. The approval of the PSTGs is a critical path item for Task 8, development of the upgraded EOPs.

2.5 Develop Writer's Guide

Task 5 relates to the responsibility of the SNPS Operations Section for the development of the Shoreham Specific Writer's Guide. This task is scheduled for one full-time engineer for one month. Task 5 can be performed in parallel with the development of the PSTGs.

2.6 Review/Approve Task No. 5 (Develop Writer's Guide)

Task 6 relates to the review and approval of the Shoreham Writer's Guide by the Operations Section. A complete review/approval cycle will take three weeks. The development of the Writer's Guide is a critical path item for Task 7.

2.7 Prepare a Procedures Generation Package

A Procedures Generation Package consisting of the PSTGs, the Writer's Guide, a description of the program for the validation of the EOPs and a brief description of the training program for the upgraded EOPs will be prepared for submittal to the NRC. The Operations Section will be responsible for coordinating the task and assembling the input from the other sections. This task will require approximately two weeks for the generation of the program descriptions; submittal to the NRC will follow shortly thereafter.

2.8 Develop Draft EOPs

Task 8 relates to the responsibility of the Operations Section to develop an upgraded version of the EOPs based on the PSTGs and Writer's Guide developed in Tasks 3 and 5, respectively. This effort is scheduled for one full-time engineer for a duration of two months.

2.9 Review/Approve Task No. 8 (Develop Upgraded EOPs)

Task 9 provides the opportunity for the Operations Section and other appropriate individuals to review and approve the draft EOPs. The complete review/approval cycle will take three weeks. Approval of the EOPs is a critical path item for Tasks 21, 22, 23 and 24.

2.10 Establish Event Selection Methodology

Task 10 relates to the selection of events to exercise the draft EOPs discussed in Chapter I, par. 3.1.4. Task 10, the Methodological Task, is the responsibility of the Nuclear Systems Engineering Division. They will be supported in this effort by the Operations Section and the PRA Group. The duration of Task 10 is three calendar weeks. This task will be used to establish a method whereby the selected events can be traced to (a) the SNPS PRA and (b) the systems review that underlies the BWROG Rev. 3 EPGs and the SNPS PSTGs developed therefrom. Accordingly, the key to this effort is a meeting among the Operations Section, PRA Specialist, NED, NOSD and the Technical Review Leader to establish the flow of information and its documentation.

2.11 Review/Approve Task No. 10 (Establish Event Selection Methodology)

Task 11 provides an opportunity for NED, NOSD and the Technical Review Leader to review and approve the methodology proposed for selection of events to exercise the draft SNPS EOPs. Task 11 is a one calendar week effort involving NED, NOSD and the Technical Review Leader for one equivalent man-week each. Task 11 is a prerequisite for Task 12, Select Events.

2.12 Select Events

Task 12 relates to the responsibilities of the PRA Specialist, the Operations Section and the Computer Software Engineer (NED) for the selection of events. The PRA Specialist has the

2.12 Select Events (Cont'd.)

lead responsibility for this eight calendar week effort in which they will provide 1.5 equivalent full-time engineers. An Operations Engineer will provide part-time support at a two man-week level of effort over the task length. The Computer Software Engineer will provide one full-time engineer over the eight calendar week period. It should be noted that although the Computer Software Engineer is not involved in the development of the Event Selection Methodology (Task 10), he is nevertheless involved in Task 12 to prepare for the development of the simulator Data Acquisition Plan (Task 14). Task 12 is a prerequisite for Task 13.

2.13 Review/Approve Task No. 12 (Select Events)

Task 13 includes all activity associated with review and approval of the event selection process. During the approval process, a four week task, LILCO Nuclear Engineering will provide one equivalent full-time engineer. The events selected will be reviewed by NOSD, the Technical Review Leader, Operations Section, Computer Software Engineer and the PRA Group. Task 13 is a prerequisite for Tasks 23 and 24.

2.14 Simulator Event Verification/Data Acquisition Plan

Task 14 relates to the comparison of the selected events with characteristics of the Limerick Simulator to evaluate the differences between Limerick and Shoreham responses. Documenting and analyzing differences will be a 3 week effort by an Operations Engineer and the Technical Review Leader. Task 14 also relates to planning for exercising the SNPS draft EOPs and the generation of real-time task data discussed in Chapter I, par. 3.1.5. The Computer Software Engineer holds prime responsibility for development of this data acquisition plan. They will begin a six calendar week full-time effort, when Task 13, "Review/Approve Selected Events" is completed. The Computer Software Engineer will be assisted by an Operations Engineer.

2.15 Review/Approve Task No. 14 (Simulator Event Verification/ Data Acquisition Plan)

The Nuclear Engineering Department, Nuclear Operations and Support Department and the Technical Review Leader will review the simulator data acquisition plan during this two calendar week period. The effort associated with the review and approval of Task 14 is projected at one man-week each for both NED and NOSD, over the projected two calendar week period. The Technical Review Leader will provide assistance for the duration of Tasks 14 and 15. Task 15 is a prerequisite for the Simulator Exercises, Task 22.

2.16 SPDS Safety Analysis

Task 16 relates to the preparation of a written safety analysis on SPDS parameter selection. This will require a Computer Software Engineer for ten full-time weeks.

2.17 SPDS Interface with the Limerick Simulator

Task 17 relates to the detailed study and design of the interface between the Shoreham Emergency Response Facility Computer System and the Limerick Simulator (Chapter I, paragraph 3.1.7). This will be a seven man-week effort for the Computer Software Engineer.

2.18 SPDS Event Selection

Task 18 will require a Nuclear Systems Engineer for two man-weeks to select events from Task 13 to demonstrate the effects of SPDS upon operator performance.

2.19 Generate SPDS Data Tape

Task 19 will require a three man-week effort by the NED Computer Software Engineer to generate a data tape to be used for SPDS validation. This Task requires input from Tasks 14, 17 and 18.

2.20 Evaluation of the Effects of SPDS

Task 20 relates to evaluating the effects of SPDS in the control room by evaluating the simulator runs with and without SPDS. A questionnaire will be prepared with specific references to the SPDS events. This will be a two man-week effort with input from Nuclear Engineering, Operations and the the Technical Review Leader. The questionnaire will be given to the operators after the Simulator Run, Task 22.

2.21 Operator Training

Task 21 relates to the exercise of the SNPS draft EOPs and the generation of real-time task data at the Limerick simulator as discussed in Chapter I, par. 3.1.5. Task 21 represents an interactive effort between the developers of the draft SNPS EOPs and three Senior Reactor Operators (SROs) whereby the SROs will be familiarized with the draft EOPs and the selected events that will be used to generate real-time task information on the Limerick simulator. The Operations Section will provide a 4.5 man-week level of effort over the four calendar weeks involved; two weeks of which are preparatory time and the latter two weeks of which are actual instruction time. This Task requires completion of prerequisite Tasks 9 and 13 which reflect completion and approval of the draft Plant Specific Emergency Operating Procedures and the Selection of Events. This Task is itself a prerequisite to Task 22, the Conduct of Simulator Exercises discussed in the next paragraph.

2.22 Conduct Simulator Exercises

Task 22, under the direction of the Operations Section is a one calendar week effort conducted at the Limerick Simulator to generate real-time task data. Participants include:

Operations Engineers	(2.5 full-time man-weeks)
Computer Engineers	(2.5 full-time man-weeks)
LILCO Operations	(3 full-time SROs)
LILCO NOSD	(one man-week)
LILCO NED	(one man-week)
Human Factors Consultant	(one man-week)

2.22 Conduct Simulator Exercises (Cont'd.)

The principals of this Task will be an Operations Engineer who will conduct the exercises, Limerick Simulator Management and the Computer Software Engineer. Other participants are included as observers in preparation for their work as members of the ERC Review Team. This Task is a prerequisite for Tasks 23 and 24, Task Analyses.

2.23 Information Requirements Task Analysis

Task 23 relates to "Task Analysis in Terms of Information Requirements, Decision Requirements and Action Requirements" as discussed in Chapter I, par. 3.2. This four calendar week task represents efforts of the same Review Team members identified in Task 22, but, at different manpower levels:

Operations Engineer	(four man-weeks)
Human Factors Specialist	(two man-weeks)
I&C Engineering	(one man-week)
Training	(one man-week)
Computer Software (SPDS Design)	(one man-week)

This Task is a prerequisite for Task 25, Control Room Inventory.

2.24 Workload/Work Station Task Analysis

Task 24 relates to "Task Analysis in Terms of Work Station and Manning Requirements" discussed in Chapter I, par. 3.4. Task 24 represents the activity of the Review Team relative to identification of Human Engineering Observations. Event map preparation involves placing required operator actions on control room maps. This three calendar week activity will represent a three man-week effort each on the part of the Technical Review Leader and LILCO I&C Engineering. The Analysis portion is projected to occupy three calendar weeks and will involve the equivalent full-time effort of one representative of the Operations Section, I&C Engineering, SPDS Engineering, Nuclear Plant Training and the Technical Review Leader. This Task is a prerequisite for Task 25, Control Room Inventory.

2.25 Control Room Inventory

Task 25 relates to the verification of the Task Analysis requirements by performing the Control Room Inventory and documenting results. This will be a 3 man-week effort involving the Technical Review Leader, Operations Section and Nuclear Systems Engineering.

2.26 Control Room Survey

Task 26 relates to performing NUREG-0700 requirements not addressed in NUREG/CR 1580 and assuring that all HEDs generated in the 1981 Control Room Survey will be addressed. This will be a 3 man-week effort involving Nuclear Systems Engineering, SNPS Operations and the Technical Review Leader. Task 26 may be performed in parallel with Task 25.

2.27 Assessment of HEOs and Resolution of HEDs

Task 27 relates to the assessment of Human Engineering Observations identified in tasks 23, 24, 25 and 26. Any HEO that results in an increase in the potential for operating crew error or is a potential impact on safety will be designated as Human Engineering Deficiency. HEDs will be subsequently categorized and recommendations for correction and/or resolution will be developed. This task has a projected duration of ten weeks with input by all Review Team members.

2.28 Preparation of the Final Report

The Operations Section will be responsible for the generation of a final report to document the methodology and the results of the ERC Program. The Final Report will also identify each HED with a recommended resolution/correction. A schedule for the correction/resolution of these HEDs based upon assessment categorization will be provided. This task is expected to require approximately six weeks. The Final Report will be submitted to the NRC shortly thereafter.

