

November 19, 1982



SECY-82-462

POLICY ISSUE
(Notation Vote)

For: The Commissioners
From: William J. Dircks
Executive Director for Operations
Subject: HUMAN FACTORS PROGRAM PLAN
Purpose: To obtain the Commission's approval of the NRC
Integrated Human Factors Program Plan

Discussion: Following the TMI-2 accident, the Commission has increased the attention given to the human factors aspects of the design, construction and operation of nuclear power plants. Recognizing the need to coordinate these activities, the Commission's Policy and Planning Guide for 1982 directed the staff to develop a long range human factors program plan. The enclosed program plan presents the staff's response to that direction.

The purpose of the plan is to ensure that proper consideration is given to human factors in the design, operation and maintenance of nuclear facilities. This initial plan addresses nuclear power plants, and describes (1) the technical assistance and research activities planned to provide the technical bases for the resolution of the remaining human factors related tasks described in NUREG-0660, "The NRC Action Plan Developed as a Result of the TMI-2 Accident", and (2) the additional human factors efforts planned in response to human factors concerns identified while carrying out the Action Plan tasks or identified by the Human Factors Society. The plan represents a systematic and comprehensive approach for addressing human factors concerns important to nuclear power plant safety in the FY 1983-1985 time frame.

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The program plan consists of six major program elements; the principal goals and products planned for each of the six elements are summarized as follows:

Staffing and Qualifications - Ensure adequate staffing for safe plant operation and support. Principal products will be proposed rules on licensed operator staffing, minimum qualifications of shift crews, fitness for duty, and revisions to 10 CFR Parts 50 and 73.

Training - Ensure that personnel are trained to meet job performance requirements and that training is responsive to identified safety issues. Principal products include staff criteria for evaluating industry training programs, improved inspection guidance, and development of an INPO accreditation program.

Licensing Examinations - Develop valid and reliable examinations and a reliable, resource-efficient examination process. Principal products are improved examinations and examination processes, including guidelines for examiners.

Procedures and Testing - Ensure operator capability to maintain plant critical safety functions and mitigate consequences of initiating events through adequate and effective plant procedures and test programs. Principal products include guidance for procedures preparation, and inspection modules for procedures evaluation.

Appendix A of the plan provides a status summary of the TMI Action Plan items, categorized by completed or continuing items and by items still under development. Estimated completion dates have taken into account the recommended prioritization plan described in NUREG-0933, "A Prioritization of Generic Safety Issues," and will be an input to the staff's Action Plan rebaselining efforts. Activity schedules will be adjusted where necessary to be consistent with the rebaselined Action Plan items.

Man-Machine Interface - Reduce design-induced human errors through improvements to man-machine interfaces. Principal products include guidelines or Regulatory Guides for design or design improvement, information management, and status monitoring.

Management and Organization - Ensure adequacy of utility management and organizational design for safe plant operation. Principal products are management and organization evaluation guidelines.

The Human Factors Program Plan also addresses the recommendations of the Human Factors Society. Appendix B of the enclosed plan summarizes the major Human Factors Society recommendations, and compares them with the staff's planned and completed activities. Forty of the Society's 51 recommendations have either been acted on and completed, or are addressed in the enclosed plan. An additional six recommendations are under active consideration, but activities to implement the recommendations are not yet programmed. Two of the recommendations are not applicable to this human factors program plan, and the staff is in disagreement with three of the recommendations.

Resources

The involvement of human factors considerations in the regulatory and research functions of the NRC is expected to be a continuing activity. The initial program schedule, shown as Appendix C of the enclosed program plan, covers Fiscal Years 1983 through 1985. The estimated NRC resource requirements for these three years are listed below for NRR and RES.

	FY-83		FY-84		FY-85	
	PSY	\$K	PSY	\$K	PSY	\$K
NRR	41	11,824	38	5,550	33	6,070
RES	8	6,425	8	8,550	8	7,900

The ability of the staff to complete a number of plan activities in the planned schedules are dependent on the timely and successful execution of human factors programs by industry organizations. In particular, the INPO job task analysis effort is needed for the development of minimum training requirements and the analysis/improvement of licensing examinations. An extensive program of external coordination and communication to monitor industry activities is part of the plan.

The application of human factors principles to the regulatory and research activities of the Commission is expected to be a continuing activity. The plan will be maintained by the DHFS, and programs will be added/modified on the basis of the results of current programs, the shift of regulatory responsibilities to the regional offices, and in response to future regulatory issues involving human factors disciplines. The program plan will be updated on an annual basis.

Program Direction

The Director, Office of Nuclear Reactor Regulation, will have overall responsibility for assuring that the NRC Integrated Human Factors Program Plan is properly executed. To assist the Director in his responsibilities a Human Factors Review Group (HFRG) will be established. The HFRG will be chaired by the Director, DHFS and will include the Director, DFO, and representatives of the Office of Nuclear Reactor Regulation, the Office of the Nuclear Regulatory Research, the Office of Nuclear Material Safety and Safeguards, the Regional Offices, and the Office of Resource Management. The Director, Office of Nuclear Reactor Regulation is responsible for implementing the plan for nuclear power plants. Implementation of the plan for fuel cycle facilities is the responsibility of the Director, Office of Nuclear Material Safety and Safeguards. The human factors research program required to meet user needs is the responsibility of the Director, Division of Facility Operations. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process. An annual report on the staff's success in executing this plan will be provided by the HFRG in December of each year beginning in December 1983.

ACRS Comments

The staff briefed the ACRS on the Human Factors Program Plan on November 5, 1982. The staff agrees with the comments provided by the ACRS in their letter of November 9, 1982, and concurs with their recommendations with the following exceptions:

The Human Factors Society has conducted an independent human factors appraisal of the nuclear power industry. The Society's recommendations were taken into account in developing the plan. To conduct a detailed staff appraisal at this time would require significant staff resources and would delay plan implementation.

It would be desirable to have a full time Program Manager responsible for the program. However, in view of limited staff resources, the use of the Human Factors Review Group provides a means of enhancing coordination among the NRC Offices involved in plan implementation. This group, together with the responsibilities of individual managers as specified in the plan, provides the staff's recommended method of solving the managerial issue.

Recommendation:

1. That the Commission approve the proposed Integrated Human Factors Program Plan.
2. Note that TMI restart hearing concerns regarding the accuracy and credibility of the examinations, and any weaknesses resulting from simultaneous reliance on licensee training and the NRC examinations as independent checks of each other, are addressed in Sections III-2 (Training) and III-3 (Licensing Examinations) of the plan.
3. Note that the program plan will receive wide distribution both within the NRC and the nuclear industry.
4. Note that the priorities assigned to the Action Plan items identified in Appendix A will be revised to be consistent with the final rebaselined Action Plan.



William J. Dircks
Executive Director for Operations

Enclosure:
Proposed Integrated Human
Factors Program Plan

Commissioners' comments or consent should be provided directly to the Office of the Secretary by c.o.b. Friday, December 10, 1982.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Friday, December 3, 1982, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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INTEGRATED

HUMAN FACTORS PROGRAM PLAN

NOVEMBER, 1982

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NRC INTEGRATED HUMAN FACTORS PROGRAM PLAN

I. INTRODUCTION

PURPOSE

The purpose of the NRC Integrated Human Factors Program Plan is to ensure that proper consideration is given to human factors in the design, operation, and maintenance of nuclear facilities. This initial plan addresses nuclear power plants (NPP) and describes (1) the technical assistance and research activities planned to provide the technical bases for the resolution of the remaining human factors related tasks described in NUREG-0660, "The NRC Action Plan Developed as a Result of the TMI-2 Accident," and NUREG-0737, "Clarification of TMI Action Plan Requirements, and (2) the additional human factors efforts identified during implementation of the Action Plan that should receive NRC attention. The plan represents a systematic and comprehensive approach for addressing human factors concerns important to nuclear power plant safety in the FY-83-85 time frame.

BACKGROUND

A thorough understanding of functions, capabilities, and limitations of the personnel involved must be included to evaluate the safety of nuclear power plants. The accident at Three Mile Island Unit 2 (TMI-2), identified the need to bring human factors consideration into the mainstream of nuclear power plant regulation and operation. NUREG-0660 described a number of tasks to be performed by the nuclear industry and the U.S. Nuclear Regulatory Commission. A significant number of these tasks were aimed at improving nuclear power plant safety through increased attention to the human element. Considerable progress has been made on many of these Action Plan items. Appendix A tabulates those Action Plan items that have been or are being implemented, and those items that are in the process of being resolved as part of this plan.

CURRENT ACTIVITIES

In June and December 1980, the Commission issued Policy Statements augmenting the Commission's regulations with the requirements in NUREG-0737, "Clarification of TMI Action Plan Requirements." To date, over twenty licensing reviews have been completed with increased attention having been given to the following human factors areas.

- o review of NPP staffing to ensure that the numbers, functions, and qualifications of personnel are adequate for safe operation
- o review of training programs for both licensed and nonlicensed NPP staff to ensure that personnel are able to meet existing job performance requirements

- o review of procedures and startup testing programs to ensure their adequacy and effectiveness
- o review of NPP control rooms and remote shutdown panels to ensure that they are designed to facilitate the man-machine interface
- o review of utility management and organization to ensure its adequacy to support safe NPP operation

The Commission has also recognized the need to codify the need for human factors involvement in nuclear power plant design, construction and operation. Three proposed 10 CFR Part 50 Appendix A General Design Criteria have been drafted and are currently being reviewed by the staff. The three criteria, proposed GDC 65, 66 and 67, address human factors engineering; operability, surveillance and maintainability; and organization and management.

More recently, the Commission approved SECY-82-111, "Requirements for Emergency Response Capability." This action applies important human factors requirements to operating plants, primarily in the areas of man-machine interface (MMI), upgraded procedures, and related training. This effort will be the major focus for human factors activities for operating plants during the next three years. The schedule for accomplishing these activities will be established through negotiation between the NRR Project Manager and the utilities.

PROGRAM PLAN AND RESOURCES

The Human Factors Program Plan is structured as follows:

- o Section II describes a number of special issues which either affect all aspects of the program or require involvement of more than one program element for their resolution.
- o Section III addresses the six major program elements to be addressed in FY-83 through FY-85;
 - Staffing and Qualifications
 - Training
 - Licensing Examinations
 - Procedures and Testing
 - Man-Machine Interfaces
 - Management and Organization

Activities planned for these program elements will provide the technical bases for developing guidance for the nuclear industry and will improve the capability of the staff to perform licensing activities effectively. They will also support decisions regarding the degree of regulation required to

resolve the technical issues. If the results of the programs indicate that new requirements should be promulgated, such proposals will undergo the normal review process, including review by the Committee for the Review of Generic Requirements (CRGR). Section III incorporates both licensing (NRR) and research (RES) activities and tasks discussed in the six program elements.

Figure I-1 shows the resource allocation to each of the six program elements for FY-83/84. The program is balanced in that approximately one half of the resources address the human element in design aspects (MMI and procedures), and the other half address the human element in operational aspects.

- o Section IV describes RES planning for potential programs in support of NRC human factors user needs that could be applied beyond FY-85.
- o Appendix B provides the staff's initial response to the recommendations provided by the Human Factors Society in NUREG/CR-2833, "Critical Human Factors Issues in Nuclear Power Regulation and a Recommended Comprehensive Human Factors Long-Range Plan."
- o Appendix C provides the schedule of activities for each of the six program elements. Activities are those either planned or underway for the Office of Nuclear Reactor Regulation (NRR) and Office of Nuclear Regulatory Research (RES) and related major activities initiated at the Institute of Nuclear Power Operations (INPO), the Electric Power Research Institute (EPRI), the Edison Electric Institute (EEI), and the Halden project.
- o A glossary is provided in Appendix D.

PROGRAM MANAGEMENT, COORDINATION AND INTEGRATION

The success of this human factors program plan relies on effective interactions within the NRC and between the NRC and industry. The systems approach taken in this plan is intended to provide assurance that NRC human factors activities are appropriately integrated and that adequate and accurate human factors information is developed. The plan recognizes that activities initiated within INPO, EPRI, EEI, Owners' Groups, and individual utilities often provide essential information to complement the activities described. To assure that available information is effectively and efficiently used, these activities, and those at other Federal Agencies and in foreign countries, will be coordinated and integrated with those described in this plan.

Interaction between NRR, RES, other NRC Offices, NRC contractors and the industry is also necessary to ensure program success. Beginning in the second quarter FY-83, working level meetings will be held as outlined below to ensure that the programs identified in this plan are fulfilling the objectives of this plan. These meetings will provide a mechanism to enhance the integration of all interactions. It is anticipated that the Human Factors Program Plan will be updated, formally, once a year. This will be prior to the initiation of the annual budget cycle. Specifically, the following program management activities are envisioned:

- o Three program reviews will be conducted each year at approximately four month intervals: October, February, and June.

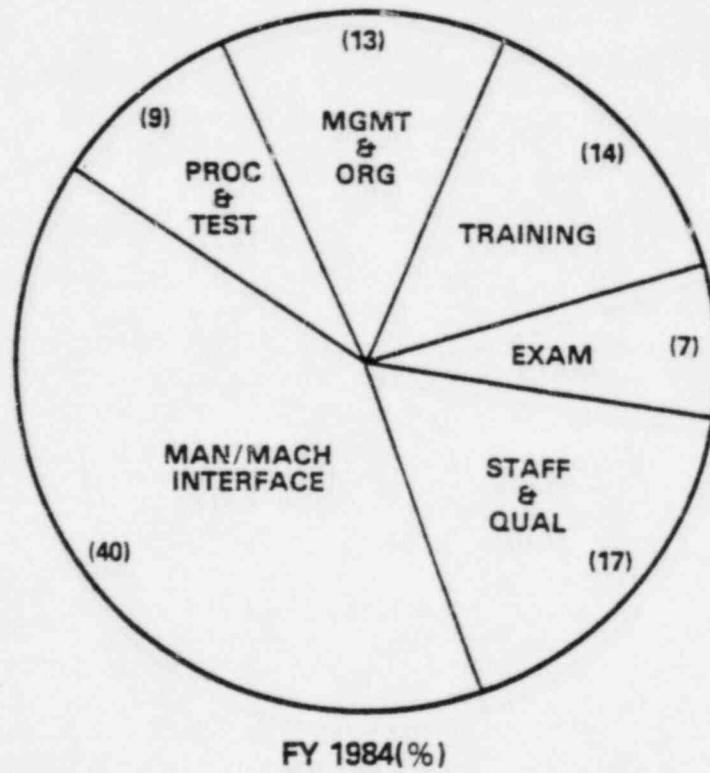
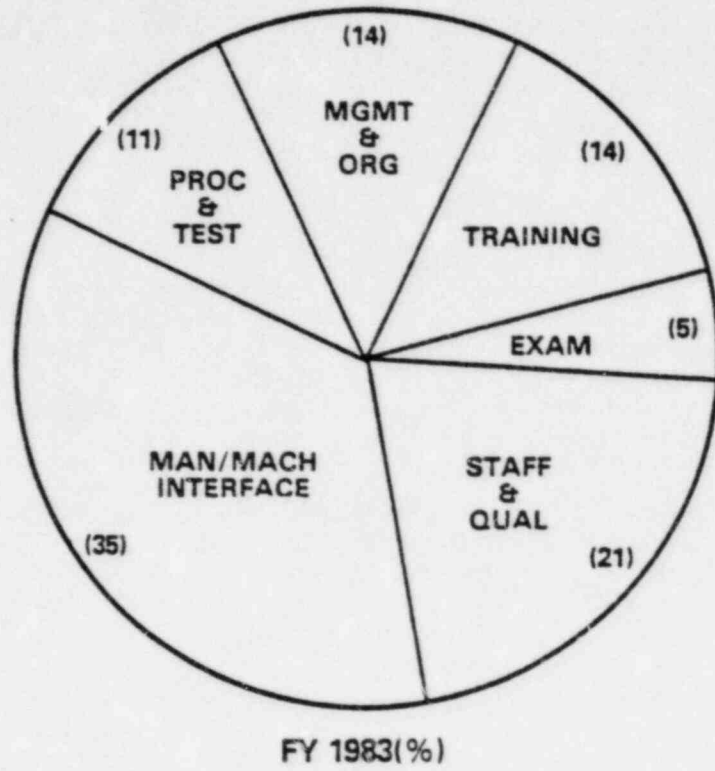


Figure I-1. Distribution of Developmental Resources

- o Branch Chiefs will be tasked to present the status of their respective programs.
- o The October review will be the yearly updating of projects accomplished during the prior fiscal year. The status of ongoing projects and current plans for the next fiscal year, consistent with available budget and resources, will be presented.
- o The February review will be a status update and will include a discussion of any identified requirements for new or revised projects for future fiscal years. The results of this review will be the annual revision of the Human Factors Program Plan.
- o The June review will emphasize accomplishments and will finalize information and data needed to update the Human Factors Program Plan for the upcoming fiscal year.
- o The principal program plan reviewers will be the Director, Division of Human Factors Safety and the Director, Division of Facility Operations. Senior staff members will be included.
- o Industry representatives with programs relevant to the plan (e.g., INPO and EPRI) will be invited to attend and participate. They will be asked to report the status of their programs such as job/task analyses, maintenance programs, accreditation of training, and management and organization practices.

