NUREG-0616

# Report of Special Review Group, Office of Inspection and Enforcement on Lessons Learned From Three Mile Island

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U.S. Nuclear Regulatory
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# Report of Special Review Group, Office of Inspection and Enforcement on Lessons Learned From Three Mile Island

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Special Review Group

**Division of Reactor Construction Inspection**
**Office of Inspection and Enforcement**
**U.S. Nuclear Regulatory Commission**
**Washington, D.C. 20555**

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B. Summary of Individuals and organizations contacted by Special Review Group (SRG).

C. TMI Inspection Reports

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List of Abbreviations

On September 26, 1979, M. E. (Mike) Rogers suffered a fatal heart attack. Mike's efforts on the SRG, particularly in the preparation of security and safeguards related sections, have significantly contributed to completion of the SRG's task. Members of the SRG acknowledge Mike's fine efforts and extend our sincere sympathies to his family.

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## 1.0 Foreword and Results

### 1.1 Background

The IE Special Review Group (SRG) was constituted by V. Stello, Jr., Director, Office of Inspection and Enforcement (IE), in a memorandum to IE Management dated July 12, 1979, to review the lessons learned from the Three Mile Island (TMI) Accident. This memorandum is enclosed as Appendix A to this report.

The members of SRG were selected on the basis of their qualifications and experience in IE. Management oversight for SRG has been provided by H.Thornburg, Director, Division of Reactor Construction Inspection, M. Howard, Director, Division of Safeguards Inspection and L. Cobb, Executive Officer for Administrative Support.

SRG members were selected mainly from Regional Offices. Several of the members had been assigned to Three Mile Island following the accident. Several members had been assigned to the Incident Response Center in NRC Headquarters following the accident. Several other members had no direct involvement in responding to the accident. IE functional areas represented in the membership of SRG include: Reactor Operations, Reactor Construction, Vendor Inspection, Safeguards, Administrative, Fuel Facilities and Materials Inspection, and Performance Appraisal.

SRG was divided into two groups, one to review the preventive aspects and one to review the responsive aspects. This action was taken so that the qualifications of individual SRG members could be utilized most efficiently across the spectrum of matters considered. Although for the most part the two groups worked separately, each member of SRG has reviewed the entire report and concurs in its contents.

The findings and recommendations in this report represent consensus opinions based not only on the personal experience of SRG members but also on information obtained from individuals, organizations, and other references listed in Appendices B, C, and D.

## 1.2 Summary of Findings

The SRG has considered the Three Mile Island (TMI) accident in two of the several dimensions of the program of the Office of Inspection and Enforcement - prevention of accidents and response to accidents. In terms of prevention, SRG first considered the factors that contributed to the accident. The operating experience with B&W nuclear power plants before the TMI accident indicated that integrated plant response to turbine trips from power was not as expected. This is clearly shown in NUREG-0600. This fact was perceived to varying degrees by a consultant to ACRS, by certain NRC staff members, and by several B&W engineers. These perceptions, derived from various perspectives of previous operating experience, were not drawn together, recognized, and acted upon in a coordinated manner by either the industry or NRC. Had all lines of communication been open and linked, the operators at TMI on March 28, 1979, might well have had correct insight into the response of the system to successfully cope with the transient that led to significant core damage and the consequences that followed. This underscores the importance of communication at all levels.

System design and designation of safety-related equipment also appear to be TMI contributing factors. Pressurizer design and configuration; secondary system heat capacity in the transient situation; and Electromatic Relief Valve (EMOV) qualification, actuation and control circuit, and piping design are examples. THe EMOV was not designated as a safety-related component; yet, it was significant in the accident.

Deficiencies in administrative controls also played a key role in the accident. The unavailability of the Emergency Feedwater System, failure to follow procedures that might have led to recovery form the transient without core damage, the state of maintenance of certain key systems, and the unavailability of radiation survey instruments are considered by SRG to be consequences of administrative control deficiencies. Quality assurance in its largest sense is the master control system available to management to ensure that all management control systems are operable and effective in terms of providing safety. It is evident that the master control system was not implemented effectively at TMI.

The NRR Lessons Learned Task Force has emphasized the need for increased technical competence in support of the operating force. SRG generally concurs in this and other findings of that task force. SRG also believes that maximum technical competence should be readily available at all levels in the licensee's organization and in all levels of contractor organizations.

SRG also sees the need for the highest level of technical competence at all levels within NRC and within IE. Technical competence is the factor which can provide insight for understanding operating experience.

Human factors played a key role in the precursor events, in the accident scenario, in the response to the accident, and in many other related aspects. Human factors are involved in the perception of the precursor events in the man-machine interface, and in the operators' response to the event. Human factors appear to be a fertile area for consideration. Training and technical qualifications are the most commonly used approaches to influencing human factors. This area, which is not well understood, should be better developed.

SRG's task in the preventive area is to consider the contributing factors for the TMI accident in terms of the IE program and its interfaces in the broadest sense. Too narrow consideration would be ineffective and hazardous. One of the prime lessons from TMI is the importance of evaluating and learning from experience.

SRG finds that the IE inspection program was ineffective in certain preventive areas, and finds the need for: continued revision toward independent verification; increased emphasis on quality assurance programs, administrative control systems and vendor and design quality; increased emphasis on staff technical qualifications and formalization of qualification requirements; a more effective enforcement program; more attention to plant performance and its interpretations; and more effective channels of communication within IE and across the IE interface with other NRC staff components, particularly in the resolution of identified technical problems. In terms of interface and design considerations, the designation of safety-related systems must be reconsidered and delineated so that the inspection program can be more effectively applied in the interest of safety.

SRG believes this is a matter of redirecting and strengthening the program, strengthening interface relationships, better definition of staff technical qualifications, and in some areas significant revision of program and staff. SRG has also made several recommendations that extend the reach of regulatory requirements and quality assurance requirements, which should increase the effectiveness of the IE inspection program and contribute to public safety.

SRG considered the IE response to the TMI accident in terms of inter - and intra-agency arrangements, NRC and IE policy, procedures, facilities, equipment, personnel qualifications and training, and the state of preparedness. SRG also considered the state of licensee emergency preparedness. In addition, SRG projected its consideration to other accident and emergency scenarios involving other types of licensees and functional areas (e.g., materials licensees and transportation areas).

In terms of the IE responsive program, SRG has found need for: NRC policy clarification in several areas, expansion of the NRC Operations Center, increased field response capability, more formalized agency interface arrangements, increased training and qualification of response personnel, increased inspection attention to licensee emergency response procedures and preparations, and enhancement of present licensee emergency response preparations.

SRG did not find that the IE response to the TMI accident was ineffective; however, it did find a need for improvements to provide for effective, efficient, and timely response to the variety of types of emergency situations that can occur and which must be properly responded to.

SRG has reviewed much of the available documentation on the TMI accident and has interviewed a number of NRC staff members and representatives of special groups related to TMI activities. The perceptions upon which the recommendations in this report are based are those of the SRG in the July-September 1979 time frame. The story is emerging, many investigations and reviews are underway, and the IE Investigation Report NUREG-0600 has been published. The basis for proper insight into the accident, its precursors, causes, sequence of events, and response is still emerging but not complete.

SRG has recognized the potential for shortsightedness in considering this matter too narrowly or in considering causal factors and incident response too narrowly within the scenario at Three Mile Island. The contributing factors appear to be the classical ones for the greater fraction of major industrial accidents: design, administrative control, human performance, personnel training and qualifications, communications, etc. Each accident appears to involve generally the same causal factors weighted differently in terms of importance in their contribution to the cause. As indicated above, the approach to incident response was broad in terms of the factors related to response and the various types of response required.

SRG has performed this review and has made its relatively large number of recommendations with candor. The SRG believes with equal candor that the IE Program is, in general, soundly based and has been, to a large extent, adequately implemented. However, it recognizes that deficiencies exist that need correction. It is with this in mind that the many specific and general recommendations are made. SRG has provided the background for the recommendations and has generalized them and characterized them as to impact in Section 1.3 of this report. It is recognized that the totality of effort suggested by all of the recommendations is significant in terms of staff effort, additional positions, and program dollars. Value/Impact considerations were not within the charter of SRG at this point and therefore have not been addressed.

As stated elsewhere in the report, these recommendations have been made for consideration by IE Management on the basis of lessons learned by IE from the Three Mile Island accident.

SRG recognizes that IE functions as a part of the NRC organization, performing inspections and investigations. Rules, regulations, standards, and guides are issued by Standards Development; licenses are issued by Nuclear Reactor Regulation and Nuclear Material Safety and Safeguards; and the agency's research effort is supervised by Research. IE has a feedback role to each of these other line functions. Also, the effectiveness of the inspection and enforcement programs depends upon cooperation, interfacing, and communication with other NRC organizations and other agencies. For this reason some SRG recommendations involve other offices within NRC.

SRG recognizes that work is in progress throughout NRC in a number of areas it has addressed. We also recognize that action has already been completed in several other areas. Nevertheless, we have made recommendations to lend support to those efforts underway.

## 1.3 Summary of Recommendations

SRG has made a number of specific recommendations in connection with its review of lessons learned from TMI and its consideration of related matters. These recommendations are detailed in the Sections on the IE Preventive Program (Section 2) and the IE Responsive Program (Section 3).

This section (1.3) contains a summary of the specific recommendations presented in topical form to provide the Director, Office of Inspection and Enforcement, an overview from which to deal with the broad issues. The specific recommendations constitute the consensus of SRG views on how the related problems should be remedied. The general recommendations contained in this section are cross-referenced to the specific recommendations in Sections 2 and 3.

SRG recognizes that many of the recommendations encompass matters and policy beyond IE. Nevertheless, SRG believes that those areas should be considered to provide IE the authority and regulatory tools to best carry out its preventive and responsive programs. Recommendations made within the sphere of IE's authority have been made to improve implementation of preventive and responsive programs.

The two SRG sections (Preventive and Responsive) considered training of IE personnel, as noted in Sections 2.4.1 and 3.7.2 of this report. Each SRG section dealt with the problem differently. One section made detailed recommendations, while the other made recommendations in less detail. It is apparent that SRG believes that the qualifications for IE technical personnel should be clearly stated and that a system should be developed for ensuring that these qualification levels are met. SRG recommends that IE management take these specific recommendations under consideration in systematizing training in IE. SRG believes further that this matter has a high priority.

The SRG has attempted to assess the approximate impact of its recommendations in this section. The key to this initial impact assessment is as follows:

1/ Potential Rule Change.

2/ NRC Policy Matter.

3/ IE Policy Matter.

4/ Potential Significant Cost to Licensees.

5/ Involves NRC Manual Chapter Revision.

6/ Potential Significant Cost Impact on NRC.

7/ Potential Significant Backfit Consideration.

8/ Potential Significant Cost Impact on NRC Manpower Resources.

9/ Potential Bulletin or Circular and Followup Action.

1.3.1 Regulatory Policy Matters (Preventive)

- o Designation of safety related components, systems, and structures should be clarified and extended. (2.6.1 Recommendation 1). 1/ 2/ 7/

- o The concept of shared systems between dual unit facilities should be reconsidered. (2.6.3 Recommendation 1) 2/ 7/

- o The extent of attention to training and qualification of nonlicensed licensee personnel should be increased. (2.4.2 Recommendations 1, 2, 3, 4, 5, 6 & 7) 1/ 7/

- o Licensees should be required to admit NRC inspectors to site controlled areas after NRC has certified them to be properly qualified. (2.2.1 Recommendation 2; 3.8.1 Recommendation) 1/

- Licensees should be required to upgrade radiation protection, plant chemistry, and radioactive waste management programs through periodic review. (2.5.5 Recommendations 1, 2, 3, & 4; 2.6.1 Recommendations 5 & 6) 1/ 7/ 8/

- A program for component qualification through independent verification and testing and by establishing an NRC data bank should be accelerated. (2.6.3 Recommendations 2, 3 & 4) 2/ 6/ 7/ 8/

- Increased emphasis should be placed on understanding human factors as they relate to safety and security and on understanding the man-machine interface as it relates to safety of reactor operation. (2.7 Recommendation 3; 2.4.2 Recommendation 6). 2/

- All applicable codes and standards should be recognized in 10 CFR 50.55a; viz., IEEE and ACI. (2.6.1 Recommendation 2) 1/

- The need for periodic power plant testing throughout the lifetime of the plant should be considered. (2.6.3 Recommendation 5) 1/ 4/ 7/ 8/

- SAR changes made by licensees should be reported to NRR periodically. (2.6.1 Recommendation 3) 1/ 2/

- Architect Engineers and Nuclear Steam System Suppliers should be brought under NRC regulatory authority (2.6.2 Recommendation 1) 1/ 2/ 8/

### 1.3.2 Office Interactions (Preventive)

- There should be more interaction between IE and NRR on safety issues at all levels. (2.3.1 Recommendations 1, 2 & 3) 2/

- The extent of IE participation in reviewing the qualification and training of nonlicensed and licensed plant personnel should be increased. (2.4.2 Recommendations 1,2,3,4 & 5) 2/ 8/

- IE should participate with NRR in the determination of equivalence of alternative positions taken by licensees with respect to NRC Regulatory Positions stated in Regulatory Guides. (2.6.1 Recommendation 4) 2/

- NRC should upgrade and emphasize systematic collection, evaluation, and response to operating, construction, and component reliability experience within NRC. (2.3.1 Recommendations 1 & 2; 2.5.3 Recommendation 2; 2.7 Recommendations 1, 2, 3, & 4) 1/ 2/

- An integrated system for review and resolution of safety issues raised by NRC staff members with emphasis on resolution of differing views should be established. (2.3.1 Recommendations 1 & 2; 2.3.2 Recommendation) 2/

1.3.3 IE Inspection Policy (Preventive)

- The extent to which the Preventive Inspection Program can be degraded during crises should be articulated. (3.16 Recommendations 1, 2 & 3) 3/

- The inspection program at the design stage should be upgraded. (2.6.2 Recommendations 1, 2 & 3) 3/ 8/

- The inspection program should be oriented more toward direct observation, proper work performance, and as-built configurations. (2.2.1 Recommendation 1; 2.6.2 Recommendation 3) 3/

- Emphasis on independent assessment in the inspection program should be increased. (2.2.2 Recommendation). 3/ 6/ 8/

- Emphasis on effectiveness of licensee management control systems should be increased in the inspection program. (2.5.1 Recommendations 1, 2 & 3) 3/

- Emphasis on onsite and in-office review and evaluation of plant enforcement and operation and construction experience to identify problems should be increased. (2.7 Recommendations 2 & 3; 2.5.1 Recommendation 2; 2.2.3 Recommendation 2) 3/

- Increased participation in the IE field inspection program by Regional Management should be required. (2.2.3 Recommendation 1; 2.3.3 Recommendation 2; 2.5.1 Recommendations 2 & 3) 3/

- More direct involvement by licensee management in inspection closeouts should be achieved. (2.3.3 Recommendations 1 & 2; 2.5.1 Recommendation 3; 2.5.2 Recommendation 4) 3/

- Management support of licensee performance appraisal, IE program appraisal, and internal audit efforts should be reinforced. (2.2.3 Recommendation 6; 2.5.1 Recommendation 4) 3/

- Emphasis on effectiveness of site safety reviews performed by licensees should be increased. (2.5.4 Recommendations 1 & 2) 3/

- The construction inspection program should be reviewed and revised, using extension of inspection policy recommendations made for operating plants based on TMI and other recent experiences. (2.6.3 Recommendation 2; 2.6.2 Recommendation 3) 3/ 8/

- The enforcement program should be upgraded, processing of noncompliances expedited, and emphasis on plant safety should be stressed. (2.8 Recommendations 1 & 2) 3/

- The inspection program in the area of review of licensee procedures should be upgraded, emphasizing effectiveness and usefulness of procedures. (2.2.4 Recommendation) 3/ 8/

- Regional management performance should be reviewed more frequently. (2.2.3 Recommendation 6) 3/

- Outage control and maintenance programs at operating plants should be reviewed for adequacy and effectiveness. (2.2.1 Recommendations 4 & 5; 2.5.2 Recommendations 1, 2, 3 & 4; 2.5.3 Recommendations 1 & 3) 3/ 8/

- Inspection guidance should be developed for field verification of licensee actions in connection with NUREG-0578. (2.2.3 Recommendation 5) 3/

- Preoperational and startup testing inspecton Programs should be revised to focus more on quality assurance and provide better coordination. (2.5.2 Recommendations 1 & 2; 2.5.1 Recommendation 3) 3/ 8/

### 1.3.4 IE Organizational Structure (Preventive)

- Function of Regional Branch Chiefs and Section Chiefs should be reviewed and revised to clearly define their responsibilities. (2.2.3 Recommendation 1) 3/

- IE organizational structure and administration practices should reflect and be arranged to to expedite implementation of program changes presently underway or under consideration. (2.2.3 Recommendations 2, 3 & 4) 3/

1.3.5 Qualifications of Inspection Personnel (Preventive)

- Standards for qualification of all categories of IE professional personnel in IE as related to the inspection program should be established. (2.3.3 Recommendation 3; 2.4.1 Recommendations 1, 2, 3, 4, 5, & 6) 3/

- All inspection personnel should meet the above standards. (See item above) 3/ 6/ 8/

1.3.6 Lines of Authority and Responsibility (Responsive)

- Lines of authority and responsibility between agencies involved in response to an accident at a licensed nuclear facility should be more clearly stated. (3.3.2 Recommendation 3.4.1 Recommendation; 3.4.4 Recommendations 1, 2 & 3) 1/ 2/

- Lines of authority and responsibility within NRC should be more clearly defined for each office in NRC that is involved in emergency response and emergency response planning with lead office designations for various functions clearly delineated. (3.2 Recommendations 2 & 3; 3.3.1 Recommendation; 3.3.2 Recommendation; 3.3.3 Recommendation; 3.3.4 Recommendation; 3.3.5 Recommendation 1; 3.4.2 Recommendations 1, 2, 3 & 4; 3.4.3 Recommendation 1; 3.14.1 Recommendations 1, 2 & 3) 1/ 2/

- Statutory status for IE should be pursued to the extent possible. (3.2 Recommendation 1) 1/ 2/

1.3.7 Regulatory Policy (Responsive)

- Policy and direction regarding NRC assistance to licensees in emergency situations vs NRC's regulatory role should be clarified. (3.6.1 Recommendation) 2/

- NRC policy regarding directing licensee operations in emergency situations should be clarified. (3.6.2 Recommendation) 2/

- NRC policy regarding responsibility and authority to follow license requirements during the accident situation should be clarified. (3.5 Recommendation) 1/ 2/

- NRC should upgrade response capability for transportation accidents. (3.13.11 Recommendations 1 & 2; 3.15.5 Recommendations 1, 2, 3, 4, 5 & 6) 2/ 6/

- NRC policy regarding safety vs. security in emergency situations should be clarified. (3.6.5 Recommendation) 2/

- Installation of reactor or turbine trip-actuated voice and video recorders in nuclear power plant control rooms should be required. (3.10.5 Recommendation 2; 3.12.1 Recommendation 2) 1/ 4/

- Licensees should be required to maintain information logs and records, if possible, during and pertaining to accident situations. (3.12.1 Recommendations 1, 2, 3 & 4) 1/

- Licensees should be required to incorporate protective action guides as defined by the states in their emergency plans. (13.13.2 Recommendation) 1/

- 10 CFR 50.54 should be amended to require that licensees maintain an effective emergency plan for the lifetime of the facility. (3.13.1 Recommendation 1; 3.13.8 Recommendation 1) 1/

- Immediate notification of NRC by licensees via NRC "hot line" of general and site emergencies should be required. (3.13.10 Recommendations 2 & 3) 1/

- 10 CFR 50.59 should be amended to include changes in emergency plans, emergency plan implementing procedures, and emergency resources, equipment, and instrumentation. (3.13.1 Recommendation 2) 1/

- NRC requirements concerning licensed personnel in the control room should be revised. (3.13.12 Recommendations 1, 2, & 3) 1/ 4/

- Regulatory Guide 1.101 should be upgraded in terms of TMI-2 experience, particularly in terms of integrating support organizations and establishing a plan for emergency plan testing in accordance with acceptance criteria specified by NRC. (3.4.4 Recommendation 4; 3.13.1 Recommendation 3; 3.13.6 Recommendations 1 & 2; 3.13.7 Recommendation 2; 3.13.8 Recommendations 2 & 3) 2/

- NRC and licensees should be required to designate emergency coordinators during emergency situations. (3.11.5 Recommendation) 2/

- NRC Manual Chapter 0502 should be revised to the state of NRC preparedness in terms of TMI lessons learned. (3.4.3 Recommendation 5; 3.2 Recommendation 3; 3.4.2 Recommendation 1; 3.4.4 Recommendation 2; 3.14.4 Recommendation) 5/

- Development of AIF emergency organization concept for all nuclear power plant licensees should be encouraged, if the concept develops acceptably. (3.4.4 Recommendation 4) 2/

- Emergency dose limits for NRC personnel in emergency situations should be developed. (3.6.4 Recommendation) 2/

- Tests of licensee emergency plans should be required. (3.13.8 Recommendations 1, 2, & 3) 1/

1.3.8 Ensure Staff Support (Responsive)

- Designate key staff positions to support IRACT in various types of emergencies. (3.4.3 Recommendations 2 & 3; 3.14.7 Recommendation) 2/

- Be prepared to direct existing resident inspectors from unaffected sites to support IE response to an emergency. (3.16 Recommendation 3) 3/

1.3.9 Preparedness and Drills (Responsive)

- A program of regular integrated drills involving NRC and licensees should be required. (3.4.3 Recommendation 4; 3.13.7 Recommendations 1 & 2; 3.13.8 Recommendations 2 & 3; 3.14.5 Recommendations 1 & 2) 1/ 2/

- Licensee security contingency plans should be reviewed in terms of coping with a major accident. (3.15.2 Recommendation) 2/ 8/

- NRC Emergency Preparedness planning and staff assignments should be reviewed and revised. (3.14.1 Recommendations 1, 2 & 3) 2/

1.3.10 NRC Equipment and Facilities (Responsive)

- Information telemetry system for replaying incident information and data response from nuclear power plants during accident situations to the Headquarters Operations Center should be developed and utilized. (3.11.10 Recommendations 1 & 2) 2/ 6/

1.3.11 Qualification and Training (Responsive)

- Training and qualifications of all NRC personnel who could be involved in incident response should be centralized and upgraded. (3.7.2 Recommendations 1, 2, 3, 4, 5, & 6; 3.7.3 Recommendations 1, 2 & 3; 3.10.4 Recommendations 1, 2, & 3) 2/ 6/ 8/

- o Emergency response training for State and local personnel as a second priority for the NRC Training Center should be considered. (3.7.2 Recommendation 6; 3.7.3 Recommendation; and 3.10.4 Recommendation) 2/ 8/

- o Intense attention should be given to qualifications and training of licensee personnel in incident response. (3.7.1 Recommendations 1, 2 & 3) 1/ 2/ 8/

1.3.12 IE Policy Clarification (Responsive)

- o Policy regarding on-call availability of Resident Inspectors should be developed. (3.11.7 Recommendations 1 & 2) 3/

- o Standard minimum emergency response plans, procedures, and capability requirement for the regional offices should be developed. (3.4.2 Recommendation 4; 3.3.4 Recommendation; 3.6.3 Recommendation; 3.13.10 Recommendation 5; 3.14.2 Recommendation 3; 3.14.3 Recommendations 1, 2 & 3; 3.14.6 Recommendation) 3/ 6/

- o A revised policy regarding investigations and utilization of investigators should be developed. (3.10.1 Recommendation; 3.10.2 Recommendation; 3.10.3 Recommendation; 3.10.5 Recommendation 1; 3.10.6 Recommendation; 3.10.7 Recommendation; 3.10.8 Recommendation; 3.12.2 Recommendation) 3/

- o A policy regarding independent measurements during the accident situation should be developed. (3.6.3 Recommendation) 3/ 6/

- o A fulltime Emergency Officer should be established in each regional office. (3.14.2 Recommendation 2) 3/ 8/

1.3.13 IE Preparedness and Drills (Responsive)

- o A program for emergency drills involving the regional offices and headquarters should be established and carried out. (3.4.3 Recommendation 4; 3.14.5 Recommendations 1 & 2) 3/

- o IE Manual Chapter 1300 should be revised to correspond with NRC Manual Chapter 0502 and lessons learned from TMI 2. (3.3.5 Recommendation 3; 3.4.2 Recommendation 1; 3.13.10 Recommendation 4; 3.14.4 Recommendation) 3/

- o IE capability to record and preserve accident information should be evaluated and standardized. (3.10.3 Recommendation; 3.10.5 Recommendation 1; 3.12.2 Recommendation). 3/

- o Necessary emergency administrative services should be available in the regional offices. (3.8.2 Recommendation) 3/

1.3.14 IE Equipment and Facilities Responsive

- o Regional needs in terms of equipment and facilities for emergency response, providing a dedicated response center for each regional office should be established and provided. (3.9.3 Recommendation 1; 3.9.5 Recommendation 4; 3.14.3 Recommendations 1, 2, & 3; 3.14.6 Recommendation) 3/ 6/

- o One mobile whole body counter for location in the field should be procured. (3.9.3 Recommendation 2) 3/ 6/

1.3.15 Expedited Actions

SRG recommends that the following actions to improve nuclear power plant licensee incident response capability be taken in an expedited fashion. It is further recommended that consideration be given to taking action in the form of one or more IE Bulletins, with accompanying IE follow-up to be followed by incorporaton in applicable Regulatory Guides and Standard Review Plans.

- Assure that all Part 50 and Part 70 licensee personnel are properly trained in incident response. (3.7.1 Recommendations 1, 2 & 3; 3.13.7 Recommendation 1) 4/ 9/

- Assure that licensees have appropriate emergency supplies and equipment available for incident response. (3.9.1 Recommendations 1 & 2; 3.13.5 Recommendations 1 & 2) 4/ 9/

- Licensee emergency response organizations should be reviewed and upgraded. (3.13.6 Recommendation 2; 3.15.1 Recommendation) 3/ 8/

- Require nuclear power plant licensees to upgrade emergency communications. (3.11.1 Recommendation; 3.11.2 Recommendations 1, 2 and 3; 3.11.3 Recommendation) 4/ 9/

- Require that all Part 50 and Part 70 licensees adopt standard criteria for emergency action levels. (3.13.10 Recommendation 1) 9/

- Modify emergency procedures to include listing and telephone numbers for "sister plants," architect-engineers, nuclear steam system suppliers, vendors, contractors, consultants, state and federal agencies, local agencies, and other sources of emergency support. (3.9.2 Recommendation; 3.11.4 Recommendation; 3.13.6 Recommendation 1 and 2). 9/

- Review and revise emergency response procedures in terms of acceptable personnel accountability and access control provisions. (3.13.3 Recommendation; 3.15.3 Recommendation 1; 3.15.5 Recommendation) 9/

- Review and revise emergency response procedures in terms of provisions for reentry and recovery. (3.13.4 Recommendations 1 & 2) 9/

- Review emergency response organization in terms of availability of technical support. (3.13.6 Recommendations 1 & 2; 3.15.1 Recommendation) 9/

- Review licensee security plans in terms of adequacy for emergency response. (3.15.1 Recommendation; 3.15.2 Recommendation; 3.15.3 Recommendation 2; 3.15.6 Recommendation) 9/

- Ensure that all licensees have adopted State Protective Action Guides as applicable. (3.13.2 Recommendation) 9/

## 2.0 Findings and Recommendations Regarding the IE Preventive Inspection Program

### 2.1 Introduction

Section 2 of this report deals with the SRG's recommendations related to prevention of an accident such as the one at TMI-2. The material presented is a compilation of information gained through review of TMI-2 reports, interviews with investigators, IE management, IE inspectors and industry representatives.

This activity was accomplished by a group composed of inspectors and first level supervisors. Each regional office and the IE headquarters staff were represented. Reactor operations, health physics, reactor construction, and vendor inspection experience are reflected in this section of the report. Although there was no attempt to limit the scope of this section to power reactors, no specific program reviews were conducted for other utilization facilities nor were any recommendations made to any part of the IE program except for power reactors.

## 2.2 IE Inspection Program

The Nuclear Regulatory Commission (NRC) establishes criteria and regulations which are the bases for licensing nuclear facilities. A basic policy of the NRC is that it is the responsibility of the licensee to design, construct and operate the facility in a safe manner and in compliance with NRC regulations. To ensure that the licensee is meeting his responsibilities and is in compliance with regulations, the NRC inspects licensed facilities periodically.

The Office of Inspection and Enforcement (IE) is responsible for the development and administration of policies and programs, for conducting inspections and investigations of licensee facilities and operations, to ascertain compliance with regulations and license conditions, and for verifying that the licensee is taking appropriate actions to ensure the health and safety of the public. The policies and programs are primarily developed by IE Headquarters.

Administration of the inspection program, including the conduct of inspections and investigations, is the responsibility of the regional offices; inspections and investigations are conducted throughout the life cycle of the facility. The program is both preventive and reactive. Routine, planned, periodic inspections to assess safety of operation are considered to be preventive. Preventive inspections are audit examinations in which licensee activities and facilities are examined on a sampling basis. Investigations and responses to unplanned licensee events are essentially reactive; i.e., IE reacts to the events or conditions as they occur or when they are reported to the NRC.

### 2.2.1 Inspection Program Emphasis - Direct Observation

The IE inspection strategy of verifying licensee compliance with regulatory requirements has historically been of an "audit" nature. The audit concept involves sampling licensee activities related to safety systems, evaluating the sample for compliance, and extrapolating the results of the evaluation to make a judgment about the entire licensee activity. The audit for any given sample consists of three basic steps:

- Review of procedure(s) applicable to the activity or system.
- Observation of the work activity.
- Review of records related to the activity or system being inspected.

Considering the number of licensed facilities, the complexity of hardware, and the limited NRC staff size, the audit concept has been found to be a relatively cost-effective inspection strategy.

A major criticism of the audit concept as implemented by IE in the past has been that it concentrated excessively on paperwork reviews to the neglect of direct observation. Recent innovations introduced by IE to place more emphasis on the direct observation of licensee activities are the resident inspector program and concept of increased independent assessment (see Section 2.2.2).

The resident inspector program provides for the permanent assignment of an IE inspector at the licensee facility. The resident inspector (RI) primarily performs observation of work activities. Since he is assigned fulltime to the facility, a larger sample size is inspected.

The TMI-2 inspection program for preoperational test, startup test and operations phases consisted of the application of the audit concept without benefit of the newer innovations. At TMI-2 procedure review and test results evaluation utilized over 40% of the total inspection hours. Approximately 12% of the total inspection hours was devoted to witnessing of test performance (this is probably closer to 20% of inspection hours if independent inspection time is considered).

NRC inspectors and management personnel indicated in interviews and memoranda that they feel that the IE inspection program effectiveness could be improved by placing more emphasis on observation of work. The resident inspector concept should have a positive effect on this. However, certain NRC policies and licensee practices hamper regional inspector effectiveness in observing work activities. These are unannounced NRC inspections, limited NRC inspector access to the licensed facility, and the accommodation of certain licensee requests to limit the number of inspectors at their site during certain time periods.

IE policy requires that NRC inspections normally should be unannounced. This essentially means that the licensee is unaware of a planned NRC inspection. Since the inspection is unannounced, the inspector frequently does not have advance knowledge of the status of facility activities or of the availability of key licensee personnel that may be required for resolution of problems. Both of these aspects of unannounced inspections reduce the effectiveness of the inspection program by placing a constraint on the inspector's ability to plan inspection activities. This situation should improve with full implementation of the resident inspection program.

Observation of work activities by the NRC inspector requires access to all areas of the plant. Restricted facility access has been a problem for many years. Some licensees require inspectors to be escorted in most plant areas. The reason often given is the inspectors are not sufficiently familiar with the facility and/or do not meet licensee training requirements for unescorted access. Sometimes the licensee requires the NRC inspector to attend a health physics orientation course before access is granted, causing considerable delay and lost inspection time. A recommendation for IE training to minimize this delay is made in Section 2.4.1 below.