2.29 Resolution/Correction of HEDs

Finalization of proposed HED resolutions and/or corrections will be initiated approximately four weeks after the start of task 27 based on assessment categorization as discussed in par. 3.7 of Chapter I. All members of the Review Team will be responsible for this task, however, the scheduling information cannot be developed until the HEDs have been identified.

THE SNPS EMERGENCY RESPONSE CAPABILITY MILE

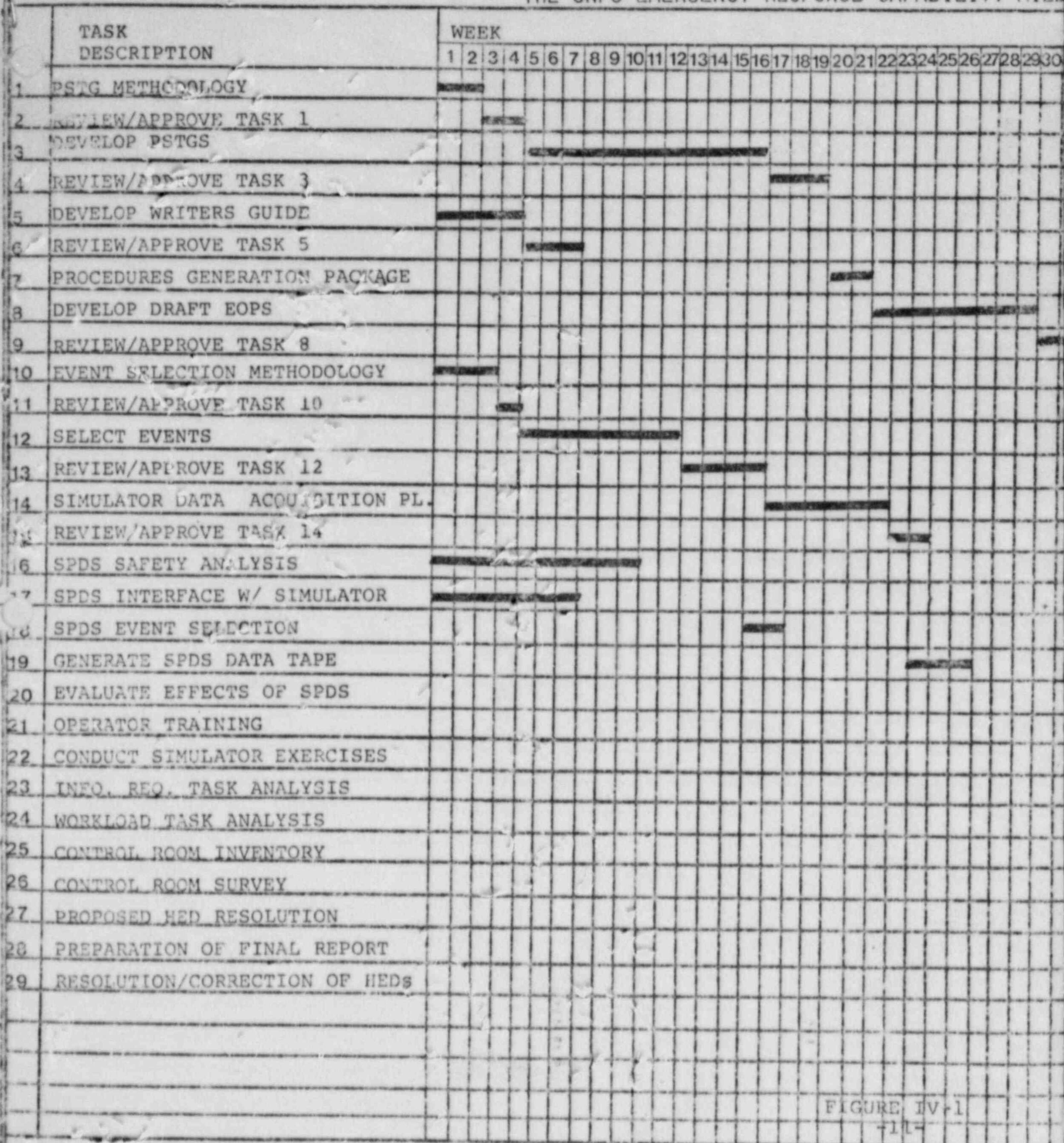
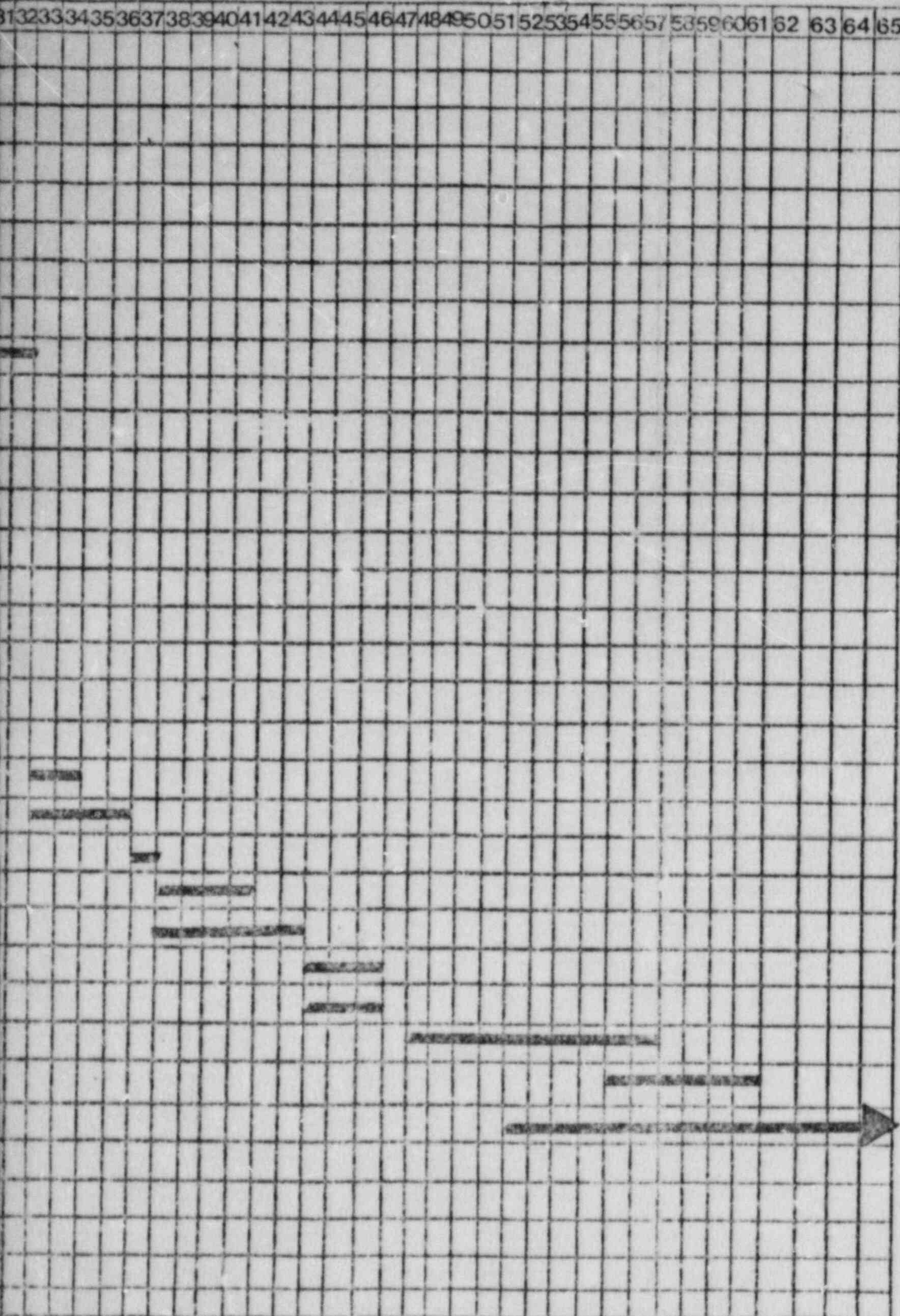


FIGURE IV-1

STONE SCHEDULE



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CHAPTER V: DATA MANAGEMENT

1.0 INTRODUCTION

NUREG-0700, at par. 2.4, Data Management, indicates the criteria by which data for a human engineering effort should be managed.

> The control room design review process will involve a systematic use of a substantial number of existing documents and preparation of new materials. The purposes of the reference materials, forms, and other working papers suggested in these guidelines are (1) to record results of analyses, inventories, and surveys; (2) to provide a support base to manage and execute the various steps in phases of the systems review; (3) to provide a design data base, such as a control room design requirement, from which future control room modifications may be assessed; (4) to establish a review data base which can be rapidly assessed for NRC audit. Methods of data management should be established before the review process is initiated. (op. cit., p. 2-3)

In order to facilitate the planning process for data management, each of the tasks associated with the project were subjected to a detailed planning process. The results of that planning process are found in this document at Chapter IV, Scheduling. The information provided in this Chapter on Data Management follows the task numbering scheme in Chapter IV.

2.0 DATA MANAGEMENT (BY TASK)

2.1 Task 1 prepares a methodological document for the development of the PSTGs. It will identify appropriate input information and will establish the method by which input information, i.e., plant design bases, is translated into PSTG operator task content and/or sequence. The document will also establish the documentation and control methods for (a) input information, i.e. plant design bases, (b) translation assumptions, e.g. applicability of response curves to procedural step content and/or sequence, and (c) output information - the PSTGs. The document will designate the systems to be used for selection, cataloging, filing and updating of source documents, the controls for maintenance and dissemination of approved consistent assumptions, and the retrievable filing of output information with associated review documentation.

2.2 Task 2 relates to the review and approval of the methodological document for PSTG development. Approval documentation and maintenance of the methodological document by which PSTGs will be (re)generated will be maintained by the Nuclear Engineering Department.

2.3 Task 3 covers activities of the Nuclear System Engineering Section for the development of the PSTGs. The data management systems to be employed will be defined in the methodological document described above at par. 2.1.

2.4 Task 4 relates to the review and approval of the PSTGs. Approval documentation and maintenance of the PSTGs is that responsibility of NED.