Figure I-2 depicts program element interrelationships and how they relate to industry operations. This Figure illustrates the special interrelationships between the Staffing and Qualifications, Training and Licensing Examinations elements, and between Training, Licensing Examination and Procedures and Testing elements. In addition, there are element-to-element interrelationships between the Training and Licensing Examination elements and the Procedures and Testing and Man-Machine Interface elements.

The Director, Office of Nuclear Reactor Regulation has overall responsibility for assuring that the NRC Integrated Human Factors Program Plan is properly executed. To assist the Director in his responsibilities a Human Factors Review Group (HFRG) will be established. The HFRG will be chaired by the Director, DHFS and will include the Director, DFO, and representatives of the Office of Nuclear Reactor Regulation, the Office of Nuclear Regulatory Research, the Office of Nuclear Material Safety and Safeguards, the Regional Office, and the Office of Resource Management. The Director, Office of Nuclear Reactor Regulation is responsible for implementing the plan for nuclear power plants. Implementation of the plan for fuel cycle facilities is the responsibility of the Director, Office of Nuclear Material Safety and Safeguards. The human factors research program required to meet user needs is the responsibility of the Director, Division of Facility Operations. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process. An annual report on the staff's success in executing this plan will be provided by the HFRG in December of each year beginning in December 1983.

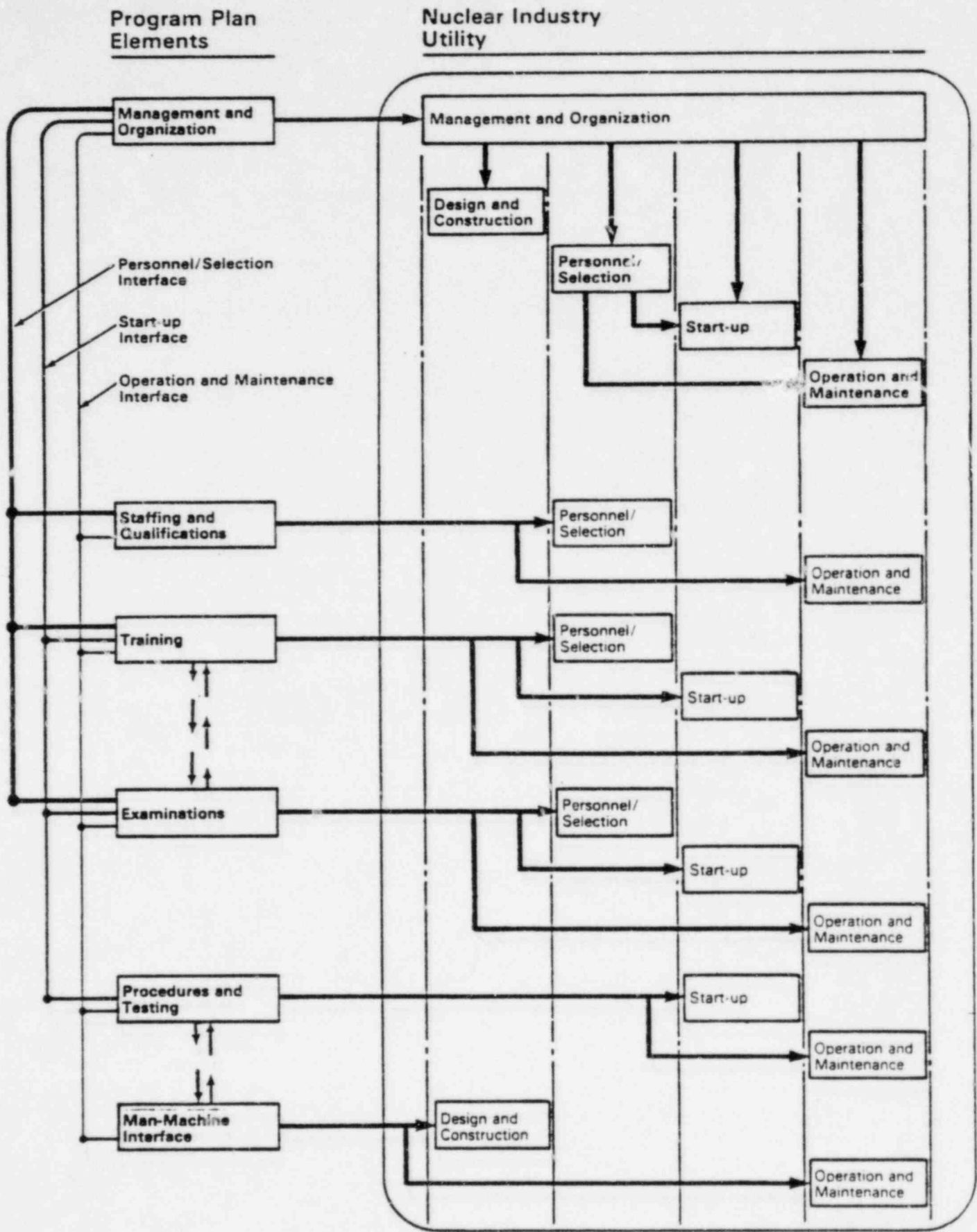


Figure I-2. Program Plan Element Integration

II. SPECIAL ISSUES

Several substantive concerns and issues have been identified and are discussed below. These issues will have varying degrees of impact on all the programs described in Section III.

A. Regionalization

The regionalization process for the human factors area has been initiated for operator licensing examinations. Additional technical review activities will be implemented by the regions during FY-85 and beyond, including reviews of procedures, modified training programs and management. NRC Headquarters will retain the responsibility for developing policy guidance for human factors issues, and will issue guidance to ensure consistency of reviews among Regions, conduct generic audits, and train regional reviewers. Once policy guidance has been developed, sufficient time must be provided to allow adequate training of appropriate regional personnel and, to the extent needed, human factors professionals added to the regional staffs. It is probable that except for operator licensing and emergency operating procedure (EOP) reviews, no major changes in human factors reviews will take place during the FY-83 through FY-85 time frame. The actual number of reviews to be done by the regions will be determined based on timing of regionalization and the resources available to the regions to develop a review plan responsive to headquarters policy guidance.

B. "Hardware" vs "Training/Procedures" Solutions to Problems

Frequently, solutions to design-related human factors problems in operating NPP's are based on people-oriented changes, e.g., modifications to operator training or procedures. While this may be an appropriate resolution of some issues, overuse of this approach may overload both operators and operator training programs. Any decisions to adopt training as a solution to a safety issue instead of a design modification must recognize and incorporate the continuing cost of expanded training, increase of crew size, and increase in number of shifts in the cost/benefit evaluation.

C. Maintenance

The primary issue in the maintenance area is one of determining the need for and extent of regulatory involvement by NRR. Risk studies, maintenance assessment activities, and incidents at NPP'S have established the importance of maintenance to safety. Program plan activities will address design for maintainability, maintenance procedures and documentation, maintenance personnel qualifications and training, preventive maintenance, maintenance work authorization and control, outage planning and management, inventory control, and management of maintenance activities. Results of these activities will indicate the extent to which regulatory attention should be focused on maintenance. Design criteria when developed will be evaluated for use as part of rulemaking, or as a part of regulatory guidance.

D. Simulators

Simulators are used throughout the industry for training operators. Recently, simulator examinations have been required for initial and requalification examinations at sites with plant-specific simulators. However, a clear regulatory position on the role of simulators, and their required level of fidelity to control room and plant design for training purposes, has not been established. Such a position including regulatory guidance on the use of simulators in training, plant drills, and examinations will be developed on the basis of the activities of the program plan addressing simulators.

E. Probabilistic Risk Assessment (PRA)

Human reliability data on specific nuclear power plant operations are limited. Where such data exist in other fields, (e.g., military, aerospace), their applicability or adaptability to the nuclear power industry are uncertain, and difficult to verify. Although RES has ongoing and planned research to produce human reliability data, it is a long-term effort. Few substantial improvements in the confidence of the human error rate assumptions used in probabilistic risk assessment (PRA) can be expected in the FY-83 through FY-85 time frame.

F. Advanced Technologies

Existing nuclear plant designs are currently being modified to make use of advanced technologies. Additional modifications are expected to be introduced, based on these and on developing technologies. For example, SECY 82-111 requires that a safety parameter display system (SPDS) be provided in plant control rooms. Most of the SPDS designs are based on computer technology and cathode-ray tube (CRT) display techniques. Since these technologies are being introduced into existing NPP designs, it is anticipated that these expanded data and information management capabilities will be applied to other plant processes. As these new control and display technologies are being developed, guidance pertinent to the interface between them and the operator will be developed.

G. Other NRC Human Factors

This plan does not include all NRC human factors activities, especially those of a unique circumstance such as the psychological effects of TMI-1 restart or the activities in the Office of Nuclear Material Safety and Safeguards (NMSS). Future revisions to the plan will incorporate additional human factors activities within the NRC and reflect the experience and lessons learned from the application of this plan. Future revisions will also provide details of the programs, including research in human reliability, to support PRA.

III. PROGRAM ELEMENTS

A major purpose of this Human Factors Program Plan is to develop the technical basis for establishing human performance criteria to support regulatory decisions. The NRC, EPRI, EEI, INPO, Department of Energy (DOE), organizations in foreign countries, and individual utilities are all collecting data and information that will be useful. This section describes the NRC efforts for FY-83 through FY-85 to develop the technical bases for regulatory review of NPP Staffing and Qualifications, Training, Licensing Examinations, Procedures and Testing, Man-Machine Interface, and Management and Organization. If results of the programs indicate that new requirements should be promulgated, such proposals will be carefully considered and subjected to all regulatory review processes. Schedules for the six program elements are shown in Appendix C. The numbering system of this Section corresponds to that of Appendix C.

1. Staffing and Qualifications

The goal of this element is to ensure that staffing is adequate for safe operation and support of nuclear power plants. This goal will be met by developing guidelines and regulatory requirements addressing (1) the numbers and functions of NPP staff needed to safely perform all required plant operations, maintenance, and technical support activities for each operational mode; (2) the minimum qualifications of plant personnel, in terms of education, skill, knowledge, training, and fitness for duty; and (3) appropriate limits and conditions for shift work including overtime, shift duration, and shift rotation.

The benefits which result from accomplishing the goal are:

- o reduced risk to the public by reducing human error based on improved operating personnel qualifications for responding to unanticipated events
- o reduced risk to the public by reducing human error based on improved work scheduling activities
- o better definition of what operators are expected to do in light of the perception that safety issues are being resolved by training/procedures modifications

The issues in this element are:

- o the possible impact on safety due to the lack of sufficiently qualified individuals
- o the need for a technical basis for developing requirements for training, experience, and education, e.g., need for college degrees.

1.1 NPP Staffing Requirements

In order to determine the appropriate minimum shift staffing requirements for NPP personnel, the following activities will be performed:

- o survey current staffing practices of both domestic and foreign utilities to provide data required to evaluate current practices and regulations and correlate staffing levels with variables such as plant size, control room size, and plant/control room layout (NRR/RES)
- o evaluate the need for engineering expertise on shift through determination of the functions and duties required, using results from job/task analysis and evaluation of the current shift technical advisor experience (NRR)
- o develop manpower projection and allocation models for operations, maintenance, and support functions through development of job performance measures, and collection and evaluation of job/task analysis data to provide a prediction method for future changes in requirements or plant design and simulator experimentation (NRR/RES)

1.2 NPP Personnel Qualifications Requirements

The implementation of SECY 82-162A "An Integrated Plan on Shift Crew Qualifications" will integrate industry and NRC efforts to determine the appropriate minimum training, education, and experience requirements for shift operating crews. The results of the following activities will address the overall issue of NPP staff qualifications:

- o evaluate job/task analyses data to determine knowledges, skills and abilities needed to perform jobs and establish minimum qualifications requirements (RES and Industry)
- o conduct simulator experiments that will yield job performance measures and crew interaction results applicable to curriculum development (RES)
- o assess the relationship between education, training and experience requirements, and job performance to identify the trade-offs among these related factors (NRR/RES)
- o evaluate the feasibility and value of licensing or certifying NPP personnel other than licensed operators (NRR/RES)
- o conduct studies of human performance and reliability to identify minimum levels of acceptable performance (RES)
- o conduct studies to establish a technical basis for fitness for duty requirements (RES)

1.3 Guidance on Limits and Conditions of Shift Work

In order to determine the appropriate limits and conditions of shift work, activities are planned (1) to determine the effects of varying shift duration using nuclear power plant simulators (RES); and (2) to survey and assess experience of other industries with job requirements similar to the nuclear industry with regard to shift arrangements and rotations (NRR/RES). This effort will allow the NRC to establish trade-offs among factors affecting shift work and overall safe performance requirements. At this time the effects of different shift rotation schedules have not been identified as a significant cause of performance decrement or unique human error. A specific research project to evaluate shift rotation effects will be planned if shift rotation is found to be a source of serious human factor problems.

1.4 Industry Activities

INPO's surveys of industry staffing levels and its program on job/task analysis for operating and support personnel provide a data source for developing criteria for staffing levels and qualifications of personnel. EEI has completed work on selection testing instruments for NPP Operators which will be used in NRC efforts on qualifications. Industry committees (ANS 3.1) are also developing recommendations on staffing and qualifications.