Additional delay may occur if the licensee employee assigned to escort the inspector is not altogether free owing to other demands on his time. This most often occurs during outages when extensive maintenance, modification, and/or refueling activities are in progress. Licensee personnel are busiest then and there has been an informal policy of accommodating licensee requests to limit the number of NRC inspectors and therefore their impact on key licensee personnel. Yet, it is during outages when direct observation is probably most important; the many parallel activities in progress offer the greatest opportunities for introduction of errors into plant systems. The SRG believes NRC inspection effort should be intensified during outages and at the same time recognizes the need for limiting NRC impact on key licensee personnel. Assurance of NRC inspector access without unnecessary escort requirements or undue delay for training would help this.

Recommendations

1. The Office of Inspection and Enforcement should take additional action to emphasize observation of work activities.

2. Action should be taken to ensure trained inspector access to licensee facilities with minimum delay.

3. For major outages the IE inspection program should be revised to require an IE/licensee management meeting to review outage accomplishments, major modifications, systems status, and other significant conditions before return to power.

4. The IE inspection program should be revised to incorporate provisions for review of major outage schedules as a basis of inspection planning.

5. The IE inspection program should place additional emphasis on outage control and require IE to observe a larger portion of plant modifications and changes. Team inspections by regional inspectors during outages should complement the resident inspector's activities.

### 2.2.2 Independent Assessment

Independent assessment refers to the verification or assessment of licensee activities by an organization independent of the licensee. This could be performed by NRC personnel or by an independent contractor under the direction of the NRC. The primary advantage of independent assessment is that it provides a direct interface with the licensee systems, personnel or procedures to validate the adequacy or accuracy of the item in question. It thus provides the NRC with increased confidence in the licensees' ability to operate the facility safely.

Independent assessment consists of such techniques as confirmatory measurements performed by NRC personnel or NRC contractors. The objective is to provide direct NRC involvement in verifying the adequacy of licensee activities, while minimizing any interference with those activities.

Independent assessment complements the review of procedures, observation of work in progress and review of records. To date, independent assessment has been limited to the general areas of health physics, effluent monitoring, leak rate testing and nondestructive examinations. Even in these areas the scope of IE's independent assessment has been relatively narrow compared to the range of activities being performed by the licensee.

Independent assessment can take the form of NRC inspectors performing an examination or test, calculation of values, or taking a sample for subsequent analysis. Conversely, it can take the form of providing a known sample to the licensee for analysis. There were several examples of the application of independent assessment of TMI-2. For example, NUREG-0600 identified that NRC independent calculation of the reactor coolant system (RCS) leakage rate showed that TMI-2 was actually operating outside of the technical specifications, although the licensee's calculation did not.

IE has studied the concept of independent assessment for several years and has determined that it is feasible and that it would provide significant benefits as an inspection strategy. However, staffing and budgetary limitations have prevented implementation of a viable program.

Recommendation

An expansion of independent assessment with adequate planning, direction, management and guidance should be undertaken. The correct ratio of IE to contractor resources should be established and procedures developed. A dedicated task group with actual power plant experience in diverse areas such as calibration, NDE, and HP should be created to oversee development of this program.

2.2.3 Program Administration

Administration and implementation of the inspection program is the responsibility of the IE regional offices.

Regions are organized functionally with primary responsibility for overall accomplishment of the inspection program assigned to branches and subordinate sections. Specific branches are assigned responsibility for designated phases of the inspection program which correspond to phases of the life cycle of a plant as it progresses from preconstruction through operations.

Responsibility for accomplishing the inspection program for a given phase is assigned to a Project Section. The Section Chief is the first level of supervision in the inspection program. The Project Section Chief assigns the responsibility to a project inspector.

Actual implementation of the program has been accomplished by project inspectors supported by specialist inspectors. The concept is basically that the overall inspection program is under the purview of the project inspector and that specialist inspectors perform detailed inspections within specific disciplines in support of the project inspectors. A project inspector coordinates all inspection activity at those sites assigned to him and performs inspections in those areas where he has sufficient expertise. Past practice has been to assign one project inspector the responsiblility for several nuclear plants. In addition, some inspectors have been assigned collateral responsibilities for inspecting research reactors. The resulting workload may lead to superficial attention to some elements of the inspector's responsibility.

There are policies within IE, which apparently vary from region to region, that require rotation of project inspectors to a different project after a specific time period. The purpose of this rotation is to assure continued objectivity of the inspector. Other conditions may also require transfer of project inspectors. During the Unit 2 preoperational and startup inspection program at TMI, IE changed project inspectors twice. The SRG discussed this with two of these inspectors, who believed that there was no detrimental effect. However, SRG believes that continuity of assignment is an important factor that should be considered by management in making assignments. The advent of the Revised Inspection Program (RIP) will add new dimensions to the problem of inspector assignment.

The SRG has observed that each of the five regions has a different organizational philosophy for accomplishing the IE inspection program. While there are many reasons for this situation, including workload, managerial prerogatives, and availability of specialist inspectors, these differences raise questions about the uniformity of inspection program accomplishment. With the advent of the resident inspector concept, a need exists to define functional responsibilities for this new program. This offers an opportunity to reexamine the broader issue of the regional reactor inspection organization.

The SRG reviewed the preoperational test and startup inspection history for TMI-2 based on computer data and the inspection reports. The preoperational testing phase becomes effective approximately eighteen months before the issuance of the operating license (OL) and overlaps the construction and startup phases. The preoperational test inspections at Three Mile Island 2 appear to have been initiated in February 1976.

During the period from initiation of the preoperational inspection program through the last operations inspection before the accident, there were fifty preoperational inspections, twelve startup inspections and nineteen operations inspections. Of these eighty-one inspections, the project inspector conducted six of them by himself. Forty-four were conducted by specialists without the project inspector. Thirty-one were joint inspections.

Most of the joint inspections (27) were conducted by specialist inspectors from the same branch as the project inspector. Of twenty-eight inspections involving emergency planning, environmental, radiation protection, safeguards and security, the project inspector was involved in only four. Interviews with project inspectors and specialists revealed that oral debriefings with the project inspectors was standard practice and that the project inspector concurred by signing the inspection report. It is generally believed that joint (team) inspections are more effective because several areas or disciplines are inspected simultaneously allowing common features, such as administrative procedures, to be inspected in more depth.

The eighty-one inspections involved forty-six different inspectors from all of the Region I branches (except construction). Regional management participated in five of the eighty-one inspections. Four of the regional managers were Section Chiefs from the Reactor Operations and Nuclear Support Branch; one was a Section Chief from the Fuel Facilities and Materials Safety Branch. In discussions with Section Chiefs, reasons given for not participating in more onsite inspections included too much paperwork, assignment of collateral duties only remotely associated with the inspection program, and over involvement with administrative detail.

The review of TMI-2 inspection reports revealed that the licensee Station Superintendent and Unit 2 Superintendent rarely attended NRC exit interviews during preoperational and startup inspection phases. The Superintendent of Technical Support, Unit 2, frequently represented the licensee, and the Test Superintendent was often the senior management representative during preoperational exit meetings. The Test Superintendent was not an employee of Metropolitan Edison. Further, at the start of the preoperational phase, the management meeting required in the IE manual apparently was not held with the licensee. Based on the above, it appears that there was a minimal interface between licensee management and NRC/IE management.

The SRG reviewed NUREG-0578, <u>TMI-2 Lessons Learned Task Force Status Report and Short Term Recommendations</u>. Many of the specific recommendations will require direct inspection effort on the part of IE as licensees develop procedures, install equipment and perform tests required by the NRR Lessons Learned Task Force.

Recommendations

1. Regional line level management should be more actively involved in the supervision of inspectors at the site. This will involve consideration of what constitutes adequate supervision and what is the function of the Section Chief.

2. Project and resident inspectors should be required to perform a project status review periodically with inspectors who have conducted inspections at the site to integrate findings and identify areas of common concern.

3. Resident inspectors assigned to sites which are in the preoperational and startup phases should be supplemented by a preoperational inspection team leader from the regional office. The team leader, who would also serve as a backup resident inspector would plan and direct the preoperational inspection program from the regional office. Site coordination would be the responsibility of the resident.

4. The current regional organization relative to the reactor inspection program should be reviewed to identify changes required to implement the resident program. The use of inspector resources (e.g. project, resident, specialist) should be examined with the goal of establishing as uniform regional organization as is practical.

5. A group of inspection specialists should develop specific IE inspection guidance to review licensee actions related to NUREG-0578.

6. An independent IE organization should periodically audit regional implementation of the IE inspection program, to verify consistency and conformance with established IE policy. This independent audit group should report directly to the Director, Office of Inspection and Enforcement.

2.2.4 IE Review of Licensee Procedures

A basic requirement of the NRC program is that licensees develop and implement procedures for those activities that affect quality of structures, systems, and components. The IE inspection program, as one element of the audit concept, provides for the review of licensee procedures to determine their adequacy.

The nature of procedure content and the specific procedure format varies depending on the task. As a minimum all procedures must meet the criteria established in 10 CFR 50 Appendix B. In addition, Requlatory Guide (RG) 1.33 endorses American National Standards Institute (ANSI) N18.7, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants," as an acceptable means of meeting NRC requirements. This ANSI standard provides detailed instructions for the format and content of procedures and is referred to in IE inspection program guidance.

There were instances of procedure inadequacies at TMI, not only in procedure content but also in licensee management review. This latter aspect is addressed in Section 2.5 of this report. IE inspection of procedures apparently was not effective in determining licensee procedure adequacy.

To be effective, NRC procedure review must relate procedure technical content to system configuration and operation. This means that effective procedure review must correlate the procedure content with system drawings, piping and instrumentation documents, flow diagrams and system installation. Effective procedure review, in addition to document and drawing review should include direct observation of hardware. Procedure review in this depth requires the application of many more man-hours than has previously been possible. The complexity and number of plant systems is such that no one individual has the technical capacity to adequately review all plant procedures.

Procedure revision by the licensee is a frequent event due to plant modifications, changes to interfacing systems, and changing regulatory requirements. For safety-related systems, procedure revisions must be reviewed by the plant independent review groups and these are reported in the minutes of the independent review group meetings. IE inspectors have a mechanism through the independent review group minutes to detect and identify procedure revisions which affect safety systems.

Recommendation

IE review of the technical adequacy of licensee procedures should be significantly improved. Step-by-step evaluation of adequacy including correlation with the as built system should be done for important procedures. Inspection guidance should be issued regarding number (fraction) and type of procedures which should be given this depth of review. Inspector resources needed to accomplish the program should be obtained.

## 2.3 Communications

Regulation of the nuclear industry involves the development of regulations, standards and criteria, their application, and inspection of licensed activities to assure the health and safety of the public.

The NRC is organized into major offices which are assigned the above functions. Integration of those functions into an effective regulatory system required continuous communication across the organizational interfaces.

### 2.3.1 IE Interactions with the Office of Nuclear Reactor Regulation (NRR)

Within the NRC the most dynamic interaction in relation to inspection and enforcement is the IE/NRR interface. NRR essentially establishes safety requirements for nuclear plants through safety analysis review. The facility system design and construction criteria are outlined in the SAR and operational limits are defined in the technical specifications.

IE verifies compliance with requirements; in the process of inspection, new safety issues are sometimes identified. Safety issues must be coordinated with NRR to arrive at a satisfactory resolution. During SRG interviews with IE management and inspection personnel, the IE/NRR interface was identified as a problem area, particularly in regard to timeliness of NRR response to issues referred to IE.

No specific examples of inadequacies were identified in relation to TMI. The J. S. Creswell memorandum to J. F. Streeter, "CONVEYING NEW INFORMATION TO LICENSING BOARDS - DAVIS-BESSE UNITS 2 AND 3 AND MIDLAND UNITS 1 AND 2," dated January 8, 1979, regarding the Davis-Besse transient was handled by NRR in a timely manner according to existing procedures. However, hindsight indicates that Creswell may have identified some of the design factors that contributed to the TMI accident.

The SRG was informed that NRR had a copy of the "Michelson Report" concerning small pipe break LOCAs and B&W plants before TMI. SRG is not confident that the

TMI accident would have been averted, if IE had been provided the report. However, it believes the current exchange of information between IE and NRR may not provide these organizations with the best information upon which to make decisions. The SRG believes that agency perception of such matters can be sharpened by use of more joint IE/NRR review groups to deal with potential safety questions.

These groups, normally ad hoc, would be staffed for evaluating of a particular issue or range of issues. While the individual review groups may be ad hoc, a permanent mechanism would be needed to ensure that safety issues are referred to an appropriate review group, to see that a group is established if not already existing, to keep track of progress, and to ensure that other interested parties (ACRS, licensing boards, other NRC offices, etc.) are kept informed. While these duties could be assigned as a collateral function of a manager from each office (IE and NRR), the SRG believes that the additional work load might be prohibitive and that it might be better assigned to an IE/NRR liaison group representing the management of both. Such a group would also be a logical point for handling of dissenting views on safety-related technical issues raised in the field and for ensuring appropriate routing of externally generated information (e.g., the "Michelson Report") on such issues. The SRG believes that establishment of a liaison group as discussed here should be considered. However, the SRG limits its recommendation on this matter to a joint IE/NRR committee to define methods for more joint review of safety issues and for improvement of the information flow between the two offices.

IE inspection personnel believe that there should be greater interaction between the NRR technical reviewers and IE inspectors to enhance the effectiveness of both organizations. It is recognized by the SRG that workloads and current staffing levels limit the extent of IE/NRR interaction. However, joint IE/NRR efforts, such as those by the seismic qualification review team, the field review of electrical and instrumentation systems, and the Bulletins and Orders Task Force have been effective and should be expanded.

<u>Recommendations</u>

1. Joint IE/NRR review groups should be used to evaluate safety-related issues identified by IE.

2. IE and NRR should establish an ad hoc committee to define the mechanism for effecting the above recommendation. The committee should also examine the current systems for information exchange between the two offices and recommend changes for improvement.

3. The IE/NRR interfacing should include more interaction between NRR Project Managers and reviewers and IE inspectors. An interoffice agreement on joint IE/NRR site reviews should be implemented.

### 2.3.2 Handling of Differing Views Within IE

During routine inspections and event reviews in the regional offices certain events, designs, or conditions are identified as potentially serious or generic. The handling of these situations normally results in a memorandum to IE Headquarters and/or a proposed bulletin or circular. The IE Action Item Tracking System helps ensure that a response is generated and returned to the originator. Situations have occurred, however, where the response may not have satisfied the concerns of the originator.

While it is a relatively simple matter to gather facts and figures during an inspection or review of an event at a nuclear power plant, assessing their significance is a matter of technical judgment. Different persons may, and often do, view the same facts in a different light. This can lead to situations where a request for further evaluation of an observed condition or occurrence may be denied by a reviewing staff member. While there is a genuine and sincere open door/dissenting view policy, for a variety of reasons, an individual may be reluctant to use the established system. Although he may not feel satisfied with the response, he may not feel strongly enough or sufficiently confident to raise a strong objection. The net result of this situation is that one individual in the reviewing organization may stop the further evaluation or action requested. The potential exists that due to an error in judgment or perspective on the part of one individual, a failure to continue the request through the process may result when perhaps it should continue.

The SRG has recommended (Section 2.3.1) that IE identified safety issues be reviewed by a joint IE/NRR ad hoc committee. In cases where a field identified safety issue is rejected by internal IE review, the SRG believes that rereview by such a joint committee should be automatic unless the originator formally indicates his satisfaction with the review. In addition, to ensure that the originator's viewpoint is not lost, he should be an active participant in the rereview. Adverse action by the committee would not abrogate the originator's right of further appeal, but the need for its use should be greatly reduced.

Recommendation

The SRG believes that procedures should be developed to provide for automatic rereview of field identified safety issues which have been rejected within IE. Consideration should be given to having this rereview performed by a joint IE/NRR committee.

2.3.3 IE-Licensee Interfaces

Among the many avenues of communication between IE and licensees are:

- Direct inspector interaction with licensee personnel.
- Exit interviews.
- Inspection reports and transmittal letters.
- Immediate Action Letters (IAL).
- Routine and special meetings between IE Regional management and utility corporate management.
- IE Information Notices.
- IE Circulars.
- IE Bulletins.

While these channels should be clear and uncomplicated, the SRG has identified three areas where IE/licensee communications may be improved: exit interviews, management interviews and bulletins. Bulletins are discussed in Section 3.16.

Exit interviews are intended to be the forum where, at the close of the inspection, inspectors discuss with senior station management the inspection findings, emphasizing noncompliance needing corrective action, unresolved items needing further review, and other inspector concerns. In reviewing inspection reports from before the TMI accident, SRG noted that the station superintendent and the Unit 2 superintendent rarely attended IE exit interviews during pre-operational and startup inspection phases.

Currently, the IE program requires meetings between senior IE regional management and licensee corporate management. Among the purposes of such meetings are the frank discussion of the plant operating and enforcement history. These meetings are important for informing senior licensee management of any concerns about plant operation and about station and corporate management. As such, the SRG believes these management meetings are an effective enforcement tool and that their frequency should be increased. (See also Section 2.2.1)

Recommendations

1. IE should reemphasize to licensees the importance of having the project manager or the station superintendent attend all IE inspection exit interviews.

2. Meetings between senior IE regional management and senior licensee corporate management should be held annually.

3. Improve inspector training on conducting exit interviews and other management meetings.

## 2.4 Qualification and Training

### 2.4.1 Inspector Qualification and Training

The NRC competes in the same manpower pool for experience and talent as licensees, vendors and contractors in the nuclear industry. Only a limited number of people are available with technical knowledge, experience, judgment, integrity and tenacity desired in an inspector. IE must provide training to develop or enhance basic inspection skills and also to improve and maintain technical skills. It is important that IE inspectors in general be as well qualified technically as the licensee personnel with whom they interact. The public expects no less, particularly, in the aftermath of the TMI accident, and the IE training effort should reflect that expectation.

Reactor operations inspectors receive an initial eight weeks of headquarters training, consisting of BWR or PWR fundamentals, advanced BWR or PWR systems, simulator training, and inspection fundamentals. Additional training, given in the regions, include study of federal regulations, safety analyses reports, regulatory guides, IE manual, and participation in power plant inspections. This training should be completed within the first two years of employment. Refresher training, of one week duration, begins fifteen to twenty-one months after completion of the initial training and recurs at about the same frequency thereafter.

As a result of TMI, IE management recognized a need for additional training regarding such things as offnormal transients and accidents. Extending initial training to ten weeks, an additional week on advanced systems and another week of simulator training is being considered. The SRG endorses such additional training.

The initial training program for project and resident construction inspectors consists of BWR and PWR fundamentals courses, inspection fundamentals and courses on quality assurance, concrete, welding, nondestructive examination, electrical technology and instrumentation. Refresher training is proposed in the above listed construction technology courses. At present, resident inspectors get the same training as region based inspectors.

IE training personnel indicate that an inspector who completed the training could not qualify as a senior reactor operator (SRO) owing to lack of plant specific knowledge, including manipulation of the reactor controls. The SRG believes that NRC takeover of a plant during an accident to the extent of actual manipulation of controls is neither reasonable nor desirable. However, resident inspectors should attain familiarity with the plant sufficient to throughly understand any control manipulation or plant modification done by the licensee. A resident would not have such detailed knowledge, when first assigned to a site; the SRG believes an on-the-job training/study program should be defined to attain the knowledge within a reasonable time after assignment.

The SRG recognizes the increased visibility of the resident (construction or operations) inspector. To the general public, the media, and to a great extent the plant personnel, the resident inspector is the NRC. As such, he is subject to wide ranging and detailed questions on NRC policies, decisions, and announcements, as well as questions on safety in operation and construction of a nuclear power plant. Resident inspectors should be prepared to effectively represent the NRC in contacts with these diverse groups.

A resident may have to follow-up on allegations made in connection with the assigned facility. On occasion the allegations may lead to a full scale investigation. The SRG believes resident inspectors should be given investigation training; however, SRG also believes that a resident's participation in a full scale investigation at his own facility should be carefully limited.

Reactor health physics inspector training consists of BWR and PWR fundamentals courses, BWR/PWR radwaste systems, and inspection fundamentals. No refresher training is specified. Additional training currently consists of occasional short courses (e.g., Harvard Filter Testing Course, LASL Respirator

Training Course, etc.), occasional attendance at professional meetings, and regional seminars. Because health physics technology is constantly changing and because of the importance of NRC inspector's maintaining competence, these opportunities should be expanded to cover other technical areas in which the state of the art is changing. Examples of areas where there is current need are internal dosimetry, instrument performance, and neutron dosimetry. There is also need for in-house IE training on the inspection modules for radwaste management and radiation protection to promote a more uniform understanding and application of the technical and regulatory bases for the inspection requirements.

The SRG also believes that IE experience at TMI-2 indicates a deficiency in fundamental health physics and emergency response training. All inspectors should have a basic understanding of radiation protection units, limits, measurements, instrument use and respiratory protection practices.

To gain entry to most plants, IE inspectors are subject to the same refresher training requirements in health physics as any other visitor whatever their training. To the extent that the inspector is reviewing the training program, this is not time wasted. However, at other times it can be an impediment to early entry on an unannounced inspection or to free movement about the plant. Region based health physics, refresher training including respirator fitting and medical examination, needs to be given to inspectors, certified by IE, and recognized by licensees so that only limited plant specific training on security, emergency response, and radiation protection need be given to obtain unescorted access.

Recommendations

1. Expand initial inspector training to include courses on basic health physics and emergency response.

2. Define an acceptable level of plant specific knowledge needed by an operations resident inspector and develop a guided self study program to reach that goal within a specified period of time. Inspector progress should be audited by his supervisor.

3. In addition to technical training, resident inspectors should be given training appropriate to their unique role of representing the NRC onsite. Such topics as conduct of meetings with public and media representatives should be included. Methods for keeping the resident abreast of NRC policies, decisions, and announcements should be developed.

4. Give regional office training and annual refresher training in health physics, emergency response, and respiratory protection (including mask fitting, medical examination and bioassay) to all inspectors, so that unescorted admittance be granted to licensee facilities with only short delay for site specific orientation. Inspectors should be provided with credentials certifying receipt of training.

5. Give health physics inspectors training on radiation protection and radwaste inspection modules to improve consistency in interpretation of requirements. Schedule refresher training on pertinent technical subjects be scheduled for health physics inspectors.

6. Develop special courses to train IE inspectors in the proper method of conducting an investigation.

### 2.4.2 Licensee Training

Licensed operators at TMI at the time of the accident met qualification and training requirements imposed by 10 CFR 50, 10 CFR 55, and American National Standards Institute (ANSI) N18.1 - 1971, "Selection and Training of Nuclear Power Plant Personnel." Despite this, the IE investigators of the TMI accident and others have identified operator performance problems which suggest training weaknesses. Included was the emphasis on maintaining pressurizer level to the extent that it delayed recognition of the loss of coolant through a relief valve that had failed to close. The NRC Office of Nuclear Reactor Regulation (NRR) Task Force on Lessons Learned at TMI makes a number of operator training recommendations regarding off normal transients, accident analyses, and emergency procedures. The SRG endorses these recommendations.

Regulation of operator training consists basically of approval by NRR of the licensee's training program for licensed operators and examination by NRR of first time candidates for an operator's license, and inspection by IE of the licensee's implementation of this training commitment. Biennial renewal of an operator's license, including examination, is largely left to the licensee, other than the aforementioned IE verification of licensed operator participation in the prescribed training programs. Beyond the initial examination, there is little direct NRC verification of operator competence in the license renewal cycle.

Performance problems indicating weaknesses in the training of unlicensed personnel (auxiliary operators, maintenance, radiation chemistry technicians, etc.) were identified by the IE investigation group and others at TMI. Included were problems with emergency plan implementation and awareness, knowledge of the plant, and knowledge of basic radiation survey and exposure control practices in the high radiation fields attending the accident. In the case of radiation chemistry technicians, cycling between their dual responsibilities of radiation protection and chemistry also appeared to be a potentially deleterious influence on competence.

Qualification and training standards for unlicensed personnel in ANSI N18.1 -1971 are vague. They basically specify only experience but nothing explicit as to quality. In effect, quality of training is the licensee's responsibility. NRC has no minimum acceptable competency requirements despite the fact that the work of unlicensed personnel can affect public health and safety. IE inspections do not directly review competence. The SRG believes that minimum competency requirements for unlicensed personnel, including radiation chemistry technicians, and auxiliary operators should be established and made subject to IE audit of operating power plants.

Construction permit applicants are required under 10 CFR 50 to have a quality assurance program for construction of nuclear power plants. Qualifications for inspection, examination, and testing personnel for the construction phase are delineated in ANSI N45.2.6 - 1973, "Qualifications of Inspection, Examinations and Testing Personnel for the Construction Phase of Nuclear Power Plants." Basically, the licensee and his contractors are responsible for assuring that the standard is met. The NRC does not directly examine or license these plant or contractor personnel. IE indirectly evaluates their training and qualifications by inspecting the implementation of the QA program. The SRG recognizes the need for making minimum qualification requirements subject to IE enforcement.

Licensees normally require annual refresher training in radiation protection for all persons who enter controlled areas. This training usually requires less than one day and frequently is the same for all workers regardless of the nature of their work. Clearly the needs of workers who are expected to be able to do self monitoring in radiation areas differs from those of a contractor who may work under escort or under monitoring coverage by the plant staff. Refresher training for the former should strongly emphasize understanding of instrument use while that for the latter would not. Similarly, health physics training for radiation protection and other emergency response personnel should stress problems of working in radiation fields attendant to an accident.

General refresher training is also inappropriate for radiation chemistry technicians who are familiar with radiation control policies and practices from their daily work. Their refresher training should aim toward upgrading their general health physics competence. It should include such topics as the technical basis for station policies, practices, procedures and changes thereto, emergency plan implementation, station problem areas both administrative and technical, industry experience, and changes in regulatory requirements. Such training is normally outside the competence of the training staff and should, therefore, be given by a station health physicist or knowledgeable consultant.

The ability of the operators at a nuclear power plant to perform effectively is a function of qualification, training, motivation and physical and mental alertness. Excessive work hours can affect the ability of the operators to recognize and cope with conditions requiring attention. NRC currently has no limits on the hours a worker (e.g., operator, maintenance worker, or HP technician) can work. There is currently no requirement to assess the capability of the worker to perform the complex function of operating a nuclear power plant.

Recommendations

1. The NRC should form a group with representatives from IE, NRR, and Office of Standards Development (OSD) which would be responsible to establish minimum competency standards for various categories of unlicensed plant and contractor personnel and to define correspondingly acceptable training and refresher programs. The group should consider the extent of radiation protection refresher training needed by the various groups. Exchange with industry and professional groups is encouraged.

2. The group should identify regulatory changes needed to make the standard enforceable. NRC licensing and/or recognition of certification by other cognizant groups should be considered.

3. The group should establish a program for continuing verification of competence of unlicensed personnel through the IE inspection program.

4. Inspection guidance in the IE Manual should be amended to assure that the standards are met and that suitable training programs are implemented.

5. IE, with the assistance of NRR should develop a program for continuing verification of licensed operator competence. The program should factor in the recommendations of the NRR Lessons Learned Task Force and should extend beyond training records verification to direct interaction with the operator. It should also include review of operator performance on the simulator in routine and abnormal situations. Qualification standards for the examiners/inspectors should be established.

6. The NRC should develop maximum work hour criteria and establish them as requirements through suitable changes to the regulations.

7. The feasibility of establishing some form of "ability to perform test" should be investigated.

## 2.5 Administrative Controls

Administrative controls are the rules, orders, instructions, procedures, policies, practices, and designations of authority and responsibility related to the operation of the nuclear plant. They essentially define and place bounds on activities and provide the means whereby management can verify that its directives are effectively carried out. The administrative controls include provisions for coping with off-normal and emergency conditions. Therefore, safe operation of the plant is a direct function of the effectiveness of licensee administrative controls.

Title 10 of the Code of Federal Regulations requires the licensee of a nuclear power plant to establish managerial and administrative controls to ensure safe plant operation. Appendix B to 10 CFR 50 sets forth the requirements for such controls and 10 CFR 50.36 specifies that the technical specifications will include administrative controls.

The NRC has endorsed ANSI N18.7 titled "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants" via Regulatory Guide 1.33, as an acceptable means of complying with the regulations. Administrative control is a very broad, all encompassing topic which includes all aspects of station operation. Major areas of interest are licensee management, maintenance, quality assurance, and independent review/audit.

The SRG reviewed documentation related to the TMI accident and the prior IE Inspection Reports. SRG concluded that licensee personnel frequently ignored station procedural requirements and that administrative controls were not effective in many different functional areas of the station. Furthermore, it appears in this case that the IE program, although able to repeatedly identify problems, was not effective in preventing recurrences.

### 2.5.1 Licensee Management

Licensee management is required to prepare and implement those administrative controls necessary for safe operation of the plant. This includes management accountability for ensuring that all NRC rules, regulations, and license commitments applicable to their plant are complied with. One of the objectives of the IE inspection program is to verify licensee management effectiveness by inspecting the administrative control system. However, there are no objective criteria in the present IE program to assess licensee management effectiveness. There are indicators, however, of effectiveness, even though they may be subjective, which should alert IE management that more attention should be placed on a licensee. These indicators are largely a function of the judgment and experience of the inspector.

Clear definitions of responsibility and authority of licensee managers are an essential part of administrative control of the plant. These should be defined and documented in position descriptions and organizational charters. In addition, the qualifications of each position must be documented and for each individual appointed to a management position, the individuals qualifications must be verifiable.

The NRR Lessons Learned Report (NUREG-0578) placed great emphasis on the command and control function of the shift supervisor and noted that the shift supervisor at TMI essentially performed functions normally thought of as control room operator functions. In so doing, the shift supervisor was distracted from his management functions. NUREG-0578 also addressed the fact that shift and relief turnover procedures need upgrading. The SRG recognizes and supports the NRR positions in relation to the above.

IE Investigation Report, NUREG-0600, identified several significant occurrences related to management controls:

- The method of informing plant technicians of procedural changes was to place a note on the bulletin board.

- Failure to revise a radiation monitoring procedure to correspond to changes in management memoranda.

- Many instances were identified of failure to follow procedures.

The TMI IE Inspection Reports for the preoperational, startup, and operations phases included the following items related to licensee management:

- IE Inspection Report No. 78-36 noted there was insufficient designation of responsibilities and inadequate training in the radiation protection area.

- IE Inspection Report No. 79-04 stated there was a problem with assignment of responsibilities in radiation protection.

- IE Inspection Report No. 78-24 noted there was no administrative procedure defining responsibilities for nonroutine event reporting and followup.

- IE Inspection Report No. 78-36 noted that, based on the number of discrepancies, corrective action was needed to assure conformance with administrative controls.

In summary, IE inspections identified several conditions related to inadequate licensee management and organization. From NUREG-0578 and NUREG-0600, it appears that adequate corrective action was not taken by the licensee. Lack of adequate corrective action by management to prevent recurrence of problems is common to the subsequent sections of this report dealing with plant maintenance, quality assurance, and radiation controls. The SRG believes that licensee management was deficient in this area and that the IE program in this case was apparently ineffective in either obtaining corrective action or following up to verify satisfactory licensee management corrective actions.

Recommendations

1. The IE inspection program should be modified to emphasize assessment of the effectiveness of licensee management control systems.

2. IE regional management should periodically review licensee inspection history for indications of management control weaknesses. Weaknesses identified should be resolved in appropriate meetings between licensee and IE management.

3. IE regional management should participate more actively in exit and management meetings at licensee facilities to increase visibility of IE management and to strengthen the IE program.

4. IE studies of approaches to measuring licensee performance should be reevaluated and utilized to define and implement a licensee performance appraisal system.

### 2.5.2 Quality Assurance

The NRC requires formalized QA programs during reactor design, construction, testing and operations. Quality assurance in its broadest sense is a managerial control system used by licensees throughout the life of a nuclear power plant to assure the quality of safety related plant features and activities. Appendix B of 10 CFR 50 defines quality assurance as comprising planned and systematic actions necessary to provide adequate confidence that a structure, system or component will perform satisfactorily in service. Every licensee is required by 10 CFR 50.34 to include in its Safety Analysis Report a description of its quality assurance program. For an operating plant such as TMI, the licensee must include in its Final Safety Analysis Report (FSAR) information pertaining to the managerial and administrative controls, of which quality assurance is a part, to be used to assure safe operation of the plant.

The quality assurance program as defined by the eighteen criteria of 10 CFR 50 Appendix B is only applied to safety-related structures, systems, or components and safety related activities. Other items and activities are not covered by 10 CFR 50, Appendix B and it is the licensee's prerogative as to what degree of quality assurance is applied to them.