2.5 Task 5 prepares a Writer's Guide following the guidelines of NUREG-0899.

2.6 Task 6 relates to the review and approval of the Writer's Guide. Approval documentation and maintenance of the Writer's Guide will be maintained by the SNPS Operations Section.

2.0 DATA MANAGEMENT BY TASK, (CONT'D.)

2.7 Task 7 involves the preparation of a Procedures Generation Package for submittal to the NRC, consisting of the PSTGs, Writer's Guide and descriptions of the programs for validation of the EOPs and the training program for the upgraded EOPs.

2.8 Task 8 will use the Writer's Guide and the Shoreham PSTGs to develop the draft version of the Shoreham-specific Emergency Operating Procedures.

2.9 Task 9 relates to the review and approval of the draft EOPs. Approval documentation and maintenance of the EOPs will be maintained by the SNPS Operations Section.

2.10 Task 10 prepares a methodological document for the selection of events to exercise the draft EOPs. It will establish the method by which input information, i.e., operational experience and PRA data will be blended into a list of events deemed suitable to fully exercise the draft EOPs, thereby generating adequate operator task information. The methodological document will also establish the documentation and control of (a) input information, i.e., LERs and PRA data, (b) translation assumptions, e.g., probability limits, and (c) output information - the final list of selected events. The document will designate the systems to be used for selection, cataloging, filing and updating of source documents, the controls for maintenance and dissemination of approval, consistent assumptions and the retrievable filing of output information with associated review documentation.

2.11 Task 11 relates to the review and approval of the methodological document for event selection. Approval documentation and maintenance of the methodological document by which on-going operating experience and additional PRA data will be reevaluated will be maintained by LILCO NED.

2.0 DATA MANAGEMENT BY TASK, (CONT'D.)

2.12 Task 12 covers selection by the Nuclear Systems Engineering Division (which includes the PRA Group) of events for analysis. The data management systems to be employed will be defined in the methodological document described above at par. 2.10, (Task 10).

2.13 Task 13 relates to LILCO review and approval of the list of events selected to exercise the draft EOPs. Approval documentation and maintenance of the list of selected events will be maintained by LILCO Nuclear Engineering.

2.14 Task 14 identifies the differences between Shoreham and the Limerick Simulator in order to confirm the validity of simulating Shoreham Specific EOPs at Limerick. Differences will be documented so they may later be incorporated into the software modeling or preparatory operator training. Task 14 also develops a planning document, the Simulator Data Acquisition Plan for exercising the SNPS draft EOPs to generate real-time task data. It will establish the method by which simulator runs will be conducted, simulator data will be collected, supplementary calculations will be performed and incorporated into the simulator tapes, and how data will be reduced, documented and controlled. The Plan will also establish the documentation and control of (a) input information, i.e., selected events, (b) performance assumptions, e.g., operator responses to selected events during the simulator runs, and (c) output information - the real-time task data. This task will be the responsibility of the Nuclear Engineering Department, Operations Section and the Technical Review Leader. Document control will primarily be the responsibility of NED.

2.15 Task 15 relates to LILCO approval of the software modeling and the Simulator Data Acquisition Plan, Task 14. Approval documentation and software maintenance will be the responsibility of LILCO Nuclear Engineering. Review, approval documentation, and maintenance of the Simulator Data Acquisition Plan, by which future events will be analyzed on a simulator, will be the responsibility of LILCO Nuclear Engineering.

2.0 DATA MANAGEMENT BY TASK, (CONT'D.)

2.16 Task 16 will prepare a written Safety Analysis on SPDS parameter selection as required by NUREG 0737, Supplement 1, par. 4.2.a. The Safety Analysis will be submitted to the NRC as part of the Final Report. This will be the responsibility of LILCO Nuclear Engineering.

2.17 Task 17 will study the technical tasks required to perform the interface between the Shoreham Emergency Response Facility Computer System and the chromatic terminals that will be installed at Limerick by LILCO. This will be the responsibility of LILCO Nuclear Engineering.

2.18 Task 18 will choose events from Task 13 that will demonstrate the effects of SPDS on operator response. This will be the responsibility of LILCO Nuclear Engineering.

2.19 Task 19 generates a data tape for those events selected in Task 18 for SPDS testing. This tape will be an updated SPDS database and be sent to the chromatic terminals at Limerick through modem. This is the responsibility of Nuclear Systems Engineering.

2.20 Task 20 will be conducted in conjunction with Task 22, the simulator run. This Task requires the Simulator to run the selected events with and without SPDS. A questionnaire will be prepared to analyze the effects of SPDS. This will be the responsibility of Nuclear Systems Engineering.

2.21 Task 21 covers orientation of the LILCO SROs by the Operations Engineer in preparation for the simulator runs. This responsibility of the Operations Section will be defined in the methodological document defined above at par. 2.14. The scope of orientation will be established in Task 14.

2.0 DATA MANAGEMENT BY TASK, (CONT'D.)

2.22 Task 22 involves the generation of real-time task data at the Limerick Simulator. The documentation requirements for the simulator runs and control of that documentation will be defined in the methodological document described above in par. 2.14. Task 22 is the responsibility of the Operations Section.

2.23 Task 23 covers the Task Analysis in terms of information requirements. Figure I-3 illustrates the format in which the analysis information will be presented. The information input (operator action requirements) for this task will be the draft EOPs. Approval documentation and maintenance of the Task Analysis data forms will be the responsibility of the Operations Department.

2.24 Task 24 covers activities of the Review Team in performing the Workload/Workstation Task Analysis. The first step in the analysis is the generation of the event maps as discussed in Chapter I, Section 3.4. Generation of the facsimile maps and verification of their accuracy is the responsibility of LILCO I&C Engineering. At the completion of the Workload/Workstation Analysis, the optimum Control Room and crew placement are recorded on a SNPS Control Room Event Map. Generation of these documents is the responsibility of the Review Team. Approval documentation and maintenance of the event maps will be the responsibility of the Operations Department.

2.25 Task 25 relates to the activities associated with determination of the Control Room display requirements and the Control Room inventory. The determination of display requirements for the Control Room hardware will be accomplished through Task Analysis. Task Analysis Forms will be compared against existing Control Room instrumentation by LILCO Operations and I&C who will generate an HEO when the Control Room display does not appear to be adequate.

2.0 DATA MANAGEMENT BY TASK, (CONT'D.)

2.26 Task 26 relates to the activities associated with assuring the 1981 NUREG/CR-1580 Control Survey meets all the criteria of NUREG-0700, Chapter 6. Operations will be responsible for developing the list of additional human factors requirements for the Shoreham control room. Any remaining unresolved HEDs are being tracked as described in the next section, 2.27.

2.27 This task relates to the assessment of Human Engineering Observations, identification and categorization of Human Engineering Deficiencies and the proposed resolution/correction of these HEDs. All HED forms (Figure I-7) will be stored on a computerized Database Tracking System. Individuals will be assigned responsibility for correcting an HED; this list will be maintained by an Action Item Tracking System. Operations will be responsible for both of the tracking systems.

2.28 Task 28 involves the generation of the Final Report for submittal to the NRC. In addition to the identification of methodology changes and the categorization, proposed resolution and scheduling thereof, the final report will also include an SPDS safety analysis addressing parameter selection.

APPENDIX A

REGULATORY BACKGROUND TO NUREG-0737, SUPPLEMENT 1

1.0 Kemeny Report Findings and Recommendations

In Finding A, "Assessment of Significant Events," the Kemeny Commission reported that:

The control room was not designed with the management of an accident in mind. For example:

a. Burns and Roe, the TMI-2 architect/engineer, had never systematically evaluated the control room design in the context of how well it would serve in emergency situations.

b. The information was presented in a manner which could confuse operators:

(i) Over 100 alarms went off in the early stages of the accident with no way of suppressing the unimportant ones and identifying the important ones. The danger of having too many alarms was recognized by Burns and Roe during the design stage, but the problem was never resolved.

(ii) The arrangement of controls and indicators was not well thought out. Some key indicators relevant to the accident were on the back of the control panel.

(iii) Several instruments went off scale during the course of the accident, depriving the operators of highly significant diagnostic information.

(iv) The computer printer registering alarms was running more than 2½ hours behind the events and at one point jammed, thereby losing valuable information.
(Assessment no. 8)

These concerns: (i) alarm prioritization, (ii) control arrangement, (iii) inappropriate instrument selection and (iv) data recording capability persist to this date within the NRC's Division of Human Factors Safety and were among the chief influences on the development of the Guidelines for the CRDR (NUREG/CR-1580: incorporated into NUREG- 0700, Chapter 6).

2.0 NUREG/CR-1270, Human Factors Evaluation of Control Room Design and Operator Performance at TMI-2, the "Rogovin Report"

The Rogovin Report introduced the nuclear industry to the concept of "task analysis," for which reason it is pertinent to this review. In its overview on control room design, par. 3.1, it states:

> By corollary, the crux of effective design, from an HFE perspective is the translation of operator functions into specific tasks and subsequently, into quantifiable information and performance requirements. (page 29)

Importantly, the Rogovin Report's understanding of "the crux of effective HFE design" corresponds with that found in MIL Spec-H-46855B, where, in discussing general analytical requirements, the following definition of the analytical problem is found:

> Starting with a mission analysis developed from a baseline scenario, the functions that must be performed by the system in achieving its mission objectives shall be identified and described. These functions shall be analyzed to determine the best allocation to personnel, equipment, software, or combinations thereof. Allocated functions are further dissected to define the specific tasks which must be performed to accomplish the functions. Each task is analyzed to determine the human performance parameters, the system/equipment/software capabilities, and the tactical/environmental conditions under which the tasks were performed. (MIL-H-46855B, Human Engi- neering Requirements for Military Systems, Equipment and Facilities, 31 January 1979, par. 3.1.1.a, p. 2)

What can be seen in this comparison is that the Rogovin Report limited itself to an analysis of pre-defined list of tasks, "task analysis." It did not address the identification of functions, the "mission analysis," and did not address the allocation of functions to machine vs. man. This limitation was self-imposed, owing to the fact that the Rogovin Report limited its inquiry to the TMI event sequence itself.