1.5 End Products

The products of the activities outlined in this element are:

- o a rule on licensed operator staffing at nuclear power plants (FY-83)
- o a rule on fitness for duty (FY-83)
- o a rule on minimum qualifications of shift crews (FY-84)
- o a rule revising 10 CFR Parts 50 and 73 (FY-83)
- o proposed revisions to ANSI/ANS 3.1, "Selection, Qualifications and Training of Personnel for Nuclear Power Plants" (FY-85)
- o revision of Regulatory Guide 1.8, "Personnel, Selection, and Training" (FY-85)

Figure III-1 describes the sequence of activities leading to these end products.

1.6 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Licensee Qualifications Branch (LQB), NRR, is responsible for the conduct of all NRR activities listed in Sections 1.1, 1.2 and 1.3, identifying research and standards needs to assist in implementing the regulatory process, identifying required dates for products from research the for standards, and managing the NRR technical assistance program. The Chief, Human Factors Branch, RES is responsible for developing

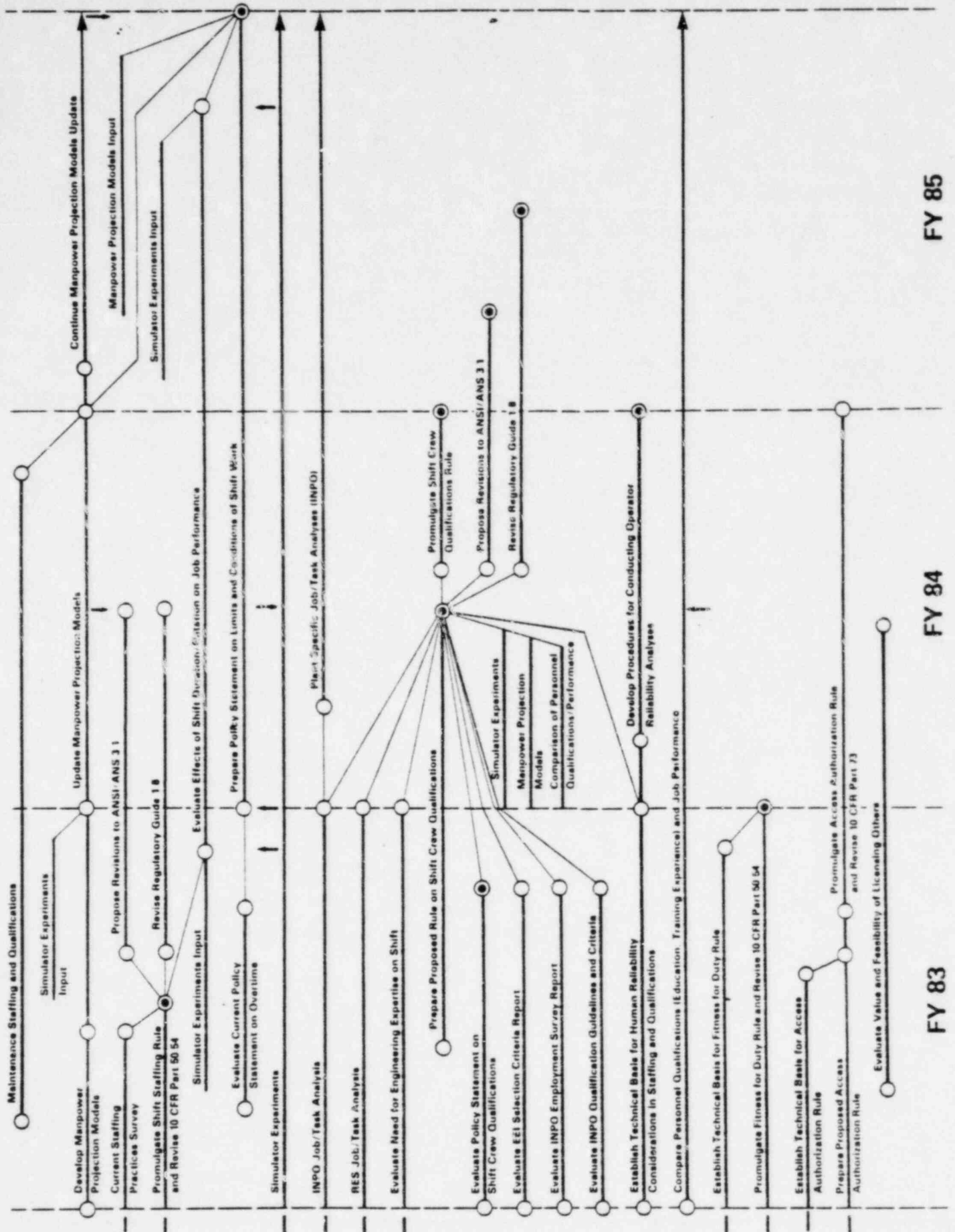


Figure III-1. Staffing and Qualifications Activity Sequence

and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

2. Training

The goal of this element is to provide means for ensuring that personnel are able to meet job performance requirements, that training properly accounts for pertinent safety issues, and that a mechanism exists for upgrading and assuring the quality of training programs. This goal will be met by (1) developing training guidance and criteria; and (2) developing and implementing reliable and objective procedures for use by NRR and Regional Offices in assessing the adequacy and effectiveness of training programs.

The benefits which result from accomplishing this goal are:

- o reduced human errors during operation and maintenance
- o increased licensed operator's knowledges, skills and abilities to respond to unexpected events
- o improved effectiveness and efficiency of licensed and non-licensed training programs
- o focusing the utility training programs to the knowledges, skills and abilities required to operate the NPP safely

The issues in this element are:

- o extent to which accreditation can lead to reduced regulatory activities
- o need for a systematic approach to the development of current utility training programs
- o quality and effectiveness of training as a function of number of hours of instruction.

2.1 Training Guidance and Criteria

INPO has developed general guidelines for improving the quality of NPP training and has recently initiated an effort to accredit utility training programs. However, this program is voluntary, and in order to ensure that NRC has the ability to more effectively evaluate utility training programs and have assurance that the training requirements are sufficient to meet NRC licensing evaluation, additional training criteria need to be developed. The training program evaluation criteria will be derived through the investigation or application of:

- o a systems approach to training ensuring integration within training programs such as the Instructional Systems Development (ISD) process (NRR/RES)
- o needs assessments, from INPO and RES such as knowledges, skills and abilities and results of Task Analyses that will lead to curriculum development for licensed and nonlicensed training programs (NRR/RES)
- o the role of simulators, and their requisite fidelity and type, in training programs (NRR/RES)
- o the relative effectiveness of differing training methodologies to the extent they are determined uniquely different (RES)

2.2 NRC Training Assessment Procedures

In order to provide adequate criteria and procedures for performing consistent and objective reviews of NPP training programs, the following activities will be performed:

- o develop audit criteria based on a systems approach (NRR)
- o pilot test the audit criteria on training programs conducted by nuclear steam supply system (NSSS) vendors and selected licensees to verify the adequacy of the guidance (NRR)
- o modify audit criteria based on pilot test results (NRR)
- o publish final criteria for use by NRR (NRR)
- o develop improved training inspection modules for use by Regional Offices to remedy current deficiencies and be responsive to new applications (NRR/OIE)

2.3 Industry Activities

INPO has undertaken a major program to ensure the adequacy of utility training programs. This effort has established an accreditation process that will serve to enhance utility training programs. INPO has also developed technical reports presenting guidelines and criteria for training and qualifications for both licensed and nonlicensed NPP personnel. Their job/task analysis will identify knowledges and skills to be used as the foundation for the development of curriculum for training programs for licensed and selected nonlicensed personnel. EPRI has initiated a review of uses of simulators and task trainers for developing diagnostic skills.

2.4 End Products

The products of this program element will include:

- o criteria for evaluating industry training programs for licensed personnel (FY-83) (NRR)
- o criteria for evaluating industry training programs for nonlicensed personnel (FY-84) (NRR)
- o modifications to 10 CFR Part 55 and Regulatory Guide 1.8 (FY-85) (RES)
- o revision of ANSI/ANS 3.1 (FY-85) (RES)
- o revised Chapter 13.2 of NUREG-0800, "Standard Review Plan" (SRP), (FY-84) (RES)
- o improved Office of Inspection and Enforcement (OIE) inspection modules (FY-84/85) (NRR/RES)

Figure III-2 describes the sequence of activities leading to these end products.

2.5 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Licensee Qualifications Branch (LQB), NRR, is responsible for the conduct of all NRR activities listed in Sections 2.1 and 2.2, identifying research and standards needs to assist in implementing the regulatory process, identifying required dates for products from research and for standards, and managing the NRR technical assistance program. OIE is responsible for the development of modified Inspection Modules based on input from NRR. The Chief, Human Factors Branch, RES, is responsible for developing and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

3. Licensing Examinations

There are two major goals of this element 1) to develop valid and reliable reactor operator (RO) and senior reactor operator (SRO) licensing examinations to ensure the adequacy of training and the capability of candidates to safely operate NPP; and (2) to develop and implement a standardized examining process that will ensure consistency, reliability and efficiency across examiners, facilities, and regions.

The benefits which result from accomplishing this goal are:

- o improved confidence that individuals that are licensed have those knowledges, skills and abilities required to perform on the job
- o better focused utility training programs
- o reduced licensee and NRC resource requirements to prepare and administer the operator licensing examinations.

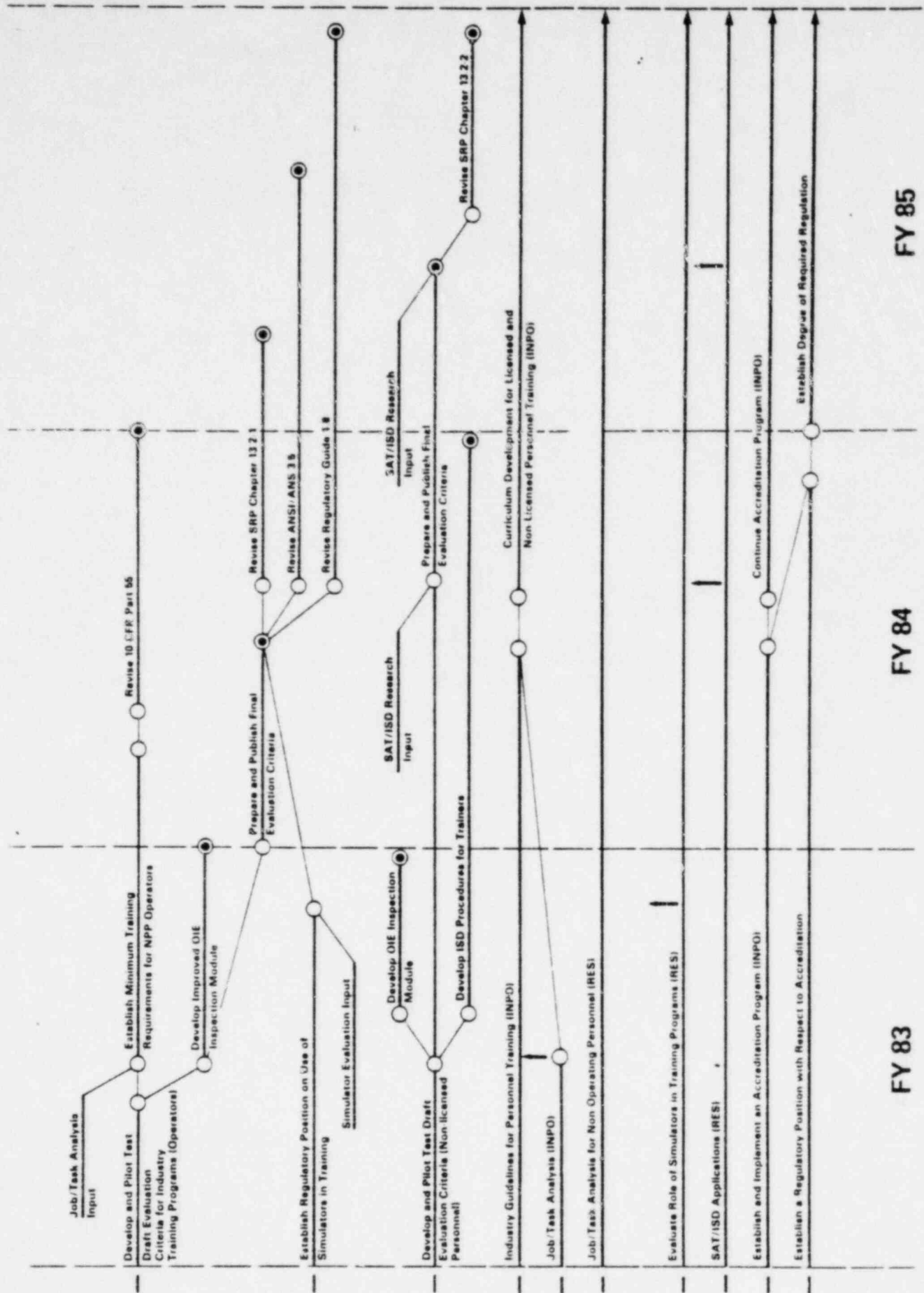


Figure III-2. Training Activity Sequence

The issues of concern in this element are:

- o modifying the examination process without unnecessary impact to current license candidates and training programs
- o the need to ensure that the licensing examination is a valid measure of the operator's ability to perform necessary tasks and functions
- o the need to correlate the licensing examination with improved training programs
- o the need for more consistent examinations and examining practices by NRC examiners
- o obtaining objective performance measures to assess examination validity.

3.1 The Examination Content

In order to identify the proper content of RO and SRO licensing examinations, the following activities will be performed:

- o identify the RO and SRO tasks and duties and required knowledges, skills and abilities necessary for safe performance using INPO and RES generic job/task analyses and to the extent available, plant specific analyses. (NRR/RES)
- o develop objective and subjective measures of on-the-job performance through the use of job/task analyses to measure learned skills and knowledges and to assess the ability of the examination to predict the competence of operators (NRR/RES)
- o develop and update a computerized bank of examination questions and examination scores for use in test validation, and use the computerized question and test score files to perform item analyses on examination results, focusing on reliability, difficulty, and discriminability of examination items (NRR)
- o perform content analysis of existing examination questions by subject matter experts to ensure that the appropriate types and levels of knowledges and skills are being included in examinations (NRR)
- o elicit training program information from utilities on specific content, learning objectives, and internal examinations for incorporation into the computerized examination bank (NRR)
- o determine the relationship between performance on the examination and subsequent job performance (NRR/RES)

3.2 The Examining Process

New examining procedures will be evaluated to increase the efficiency, reliability, and validity of the licensing examination process. The following activities will be performed:

- o assess the problems and issues involved in the current examination process from examiner, candidate, and utility perspectives (NRR)
- o review examination practices in other applicable organizations (e.g., FAA, airlines, DOD, NASA, Coast Guard, and Educational Testing Service) (NRR)
- o identify optimal format and procedures for each examination component, including:
 - written (e.g., open-ended vs objective questions)
 - simulator (e.g., generic vs plant-specific)
 - oral (e.g., standardized vs individualized questions)to provide a model for evaluating proposed changes to the current examination process (NRR/RES)
- o develop standardized examination practices and guidelines, and train examiners on test development, administration and grading techniques to assure consistency and reliability (NRR)
- o assess the impact of regionalization on examining procedures, practices and resources (NRR/OIE)

3.3 Long-Term Efforts

A long-term effort will be undertaken in FY-84 to identify state-of-the-art advances in testing, measurement, licensing and validation applicable to NPP operator examinations. New strategies of licensing such as FAA's "check-pilot concept" will be explored, and better training audit procedures will be used to assure candidate capability. Technological advances in operator licensing (e.g., computerized testing systems) will be evaluated. Objective measures of on-the-job performance will be used to evaluate the performance-based validity of any new system selected, if available.