Quality assurance as defined by 10 CFR 50 Appendix B includes quality control, but in actual implementation at a facility, the functions of QA and QC may be assigned to different organizational units. In addition, at operating plants the administrative controls may be so designed that some QA functions may be performed by other groups. However, in these cases the fundamental concept of independence for inspection and audit must be observed.

The IE inspection program focused on the concept of safety related and the binary concept of either safety or non-safety causes difficulty in the application of QA, particularly in defining systems boundaries and the applicability of QA to those systems that may perform dual functions depending on plant status. The SRG has addressed the problem of definition of safety related in Section 2.6 of this report.

The quality assurance function for a nuclear power plant should be continuous throughout the phases of the life cycle of the plant. The phases of the plant life cycle overlap and therefore there is an overlapping of QA functions from one phase to another. One example of this is the approximately one year overlap of the construction and preoperational test phases. During the overlap of these phases, there are two QA plans in effect which may lead to some confusion, if they are not adequately coordinated. The existence of the construction QA program may, in fact, lead to lesser attention of the preoperational QA program. As the program progesses into the operations phase, the QA program merges into the total station administrative controls programs.

The effect in both cases is to dilute the effectiveness of QA. An apparent reduction in QA involvement at TMI during preoperational testing was justified by the Metropolitan Edison rationale that the preoperational testing activities by and of themselves were QA activities. This philosophy overlooks the need for independence of audit and inspection activities in relation to change control, system modification for test, system restoration, test status control and calibration. The pressures of schedules during preoperational testing, and the concurrent number of tests in progress at any given time introduce an extraordinary opportunity for error.

An additional problem with the IE inspection program is that the QA program for the operations phase is usually reviewed in the preoperational test phase. A significant time period can occur before full implementation of the operations QA program; frequently, program changes and staff changes are made during this interim period. There is a need for a final review of the QA program in conjunction with the total concept of the administrative controls program before operation.

The IE investigation of the TMI accident (NUREG-0600) identified several areas of ineffective quality assurance. In addition, the TMI inspection reports detail many inadequacies with QA. In a recent investigation of allegations at TMI-1 which is documented in IE Inspection Report No. 50-289/79-10, the licensee was cited for noncompliance with the QA requirements for failure to take adequate corrective action. In that QA is a corporate level activity, any inadequacies would usually apply to both units. For example, IE investigation of the TMI accident indicated that the licensee failed to randomly or routinely inspect by independent methods operations surveillance activities. Both 10 CFR 50 Appendix B and ANSI N18.7, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants," require independent checking or inspection.

Furthermore, the TMI investigation identified that test documentation records required by 10 CFR 50 Appendix B and by licensee administrative controls were not kept as objective evidence of work performed nor were they reviewed by the licensee managers and/or supervisors as required. Licensee personnel stated during the investigation that there was insufficient storage space for records. The record storage problem had been reported in IE Inspection Report No. 78-18, which noted that TMI would be unable to meet their commitment to comply with ANSI N45.2.9, "Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants," before June 1, 1979.

The IE inspection reports for preoperational, startup, and operations inspections also noted:

- QA audits were not performed as required.

° Temporary change control requirements had not been adhered to. (NUREG-0600 also identified inadequate change control as a problem.)

° Licensee failed to perform composite sample checks per technical specification requirements.

° Audit of responsibilities of supervisor and foremen in radiation protection and health physics organization was performed by the supervisor.

The IE inspection reports for TMI indicate that there was very little contact with TMI QA/QC personnel by NRC inspectors during inspections and that rarely did QA/QC supervisors participate in NRC exit interviews.

The QA failures noted above, together with the absence of QA representation at exit interviews, suggests that Metropolitan Edison management did not consider QA/QC an important element of station management.

Recommendation

1. The QA program requirements for the preoperational and startup test phase should be reemphasized by NRR by revision of the Standard Review Plan.

2. The IE inspection program for the preoperational and startup test phase should be strengthened to require additional QA inspections.

3. The IE inspection program should include a provision for a licensee/IE management meeting to perform a final review of the operational QA program in relation to the total administrative control program just prior to facility operations.

4. IE should reemphasize the importance of the QA function and require a licensee QA representative to attend IE inspection exit interviews. IE inspectors should meet with licensee QA personnel during site inspections.

2.5.3 Plant Maintenance

Maintenance of safety related items is an essential function to prevent degradation of equipment and verify continuing operability. Where degradation is detected, corrective maintenance must be performed to restore the safety systems to a condition which assures availability and adequate reliability. In addition, maintenance activities must be controlled to assure that temporary changes to systems or equipment which occur as part of this maintenance activity are documented and that the systems are restored to the original configuration and tested upon completion of maintenance. This is of particular importance in redundant systems where design intent can be thwarted by bypass jumpers or lifted leads.

As part of the application for a license, the licensee is required to submit to the NRC plans for conduct of normal operations including maintenance, surveillance and periodic tests of structures, systems, and components in accordance with 10 CFR 50.34. As guidance, NRC has issued Regulatory Guide 1.33, which endorses ANSI N18.7, as an acceptable approach to administrative controls which contains requirements for maintenance. The technical specification for plants required by 10 CFR 50.36 define safety limits limiting safety system settings, and limiting conditions for operations. These Technical Specification requirements indirectly force the licensee to perform maintenance activities as corrective action to maintain plant parameters within operating boundaries.

The IE inspection program initially addresses maintenance through the quality assurance program review conducted during the preoperational phase inspection. It requires a review of the maintenance program, including corrective and preventive aspects, administrative controls, and implementation. It references the applicability of ANSI N18.7. A maintenance program for plant operations is not required until an OL is issued. The maintenance program inspection may be deferred, but must be completed during the first six months following OL issuance.

Scheduled maintenance and plant modifications are reviewed and approved by Plant Operations Review Committee (PORC) without approval of the NRC. There is no requirement for the licensee to obtain NRC approval prior to making modifications to the operating plant. SRG is of the opinion that activities during refueling such as routine maintenance and plant modifications should be reviewed by IE prior to the work being done and observed by IE during the activity. (See Section 2.2.1)

Subsequent to the issuance of the plant operation license, there is an IE program requirement to perform an annual maintenance inspection (eligible for reduced frequency), a three year program review and a requirement to perform a maintenance inspection during refueling.

Technical specifications require a large number of systems, components and structures to be operable or repaired within a given time. Maintenance is required to be accomplished in accordance with approved procedures if it is to be performed on safety related equipment. IE currently reviews the maintenance program to ensure that the program accomplishes the objective of maintaining plant equipment in accordance with the provisions of the Quality Assurance Plan. The use of a Preventive Maintenance (PM) program varies from utility to utility. Some licensee maintenance programs can be characterized as "wait until it breaks, then fix it."

Closely related to maintenance and repair of equipment is the calibration of measuring and test equipment. Criterion XII of 10 CFR 50 Appendix B places controls on measuring and test equipment and specifies that to assure accuracy, inspection, measuring and test equipment shall be calibrated, adjusted and maintained at prescribed intervals. To be effective, the calibration must be done prior to use against certified equipment having known valid relationships to nationally recognized standards. Depending on organizational functions and responsibilities, calibration may be a function of maintenance, instrumentation and control, or quality assurance.

The TMI accident scenario included a number of situations involving permanent process equipment and portable measuring equipment that were deficient from a functional standpoint. Some of these had been identified by the licensee as deficient for several months, and in one case, the equipment apparently had not operated satisfactorily since installation and startup of TMI.

An example of this is the Electromatic Relief Valve (EMOV) leakage which caused the temperature of the discharge pipe to be in excess of the normal temperature. The facility had been operating in this mode for an extended period of time (Fall 1978). This condition is an example of how inadequate maintenance not only reduces the availability of equipment and thus reduces capability to respond to offnormal events, but also how it creates psychological conditioning of operating personnel. This latter aspect had a direct role in the operator's interpretation of events during the accident; the operators had become accustomed to seeing the pressurizer EMOV discharge pipe high temperature and therefore felt this high temperature was normal and did not associate it with an open valve.

Other examples are:

- Previous failures of pressurizer heater breakers.

- Inoperable automatic water sampler at a downriver station (since January 1979).

- Two laboratory counters inoperable since Unit 2 startup.

- Pre-accident leakage of makeup system components.

- Less than one half the inventory of portable radiation dose rate instruments was available for use at the time of the accident. Most of the defective instruments were in the repair shop with no parts to fix them and/or no manpower to work on them.

Calibration of equipment at TMI apparently was a continuous problem not limited to one specific area. IE Inspection Report No. 78-10 was primarily concerned with inspection of administrative controls and reported a noncompliance for failure to calibrate torque wrenches used in safety-related activities. IE Inspection Reports No. 78-05 and No. 78-20 reported on the containment leak rate test; both noted problems with calibration of instruments. IE Inspection Reports No. 78-31 and No. 79-04 reported problems with calibration of survey instruments; IE Inspection Report No. 78-31 noted that there were maintenance problems and that 70% of the instruments were out of calibration. Just prior to the TMI accident, IE Inspection Report No. 79-04 reported that twenty survey instruments awaited calibration repair.

The above items indicate that maintenance and administrative controls were not effective at TMI. It appears that the IE program although effective in identifying problems, was not effective at TMI in obtaining satisfactory corrective action.

Recommendations

1. A survey of all operating plants should be conducted to determine the effectiveness of maintenance programs. As a minimum the survey should identify:

a. Maintenance staffing characteristics such as number per shift, types of skills, and training of the staff.

b. Maintenance practices such as what types of maintenance can be performed on back shifts, the number of technicians involved, relationship to QA/QC, spare parts philosophy and inventory, and preventative maintenance.

c. Change management related to jumpers, temporary modifications, bypass, out-of-service equipment and others.

The survey results should provide IE with adequate information to assess the adequacy of current licensee practices and to identify necessary changes.

2. Evaluate the need for more comprehensive reporting requirements with attention on failure analysis of failed equipment. This should be considered in relation to Licensee Event Report (LER) evaluation and the Nuclear Plant Reliability Data System (NPRDS) interface. (Section 2.7)

3. The SRG feels that requiring implementation of a preventative maintenance program at licensed facilities should be studied to determine if such a requirement should be universally imposed.

4. The IE inspection program should require and verify that the maintenance program be in effect and adequately staffed prior to operation of the plant.

5. Expand IE inspection efforts in the area of instrumentation calibration. Include portable equipment and accident response instrumentation.

### 2.5.4 Independent Review and Audit

A fundamental concept of managerial/administrative controls as related to safety related activities is that of independent review and audit. Independence is integral to 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Recovery Plants." Criterion III, "Design Control"; Criterion X, "Inspections"; and Criterion XVIII, "Audits"; each specifically require independence of the verifier from the persons/groups doing the work.

As stated previously, NRC has endorsed ANSI N18.7 through Regulatory Guide 1.33. ANSI N18.7 has detailed and specific requirements for independence in several areas; those of most concern at this point are the independent review and audit functions. Basically, there is a requirement that activities occurring during the operational phase shall be independently reviewed periodically by persons having sufficient experience and competence in the area of review. The independent review can be accomplished by a standing committee of a designated organizational unit.

The several conditions which require review by the independent review groups include:

- Proposed changes in procedures, changes in the facility as described in the SAR, and proposed tests which involve a change in the technical specifications.

° Approved changes to the technical specifications or license amendments relating to nuclear safety prior to implementation.

Other conditions that require independent review are violations of applicable codes, regulations, technical specifications, and internal procedures and instructions having safety significance.

At TMI, the Plant Operations and Review Committee (PORC) has the function of independent review. The IE investigating team reported in NUREG 0600 that the PORC apparently performed an inadequate safety evaluation and review of the emergency feedwater procedure change which allowed the plant to operate outside the license requirements. NUREG-0600 also reported the implementation of a procedure revision which changed the assembly and accountability features of the Emergency Plan. This procedural change was implemented by issuance of a memorandum before being reviewed by PORC, contrary to the technical specifications.

IE Inspection Report No. 78-29 reported a problem with the offsite Generation Review Committee (GRC) memberships and also discussed a failure of the PORC to provide timely minutes of PORC meetings.

NUREG-0600 in discussing the failure of the PORC to adequately review the emergency feedwater procedure change noted that a breakdown occurred in several areas, including engineering, management, and operations. There were other indications, in the investigation report and inspection reports, of inadequate technical review, including:

° IE Inspection Report No. 78-36 noted that the procedure used to calculate reactor coolant pumps seal return flow was in error.

° Incorrect designation on annunciator alarm windows and in the applicable procedure was reported in IE Investigation Report No. 78-30.

- NUREG-0600 identified that the reactor coolant system leakage procedure was in error, misleading operators to believe the plant was within Technical Specifications, when actually it was not.

- NUREG-0600 reported that supervisory review of completed surveillance procedures was not routinely performed.

Recommendations

1. IE should evaluate the adequacy of the independent safety reviews at all operating plants. The review should be conducted by an independent audit group and should consider the competency of plant staff members to review proposed design changes and the interface between plant staff review, offsite review, and design groups.

2. The NRC resident inspectors should periodically attend the onsite review group meetings.

### 2.5.5 Radiation Controls

A radiation control program is necessary to maintain safe working conditions within the plant and to limit radioactivity releases to the environment. Radiation control procedures compatible with the requirements of 10 CFR 20 are required by a licensee's technical specifications. The procedures must include exposure limits and must be made available to all employees. Although radiation safety is a responsibility of each worker, overall responsibility for program implementation is vested in a radiation chemistry group. This group is typically responsible for developing radiation safety procedures and standards, for confirming that radioactive waste releases meet regulatory requirements, for maintaining plant chemistry within specifications, for assuring that appropriate radiation protection training is given, for conducting of a routine and special surveillance program, for maintaining personal exposure records, for approving the manner in which radiation work is done, for assuring that quality is maintained in the technical aspects of the radiation control program, and for assuring that the controls and standards are followed.

Because of the diverse groups (e.g., operating, maintenance, and contractors) involved, and because conflicts arise between the different groups, strong backing of station and utility management is a necessity. The supportive attitude by management must be apparent not only in periodic radiation training but also in the day-to-day manner in which safety is considered, in the way intergroup conflicts are resolved, and in the way violations of the radiation control standards are handled. A weak radiation protection program represents a direct failure of station and utility management.

In addition to providing strong support, management needs an independent evaluation of the technical soundness of the radiation control program and its implementation. Normal quality assurance audits do not provide the technical expertise, and routine reviews by radiation chemistry supervision do not provide the independence needed for an adequate technical (peer) review. The capability for this review is normally not found within the station and sometimes not within the utility.

Standard Technical Specifications, Section 6, "Administrative Controls," require independent review and audit of radiation safety, but the requirement that it be a thorough technical audit is not so strongly put. The performance of different licensees varies considerably and sometimes the only peer review comes in IE inspections.

A somewhat similar situation prevails in radiochemistry in that an independent technical review is needed, is implied but not strongly stated in the technical specifications, and is not normally available within the plant or perhaps within the utility. Except for radioactivity quantification, IE inspections in this area normally are not a strong technical review because of the weak radiochemistry background of most inspectors performing these inspections.

Numerous health physics problems, notably control of radiation exposures, were identified by the IE investigation group and others at TMI during the emergency. These generally reflected basic weaknesses in the radiation controls related to personnel qualifications and training, emergency planning, and program management. The weaknesses were noted in the performance of contract health physics technicians as well as in licensee employees. Past inspection reports at TMI indicated that some of the problems were seen but apparently were not effectively identified and corrected. This failure of the IE inspection and enforcement program may result partly from the relative innocence of both the NRC and the licensee regarding the potential significance of such problems. Seemingly minor problems, not appearing to be of direct safety significance, were usually involved. The TMI accident adds a new frame of reference for viewing such problems.

The failure also may result from lack of clear regulatory authority on the part of IE to require quick corrective action on such items. Thus, such problems, some of which may have been present from early plant operation, linger while IE and the licensee engage in a repeating cycle of inspections, discussions, correction, reinspection, discussion, more correction, etc.

Further, because of the sampling nature of IE inspection, some weaknesses may not be discovered early in the inspection cycle. This, together with the lack of sufficient imperative for licensees to take prompt corrective action in the areas of health physics, chemistry, and radwaste management, is regarded as a significant weakness in the NRC inspection and enforcement program.

The SRG believes that many radiation problems of the type observed at TMI can be discovered and corrected early in the inspection cycle by increased emphasis on in-depth procedure review during the preoperational phase, more frequently scheduled inspections during the operational phase and by a one time comprehensive examination of radiation protection, chemistry, and radwaste management. This review should be regarded by both the licensee and the NRC as a significant milestone in the life of the plant. Such a review should also be considered for all plants now operating.

Routine operational phase inspections of radiation protection and radwaste are each performed annually. Radiation protection during refueling is reviewed approximately every other year. For some plants, the interval between inspections is too long to permit effective followup of licensee corrective actions and commitments. Also, the sheer volume of records generated between inspections by the licensee may lead to an imbalance between record review and direct observation. Generally, the SRG believes that the frequency of these inspections, including radiation protection review during major outages, should be increased. In some cases, doubling of the annual frequency may be appropriate. Regional management should identify where additional effort is necessary. The SRG recognizes the need for more radiation specialists to effect such an augmented program. Current inspector workload and onsite time requirements already cause in-office preparation and post-inspection review to be slighted.

Recommendation:

1. Technical specifications should be amended to require a technical audit of radiation protection, chemistry, and radwaste management programs at a frequency not to exceed three years. The audit team should include persons meeting ANSI N18.1-1971 "Selection and Training of Nuclear Power Plant Personnel" (or successor standard) qualification for radiation protection manager and radiochemist.

2. A comprehensive review of health physics, chemistry, and radwaste management should be done by IE with NRR participation during the first year of plant operation. A similar review should be done at all operating plants.

3. Preoperational inspection guidance should be strengthened to require detailed review of all radwaste release procedures, release quantification procedures, installed monitor calibration procedures, and all procedures relating to in-plant exposure control

4. IE regional management should review the current radiation protection and radwaste management inspection programs to identify plants where increased inspection frequency is needed. Inspector resources should be increased to support an augmented inspection program.

## 2.6 Plant Design

A review of the events and conditions associated with the TMI accident reveals a number of significant design related factors which could have contributed, either directly or indirectly, to the accident sequence. Design activities are the front end of the life cycle of the nuclear power plant. Therefore, prevention of design errors and correction of deficiencies detected during design are more effective than correcting deficiencies discovered during later phases of the plant life cycle. An important aspect of this is the assurance of adequate design inputs, such as designation of structure, system, or component (SSCs) as safety-related, which provide the key to definition of an adequate quality assurance program. The SRG recognizes that design of SSCs is primarily under the purview of NRR. The NRR Lessons Learned Task Force has identified many design concerns which are being pursued from the licensing viewpoint. The SRG believes that IE inspections can be made more effective and can provide greater assurance of nuclear plant safety if improvements are made in the NRC specification of design inputs, additional inspection effort is placed on design control, and design verification is upgraded.

### 2.6.1 NRC Design Inputs

Design inputs including performance requirements and criteria, are described collectively in regulations, rules, specifications, Regulatory Guides, and standards. Major design inputs are the 10 CFR 50, Appendix A, "General Design Criteria," and 10 CFR 50.55a, "Codes and Standards". A significant aspect of design inputs is the categorization of plant SSCs as to function, either safety-related or not safety-related. This categorization of any given SSC determines whether or not the IE inspection program applies to it; i.e., if it is categorized as safety-related, it is a candidate for inclusion in the IE construction inspection program.

The categorization of SSCs as safety-related requires that the licensee include them in the quality assurance program and address them in the safety analysis report (SAR). Regulatory guides (RGs), referenced in the SAR although not mandatory, describe acceptable design approaches but permit an applicant to pursue an alternative design if equivalent. During the design and construction phases, commitments defined in the SAR frequently are revised by the licensee without NRC review and approval. This is permissible by present licensing criteria and does not require formal review until the final SAR is submitted. Since the SAR is a basic input to inspection planning uncontrolled SAR changes introduce uncertainty in the IE inspection process.

The TMI-2 accident, as documented in the reports NUREG-0600 and NUREG-0578, demonstrates that many of the systems and components that malfunctioned during the accident sequence were not categorized as safety-related. Examples are the power operated relief valve and pressurizer heaters. In addition, some of the systems and components categorized as not safety-related, such as the letdown and makeup systems, played significant roles in offsite releases as well as in recovery of the plant from the accident.

The lesson to be learned is that system interaction and specific situations can significantly change the role of SSCs and that there is a need to redefine the concept of safety-related into a system that will assign SSCs to a category representative of their importance to safety and provide the basis for application of QA/QC to a degree suitable for each SSC.

The concept of safety-related had a psychological impact on the operators at TMI as reported in NUREG-0600. During the investigation it was stated that one reason the operators did not believe certain instrumentation readings was that those particular instruments were not safety grade.

The TMI accident vividly demonstrated that at least two broad categories of equipment were not adequately addressed in terms of safety; i.e., post accident monitoring instrumentation and radiation protection systems (including instrumentation). Important information about plant radiation levels and releases was lost or degraded owing to inadequate range, vulnerable location, isotopic interference, and/or confusing display associated with installed monitors and samplers. Changed isotopic mixtures during accident conditions rendered noble gas monitor calibrations uncertain. High local fields inhibited release sample changing. Monitor data processing, including display and recording, was less than state of the art and, at times, was inadequate. Complete monitoring system readout was found only in the control room, which added to the crowding there. The extent of these problems seen during the TMI accident was not effectively anticipated in either the licensing review or the inspections by the NRC.

Recommendations

1. The definition of safety related, and other related terms such as "essential," "safety grade," and "important-to-safety," that are utilized by NRC should be examined. Safety related should be defined to remove ambiguity and introduce specificity. These definitions should be considered in terms of the interrelation between 10 CFR 50 Appendix A, General Design Criteria, and 10 CFR 50, Appendix B, "Quality Assurance Requirements, for Nuclear Power Plants and Fuel Reprocessing Facilities." This task of integrating Appendix A and Appendix B will necessitate adopting a "graded" approach to quality assurance such that the "all or nothing" classification would be eliminated. QA would be applied to any given SSC only to the degree required by the classification assigned to the SSC. The SRG recommends that this be approached on a Task Force basis with IE, NRR, and Office of Standards Development (SD) participation.

2. The "Codes and Standards Section," 10 CFR 50.55a, should be reviewed and updated to include applicable industry standards (American Concrete Institute, Institute of Electrical and Electronic Engineers, and others). This would transform some design criteria which are presently only commitments into regulatory requirements and would provide a solid base for more rigorous inspection.

3. The NRC should require licensees to report revisions to the SAR on a periodic basis. Significant changes which affect safety should be reported when the proposed change is defined for NRR review. All changes should be promptly distributed to Regional offices.

4. IE should participate with NRR in determing the acceptability of proposed licensee alternatives to regulatory guides.

5. An NRC task force should take immediate steps to identify installed radiation monitoring/sampling systems as safety-related and to establish acceptance criteria for them, considering TMI experience. Considerations should include state-of-the-art data handling, the need for additional data display outside the control room, and the need for requiring automatic grab sampling capability on release paths. Impose these criteria as requirements on licensees.

6. IE inspection guidance for the monitoring systems should include acceptance criteria. The system and all related calibration and release procedures should be examined before an operating license (OL) is issued.

### 2.6.2 Design Control

An important aspect of the design process for nuclear power plants is the administrative controls imposed on design activities. These controls are required by 10 CFR 50, Appendix B, Criterion III and are further amplified by ANSI N45.2.11, "Quality Assurance Requirements for the Design of Nuclear Power Plants," which is endorsed by RG 1.64.

These controls are developed and implemented by the licensee and inspected by IE using the audit technique. Design controls are inspected as an integral part of the reviews of the licensee's QA program before and during construction. This is supplemented by design control inspections conducted by the Licensee Contractors and Vendor Inspection Branch (LCVIB) of nuclear steam system suppliers (NSSSs) and architect engineers (AEs) during construction. These are minimal efforts and, in addition, the LCVIB does not have the legal means to enforce corrective action when findings are adverse.

Design changes and plant modifications during operations are monitored through IE inspections and IE review of licensee independent review group activities.

An important objective of design control is that the as-built configuration of the plant corresponds to the formal documentation, such as physical layouts, schematics, and P&IDs. Some important functions are interface controls, design change controls, and design verifications.

There are several instances in the TMI accident literature that report plant as-built conditions not in conformance with design documentation. Examples are:

- Improper identification of steam generator A and B sample lines.

- Inability of plant auxiliary operators to identify or locate decay heat valves.

- Solenoid switch wiring for condensate polisher valve controls not in accordance with drawing.

- Wiring error related to condensate booster pump auto/manual switch.

- Location of pressurizer relief valve discharge pipe thermocouple.

These conditions may have resulted from inadequate licensee design control, testing, inspection or training.

Recommendations

1. Interdisciplinary teams from IE and other NRC offices should perform frequent audits of licensee and licensee contractor design controls. Architect engineers and nuclear steam system suppliers should be brought under NRC regulatory authority.

2. The IE inspection program should be strengthened by including specific requirements to audit design changes in the field during construction and preoperational testing.

3. IE inspections should concentrate on a comparison of as-built conditions with design criteria and drawings.

### 2.6.3 Design Verification

Design verification is a means for demonstrating that the performance of SSCs meet the design intent. Criterion III of Appendix B, 10 CFR 50 specifies three generally accepted methods of design verification: design reviews, alternate calculations, and qualification testing. Qualification testing is the most stringent and positive method, but due to the expense involved and in some cases the complexity of equipment or state of the art limitations, the other methods may be used.

Qualification of SSC is addressed by NRR in the Standard Review Plan and by IE in its inspection program. The IE program is minimal, in that it only requires verification that a qualification report or evidence of qualification, such as a letter of conformance, is available at the plant site for NRC review. Qualification is directly related to the concept of safety-related; only those SSCs classified as safety related are required to be qualified.

The TMI accident provided several salient examples of performance inadequacies that could have been precluded by comprehensive design verification in conjunction with adequate design inputs. The power operated relief valve and radiation monitoring instrumentation were two examples of equipment that failed to perform adequately under adverse accident conditions. Apparently these items were not qualified for the intended service, or the most adverse conditions of anticipated accidents were not considered in the design application.

Aspects of design adequacy in relation to shared systems among dual units apparently were not addressed properly at TMI. An example of a shared system interaction was the ventilation system imbalance between TMI-1 and -2 which lead to the spread and release of radioactivity. Preoperational testing to demonstrate design adequacy of shared systems and capability to function in a degraded mode apparently was not satisfactorily accomplished.

NRC requires that licensees conduct a program of tests during the preoperation and startup phases of the power plants. This testing demonstrates that required systems are capable of performing as designed. These tests are diverse and comprehensive in nature, but are limited by the fact they are conducted very early in plant life. There is no current program that requires follow-up on testing of the type conducted during the startup test program. Certain plant responses to transients are dependent on such parameters as decay heat inventory, control rod patterns, boron concentration, core burnup, and xenon. The anomalous pressurizer level behavior at TMI following a turbine trip did not occur during the startup testing program.

Recommendations

1. NRC should reevaluate the concept of shared systems between dual units. Systems shared between units should be subject to more in-depth design verification in the design phase, due to the probability of interaction.

2. Revise the construction inspection program to enlarge the sample of components reviewed for qualification. Consideration should be given to establishing an IE:HQ environmental qualification review group similar to the Seismic Qualification Review Group to perform reviews which would include components from all systems categories.

3. Establish a data bank of qualification reports by report number, vendor, and component.

4. Revise the IE inspection program to include postive requirements and criteria for evaluating and determining acceptability of environmental qualification reports for components and systems and qualification of testing laboratories.

5. Initiate a study by IE and NRR to evaluate the need for a continuing program of testing at nuclear power plants to confirm that plant behavior later in plant life continues as expected.

## 2.7 Evaluation of Events at Nuclear Power Facilities

Certain events which may have safety significance occur during the life of nuclear power plants. These include such problems as pipe leaks, unplanned releases, component failures, and transients. Current technical specifications and regulatory guides specify that some of these events should be reported to the NRC in a time frame commensurate with their significance. These reporting requirements have been somewhat expanded by the IE Bulletins issued after the TMI accident.

The review of the TMI accident indicated that certain precursor events had been reported to the NRC. It appears likely, however, that the full significance of these events was not identified so that appropriate corrective action could be taken. Such events occurred at TMI as well as other B&W facilities.

Technical specifications establish the requirement for the licensee to analyze the cause of the event and establish the nature of actions taken to prevent recurrence.

IE has programmatic inspection guidance requiring that selected events be reviewed to ascertain whether the licensee's review, corrective action, and reporting of identified events are in conformance with regulatory requirements, licensee procedures and controls.

The depth and quality of the NRC review depends on several factors. Variation in technical specifications as to what must be reported can result in similar events being reportable at one facility and not at another facility. Inconsistencies in the classification of safety-related components and systems also produces nonuniform reporting of events. The technical strength of the reviewing inspector also affects the adequacy of the review performed. Since events and their reports involve electrical, hydraulic, instrumentation, and radiation problems, as well as reactor transients, no one person should be expected to perform an adequate in depth evaluation in all these areas. Events of seemingly minor significance occurring at different plants may take on added seriousness when taken together. The potential for system and component interactions increasing the consequence of an event can be recognized only by analyzing events at plants in every region.

The adequacy of the review performed by the licensee also varies from facility to facility. Such factors as whether or not the analysis and report preparation are accomplished at the site or in the corporate office may affect the depth of the licensee's event review.

The Nuclear Plant Reliability Data System (NPRDS) is an industry wide system for collecting failure data on plant systems and components. Participation is not presently required by the NRC and the involvement by licensees varies from complete participation to essentially none. Since participation is voluntary, some nuclear plant licensees do not participate. The data bank therefore does not include all nuclear component and systems failures. The SRG feels that mandatory participation in NPRDS will provide a more comprehensive and complete data base for evaluating reliability and for early identification of failure trends.

In the area of events caused by personnel error, most of the corrective actions have focused on retraining of people and improving procedures. No significant analysis has been done by the licensee to understand why the person made the error. The whole subject of the man/machine interface and its relationship to occurrences at nuclear facilities has not been adequately addressed with the objective of identifying and correcting the underlying cause of personnel error. Personnel errors also occur during power plant construction and modifications, resulting in improper equipment installation and testing.

An additional aspect of event reporting deals with events which do not meet any of the reporting requirements. Resident inspectors will provide NRC with day-to-day contacts at the site. No requirement exists that the resident inspector pass on information about an event or transient not otherwise reportable.

Recommendations

1. Develop guidance for the resident inspector to relay for further NRC analysis information about events not reported by the licensee.

2. A headquarters Support Group should be established or an existing technical group expanded to include specialists in such areas as instrumentation, core physics, mechanical and electrical engineering, and thermal-hydraulics. This group would work full time doing in-depth analyses of LERs and would select events for analysis by the Event Analysis Group described below. Expanded computer searches for related events could be done by this group.

3. A standing Headquarters based Event Analysis Group should be established to analyze events at licensed facilities. This group should consist of technical representatives from IE, NRR, the NSSSs and the AEs.

The role of this group would be to confirm licensee analyses of events which might be potential safety problems. This group should gain a national perspective to identify potential generic problems or synergistic conditions.

Since this group would work with a large number of reports, it should be able to identify necessary improvements to reporting requirements. Such changes could include the scope of the events to be reported, the depth of the report, and any other appropriate items.

For identified transients, computer codes used for the FSAR accident analyses could be run for the observed plant data. This would serve several functions. The first could be increased confidence in the FSAR analyses. The second would be early identification of anomalous plant behavior. Additionally, it may become apparent that added instrumentation or data records are necessary to analyze the transients. This discovery could be used to establish the need for selected instrumentation improvements so that future events can be better evaluated. Additionally, this group would include specialists to analyze personnel errors. It should include human factors experts, psychologists, man/machine interface specialists, and members from other related fields. This group should analyze selected events which involved personnel error, with the goal of identifying the underlying cause (e.g., confusing panel design, fatigue, and inadequate skills or training for the job) of each event. It would then be able to make recommendations to the appropriate office of the NRC to bring about the appropriate corrective action. Licensee participation in NPRDS should be required. (See Section 2.5.3; Recommendation No. 2)

## 2.8 Enforcement

An objective of the IE inspection program is to determine if the licensee is meeting regulatory requirements and the license conditions of his plant; i.e., that the facility and operations are in compliance. If noncompliances are identified, enforcement actions are used to provide incentives for the licensee to initiate corrective action sufficient to bring the plant into compliance. Enforcement actions are applied in a degree commensurate with the nature of the noncompliances and patterns of recurrence. Routine enforcement action taken by the regional offices normally consists of a "Notice of Violation." IE:HQ prepares the enforcement package for escalated enforcement actions.