2.0 Rogovin Report, (cont'd.)

> This 150 minute sequence . . . is in no way intended to be an exhaustive enumeration of design deficiencies or operator activities. (ibid., p. 48)

Notwithstanding this lack of attention to the matter of event identification, the Rogovin Report nevertheless presented the entire analytical strategy that was ultimately to surface in the NSSS Owners Groups and in SECY-82-111, later Supplement 1:

- o Identification of all system functions
- o Allocation of those functions to man or machine
- o Definition of operator tasks
- o Task analysis in terms of information requirements, decision requirements and action requirements
- o (Task) Analysis (in terms) of workstation and manning requirements
- o Preliminary (re)design
- o Design evaluation using workstation mock-ups
- o Final design
- o Test and evaluation of system capabilities against the original functional requirements. (par. 3.6.1)

The above cited analytical approach was specifically proposed to the Office of Nuclear Reactor Regulation by LILCO in its April 14, 1983 licensing submittal (SNRC-863) based upon (a) the apparent correspondence between the Rogovin Report methodology and the required methodology in Supplement 1 at par. 5.1.b.ii, (b) the correspondence between the Rogovin Report methodology and the required methodology in MIL-H-46855B cited above, (c) the precise transition that the Rogovin Report methodology provides between the BWROG Owners Group

2.0 Rogovin Report, (cont'd.)

activity [functional allocation review and task definition] and the LILCO, plant-specific activity [task analysis], and (d) the sound engineering methodology that, in LILCO's opinion, is represented by the Rogovin Report methodology.

3.0 NUREG-0659, "Staff Supplement to the Human Factors Engineering Guide to Control Room Design Review" (NUREG/CR-1580)

The HFE Guide to CRDR (NUREG/CR-1580) contained a checklist for Control Room Design Review that addressed, among other items, workstation design, control and display design, labeling, color coding, and habitability. These items were addressed without reference, necessarily, to ". . . the tactical conditions under which the tasks are conducted" (MIL-H-46855B, par. 3.1.1.a). For this apparent reason, the industry-wide comments contained in NUREG-0659, Appendix A were critical of CR-1580. Within the context of that critique, the problem of "selection of events for analysis" that was unaddressed by the Rogovin Report was succinctly addressed:

> Since the control room operating procedures used at a plant are implicitly based on the established allocation of functions between systems and human operators, procedures should be helpful in identifying the operator functions and their interfaces with plant systems. It is important, however, not to rely solely on procedures, especially if they have not been updated in accordance with Task Action Plan Items I.C.1 and I.C.9. To achieve a meaningful analysis of control room operator task resource requirements and performance criteria, the identification of functions and interfaces must be complete and must represent what actually goes on in the operating events being studied. If the existing procedures do not meet these conditions, engineering analysis and consultation with operating personnel will be necessary to assure adequate identification of functions and their interfaces. It is expected that the analysis already performed for Tasks I.C.1 and I.C.9 will

3.0 NUREG-0659, "Staff Supplement to the Human Factors Engineering Guide to Control Room Design Review" (NUREG/CR-1580) (Cont'd.)

> provide much, if not all, of the function documentation needed for transient and potential accident events, even if the revision of the procedures based on those analyses is not complete. (p. IV-13, emphasis added)

This expectation was to become the NRC position in SECY 82-111 (now NUREG-0737, Supplement 1) and the subject of NRC concern in the NRC Staff Review of the BWR Owners Group (BWROG) Control Room Survey Program, Generic Letter 83-18.

4.0 NUREG-0700, "Guidelines for Control Room Design Review"

The issue of event identification (the output of functional allocation review), missing from NUREG/CR-1580 resurfaced in NUREG-0700, especially Appendix B. In that Appendix, a definition of terms and methodological approach similar to the Rogovin Report can be found, for which reason Appendix B has been helpful to LILCO in the preparation of this Plan. Nevertheless, it is important to note that the boundaries of event analysis were not defined in NUREG-0700:

> NUREG-0700 is not prescriptive as to failure events to be analyzed. (par. 3.4.2.2)

5.0 NUREG-0801, "Evaluation Criteria for DCRDR"

Some clarification of the problem of event identification was provided in NUREG-0801 published in October 1981. In its Preface, a task analysis is shown to be the integrator of CRDR with EOPs and operator training. Furthermore, an emphasis on abnormal and emergency events is found therein:

> A task analysis should be performed as the basis for the systems review of the control room design, determining the operator training and staffing needs, determining the information the SPDS will present, and developing EOPs. NUREG-0700 and NUREG-0799 both identify a task analysis that will tell what information is needed by the operating

5.0 NUREG-0801, (cont'd.)

> crew. The task analysis that is performed in developing upgraded EOPs as described in Task Action Items I.C.1 and I.C.9 is the same task analysis that is used in identifying improvements to operator training. At a minimum this analysis should emphasize abnormal and emergency operating conditions. It is anticipated that the task analysis will be completed well in advance of the vendor or owners group generic emergency procedure guidelines. (page x.)

This language provides a number of methodological clarifications:

- o task analysis simultaneously drives: (a) CRDR, (b) operator training and staffing, (c) SPDS parameter selection and (d) plant specific EOP development.
- o the boundary of analysis (at the time of NUREG-0801) was defined as "abnormal and emergency events."

The language of NUREG-0801 (cited above) also presents a number of methodological problems that require explanation. First, refer to Figure 1-1 which provides an overview of the entire HFE process as it is both implicitly and explicitly conducted in (a) the original plant design process, (b) the owners groups and (c) the specific plant.

As indicated in NUREG-0659 and as shown in Fig. A-1, an implied functional allocation and task analysis was inherent in the initial plant design; these implied man/machine allocations were "captured" to a large degree by the control room operating procedures. TMI called into question these implied allocations and required that they be made explicit in the context of a known set of emergency events - those events being determined by "realistic" (as against FSAR Chapter 15) transient and accident assessment and system design review. The output of this systems review, realistic transient and accident assessment, and functional allocation review was an NSSS vendor-specific set of EOP guidelines. These guidelines contain a defined set of operator tasks, as "expected" by NUREG-0659. It is

SHOREHAM ERC PROGRAM CONCEPTUAL OVERVIEW

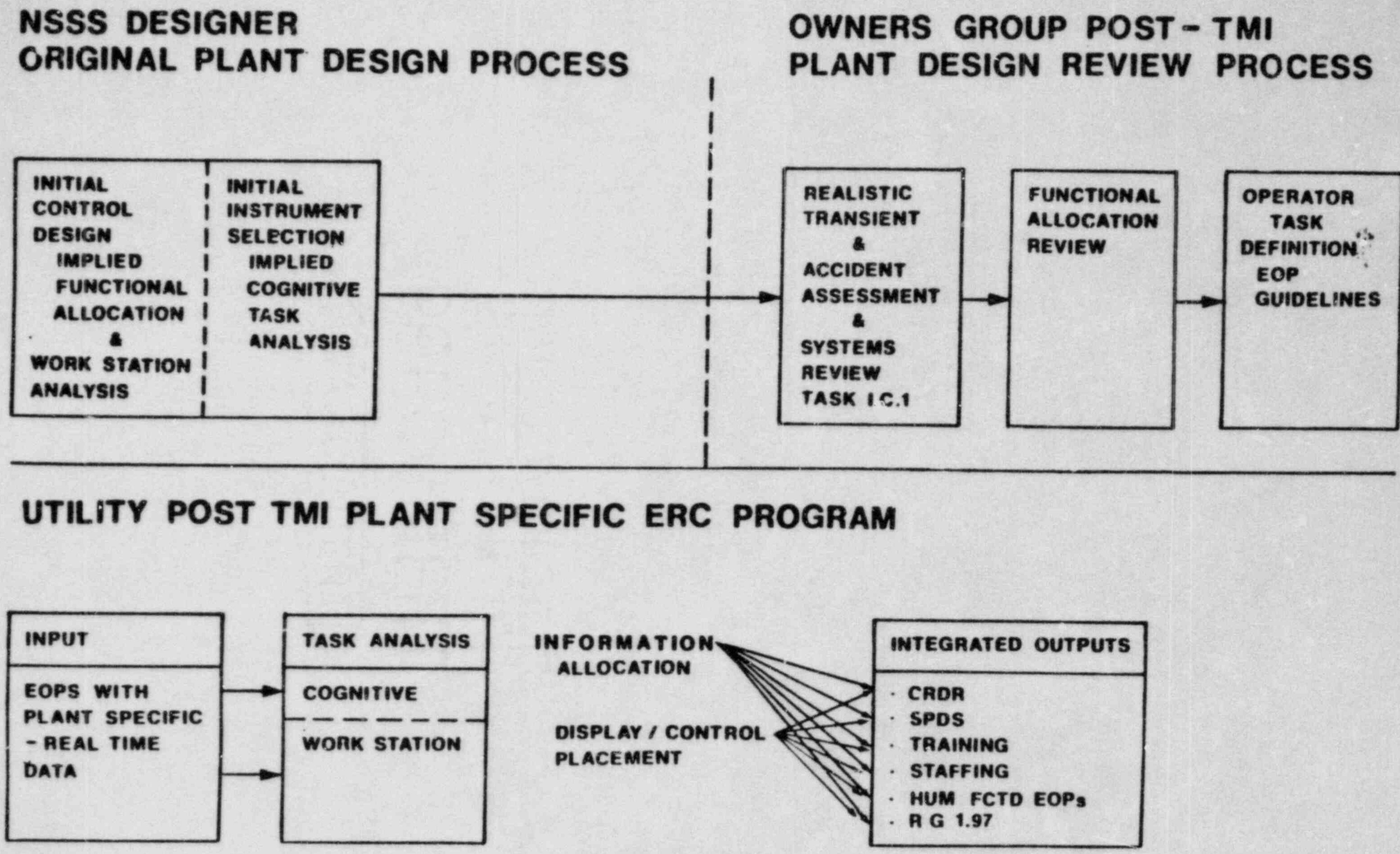

FIGURE A-1

5.0 NUREG-0801, (cont'd.)

important to note that this owners group activity did not constitute a task analysis. Operator tasks having been so defined, it remains for each plant to perform a plant-specific task analysis and "capture" the results in the plant-specific procedures, training and staffing, SPDS, Reg. Guide 1.97 instrumentation, and possibly modified control room.

6.0 Generic Letter 83-18, "NRC Staff Review of BWR Owners Group Control Room Survey Program"

Generic Letter 83-18 has the effect of expanding the planning requirements set forth in NUREG-0737, Supplement 1. At par. 5.2.a, Supplement 1 requires that "All licensees shall submit a program plan . . . that describes how items 1, 2, and 3 above will be accomplished." "Items 1, 2, and 3 above" refer to:

(i) The establishment of a multidisciplinary review team and a review program incorporating accepted human factors principles.