3.4 Industry Activities

INPO's generic RO and SRO job/task analysis will be a major input in the development of content valid examinations and will provide a basis for attempting to establish operator performance criteria. Plant-specific job/task analysis performed at individual sites will be used to the extent

available. Utility training programs will be monitored to ensure consistency between training program curriculum and objectives, and the content and level of knowledge assessed in NRC examinations. Subject-matter experts from utility operating staffs will also be used in the development of content valid examinations.

3.5 End Products

The products of this program element include:

- o short-term modifications to existing examinations (FY-83/84)
- o an improved examining process including examiner guidelines (FY-83/84)
- o long-term improved examinations (FY-85)
- o modifications to 10 CFR Part 55 (FY-85)
- o recommended revisions to ANSI/ANS 3.5 "Nuclear Power Plant Simulators for Use in Operator Training" (FY-85)
- o revision of Regulatory Guide 1.149 "Nuclear Power Plant Simulators for use in Operator Training"(FY-85)

Figure III-3 depicts the sequence of activities leading to these end products.

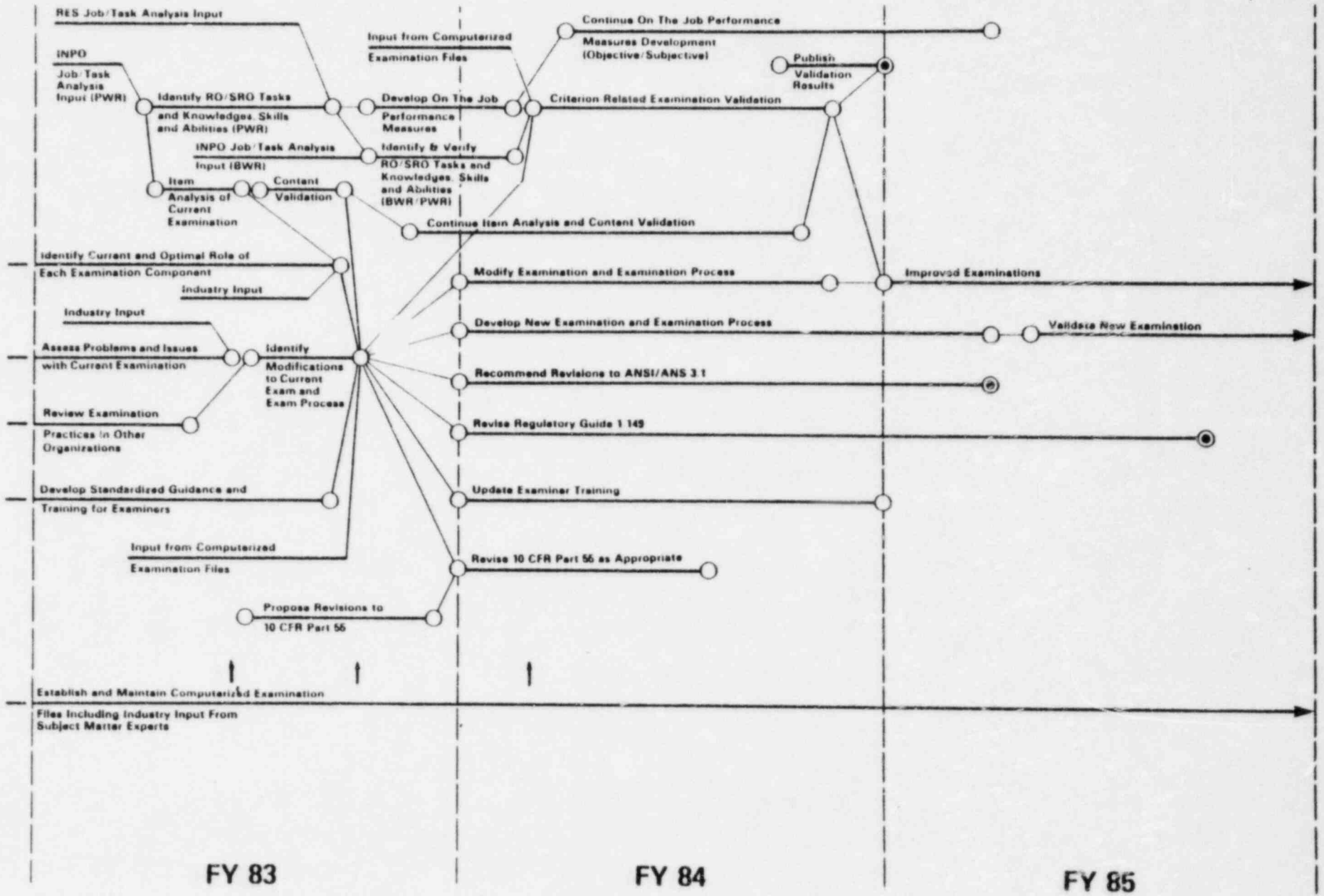
3.6 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Operator Licensing Branch (OLB), NRR, is responsible for assuring regulatory requirements for the near term improvements in examinations and the examination process, for identifying research and standards needs to assist in implementing the regulatory process of examinations identifying required dates for products from research and for standards, and managing the NRR technical assistance program. The Chief, Human Factors Branch, RES, is responsible for developing and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

4. Procedures and Testing

The goal of this element is to ensure the adequacy and effectiveness of procedures and plant test programs. Achievement of this goal will allow operators to maintain plant safety functions under all conditions, including the ability to control upset conditions without first having to diagnose the specific initiating events. This goal will be met by: (1) developing guidelines for preparing, and criteria for evaluating, emergency operating, operating, and

Figure III-3. Licensing Examinations Activity Sequence



other procedures which affect plant safety; and (2) upgrading the procedures, training the operators in their use, and implementing the upgraded procedures. In addition, the adequacy of the initial test program, to demonstrate that the facility will perform as predicted, will be reassessed.

The benefits which result from accomplishing this goal are:

- o reduced risk to public health and safety through use of procedures which increase operator's ability to control upset conditions, including degraded core conditions.
- o provide a framework for evaluating and integrating procedural fixes proposed as the resolution to unresolved safety issues into current procedures without introducing potential error in the other procedures areas.

4.1 Procedures Guidance and Criteria

This effort will provide guidance to improve emergency operating procedures (EOPs), abnormal operating procedures (AOPs), operating procedures (OPs), maintenance procedures (MPs), and procedures for emergency plan implementation, refueling, administration, safeguards, and security. It is anticipated that the methods employed in the generation of NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures" will be followed in developing guidance for other procedures. If required, industry will develop generic technical guidelines and the NRC and industry will coordinate the development of human factors guidelines. NRR and OIE are jointly developing inspection modules for use by the regions in auditing EOPs. Similar inspection modules will be developed for other procedures when guidelines for their upgrading are developed. The following activities are planned:

- o develop guidelines for implementing revisions to EOPs (NRR)
- o develop an inspection module and associated training for Regional audit of procedures (OIE/NRR)
- o develop guidelines for preparation of operating and maintenance procedures (NRR)
- o develop programs for upgrading other procedures (NRR)
- o develop methodologies/criteria for evaluating technical guidelines and procedures (RES)
- o develop methodologies/criteria for human factors evaluation of procedures (e.g., readability, comprehensibility) (RES)
- o develop methods and evaluate alternative techniques and formats for presenting procedures (e.g., computerized CRT presentation) (RES)
- o develop methods and evaluate the in-plant effectiveness and impact of upgraded procedures (NRR/RES)

4.2 Development of Test Program

NRC has completed the short-term testing objective of verifying that maximum opportunity for operator training for off-normal events is made during the initial test program. The need for reassessing the adequacy of the initial test programs and revising Regulatory Guide 1.68, "Initial Test Programs for Water Cooled Nuclear Power Plants," will be determined in FY-84.

4.3 Industry Activities

Owners' Groups, supported by the vendors, have developed generic EOP technical guidelines. INPO and industry have prepared a detailed writer's guide for licensees and applicants to use when preparing EOPs. EPRI has worked to ensure that efforts regarding the safety parameter display system (SPDS) are fully integrated with the symptom-based EOPs.

4.4 End Products

The products of this effort will be:

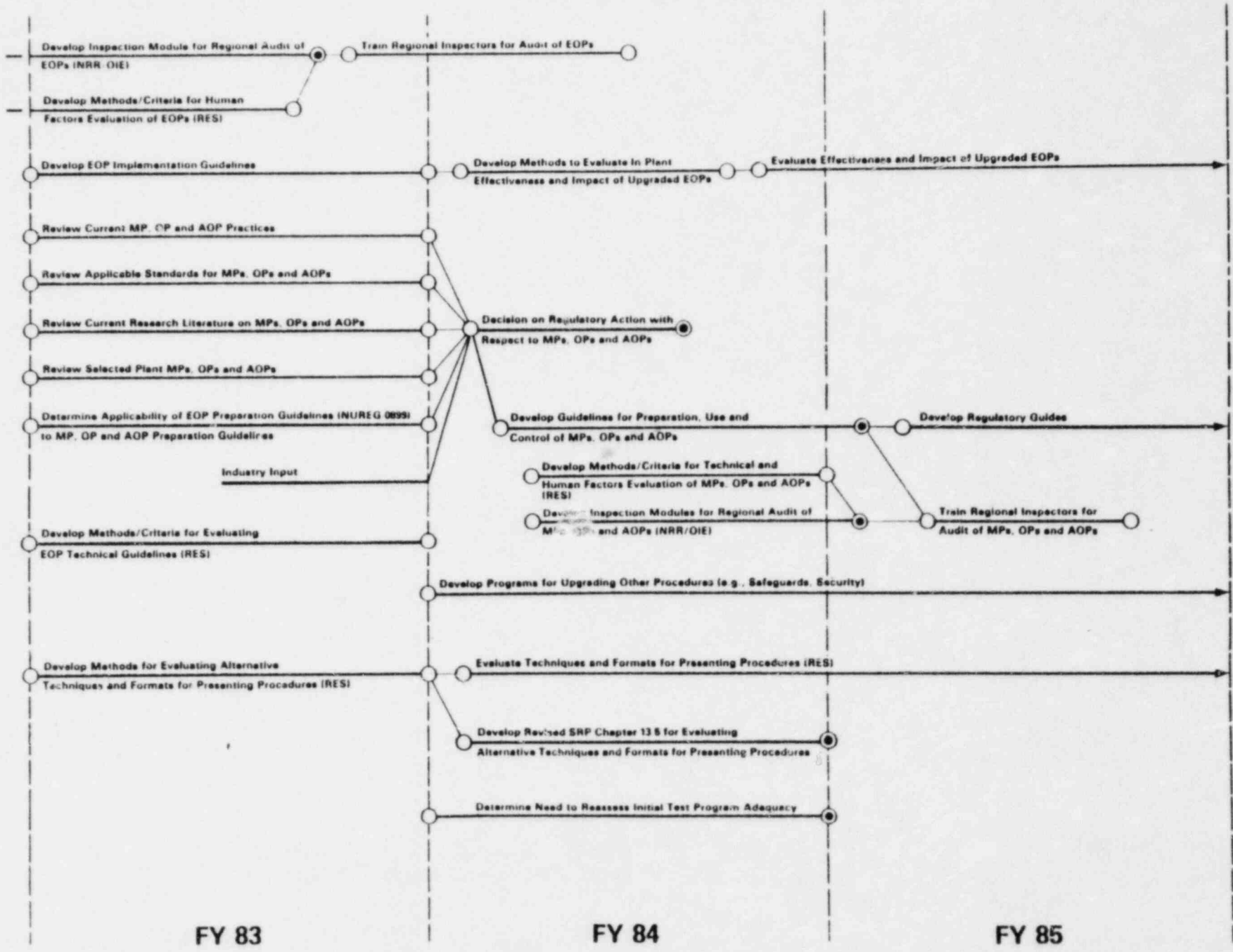
- o the development of guidance similar to NUREG-0899 to be used by the industry to prepare upgraded MPs, AOPs, OPs, and other procedures
- o the development of inspection modules for use by the Regional Offices for evaluating EOPs (FY-83) and AOPs, OPs, MPs, and other procedures, as necessary (FY-85)
- o a review and evaluation of the adequacy of current initial test program requirements (FY-84)
- o the development of methodology for evaluation of generic EOPs

Figure III-4 describes the sequence of activities leading to these end products.

4.5 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Procedures and Test Review Branch (PTRB), NRR, is responsible for the conduct of all NRR activities listed in Sections 4.1 and 4.2, identifying research and standards needs to assist in implementing the regulatory process, identifying required dates for products from research and for standards, and managing the NRR technical assistance program. The Chief, Human Factors Branch, RES is responsible for developing and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

Figure III-4. Procedures and Testing Activity Sequence



5. Man-Machine Interface (MMI)

The goal of this element is to ensure the adequacy of the MMI in all aspects of NPP operation and maintenance relative to the safe performance of the man-machine system. This goal will be met by developing (1) human factors engineering guidelines for correcting man-machine interface problems; and (2) regulatory guidance to assure that human factors engineering is appropriately integrated into new designs and incorporated into advanced technological improvements to existing designs.

The benefits which will result from accomplishing this goal are:

- o significant reduction in human errors through improvements in control rooms and plant design
- o efficient and effective job performance by operational personnel through improvements in control room design
- o enhanced (cost-efficient) operational performance and/or improved allocation of functions to man and machine
- o increased plant availability and safety thru effective maintenance activities

The issues in this element are:

- o extent to which regulatory positions should be developed for MMI issues beyond the control room
- o need for regulatory guidance on the use of advanced technologies

A significant concern within this element is the issue of backfitting. It is the position of the staff that SECY 82-111 be implemented for all licensees. Other MMI issues identified in this program plan are directed at providing evaluation tools for (1) the next generation of plants and (2) changes expected to be proposed by licensees such as upgraded systems for managing information and data and improved annunciator systems. Also, these efforts will significantly improve the capability of the staff to evaluate reactor incidents involving man-machine interface errors and provide capability to evaluate advanced designs for the next generation of plants.

5.1 MMI Guidance for Existing Designs

To date, regulatory attention has been primarily limited to those interfaces that exist in the control room and at the remote shutdown panel. Further guidance is needed regarding: (1) maintenance; (2) local control stations and auxiliary operator interfaces; and (3) emergency response facilities and preparedness. Additional guidance may also be needed in the area of improvements to existing annunciator systems.