Routine enforcement action is normally transmitted to the licensee within twenty days from the date of the inspection. Since routine enforcement usually relates to matters of low safety significance, the time lapse of twenty days plus the additional time allotted for the licensee response is acceptable.

Higher levels of enforcement action represent significantly higher concerns related to safety or concerns about the licensee's ability to meet regulatory requirements. These concerns are normally expressed to the licensee during the inspection and in special meetings convened between IE regional and licensee corporate management. At these meetings, the licensee's ongoing and proposed corrective actions are discussed, as is the fact that escalated enforcement action is being contemplated. A report covering the management meeting, including licensee commitments, is normally transmitted within twenty days of the meeting. In some cases, an Immediate Action Letter (IAL) is transmitted within a day of the meeting. If a licensee is recalcitrant in an area of significant concern to IE, a show cause order may be issued. All of this normally takes place shortly after the inspection, the exact time depending upon the immediacy of IE's safety concern.

Beyond the short term actions described above, enforcement case processing slows down. When escalated enforcement is considered, a package prepared for IE headquarters issuance includes the original inspection report and the associated "Notice of Violation." In complicated cases, the time interval between the orginal inspection and the official transmittal of the escalated enforcement "package" the time interval may be months. Meanwhile the licensee takes corrective action while awaiting official communication of the escalated enforcement action. Significant delays reduce the impact of escalated enforcement action because the licensee may perceive the delay as unconcern or indecisiveness on the part of NRC.

The SRG believes that a significant delay between inspection and transmittal of the inspection results in an official inspection report is inappropriate. The inspection report, including the "Notice of Violation," should be processed as promptly as those associated with routine enforcement action.

A problem unique to the resident inspection program exists where the resident inspector issues his inspection report monthly. A letter advising the licensee of the item of noncompliance is normally not issued until the IE Inspection Report is released. Therefore, official transmittal of an item of noncompliance could be delayed as much as fifty days.

In relation to TMI, there were no escalated enforcement actions and the plant enforcement history did not indicate that Metropolitan Edison was a below average licensee. However, as noted elsewhere in this report, the TMI inspection reports contained repetitive items of inspector concerns in diverse areas of plant operation, specifically health physics and equipment calibration. It was noted by the SRG that in this case the IE inspection program appeared to be more effective in identifying problem areas than in obtaining corrective action. There may be several reasons for the inability to obtain corrective action.

- Management support of the inspection findings may have been inadequate.

- The lack of clearly stated regulatory requirements may have prevented enforcement actions.

- The inspection findings may have been insufficient to support enforcement action.

- The inspectors may not have been aggressive in developing the case for enforcement with Regional management.

Whatever the specific reasons may have been, SRG believes that aggressive enforcement action applied in a timely manner could contribute to preventing accidents such as the one at TMI on March 28, 1979.

It should be reiterated here that effective enforcement action relies on well defined regulations for safety related SSCs which form the basis for inspection and legal action.

If the inspection program identifies a potential safety problem in relation to a SSC not designated as safety-related in the SAR or not covered by technical specifications, the formal process for obtaining an NRR decision introduces a significant time lag in resolving the original problems.

As discussed in Section 2.3, a more effective interface with NRR is needed to resolve field identified problems.

Recommendations

1. The enforcement program should be studied to: determine methods for increasing the effectiveness of enforcement actions or sanctions; improve the timeliness of communications and enforcement action transmittals to licensees; establish interfaces with licensees to assure licensee awareness of NRC concerns; and establish enforcement actions more directly correlated with the degree of safety concern.

2. Enforcement policy should be reviewed with particular emphasis on IE:HQ and OELD interface to assure timely processing of escalated enforcement action.

# 3. Findings and Recommendations Regarding Emergency Preparedness and Response

## 3.1 Introduction

### 3.1.1 Objectives

This section draws upon Three Mile Island and other experience of employees of NRC and other organizations in order to identify weaknesses in IE's emergency preparedness and response and to propose appropriate corrective action.

### 3.1.2 Scope

It is sometimes difficult to distinguish between activities aimed at preventing accidents and those aimed at responding once an accident has occurred. This section concerns preaccident (perhaps preventive) and postaccident (responsive) activities that relate to IE's ability to cope with accidents. Both licensee and NRC activities relating to accident response are considered.

Where possible, recommendations are specific. Whether specific or general, cognizant managers will be asked to evaluate and refine the recommendation before implementation.

## 3.2 IE Mission

Stated broadly, NRC's mission is to protect public health and safety, the environment, and property; to provide for common defense and security; and to inform the public of actual or potential hazards. NRC's mission regarding emergency response includes obtaining and providing information, evaluating situations, assisting licensees and other agencies, and providing direction.

Although the emergency response mission of NRC is rather clear, the emergency response mission of IE is not. This uncertainty of the IE mission may have resulted from the lack of statutory recognition of IE by the Energy Reorganization Act of 1974.

The emergency response mission of IE should be stated clearly in order to achieve the most workable relationship with other organizations inside and outside NRC and to achieve the most effective accident response capability within IE. (See "Assistance vs Regulation," Section 3.6.1, and "Takeover from Licensee," Section 3.6.2.)

Recommendations

1. Achieve statutory recognition of IE to formalize its entire mission.

2. Publish a concise statement of the IE emergency response mission, to include: ensuring the emergency preparedness of NRC and NRC licensees; providing direction and manpower following an accident involving NRC-licensed material; and ensuring the historical preservation of accident information for use in future prevention and response activities.

3. Revise Manual Chapter 0502, "NRC Incident Response Program," to explicitly define IE's mission, particularly in the areas of onsite direction of NRC activities and providing assistance to the licensee.

## 3.3 Organizational Functions and Responsibilities

### 3.3.1 Assignment of Organizational Functions and Responsibilities

IE and other NRC offices do not have clearly assigned roles for protecting public health and safety, the environment, and property, for providing for common defense and security, and for informing the public of actual or potential hazards during an emergency. Thus, the relationship of IE to other NRC Offices, to other agencies, and to the public is uncertain under accident conditions.

This uncertainty could cause confusion, duplication, inaction, and conflict interfering with the NRC emergency response mission. (See "Organizational Interfaces," Section 3.4.)

Recommendation

Once IE's emergency response mission is well stated (Section 3.2.), its responsibility and resultant authority should be clearly assigned and distinguished from the responsibility and authority of other NRC Offices and other agencies.

### 3.3.2 Description of Organizational Functions and Responsibilities

Organizational functions, responsibilities, and authorities within and outside NRC are not described clearly and conveniently. Everyone responding to an emergency should have ready access to such information in order to understand their obligation and the obligation of others. (See "Organizational Interfaces," Section 3.4)

Recommendation

IE should establish and maintain (via change notice system) a catalog describing organizational functions, responsibilities, and authorities of NRC and other Federal agency components, of State and smaller governmental agencies, and of medical, fire, police, and other emergency services in major cities and near licensed facilities.

### 3.3.3 The Role of Inspection and Enforcement

The Office of Inspection and Enforcement, NRC's principal contact with operating licensees, is better acquainted with licensee facilities, equipment, products, personnel, and procedures than any other NRC organizational component. Because of this familiarity, IE should be primarily responsible for NRC response at accident sites. In this role, IE should be required and be able to draw on the specialized capabilities of other NRC components. To the extent possible, mobilization of IE personnel and other resources should be preplanned. Responsibilities, authorities, and lines of communication should be made apparent quickly to all involved. (See "NRC Emergency Preparedness," Section 3.14.)

Recommendation

Formally establish IE as the NRC component primarily responsible for NRC activities at accident sites. To the extent possible, predetermine a chain of command within and beyond IE to ensure proper direction of site activities and proper communication of site information.

### 3.3.4 Regional Organization, Plans, and Procedures

Nonuniformity of regional emergency response organizations, plans, and procedures hinders interregional and headquarters assistance effort. For example, Region II and Region III inspectors sent to TMI were unfamiliar with the Region I Incident Response Plan. (See "Regional Emergency Response Plan," Section 3.14.2.)

Recommendation

To the extent possible, regional emergency response organizations, plans, and procedures should be identical. An Emergency Officer position should be uniformly established in each region, as well as in headquarters, to ensure this.

### 3.3.5 The Role of the IE Inspector

The role of the IE inspector in responding to an emergency needs to be clarified. TMI revealed that the roles of some site response team members were not clearly identified in advance. Inspectors arrived at TMI without training in such emergencies or a clearly delineated scope of authority and responsibility. In contrast, somewhat more specific roles are defined in the

Headquarters and Regional Incident Response Plans for Operations Center personnel. Current guidance regarding the inspector role is provided in IE Manual Chapter 1300 (Incident Response Actions).

Regional and resident inspectors must be prepared to respond to a spectrum of emergencies. An initial group of inspectors, perhaps as many as a dozen, may be dispatched to the site. This will depend on the type of emergency and the extent of information available. TMI demonstrated that IE must be prepared to mobilize a hundred or more people on fairly short notice following a major reactor accident.

IE site teams engage primarily in information gathering/dissemination, evaluation of events and licensee actions, and assistance to the licensee or other onsite agencies. It is assumed that any direction of the licensee's operation would originate from the headquarters Executive Management Team (EMT). It is not envisioned that the IE site team be capable of "taking over" the facility or manipulating plant components. However, direction of operations via the licensee's organization should be within the capabilities of this team's expertise. (See "Takeover from Licensee," Section 3.6.2.)

The IE site team structure must be preplanned to include adequate seniority levels and technical disciplines, and to include emergency preparedness expertise, if available. (See "NRC Emergency Response Plan," Section 3.14.1.)

Recommendations

1. Revise IE Manual Chapter 1300 to identify typical response teams for various classes of emergencies and to indicate typical initial tasks, as in the examples below. Include guidance and decision criteria to allow the Regional Director to determine the appropriate team size and composition.

Typical IE Site Team For Major Reactor Accident

| Individual | Task |
| --- | --- |
| Regional Director | Site Team Leader |

| Individual | Task |
|---|---|
| . Section Chief/Branch Chief | Coordination |
| . Lead Resident (Project Inspector) | Control Room Lead Monitor |
| . Resident (RONS Inspector) | Control Room Communicator |
| . RONS Project Inspectors | Control Room or In-plant Monitor |
| . FFMS Inspectors | Environmental Monitoring |
| . FFMS Inspectors | Onsite Radiation Protection and Radwaste Management |
| . Public Affairs Representative | Communications to Media/Public |
| . Regional Investigators | Data/Information Retention |
| . Additional RONS and FFMS Inspectors As Necessary | |

Typical IE Site Team For Minor Reactor Accident

| Individual | Task |
|---|---|
| . Section Chief/Branch Chief | Site Team Leader |
| . Lead Resident (Project Inspector) | Control Room/Facility Monitor |
| . Resident (Project Inspector) | Control Room Communicator |
| . FFMS Inspector(s) | All HP Aspects |
| . Public Affairs Representative | Communications to Media/Public |

Specialist inspectors in a particular discipline may be included, depending on the type of incident.

Typical IE Site Team For Major Transportation or Materials Accident

| Individual | Task |
|---|---|
| . Section Chief/Branch Chief | Site Team Leader |
| . Principal Inspector (If facility related) | Monitor and Communications |

| | |
|---|---|
| . FFMS Inspectors | Environmental Monitoring |
| . FFMS Inspectors | Onsite Radiation Protection and Radwaste Management |
| . Security Inspectors (If transportation related) | Monitor and Communications |
| . Investigators | Data/Information Retention |
| . Public Affairs Representative | Communications to Media/Public |

2. Advise licensees of the role of IE response teams. Arrange that such teams are granted immediate access to the site and/or control centers.

3. Revise IE Manual Chapter 1300 to provide for the use of regional inspectors from unaffected regions as part of the NRC Operations Center support staff and as backup support at the scene. These individuals should be used to augment existing staff in areas such as communications, data/status maintenance, and evaluation. On-scene needs from unaffected regions will depend on the scope and duration of the emergency.

## 3.4 Organizational Interfaces

### 3.4.1 Description of Organizational Interfaces

Organizational interfaces within and outside NRC are not clearly and conveniently described. Everyone responding to an emergency should have ready access to such information in order to provide and obtain prompt and proper assistance.

Recommendation

In the catalog of organizational functions, responsibilities, and authorities recommended in Section 3.3.2, define the interfaces of NRC and other Federal agency components; State and smaller governmental agencies; and medical, fire, police, and other emergency services in major cities and near major licensee facilities. For convenience, cross reference this catalog by organizational name and areas of responsibility.

### 3.4.2 Interfaces Internal to IE

Relationships among groups within IE require clarification to ensure smooth functioning in emergencies. NRC Manual Chapter 0502 (NRC Incident Response Program) and IE Manual Chapter 1300 (Incident Response Actions) provide some direction in this regard, although the direction provided by these manual chapters was not always followed during NRC's response to TMI. The IE manual chapter, last revised on 12/11/75, needs revision. For example: the titles and functions of certain IRACT members are not current or consistent with NRC Manual Chapter 0502; Division Directors have written supplemental guidance that should be formalized as part of Manual Chapter 1300; regional office functions relating to the role of the onsite team require additional direction; and criteria for the Regional Director's assuming on-scene duties are not specified. Communications among IE groups were affected by inadequate understanding of relationships.

Recommendations

1. Revise IE Manual Chapter 1300 to be consistent with the IE organization and NRC Manual Chapter 0502. Provide additional details concerning individual responsibilities.

2. Clarify the emergency response role of the IE Regional Director. Specify a requirement for the Regional Director to go to the scene of any Site or General Emergency, as defined in Regulatory Guide 1.101.

3. Clarify "chain of command" relationships between the on-scene leader, the Regional Response Center, and the IRACT. (This may be needed if the IRACT Director, due to the type of accident, is from outside IE.)

4. Clarify Regional Response Center functions, once the NRC Operations Center is fully manned and the IRACT is functioning. It would appear that at this point the Regional Response Center team should become engaged in peer review and in rendering communication assistance to outside agencies or the media. The

command, control, and communications link should be directly between the IRACT and the Regional Director, whether in the regional office or at the scene. Revise IE Manual Chapter 1310, "Regional Office Incident Response Actions," appropriately.

### 3.4.3 Interfaces Internal to NRC

The relationships among offices and groups within NRC require clarification to ensure a coordinated agency response to emergencies. Guidance for overall NRC response actions is contained in NRC Manual Chapter 0502 and IRACT Implementing Procedures. This guidance, although generally clear, was not followed exactly at TMI. For example, information flow between the IRACT and the Executive Management Team (EMT) was not in accordance with the IRACT operating procedure. Also, NRR staff functions at the TMI site (which were not addressed by Manual Chapter 0502) sometimes complemented and sometimes duplicated those performed by IE staff members. Duplication also occurred between the region and headquarters.

Recommendations

1. As the organization chartered to take the lead in NRC emergency preparedness, IE should provide guidance and training to all NRC offices regarding emergency response functions and responsibilities. This would include formalized training/briefings to the Commissioners and to EMT and IRACT members.

2. Identify key staff positions required to support IRACT for various types of emergencies.

3. Establish criteria and procedures for NRR and other NRC offices to provide assistance to IE at the emergency site.

4. Conduct drills annually, in conjunction with a licensee and regional drill, that would mobilize the entire headquarters incident response team. (See "Drills," Section 3.14.5)

5. Revise NRC Manual Chapter 0502 to clarify the duties of various NRC Offices regarding Items 1-4, above.

### 3.4.4 Interfaces External to NRC

Interfaces among governmental agencies, the licensee, and other organizations responding to the TMI accident were not well defined. Coordination problems existed for the licensee in seeking to obtain the assistance of onsite and offsite organizations and to manage large numbers of people at the site. The numerous regulatory and other State/Federal activities conducted on and off site were not always well coordinated.

Industry and regulatory agencies have recognized the need for preplanned management schemes. The Atomic Industrial Forum (AIF) is developing an "emergency organization" scheme that could serve the licensee's needs. The NRC identified the need for effort in this area and established the Task Force on Emergency Planning to: (1) develop for Commission consideration a list of major issues for rulemaking; (2) describe and objectively critique NRC's current emergency planning process; and (3) define and recommend an approach for developing a comprehensive plan that would formulate the scope, direction, and pace for NRC's overall emergency planning activities.

For State and local agencies, the planning elements that to date have been identified as important to an effective plan are found in the "Guide and Checklist for the Development and Evaluation of State and Local Government Radiological Emergency Response Plans in Support of Fixed Nuclear Facilities" (NUREG-75/111 and Supplement). For licensees, the necessary elements of emergency plans have been identified in Appendix E to 10 CFR Part 50, "Emergency Plans for Production and Utilization Facilities," Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants," and Regulatory Guide 3.42, "Emergency Planning For Fuel Cycle Facilities and Plants Licensed Under 10 CFR Parts 50 and 70."

Recommendations

1. Recommendations made by the Task Force on Emergency Planning should be acted upon by cognizant managers. Interagency issues should be quickly resolved.

2. Revise NRC Manual Chapter 0502 to provide guidance regarding coordination of the NRC emergency response actions with all outside agencies. (Current guidance pertains essentially to DOE and the FBI.)

3. Take steps to ensure NRC acceptance as the lead agency for responding to nuclear emergencies. Clarify jurisdictional boundaries between NRC and other State/Federal agencies.

4. Monitor development of the AIF emergency organization scheme for all licensees and incorporate into Regulatory Guide 1.101, if appropriate.

## 3.5 Application of Regulations and License Conditions

The application of regulations and license conditions is more difficult during an emergency than during normal operation. Inspectors can face requests for permission to exceed a regulatory limit, to violate a limiting condition for operation, or to ignore a surveillance requirement when, in the licensee's view, compliance would create a worsening situation. For example, in an emergency a licensee might request permission to release radioactive gas at a greater rate or concentration than permitted by technical specifications, or to exceed a personal exposure limit in order to rescue personnel or mitigate the accident; or to take out of service a normally required instrument or piece of equipment.

While such relief might sometimes be justifiable, it does not appear appropriate to give blanket relief from regulations or technical specifications during an accident. Had the licensee adhered to the technical specifications by following procedures, the accident at TMI may have been mitigated. (Had the Loss Of Reactor Coolant/Reactor Coolant System Pressure emergency procedure

(EP 2201-1.3) been followed, high pressure injection would not have been interrupted or throttled with the RCS at low pressure conditions. Had the Pressurizer System Failure Procedure (EP 2202-1.5) been followed, the electromatic relief isolation valve would have been closed before initiation of the TMI accident.)

When a plant becomes involved in a serious accident situation like TMI, the applicability of technical specification requirements may become essentially undefined because the context in which they were established may no longer exist. At such times, the central problems to be addressed are maintaining adequate core cooling, controlling radioactivity releases, and achieving a stable situation. IE inspectors and licensees should not be distracted by LCOs that may no longer be applicable. Conversely, special LCOs might be appropriate during accident conditions.

Regulatory requirements relating to radiation exposure limits are given in Title 10, Code of Federal Regulations Part 20 (10 CFR 20). Within reasonable limits, exposures would be subsidiary to considerations of personal or plant safety. It may be appropriate to reevaluate 10 CFR 20 limits, as they currently stand, or to examine the possibilities for deviating from those limits.

Technical specifications and regulations reflect a lengthy process of safety analysis and review. They provide carefully constructed guidelines for safe conduct of the facility. To depart from them during an accident may be precarious. Only if it can be clearly demonstrated that adherence to regulations or technical specifications will worsen the accident should departure be allowed. Departure from technical specifications should have the concurrence of the most senior licensee and NRC personnel available at the time before such a departure.

The application of regulations and license conditions in emergency situations should be described, perhaps in the regulations and licenses themselves. This would benefit licensee and NRC personnel making difficult decisions during an emergency. Perhaps a separate section of the technical specifications should be devoted to abnormal operations.

A related question is whether, during an emergency, a licensee may perform every function permitted during normal operation. For example, following a significant reactor accident may the licensee release gaseous and liquid effluents in the normal operational manner? If a function is inherently safe during normal operation, can that function logically be prohibited during an emergency unless the function has become unsafe? This question deserves a policy statement regarding licensee authority to abide by license conditions in an emergency.

In a slow-paced emergency like the Three Mile Island accident, questions of application of regulations and license conditions can be referred for regional or headquarters action. But during a fast-paced emergency, inspectors on site could be required to answer such questions with little or no time for regional or headquarters consultation.

Recommendation

Establish and announce a firm policy regarding the responsibility and authority of licensees to follow and the authority of licensees to violate regulations and license conditions during emergencies. Provide additional guidance, as necessary, for the benefit of licensees and IE inspectors.

## 3.6 IE Policy and Direction

### 3.6.1 Assistance vs. Regulation

A troublesome aspect of emergency response is whether NRC's role should be to assist or to regulate the licensee. This problem resolves easily during minor emergencies but not during major emergencies. Given NRC's mission of protecting public health and safety, it is natural to assume an assistance role during emergencies to ensure such protection. Once established, an assistance role might be continued unnecessarily. On the other hand, it is possible that assistance could be terminated prematurely. Neither situation would be desirable.

Whether to assist depends on the nature of the emergency, the licensee's capability, the dictates of outside influences, and the tendencies of involved personnel. Advantages of assisting include obtaining more information, applying more manpower and equipment toward controlling the emergency, and perhaps increasing public confidence that the situation is under control. Disadvantages include loss of manpower and equipment from other activities, the difficulty of reverting to a regulatory role, and the sharing of responsibility with the licensee. The NRC may incur legal or financial obligations or be subject to conflict of interest once the regulatory role is abandoned. (See "Adverse Effect of Accidents on Other IE Activities," Section 3.16.)

It may not be possible to state a detailed policy applicable to every emergency. However, some policy and direction are needed to form the basis for reasonably uniform management decisions for various emergencies.

Recommendation

Publish a statement of NRC policy regarding assisting licensees. The statement should identify conditions (e.g., licensee unavailable, undermanned, or overwhelmed) under which assistance might be warranted. The statement also should discuss the limits of providing advice, direction, and equipment.

### 3.6.2 Takeover from Licensee

A step beyond providing assistance to a licensee during an emergency might be to interpose NRC direction by relieving licensee management during emergency response. This could be a natural course of action following a transportation accident, particularly if the licensee could not respond quickly. On the other hand, it could be a serious action if invoked in the licensee's facility. Policy and direction in this regard are needed to form the basis for reasonably uniform management decisions. (See "The Role of the IE Inspector," Section 3.3.5.)

Recommendation

Referencing the statutory authority, publish a statement of NRC policy regarding takeover from licensees. The statement should identify conditions under which takeover might be warranted, such as:

- Licensee unavailable
- Licensee proposing to perform or performing actions which are not prudent or legal
- Licensee understaffed or overwhelmed
- Licensee uncooperative

### 3.6.3 Independent Measurements

While in the case of TMI Region I was reasonably well equipped and trained to perform independent measurements, IE as a whole is not uniformly equipped and trained to perform independent measurements following an accident. This weakness may result from lack of policy and direction. Any doubts about the need for postaccident independent measurements should have been resolved by TMI. Such measurements are needed to confirm and supplement licensee measurements within and outside the licensee's property. (See "IE Instrumentation and Equipment," Section 3.9.3, and "Regional Capabilities," Section 3.14.3)

Recommendation

Publish a statement of policy regarding postaccident independent measurements. On the basis of this policy, establish a continuing program for uniformly training and equipping regional personnel to perform such measurements. Establish a centrally located facility to provide these training and equipment services and to provide radiochemistry support to the regions during both normal and emergency operations.

### 3.6.4 Emergency Dose Limits for NRC Personnel

The TMI accident created a significant potential for exposure of some NRC personnel. Inspectors and others faced significant radiation fields, potentially significant airborne concentrations in the plant, and the possibility of exposure through resultant release plumes. Three questions are raised by this situation. First, what dose limits, for both internal and external exposure, apply to NRC personnel in emergencies? Second, do any NRC employees (inspectors and others) have the right to refuse assignments because of their potential for radiation exposure? Third, does working for the NRC imply some employee acceptance of risk to radiation exposure?

#### Recommendation

Publish in the NRC Manual statements of NRC policy regarding emergency dose limits and whether an employee has the right to refuse assignments, during both normal and emergency conditions, because of the potential for radiation exposure.

### 3.6.5 Safety vs. Security

A potential conflict exists between the simultaneous needs to control and permit access to Part 50 and 70 facilities. On the one hand, access must be controlled for the physical protection of special nuclear material. On the other hand, access must be permitted to ensure the safe use of such material. During normal operation these needs are compatible. However, during abnormal operation access controls could interfere with actions necessary to prevent or mitigate an accident.

Policy and direction regarding this potential conflict between two worthwhile facets of regulatory control are needed as a basis for a uniform inspection/emergency response program in this area. (For further discussion, see "Safety vs. Security," Section 3.15.4.)

Recommendation

Publish a statement of NRC policy regarding the relative importance of controlling access to Part 50 and 70 facilities to satisfy Part 73 and of permitting access to such facilities to perform tasks essential to safety. Also, require that the topic be addressed in licensee contingency plans.

## 3.7 Training and Qualification

Adequate numbers of qualified, competent personnel are required for operation and inspection of a nuclear facility. Licensee personnel must be qualified not only to operate the facility safely but to monitor operations and processes and to react promptly and accurately to transients and accidents. NRC personnel must be knowledgeable to a level adequate to evaluate compliance with applicable regulations, to observe and critique operational or functional actions and systems, and to comprehend the workings of facility components. They must know when a situation may be getting out of control and know appropriate actions or courses of action to prevent the situation from jeopardizing the health and safety of the public.

In an emergency, the inspector may be called upon to recommend corrective action, should the licensee be unable to grasp the significance of the situation.

The terms "training," "qualification," and "certification" used in this section are defined as follows:

. Training - Instruction of personnel through formal classroom courses, self-study, informal lectures and discussions, and on-the-job experience to achieve a minimum level of proficiency. Training may include tests or examinations.

. Qualifications - The sum of an individual's training activities and experience, which when reviewed and evaluated by appropriate management may result in the certification or approval of the individual to perform specified functions.

. Certification - The formal written recognition by an appropriate body or official that an individual's qualifications meet or exceed job requirements. The process of receiving certification may require examination or testing.

### 3.7.1 Licensee Personnel

Currently, qualification requirements for power plant personnel are specified in the American Nuclear Standards Institute (ANSI) publication ANSI N18.1, "Qualification of Power Plant Personnel," which is to be replaced by American Nuclear Society (ANS) publication ANS3.1, "Selection and Training of Nuclear Power Plant Personnel." Various deficiencies in licensee personnel training and qualification were identified at TMI after the accident.

At TMI, five of twelve radiation/chemistry technicians and nine of twelve radiation/chemistry technician juniors did not meet ANSI N18.1.

TMI procedure 1670.9, "Emergency Training and Emergency Exercise," specifies by job title the assignment of emergency duties and the training to be provided. Forty-eight TMI employees had not received the required training.

NRC review of the retraining program of the Radiation Protection Department at TMI noted that the TMI retraining program did not meet the requirements of ANSI N18.1, Section 5.5.1, in that major retraining was either not conducted entirely in some areas or was severely limited in other areas.

10 CFR 50.57, "Issuance of Operating License," Section 50.57.a(4), states, ". . . an operating license may be issued . . . upon finding that . . . the applicant is technically and financially qualified to engage in the activities authorized by the operating license in accordance with the regulations in this chapter. . ." Failure of a licensee to provide a staff trained and qualified to properly respond to accidents should be cause to withhold the Operating License.

Recommendations

1. Review Part 50 and 70 licensee training records and interview trainees to ensure adequate training and resultant qualifications in the various areas of emergency preparedness. Verify that personnel assigned meet or exceed the training requirements of ANSI N18.1 and/or other applicable guidance.

2. Review shift staffing procedures to ensure that all emergency team, emergency organization, and minimum shift crew training and qualifications are met when personnel are assigned or selected for a shift.

3. If the above have not been specifically inspected since March 1979, they should be inspected by March 1980.

4. Licensee personnel should be given additional training in plant operations under emergency conditions or when high contamination is present.

3.7.2 IE Personnel

As discussed previously in Sections 3.2, 3.3, and 3.4, the emergency role of IE is not clearly defined. This has resulted in insufficient emergency response training of NRC inspectors.

Current IE training does not include adequate health physics, public affairs, security, or IE emergency response training. No standardized program exists within IE to certify that personnel are qualified to respond to emergencies. The quality of emergency response may be a function of who is available to respond. No specific training guidelines for supervisory personnel are established.

Resident inspectors are the front line of assurance that the public health and safety will be protected. As such they must be highly trained and skillful individuals. Common public perception is that the NRC inspector knows everything about facility operation and that he could "take over" if necessary to ensure proper operation. Although a takeover capability is not envisioned, the public's expectation of highly qualified inspectors must be met. (See "The Role of the IE Inspector," Section 3.3.5.)

During interviews and discussions with IE personnel, several items and opinions were disclosed about personnel training and qualifications:

- If an "average" NRC inspector had been in the TMI control room at 0400 on March 28, 1979, he would not have been familiar enough with the reactor to have known in detail what was happening or to have taken actions which may have mitigated the accident.

- Some NRC operations personnel dispatched to TMI were unfamiliar with B&W PWR characteristics. Some construction inspectors assigned to TMI had little training in emergency response activities.

- Some NRC radiation protection and environmental personnel dispatched to TMI had not completed orientation training or were not normally assigned to reactor radiation protection or environmental inspection programs.

- In assigning facilities to operations inspectors, facilities have been assigned without regard to prior site-specific training.

- Inspectors and other NRC personnel need additional radiation protection training in order not to contaminate or endanger themselves. Specifically, this includes training in survey meter operation, calibration, and limitations; respirator protection and use; use of thyroid blocking agents (KI) and potential side effects; exposure limits for NRC personnel; decontamination procedures and techniques; air sampling methods and limitations; and personal dosimetry.

- Current NRC operations inspector training courses and simulator instruction yield significantly less than the training required of applicants for Senior Reactor Operator (SRO) licenses.

- Some members of NRR deployed to TMI during the accident had little familiarity with reactor plant operations, plant systems, or health physics controls.

The above comments suggest that:

- NRC does not require its own personnel to be trained formally in emergency response functions. Some personnel may not be adequately trained.

- Not all NRC personnel are adequately trained in health physics and security, if outside their functional inspection or review responsibility.

- Some NRC inspectors may not meet the knowledge level necessary to observe, assess, and evaluate the licensee's operator actions during transients to know when errors or mistakes are being made or are about to be made. This could result in the NRC being in the control room only as an observer during an accident in which the public health and safety is endangered.

The NRC should strengthen its training to ensure that all inspectors in the field are qualified to conduct inspections and to respond to emergencies. Toward this end, the Special Review Group has evaluated current NRC inspection and emergency response programs and training programs, interviewed inspectors, and discussed with the IE Training Branch proposed improvements to the training program. Improvement in the IE training program appears to be developing slowly.

The Special Review Group recognizes that the recommendations proposed in the area of training are expensive and represent a significant departure from existing programs. However, the need for qualified individuals must be met. To this end, NRC and IE must make a dedicated commitment to training.

Recommendations

1. Establish an Office of Training, which would operate an NRC Training Center. Locate the NRC Training Center to take advantage of simulator facilities and existing reactor proximity; for example, near the TVA Training Center in Chattanooga, Tennessee. New IE personnel should attend appropriate Training Center courses, or receive certification of competence, before being allowed to conduct unescorted inspections or being assigned lead responsibility for a facility. Existing IE inspectors should be certified or should attend appropriate Training Center courses until certification is received. The Training Center should conduct for IE, as a minimum, courses dealing with the following:

- Reactor operations (BWR, PWR, HTGR), including thermodynamics, hydrodynamics, transient behavior, safety limit deviations, etc.
- Reactor operations (facility specific)
- Health physics
- Security
- Emergency planning/response
- Inspection techniques
- Regulations
- Fuel facility operations
- Test/research reactor operations
- Transportation of radioactive materials
- Reactor simulator
- Investigation and law
- Fuel cycle overview
- Environmental protection
- Yearly reactor operation experience transient history and developments
- Core physics (BWR and PWR)

- Public affairs
- Independent measurements
- Radwaste systems

The Office of Training should offer similar courses for other NRC offices as part of the Training Center curriculum. Examples include:

- Development of Safety Evaluation Reports (SER)
- Short course on reactor operations
- Development of Standard Review Plans
- Standard Technical Specifications
- Other courses to be specified by Office Directors.