(ii) The use of function and task analysis . . . to identify control room operator tasks and information and control requirements during emergency operations. This analysis has multiple purposes and should also serve as the basis for developing training and staffing needs and verifying SPDS parameters.

(iii) A comparison of the display and control requirements with a control room inventory to identify missing displays and controls.

Generic Letter 83-18 adds the following specific planning and reporting tasks:

(i) Document the qualifications of survey team members and number and extent of plant personnel participation. (This corresponds to Supp. 1, item 5.1.b.i and was partially addressed in LILCO's Preliminary DCRDR Program Plan. Specific personnel commitments are made in this Plan in Chapter III, par. 2.2 and Review Team Resumes are supplied in Appendix B).

(ii) Identify portions of the plant's DCRDR not performed in accordance with the methodology specified in the BWROG Program Plan. (LILCO was a non-participant in this activity but will assess its possible impact on its current list of unresolved HEDs.)

6.0 Generic Letter 83-18, (cont'd.)

(iii) Discuss your program for prioritization of HEDs, reporting of DCRDR results, and implementation of control room enhancements. (HED prioritization is covered in this Plan at Chapter I, par. 3.7; reporting of DCRDR results and implementation of enhancements will be addressed in the Final Report).

Generic Letter 83-18 also expects BWR NTOLs (and others) to

b. Complete the BWROG Control Room Survey Checklist Supplement. (Refer to item ii, immediately above)

c. Prioritize HEDs, determine corrective actions, develop an implementation schedule, and report the results of the DCRDR to the NRC. (To be addressed in the Supplement 1 Final Report submittal)

d. Repeat portions of the task analysis using updated plant specific EOPs to account for the differences in the new procedures. (Discussed in Chapter I, pars. 3.2 and 3.3)

e. Update operating experience review (Discussed in Chapter I, par. 3.6)

(Cf.: G.L. 83-18, pp. 1-2)

7.0 NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures"

NUREG-0899 expands the discussion on task analysis found in Supplement 1 and provides specific methodological guidance not found there:

For operating plants, existing EOPs with supporting documentation and technical guidelines should provide a significant portion of the function and task analytic data. Thus, the plant specific EOPs, the generic technical guidelines and/or plant specific technical guidelines should provide the initial cut at identifying functions, their associated hardware systems, the actions that must

7.0 <u>NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures" (Cont'd.)</u>

be taken (by man and machine), and circumstances under which they must be taken. To the extent that this information is not contained in the technical guidelines, or is not adequately addressed in the plant specific EOPs, it will be necessary to carry out the task analysis as a separate effort.

The specific depth to which task analytic data needs to be collected will depend on its intended application. Thus, in some form, task analysis can be used to support:

- o Development of procedures,
- o Evaluation of existing man/machine systems,
- o Specification of design requirements for man/machine systems,
- o Evaluation of existing training programs,
- o Specification of training needs,
- o Evaluation of existing personnel qualification criteria,
- o Specification of personnel qualification criteria,
- o Evaluation of existing staffing requirements,
- o Specification of staffing needs.

Inasmuch as the information needs of these areas may overlap, a given task analysis may support a broad range of objectives. Hence the task analysis supporting development of plant-specific EOPs will also provide support for the control room design review to the extent that required controls and indications can be specified <u>for emergency operation</u>.

7.0 NUREG-0899, (cont'd.)

> Furthermore, coordinating control room design review with EOP development can provide useful information on preferable locations for controls and indications. The specific technique(s) for carrying out a task analysis may be based on approaches found in the literature (see the Bibliography), or may be based on approaches developed by the industry. (par. 3.3.3, pp. 8-9, emphasis original)

It is important to note that the plant specific technical guidelines ". . . should be subject to examination under the plant's overall Quality Assurance Program." (ibid., par. 4.4, p. 12)

NUREG-0899 also requires the development of a "Plant Specific Writer's Guide." Importantly, in addition to "style and format" issues typically addressed in a writer's guide, this writer's guide must address the issues of Sequencing (5.7.1), Time Dependent Steps (5.7.6), Concurrent Steps ["The maximum number of concurrent steps should not be beyond the capability of the control room staff to perform them."] (5.7.7), Consistency Between Staffing and Procedures (5.8.1), Division of Responsibility (5.8.2) and Staffing of the Control Room (5.8.3).

The development of the Plant Specific Technical Guidelines, Plant Specific Writers Guide, and upgraded, human-factored EOPs is part of the Procedures Generation Package summarized in NUREG-0899 at par. 7.2. LILCO has committed to the development and implementation of such a package in its preliminary Supplement 1 licensing submittal, SNRC-863, dated April 14, 1983, a schedule for which is contained therein.

8.0 NUREG/CR-3371, "Task Analysis of Nuclear Power Plant Control Room Crews"

The methodological objectives discussed in NUREG-0899 (par. 2.7, above) are reinforced by NUREG/CR-3371. In NUREG-0899, it can be seen that a task analytic effort can support, among other things, specification of staffing needs, specification of personnel qualification criteria, and development of procedures. NUREG/CR-3371 reiterates and expands these objectives as follows:

8.0 NUREG/CR-3371, (cont'd.)

The two objectives of the plan (NUREG/CR-3371) were to:

(1) Improve plant operation to reduce the factors contributing to accidents

(2) Improve the ability of operating staffs to recognize such events and take appropriate action

The development of regulatory guidance needed to implement these objectives raises a number of questions for which data have not been available:

(1) Based on the tasks to be performed, and with emphasis on abnormal and accident conditions, what are the needs of control room operating crew members as to numbers, qualifications, organization, and division of work?

(2) How should operating procedures be written, formatted, and presented to facilitate performance by crews in stressful, accident conditions?

(3) What are the information needs of crews and how do they relate to control room design and interpersonal communication requirements under normal and stressful conditions?
(op. cit., pp. 1-1, 1-2)

LILCO is of the opinion that these objectives coincide with its own. The question is, however, whether the methodology employed by NUREG/CR-3371 is consistent with those objectives.

9.0 NUREG/CR-1875, "Evaluation of Emergency Operating Procedures for Nuclear Power Plants"

NUREG/CR-1875 reviewed LOCA Procedures at nine (9) nuclear plants. Based on that review, the report concludes that procedures ". . . must indicate the location of each required control and indicator." (p. 1-4) This recommendation is based on the fact that "Adequate panel markings have not been provided for in the past." Accordingly, this document raises the issue of the relationship of control panel demarcation and procedural detail. A followup document, "Human Engineering Guidelines for Use in Preparing Emergency Operating

9.0 NUREG/CR-1875, "Evaluation of Emergency Operating Procedures for Nuclear Power Plants" (Cont'd.)

Procedures for Nuclear Power Plants" (NUREG/CR-1999) contains an example of a "Model Emergency Procedure" that will be assessed in the development on the Plant Specific Writer's Guide discussed above.

10.0 Methodological Issues Associated with Symptom Based Procedures

The BWR Owners Group and the Staff concluded early in the procedure development process that symptom based (rather than event based) procedures represented a better operational strategy to provide "defense in depth." Accordingly, the development of the BWROG EPGs (particularly Rev's. 2 & 3) was driven by a desire to cover all safety challenges (entry conditions) and related contingencies based on the plant systems ". . . as they are currently configured." (Cf.: Generic Letter 83-05, Enclosure 2, p. 1.) The resulting symptom based procedures are structured not to be event sensitive. However, the actual use of the EPGs does depend upon the precipitating event(s) that require the operators to "traverse" the entry conditions and related contingencies.

NUREG-0659 and NUREG-0801 both state that the procedures developed in response to Task Action Item I.C.1 would ". . . represent what actually goes on in the operating events being studied," and therefore, that those procedures would be capable of "driving" the task analysis, but, the task analysis will also have to consider the real-time use of the EPG's in response to a set of precipitating events.

The process that LILCO will use to select precipitating events to exercise the EPGs is discussed in Chapter I, par. 3.1.4.

11.0 Methodological Issues Associated with Selection of Operating Events

As discussed above at par. 10.0, development of the EPGs resulted in symptom based procedures. This development process involved a systems review of the GE NSSS design by GE and industry engineering and operations personnel and covered all safety challenges (entry conditions) and related contingencies based on the plant systems ". . . as they are currently designed." (Cf.: Generic Letter 83-05, Enclosure 2, p. 1). (Refer to Figure 1.2) "The guidelines (also) address(ed) operator errors by checking the effects of directed operator actions and providing guidance for those cases where previous operator actions were unsuccessful." (ibid., p. 3), LILCO feels that a reiteration of this process is appropriate for the selection of operating events. Accordingly, personnel qualified in the development of EPGs and Plant Specific Technical Guidelines will be responsible for "Experience Based Event Selection".

Figure A-2 also illustrates an event selection process based on Probabilistic Risk Assessment (PRA) data. Since a PRA has been performed on the Shoreham plant, the events considered therein to be significant contributors to risk will be combined with the event list generated by the PSTG developers. LILCO considers that the resulting event list will be adequate to (a) completely "exercise" the PSTGs and (b) provide a full range of real-time operator task information for task analysis.