Maintenance

Activities dealing with the human factors approach to maintenance are designed to characterize the areas of emphasis and direction the staff should follow. The significant areas are:

- o monitor and coordinate NRC activities related to maintenance, such as those addressing maintenance procedures, maintenance personnel qualifications and training, and MMI in maintenance activities (NRR/RES)
- o monitor maintenance improvement activities of the nuclear industry, for example, INPO's efforts on reliability-centered maintenance and EPRI's work in preventive maintenance and job performance aids (NRR)
- o determine the appropriate extent of NRC's role in NPP maintenance (NRR)
- o develop an additional General Design Criterion addressing human factors issues in maintenance (RES)
- o develop design-for-maintainability guidance for selected maintenance areas (NRR)
- o develop Regulatory Guides addressing maintainability guidelines and the application of human factors principles to the general issue of NPP maintenance (NRR/RES)

Local Control Stations and Auxiliary Operator Interfaces

Information is required to enable the NRC to determine if guidance on local control station design and auxiliary operator interfaces with these stations should be developed. This information will be developed through the following activities:

- o conduct job/task analyses of control room crew activities to identify and describe communications and control links between the control room and auxiliary control stations (RES)
- o analyze auxiliary personnel functions based on control room crew task analyses to estimate the potential impact of errors to plant safety (NRR/RES)

Emergency Response Facilities and Preparedness

To meet the intent of emergency preparedness requirements, several activities are planned:

- o support OIE in developing emergency response facility (ERF) review procedures (NRR)
- o develop a criteria manual for emergency preparedness at fuel cycle facilities (NMSS/RES)
- o analyze interfaces between licensees and Federal, State, and Local emergency preparedness agencies to identify and correct potential weaknesses (RES)
- o evaluate the human factors considerations in licensee emergency notification and provide guidance as required (RES)

Improvements to Existing Annunciator Systems

NUREG-0700, "Guidelines for Control Room Design Reviews" provides a "standard of quality" for annunciator systems which, if incorporated, should minimize the potential for human error associated with these systems. However, some of these standards will be difficult to apply to existing control rooms except as long-term design modifications. Also, an assessment of the impact of the NUREG-0700 guidelines on operating control rooms is needed to identify possible revisions to the guidelines. The following activities are planned:

- o develop guidance for near-term annunciator improvements which address techniques for implementing the quality standards of NUREG-0700 (NRR)
- o assess the impact on operating NPP control rooms of incorporating the features required to meet NUREG-0700 (NRR)
- o determine the feasibility of an operational aid system based on a combination of generalized annunciator alarm prioritization and procedures (NRR/RES)

5.2 MMI Guidance for Designs Based on Advanced Technologies

Existing human engineering guidelines for NPP control rooms primarily address control, display, and information concepts and technologies which are now being used in process control systems. While these guidelines are adequate for assessing and upgrading the MMIs in the current generation of NPP's, they may not be sufficient for assessing advanced and developing technologies that may be introduced into existing and future generation designs. This concern will be addressed through investigation in the areas listed below.

Computers

Presently, no NRC guidance is available concerning the management of data and information in the NPP control room during abnormal events, transients, and accidents. During FY-83, NRR will develop a technical report on the uses of digital computers in control room operations. The report will define functional uses of computers and rank these uses with regards to plant safety. Based on the report, a program plan will be developed to evaluate important safety problems. The program plan will be developed as a joint effort between NRR and RES. Products of the program will include guidelines on control room information management during severe transients and accidents, Regulatory Guides on information management, and a regulatory position on the use of digital computers in control rooms.

Advanced Controls and Displays

Presently 10 CFR Part 50.34(f), "Additional TMI-Related Requirements," requires each applicant for a light-water-reactor construction permit or manufacturing license to provide, for NRC review, a control room design that reflects state-of-the-art human factor principles.

To provide staff guidance pertinent to the interface between new control and display techniques and the human operator, the following activities are planned:

- o develop evaluation methods and design criteria related to visual displays (NRR/RES)
- o establish criteria needed for regulatory assessment of advanced control room concepts (RES)
- o initiate a program to track new and developing technologies that have potential for application in NPP control rooms (NRR/RES)
- o investigate the feasibility and desirability of installing audio-visual recording systems in control rooms (NRR)
- o identify control and display requirements for crew response needs subsequent to seismic events (RES)

Function Allocation

An integrated program plan for investigating function allocation will be developed to determine:

- o the NPP functions involving a human component (NRR/RES)
- o whether current function allocations (especially in control rooms) permit reliable performance of functions assigned to humans (RES)
- o identify design changes which enhance function performance (NRR/RES)
- o the need to reallocate functions between the human and machine components of the NPP system (NRR/RES)
- o which functions should be reallocated (NRR/RES)
- o the feasibility/desirability of applying cognitive workload measurement techniques to a selected list of operator functions (RES)

The implementation of this program will provide data necessary for establishing a regulatory position on function allocation and the appropriate roles of the human components.

Advanced Annunciator Systems

Advanced technologies are expected to be utilized in the development of improved NPP annunciator systems. A regulatory position on longer-term annunciator improvements will be developed based on an evaluation of results from EPRI, RES, Halden, and other advanced concept activities at Seabrook and Savannah River. NRR will develop the regulatory position.

Safety Status Indication

Based on a current project investigating means for monitoring and verifying operations, tests, and maintenance activities, the staff will make a preliminary determination concerning:

- o the adequacy of operational systems designed to be in conformance with Regulatory Guide 1.47 (NRR)
- o the comparative adequacy of status monitoring in plants that do not have automatic monitoring systems (NRR)
- o the development of long-term improvement guidance addressing the feasibility and value/impact of instrumentation backfits and the application of state-of-the-art logic schemes (NRR/RES)

5.3 Industry Activities

The nuclear industry has several efforts devoted to MMI issues. INPO and EPRI programs in the area of maintenance and EPRI's work on backfitting annunciator improvements, control room enhancement, and display research for the safety parameter display system are all contributing significantly to the resolution of human factors concerns in the control room.

5.4 End Products

The products of this element include:

- o a technical report addressing design-for-maintainability (FY-84) (NRR)
- o regulatory position addressing local control stations and auxiliary operation interfaces (FY-84) (NRR)
- o emergency response facilities (ERF) review procedures (FY-83) and ERF review reports (through FY-85) (NRR/RES)
- o a technical report addressing near-term annunciator improvement (FY-83) and long-term improvement (FY-84) (NRR)
- o a technical report on control room information management during severe transients and accidents (FY-84) (RES)
- o a technical report on the use of computers for data and information management in control rooms (FY-84) (RES)
- o a Regulatory Guide on information management methods (FY-85) (RES)
- o a report on the means for investigating function allocation (FY-84) (RES)
- o a Regulatory Guide on advanced annunciator design and operation (FY-85) (RES)
- o a technical report addressing safety system status monitoring (FY-85) (NRR)
- o report on the need for automatic system status monitoring systems (FY-84)
- o revision to Regulatory Guide 1.47 (FY-85) (RES).

Figure III - 5 describe the sequences of activities leading to these end products.

Figure III-5. Man-Machine Interface Activity Sequence (page 1 of 4)

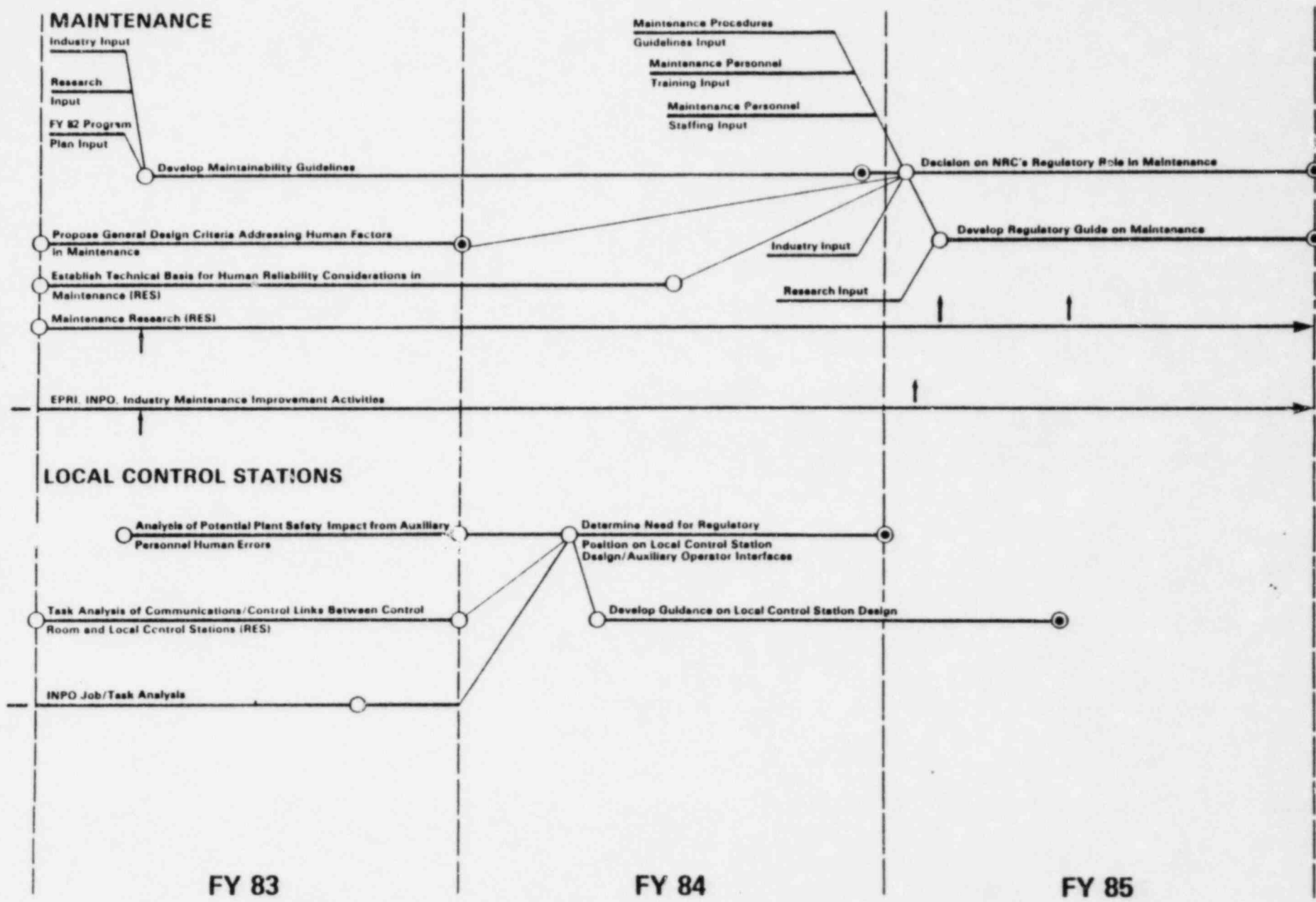


Figure III-5. Man-Machine Interface Activity Sequence (page 2 of 4)

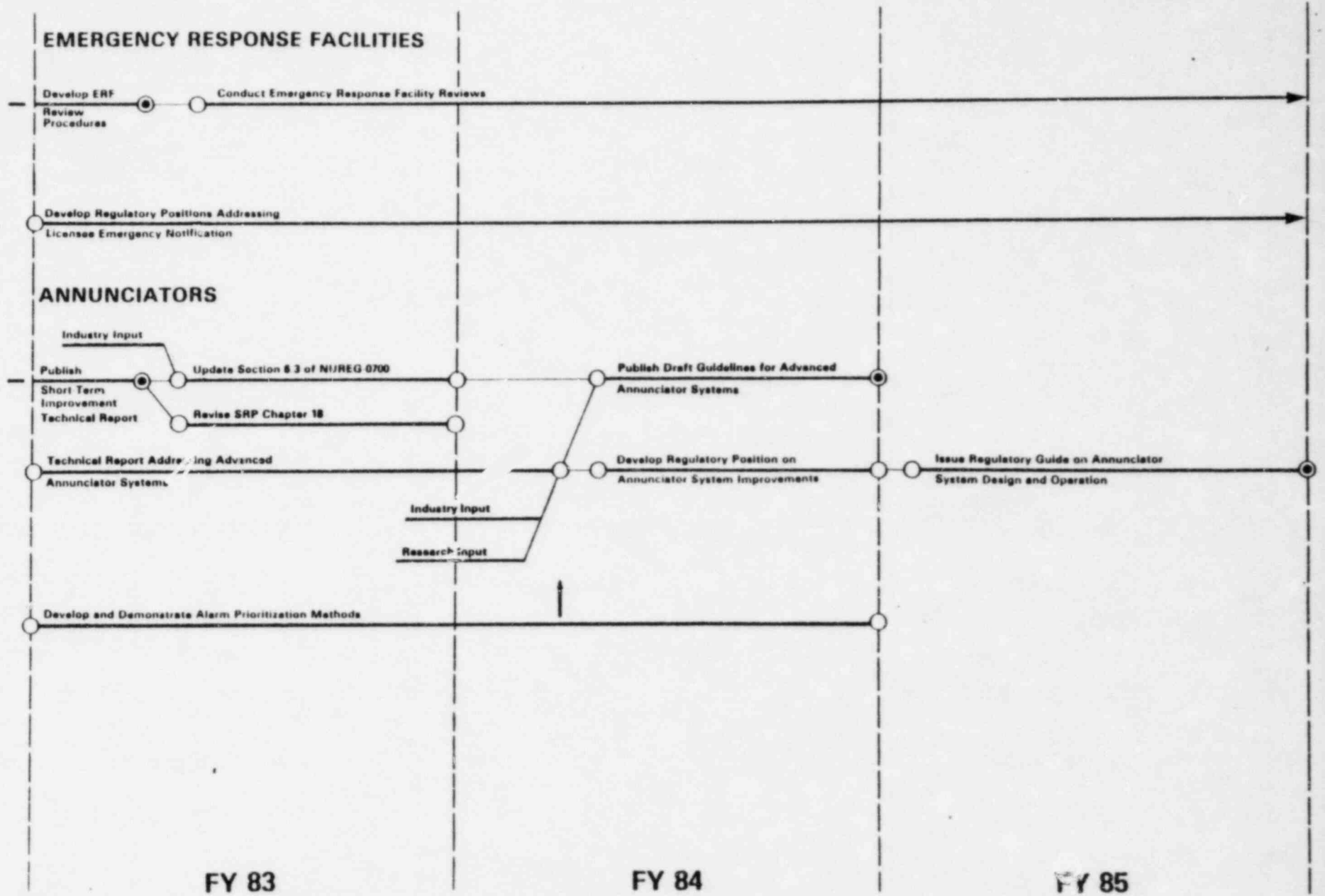


Figure III-5. Man-Machine Interface Activity Sequence (page 3 of 4)