Simulator training should be given to resident inspectors for hands-on training on a plant simulator most closely resembling their own site. For example, Surry resident inspectors should receive training on the VEPCO simulator. This will enhance the resident's capabilities in an accident situation.

Certification of IE inspectors should be made by an appropriate certification board or official. In the event an individual is considered qualified by the Regional Director but has not completed formal training, the Regional Director could recommend immediate evaluation and certification of the individual.

To support training needs for supervisors or for other NRC offices, short courses may be developed in some of the above areas. For example, a supervisor refresher on emergency planning should be given.

A major commitment to training is recommended. The Training Center should conduct an extensive training program for new-hires as well as support existing staff training. Certain courses (such as the resident inspector training courses) should be repeated frequently to allow a newly hired inspector to complete training and certification within one year of hire.

2. Promptly establish training and certification programs to prepare reactor resident inspectors to be responsive in the event of an accident, as well as to perform routine inspections. Certify both existing and new resident inspectors.

Other training activities and certification of residents should be controlled by the regions under an IE standardized program. Key aspects of this program include:

- Training for Resident Inspectors:
  - Commence "on-the-job" training immediately upon hire/relocation to site. (Be identified as a "trainee" to the licensee before certification).
  - Regional "orientation" for 2-3 weeks during first month of service with the NRC.
  - NRC orientation course.
  - 10-Week BWR/PWR course, including: reactor technology - 4 weeks; advanced technology and/transients - 3 weeks; simulator training - 2 weeks; and operation - 1 week (Portions of this course are currently being developed.)
  - Health physics introduction - 3 days
  - Security, public affairs; emergency planning/response training - 2 days.
  - Fundamentals of inspection - 1 week.
  - Self-taught courses on Atomic Energy Act, Code of Conduct, Enforcement, and 10 CFRs.
  - Complete site-specific "Qualification Notebook," including such items as system drawings/walkdowns, plant/system descriptions, administrative controls for facility, and facility emergency plan.
  - Accompany region-based operations inspectors on inspection activities at the resident inspector's site.
  - Accompany region-based operations inspectors on inspections at other facilities quarterly. (Should include several days in the regional office.)

The Resident Inspector trainee should complete the entire training cycle by the end of the first year of employment. Written exams given as part of the classroom portion of training, a completed Qualification Notebook, other written products of the trainee, and inspector evaluations can provide management sufficient information regarding the individual's progress.

- Certification for Resident Inspectors

  - Complete 1 year of NRC employment
  - Complete formal training (classroom and simulator training)
  - Complete other training, Qualification Notebook, and on-the-job training as listed above.
  - Be recommended for certification by the Section Chief and by the Branch Chief or Regional Director.
  - Be examined and certified by a certification board or official.

- Required training to maintain resident inspector proficiency:

  - Attend BWR/PWR (as applicable) refresher - 1-week every year. At least 50% of the time should be spent on the simulator.
  - Attend refresher on inspection techniques, health physics, security, and emergency planning - 1-week/year.
  - Participate in one inspection per quarter at another facility.

- Optional Resident training:

  - Management Oversight and Risk Tree (MORT) Course - 1-2 weeks
  - Public Affairs Training - 1 day

3. To provide for individual recognition and documentation, develop a program leading to a Senior Resident Inspector (SRI) certification, which requires the inspector to have site-specific knowledge adequate to ensure facility comprehension and the ability to evaluate transients and accidents. This will require knowledge at a level adequate to direct licensee actions, if necessary.

4. Expand training for IE supervisors and management to ensure that fundamentals in various disciplines and licensee operations are retained in order to ensure that supervision/management is prepared to direct NRC emergency activities. The following training is recommended:

- RONS Section Chiefs and Branch Chiefs should attend a 1-week BWR/PWR refresher every two years.
- RONS Section Chiefs and Branch Chiefs should attend a 1-week refresher in health physics, security, and emergency planning every three years.
- Health physics and security supervisors should attend a 1-week BWR/PWR, fuel facility, and test/research reactor refresher every two years.
- Regional Director and IE Division Director should attend a refresher on BWR/PWR operations, health physics, and emergency planning every three years.

5. Review training needs for IE staff not directly involved in operating reactors to ensure staff readiness for emergencies. Several suggested training courses are:

- DOE investigator course
- MORT training
- Radiological emergency response operations (DOE)
- Specific training regarding transportation accidents or fuel/materials facilities.
- Headquarters staff refresher on BWR/PWR operations, health physics, and emergency planning.
- Construction inspector training concerning emergency response.

6. Consider offering training in emergency response to appropriate State and local agencies.

7. Conduct emergency response training, as necessary, for other Offices and Divisions within NRC.

### 3.7.3 Other NRC Personnel

Activities of the Executive Management Team (EMT), Incident Response Action Coordination Team (IRACT), the Commissioners, and others during TMI disclosed the need for intra-NRC training in accident response to ensure familiarity with roles and responsibilities, and with intra-agency and interagency interfaces.

The agency does not have an established program for training personnel in the various offices. Staff members with expertise in a specific discipline may require general reactor technology training or other general orientation courses. All new-hires to the agency should attend a NRC orientation course within the first month of employment.

Recommendation

1. Establish an emergency response training program involving all levels of NRC employees. Periodically brief the NRC Commissioners, EMT members, and IRACT members concerning emergency preparedness.

2. Office Directors should identify courses to be offered by the Office of Training for their staffs. This may include short courses for supervisors (similar to recommendation No. 4 in Section 3.7.2) or courses in a specific discipline or technical area.

3. The Office of Training should develop a curriculum to meet the needs of other NRC offices.

## 3.8 Administrative Controls

### 3.8.1 Licensee Controls

Licensee administrative controls can adversely affect IE during an emergency. For example, site access controls, training requirements, medical examination requirements, radiation exposure limitations, and controls on access to data and personnel could hamper inspections and investigations.

Recommendation

Ensure that licensee administrative controls do not intentionally delay or unnecessarily hamper IE personnel.

### 3.8.2 NRC Controls

Certain NRC administrative matters affect IE's ability to respond rapidly to an emergency and to maintain effective long-term inspections or investigations. Among these are: prompt availability of money, tickets, and transportation; work hours; length of assignment; returns to normal duty office; overtime and holiday assignments and compensation; security, respiratory protection, and radiation protection training credentials; radiation exposure limits and records; and provision of personal dosimetry and respiratory protection equipment.

Recommendation

Establish and document policy regarding all administrative matters affecting IE's ability to function effectively and efficiently in response to an emergency. Provide services and supplies as necessary.

## 3.9 Resources

### 3.9.1 Licensee Instrumentation and Equipment

During the TMI accident, instrumentation and equipment problems contributed to reduced response effectiveness. The licensee emergency plan and implementing procedures required actions which could not be supported, during the initial phase of the accident, by existing licensee resources.

Ample resources must be available and operable to respond to an accident. Licensee instrumentation and equipment must be maintained adequately to perform designated functions.

Several difficulties were identified during the occurrence of hurricanes affecting Region II. On September 3, 1979, during the passage of Hurricane David over the Florida Power and Light's St. Lucie facility, the plant lost power to the plant meteorological tower. The plant meteorological tower was only provided offsite power. During hurricane Frederic, which passed near the Farley Plant on September 12, 1979, it was found that the licensee's windspeed indicator was effective to a maximum speed of 50 mph, well below the hurricane wind speed.

Recommendations

1. All Part 50 and 70 licensees should review existing emergency plans and implementing procedures to ensure that specified actions can be performed. This review should include but not be limited to an assessment of the following:

- Availability and operability of survey instruments
- Availability and adequacy of vehicles to be utilized by environmental survey teams:
  - 4-wheel drive vehicles
  - Snowmobiles, etc.
  - Boats
  - Helicopters
- Availability of direct reading dosimeters
- Availability, range, location, and readout of plant radiation instrumentation
- Availability and replenishment of respirator protection equipment
- Ability to sample in high radiation fields
- Location and availability of counting laboratories during high inplant radiation levels
- Availability and adequacy of environmental samplers:
  - Resin columns for iodine in milk
  - Silver zeolite in charcoal adsorber cartridges
  - Battery or generator
  - TLDs

2. The licensee's meteorological system should be supplied with dedicated power or backup emergency power. The windspeed indicators should be upgraded to allow measuring the highest expected wind speed.

### 3.9.2 Licensee Other Resources

Following the TMI accident the licensee had to draw on resources from outside its own organization, as well as resolve problems concerning instrumentation and equipment as discussed in the previous section. To a great degree the quantity and location of these resources was determined on a spur-of-the-moment basis. The need for these resources changed as the emergency progressed. The licensee's procedures must allow some flexibility in the area of outside resources.

#### Recommendation

Each Part 50 and 70 licensee's emergency plans and procedures should include the name, location, and number of individuals, companies, governmental agencies, and other utilities which could furnish either personnel or equipment in support of the licensee's emergency effort. This should include but not be limited to:

- Technical personnel from vendors, architect/engineers, and other contractors associated with design and development of the plant.
- Operations and health physics personnel from other utilities.
- Local commercial suppliers of office equipment, trailers, and canteen services.
- Radiation protection and environmental monitoring consultants.
- Contract security agencies to supplement security force.
- Local military bases which can furnish logistical support.

### 3.9.3 IE Instrumentation and Equipment

A licensee may not have have a supply of radiation protection instruments and equipment adequate for a major accident. Thus, responding IE personnel should transport instruments and equipment essential to the IE function and to assist the licensee, if necessary. Size limitations, the rigors of travel, and other peculiarities bear heavily on the nature and number of such instruments and equipment, which could include portable survey instruments, personal dosimeters, respiratory protection equipment, air samplers, and sample counting instruments. (See "Regional Capabilities," Section 3.14.3.)

Recommendations

1. Determine regional instrument and equipment needs and transportation methods. Purchase instruments, equipment, calibration sources, carrying cases, and other accessories, and provide specialized training regarding calibration and use. Establish a full-time position at each region for the purpose of maintaining, calibrating, and transporting such instruments and equipment.

2. Procure a mobile whole body counter to be installed at one regional office, which would transport it to any accident site, as necessary.

### 3.9.4 IE Other Resources

The nature, size, and duration of an emergency will determine the extent to which IE would have to draw on outside resources. NRC personnel involved in the response to TMI have identified various resources as being available to NRC on short notice. Contacts developed in the TMI response are a resource that should not be lost in the post-TMI planning processes. One problem encountered at TMI was the difficulty of obtaining prompt assistance from NRC medical consultants, one of whom was also consulting to the State of Pennsylvania.

Recommendations

1. NRC and regional emergency response plans should include the name, location, and number of individuals, companies, and agencies that could furnish support. This should be site specific, where necessary, and should include but not be limited to:

- Medical Consultants
- Other technical personnel and equipment
- Additional monitoring capability (IE, DOE, EPA, State Environmental)
- Local commercial suppliers of office equipment, trailers, vehicles, canteen services, and air travel
- Contract security organization
- Communication capabilities (Forestry, GSA, State Police)
- Local military bases which can furnish logistical support

2. To the extent possible, ensure that NRC medical consultants will be willing to respond whenever and wherever needed, and that they will not be encumbered by consulting arrangements with licensees or other organizations.

### 3.9.5 NRC Operations Center and Regional Response Centers

At about 0800 on March 28, 1979, the Region I Response Center and the NRC Operations Center were activated.

The Region I Response Center is located in a 24' x 40' second floor conference room. Upon activation, certain Region I personnel bring their telephones, to connect to phone jacks located on the wall, and arrange the conference room furniture as required.

The NRC Operations Center (Figure 3.9.5.1) consists of two work areas 20' x 25', one support office 13' x 9', and one file room 13' x 10'. One work area, the Executive Management Team (EMT) room, seats 10 in a U-shaped table arrangement. The other work area, the Incident Response Action Coordination Team (IRACT) room, has 12 tables seating 15. There are 9 telephone extensions in the EMT room and 11 telephone extensions in the IRACT room. Since TMI, as discussed in Section 3.11.2, a hotline telephone console has been added to the IRACT room.

Supplies for the NRC Operations Center include TV, telephone (20 channel) recorder/playback system, status boards, and projector. Reference material, including site emergency plans, is kept in the file room.

During the TMI event, 80 people were in the IRACT room at one time. Over 30 people were in the EMT room at one time. There was no method of controlling access. There was confusion over the status of events. Time was wasted briefing new people individually. The ventilation system was turned off at night. People on call were able to sleep in chairs or in adjacent offices. There were limited provisions for food. Staff from other Divisions and Offices did not have adequate space or communications.

The Region I Response Center also did not have adequate work space or communications. Telephone lines were not recorded, so reconstruction of conversations depended on telephone record sheets.

From the standpoint of physical facilities, neither Region I Response Center nor the NRC Operations Center was able to support the TMI accident effectively.

Recommendations

1. Redesign and reconstruct the NRC Operations Center to support a major accident (Figure 3.9.5.2). As a minimum, the Operations Center should contain or be designed to the following criteria:

- EMT Room
  - Maintain existing size (20' x 25').
  - Place acoustic material on walls to reduce background noise.
  - Locate centrally to surrounding support offices.
  - Restrict access to EMT.
  - Place all telephone extensions in EMT room on each EMT phone.
  - Conference chaining capability on EMT phones.
  - Install a voice recorder system in EMT room to record decision making process.
  - Install a facility data CRT computer terminal in EMT room (See "Equipment," Section 3.11.10).

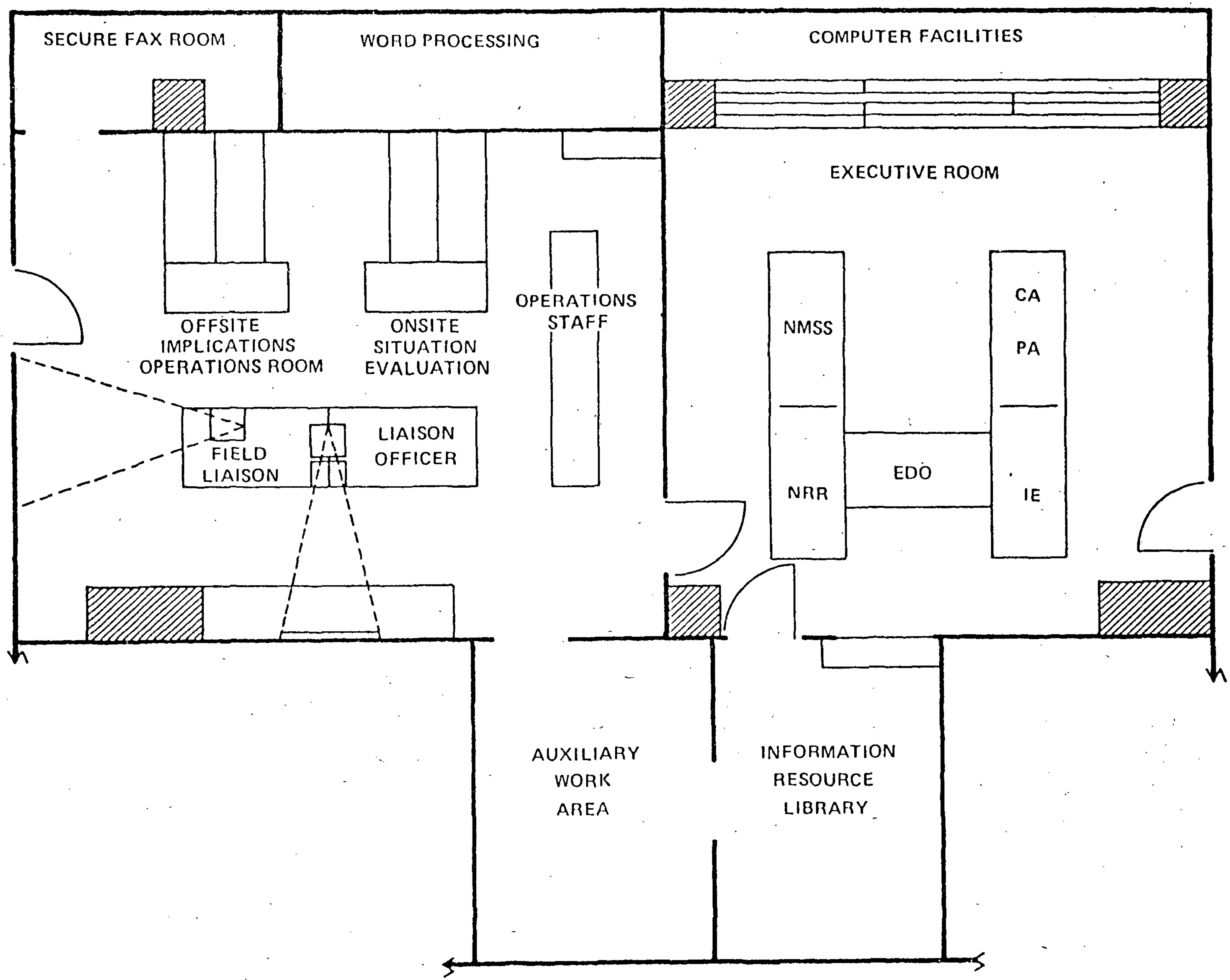
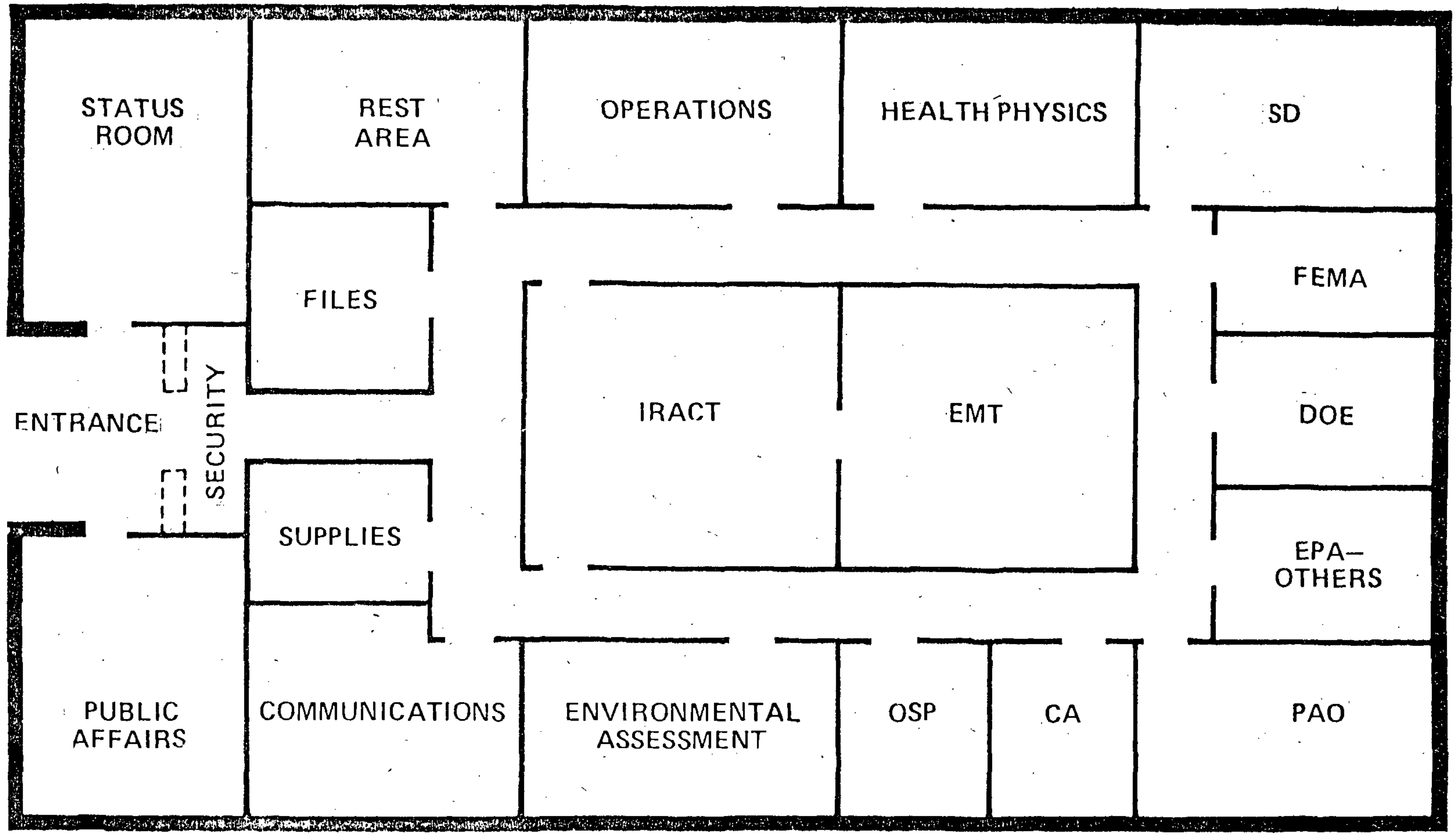



FIGURE 3.9.5.1
EXISTING NRC OPERATIONS CENTER



STATUS ROOM
REST AREA
OPERATIONS
HEALTH PHYSICS
SD
FILES
FEMA
ENTRANCE
SECURITY
IRACT
EMT
DOE
SUPPLIES
EPA– OTHERS
PUBLIC AFFAIRS
COMMUNICATIONS
ENVIRONMENTAL ASSESSMENT
OSP
CA
PAO


FIGURE 3.9.5.2

IRACT Room

- Provide for a staff of two people per IE Division and each of the other NRC offices, to coordinate EMT requests between the EMT room and Evaluation Team (ET) rooms.
- Install an intercom system between the EMT and IRACT rooms.
- Maintain existing size (20'x 25').
- Place acoustic material on walls to reduce background noise.
- Install partitions to enclose the working space of each Division and Office.
- Install a facility data CRT computer terminal in the IRACT room (See "Equipment," Section 3.11.10).

Evaluation Team (ET) Rooms

- Provide separate rooms for:
  - Operations
  - Health physics
  - Environmental assessment
  - Office of State Programs
  - Office of Standards Development
  - Public Affairs Officer
  - Congressional Affairs
  - Administration
  - Federal Emergency Management Agency (FEMA)
  - Department of Energy (DOE)
  - Environmental Protection Agency (EPA)

Size each ET room for the number of participants anticipated for efficient operation. Install acoustic wall material and telephone intercom connections to the IRACT room. Each telephone should also have two outside lines.

- Install a facility data CRT computer terminal for status update in the operations, health physics, and environmental assessment rooms.

- Communications Room

  - Route all EMT, IRACT, and ET room telephone extensions through a master telephone console.
  - Install a master page system to allow paging among all the rooms.
  - Install a "beeper" system to retain contact with selected people throughout the building.
  - Provide space for an operator and assistant.
  - Install the telephone recorder and EMT voice systems.

- Status Room

Provide a conference room (20' x 25') with a stage and status board area where a complete update of all pertinent information can be displayed. Install a facility data CRT computer terminal in Status Room. Also, install message boards, personnel in/out boards, and a TV for news reports.

- Security Station

At the entrance to the emergency center complex, provide a security guard station to control, limit, and record access, and to issue nametags.

- Public Affairs Room

Provide a small conference room (15' x 25') for press conferences and issuing news releases, and for a point of contact with media and public officials.

- File Room

  Provide file room for secured storage of emergency plans, maps, overlays, and reference materials.

- Rest Area

  Provide a room where EMT members may rest and eat.

2. Recognizing that recommendation 1, above, is essentially a "long term fix," the following items are recommended for a "short term fix" for the existing NRC Operations Center:

- Place acoustic material on the walls (and ceiling if necessary) in the EMT and IRACT rooms to reduce background noise.
- Install emergency lighting in the EMT and IRACT rooms.
- Install a voice recorder system in the EMT room.
- Install a Communications Room next to the EMT room. The Communications Room should have a master telephone console with all EMT and IRACT room extensions, and an office intercom system with existing intercom extensions. The Communications Room should be the location of the hotline telephone system from the licensees, and the location of the telephone recorder system. The Communications Room should have the "beeper" system and a status board to indicate beeper holders.

3. Provide each NRC regional office a dedicated Regional Response Center room with, as a minimum, the following:

- Ten dedicated phone lines plus existing hotlines.
- Telephone recorder system for the dedicated phone lines.
- Status boards, maps, etc.
- Telephone chaining capability for conference calls, on dedicated phone lines.
- Office page system

- Reference room with reference materials, file cabinets, etc.
- TV and videotaping capability.
- A DARE employee to maintain Response Center resources.

4. Provide emergency lighting and around-the-clock air conditioning for all regional and headquarters emergency response facilities.

## 3.10 Investigation

### 3.10.1 Present IE Policy on Conduct of Investigations

Through interviews of NRC investigative personnel and examinations of existing documents, the SRG has determined that both IE and NRC have no formal guidance covering the conduct and reporting of investigations. Temporary Instruction 1260/1 on the IE Investigation Program issued on July 1, 1979 emphasizes the importance of an effective investigation program to both support and complement the IE inspection program. The Temporary Instruction further emphasizes that the investigative program should be managed by a "separate and distinct organizational entity."

Recommendation

Place increased emphasis on completing the Investigation Manual chapter presently under development.

### 3.10.2 Investigator Authority

SRG's review of the IE TMI Investigation Team's findings noted that team members had not been delegated the authority to administer oaths. Team members indicated that in several instances during the investigation this authority could have enhanced the quality of statements received and in some cases diminished the necessity for second and third interviews.

The Commission has the authority to administer oaths and obtain sworn statements pursuant to Section 161C of the Atomic Energy Act (42 USC 2201). On August 14, 1979, the Commission voted to delegate the authority to administer oaths and affirmation to the Director of IE. This authority may be redelegated to individual inspectors and investigators on a case by case basis after consultation with the Office of the Executive Legal Director.

Recommendation

Promptly redelegate to appropriate inspectors and investigators the authority to administer oaths and affirmations following emergencies.

### 3.10.3 Interview Transcriptions

TMI investigation team members were hindered by transcription delays in their review of interview tapes. It had been decided, apparently based on the sensitive nature of the material, that all transcriptions would be handled through the Region I typing pool. Manpower problems and transportation of tapes and transcripts between the team and Region I typing caused significant delays. Regional typing pools are not staffed to support the level of work that may result from a major investigation effort.

On the other hand, the Presidential Commission on TMI retained the services of a professional transcription service and the TMI Special Inquiry Task Force retained a court reporter service. Such services are utilized by other governmental agencies handling sensitive information. In many instances these services furnish cleared personnel.

Recommendation

Retain professional transcription service to work with investigation teams at accident locations. Also, assign a permanent clerical staff to the teams to handle administrative and clerical functions.

### 3.10.4 Qualification and Training

Temporary Instruction 1260/1 refers to the "special talent, training and skills" required by investigators. Except for a brief instruction on the conduct of interviews, given during the Inspector Orientation course, the NRC has no formal training program tailored to investigator needs.

At the present time, qualified investigative personnel are recruited from outside agencies. Regional inspection personnel, who frequently assist in investigations, have no training in investigative techniques, or knowledge of the laws of evidence or criminal procedures. (See "Training and Qualification of IE Personnel," Section 3.7.2.)

Recommendations

1. Prepare a formal training program within IE to familiarize the regional investigative staff with the peculiar needs of NRC.

2. Consider the various training programs offered by outside agencies during the interim period of establishing an NRC program.

3. Establish a training program to familiarize regional inspectors with investigative techniques and procedures.

3.10.5 Timeliness

The formal IE investigation into the TMI accident was not initiated at the site until April 10, 1979, two weeks after the accident. Members of the investigation team have stated that a trained investigator should have been dispatched with the inital response team to organize and retain portions of the supportive evidence (notes, logs, etc.) which were lost during the initial days of the accident. Although Region I dispatched two investigators with the initial response team, both were assigned duties other than investigation.

Recommendations

1. Assign one or two investigators to the initial response team to observe and to protect the integrity of documentary evidence.

2. Require that power reactor licensees install a video and sound recording system in every power reactor control room, to be activated in the event of a reactor or turbine trip. This system would record control room activities during the initial phases of an accident to assist NRC and licensee in reconstructing the facts of the accident.

### 3.10.6 Legal Assistance

Members of the TMI investigation team indicated that many legal questions arise during an investigation of this magnitude. These could include such matters as whether to advise an interviewee of the legal sanctions under Title 18 U.S.C. Part 1001, the administering of oaths, or the issuance of administrative subpoenas.

Recommendation

Assign a member of ELD legal staff to each accident investigation team to provide such assistance as may be needed.

### 3.10.7 Coordination with Other Agencies

In the area of investigations, the Commission coordinates principally with the Federal Bureau of Investigation. In these instances coordination is developed on a regional or individual basis. Lead authority in these cases would go to the Bureau, but the IE investigators' authority and role in these circumstances is not defined. While the FBI is considering a case for its criminal aspects, it is not necessarily concerned with problems of public health and safety. Additionally, the Bureau may not wish to publish information developed in the course of an investigation, whereas the Commission, from a health and safety standpoint, would. The IE investigator needs to be involved in all aspects of an investigation to be able to evaluate information in light of NRC's charter.

Recommendation

IE should provide guidance regarding the role of the investigator in the conduct of joint investigations with other agencies.

### 3.10.8 Liaison with Other Investigative Agencies

It is difficult to coordinate effectively with another investigative agency without first establishing and maintaining good liaison. The NRC requires licensees to establish and document liaison with assistance agencies, but does not encourage regional investigators to pursue liaison with agencies which could render valuable assistance in many areas.

A vast amount of intelligence information developed by other investigative agencies could affect NRC licensees or facilities. In many cases the information never reaches NRC, because these agencies are not cognizant of our needs.

Recommendation

Encourage regional offices to develop and maintain liaison with outside investigative agencies (e.g., Federal Bureau of Investigation; Drug Enforcement Agency; Alcohol Tobacco, and Firearms; Secret Service; Customs; and State Police Organizations).

## 3.11 Communication

Communication plays a vital role in accident response. Individuals and organizations are not effective if they can not communicate. Decision makers must obtain accurate and timely information, and their decisions must be accurately and swiftly disseminated to ensure effective action.

The structure of a communication system is dictated by organizational structures, interfaces, and needs. (See Sections 3.3 and 3.4.) Communication links between organizations must be clearly understood by organization members. In part, this can be accomplished by training and drills. The material/equipment needs to support communications must also be met.

### 3.11.1 Licensee Management

During the initial phases of the TMI emergency, members of licensee management had to be notified and in most cases summoned to the site. Little difficulty was experienced by plant personnel in reaching these individuals, primarily due to the fact that it was early morning on a normal workday. Had the emergency occurred on a weekend or early evening when many people are away from their homes, this could have impeded plant personnel efforts to reach their management.

#### Recommendation

Require all Part 50 and Part 70 licensees to review their emergency notification procedures and ensure that key management personnel are equipped with beeper units to enhance prompt communication in an emergency.

### 3.11.2 Site Telephones

On March 28, 1979, from 0704 until 0800, TMI was unable to contact the NRC through the Region I commercial telephone answering service. The answering service did not have instructions to notify other Region I personnel when the designated regional duty officer could not be reached. During the accident, the need for continuous telephone communication with the licensee was demonstrated. Because of the possibility of inadvertent disconnect and subsequent reconnect difficulties, a dedicated line was installed between TMI and NRC.

Subsequent to the accident, NRC installed direct "hotlines" from all power reactor control rooms and other selected facilities to the NRC regional office and to the NRC Operations Center in Bethesda. These telephone lines are now monitored continuously by the NRC, and a second dedicated line linking each facility to regional and headquarters emergency centers is planned. This line is expected to be a "radiation monitoring" line, whereas the first line provides direct control room communications.

Being part of the Centrex system, the dedicated telephone lines are subject to whatever weaknesses exist within that system. A recent failure of the Centrex system left the NRC without the use of these lines for several hours.

Recommendations

1. Expedite installation of the second dedicated telephone line to each major facility. Both dedicated telephone lines should contain sufficient flexibility to accommodate additional tie-ins, such as from an offsite "command center" or trailer complex.

2. Consider backup communication links to enhance reliability in the case of a Centrex interruption. For example, a radiotelephone link to the licensee's microwave communication system may be appropriate.