APPLICATION OF OPERATING EXPERIENCE IN THE SHOREHAM ERC PLAN

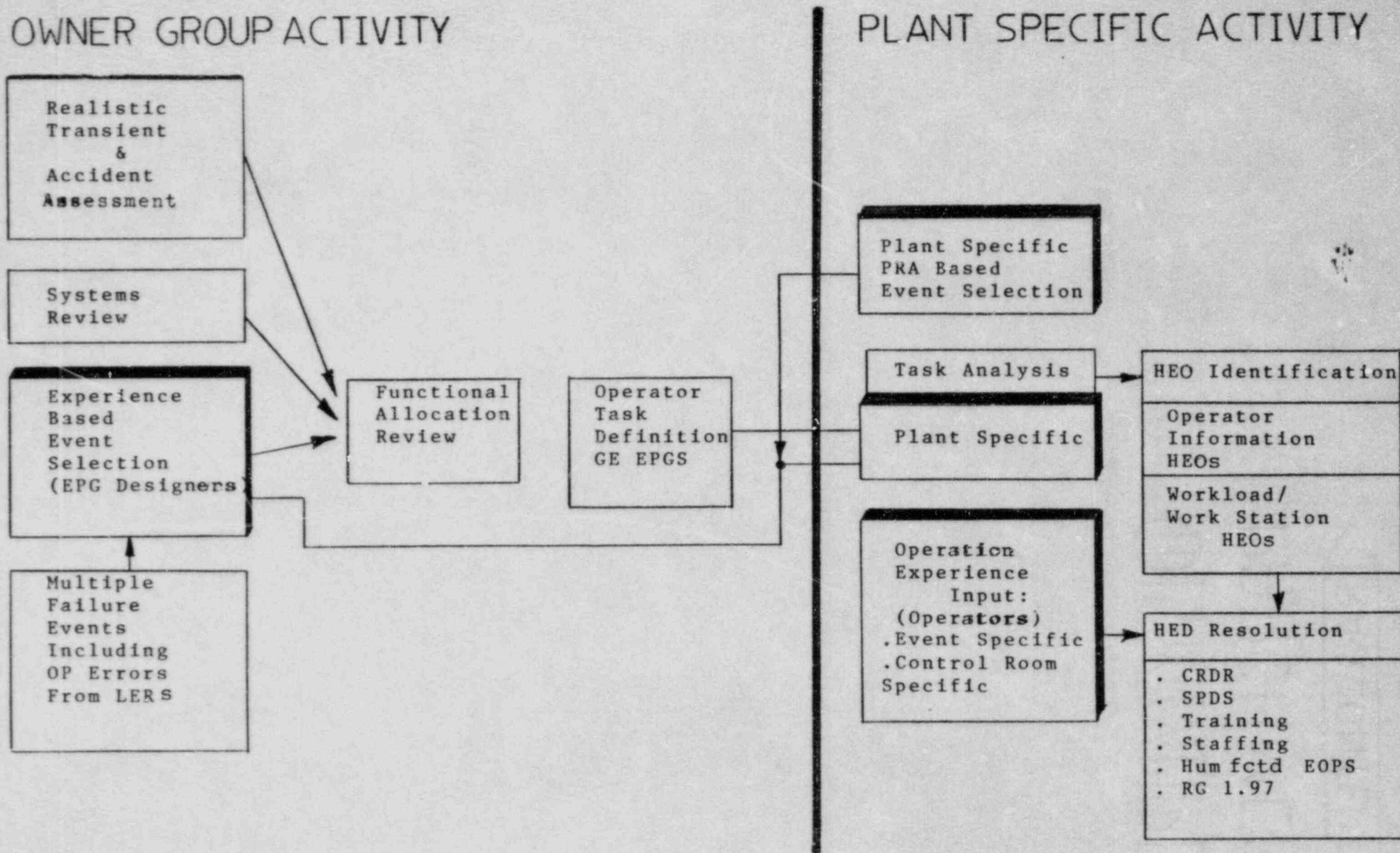

FIGURE A-2

12.0 NUREG-1000, "Generic Implications of ATWS Events at the Salem Nuclear Power Plant," (2 vols.)

Chapter 4 (Volume 1) of NUREG-1000 addresses ATWS Events and Operator Response. After reviewing the consequences of a BWR ATWS, the staff concludes that ". . . the time available for an operator to decide to take these actions [manual scram, manual control rod insertion, manual RPV level reduction, and manual initiation of SLC] is less than two minutes for the worst case." "Because several actions must be taken simultaneously in a short time frame, the probability of operator error is high." (op. cit., par. 5.2.5, p. 4-11)

Within this context of highly probable operator error, the staff goes on to note that, "The ATWS must be diagnosed from plant status indicators." (ibid., par. 4.4, p. 4-11). This diagnostic requirement apparently led the staff to conclude

> that operators should be trained to back up all automatic scrams with a manual scram. Specifically, operators should be trained to manually trip the reactor based solely upon receipt of positive indication' of a reactor 'trip demand.' (ibid., par. 4.6.2, p. 4-16)

Such a requirement, in effect, reduces operator diagnosis to a rule following procedure based on ". . . control room indicators that inform the operator of the present existence of a reactor scram demand." (ibid.)

The staff goes on to explain that

> This is an abstract discussion. The practical side is that utilities should choose the specific control room indications based on which the operators will be directed to manually trip the reactor without analyzing the indications or confirming them with other indications. This is not a change in operating philosophy. Previous guidance has dealt with operators taking actions to defeat automatic safety systems or other actions in the non-conservative direction. The specific indicators chosen by utilities should be immediately recognizable and reliable. To be immediately recognizable, the indicators should be carefully

12.0 NUREG-1000, (cont'd.)

> reviewed as part of the Detailed Control Room Design Review. To be reliable, the indicators should have a reliable power supply, a valid signal source, and regular testing for operability. Using these criteria to manually scram the reactor will simplify the operator diagnostics and decision making required to make a prompt response to a RPS failure or an ATWS. (ibid., p. 4-16, emphasis added)

LILCO concurs with the above statement, namely, that (a) a manual scram in response to pre-chosen indications is a practical alternative to analyzing the indications or confirming them with other indications and that (b) carefully reviewing the pre-chosen indicators is within the scope of the DCRDR portion of LILCO's Supplement 1 response. Accordingly, LILCO will choose indications requiring manual scram upon reactor trip demand, insure that those indications are acceptable from a human factors standpoint, and insure that those indications are (a) reliably powered, (b) have valid signal sources and (c) are regularly tested for operability.

It is important to note, however, that manual scram initiation in response to reactor trip demand only covers the Salem ATWS scenario. It does not address the human factors problems associated with an ATWS with other simultaneous or consequential failures. Fortunately, Rev. 2 (and beyond) of the BWROG EPGs ". . . do treat ATWS with other simultaneous or consequential failures" and therefore, ". . . BWR procedures, as guided by the BWR Owners Group EPGs, do not require immediate changes based on the Salem events." (ibid., p. 4-17). Since the Shoreham-specific task analysis is specifically designed to study the real-time utilization of operators. LILCO is confident that its analytical methodology will uncover any "timing constraints" (Cf.: NUREG-1000, par. 4.6.1) associated with either the simple Salem type ATWS event or an ATWS together with simultaneous or consequential failures.

12.0 NUREG-1000, (cont'd.)

The probability of this important part of the task analysis is based not only on the EPG or EOP structure, but on the events selected to exercise those EOPs. Consequently, without prejudice to the results of the event selection process described in Chapter I of this Plan, LILCO hereby commits to task analyzing both the simple and complex ATWS scenarios determined by the Shoreham PRA to be significant contributors to risk.

13.0 NUREG/CR-2833, "Critical Human Factors Issues in Nuclear Power Regulation and a Recommended Compre hensive Human Factors Long Range Plan"

NUREG/CR-2833, issued in August 1982, addresses a wide range of issues on the subject of HFE. Of particular interest to LILCO is the methodological guidance the document offers. Of key concern is an appropriate HFE methodology to be used for a completely designed plant.

Figure A-3 illustrates the recommendations of the Human Factors Society of America for ". . . all the major steps that are required for . . . preliminary design through development, construction, testing and evaluation to operation and maintenance."

> It is reasonable to question whether the system [atic] approach has value for incorporating human factors into systems that have already been designed and constructed. We believe that it does. To be sure, some of the elements of the system[atic] approach cannot be applied. Unfortunately some of the most fundamental elements have already been determined. Nevertheless, even for an after-the-fact analysis, the system[atic] approach provides a valuable organizing framework. It also provides a systematic context within which dependencies and interactions can be identified and solutions to problems and deficiencies can be developed. Working within the framework of the system[atic] approach fosters and enforces the awareness of the ramifications of human factors decisions upon other functions of the system and upon total system performance. (NUREG/CR-2833, Executive Summary, p. 7, emphasis added)