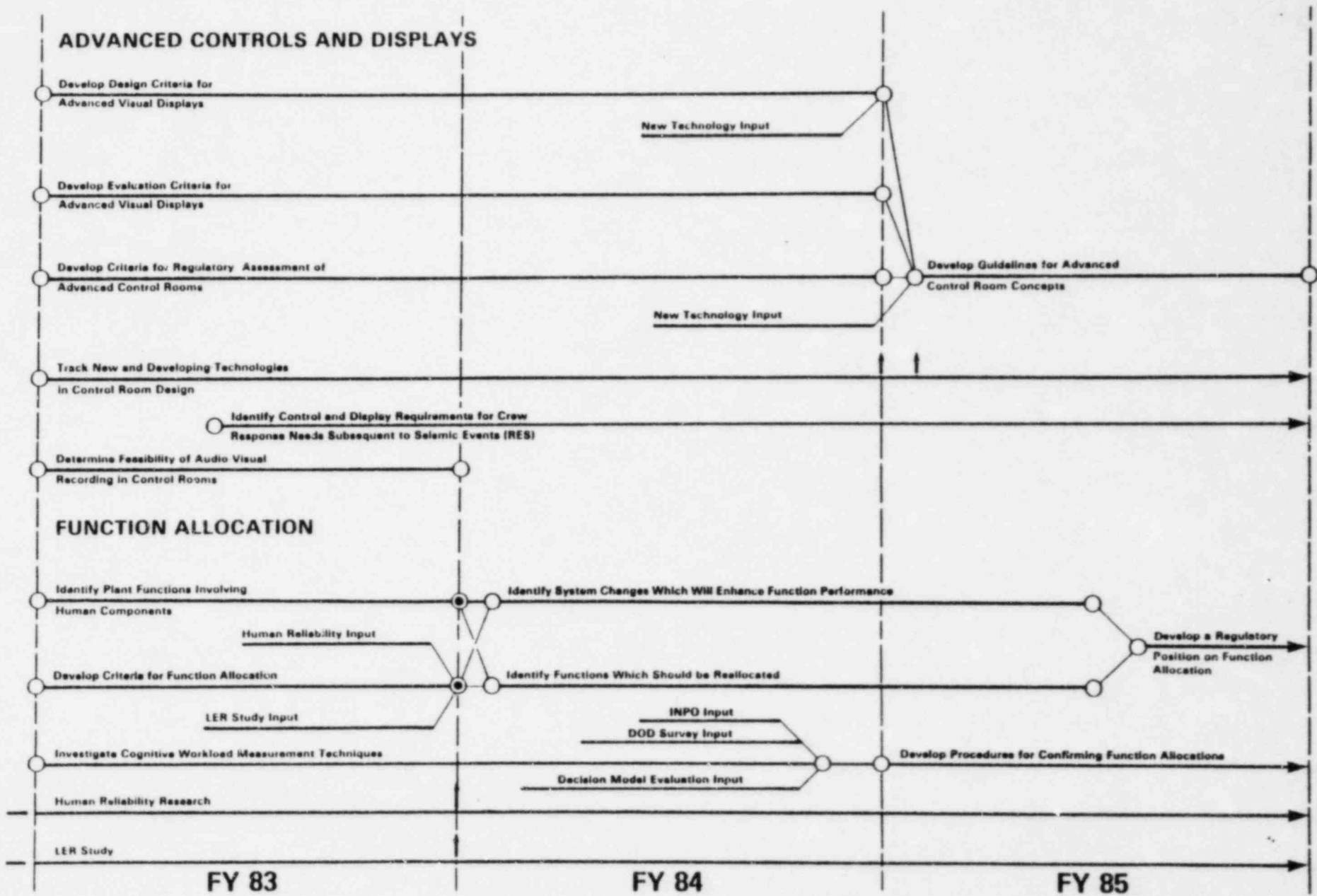
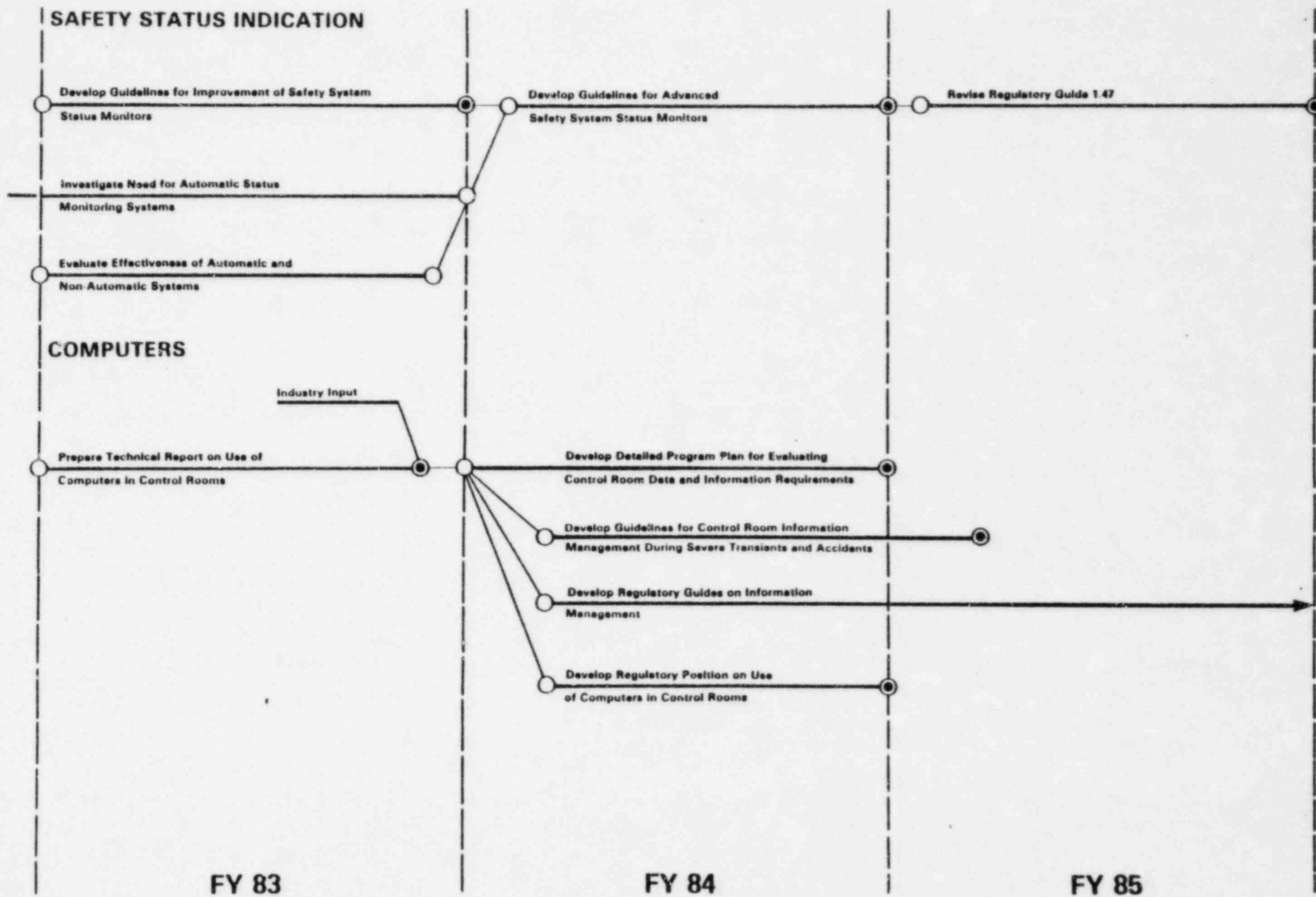


Figure III-5. Man-Machine Interface Activity Sequence (page 4 of 4)



5.5 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Human Factors Engineering Branch (HFEB), NRR, is responsible for the conduct of all NRR activities listed in Sections 5.1 and 5.2, identifying research and standards needs to assist in implementing the regulatory process, identifying required dates for products from research and for standards, and managing the NRR technical assistance program. The Chief, Human Factors Branch, RES, is responsible for developing and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

6. Management and Organization

The goal of this element is to ensure the adequacy of utility management and organizational design for safe nuclear power plant operation. This goal will be met by accomplishment of the following objectives: (1) develop management and organization guidelines for ensuring acceptable management and organizational practices during plant design, construction, and operation; (2) develop and implement reliable, objective performance evaluation procedures for use by the staff in assessing the effectiveness of management and organizational functions, such as operations, security, technical support, and safety review committees, and characteristics such as communications and attitudes toward safety; and (3) develop in coordination/ cooperation with INPO a training program for prospective plant managers, and other appropriate managers.

The benefits which will result from accomplishing this goal are:

- o reduction of the number and severity of issues that could lead to unsafe NPP conditions
- o a better focused, safety sensitized organization with resources to support technical issues
- o a management and organizational design which is responsive to resolution of technical issues, and allocates resources and responsibility to ensure public health and safety

The issues of concern in this element are:

- o lack of objective measures to assess management and organization
- o sensitivity of industry to regulation of their management

6.1 Management and Organization Guidelines

Revised guidelines will be developed that emphasize the responsibility of the utilities to develop and justify management and organization plans. These revised guidelines will be revised through accomplishment of the following activities:

- o analyze current industry efforts in management and organization planning by reviewing Safety Analysis Reports, by reviewing selected management and planning documents from utilities, and by reviewing related industry practices to provide a standard set of descriptors (NRR)
- o determine which management and organizational elements (e.g., individuals, safety review groups, communications throughout the utility, and overall corporate structure) relate directly or indirectly to safety. This task will be done by reviewing existing documentation and applicable literature, incorporating the views of management and organization subject matter specialists, incorporating the views of nuclear industry specialists, and by analyzing available data on elements related to management and organization and data related to indicators of safety (NRR/RES)
- o establish safety performance standards by deriving empirically the relationships between organizational and management practices and safety related performance outcomes symptomatic of general plant safety, nuclear safety, and plant security. Research is currently underway investigating alternative approaches for accomplishing this task (RES)
- o identify innovative ways in which organization and management can be structured to optimize plant and public safety. This will be accomplished through analysis and enhancement modeling of organization and management functions and roles, in conjunction with subject matter experts from NRC licensing and inspection activities, and from the nuclear industry (RES)
- o identify those management and organization elements which are appropriate to regulation (NRR/RES)
- o conduct industry reviews, advisory panel meetings, and several pilot tests of applicants and selected licensees (NRR)
- o working with industry, assess the appropriate licensing or certification program for key utility employees (e.g., Prospective Plant Superintendents, Maintenance Managers, etc) (NRR/RES)

6.2 NRC Assessment Procedures

Results of the management and organization guidelines effort will be used to revise assessment procedures and modify the SRP. Two tasks are involved in developing assessment procedures or review documents to be used by the NRC in judging the adequacy of utility management and organization. These are (1) a review document containing criteria to be used to assess utility written submissions on their management and organization plans, and (2) a review document with protocols for site visits or incident reviews by the NRC. In addition, technical reviewers will be trained to improve interview capabilities. This will involve training workshops on the use of the revised SRP and developing a reviewer handbook for use while conducting onsite reviews.

6.3 Industry Activities

As approved by the Commission, the number of Performance Appraisal Team (PAT) inspections has been reduced in recognition of similar plant evaluations conducted by INPO. NRC review of INPO effectiveness in this program has been arranged through a NRC-INPO coordination plan. INPO has also initiated a program to evaluate utility management for plants under construction. To date this is accomplished by self-initiated evaluations by the utilities using criteria supplied by INPO, but INPO may conduct on-site evaluations at a later date. INPO has also started a program of workshops for utility managers to assure that they are committed to quality work in conformance with applicable guides and regulations.

6.4 End Products

NRR has developed draft guidelines that will be pilot tested and revised in FY-84, with interim guidelines being published in FY-85. The interim guidelines will be used by the industry and NRC until experience using the guidance or new information generated by RES efforts is available. At that time, the interim guidelines will be changed or finalized as appropriate. In addition, Chapters 13.1 and 13.4 of the SRP will be revised (FY-84). Figure III-6 describes the sequence of activities that lead to these end products.

6.5 Responsibility

The responsibility for implementation of the activities described in this program element is divided. The Chief, Licensee Qualifications Branch (LQB), NRR, is responsible for the conduct of all NRR activities listed in Sections 6.1 and 6.2, identifying research and standards needs to assist in implementing the regulatory process, identifying required dates for products from research and for standards, and managing the NRR technical assistance program.

The Chief, Human Factors Branch, RES, is responsible for developing and managing the research to meet NRR requirements and to deliver the products in a timely manner consistent with quality and programmatic constraints. The research will be carried out in accordance with the February 3, 1982 established procedures for the NRC research process.

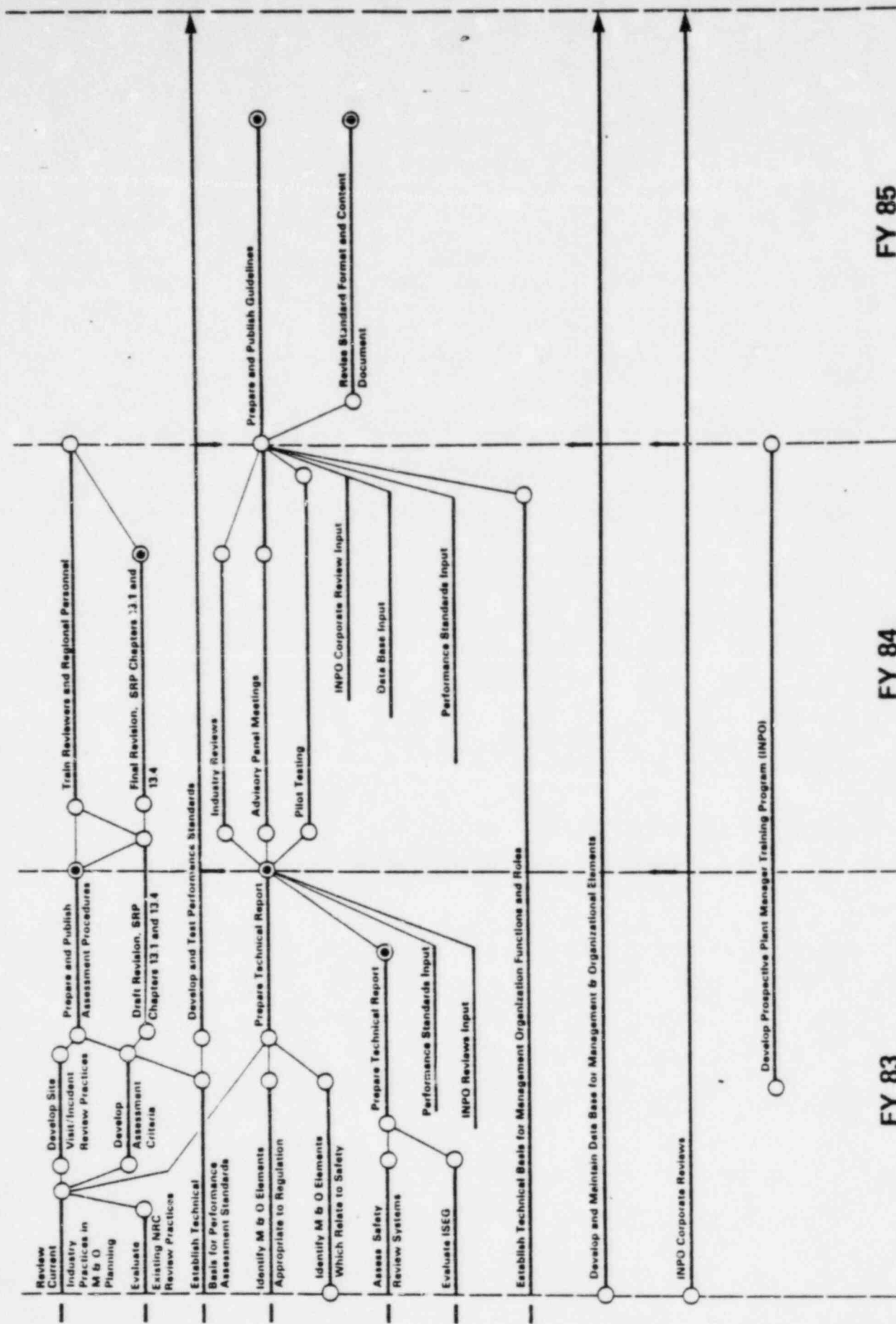


Figure III-6. Management and Organization Activity Sequence

IV. LONG RANGE RESEARCH

A. Introduction

The human factors research program elements described in Section III of this program plan were developed to meet the NRC's short-term (FY-83 through FY-85) objectives and are aimed primarily at developing data to address current regulatory issues involving commercial NPP's. The purpose of this Section is to provide a general description of research efforts that RES is planning in anticipation of requests by user offices for long-term (beyond FY-85) research in human factors.