3. Establish contractual arrangements with telephone companies serving major facilities to ensure swift installation of telephone facilities necessary to support extensive communications following an accident.

### 3.11.3 Licensee Radios

It was apparent during the course of the TMI emergency that the licensee's radio communication capabilities were inadequate. Security and operations personnel both utilized the same two-channel portable FM transceivers (each having a separate channel).

In the case of security, the number of radios available was insufficient for the increased manpower needed for additional post requirements. On April 9, 1979, the security force was provided additional portable radios, raising the total from approximately twenty to thirty transceivers. This increased capability, combined with existing plant paging and conventional telephones and a requirement that security personnel not equipped with portable radios call the security control center every thirty minutes to report their status, enabled the licensee to control the situation.

Radiation monitoring teams were faced not only with the problem of insufficient numbers of portable units but also the problem of poor reception and transmission. Without repeaters and antennas strategically positioned in the area, the portable units were not capable of reaching the command center or reactor control rooms.

The licensee borrowed U.S. Forestry Service portable units to supplement their communications.

On September 3, 1979, Hurricane David passed over the Florida Power and Light Company's St. Lucie nuclear plant. Problems encountered included loss of the B train power supply and battery for approximately one hour. The plant microwave and radio system to the system load dispatcher were on the B power train. Had the telephone poles been knocked down, all offsite communications would have been lost. The NRC hotline and licensee commercial numbers are carried over the same telephone lines.

Recommendation

Require Part 50 and Part 70 licensees to review their emergency communication capabilities and to consider:

- Purchase of additional portable FM transceivers and charging units.
- Installation of FM mobile units in site emergency and survey vehicles.
- Installation of repeaters in the vicinity of the site.
- Installation of a hard wired antenna for the control building.

- Installation of wiring for an NRC antenna to be connected in the event of an accident.
- Installation of National Warning System (NAWAS) radio communications to the State NAWAS system and provision of the system with vital power.

### 3.11.4 Licensee Technical Support

During the early phases of the TMI emergency, the licensee experienced difficulty in contacting and obtaining assistance from the steam system supplier, architect/engineer, and various other contractors involved in the development of the plant.

The IE Investigation Team addressed the issue in stating, "The provision of substantive technical support to the management team directing emergency actions on operational matters suffered primarily as a result of communication difficulties. The physical communications facilities were inadequate to handle the volume of information requests and transmittals that this kind of accident required."

Recommendation

Require licensees to incorporate into their emergency procedures and to keep current the following:

- Lists and telephone numbers of senior operating personnel at similar plants.
- Lists and telephone numbers of steam system supplier, architect/engineer, and other contractor personnel involved in design or construction of the facility. The licensee should be required to ensure that prompt technical support is available at all times.

### 3.11.5 Licensee/NRC Interface

The physical communication capabilities of both the licensee and NRC were inadequate. In addition, there was no effective exchange of information between the two organizations. In many cases the NRC was not aware of readings and observations made by licensee personnel. As stated in the IE Investigation Team report on TMI, the licensee was not furnished NRC survey team data for several days into the accident.

Recommendation

During future accidents, both the NRC and the licensee should appoint a communications or information coordinator to accumulate and transmit data from field teams.

### 3.11.6 NRC Radios

NRC personnel have indicated that the TMI site inspection team was severely hampered during the initial forty-eight hours by the lack of portable radios/devices for communication between members. On March 30, 1979, the U.S. Forest Service, at the NRC's request, provided portable radios and support equipment. Had a major forest fire emergency existed or occurred, this vital equipment may have been unavailable. The Forest Service equipment, which was highly regarded by NRC personnel, reduced significantly the communication problems encountered. During the accident, however, the NRC was unable to monitor or transmit on the National Warning System (NAWAS) or the law enforcement channels utilized by State and local governments.

The NRC does not have any portable transceivers. During the initial response to an accident (especially a transportation accident), field communication is important. Later, support may be augmented by the Forest Service or DOE Nuclear Emergency Search Team (NEST) communications.

Recommendations

1. Review current systems and procure at least ten portable radio transceivers, with repeater units, for each Regional office. This equipment should be standardized and interchangeable among regions.

2. Equip each regional mobile laboratory (Section 3.14.3) with: 40-channel CB with high gain antenna; NAWAS and law enforcement transceiver, with antenna; and receiver/transmitter base station with antenna plus repeater for the NRC portable radio system.

### 3.11.7 Resident Inspectors

Resident inspectors are being assigned to facilities as rapidly as possible. It is desirable that resident inspectors be available "on call" much of the time away from the site, both for communication to their regional office and for "emergency call" to the facility.

#### Recommendations

1. Provide each resident inspector a "beeper," the beeper number to be kept by the regional office, the NRC Operations Center, and the licensee. If available, the beeper should be of the voice-message type. It is recognized that there will be times when the beeper is out of range or otherwise unavailable and that not all reactor locations have a local beeper service. The purpose of the beeper is to increase the probability that residents can be reached.

2. Provide each resident a four-wheel drive vehicle equipped with two-way radio to the facility and a mobile telephone.

### 3.11.8 Support from Other Agencies

Both the licensee's and the NRC's communication capabilities proved inadequate during the early stages of the emergency.

The Pennsylvania State Police provided communication assistance through their mobile command post located at "trailer city." The State Police trailer furnished State-wide radio capability in addition to telephone and public address systems.

The U.S. Forestry Service furnished NRC with a "Field Cache" radio network and the technical personnel to install and operate the system. A communications command post established in the IE trailer was furnished an 8-channel network for communication with TMI control rooms, NRC and DOE radiation survey teams in the fields, and the emergency evacuation command post in Carlisle. In addition, IE was able to furnish the licensee two channels.

Representatives of the Office of Administration's Telecommunications Branch have stated that contacts are being established with the U.S. Forest Service, DOE (NEST), GSA, DOD, and other agencies which can furnish similar radio communications systems in the event of an emergency.

Recommendation

In lieu of actually purchasing a similar communication network and training personnel in its operation, NRC should accelerate present negotiations with outside agencies and establish formal agreements to ensure communications when needed.

3.11.9 Support from Within the NRC

The Telecommunications (Tel Com) Branch within the Office of Administration is responsible for giving IE technical support and providing communications equipment.

Representatives of Tel Com indicated their intention to develop procedures and to conduct a site-by-site survey to analyze communication needs for future emergencies. The representatives stated that due to present staffing this will not be accomplished for a year to eighteen months after additional personnel are hired.

Tel Com has a Telex from Federal Emergency Management Agency (FEMA), which reports all current disaster information and weather conditions. At the present time, this information is examined by Tel Com in relation to its possible effect on nationwide communications. Tel Com has provided Region II with a teletype circuit for monitoring National Hurricane Center advisories. A similar teletype installed in Region V for earthquake information may be appropriate.

Recommendations

1. IE should assist Tel Com in assessing and evaluating communications available to NRC at potential emergency locations. Develop a Temporary Instruction to examine these areas during routine inspections. Technical instruction to the inspectors could be furnished by Tel Com personnel visiting the regions.

2. IE should arrange with Tel Com to furnish disaster and weather information to the Incident Response Action Coordination Team (IRACT) after an accident.

3. Tel Com should arrange Early Reporting Service teletype communication between Region V and the National Earthquake Information Service, Golden, Colorada.

3.11.10 Equipment

Before the TMI accident, the NRC emergency preparedness philosophy was to establish communications with the site and to dispatch a site inspection team. Following the TMI accident, the Executive Management Team was unable to receive timely plant status information. Meteorological information was telephoned hourly by NRC personnel to meteorological analysts. Radiation monitor readings were also telephoned periodically to the NRC. However, assimilation and dissemination of the information was slow and sometimes inaccurate.

Following the TMI accident, the SRG interviewed IE inspectors, NRR and EMT personnel, and communications specialists in the NRC and an NRC emergency preparedness consultant. One suggestion, telemetry of data from each facility to the NRC, has been widely discussed.

Certainly, advanced technology is available to telemeter data. Several system components are:

. Satellite Communication. COMSAT and other satellites are available to the NRC at competitive rates. Installation of receivers and broadcast units is complex; however, system reliability is high.

. Remote Terminal. Microprocessors to collect and collate information from plant process monitors, meteorological sensors, and plant operating parameters are available to interface with an acoustic data-link to remote terminals (NRC regional office and headquarters). Microprocessors could be accessed by telephone upon notification of an accident.

. Time-Shared Analysis of Data. Time-share computer systems, or dedicated microprocessor or minicomputer systems, are available to receive the data from a remote terminal or perhaps from the licensee's process computer, and provide a graphic output to CRT displays. These units can provide maps of the site with resultant demographic and topographic data superimposed and with resultant plume dispersions shown. Also, files of reactor parameters and release information are available. These data can be displayed at a number of remote locations.

During operation of the NRC Operations Center, information on plant parameters, in-plant coolant sample analysis, environmental monitoring data, plant effluent monitors, and in-plant radiation surveys was received and hand recorded. However, this information was not disseminated effectively. Currently, NRC is utilizing the TERA Corporation field management system of computerized information retrieval. This TERA system could be used for information storage and modification concurrently with information display at several remote terminals. In this manner, the existing TERA system could be used to display at several locations, current accident related data, allowing simultaneous review by various NRC personnel. (See Figure 3.11.10)

The value of data from these systems is worthy of consideration. If NRC can receive more complete, accurate, and useful data, the consequences of an accident might be reduced.

Recommendations

1. Establish a task group of IE and other NRC personnel, including the Telecommunications Branch, to evaluate and determine the feasibility of such telemetry systems and alternatives.

2. Use the existing TERA system to store facility data for display in the NRC Operations Center complex.

## 3.12 Documentation

### 3.12.1 Licensee Documentation

During the early stages of an accident there is a tendency, perhaps a necessity, not to record information that would have been useful for both accident control and after-the-fact evaluation purposes. Although record maintenance should not detract from essential accident control or recovery activities, the importance of accident records should not be underestimated. Reasonable steps should be taken to avoid losing such information.

During the early hours of the accident at TMI the control room log was not adequately maintained in accordance with the licensee's Administrative Procedure 1012 (Shift Relief and Log Entries). Many items having significant safety implications were not recorded during the early hours of the accident. The plant computer is normally employed to generate records of selected plant parameters at TMI. Portions of this record were not documented on the computer printout. Survey records, RWP's, and access records were not adequately maintained during the first few days following the accident.

Recommendation

1. Require licensees to maintain normal logs, if possible, throughout an accident.

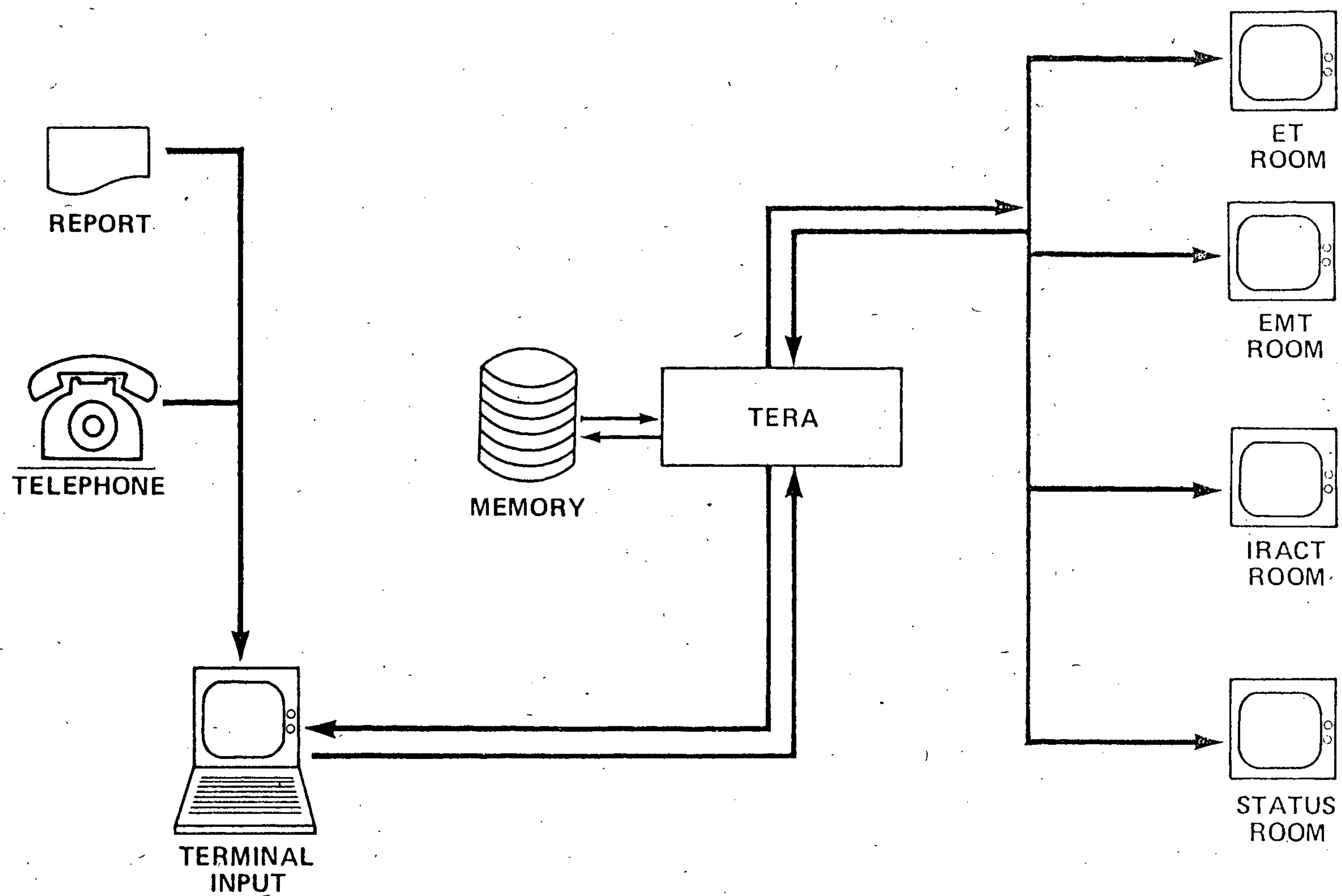



FIGURE 3.11.10
FACILITY DATA SYSTEM

2. As recommended in Section 3.10.5, power reactor licensees should install in every reactor control room a reactor or turbine trip actuated, videotape camera/recorder and a multichannel voice recorder to capture conversations and instructions that otherwise might be lost.

3. Licensees should consider the use of computerized storage systems to record, display, and analyze selected plant parameters. These systems should be powered by a vital power supply.

4. Licensees should consider the installation of backup computer printout facilities to ensure that no records are lost in the event the printer fails or the paper runs out during an accident.

### 3.12.2 NRC Documentation

IE personnel responding to accidents may not be properly equipped or trained to record pertinent information. At TMI, some IE personnel were not maintaining formal logs during the first few days of the accident response. Various means of record keeping were developed on an ad hoc basis. NRC Operations Center personnel tended to rely on the multichannel telephone recorder and some did not maintain detailed written logs during the TMI response.

Recommendation

Evaluate and standardize IE's capability for recording information and provide adequate supplies of logs, forms, recording devices, and other needs. Train IE personnel in the general area of information recording and in specific techniques used by NRC and licensees at various sites.

## 3.13 Licensee Emergency Preparedness

The state of emergency preparedness of Part 50 and 70 licensees varies significantly. During a review of the TMI inspection history, NRC inspectors stated that TMI was a typical facility. However, when coping with an actual event, the state of emergency preparedness at TMI was found inadequate. In addition, the Special Review Group notes that there does not appear to be consistent NRC regulatory guidance, regarding emergency preparedness, between facility types.

### 3.13.1 10 CFR Part 50 and Regulatory Guide 1.101

The regulatory requirements for licensee emergency planning are not as concise as for other phases of nuclear safety. Appendix E of 10 CFR Part 50 requires a safety analysis report to contain elements of an emergency plan. However, Appendix E is a generalized document subject to considerable interpretation. Furthermore, once an operating license is received, emergency preparedness generally becomes a function of licensee motivation not supported or encouraged by a regulatory basis.

NRC Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants" (Revision 1, March 1977), contains NRC guidance for developing emergency plans in the Final Safety Analysis Report (FSAR). The Three Mile Island Emergency Plan was completed for FSAR review and approval in 1974. Therefore, the guidance in RG 1.101 is not binding, nor does RG 1.101 require upgrading of previously submitted emergency plans.

At Three Mile Island and other reactor facilities, NRC permits variation in emergency plans and implementation, because a uniform standard (e.g., RG 1.101) has not been imposed as a license condition. A uniform approach to emergency planning and clear delineation of minimum acceptable programs is imperative.

Recommendations

1. Amend 10 CFR 50.54, "Conditions of Licenses," to clarify that 10 CFR 50, Appendix E, is a license requirement.

2. Amend 10 CFR 50.59, "Changes, Tests, and Experiments," 10 CFR 50.59(a)(2), which defines an "unreviewed safety question," to include the emergency plan, emergency plan implementing procedures, and emergency resources, equipment, and instrumentation.

3. Form a committee representing Office of Standards Development, Office of Nuclear Reactor Regulation, and Office of Inspection and Enforcement to revise RG 1.101 to provide clear requirements and specific minimum acceptable criteria, including the following:

- Minimum number and availability of emergency equipment and instruments.
- Minimum number and availability of self-contained breathing apparatus and minimum breathing time.
- Minimum number of licensee drills and drill acceptance criteria.
- Maximum time allowed licensee until 100% accountability of personnel.

3.13.2 Protective Action Guides

In September 1975, the U.S. Environmental Protection Agency published the "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA520/175001). This document, when coupled with two U.S. Nuclear Regulatory Commission guidance documents, "Guide and Checklist for the Development and Evaluation of State and Local Government Radiological Emergency Response Plans in Support of Fixed Nuclear Facilities" (NUREG75/11, December 1974) and "Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants" (NUREG-0396, December 1978), requires that preestablished guidance be developed for radiation protection.

The State of Pennsylvania Protective Action Guide (PAG) established three action levels, as follows: Level I (whole body F 500 mrem), Level II (whole body 500 mrem to 5 rem), Level III (whole body J 5 rem). Early during the TMI accident, onsite dose rates up to 150 mrem/hr at the edge of the restricted area were measured. The licensee should have considered the possibility that if this dose rate occurred for several hours, State PAG limits of 500 mrem (Level II) could have been reached. The Level II associated protective actions are: (a) to instruct individuals to take cover and (b) to selectively evacuate individuals (pregnant women and children).

Review of the IE Investigative Team material and IE Records indicates that the TMI staff reacted negatively to the evacuation decision reached by NRC Headquarters and the State of Pennsylvania. However, onsite radiation levels, coupled with the continuing nature of the releases, indicate that the protective actions were in accordance with the State's preestablished criteria.

Recommendation

Require NRC Part 50 licensees to immediately review their emergency plans and their applicable State Protective Action Guides to verify that action levels specified in the Protective Action Guides are incorporated into the emergency plan and implementing procedures.

### 3.13.3 Personnel Accountability and Access Control

NRC Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants," Annex A, Section 6.4.1 states, "The emergency plan should provide for timely relocation of persons in order to prevent or minimize exposure to radiation and radioactivity." Three Mile Island radiation emergency procedure 1670.4, "Evacuation Procedure," states that foremen and supervisors are responsible for conducting a head count and reporting missing personnel. Procedure 1670.4 also states that the Station Engineer will dispatch a search and rescue team for missing personnel. TMI procedure 1670.7, "Emergency Assembly, Accountability, and Evacuation was improperly changed without the required review and approval. Implementation of this procedure on March 28, 1979, was impeded by conflicting accountability directives.

Following the Three Mile Island accident, personnel accountability was not adequately performed. Beginning at 0655 on March 28, 1979, when a site emergency was declared, control and accountability of individuals on the island was insufficient. The access control situation deteriorated to the extent that the licensee did not have accurate knowedge of who was onsite during the emergency until March 30, 1979.

Recommendation

Issue a Temporary Instruction requiring a comprehensive inspection of licensees' personnel accountability and access control programs by March 1980.

### 3.13.4 Reentry and Recovery

10 CFR 50 Appendix E, Section IV.J, requires a licensee's emergency plan to contain criteria to be used to determine when, following an accident, reentry of the facility is appropriate or when operation should be continued. Regulatory Guide 1.101, Annex B, Section 2.2.9 recommends that "procedures and guidelines . . . be developed for reentry to previously evacuated area for the purpose of saving lives, search and rescue of missing and injured persons, or manipulation, repair, or recovery of critical equipment or systems . . . ."

Three Mile Island experienced significant in-plant radiation and contamination. Reentries resulted in personal contamination and radiation overexposure incidents. Previous licensee emergency plan drills did not consider widespread contamination of the facility or high radiation levels. The SRG believes extensive review of reentry and recovery planning is necessary.

Many procedures developed during recovery from the TMI accident have applicability at all facilities and may be required regardless of the intial accident. These should be postulated and developed in advance to avoid the extensive procedural generation effort following an accident. Examples are:

- Loss of critical instrumentation
- Sampling when fission products are present

- High auxiliary building radiation levels limiting access to critical components
- Reactor coolant pump operations when the RCS is solid or under limiting (high vibration) conditions
- Handling of high level waste
- Plant operations with high level contamination in the reactor building atmosphere

Recommendation

1. Require all licensees to review current reentry/recovery plans and procedures to ensure adequate planning, including, but not limited to: facility models, such as TMI; accident personnel control; adequately (conspicuously) labeled valves and pipes; photographs/drawings of plant area with valve and equipment locations; and high level sampling procedures.

2. IE and NRR should evaluate the need for the development of post-accident plant operations procedures. Required licensee procedures should be promulgated via a change to Regulatory Guide 1.33.

### 3.13.5 Supplies and Equipment

10 CFR 50, Appendix E, Section IV.F requires the emergency plan to contain provisions for emergency first aid and personal decontamination and monitoring. Regulatory Guide 1.101, Annex A, Section 6.5.2 (capabilities for decontamination and first aid) and Section 7.3.1.(onsite systems and equipment) indicate items to be identified in the emergency plan.

TMI procedure 1670.12, "Emergency Equipment Located at Emergency Control Center," delineates emergency equipment and supplies available to support emergency operations. During the TMI event, the initial supplies and equipment onsite, including those specified in procedure 1670.12, were insufficient to support necessary activities (respirators, monitors, personal extremity monitoring, decontamination supplies at washdown areas, and long-handled tools for sample handling). As additional supplies and equipment were brought to TMI by other utilities and subcontractors, the TMI emergency organization began to coordinate acquisition and identification of these resources.

Recommendations

1. Require that licensees review current emergency plans to ensure that procedures identify a responsible member of the emergency organization who will coordinate initial requests for supply and equipment assistance from offsite support groups.

2. Require that licensees review emergency plans and available equipment for adequacy in the event of a major accident. Licensees should procure equipment, revise the emergency plan and procedures, initiate contractual support services, etc., as necessary.

### 3.13.6 Response Organization

10 CFR 50, Appendix E, Section IV.A requires emergency plans to contain the organization for coping with radiation emergencies. Regulatory Guide 1.101 Annex A, Section 5 indicates the emergency plan ". . .should describe the emergency organization that would be activated. . ." The TMI emergency plan does not address offsite support from other utilities.

Following the TMI accident, representatives from various contractor and utility organizations responded to provide assistance to TMI. Interfaces between these diverse organizations was difficult (See "Interfaces External to NRC," Section 3.4.4.)

TMI had also modified both the unit and corporate organizations from that shown in the Technical Specifications in effect on March 28. This change had not received NRC approval. The organization changes may have contributed to confusion during the accident response.

Recommendations

1. Revise Regulatory Guide 1.101 to specifically reference support which may be received from other utilities or contractors.

2. Require all licensees to review their emergency organization to identify where special advisory groups and technical support will be incorporated. The review should include preplanning to identify similar facilities from which to obtain assistance. The licensees should ensure that their organization is consistent with their Technical Specifications and Emergency Plan.

### 3.13.7 Drills

A drill, as opposed to a test (Section 3.13.8), is a learning experience and teaching aid for licensee personnel. The drill is also used to assess the adequacy of procedures and major aspects of the emergency plan. Drills, therefore, should be varied and incorporated into personnel training programs.

Appendix E, Section IV.I, of 10 CFR 50 specifies that the emergency plan should contain provisions for testing, by periodic drills, radiation emergency plans to ensure that licensee employees are familiar with their specific duties. Regulatory Guide 1.101, Annex B, Section 2.3.5 specifies, "Procedures should provide for practice drills that use detailed scenarios . . . ."

During the first year of operation, TMI conducted seven emergency drills. Eight items requiring corrective action, identified during the licensee's review of these drills, were uncorrected as of the TMI accident date. On November 2, 1978, a simulated loss of coolant accident drill failed to identify inadequacies in their program (radiation monitor ranges, lack of instruments, lack of respirators, access control, personal monitoring, etc.).

Current NRC philosophy allows a licensee to define "drill." Licensee drills may be routine, announced, or pre-established, with participants pre-trained and forewarned. The NRC has not established criteria to ensure that the drills are varied or that at some frequency every facility employee participates in the drills in his emergency assignment.

Recommendations

1. Require all licensees to review facility training records for each individual functioning in a position described in the emergency plan. For each individual identified, the licensee training program should certify successful completion of formal training courses and examinations, and successful drill participation every two years.

2. Amend Regulatory Guide 1.101 to provide an Annex C containing several detailed scenarios acceptable to be used for drills.

3.13.8 Tests

A test is a formal measure of ability and implies performance to some established criteria. The NRC currently does not have criteria for determining that licensee performance is unacceptable.

The NRC can determine that the licensee has an acceptable state of emergency preparedness only by conducting or observing a test of the licensee's plan and procedures, and implementation thereof. Failure of the test may result in the need for immediate licensee corrective action or possibly limiting facility operation until corrective action is complete.

It is likely that if the November 2, 1978, TMI drill had been adequate, plan and procedure inadequacies of the type that occurred during the March 28, 1979, event would have been identified. This drill was observed by four NRC inspectors but no unacceptable items were identified. The TMI drill of November 2 did not completely demonstrate the adequacy of the emergency plan or implementing procedures, because facility personnel were expecting the exercise, it was conducted during the day shift when the maximum shift crew was present, and simulated actions were permitted (e.g., simulating respiratory protection throughout the plant).

Recommendations

1. Amend 10 CFR 50.54, "Conditions of Licenses," to state:

"The licensee shall maintain for the life of the facility an adequate state of emergency preparedness, as specified in Appendix E. A license may be revoked, suspended, or modified for failure of the licensee to maintain an adequate emergency preparedness capability. The Commission shall conduct tests, as necessary, to demonstrate compliance with this part." (The last sentence is consistent with Parts 30.53 and 70.56.)

2. Amend Regulatory Guide 1.101, Annex B, Section 2.3.5, "Tests and Drills," to include a third paragraph, as follows:

"Licensees shall establish a program for the conduct of tests of the emergency plan, implementing procedures, facilities, equipment, personnel, and other organizations. The test program function shall demonstrate adequate capability to implement all portions of the emergency plan, implementing procedures, facilities, equipment, personnel, and other organizations at least annually."

3. Develop and publish criteria for determining when the licensee's test, as described in recommendation (2), above, is unacceptable. In addition, IE and NRR should jointly participate in the development of criteria, scenarios, and administration of the NRC test as identified in recommendation (1), above, upon licensee failure to conduct an adequate test or demonstrate unsatisfactory performance.

### 3.13.9 Multiple Responsibilities

10 CFR 50, Appendix E, Section IV.A requires emergency plans to identify persons assigned to the licensee's emergency organization. Section IV.E.3 requires lists of persons with special qualifications for coping with emergency conditions.

The licensee defines the emergency organization and the various teams and positions within the organization. However, emergency functions are usually a collateral duty assignment for shift personnel. During the initial phase of the TMI accident, some individuals performed emergency functions for which they had not received complete training.

In preparing a shift complement, licensees generally do not specify which individuals are on fire brigades or radiation monitoring teams. Licensees typically establish a shift crew with the assumption that personnel have been properly trained. On backshifts or weekend shifts, when a minimum crew is present, individuals untrained in emergency functions could be assigned to emergency teams. Further, individuals could be assigned to perform more than one (perhaps conflicting) emergency function, thus degrading the licensee's ability to respond to an accident. (See "Licensee Personnel," Section 3.7.1.)

Recommendation

Require all Part 50 and 70 licensees to review shift staffing, emergency training records, and the emergency plan team requirements to ensure that emergency responsibilities are clearly assigned to qualified individuals and that multiple assignments are avoided.

### 3.13.10 Classification and Notification of Emergencies

Currently, licensees have different systems for classifying emergency situations. Some are derived from the guidance of Annex A to Regulatory Guide 1.101 (Emergency Planning for Nuclear Power Plants), as summarized below:

| | |
|---|---|
| Personnel Emergency - | Emergency treatment of an individual is required, but entire emergency organization is not activated. |
| Emergency Alert - | A potential hazard or threat has been identified and precautionary or preventive steps can be taken. |

Plant (Unit) Emergency - In-plant occurrence requiring plant emergency organization, response but an offsite hazard is unlikely.

Site (Station) Emergency - Occurrence could involve an uncontrolled release of radioactive materials to the environs and indicates potential need for offsite protective action.

General Emergency - Occurrence having serious impact on public health and safety requiring public warning and protective actions in the low population zone.

Specific standardized criteria to define each threshold should be required in order to ensure uniform notification and other action. For example, Regulatory Guide 1.101 states that action levels for declaring a site emergency should be ". . .defined in terms of instrument readings or alarms that annunciate in the control room. . .and alternatively in terms of specific contamination levels in environmental media. . ." These are general guidelines that will result in licensees setting different criteria for action. Similarly, Regulatory Guide 1.101 action levels for a General Emergency are stated, "The selection of the levels should be guided solely by postulated conditions within the plant that would be likely to lead to serious releases of radioactive products into the atmosphere." More definitive criteria would ensure that both the licensee and the NRC recognize events falling within predetermined action levels.

TMI emergency plan criteria for declaring a site emergency were satisfied within fifteen minutes, at 0415 on March 28 (loss of primary coolant pressure coincident with high reactor building pressure and/or high reactor building sump level). Even though the RCS pressure was "stable," an emergency should have been declared. Improper use of emergency classification criteria contributed to a delay of approximately three hours in TMI's classifying and declaring an emergency.

There are also inconsistencies among the severity levels of IE Manual Chapter 1300 (Incident Response Actions), the severity levels of Regional Incident Response Plans, and the emergency classifications of Regulatory Guide 1.101. For example, MC 1300 classifies a Level I emergency as one where a member of the public may receive greater than 1 rem whole-body, but the Region I Incident Response Plan classifies a Level I emergency as one where a member of the public may receive greater than 5 rem whole-body. Relating the NRC severity levels to the emergency classes of Regulatory Guide 1.101 is difficult.

The speed at which notification may be made depends on the emergency classification. Current directives provide guidance, some of which may conflict. Notification guidance is discussed IEB 79-06-A "Review of Operational Errors and System Misalignments Identified During the Three Mile Island Incident" and Regulatory Guide 1.16 "Reporting of Operating Information-Appendix A Technical Specifications." Concurrent with the installation of power reactor "hot line" telephones, licensees were advised of general criteria. An IE Bulletin is being developed to prescribe additional criteria for use of the direct line NRC telephone link. The consolidation of this guidance will improve reporting and ensure timely notification to the NRC.

Recommendations

1. Require all Part 50 and 70 licensees to adopt Regulatory Guide 1.101 to ensure standarized criteria and action levels. Each licensee should identify plant-specific criteria to allow determination of the applicable threshold.

2. Require immediate notification via the NRC "hot line" telephone of all plant, site, or general emergencies. For these three classes, specific criteria for reactors should include at least:

- Plant Emergency
  - Activation of any Safeguards Feature Actuation Systems (SFAS)
  - Accidental criticality

- Violation of a Technical Specification Safety Limit
- Flooding or localized fire that may cause a release of radioactivity or render safety systems inoperable.
- Loss of primary containment integrity during operation

. Site Emergency

- Activation of any SFAS System coincident with:
  - Reactor Containment Pressure increase of 1 psi; or
  - Reactor Containment Sump High level alarm
- Reactor Building Evacuation Alarm initiated
- A unit vent gas monitor indicates 100 times the instantaneous release limit specified in the technical specifications
- Reactor Building high range gamma monitor alarm
- Onsite release of activity exceeds 5000 times 10 CFR 20, Appendix B, Table II limits (predicted or measured)
- Offsite projected dose exceeding 1 rem whole body or 5 rems thyroid to any individual.