IDEAL HUMAN FACTORS SYSTEM APPROACH TO NPP DESIGN

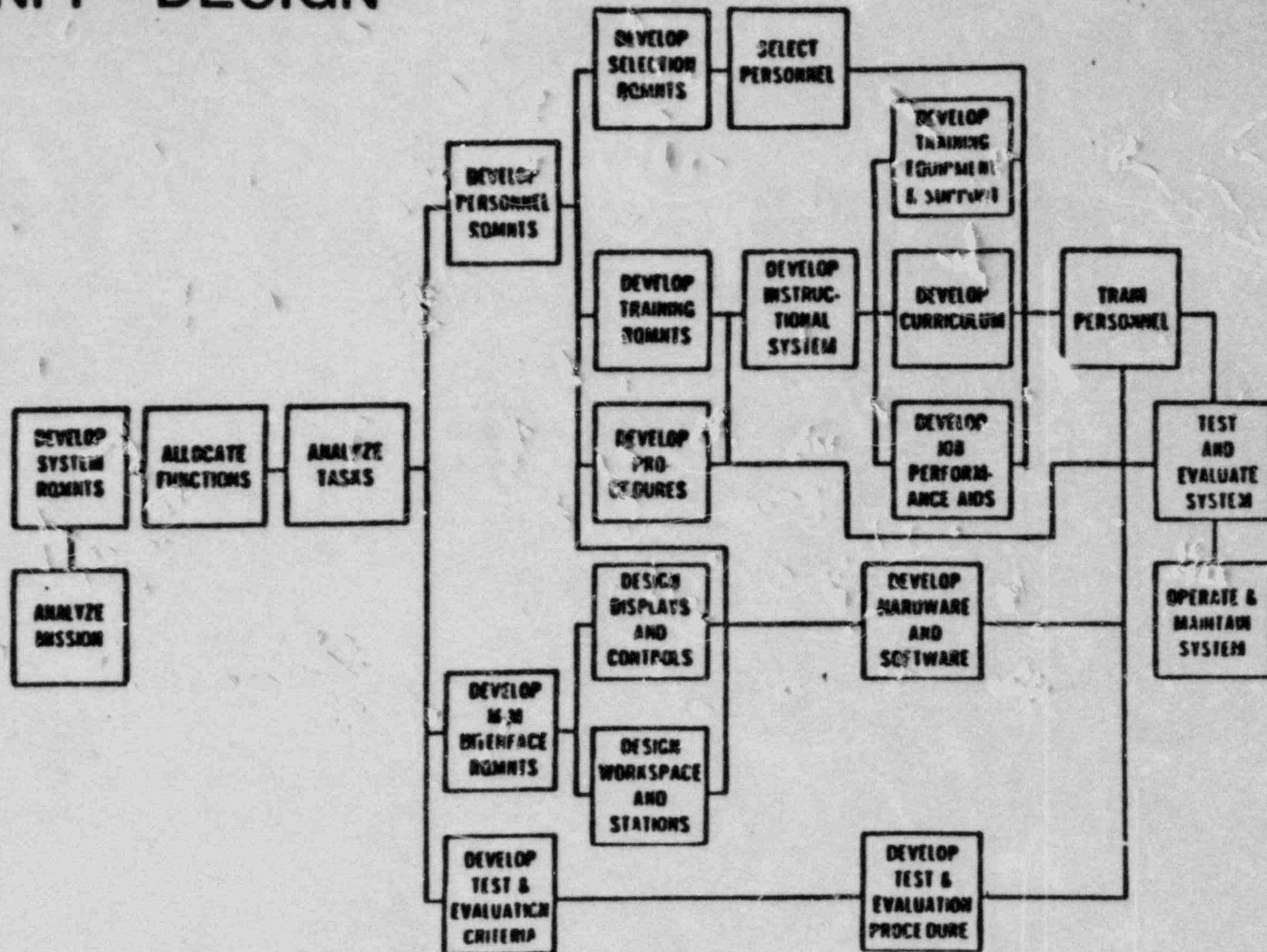

FIGURE A-3

13.0 NUREG/CR-2833, (cont'd.)

The impact of this recommendation is covered in detail in chapter I at par. 3.0, Methodology. In general conceptual terms, the basic difference between an existing design and a new design is that for an existing design, a functional allocation review is performed for the reallocation of automatic vs. manual functions. In such a case, the HFE design review process will focus on changes to personnel structure, training, procedures, displays and controls (i.e., SPDS), and appropriate modifications to the workspace (i.e., the control room). However, the task analysis for each situation is the same, i.e., design of personnel structure, training, SPDS and Reg. Guide 1.97, and the control room itself.

14.0 SECY-82-111, later issued as NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability"

As discussed in par. 1.0 of Chapter I, this document calls for the "Coordination and Integration of initiatives" that affect ". . . operator ability to comprehend plant conditions and cope with emergencies." Based on the regulatory review contained in this Appendix, LILCO interprets Supplement 1 in the following summary fashion:

1. The initiatives requiring direct integration via task analysis are:

   - SPDS design
   - Control Room design
   - Reg. Guide 1.97 instrumentation placement in the control room
   - Plant-specific, human-factored EOP design (including Plant Specific Writer's Guide)
   - Training design
   - Specification of staffing needs

14.0 SECY-82-111, later issued as NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability" (Cont'd.)

2. The initiatives requiring indirect integration (outside the scope of the EOP based analysis) are:

   - Use of the Emergency Response Facility

   - Transfer to and use of the Remote Shutdown Panel

3. The tasks to be subjected to analysis are those tasks that require operators to respond (a) to a known set of events (b) within the structure of the Plant-Specific Technical Guidelines. This means that the task analysis is circumscribed to emergency events (as opposed to the "abnormal and emergency" events prescribed in NUREG-0801).

4. The coordination and integration of initiatives is the coordination and integration of the design of those initiatives that affect operability, i.e., "operator ability to comprehend plant conditions and cope with emergencies."

5. The focus of post-TMI, human factors engineering has shifted and widened from CRDR to Emergency Response Capability or "engineered operations" within which CRDR is only one, important, inter-related part.

APPENDIX B

REVIEW TEAM RESUMES

HARRY T. CARTER

Current Position: Operating Engineer
Operations Section
Shoreham Nuclear Power Station
July, 1984 to Present

As a Plant Engineer in the Operations Section of the Shoreham Nuclear Power Station was responsible for plant Operating and Emergency Procedure development and revision. Subsequently promoted to Assistant Operating Engineer. Responsible for the implementation of all station operating activities in the absence of the Plant Operating Engineer.

Promoted to the position of Shoreham Operating Engineer in July, 1984. Responsible for directing day to day operation of the plant. Duties include: the startup, operation and shutdown of all station equipment in accordance with approved operating procedures, station technical specifications and applicable regulatory requirements; the preparation of operating records including equipment tests, reactor trips and other station parameters as required by station policy and regulatory agencies; assistance, in the form of subject matter and curriculum input, to the Nuclear Training Division with regard to the maintenance of operator license training and requalification training programs.

Education: Bachelor of Marine Engineering
New York State Maritime College,
1964

Special Training:

BWR Technology, 1979
BWR Simulator Training - Dresden (SRO Certification), 1981
BWR Observation Hatch, 1981
Shoreham Onsite Training (Specific Systems and Procedures), 1981
Heat Transfer, Thermodynamics, Fluid Flow, 1982
Mitigating Core Damage Training (SNPS FSAR, Section 13.2),
1982 Simulator Refresher Training - Limerick, 1982
NRC Pre-license Training, 1982
NRC Examination Preparation, 1982

Resume of Harry T. Carter (Cont'd.)

Previous Experience:

1971 - 1979

General Electric Company
EOOW/Shift Supervisor

Qualified as EOOW and Shift Supervisor at the SIC Naval Nuclear Prototype, EOOW at the DIG Prototype and Shift Test Engineer at the MARF Nuclear Power Plant. Assigned to the Knolls Atomic Power Laboratory Division.

1967 - 1971

Grumman Aerospace Corp.
Test Engineer
Assigned as Test Engineer for Lunar Module program.

1964 - 1967

Grace Lines, Inc.
Assistant Engineer - Steam/Diesel

Responsible for operation and maintenance of marine propulsion systems.

Reactor Startup Experience:

Knolls Atomic Power Laboratory, February 1971 - February 1979; 10+ reactor startups, SIC/DIG Naval Nuclear Prototypes.

MICHAEL J. CASE

Current Position: Plant Engineer
Operations Section
Shoreham Nuclear Power Station
1981 to Present

Responsible for the performance of engineering tasks; assisting in the supervision of plant activities, for investigations of particular plant problems and conditions, and the development of selected Section administrative and operational procedures. Specific duties include: revision of section administrative procedures in response to TMI initiated regulatory requirements, implementation of audit findings from a human engineering review of the Shoreham main control room by the U.S. Nuclear Regulatory Commission, administration of the section preventive maintenance program and special projects as directed by the Operating Engineer.

Education: Bachelor of Science
Fordham University, 1976

Received graduate level education in 1977 from the U.S. Navy Nuclear Power School. Completed U.S. Navy Nuclear Power Training program in June 1978 and was certified as an Engineering Officer of the Watch (Senior Reactor Operator Equivalent).

Previous Experience:

1978 - 1981

Employed by the U. S. Navy as a nuclear trained officer onboard the USS George C. Marshall SSBN654. Responsible for various aspects of operations, maintenance, audits, training of personnel, quality assurance and procedural development for both the ship and its associated nuclear power plant. Additional responsibilities included supervision of the ship's radiological control practices and leadership and supervision of a sixteen man section.

1977 - 1978

Received initial training in the Navy and completed an intensive training program in the operation and administration of a Naval nuclear power plant leading to certification as Engineering Officer of the Watch, a supervisory position equivalent of the Senior Reactor Operator.

ERIC J. DEAN

Current Position: Plant Engineer, Operations
Shoreham Nuclear Power Station
April, 1984 to Present

Responsible for scheduling and administration of the Surveillance Test Program within the Operations Department. Responsible for Control Room Design Review with the Operations Department.

Education: Bachelor of Engineering Physics, 1963
Cornell University, Ithaca, New York

Masters of Nuclear Engineering, 1984
University of Cincinnati
Cincinnati, Ohio

Special Training: Shift Technical Advisor Training, Zimmer Nuclear Power Station

Senior Reactor Operator Training, Zimmer Nuclear Power Station

Senior Reactor Operator Simulator Training, GE Simulator, Morris, IL

Senior Reactor Operator License Training, GE Simulator, Tulsa, OK

Station Nuclear Engineers Course, San Jose, CA

Previous Experience:

1978 - 1984

Technical Staff Engineer
Cincinnati Gas & Electric Company

Wm. H. Zimmer Nuclear Power Station
Moscow, OH 45153

As a member of the Preoperational/Startup Group, worked on the preparation of Preoperational Test Procedures. Responsible for the development of the Startup Test Program

Resume Eric J. Dean (Cont'd.)

including writing and reviewing administrative procedures, implementing procedures, installation of test equipment, training of test personnel and generation of schedules.

As a member of the Operations Department activities included: site coordinator for the Emergency Exercise held November 11, 1981; participation in the Control Room Review that was performed in 1981; participation in the design of the Station computer system upgrade and the training, conduct of drills, procedure revision and on-shift supervision of station personnel.

1971 - 1978

Startup Test Design and Analysis (STD&A) Lead Engineer
General Electric Nuclear Power Division, San Jose, CA

Location:
San Jose, CA and at the following plant sites:

Quad Cities I & II, Cordova, IL
Duane Arnold, Cedar Rapids, IA
Caorso, Caorso, Italy

Supervisor of 4-6 test engineers with responsibility for performing start-up testing at these plants. Prepared and reviewed procedures, installed and operated test equipment, conducted testing, analyzed test results and prepared test reports. Acted as technical consultant to the utility in areas of reactor engineering and transient response.

1968 - 1971
(and October, 1974 - July 1975)

Startup Test Design and Analysis Engineer
General Electric Atomic Power Equipment Division
San Jose, CA

Resume Eric J. Dean (Cont'd.)

Location:
San Jose, CA and at the following plant sites:

Tarapur I & II, Tarapur, India
Tsuruga, Tsuruga, Japan
Dresden II, Morris IL
Millstone I, Niantic, CT
Pilgrim I, Plymouth, MA
Vermont Yankee, Brattleboro, VT
Hatch I, Baxley, GA

Prepared startup test specifications and procedures. Performed nuclear and thermo-hydraulic calculation for new reactor cores. Installed and calibrated test equipment. Conducted startup tests, and prepared test result reports. Provided training and instruction to the utility staff.

Taught the following courses:

1. Station Nuclear Engineering
2. Process Computer Engineer training
3. Startup Test Engineer Simulator class (GE Simulator, Morris, IL)

Developed and performed the initial process computer testing program at Tsuruga, Dresden II and Vermont Yankee.

1965 - 1967

Engineer
Westinghouse Electric Company
Jackass Flats, Nevada

Installed and tested instrumentation and data recording equipment for pre-operational and operational testing of the NERVA nuclear rocket.