B. Program Elements

The six program elements of the anticipated long-term human factors research program will address applicable human factors needs for five general types of licensed facilities. These are: advanced Light Water Reactor (LWR) nuclear power plant design concepts, non-LWR nuclear power plants, test reactors, fuel cycle facilities, and unresolved human factors needs for current LWR nuclear power plants.

1. Staffing and Qualifications Research

Research beyond FY-85 is in preliminary planning to address staffing and qualification needs for each of the five general types of licensed facilities discussed above. The research methods and techniques developed through FY-85 are expected to be generally applicable; however, the unique or different technology requirements for non-LWR power reactors such as the liquid metal fast breeder reactor (LMFBR) and fuel cycle facilities such as reprocessing plants may necessitate the development of new ways to assess staffing and qualifications of personnel.

An example of an area of anticipated concern is that over the next decade the increasing demand for operators may result in a significant change in the population requirements. This change will be driven by both the increased need for operators which may overtax traditional sources and the change in the nature of the operator's job as control rooms move towards advanced technology applications in new display and control concepts, greater computerization, and automation. Research may be needed to determine what effect, if any, these changes will have on staffing and qualification requirements.

2. Training Research

Just as new technology and new applications may require changes in staffing and qualifications, so they may also have impact on training and retraining. FY-86 through FY-89 research for training is in preliminary planning to establish criteria which can be used to determine the adequacy of training programs for the five general areas. Examples of anticipated research projects are: development of valid and reliable operator performance measures, collection of job/task analysis data, and development of the operator examination data

bank. Additionally, anticipated changes in control room design, specifically, increased computerization and incorporation of advanced control and display systems, can be expected to require research to develop new training evaluation data and methods.

3. Examination Research

Current research in the area of operator examination is focused on assuring that the RO and SRO examinations reliably and validly measure the operator's ability to safely operate the plant. The effectiveness of the examination process for reactor operators may need to be investigated in light of the anticipated change in the population of reactor operators due to the changing nature of the job (e.g., automation and computerization in advanced control rooms) and the rapidly increasing demand for operators caused by both the increasing number of operating NPP's and the requirements for more operators on shift.

Research on non-LWR power plants and fuel cycle facilities is in preliminary planning to determine which positions should be licensed or certified and what are the most effective methods for examination including determination of examiner qualifications.

4. Procedures Research

Long-term research is in preliminary planning to address procedures and job aids for the five general areas. The interaction of increased information availability, personnel information requirements, and computerized/job aids are expected to create new procedure requirements. Anticipated effects of computerized large data base management systems and memories may require research to evaluate the adequacy of the then-existing regulations and guidelines for procedures. The research program on procedures will provide the technical basis for appropriate regulatory actions, with particular emphasis in the area of maintenance procedures.

5. Man-Machine Interface

Research beyond FY-85 should be directed toward assuring an adequate base for regulation of new MMI design concepts which can be expected in the next decade. The new concepts will arise from several sources: applications of technologies such as video display terminals, artificial intelligence, or synthetic voice interaction between computer and user. Automation of many control room functions can be expected in future design concepts. Research plans to provide the technical data base for criteria, Regulatory Guidelines, and standards for such topics as: effects of automation on manual backup operations; supervisory control systems, computerization and display of procedures, and analysis of cognitive data management systems. Research will be continued on the effects of severe stress (e.g., severe seismic events) on human performance with respect to safe operations.

6. Management and Organization

The near-term focus in management and organizational research is on management and organizational functions (operations and safeguards) for current LWR power plant operations. While these human factors activities address, in general, NRC immediate and short-term requirements and respond to Human Factors Society recommendations in the management area, they do not address other important nuclear industry organization and management responsibilities that affect the public safety. Research is in preliminary planning to develop a better understanding of the full range of management roles in LWRs relative to public safety and to provide a technical basis for appropriate regulatory action in this area.

Human factors research on management and organization is in preliminary planning to address the four other general areas of interest. Considerable differences in management structure and objectives, particularly for fuel cycle facilities, likely will be identified. The methods and information gained in FY-83 through FY-85 will be appropriately applied to those concerns of interest.

C. Human Reliability Integration

The six elements are supported by human factors research for the development of human reliability data, data storage and retrieval methods and human reliability models. The principal human reliability research emphasis in FY-86 through FY-89, will be refinement of the human performance data bank which was developed in FY-82 through FY-85, applications of the maintenance performance model developed in the same time period; and, verification of the cognitive models and error analysis techniques which were initiated in late FY-84. Lessons learned through application of these human reliability products in NPPs probabilistic risk assessments will provide valuable feedback to determine the adequacy of data and models.

APPENDIX A

TMI ACTION PLAN STATUS

The two tables of this Appendix present the status of the TMI Action Plan items (NUREG-0660/0737). Table A-1 provides the staff review status for those items that have been or are in the process of being implemented. The status applies to operating reactors. For OL applicants, the status is "continuing" for all items. Staff developmental efforts for these items are essentially complete; however, some items have been resolved on the basis of a short-term solution, and staff efforts to improve the technical quality of these solutions will continue. These efforts are described in the individual program elements and are also repeated in Table A-2.

Table A-2 identifies those Action Plan items which are still under development, or which require additional staff action to provide technical improvement. References are to the program element schedules given in Appendix C. The schedules for completing these items have been compared with the recommended prioritization plan described in NUREG-0933, "A Prioritization of Generic Safety Issues." The NUREG-0933 priorities are shown in parentheses after the title of the Action Item. The prioritization coding is as follows:

- HIGH - Strong efforts to achieve practical resolution are appropriate.
- MED - The potential for safety improvement may be substantial and worthwhile.
- LO - Safety deficiency is minor and does not merit substantial attention. Little or no prospect for substantial/worthwhile improvement.
- TBD - Priority not yet established.
- TMI - Implementation mandated by NUREG-0737.
- LI - Licensing improvement issue - not prioritized.

The staff's estimated completion dates have taken into account these priorities, along with considerations of the additional time required to resolve the individual action items, and available staff resources.

<u>ITEM</u>	<u>TITLE</u>	<u>PRIMARY REFERENCE DOCUMENT</u>	<u>OPERATING REACTOR REVIEW STATUS:</u>
I.A.1.1	Shift Technical Advisor	NUREG-0737	Complete
I.A.1.A	Shift Supervisor Administrator Duties	NUREG-0660	Complete
I.A.1.3	Shift Manning	NUREG-0737	Complete
I.A.2.1	Immediate Upgrading of Reactor Operator and Senior Reactor Operator Training and Qualifications	NUREG-0737	Complete
I.A.2.3	Administration of Training Programs	NUREG-0737	Complete
I.A.3.1	Revise Scope and Criteria for Licensing Examinations	NUREG-0737	Continuing
I.A.4.1	Initial Simulator Improvement	NUREG-0660	Complete
I.B.1.2	Independent Safety Engineering Group	NUREG-0737	N/A
I.C.1	Guidance for the Evaluation & Development of Procedures for Transients and Accidents	NUREG-0737	Continuing
I.C.2	Shift and Relief Turnover Procedures	NUREG-0660	Complete
I.C.3	Shift Supervisor Responsibilities	NUREG-0660	Complete
I.C.4	Control Room Access	NUREG-0660	Complete
I.C.5	Procedures for Feedback of Operating Experience to Plant Staff	NUREG-0737	Complete
I.C.6	Guidance on Procedures for Verifying Correct Performance of Operating Activities	NUREG-0737	Complete
I.C.7	NSSS Vendor Review of Procedures	NUREG-0660	N/A
I.C.8	Pilot Monitoring of Selected Emergency Procedures for NTOL Applicants	NUREG-0660	N/A
I.D.1	Control Room Design Reviews	SECY 82-111	In process
I.D.2	Plant Safety Parameter Display Console	SECY 82-111	In process
II.B.4	Training for Mitigating Core Damage	NUREG-0737	In process

Table A-1. TMI Action Plan Status - Implementation

<u>ITEM</u>	<u>TITLE</u>	<u>APPENDIX C REFERENCE</u>	<u>ESTIMATED COMPLETION DATE</u>
I.A.1.1	Shift Technical Advisor (TMI)	1.2	4QFY83
I.A.1.3	Shift Manning (TMI)	1.2, 1.4	FY84
I.A.1.4	Long-term Upgrade of Operating Personnel and Staffing (TBD)	1.3, 1.4	FY85
I.A.2.2	Training & Qualifications of Operational Personnel (HIGH)	1.3, 2.1	4QFY84
I.A.2.3	Administration of Training Programs (TMI)	2.2	4QFY84
I.A.2.4	NRR Participation in Inspector Training (LI)	--	4QFY84
I.A.2.5	Plant Drills (LO)	--	2QFY83
I.A.2.6	Long-term Upgrading of Training & Qualifications (TBD)	1.1, 2.1	3QFY84
I.A.2.7	Accreditation of Training Institutions (MED)	2.2	4QFY85
I.A.3.1	Revise Scope & Criteria for Licensing Examinations (TMI)	3.1	4QFY83
I.A.3.2	Operator Licensing Program Changes (MED)	3.1, 3.2	4QFY84
I.A.3.3	Requirements for Operator Fitness (TBD)	1.3	FY84
I.A.3.5	Establish Statements of Understanding with INPO & DOE (LI)	--	Continuing
I.A.4.1	Initial Simulator Improvement (TBD)	2.1	4QFY83
I.A.4.2	Long-Term Training Simulator Upgrade (TBD)	2.1	FY85
I.B.1.1	Organization & Management Long-Term Improvements (MED)	6.1	3QFY83
I.B.1.2	Evaluation of Organization & Management Improvements (TMI)	6.1, 6.2	4QFY83
I.C.6	Guidance on Procedures for Verifying Correct Performance of Operating Activities (TMI)	4.1-	4QFY83
I.C.9	Long-Term Program Plan for Upgrading of Procedures (MED)	4.1	4QFY84
I.D.3	Safety System Status Monitoring (MED)	5.2.5	4QFY85
I.D.4	Control Room Design Standard (TBD)	5.1, 5.2	4QFY84
I.D.5	Improved Control Room Instrumentation Research (TBD)	5.2	4QFY89
II.B.4	Training for Mitigating Core Damage (TMI)	--	4QFY83

Table A-2. TMI Action Plan Status - Development

APPENDIX B

HUMAN FACTORS SOCIETY RECOMMENDATIONS AND THEIR CORRELATION WITH STAFF PROGRAMS IN HUMAN FACTORS

INTRODUCTION

The findings of the TMI-2 Lessons Learned Task Force emphasized the importance of human performance in nuclear power plant safety. Subsequently, the NRC contracted with the Human Factors Society (HFS) to develop a long range program plan which could serve as a basis for incorporating human factors considerations into NRC regulation and research activities. Beginning in December 1980, a Working Group of selected members of the Society reviewed human factors activities in the NRC and throughout the nuclear industry. A three-volume Final Report, "Critical Human Factors Issues in Nuclear Power Plant Regulations and a Recommended Comprehensive Human Factors Long-Range Plan," NUREG/CR-2833, was published and issued by the NRC in August 1982. This appendix summarizes and compares the 51 major recommendations from the HFS report along with the staff's program of human factors regulatory and research activities. NRC or industry activities (either completed or now underway) address 40 of these 51 recommendations. Six of the recommendations are under active consideration. Activities to implement these recommendations have not yet been initiated. The staff finds another 2 recommendations as not being human factors activities that are applicable to this plan, and disagrees in part with 3 of the recommendations. The staff disagreements relate to the Safety Parameters Display System (SPDS) and to the proper consideration of human error in Probabilistic Risk Assessment (PRA). The HFS recommends that a systems analysis be conducted to determine the need for a SPDS. The staff does not agree, and believes that the SPDS requirements as given in SECY 82-111 are appropriate. In the first of the remaining two disagreements, the HFS recommends reduction in the level of research being conducted relative to human error assessment. The plan continues research support in this area, primarily to develop an adequate data base so that human reliability (and error) can be more effectively considered in PRA. Revised approaches to human reliability in PRA are also being investigated. In the second disagreement, the HFS recommends that research emphasis should be shifted from error modeling and risk assessment to design analysis. The staff believes both human error risk assessment and design analysis to be important; both are included in the plan.

Using the Appendix

A catalog of the human factors recommendations are provided on the following pages. These recommendations are cross-referenced with corresponding staff activities. The explanation of the headings used to present each HFS recommendation are as follows:

- Para. Page - The Society's Report, Volume 2, contains the detailed recommendations. Paragraph and page references are listed for each recommendation.
- Topic - The title of the Recommendation as used in the Society's Report.

Following the title, these symbols are used:

- H - High importance rank is recommended by the Society for action by the NRC
- M - Medium importance rank is recommended by the Society for action by the NRC
- L - Low importance rank is recommended by the Society for action by the NRC
- I - Recommendation should be following immediately; or
(number) - The number of years within which the effort should be undertaken according to the Society.

- Status - The status refers to the NRC current or planned action in response to the Society's recommendation:
 - Pending - The Recommendation is under consideration at this time
 - In Place - The Recommendation has been followed and the needed action has been completed.
 - Underway - The Recommendation is being accomplished by one or more programs in NRR and/or RES.
 - Disagree - Part or all of the staff do not concur with the Recommendation. Resolution of the disagreement may take some time.

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference*</u>
4.2		<u>General Human Factors Problem Areas</u>		
4.2.1	292	Professional Human Factors Qualifications in Nuclear Power (H;I)	In Place	
4.2.2	293	NRC Organization (H;I)	Modified Action Underway	
4.2.3	294	System Integration (H;6-10)	Modified Action Underway	
4.2.4	296	Safety Related Equipment Classification (H;I)	Underway	5.2.2
4.2.5	297	Analysis and Evaluation of Operational Data (H;1-2)	Underway	
4.2.6	298	The Human's Role in Increasingly Automated Systems	Underway	Section III.5.2
4.2.7	299	Risk Assessment and Human Reliability - reduce current high level of research	Disagree	
4.2.8	300	Evaluation Criteria (H;I)	Underway	3.1
4.2.9	302	System Engineering of the Regulatory Requirements (H;I)	Underway	
4.3		<u>Human Engineering Problem Areas</u>		
4.3.1	304	Design Induced Error		

*References are to Appendix C unless otherwise noted.