. General Emergency

- Any Design Basis Accident
- Reactor building high range gamma monitor high alarm
- Offsite projected dose greater than 5 rem whole body or 25 rem thyroid.
- Any release where it is believed that more than one member of the general public may receive greater than 1 rem whole-body or greater than 5 rem to the thyroid.

3. Publish similar criteria for immediate notification by other licensees equipped with NRC hotlines.

4. Revise IE Manual Chapter 1300 to reflect the five Regulatory Guide 1.101 severity level classifications.

5. Revise and standardize regional emergency plans to be consistent with IE Manual Chapter 1300 and Regulatory Guide 1.101.

### 3.13.11 Transportation

In NUREG 0535, "Review and Assessment of Packaging Requirements and Emergency Response to Transportation Accidents," the joint NRC/DOT study group made the following recommendations:

. State and local agencies, such as emergency crews, police, health and environmental departments should have emergency plans to both advise and assist the carrier and to take appropriate control actions at the scene to protect public health and safety. The NRC and the DOT should foster development of these plans.

. Carriers of radioactive material should be required by the DOT regulations to prepare, maintain, and execute an emergency response plan for promptly notifying the shipper and government authorities, controlling the spread of radioactive material in the cargo, segregating the radioactive material from the populace, and cleaning up any spilled radioactive material.

. Shippers of radioactive materials should be required in regulations to prepare and maintain an emergency plan for promptly conveying hazards information about the shipment to the carrier and government authorities. The information in this plan should be available at all times that the shipper has a shipment in transit so shipper personnel can respond knowledgeably and promptly when they receive notice of an accident and are asked for advice.

. Shippers of radioactive materials should be required in the DOT regulations to show an emergency telephone number on shipping papers and should be encouraged by both DOT and NRC policies to voluntarily include emergency instructions with shipping papers, especially on bulk shipments.

. Carriers of radioactive materials should be prepared to assume initial costs for their responsibilities and State and local agencies should be prepared to assume initial costs for protective actions involving radioactive material as with other emergencies where protection of public health and safety is involved.

. The NRC and DOT should initiate discussions with States on the merits of advance notice requirements for shipments of radioactive material. If an advance notice requirement is judged necessary, a national requirement is preferred over a conglomeration of State requirements. Advance notice of shipments of quantities and types of special nuclear material protected in accordance with NRC regulations or DOE directives should not be required, however, because such requirements may conflict with certain Federal restrictions related to controlling sensitive information pertaining to such protected shipments.

Recommendation

1. The SRG concurs and encourages IE participation in implementing the recommendations of NUREG 0535, "Review and Assessment of Packaging Requirements and Emergency Response to Transportation Accidents."

2. The NRC should improve liaison with the States to ensure that State and local police understand notifications required for transportation accidents involving licensed material. Toward this end, NRC could provide, for distribution to State and local law enforcement agencies, cards or stickers, or information booklets containing NRC Regional telephone numbers.

### 3.13.12 Licensed Operators in the Control Room

Current regulations and technical specification requirements may not ensure that an adequate number of licensed operators are available in the control room to respond to transients. This may be of particular concern in those situations when equipment malfunctions in the course of an accident or transient.

At the time of the TMI accident the shift personnel complement met the Technical Specification requirements. At 0400 on March 28 there were two licensed control room operators in the control room and a shift supervisor (SRO) in the supervisor's office adjacent to the control room.

Some facility technical specifications (such as Crystal River Unit 3 or Browns Ferry Unit 3) are written such that only one licensed operator (RO) is required to be in the control room (and at the console). The second RO and the shift supervisor (SRO) could be elsewhere in the plant, such as in the auxiliary building, and still meet technical specifications. If an accident occurred and automatic equipment did not function properly, the single man in the control room may not be able to adequately respond. For example, during an event that challenges safety systems it is conceivable that automatic control system failures could require operator actions to manually control a malfunctioning diesel generator in support of vital bus loads and to manually control steam generator levels. The control room is too big a place for a man to single-handedly respond to a degraded equipment situation and monitor plant parameters during a transient.

It may also be appropriate to consider the need for the shift supervisor (or an assistant shift supervisor) with an SRO license to remain in the control room areas to ensure a manged response to accidents. This leadership may provide clear direction and overview when responding to a transient.

Recommendations

1. NRR should revise facility technical specifications for all single unit facilities (or multi-unit facilities with separate unit control rooms) to require the presence of two licensed operators in the control room at all times when the reactor is in Modes 1, 2. or 3.

2. NRR should evaluate multi-unit facility technical specifications to determine if additional control room operator requirements during operation in Modes 1, 2, or 3 are appropriate for facilities with shared (commom) control rooms for the multiple units.

3. NRR should evaluate the need for requiring the shift supervisor (or an assistant shift supervisor) to remain in the control room area at all times when the reactor is in Modes 1, 2, or 3.

## 3.14 NRC Emergency Preparedness

As discussed in Section 3.2, 3.3.3, 3.3.5, 3.6.1, and 3.6.2, the role and policy of the NRC in an emergency is not clearly defined. This lack of clarity is evident when one considers the emergency plans, equipment, instrumentation, and other NRC resources available on March 28, 1979.

The NRC response to TMI was significantly more than criteria required at that time. However, as evidenced by the adequacy of the NRC response to TMI, the NRC was not prepared for an event of that magnitude.

NRC was created by the Atomic Energy Act and the Energy Reorganization Act of 1974 to oversee the safe use of nuclear technology, and to protect the health and safety of the public. Therefore, NRC must be the agency of last resort; that is, the final line of defense for the public. If the licensee or other agency (DOE, EPA, HEW, State, etc.) fails to act or respond, NRC must fill the gap.

NRC reviews the design of each licensed facility, observes construction, observes testing, reviews the implementation of quality assurance, and inspects the licensee's entire operation and facility. NRC clearly is the most knowledgeable agency about licensed facilities and about transportation of licensed material.

NRC must utilize this knowledge in preparing to respond to an accident at any licensed facility to ensure the health and safety of the public. This requires that NRC have highly qualified and trained personnel, adequate equipment and instrumentation, and sufficient preplanning, such that an accident can be rapidly comprehended, analyzed, and controlled.

### 3.14.1 NRC Emergency Response Plan

The Office of Inspection and Enforcement prepared an NRC Headquarters Incident Response Plan (IRP) in 1978. The TMI response, in which various NRC offices participated, suggests the need for some changes in the Headquarters IRP.

A comprehensive emergency response plan should be developed to describe the emergency responsibilities of all NRC Offices. The TMI experience of several NRC Offices should be considered in developing the plan.

Recommendations

1. Form an ad hoc NRC Emergency Preparedness Committee representing Inspection and Enforcement, Nuclear Reactor Regulation, Nuclear Material Safety and Safeguards, Standards Development, Administration, Congressional Affairs, Public Affairs, and State Programs to revise the current IRP to include emergency plans and procedures for each participating NRC Office.

2. Establish Inspection and Enforcement as the lead Office for coordinating and implementing the IRP revision.

3. Establish the Director of Inspection and Enforcement, or alternate, as the Deputy Director of EMT.

4. Designate an individual as IE Headquarters Emergency Officer to coordinate emergency response planning.

### 3.14.2 Regional Emergency Response Plan

During the TMI accident, the Region I Incident Response Plan (IRP) was implemented and was escalated as information on the accident severity was received. The response from Region I was in accordance with the approved IRP in force at the time of the accident.

The Region I IRP needed improvement in several areas:

. Regional telephone answering and notification systems did not provide NRC contact from 0705 until 0800 on March 28, 1979.

. The initial five-man site response team included only one Operations inspector, who was not trained in B&W reactors. The lack of an individual familiar with the operating characteristics of the facility hindered rapid NRC comprehension of the severity of the accident.

. The initial site response team was not staffed to evaluate site security.

. The Region I IRP did not clearly specify that regional supervision go to the site. No supervision accompanied the initial site response team.

. Neither the Region I or NRC IRP envisioned an eventual NRC site contingent of over one hundred NRC personnel and requirements for extensive radiation protection support.

. As discussed in Section 3.9.3, 3.9.4, 3.9.5, 3.11.6, 3.11.9, and 3.11.10, the Region I IRP did not identify the equipment, communications, or other resource needs which were employed in the TMI response.

All NRC Regions currently have an IRP. However, these plans are not standardized, nor are they reviewed periodically for upgrading on the basis of other Regional experience.

A significant event necessitates a response capability, regardless of the size or geographic location of the region involved. Such response capability should be reasonably uniform among the regions.

Recommendations

1. Form an ad hoc committee of regional representatives to revise existing regional emergency plans into a standard plan by March 1980.

2. Designate in each region a senior emergency planning inspector as Regional Emergency Officer. He should have a collateral duty for maintaining the regional emergency plan, for coordinating emergency response planning between regions, and for conducting regional drills, as specified under Section 3.14.5.

3. Staff the regional offices sufficiently to ensure that all personnel are not in travel between home and office at one time.

3.14.3 Regional Capabilities

As discussed in Section 3.9, various equipment and instrumentation is needed by the regional offices to ensure adequate emergency response. These needs are independent of regional size, number of licensees, or geographic location of the region. Resources must be readily available, such that regional personnel can respond immediately and effectively.

Recommendations

1. Establish the following minimum capability in each region by mid-1980:

- Mobile Laboratory
  - Gamma Spectrometry by computer based multichannel analyzer with high resolution Ge detector
  - Alpha/Beta counting
  - Liquid scintillation counting
  - TLD dosimetry
  - Communications command center (See Section 3.11.6)
  - Meteorology (extendable 10-meter meteorology tower with wind speed, wind direction, and temperature readout inside the laboratory)
- Fixed Support Laboratory
  - Necessary standards, reagents, calibration sources, and supplies to support mobile lab
  - Sample preparation equipment
  - Low background alpha/beta counter

- Emergency Monitoring Kits

  - Survey kits with instruments (pressurized ion chambers, Xetex, HP-210, PAC-4G's, etc.)
  - Environmental sampling kits (air samplers, resin columns, filters, dredgers, core borers, bottles, silver zeolite, charcoal adsorbers, etc.)
  - Personnel protection kits
    - Self-contained rebreathers (4 hours)
    - Protective clothing, including severe weather gear
    - Signs, ropes, markers, etc.
    - Pocket dosimeters, chirpers, etc.

- Response Center

  - Dedicated licensee hotlines with speaker phones
  - Dedicated 10 incoming/outgoing lines with extensions and conference chaining capability
  - Command center room
  - Reference materials
  - Telephone recorder system
  - Personnel support room (beds, microwave, etc.)
  - Emergency lighting, power, ventilation
  - Videotaping equipment (VHS portable color camera and videopack)
  - Desk-top microprocessor for mathematical analyses (dose, meteorology, etc.)

2. Standardize equipment and instruments among regions to allow interchangeability and to ensure that support personnel responding from other regions are already trained and familiar with the equipment and instruments.

3. Provide inspectors respirator mask spectacle frames and glasses.

### 3.14.4 IE Manual Chapter 1300 and NRC Manual Chapter 0502

IE Manual Chapter 1300 and NRC Manual Chapter 0502 describe emergency response activities from slightly different perspectives. In some respects, the two Manual Chapters are not consistent.

Recommendation

Revise IE Manual Chapter 1300 and NRC Manual Chapter 0502 in conjunction with the committee assignments discussed in Sections 3.14.1 and 3.14.2. (Also, see Sections 3.2, 3.3, and 3.4.)

### 3.14.5 Drills

The NRC currently does not conduct full office and field exercises testing NRC response capability. At the time of the TMI accident, NRC was developing a series of drill exercises, none of which had been conducted.

NRC regional offices and NRC headquarters are currently at various stages of development in emergency planning. Not all regions have conducted drills based on a major accident.

Recommendations

1. Conduct the following drills:

   - Regional

     - One LOCA (power reactor) per year
     - One LOCA (power reactor) concurrent with licensee drill once per year
     - One fuel facility accident per year
     - One test/research reactor accident per year
     - One transportation accident per year
     - One materials accident per year

- The NRC Operations Center should participate with each region in one drill annually. At least one of these drills should be a LOCA concurrent with a licensee drill.

- At least one of the regional and Operations Center drills should be conducted during non-business hours.

2. Assign each Regional Emergency Officer to observe and critique one drill in another region annually.

3.14.6 Site Reference Books

During a major emergency, the Executive Management Team, Incident Response Action Coordinating Team, regional team, and others may require information such as:

- Plant drawings (piping, electrical, and plant layout)
- County maps
- Local telephone directories
- Site personnel listing
- Local airports and preflight plans
- Local law enforcement and airport car rental telephone numbers

Recommendation

In each Regional Response Center and at the NRC Operations Center, maintain site reference books for each power reactor, test/research reactor, and fuel facility.

3.14.7 Personnel Resources Matrix

The talents, training, and experience resources of the IE staff are varied and extensive, but no means exists to catalogue these resources. In response to an emergency, certain disciplines or technical backgrounds may be specifically and promptly needed. Management should have a method to rapidly identify staff members who have selected backgrounds.

The Career Management Branch assigned to the Executive Officer for Management Analysis (XOMA) is developing computerized data storage regarding IE staff training received, duty assignments, etc. which supplements computerized resume information maintained by the Office of Personnel. The XOMA file is a logical location for additional data storage concerning IE personnel resources.

Recommendation

Develop a personnel resources matrix as an addition to the IE staff data maintained by XOMA. Ultimately, such a matrix may be appropriate on an agency-wide basis. Examples of data to be stored include:

- Individuals with containment leakage expertise
- Individuals with vendor-specific core physics expertise
- Individuals with large centifugal pump expertise.
- Metallurgists
- Environmental Monitoring Specialists
- Individuals with vendor-specific instrumentation expertise
- B&W site resident inspectors

## 3.15 Security

### 3.15.1 Licensee Organization

The TMI security organization consists of a proprietary armed guard force supplemented by contract watchmen. The total TMI security complement on March 28, 1979 was forty-seven armed guards and twenty-six watchmen, covering approximately seventeen post assignments per shift.

Following the accident at 0400 on March 28, 1979, it became necessary to split the proprietary guard force into 12-hour shifts and temporarily suspend use of the contract watchmen until approximately April 2. During this initial period, the security force was primarily involved in processing emergency response personnel and equipment through the two principal access points onto the Island and through the Emergency Control Center (Information Center). Supplementing the licensee's security organization at the above locations were units of the Pennsylvania State Police. It appeared that four to eight troopers were available at or near these locations from March 28 to April 16, 1979, during the initial buildup period.

Due to onsite radiation and contamination, normal post assignments had to be abandoned and access to the island controlled at the two bridges. Routine patrols of the protected area were maintained.

On April 6-7, 1979, the security organization reassumed control of access to selected vital areas. To accomplish this increased workload, seventeen trained contract personnel had been recalled and placed into a 12-hour shift schedule. The recall of the contract watchmen actually began on April 2 and reached seventeen by April 6, 1979. Thus, on April 6 two security shifts each contained approximately fifty-five personnel. Both the proprietary guard force and contract personnel operated in a 12-hour on and 12-hour off mode with no days off until about April 18, 1979. During this period, most of the initital emergency manning and equipment arrived. An estimated 1600 persons were involved, approximately 75% of them working at the "Trailer City" location off the island. The Unit #2 Auxiliary Building was isolated because of high radiation and contamination. The use of recombiners was responsible for most Protected Area access needs along with NRC/Licensee manning of the Unit #1 and Unit #2 Control Rooms. Access to plant vital areas was estimated at 150 - 200 persons per day.

By April 18, 1979, the security organization had built up to forty-six proprietary guards, twenty-two contract watchmen, and eight guards temporarily assigned from the Oyster Creek Nuclear Generation Plant, for a total of seventy-six trained and qualified members of the Security Organization. Beginning April 18, 1979, the licensee was able to adjust the weekly work schedule for the security organization to six 12-hour days and one day off. The force continued in the two shift mode.

It became apparent early in the emergency that the licensee security organization was not prepared or equipped to handle an emergency situation of this magnitude. It is doubtful that any existing licensee security organization could adequately cope with such an accident.

In the specific case of TMI, the licensee has initiated an aggressive recruitment program to employ and train an additional 40-50 watchmen in order to reinstitute the 40-hour workweek.

Recommendation

Require all Part 50 and Part 70 licensees to assess their security organization's structure, manning, and training, from the viewpoint of ability to respond to major accidents. The review should also consider agreements with outside support agencies.

### 3.15.2 Licensee Plans and Procedures

The TMI Emergency Plan and Procedures, the Modified Amended Security Plan and Procedures, and the Security Contingency Plan and Procedures do not address security's role in radiation emergencies in detail. The TMI Emergency Plan, Section 3.1.8, states, "Security Personnel provide protection and security services for the site. They also are responsible of personnel accountability during an emergency."

The implementing procedures outline the accountability function of security personnel, but there are no procedures which set out security's other functions during a radiation emergency.

Recommendation

Request NMSS to review licensee security contingency plans presently under consideration to ensure that security's functions under emergency conditions are properly defined. Areas of consideration should include emergency organization, personnel processing, searches, and patrols.

### 3.15.3 Access Controls

The capability to use search equipment at the primary access point to the protected area of TMI was lost between March 28, 1979 and June 1, 1979. Of necessity, the primary access point facility was evacuated and equipment disabled on March 28. 1979. The equipment was temporarily moved and the facility was used as a health physics checkpoint. The licensee reverted to a visual search program, with a hands-on probable cause option, through June 1, 1979 for Unit #1 and July 1, 1979 for Unit #2. Hand-carried items were searched visually at the onset of the accident and then in detail after April 12, 1979.

A reduction in the level of search during the early phases of the accident was contrary to good security practice at a time of increased vulnerability.

The question of hands-on physical search of regular employees is presently being considered by the Commission. A decision has been deferred until November 1, 1979. However, even under emergency conditions licensees should be required to maintain the level of search consistent with the program administered under normal operating conditions. As a compensatory measure, licensees should either utilize portable equipment or a hands-on search.

Since March 28, 1979, an estimated 4500 badges were issued to Met-Ed, contractor, vendor, consultant, and U.S. Government personnel. Picture badges were processed for all personnel granted unescorted access to the site protected and vital area environs. Personnel were identified and authorized based on either Met-Ed or Government sponsorship. In order to reinforce the integrity of the authorization, the badge system was changed and needs revalidated by the sponsoring agencies at least three times since the accident date. It should be noted that the 4500 figure represents badges issued, not personnel badged. In some cases the same person received three badges as the system changed. For the most part, brief visits to the site were supported by the licensee's "Escort Badge" system if access to the protected area was a requirement. Access to controlled outer areas was permitted without escort after protected and controlled area surveillance was reestablished on April 6, 1979.

Recommendations

1. Require licensees to establish compensatory search plans and procedures for use following the loss of normal facilities.

2. Require all Part 50 and Part 70 licensees to review their current badging system and establish procedures for processing and identifying response personnel in all categories. Licensees should consider an offsite location or staging area with an individual responsible for coordinating the processing operation.

3. Require contractors, vendors, State agencies, and Federal agencies that would be involved in a site response to furnish licensees with current lists of authorized individuals who would normally respond.

3.15.4 Safety vs. Security

The security upgrades under 10 CFR 73.55 require the licensee to maintain positive controls of access to vital areas.

Access control systems installed to satisfy Part 73.55 could adversely affect the licensee's ability to control or mitigate an accident. Some conflict between security and safety might be inescapable. To date there has been no concerted effort by NRC to eliminate or minimize such conflict. The IE inspection program should include a detailed review of access control systems to ensure that safety is not affected. (Policy issues related to this topic are discussed in "Safety vs. Security," Section 3.6.5.)

Recommendation

Using inspection teams comprising regional RONS, FFMS, and Safeguards inspectors and Headquarters Safeguards personnel, inspect in detail the access control systems of every licensee required to comply with Part 73.55. Determine whether such systems unacceptably affect the licensee's ability to control or mitigate an accident.

### 3.15.5 Transportation of SNM

The present IE policy of inspecting unirradiated shipments of Special Nuclear Material (SNM) eventually could lead to an accident embarrassing both to IE and NRC. At present, unarmed and poorly equipped inspection teams follow SNM shipments from point of origin to destination or to point of departure from the continental U.S. The teams generally comprise two safeguards inspectors in a rental or GSA car with makeshift communication equipment. Such inspections generally last from twelve to seventy-two hours, during which the teams are expected to maintain constant visual surveillance over the transport vehicle. This inspection policy may be extended in the future to spent fuel shipments.

The embarrassment could occur if an unarmed, barely communicable team became affected by a threat against the shipment, or if a team poorly trained and equipped to handle radiation matters suddenly became NRC's sole representative at the scene of an accident.

Because of the apparently increasing likelihood of such events, safeguards inspectors should become better trained and better equipped.

Recommendations

1. Train safeguards inspectors in emergency response techniques, including radiation protection. The Emergency Response Operations Course conducted by DOE in Nevada might partially accomplish such training.

2. Provide vehicles equipped for extended trips, hazardous weather conditions, and emergency response.

3. Furnish vehicles with both inter-vehicle and field communication equipment and with secure radio communication with NRC Operations Center.

4. Install a dedicated telephone line between the NRC Operations Center and Tri-State, the principal commercial carrier of SNM.

5. Consider arming the inspection teams, which could be involved in attempted diversion or sabotage of a shipment.

6. Clarify the role of NRC Inspectors covering shipments of SNM and define the inspector's authority over the commercial transportation team.

### 3.15.6 IE Inspection Program

Current IE security inspection modules do not address the licensee security organization's functions and responsibilities under radiation emergencies. The emergency planning modules address only security's role in personnel accountability.

During emergency conditions the security force must still maintain a level of security consistent with the regulations. Security's role becomes increasingly important in the areas of assistance. At TMI it became apparent that the licensee's security organization was not prepared for an emergency of this magnitude. IE security inspectors do not examine these areas during routine inspections.

Recommendation

Revise the security and emergency planning modules to include full examination of the security organization's responsibilities and capabilities during emergency conditions. Specific areas to be examined should include the security organization structure, personnel processing, site access control, outside assistance, and radiation protection. The module should also examine security personnel training programs in the above areas.

## 3.16 Adverse Effect of Accidents on Other IE Activities

The TMI accident has had a significant impact on IE's activities. Numerous special projects have been initiated, extra bulletins issued, specific inspection activities conducted, and significant resources expended as a result of TMI.

Every accident should be expected to have a disruptive effect on routine programs. The post-accident environment will probably yield an increase in the number of IE Bulletins, Circulars, and Notices issued. In an effort to disseminate information quickly, these documents may be issued prematurely or with a less than thorough review. Numerous licensee questions and regional interpretations sometimes require revision of the documents. Recent examples of difficulty in this area include IEB 79-02 (Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts) and 79-06A-Revision No. 1 (Review of Operational Errors and System Misalignments Identified During the Three Mile Island Incident).

Accident response diverts significant IE manpower from normal inspection activities. Many inspections have been postponed or abbreviated as a result of TMI. Such diversion also affects training and other activities essential to the inspection and enforcement function.

It is entirely possible that excessive diversion of resources in support of one accident (e.g., TMI) could contribute to a future accident elsewhere or could adversely affect IE's response to such an accident.

Recommendations

1. Ensure that Bulletins, Circulars, Notices, and Temporary Instructions are accurate and explicit.

- Involve licensees more fully in the Bulletin formulation process. Licensee review might identify ambiguities or requirements that are incorrect or unrealistic before issuing Bulletins affecting many licensees.

- Temporary Instructions written in support of a Bulletin should ensure that every line item of the Bulletin is adequately inspected. TI's should not contain interpretations that the regions will then have to impose on the licensee.

2. Identify in advance modules for reduced or delayed inspection effort at unaffected facilities following an accident. Consider the following examples:

- Categories for reduced inspection frequency:

  - Selected Preoperational test review modules
  - Annual "routine" modules, such as review of procedures, annual QA review, etc.
  - Selected modules at facilities having an enforcement history of few noncompliances.

- Categories for maintained inspection frequency:

  - Quarterly Review of Plant Operations
  - Resident inspection modules
  - Refueling modules
  - Selected preoperational phase modules, such as containment leak rate test or RCS hydrotest modules
  - Preoperational QA program inspection
  - Emergency preparedness modules

3. Be prepared to direct existing resident inspectors to assist in accident response or special post-accident inspection/investigation functions. Residents from a similar facility would be valuable response team members. Whenever possible, residents should be utilized such that a site is not left without a resident.

# APPENDICES

## Appendix A

MEMORANDUM FOR: Division Directors
Regional Directors
Executive Officers

FROM: Victor Stello, Jr., Director
Office of Inspection and Enforcement

SUBJECT: SPECIAL REVIEW GROUP - LESSONS LEARNED FROM TMI

As I indicated during the Management Meeting held in Headquarters on June 13, 1979, a TMI Special Review Group (SRG) will be formed within IE to consider changes which should be made in IE and in the way IE does business based on lessons learned from TMI.

I am interested that this group be the focal point of all IE changes founded on TMI experience. I wish to be able to call on this Special Review Group to be current on these activities and to provide management overview on these activities from the standpoint of description of tasks, assignments, resource needs and expenditures, schedules and responsible individuals. I anticipate that one of the products of this SRG will be a NUREG document describing IE activities concerning TMI and descriptions of tasks and schedules. I expect that these efforts will be within the AITS as well as in a special periodic report.

One of the earliest efforts of the SRG will be to accumulate information on IE activities already underway or planned. This would include the items in the memorandum from EDO to the Commissioners, dated April 27, 1979, Actions Relating to Three Mile Island, the IE investigation, IE Bulletins and followup actions, the IE supplemental budget request (and activities planned or underway as a result of this), changes to the incident response program and the operations center, etc. The activities or tasks should be on AITS and be a part of the SRG report.

The SRG is not simply an overview group. In addition to overview, it has the responsibility of identifying areas where lessons have been learned by IE and of developing recommended actions, both short and long term. SRG will describe these recommended actions in general terms as tasks for my approval prior to expending large resources on them. Of particular importance will be the identification of the priority of tasks so that this effort can be appropriately managed.

The SRG will consider the lessons learned from TMI in terms of changes that should be made in:

- The OIE mission
- Inspection philosophy, policies and programs
- Organization and organizational interfaces (internal and external to IE)
- Modifications of program changes already being implemented as the revised inspection program.
- Qualification and training of IE personnel
- Incident response planning and capability

The work of the SRG is of highest priority. We must learn from our experience and apply the lessons learned to more effectively and efficiently serve the public.

Once I have approved a task and established a priority, the SRG will staff these tasks to the point where they can be transferred to the responsible IE manager for final development and implementation. All appropriate IE managers should have ample early opportunity to comment on the tasks as they are developed. The products from the SRG to the responsible manager would be as draft IE Manual Chapters, draft staff papers, etc.

Another responsibility of the SRG is to maintain a liaison with other agency activities resulting from TMI. These include such activities as the NRR Lessons Learned Task Force, the NRC TMI Investigation staff and so forth. The SRG will be expected to provide the IE perspective to matters under review or development by other NRC offices. These perspectives should be developed and supplied to those other offices sufficiently early to impact on these actions on the other offices, not simply as comments on programs developed.

It is anticipated that the SRG will deal with topics such as:

- Design problems
- Contractor performance
- Administrative controls
- Qualification and safety categorization of components and systems
- Surveillance testing and maintenance procedures

. Licensee technical capability and technical support availability

. Operator and staff training

. NRC direct verification

. Licensee emergency response

. NRC incident response

Changes considered should be generic and not so closely identified with TMI as to be responsive to TMI or very similar incidents.

In recognition of the importance of this effort, I am assigning well qualified IE staff to SRG. This assignment will be demanding on those assigned as well as the entire IE staff. In addition to this SRG effort the staff will be challenged to continue essential IE functions at the high quality level expected.

H. D. Thornburg has been designated as Director of the SRG as his highest assignment prioirty. He is expected to spend more than 50% of his time on this assignment. E. M. Howard and L. I. Cobb are designated as executive members of the SRG and are expected to spend at least 30% of their time on this project. Enclosed is a listing of personnel who are assigned full time to the SRG.

I wish to meet with the Director and Executive Members on July 11, 1979. By that time I expect that a charter will be defined by the Director and on going tasks identified. I expect also that the Director and Executive Members will have an outline for the approach of the SRG. Following that meeting I would like to meet with the entire SRG on July 17.

There is no single effort concerning IE of more ultimate importance than the SRG and the changes it will overview. A superior effort is necessary to increase our assurance of the safety of the public. I anticipate cooperation from the staff in this important effort.

Victor Stello, Jr.
Director
Office of Inpection
and Enforcement

Enclosure: As stated

cc: L. V. Gossick, EDO
H. R. Denton, NRR
E. K. Cornell, EDO
SRG Members

ENCLOSURE

FULLTIME MEMBERS OF THE SRG

D. M. Hunnicutt, Section Chief, VIP, RIV

W. L. Fisher, Section Chief, FFMS, RIII

E. B. Blackwood, PAT, IE Headquarters

M. C. Schumacher, FFMS, RIII

M. E. Rogers, SB, RI

S. D. Ebneter, Section Chief, CES, RI

D. M. Sternberg, Section Chief, RONS, RV

G. T. Gibson, FFMS, RII

B. J. Cochran, CB, RII

R. H. Wessman, RONS, RII

APPENDIX B

SUMMARY OF INDIVIDUALS AND ORGANIZATIONS
CONTACTED BY SPECIAL REVIEW GROUP

I. NRC

A. Office of Inspection and Enforcement

1. Director, Office of Inspection and Enforcement

2. Director, Region I

3. Executive Officer for Operations Support (XOOS)

4. Executive Officer for Management and Analysis (XOMA)

5. Director, Division of Reactor Operations Inspection (ROI)

6. Director, Division of Fuel Facilities and Materials Safety Inspection (FFMSI)

7. Director, Division of Safeguards Inspection (SI)

8. Director, Division of Reactor Construction Inspection (RCI)

9. Various IE personnel in:

a. Region I

b. Region II

c. Region III

d. Region V

e. Division of Fuel Facility and Materials Safety Inspection

f. Division of Reactor Operations Inspection

g. Division of Safeguards Inspection

h. Executive Officer for Operations Support

i. Executive Officer for Management and Analysis

B. TMI Investigative Committees

1. NRC Special Inquiry

2. IE TMI Investigation

3. NRR Lessons Learned

C. Other NRC personnel in the following Offices:

1. Office of Nuclear Material Safety and Safeguards
2. Office of Nuclear Reactor Regulation
3. Office of Standards Development
4. Office of State Programs
5. Office of Administration

II. Other Agencies/Organizations

A. The Mitre Corporation

B. Metropolitan Edison Corporation

C. Pennsylvania State Police

D. Atomic Industrial Forum (AIF)

APPENDIX C

## REFERENCES


| | |
|---|---|
| Regulatory Guide 1.16 | Reporting of Operating Information Appendix A Technical Specifications |
| Regulatory Guide 1.17 | Protection of Nuclear Power Plants Against Industrial Sabotage |
| Regulatory Guide 1.33 | Quality Assurance Program Requirements |
| Regulatory Guide 1.101 | Emergency Planning For Nuclear Power Plants |
| Regulatory Guide 3.42 | Emergency Planning For Fuel Cycle Facilities and Plants Licensed Under 10 CFR Parts 50 and 70 |
| Regulatory Guide 5.14 | Visual Surveillance of Individuals in Material Access Areas |
| Regulatory Guide 5.20 | Training, Equipping and Qualifying of Guards and Watchmen |
| Regulatory Guide 5.32 | Communication with Transport Vehicles |
| Regulatory Guide 5.43 | Plant Security Force Duties |
| NUREG 75/111 | Guide and Checklist for the Development and Evaluation of State and Local Government Radiological Emergency Response Plans in Support of Fixed Nuclear Facilities |
| NUREG 0396 | Planning Basis For the Development of State and Local Government Radiological Emergency Response Plans |
| NUREG 0535 | Review of Packaging Requirements and Emergency Response to Transportation Accidents |
| NUREG 0578 | TMI-2 Lessons Learned Task Force Status Report and Short Term Recommendations |
| NUREG 0600 | Investigation Into the March 28, 1979 Three Mile Island Accident by the Office of Inspection and Enforcement (50-320/79-10) |
| NRC Manual Chapter 0502 | NRC Incident Response Program |
| NRC Manual Chapter 1300 | Incident Response Actions |
| NRC Manual Chapter 1310 | Regional Office Incident Response Actions |
| IE Manual Chapter 2500 | Reactor Inspection Program |

| | |
|---|---|
| IE Temporary Instruction 1260/1 | IE Investigation Program |
| SECY 79-499 | Report of Task Force on Emergency Planning |
| SECY 79-450 | Action Plan for Promptly Improving Emergency Procedures |
| SECY 79-454 | Authority to Administer Oaths |
| IE Bulletin 79-02 | Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts |
| IE Bulletin 79-06 A | Review of Operational Errors and Systems Misalignments Identified During the Three Mile Incident |

NRC Headquarters Incident Response Plan

Regions I and II Incident Reponse Plans

Memorandum from E. G. Wenzinger, OSD to V. Benaroya, DSS, et al., dated July 17, 1979, entitled Instrumentation to Assess Nuclear Power Plant Conditions During And Following An Accident.