Resume Eric J. Dean (Cont'd.)

1963 - 1965

Engineer
Westinghouse Electric Company
Large, Pennsylvania

Performed nuclear core design calculation for NERVA nuclear rocket.

Professional Engineer, State of California

KENNETH MAGUIRE

Current Position: Control Technician, Nuclear
Shoreham Nuclear Power Station
September 1974 to Present

Responsible for the performance of trouble shooting, operation, calibration and adjustment of plant instrumentation and controls for Nuclear, Electrical and Mechanical Systems, including MOVS, AOVS, Switchgear Control Circuits, Annunciator Systems, Measurement and Test Equipment Calibrations, Process and Security Computer System and Peripherals, Security Surveillance Equipment, Seismic Monitoring, Aux. Boilers, Radio Control Crane Equipment and the Fire Detection and Protection System.

Education: High School Graduate, 1966, H. Frank Carey H.S. Franklin Square, NY
USAF 1966 - 1970, Aircraft Electronic Navagation Equipment Repairman
Nassau Community College, Control Technician Electronic and Meteorological Courses

Special Training: Honeywell 4010 Computer Hardware Maintenance Card Reader/Punch Maintenance Course, Honeywell
Line Printer Hardware Maintenance Course, Honeywell
Nuclear Power Preparatory Training, NUS Corp.
General Employee Training, LILCO
BWR Technology, General Electric Co.
Quality Assurance, LILCO
Computer Monitor Video Generator Hardware Maint., Honeywell
Electro Hydraulic Control System, General Electric Co.
ALTERREX Excitation Systems, General Electric Co.
IRD Vibration Analysis Course, IRD Co.
4010 Computer Hardware Refresher Course, Honeywell
RCA CCTV Camera Course, RCA
H100 Computer Hardware Fundamentals, Data General
H105 NOVA 3 Computer Hardware Fundamentals, Data General
Annunciator Technical Training, RIS

Resume Kenneth Maguire (Cont'd.)

Special Training (cont'd)

Fire Detection Equipment, Pyrotronics
Crimping Qualification Course, Amp Special Industries
Low Voltage Fire Detection Systems, Pyrotronics
Loose Parts Monitoring System Training Course, TEK
Fire Protection for Power Plants, Professional Loss Control Inc.
Radio Controlled Crane Training, Telemotive Inc.
Trouble-Shooting Micro Computing Systems, Attridge Electronics
Microprocessors & Microcomputers, Attridge Electronics
Seismic Instrumentation Training, Kinemetrics Inc.

Military Training: Aircraft Electronic Navagation Equipment Repairman
Introduction to USQ-28 System
Computer Logic Course
Shiran Interrogator RF Unit
Shiran Interrogator Digital Unit
Shiran Interrogator (Digital) USQ28-32-1

Previous Experience:

1973 - 1974 Control Technician Fossil
Far Rockaway Power Station

1971 - 1973 Assistant Control Operator
Far Rockaway Power Station

1966 - 1970 Aircraft Electronics Navigation
Technician, SGT, United States Air Force

Responsible for trouble-shooting, repair and calibration of radar, radio compass, Tacan, Loran, Hiran, Shiran, ILS, IFF/SIF, Altimeters and an on-board Data Logging Computer installed on RC-135 Surveillance Aircraft. Possess thorough knowledge of test equipment, ie. oscilloscopes, VTUM, oscillators, RF alignment equipment, frequency counters, spectrum analysers and system specific test equipment.

RICHARD J. PACCIONE

Current Position: Section Supervisor
Nuclear Systems Engineer
Nuclear Engineering Department
Shoreham Nuclear Power Station
May, 1984 to Present

Responsible for the operation of the Nuclear Systems Engineering Section of the Nuclear Engineering Department. This section has responsibility for engineering support activities relating to nuclear systems and components. The following activities are performed: nuclear/mechanical engineering, instrumentation and control engineering, reliability and risk assessments, inservice inspection programs, and safety evaluations.

Education: New York University - Department of Nuclear Engineering
Fall 1972 to Fall 1973, Postgraduate Work

Columbia University Graduate Faculties
Departments of Physics and Nuclear Engineering Masters in Physics, 1971

City College of New York
Bachelor of Science in Physics and Mathematics, 1969

Previous Experience:

Long Island Lighting Company July 1979 to Present

Lead Engineer, Reliability and Risk Assessment for the initiation and technical development of a program to evaluate the risk associated with the operation of the Shoreham Nuclear Power Station (SNPS). This joint utility and consultant program consisted of the following major efforts: probabilistic analyses of nuclear system reliability, accident event sequence definition and quantification, severe accident analysis of reactor and containment conditions, ex-plant radiological consequence analysis, and the evaluation of external events. Supervised a dedicated group of engineers in the performance of reliability and risk studies.

Resume Richard J. Paccione (Cont'd.)

Power Authority of the State of New York - 1977 to 1979

Staff Nuclear Engineer - Safety - Voting member and Secretary of the Authority's corporate Safety Review Committee (SRC) which serves as an independent review and audit organization for the James A. Fitzpatrick Nuclear Power Plant (GE/BWR4) and the Indian Point 3 Nuclear Plant (Westinghouse /PWR). Coordinated SRC activities as required by the committee charter and technical specifications. Performed special studies on behalf of the committee. Responsible for safety issues affecting the Authority's operating nuclear Plants and the Greene County Nuclear Project (Babcock and Wilcox PWR).

Consolidated Edison Company of New York - 1973 to 1977

Associate and Assistant Engineer, Reactor Physics and Nuclear Fuels Division - Sponsor engineer for a spent fuel inspection program conducted during first refueling outage of Indian Point 2. Test supervisor for physics testing. Cognizant engineer for core follow data and power distribution measurements.

JOHN U. VALENTE

Current Position: Section Head
Safety and Analysis Section
Nuclear Engineering Department
Shoreham Nuclear Power Station

Responsible in a supervisory capacity in the areas of thermal-hydraulics, transient analysis, analysis and computer engineering. Assisted in the development of LILCO's transient analysis capability including: fuel pin thermal and mechanical analysis; neutron kinetics and Core, NSSS and Primary Containment thermal- hydraulics. Emphasis placed on Chapters 4, 5, 6 and 15 of the FSAR. Recent projects have included: Emergency Response Capability Computer System (SPDS); Control Room Simulator and the Emergency Procedure Guidelines.

Education:
BA - Physics - Queens College/CUNY 1973
BS - Nuclear Engineering - Columbia University 1973
MS - Engineering - Columbia University 1974
SM - Nuclear Engineering - MIT 1976
Degree of Nuclear Engr'g - MIT 1976

Special Training:
Probabilistic Risk Assessment, 1980, EPRI/SAI
BWR Operator Fundamentals, 1980, General Electric

Number of workshops on nuclear thermal-hydraulic and fuel behavior modeling.

Previous Experience:

LILCO	- Engineer
Massachusetts Institute of Technology	- Research Assistant
Consolidated Edison of NY	- Assistant Engineer

ROBERT W. GRUNSEICH

Current Position: Section Supervisor
Nuclear Licensing
Nuclear Operations Support Department
Shoreham Nuclear Power Station
May, 1984 - Present

The Supervisor, Nuclear Licensing has the overall responsibility for management and coordination of all nuclear regulatory licensing and compliance matters relating to the Shoreham Nuclear Power Station which are under the jurisdiction of the Vice President, Nuclear Operations. These include regulatory licensing and compliance activities associated with obtaining and maintaining a full power Operating License, special compliance projects and programs, and Company commitments to federal, state, and local agencies.

Specific duties include: direction and management of the processing, development, and preparation of responses to all regulatory correspondence received by the Office of Nuclear; interface with regulatory agencies on the technical considerations of licensing and compliance; review of all proposed plant modifications for their impact on the plant licensing basis and to ensure compliance with 10CFR50.59; review of Shoreham Station activities such as maintenance, modifications, operational problems, and operational analyses relative to impacts on regulatory licensing and compliance; evaluation of all regulatory changes or proposed changes which could affect the Shoreham Station and the verification of the implementation of regulatory commitments.

Education: Bachelor of Chemical Engineering - 1971
Manhattan College

Special Training: Practical Nuclear Power Plant Technology, General Physics Corporation
Practical Fossil Power Plant Technology, General Physics Corporation
Environmental Engineering for Power Plants, Burns & Roe, Inc.
ASME Code, Section III, Nuclear Components, American Society of Mechanical Engineers (ASME)
Power Plant Equipment Seminar, ASME

Resume of Robert W. Grunseich (Cont'd)

Previous Experience:

1981 - May, 1984 Senior Licensing Engineer
Special Projects
Shoreham Nuclear Power Station

Assigned to the position of Senior Licensing Engineer in December, 1981, reporting to the Manager, Special Projects. Employed by LILCO in June, 1983 in that capacity. Responsible for the licensing of the Shoreham Project including: the provision of a single point interface between the project and other departments; maintenance of an understanding of construction status and the impact of licensing decisions on construction schedule and project cost; preparation of special reports, studies and investigations; establishment of priorities for licensing activities; regular project contact with the NRC in establishing short-term, long-term, and critical path activities; representation of the project at licensing-related meetings with the NRC, Stone & Webster, and General Electric.

1972 - 1981 Nuclear Mechanical Engineer
Burns and Roe, Inc.

Assigned to Washington Public Power Supply System (WPPSS) Nuclear Project No. 2. Duties included: the performance of thermal, hydraulic and other engineering calculations; assistance in the preparation of flow diagrams, piping arrangement drawings and system descriptions for both nuclear and mechanical systems; preparation of design specifications and design sketches for various mechanical components; and the process engineering and interdiscipline coordination of several nuclear systems including Nuclear Boiler Main Steam, Reactor Recirculation, Standby Liquid Control and Main Steam Isolation Valve Leakage Control. Responsibilities also included the bid evaluation, award, engineering and contract administration involving the procurement of both nuclear and conventional valves, heat exchangers, refueling bellows and other power plant components, as well as the development and coordination of a computerized listing of all plant components.

Resume of Robert W. Grunseich (Cont'd)

Promoted to Senior Engineer in 1978. Charged with contract administration and coordination of engineering for the Nuclear Steam Supply System Contract with General Electric.

Associate member of the American Institute of Chemical Engineers.

Registered Professional Engineer in the State of New York.