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
a.	305	Implement NUREG-0700 as a Requirement; Prepare Maintainability Equivalent (H;I)	Modified Action Underway	SECY 82-111 5.1.1
b.	306	Guidelines for Emergency Shutdown Panel Design (M; 3-5)	Underway	5.1.2
c.	306	Guidelines for Local Control Stations (M; 3-5)	Underway	5.1.2
d.	306	Color coding study (M; 6-10)	Underway	5.2.2
e.	307	Advanced display technology research (M; 1-3)	Underway	5.2.2
4.3.2	307	Inconsistent Control Room and Plant Design	Pending	
4.3.3	308	Annunciators and Alarms		
a.	308	Require adherence to Section 6.3 of NUREG-0700 (H;I)	Modified Action Underway	
b.	309	Standard or specification for 'traditional' annunciators (H; 1-2)	Underway	5.1.4
c.	309	Issue alarm requirements for 'traditional' annunciators (H; 1-2)	Underway	5.1.4
d.	310	Expand system status verification guidelines research (H; 1-3)	Underway	5.2.5

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
4.3.4	310	Design for Maintainability		
a.	310	Research emphasis should be shifted from error modeling/risk assessment to design analysis	Disagree - both activities are important. Both are underway now.	Section II.G
b.	311	Publish engineering design criteria guidelines for maintenance (H; 1-2)	Underway	5.1.1
c.	311	Sponsor studies for better protective clothing, tools and instruments (M; 3-5)	Pending	Section III.5.1
4.3.5	311	Design Freeze - Relative merits vs current ratchet process (H; 1-2)	Pending	5.1.2
4.4		<u>Problems in Procedures and Job Performance Aids</u>		
4.4.1	314	Specifications for Procedures Development - NRC to assume responsibility for non plant-specific specifications (H; 1-3)	Underway	4.1
4.4.2	314	Procedure Development Process - Utilities to develop plant-specific guidelines, NRC to review for compliance (H; 3-5)	Underway	4.1
4.4.3	315	Job Performance Aids - Establish the requirements for hard copy, electronic and computer based JPAs (H; 3-5)	Underway	4.1

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
4.4.4	316	Formats for Procedures and JPAs - Develop guidelines for acceptable JPA formats (H; 1-3)	Underway	4.1
4.4.5	317	Procedure Implementation and Revision - Determine effective process for implementing and revising O&M procedures (L; 6-10)	Underway	4.1
4.4.6	318	Performance Verification - Study development of an automatic system status monitoring device (M; 6-10)	Underway	5.2.5
4.4.7	318	Change of Shift Procedures - Establish criteria for accomplishing effective change-of-shift procedures (H; 1-2)	Underway	1.1
4.5		<u>Personnel and Staffing Problems</u>		
4.5.1	321	Selection - Practices and Standards		
a.	321	Validation of current and new selection procedures (H)	Industry effort underway. Not a NRC function.	1.4
b.	322	Research on Performance Under Stress (H; 1-2)	Underway	Sections III.5.1 IV.5
c.	322	Monitor & evaluate behavioral reliability program (M)	Pending	1.2
d.	322	Research new technology testing procedures (L; 6-10)	Underway	1.2

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
4.5.2	323	Operator Certification and Licensing		
a.	324	Develop objective performance standards (H; 1-2)	Underway	1.2
b.	324	Research to develop specific qualification requirements for non-licensed personnel (H; 1-2)	Underway	1.2
c.	325	Develop methods to assess and track in-plant training programs (L; 6-10)	Underway	2.2
d.	325	Experience requirements for qualification of ROs, SROs and SSS, and bases for trading experience and education (M; 1-2)	Underway	1.2
4.5.3	325	Staffing and Organizational Characteristics - Develop criteria for assessment of staffing and organizational variables effects (M; 3-5)	Underway	1.2
4.5.4	327	Shift Duration & Rotation - Determine whether and under what conditions operator performance deteriorates. Identify sensitive variables. Add to LER system (H; 1-2)	Pending	1.3

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
4.5.5	330	Factors Affecting Job Satisfaction - Establish recent turnover rates, and, if excessive, identify causes and changes needed to reduce them (H; I)	Industry effort underway. Not a NRC function.	1.4
4.6		<u>Problem areas in training</u>		
4.6.1	333	Instructional System Development		
a.	335	Establish NRC coordinator for training-related R&D efforts (H; I)	In Place	NRR/DHFS/LQB Section Leader
b.	335	Publish a Regulatory Guide for Instructional System Development (ISD) procedures (H; 1-2)	Underway	2.2
c.	336	Research in retention of critical skills and knowledges (H; 3-5)	Underway	Section III.2.1
4.6.2	336	Licensed Personnel Training - Adopt the recommendations of NUREG/CR-1750, Section 2.10 (H; I)	In Place	Sections III.2.1 III.2.2
4.6.3	338	Non-Licensed Personnel Training - Adopt the recommendation of NUREG/CR-1750, Section 2.10 for non-licensed personnel (H; I)	Underway	2.1

<u>Para.</u>	<u>Page</u>	<u>Topic</u>	<u>Status</u>	<u>Activity Reference</u>
4.6.4	340	Training Equipment - Publish a Regulatory Guide for certification of training simulators and other training devices (H; 1-2)	Pending	2.2
4.7		<u>Incident Response Plan and NRC Facilities</u>		
4.7.1	343	Incident Response Plan - Conduct a systems analysis to identify behavioral and human factors issues affecting planning for response to emergencies (M; 1-2)	Underway (partial)	5.2.3 5.2.5
4.7.2	346	NRC Headquarters Operations Center and Regional Facilities - Systems analysis to derive human performance requirements for incident response need and facilities (H; 1-2)	Underway by OIE	
4.7.3	347	Utility Emergency Response Facilities - Conduct systems analysis to determine human factors needs for ERFs (H; 1-2)	Underway by OIE	5.1.3
4.7.4	350	Safety Parameter Display System		
a.	352	Conduct systems analysis to determine the need for a SPDS (H; I)	Disagree SPDS Required by SECY 82-111	SECY 82-111

APPENDIX C
PROGRAM ELEMENT SCHEDULES

1.0 Staffing Qualifications	C-2
2.0 Training	C-3
3.0 Licensing Examinations	C-4
4.0 Procedures and Testing	C-5
5.0 Man-Machine Interface	C-6
6.0 Management and Organization	C-8

PROGRAM PLAN

	responsible office	FY 82				FY 83				FY 84				FY 85			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
2.0 TRAINING																	
2.1 Research Programs Related to Training																	
· Develop a systematic approach for NRC assessment of utility personnel selection procedures and training effectiveness.	NRR/RES																
· Revise 10 CFR Part 55 to implement minimum training requirements for NPP operators.	RES																
· Revise ANSI/ANS 3.1 and Reg. Guide 1.8 to incorporate revised minimum training requirements.	RES																
· Conduct training and job skills research for non-operating personnel.	RES																
· Conduct simulator experiments to support a regulatory position with respect to the use of simulators in training, and evaluate the optimum uses of simulators in NPP operator training.	RES																
2.2 Development of NRC Training Assessment Procedures																	
· Field test draft training guidance and evaluation criteria, and develop final training methodology and evaluation guidelines.	NRR																
a. Licensed personnel																	
b. Non-Licensed personnel																	
· Develop a revised IE Inspection module.	NRR/OIE																
a. Licensed personnel																	
b. Non-Licensed personnel																	
· Establish a regulatory position with respect to the use of simulators in training.	NRR																
· Establish a regulatory position with respect to accreditation as a means of raising training standards.	NRR																
2.3 Industry Activities																	
· Establish and implement an accreditation program.	INPO																
· Conduct job task analyses.	INPO																
· Curriculum development for licensed and non-licensed personnel.	INPO																

PROGRAM PLAN

3.0 LICENSING EXAMINATIONS

responsible office

		FY 82		FY 83				FY 84				FY 85			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3.1	The Examination Content														
	· Apply job task analyses to content and skills analysis of examination items.														
	· Develop on the job performance indices.														
	· Develop, update and maintain computerized question and examination score banks.														
	· Conduct content analysis and validation of examination questions.														
	· Industry input on training programs (content, objectives, internal examinations).														
	· Examination item analysis.														
	· Validation of modified examination.														
3.2	The Examining Process														
	· Assess problems and issues of current examinations.														
	· Review examination practices in related organizations.														
	· Identify optimal format and procedures for each examination component.														
	· Develop standardized guidelines and examiner training.														
	· Modify examination and examination process.														
3.3	Long-Term Examination Development and Validation														
3.4	Industry Activities														
	· Conduct job task analyses														
	· Conduct plant-specific job task analyses.														

C-4

PROGRAM PLAN

4.0 PROCEDURES AND TESTING	responsible office	FY 82				FY 83				FY 84				FY 85				
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
4.1 Development of Procedure Guidance and Criteria <ul style="list-style-type: none"> Develop EOP Inspection modules and train regional inspectors. Develop EOP Implementation guidelines. Develop methods and evaluate effectiveness and impact of upgraded EOPs (in-plant). Develop guidelines for preparation, use and control of MP's and OP's. Develop MP and OP Inspection modules and train regional Inspectors. Develop programs for upgrading other procedures. Develop methods and evaluate alternative techniques and formats for presenting procedures. Develop methodology/criteria for technical and human factors evaluation of procedures. 	NRR/OIE																	
	NRR																	
	NRR/RES																	
	NRR																	
	NRR/OIE																	
	NRR																	
	RES																	
	RES																	
	4.2 Test Programs <ul style="list-style-type: none"> Determine need to reassess adequacy of Initial plant test programs. 	NRR																
4.3 Industry Activities <ul style="list-style-type: none"> Prepare detailed writer's guide. Integrate SPDS with function-based EOPs. 	INPO																	
	EPRI																	
	Complete																	

PROGRAM PLAN

5.0 MAN-MACHINE INTERFACE	responsible office	FY 82				FY 83				FY 84				FY 85			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
5.1 Man-Machine Interface Guidance for Existing Designs																	
5.1.1 Maintenance																	
Develop maintainability guidelines.	NRR/RES																
Develop a Regulatory Guide on maintenance.	NRR/RES																
Conduct maintenance/maintainability research.	RES																
Develop a regulatory position addressing NRC's role in maintenance.	NRR																
5.1.2 Local Control Stations																	
Conduct task analyses of control room crew activities and analyze auxiliary personnel functions.	RES																
Develop a regulatory position addressing the NRC's role in local control station design and operation.	NRR																
Analyze potential plant safety impact from auxiliary personnel human errors.	NRR																
Develop guidelines on local control station design.	NRR																
5.1.3 Emergency Response Facilities																	
Develop ERF review procedures.	OIE/NRR																
Conduct ERF reviews and prepare review reports.	OIE/NRR																
5.1.4 Annunciators																	
Develop near-term annunciator improvement guidelines.	NRR																
Investigate feasibility of installing an operational aid system based on generalized alarm prioritization and procedures for existing plants.	RES																
5.2 Man-Machine Interface Guidance for Designs Based on Advanced Technologies																	
5.2.1 Computers																	
Develop a program plan for evaluating control room data and information requirements.	NRR/RES																
Develop guidelines on control room information management during severe transients and accidents.	RES																
Develop Regulatory Guides on information management methods.	NRR/RES																

PROGRAM PLAN

6.0 MAN-MACHINE INTERFACE	responsible office	FY 82				FY 83				FY 84				FY 85				
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
5.2.2 Advanced Controls and Displays																		
<ul style="list-style-type: none"> Provide data on evaluation methods and design criteria related to visual displays. 	RES																	
<ul style="list-style-type: none"> Establish criteria and guidelines needed for regulatory assessment of advanced control room concepts. 	RES																	
<ul style="list-style-type: none"> Identify control/display requirements for crew needs subsequent to severe seismic events. 	RES																	
<ul style="list-style-type: none"> Provide NRC support for the Halden reactor project. 	RES																	
5.2.3 Function Allocation																		
<ul style="list-style-type: none"> Establish criteria for function allocation. 	RES																	
<ul style="list-style-type: none"> Identify functions which should be reallocated. 	RES																	
<ul style="list-style-type: none"> Develop a regulatory position on function allocation. 	RES																	
<ul style="list-style-type: none"> Investigate cognitive workload measurement techniques. 	RES																	
5.2.4 Annunciators																		
<ul style="list-style-type: none"> Develop guidelines for long-term annunciator improvement. 	RES																	
<ul style="list-style-type: none"> Prepare and issue a Regulatory Guide addressing annunciator system design and operation. 	RES																	
5.2.5 Safety System Status Indication																		
<ul style="list-style-type: none"> Evaluate effectiveness of current practices. 	NRR																	
<ul style="list-style-type: none"> Develop guidelines for short-term improvement of safety system status monitors. 	NRR																	
<ul style="list-style-type: none"> Investigate need for automatic status monitoring systems. 	NRR																	
<ul style="list-style-type: none"> Develop guidelines for long-term improvement of safety system status monitors. 	NRR																	
<ul style="list-style-type: none"> Revise Regulatory Guide 1.47. 	NRR/RES																	
5.3 Industry Activities																		
<ul style="list-style-type: none"> Annunciator research. 	EPRI/INDUSTRY/HALEN																	
<ul style="list-style-type: none"> Maintenance research. 	EPRI/INFO																	
<ul style="list-style-type: none"> Control room enhancement. 	EPRI																	
<ul style="list-style-type: none"> Advanced display research. 	EPRI																	

PROGRAM PLAN

8.0 MANAGEMENT AND ORGANIZATION		FY 82		FY 83				FY 84				FY 85			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
6.1	Development of Management and Organization Guidelines														
	· Review current industry practices in management and organization planning.														
	· Identify management and organization elements which relate to safety.														
	· Identify management and organization elements appropriate to regulation.														
	· Assess safety review systems and evaluate ISEG.														
	· Establish technical basis for organization and management functions and roles.														
	· Pilot-test draft guidelines and conduct industry reviews.														
	· Establish safety performance standards by assessing relationships between management and organization elements and safety-related performance indicators.														
	· Develop and test performance standards.														
	· Develop and publish final guidelines.														
	· Revise standard format and content document.														
6.2	Development of NRC Assessment Procedures														
	· Evaluate existing NRC review practices.														
	· Develop revised assessment procedures.														
	· Revise SRP Chapters 13.1 and 13.4.														
	· Train technical reviewers and regional personnel.														
6.3	Industry Activities														
	· Evaluation program for plant and corporate management.														
	· Develop prospective plant manager training program.														

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APPENDIX D

GLOSSARY

ANS	American Nuclear Society
ANSI	American National Standards Institute
AOP	Abnormal Operating Procedure
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CRGR	Committee for the Review of Generic Requirements
CRT	Cathode Ray Tube
DFO	Division of Facility Operations
DHFS	Division of Human Factors Safety
DOE	Department of Energy
EDO	Executive Director for Operations
EEI	Edison Electric Institute
EOP	Emergency Operating Procedure
EPRI	Electric Power Research Institute
ERF	Emergency Response Facility
EXAM	Examination
FAA	Federal Aviation Agency
FY	Fiscal Year
HFB	Human Factors Branch
HFEB	Human Factors Engineering Branch
HFRG	Human Factors Review Group
HFS	Human Factors Society
INPO	Institute for Nuclear Power Operation
ISD	Instructional System Development
ISEG	Independent Safety Evaluation Group

JPA	Job Performance Aid
LER	Licensee Event Report
LMFBR	Liquid Metal Fast Breeder Reactor
LQB	Licensee Qualifications Branch
LWR	Light Water Reactor
MAN/MACH	Man-Machine
MGMT & ORG	Management and Organization
MMI	Man-Machine Interface
MP	Maintenance Procedure
NASA	National Aeronautics and Space Agency
NMSS	Office of Nuclear Material Safety and Safeguards
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NRES	Office of Nuclear Regulatory Research
NRR	Office of Nuclear Reactor Regulation
NSSS	Nuclear Steam Supply System
OIE	Office of Inspection and Enforcement
O&M	Operations and Maintenance
OL	Operating License
OP	Operating Procedure
OR	Operating Reactor
PAT	Performance Appraisal Team
PRA	Probabilistic Risk Assessment
PROC & TEST	Procedures and Testing
PTRB	Procedures and Test Review Branch
PWR	Pressurized Water Reactor