Memorandum from J. H. Sniezek, Director, FFMSI to Boyce Grier, Director, Region I, dated August 7, 1979, "NRC Role During An Emergency."

Memorandum from A. B. Davis, Chief, FFMS Branch to L. J. Cunningham, Senior Health Physicist, FFMS, dated June 23, 1978, "Review Of NRC Emergency Planning Regulations."

Letter from William Kerr, Chairman, Advisory Committee on Reactor Safeguards to William Anders, Chairman USNRC, dated April 8, 1975. SUBJECT: "EMERGENCY PLANNING."

Memorandum from A. B. Davis, Chief, FFMS, to J. Hegner, Executive Office for Operations Support, IE,,July 9, 1979, "Comments on Draft Report of Incident Response Task Force Meeting."

Memorandum from J. Hegner, XOOS, to all Regional Members of Incident Response Task Force dated June 22, 1979, "Draft Report of Incident Response Task Force Meeting."

Memorandum from Dudley Thompson, Executive Officer for Operations Support, IE, to J. G. Davis, Acting Director, IE Dated May 14, 1979, "Incident Response Center Task Force."

| | |
|---|---|
| Metropolitan Edison | Three Mile Island Final Safety Analysis Report |
| Metropolitan Edison | Three Mile Island Emergency Plan |

| | |
|---|---|
| TMI Emergency Procedure 2201-1.3 | Loss of Reactor Coolant/Reactor Coolant System Pressure |
| TMI Emergency Procedure 2202-1.5 | Equipment Located at Emergency Control Center |
| TMI Procedure 1670.12 | Emergency Equipment Located at Emergency Control Center |
| TMI Procedure 1670.9 | Emergency Training and Emergency Exercise |
| TMI Procedure 1670.4 | Evacuation Procedure |
| TMI Procedure 1670.7 | Emergency Assembly/Accountability and Evacuation |

Three Mile Island Security Plan and Procedures

American National Standards Institute (ANSI)
ANSI 18.1, "Selection and Training of Nuclear Power Plant Personnel."

American National Standards Institute (ANSI)
ANSI 18.7 "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants."

American National Standards Institute (ANSI)
ANSI N45.2.6-1973, "Qualifications of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants."

American National Standards Institute (ANSI)
ANSI N45.2.9-1974 - "Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants."

American National Standards (ANSI)
ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants."

American Nuclear Society (ANS) ANS 3.1, "Selection and Training of Nuclear Power Personnel."

Environmental Protection Agency, Manual of Protective Guides and Protective Actions for Nuclear Power Plants (EPA/520/175001)

Appendix D

TMI-2 Inspections*

| Type | Dates | Report Number | Summary** |
|---|---|---|---|
| Operations | 1/9-12/78 | 78-03 | Inspection on January 9-12, 1978 (Report No. 50-320/78-03)<br>Areas Inspected: Routine, unannounced inspection of licensee's action on previous inspection findings; preoperational test results evaluation and test results verification. The inspection involved 68 inspector-hours onsite by three NRC inspectors and accompanying personnel.<br>Results: No items of noncompliance were identified. |
| Operations | 1/1-3/78 | 78-05 | Inspection on January 1-3, 1978 (Report No. 50-320/78-05)<br>Areas Inspected: Routine, unannounced inspection of containment integrated leak rate test and previously identified items. The inspection involved 26 inspector-hours onsite by one NRC inspector.<br>Results: No items of noncompliance were identified. |
| Operations | 1/24-27 and 1/30-2/3/78 | 78-07 | Inspection on January 24-27, 30 - February 3, 1978 (Report No. 50-320/78-07)<br>Areas Inspected: Routine, unannounced inspection of licensee's action on previous inspection findings; Fire Prevention Program; Fire Fighting Training; plant tour; review of overall startup test program; review of |

* Beginning January 1, 1978. Excludes construction and accountability inspections. Includes preoperational inspections.
** As stated in inspection report.

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| | | | actions on Bulletins and Circulars; preoperational test results evaluation and test results verification. The inspection involved 179 inspector-hours onsite by six NRC inspectors and accompanying personnel. Results: No items of noncompliance were identified. |
| Operations | 2/6-10 and 13-14/78 | 78-09 | Inspection on February 6-10 and 13-14, 1978 (Report No. 50-320/78-09) Areas Inspected: Routine, unannounced inspection of licensee's action on previous inspection findings; vibration assessment program; physical security; readiness for operating license issuance; inservice testing of pumps and valves; initial fuel load; test results review. The inspection involved 71 inspector hours onsite by four NRC inspectors. Results: Of the seven areas inspected, no items of noncompliance were identified in six areas; one apparent item of noncompliance (Infraction - failure to have audible source range indication in containment - Paragraph 7.c) was identified in one area. |
| Operations | 2/22-24/78 | 78-10 | Inspection on February 22-24, 1978 (Report No. 50-320/78-10) Areas Inspected: Routine, unannounced inspection of QA/QC administration; audits; document control; maintenance; design changes and modifications; surveillance testing and calibration control; records; and, test and measurement equipment control. |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | The inspection involved 55.5 inspector-hours onsite by two NRC inspectors.<br>Results: Of the eight areas inspected, no items of noncompliance were identified in six areas; two apparent items of noncompliance were identified in two areas (Infraction - two examples - failure to distribute drawings and drawing revisions, Detail 4.b; failure to mark and segregate out of calibration procedure for torque wrenches, Detail 9.b(1); and, Infraction - inadequate calibration procedure for torque wrench tester and torque wrenches, Detail 9.b(2)). |
| Operations | 2/28-3/1 and 3/8-9/78 | 78-11 | Inspection February 28 - March 1, and March 8-9, 1978 (Report No. 50-320/78-11)<br>Areas Inspected: Routine, unannounced inspection of licensee's action on previous inspection findings; preoperational test results evaluation and test results verification; license conditions to enter Operational Mode 4; and compliance with Title 10 requirements. The inspection involved 102 inspector-hours onsite by three NRC inspectors.<br>Results: No items of noncompliance were identified. |
| Operations | 3/23-25/78 | 78-13 | Inspection on March 23-25, 1978 (Report No. 50-320/78-13)<br>Areas Inspected: Routine, announced inspection of licensee's action |

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| | | | on previous inspection findings; preoperational test results evaluation and test results verification; license conditions for Mode 2 Operation; and facility tour. The inspection involved 44 inspector-hours onsite by two NRC inspectors.<br>Results: No items of noncompliance were identified. |
| Operations | 3/27-28/78 | 78-14 | Inspection on March 27-28, 1978 (Report No. 50-320/78-14)<br>Area Inspected: Routine, announced inspection to witness initial criticality. The inspection involved 32 inspector-hours onsite by two NRC inspectors.<br>Results: Of the one area inspected, no items of noncompliance were identified. |
| Operations | 3/30-31 and 4/5-6/79 | 78-15 | Inspection on March 30-31 and April 5-6, 1978 (Report No. 50-320/78-15)<br>Areas Inspected: Routine, unannounced inspection of licensee's action on previous inspection findings; license conditions for Mode I Operation; and licensee actions concerning an ECCS actuation and injection into the RCS on March 29, 1978. The inspection involved 38 inspector-hours onsite by three NRC inspectors.<br>Results: No items of noncompliance were identified. |

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| Operations | 5/3-5 and 8-10/78 | 78-17 | Inspection on May 3-5 and 8-10, 1978 (Report No. 50-320/78-17)<br>Areas Inspected: Routine, unannounced inspection of plant operations including shift logs and records and facility tour; licensee follow-up actions concerning selected licensee events, IE Circulars, and previous inspection findings; reactor coolant system decontamination; emergency safeguards actuation on April 23, 1978; unit auxiliary transformer design deficiency; and postulated small break LOCA. The inspection commenced during a backshift and involved 42.5 inspector-hours onsite by one NRC inspector.<br>Results: No items of noncompliance were identified. |
| Operations | 5/9-12/78 | 78-18 | Inspection on May 9-12, 1978 (Combined Report Nos. 50-289/78-09 and 50-320/78-18)<br>Areas Inspected: Routine, unannounced inspection of licensed operator requalification training, general employee training, craft personnel training, quality assurance for the Startup Test Program, startup test records, and licensee action on previous inspection findings. The inspection involved 33.5 inspector-hours onsite by one NRC inspector.<br>Results: No items of noncompliance were identified. |

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| Operations | 5/10-12/78 | 78-20 | Inspection on May 10-12, 1978 (Report No. 50-320/78-20)<br>Areas Inspected: Routine, unannounced inspection of containment integrated leak rate test report, local leak rate testing and containment systems surveillance. The inspection involved 41 inspector-hours and 5 accompaniment-hours onsite by one NRC inspector and one intern.<br>Results: Of the three areas inspected, no Items of Noncompliance were found in one area, three Items of Noncompliance were found in the second area (infraction -failure to perform airlock surveillance per the Technical Specification - paragraph 5.a; infraction - failure to implement surveillance procedures - paragraph 5.b; and, infraction - failure of an individual to monitor himself upon leaving a controlled area - paragraph 5.c) and one Item of Noncompliance was found in the third area (infraction - failure to verify the equipment hatch closed and sealed - paragraph 3). |
| Operations | 5/30-<br>6/2/78 | 78-22 | Inspection on May 30 - June 2, 1978 (Report No. 50-290/78-22)<br>Areas Inspected: Routine, unannounced inspection of administrative controls of facility procedures; format and technical content of facility procedures; procedure revisions resulting from Technical Specification Amendments; procedure revisions made in accordance |

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| | | | with 10 CFR 50.59(a) and (b); standing orders, special orders, and temporary procedures; and, licensee action on previous inspection findings. The inspection involved 22 inspector-hours onsite by one NRC inspector.<br>Results: Of the six areas inspected, no items of noncompliance were found in five areas; one apparent item of noncompliance was found in one area (Deficiency - failure to properly approve a temporary change, Paragraph 5.c). |
| Operations | 6/15/78 | 78-23 | Inspection on June 15, 1978 (Report No. 50-320/78-23)<br>Areas Inspected: Routine, unannounced inspection of reactor vessel internals modifications; pipe restraints and supports; and 10 CFR Part 21 implementation. The inspection involved 15 inspector-hours onsite by three NRC inspectors.<br>Results: No items of noncompliance were identified. |
| Operations | 7/18-21 and 7/31-8/3/78 | 78-24 | Inspection on July 18-21 and July 31-August 3, 1978 (Report No. 50-320/78-24)<br>Areas Inspected: Routine, unannounced inspection by regional based inspectors of main steam relief valve/piping modifications; plant |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | operations including shift logs and records and facility tour; licensee controls for nonroutine events; licensee followup actions concerning selected previous inspection findings, licensee events, and IE Bulletins and Circulars; measures established to implement Part 21 requirements; and selected licensee periodic and special reports. The inspection involved 93 inspector-hours onsite and two inspector-hours at the corporate office by four NRC regional based inspectors.<br>Results: Of the eight areas inspected, one item of noncompliance was found in one area (Infraction - failure to maintain the weld rod storage oven at the required temperature - paragraph 3.c). |
| Operations | 9/5-7/78 | 78-28 | Inspection on September 5-7, 1978 (Report No. 50-320/78-28)<br>Areas Inspected: Routine, unannounced inspection by a regional based inspector of SIS reset feature; licensee followup actions concerning selected previous inspection findings, licensee events and IE Bulletins and Circulars; and selected licensee special reports. The inspection involved 22 inspector-hours onsite by one NRC regional based inspector.<br>Results: No items of noncompliance were identified. |
| Operations | 9/14-15 and 19-22/78 | 78-29 | Inspection on September 14-15 and 19-22, 1978 (Report No. 50-320/78-29)<br>Areas Inspected: Routine, unannounced inspection by 4 regional based inspectors of preoperational test results; startup test results; power ascension test (witness); administrative controls for safety committees; licensee followup to IE Circular 78-08; plant operations - tour of selected areas; and, followup to a previous inspection finding. The |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | inspection involved 4 inspector-hours at the corporate office and 59 inspector-hours on site by three NRC regional based inspectors and one inspector-trainee.<br>Results: No items of noncompliance were identified. |
| Operations | 10/4-6/78 | 78-30 | <u>Inspection on October 4-6, 1978 (Report No. 50-320/78-30)</u><br><u>Areas Inspected</u>: Routine, unannounced inspection by regional based inspectors of Technical Specification compliance during startup phase operation, including limiting conditions for operation and administrative controls for design changes. The inspection involved 22 inspector-hours onsite by one NRC regional based inspector and one inspector-trainee.<br>Results: No items of noncompliance were identified. |
| Operations | 10/16-20/78 | 78-32 | <u>Inspection on October 16-20, 1978 (Report No. 50-320/78-32)</u><br><u>Areas Inspected</u>: Routine, unannounced inspection by a regional based inspector of startup test results; power level plateau data; plant operations including shift logs and records and facility tour; licensee followup actions concerning selected previous inspection findings; licensee events; IE Circulars; and, selected licensee periodic reports. |

| Type | Dates | Report Number | Summary |
| --- | --- | --- | --- |
| | | | The inspection involved 32 inspector-hours onsite by one NRC regional based inspector. <br> Results: Of the eight areas inspected, one item of noncompliance was found in one area (Deficiency - failure to comply with administrative controls for jumpers and lifted leads, Paragraph 5.a). |
| Operations | 11/7-9 and 16-17/78 | 78-33 | Inspection on November 7-9 and 16-17, 1978 (Report No. 50-320/78-33) <br> Areas Inspected: Routine, unannounced inspection by two regional based inspectors of startup test results; power level plateau data; and emergency safeguards actuation on November 7, 1978. The inspection involved 16 inspector-hours onsite by one NRC regional based inspector and one inspector-trainee, and 4 hours by one regional based NRC supervisor. <br> Results: No items of noncompliance were identified. |
| Operations | 12/4-8 and 12-14/78 | 78-36 | Inspection December 4-8 and 12-14, 1978 (Combined Report Nos. 50-289/78-23 and 50-320/78-36) <br> Areas Inspected: Routine, unannounced inspection by three regional based inspectors of plant operations including facility tour during backshift; Technical Specification Safety Limits, Limiting Safety System Settings and Limiting Conditions for Operation compliance |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | during reactor operations (Unit 2 only); plant cleanliness (Unit 2 only); RPS grounding system testing; stem mounted limit switches environmental qualification; and previous inspection findings. The inspection involved 7 inspector-hours onsite for Unit 1 and 54 inspector-hours onsite for Unit 2 by one NRC regional based inspector and 44 hours onsite by two inspector-trainees.<br>Results (Unit 1): No items of noncompliance were identified.<br>Results (Unit 2): Of the five areas inspected, one item of noncompliance was found in one area (Deficiency - failure to perform surveillance of containment isolation valves located inside containment, Paragraph 4). |
| Operations | 12/12-14/78 | 78-37 | Inspection on December 12-14, 1978 (Combined Report Nos. 50-320/78-37 and 50-289/78-24)<br>Areas Inspected: Routine, unannounced inspection by regional based inspectors of hydraulic snubber surveillance (Unit 2), Inservice Testing of Pumps and Valves and licensee action on previous inspection findings (Unit 1). The inspection involved 48 inspector-hours (Unit 1 - 32 hours, Unit 2 - 16 hours) onsite.<br>Results: Of the three areas inspected no items of noncompliance were found in two areas and one item of noncompliance was found in |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | the third area (Infraction - failure to implement surveillance procedure, Paragraph 4.f and 4.g). |
| Operations | 12/28-29/78 | 78-39 | Inspection on December 28-29, 1978 (Report No. 50-320/78-39)<br>Area Inspected: Routine, unannounced inspection by 2 regional based inspectors of transient test (witness) - generator trip from 96% power and preliminary review of test data. The inspection involved 12 inspector hours onsite by 2 NRC regional based inspectors.<br>Results: No items of noncompliance were identified. |
| Operations | 1/8-11/79 | 79-01 | Inspection on January 8-11, 1979 (Combined Report Nos. 50-289/79-01; 50-320/79-01)<br>Areas Inspected: Routine, unannounced inspection by a regional based inspector of plant operations including shift logs and records and facility tour during normal hours (Unit 2); plant operations during backshift (Unit 2); selected licensee events and periodic reports (Unit 2); and, licensee followup to IE Circular 78-08 and previous inspection findings (Units 1 and 2). The inspection involved 4 inspector-hours onsite for Unit 1, 16 inspector-hours onsite for Unit 2, and 8 inspector-hours at the corporate office by one NRC regional based inspector.<br>Results: No items of noncompliance were identified. |

| Type | Dates | Report Number | Summary |
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| Operations | 1/30-31/79 | 79-02 | Inspection on January 30-31, 1979 (Report No. 50-320/79-02)<br>Areas Inspected: Routine, unannounced inspection by a regional based inspector of licensee action on previous inspection findings and compliance with license conditions. The inspection involved 14 inspector-hours onsite by one NRC regional based inspector.<br>Results: No items of noncompliance were identified. |
| Operations | 2/9/79 | 79-05 | Management Meeting on February 9, 1979 (Combined Report Nos. 50-289/79-04 and 50-320/79-05)<br>Areas Covered: Combined routine corporate management meeting for Unit 1/third corporate management meeting for Unit 2 to discuss the Office of Inspection and Enforcement inspection program and objectives and to discuss the licensee's organization, management controls, previous IE enforcement actions, operational status, plans and programs. |
| Operations | 3/19-23 and 26/79 | 79-07 | Inspection on March 19-23 and 26, 1979 (Combined Report Nos. 50-289/79-08 and 50-320/79-07)<br>Areas Inspected: Routine, unannounced inspection of previous inspection findings (Unit 1); selected licensee events (Units 1 and 2); facility |

| Type | Dates | Report Number | Summary |
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| | | | tour (Unit 1); and licensee followup to a prompt reportable occurrence identified during the inspection (Unit 1). The inspection involved 27 hours onsite for Unit 1 and 17 hours onsite for Unit 2 by one NRC regional based inspector.<br>Results: No items of noncompliance were identified. |
| Emergency Planning | 7/25-27/78 | 78-26 | Inspection on July 25-27, 1978 (Combined Report Nos. 50-289/78-16 and 50-320/78-26)<br>Areas Inspected: Routine, unannounced inspection by a regional based inspector of emergency planning including: licensee coordination with offsite support agencies; emergency facilities, equipment, instrumentation and supplies specified in the Emergency Plan and Implementing Procedures; training of emergency personnel; Emergency Plan Implementing Procedures; licensee records relating to emergency drills; and the licensee's management controls in the area of emergency planning. The inspection involved 19 direct-inspection hours by one Regional based NRC inspector.<br>Results: Of the six areas inspected, one item of noncompliance was identified in one area. (Infraction - failure to follow procedures - Paragraph 3). |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| Emergency Planning | 11/8/78 | 78-34 | Inspection on November 8, 1978 (Combined Report Nos. 50-289/78-21 and 50-320/78-34)<br>Areas Inspected: Routine, unannounced inspection by a regional based inspector of emergency planning including: license coordination with offsite support agencies; emergency facilities, equipment, instrumentation and supplies specified in the Emergency Plan and Implementing Procedures; training of emergency personnel; Emergency Plan Implementing Procedures; licensee records relating to emergency drills; and the licensee's management controls in the area of emergency planning inspection involved 12 direct inspection hours by four regionally based NRC inspectors.<br>Results: Of the area inspected, no items of noncompliance were identified. |
| Radiation Protection | 1/5-6 and 26-27/78 | 78-04 | Inspection on January 5-6, and 26-27, 1978 (Report No. 50-320/78-04)<br>Areas Inspected: Routine, announced inspection of staffing and training of radiation protection personnel, radiation protection procedures, facilities, instruments and equipment, respiratory protection program, liquid and gaseous waste systems, effluent monitors, test of ventilation system filters, preoperational testing of instruments, observation of the status of the facility, and interviews with personnel. The inspection involved 28.5 hours onsite by one NRC inspector.<br>Results: No items of noncompliance were identified. |
| Radiation Protection | 5/5,8 and 9/78 | 78-19 | Inspection on May 5, 8 and 9, 1978 (Report No. 50-320/78-19)<br>Areas Inspected: Routine, unannounced inspection of radiation protection program during the power ascension operation, review of the |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | status and the preoperational tests performed on the ventilation systems, the radiation monitoring system, the effluent monitors, and the radioactive waste systems, and a review of outstanding items in these areas. This inspection involved 19 hours onsite by one NRC inspector.<br>Results: No items of noncompliance were identified. |
| Radiation Protection | 10/6,10-12, and 17-19/78 | 78-31 | Inspection on October 6, 10-12 and 17-19, 1978 (Combined Report Nos. 50-289/78-18 and 50-320/78-31)<br>Areas Inspected: Routine, unannounced inspection by regional based inspectors of radioactive effluent management and personnel exposures in Units 1 and 2, and of the radiation protection program and the biological shielding surveys in Unit 2 during power ascension. Upon arrival, areas where work was being conducted were examined to review radiation safety procedures and practices. This inspection involved 84 inspector-hours onsite by two regional based NRC inspectors.<br>Results: Of the four areas inspected no items of noncompliance were identified in two areas. Three items of noncompliance were identified in two areas (Infraction - failure to post and barricade a high radiation area in Unit 2 - Paragraph 4.a; Infraction - failure to conduct a timely survey during decay heat removal in Unit 2 - |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | Paragraph 4.b; and, Deficiency - failure to maintain complete records of effluent sampling in Unit 1 - Paragraph 5). |
| Radiation Protection | 2/13-15,24 25,28 and 3/1-2/79 | 79-04 | Inspection on February 13-15, 24, 25, 28, and March 1 and 2, 1979 (Combined Report Nos. 50-289/79-03 and 50-320/79-04)<br>Areas Inspected: Routine, unannounced inspection by regional based inspectors of Unit 2 Biological Shield Surveys, effluent monitoring and radwaste system operation, and the Units 1 and 2 radiation protection program during routine operation and during Unit 1 refueling, including: qualifications of radiation protection personnel; training; procedures; instruments and equipment; exposure control; posting, labeling, and control of radioactive materials and radiation areas; surveys; and notifications and reports. Upon arrival, areas where work was being conducted were examined to review radiation safety procedures and practices. This inspection involved 81 inspector-hours onsite by two regional based NRC inspectors.<br>Results: Of the twelve areas inspected, no items of noncompliance or deviations were identified in ten areas. Two items of noncompliance were identified in two areas (Infractions: High radiation area entries without adequate continuously indicating dose rate instruments - paragraph 5, and failure to adhere to procedures - paragraph 6). The |

| Type | Dates | Report Number | Summary |
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| | | | neutron radiation levels in Unit 2 were substantially greater than indicated in the FSAR and this was casued by low water levels in the neutron shield tanks - paragraph 4. |
| Radwaste | 1/5-6 and 26-27/78 | 78-04 | (See Radiation Protection) |
| Radwaste | 5/5, 8 and 9/78 | 78-19 | (See Radiation Protection) |
| Radwaste | 7/19-21/78 | 78-25 | Inspection on July 19-21, 1978 (Report Nos. 50-289/78-15 and 50-320/78-25)<br>Areas Inspected: Routine, unannounced inspection of the licensee's chemical and radiochemical measurements program using laboratory assistance provided by DOE Radiological and Environmental Services Laboratory. Areas reviewed included: program for quality control of analytical measurements; internal audit results; performance on radiological analyses of split effluent samples and spiked samples; and effluent control records and procedures. The inspection involved 44 inspector-hours on site by two NRC regional based inspectors. |

| Type | Dates | Report Number | Summary |
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| | | | Results: Of the four areas inspected, no items of noncompliance were identified in three areas, and one item of noncompliance (Infraction - failure to follow procedures - paragraph 3.g) was identified in one area. |
| Radwaste | 10/6, 10-12, and 17-19/78 | 78-31 | (See Radiation Protection) |
| Radwaste | 2/13-15, 24 25,28 and 3/1-2/79 | 79-04 | (See Radiation Protection) |
| Safeguards | 1/5-6/78 | 78-02 | Announced, Preoperational Inspection on January 5-6, 1978 (Report No. 50-320/78-02)<br>Areas Inspected: Security Plan (Guard Procedures), Security Organization, Physical Barriers, Access Controls, Detection Aids, IE Bulletin 77-04. The continued monitoring of the licensee's security program prior to the issuance of an operating license. Two Unresolved Items, 4.b and 6.a, will be inspectable by the end |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | of January 1978, approximately 1 week prior to IOL. Two inspectors spent 32 inspector-hours onsite.<br>Results: No items of noncompliance were identified. |
| Safeguards | 5/16-19/78 | 78-21 | Region I Combined Inspection (Report Nos. 50-289/78-10 and 50-320/78-21)<br>Conducted on May 16-19, 1978<br>Areas Inspected: Routine, unannounced Physical Security Inspection of the security program implemented in compliance with those applicable portions of 10 CFR 73.55 and 73.70. Specifically, the following: Security Plan, Security Organization, Physical Barriers, Access Controls, Detection Aids, Communications, Testing and Maintenance, Response Requirements, and Records. Licensee's action to IE Circular 77-04 and Bulletin 77-08 will be completed between August and December 1978. This inspection involved 56 inspector-hours by two inspectors and began during regular hours.<br>Results: No items of noncompliance were identified. |
| Safeguards | 11/27-<br>12/1/78 | 78-35 | Region I Combined Inspection (Report Nos. 50-289/78-22; 50-320/78-35)<br>Inspection Conducted on November 27 - December 1, 1978<br>Areas Inspected: Routine, unannounced physical protection inspection |

| Type | Dates | Report Number | Summary |
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| | | | by regional based inspectors. Implementation of accepted Security Plans and applicable sections of 10 CFR 73.55 relative to: Security Organization; Physical Barriers; Access Controls; Communications; Detection Aids; Testing and Maintenance; Response Procedures and Records and Reports. Licensee's upgrade actions on IE Circular 77-04 were completed and the licensee is currently finalizing compliance with IE Bulletin's 77-08 and 78-17 with an estimated completion date of February, 1979. This inspection began during regular shift hours and involved 70 inspector-hours onsite by two NRC regional based inspectors.<br>Results: No items of noncompliance were identified. |
| Safeguards | 3/19-23/79 | 79-06 | Region I Combined Inspection (Report Nos. 50-289/79-07; and 50-320/79-06)<br>Inspection Conducted on March 19-23, 1979.<br>Areas Inspected: Routine, unannounced physical protection inspection by regional based inspectors to include Security Plan, Security Program Audit, Security Organization, Physical Barriers for Protected Areas, Physical Barriers for Vital Areas, Lighting, Access Control Identification, Authorization, and Badging; Access Control-Search; Access Control-Escorting; Access Control-Vital Areas; Alarm Stations; Detection |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| | | | Aids; Perimeter Intrusion Alarm Systems; Assessment Aids; Communications; Testing and Maintenance; Compensatory Measures; Power Supply; Response; Locks, Keys and Combinations and Records and Reports. The inspection was initiated during irregular hours and involved 58 inspector-hours onsite by two inspectors. Of the twenty areas inspected no apparent items of noncompliance were found in 19 areas. One apparent item of noncompliance was found in one area (Infraction access control - vital areas - paragraph 13). |
| Environmental | 1/18-20/78 | 78-08 | Inspection on January 18-20, 1978 (Report No. 50-320/78-08)<br>Areas Inspected: Routine, announced inspection of the environmental protection program (preoperational phase), limited to the determination of status of preparedness to implement the operational environmental monitoring program including: management controls, program description, documents and procedures, and necessary instrumentation. The inspection involved 17 onsite inspection hours by one NRC inspector.<br>Results: Within the scope of this inspection, no items of noncompliance were identified. |

| Type | Dates | Report Number | Summary |
|---|---|---|---|
| Environmental | 4/17-21/78 | 78-16 | Inspection on April 17-21, 1978 (Combined Report Nos. 50-289/78-08 and 50-320/78-16)<br>Areas Inspected: Routine, unannounced inspection of environmental monitoring programs for operations, including: the management controls for these programs; the licensee program for quality control of analytical measurements; implementation of the environmental monitoring programs - radiological; implementation of the environmental monitoring programs - biological/ecological; nonradioactive effluent release rates and limits; radiation levels around the Borated Water Storage Tank (BWST); and a followup on the licensee action on previous inspection findings. The inspection involved 36 inspector-hours onsite by one NRC inspector.<br>Results: Of the six areas inspected, no items of noncompliance were identified in four areas. Three apparent items of noncompliance (Infraction - radiation levels in excess of limits in an unrestricted area - Detail 9; Deficiency - failure to sample and analyze air particulates and iodines - Detail 6.c(2); Deficiency - failure to meet Sr-89 analytical sensitivity for drinking water - Detail 6.c(3)) were identified in two areas. |

# ABBREVIATIONS

| | |
|---|---|
| ACI | - American Concrete Institute |
| ACRS | - Advisory Committee on Reactor Safeguards |
| AIF | - Atomic Industrial Forum |
| ANS | - American Nuclear Society |
| ANSI | - American National Standards Institute |
| B&W | - Babcock & Wilcox |
| BWR | - Boiling Water Reactor |
| Carlisle | - Carlisle, Pennsylvania |
| CFR | - Code of Federal Regulations |
| CRT | - Cathode Ray Tube |
| DOE | - Department of Energy |
| EMT | - Executive Management Team |
| FFMS | - Fuel Facility and Materials Safety Branch |
| GSA | - Government Services Administration |
| HP | - Health Physics |
| IE | - Office of Inspection and Enforcement |
| IE:HQ | - IE Headquarters |
| IEEE | - Institute of Electric and Electronics Engineers |

| | |
|---|---|
| IRACT | - Incident Response Action Coordination Team |
| LCO | - Limiting Condition for Operation |
| LOCA | - Loss of Coolant Accident |
| NPRDS | - Nuclear Plant Reliability Data System |
| NRC | - Nuclear Regulatory Commission |
| NRR | - Office of Nuclear Reactor Regulation |
| NUREG | - Identifies documents produced by NRC |
| OELD | - Office of Executive Legal Director |
| OL | - Operating License |
| OSD | - Office of Standards Development |
| P&ID | - Piping and Instrumentation Drawing |
| PORC | - Plant Operations Review Committee |
| PWR | - Pressurized Water Reactor |
| QA | - Quality Assurance |
| QC | - Quality Control |
| RCS | - Reactor Coolant System |
| RG | - Regulatory Guide |
| RI | - Resident Inspector |

RONS - Reactor Operations and Nuclear Support Branch

SAR - Safety Analysis Report

SRG - Special Review Group

SRO - Senior Reactor Operator

SRP - Standard Review Plan

SSCs - Structures, Systems, and Components

TMI-1 Three Mile Island Nuclear Plant, Unit 1

TMI-2 Three Mile Island Nuclear Plant, Unit 2

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16. ABSTRACT (200 words or less)


A Special Review Group of IE personnel was commissioned by Victor Stello, Jr., Director, Office of Inspection and Enforcement (IE) to develop and recommend changes in IE programs based on TMI experience. Both preventive and responsive aspects of IE programs and operations were studied. A total of 219 separate recommendations for change was generated in this review.

Preventive changes pervade all parts of the routine IE Inspection Program ranging from plant design through operation. Responsive changes focus on emergency preparedness of licensees and the NRC. In the aggregate, these changes will enhance program and organizational effectiveness of the office.

The relative priority of recommended changes and estimation of resources needed to implement them have been left to IE line management.


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