50-390

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

September 27, 1979

(TO ALL PENDING OPERATING LICENSE APPLICANTS)

Gentlemen:

SUBJECT: FOLLOWUP ACTIONS RESULTING FROM THE NRC STAFF REVIEWS REGARDING THE THREE MILE ISLAND UNIT 2 ACCIDENT

Over the past several months following the Three Mile Island accident, the NRC staff has been conducting an intensive review of the design and operational aspects of nuclear power plants and the emergency procedures for coping with potential accidents. The purpose of these efforts was to identify measures that should be taken in the short-term to reduce the likelihood of such accidents and to improve the emergency preparedness in responding to such events. To carry out this review, efforts within NRR were established in four areas: (a) licensee emergency preparedness, (b) operator licensing, (c) bulletins and orders followup (primarily in the areas of auxiliary feedwater systems reliability; loss of feedwater and small break loss-of-coolant accident analysis; emergency operating guidelines and procedures) and (d) Short-Term Lessons Learned.

The purpose of this letter is to provide for planning and guidance purposes the NRR staff position on the status and applicability of the results of these efforts to pending operating license applications. The Commission may add to or modify these staff positions after reviewing them. Additional staff requirements may be developed as NRR's Lessons Learned Task Force completes its long-term recommendations. Several other investigations, including the Presidential Commission and NRC's Special Inquiry Group, can be expected to lead to additional requirements.

Lessons Learned Task Force Report

The principal element of the staff activities listed above is contained in the report titled, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations" (NUREG-0578), a copy of which was previously sent to you. The Task Force report contains a set of recommendations to be implemented in two stages over the next 16 months on operating plants and pending operating license applications. The Task Force recommended 20 licensing requirements and three rulemaking matters in 12 broad areas.

The Advisory Committee on Reactor Safeguards has completed its review of the Task Force report. The several public meetings of the ACRS subcommittee on TMI-2 and the public meeting of the full committee on August 9 provided

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an opportunity for the presentation and discussion of public comments on the report. The ACRS letter of August 13, 1979 to Chairman Hendrie states that the Committee agrees with the intent and substance of all the Task Force recommendations, except four upon which the Committee offered constructive comments to achieve the same objectives articulated by the Task Force. The Committee also noted that effective implementation will require a more flexible, perhaps extended, schedule than proposed by the Task Force. A copy of the ACRS letter is provided as Enclosure 1.

After evaluating all comments received, the Director of NRR has concluded that the following actions are appropriate for pending operating license applications.

(a) The staff will be proposing a new rule on a Limiting Condition of Operation to require plant shutdown for certain human or procedural errors, particularly those which are repetitive in nature. As such, no action is required on your part at this time.

(b) At the present time we are delaying efforts regarding proposed rulemaking on both the inerting requirements for Mark I and II BWR containments, and the requirement regarding hydrogen recombiner capability; accordingly, no action is required on your part at this time.

(c) The ACRS comments on the shift technical advisor have resulted in our reassessment of the possible means of achieving the two functions which the Task Force intended to provide by this requirement. The two functions are accident assessment and operating experience assessment by people onsite with engineering competence and certain other characteristics. We have concluded that the shift technical advisor concept is the preferable short-term method of supplying these functions. We have also concluded that some flexibility in implementation may yield the desired results if there is management innovation by individual licensees. We have prepared a statement of functional characteristics for the shift technical advisor that will be used by the staff in the review of any alternatives proposed by applicants for operating licenses. A copy is provided as Enclosure 2. The Commission is considering whether or not additional qualifications should be required for this individual.

(d) Three additional instrumentation requirements for short-term action were developed during the ACRS review of NUREG-0578. These items relate to containment pressure, containment water level and containment hydrogen monitors designed to follow the course of an accident. Descriptions of these items are provided in Enclosure 3.

(e) An additional requirement following issuance of NUREG-0578, which concerned a remotely operable high point vent for gas from the reactor coolant system, was developed. A description of this requirement is provided in Enclosure 4.

(f) The Lessons Learned Task Force has compiled a set of errata and clarifying comments for NUREG-0578. It is provided as Enclosure 5.

Following our review of the proposed Task Force recommendations, ACRS review and comments received, the Director of NRR has concluded that all pending operating license applicants should begin to implement the actions contained in NUREG-0578, as modified and/or supplemented by items (a) through (f) above, as soon as possible. Therefore, we suggest that you should amend your application appropriately. An implementation schedule is contained in Enclosure 6. The implementation dates for the Commission rulemaking actions and those deferred actions, identified above, will be established later.

Other Review Areas

Enclosure 7 outlines the requirements developed to date resulting from the staff's Emergency Preparedness Studies. Enclosure 8 provides the implementation schedules for the emergency preparedness recommendations which, you will note, includes three of the Lessons Learned Topics. The staff position is that you should comply with each of the recommendations of Enclosure 7 in accordance with the implementation schedules shown in Enclosure 8. Further, the Commission has initiated a rulemaking procedure, now scheduled for completion in January 1980 in the area of Emergency Planning and Preparedness. Additional requirements are to be expected when rulemaking is completed and some modifications to the emergency preparedness requirements contained in this letter may be necessary.

Enclosure 9 outlines the staff recommendations concerning improvements in the area of operator training which are provided for your information. These recommendations are undergoing Commission review and most are expected to be adopted as requirements in the near future. Further Commission review in the areas of operator training and qualification can be expected to result in substantial additional requirements.

A number of other related actions on your facility may have been initiated under the direction of the NRR Bulletins and Orders Task Group. Each applicant will receive additional guidance from this group, particularly related to auxiliary feedwater systems and small break LOCAs, in the near future. Your activities should continue in these areas, as all the mentioned activities are meant to complement one another.

The measures discussed above represent a set of requirements that the staff has concluded should be implemented at this time. As stated earlier, other requirements may follow in the future. The procedures for Commission review of TMI-related issues prior to the issuance of operating licenses have not yet been established. The Commission is considering several alternatives, and you will be notified when a decision is made in this matter.

If you have any questions regarding these actions, please contact the NRC Project Manager for your facility.

Sincerely,

DB Vassallo

Domenic B. Vassallo, Acting Director
Division of Project Management

Enclosures:
1. ACRS Ltr: Carbon to Hendrie dtd 8/31/79
2. Alternatives to Shift Technical Advisor
3. Instrumentation to Monitor Containment Conditions
4. Installation of Remotely-Operated High Point Vents in the Reactor Coolant System
5. NUREG-0578 Errata
6. Implementation Schedule
7. Requirements for Improving Emergency Preparedness
8. Emergency Preparedness Improvements - Implementation Schedule
9. Improvements in Operator Training

ccs:
Service List

ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

August 13, 1979

Honorable Joseph M. Hendrie
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: SHORT-TERM RECOMMENDATIONS OF TMI-2 LESSONS LEARNED TASK FORCE

Dear Dr. Hendrie:

During its 232nd meeting, August 9-11, 1979, the Advisory Committee on Reactor Safeguards completed a review of the short-term recommendations of the TMI-2 Lessons Learned Task Force as reported in NUREG-0578. These recommendations had been reviewed, in part, by an ACRS Subcommittee at a meeting in Washington, D.C., on July 27, 1979. During its review the Committee had the benefit of discussions with members of the Task Force. Comments from representatives of the nuclear industry were also considered.

In its review, the Committee has noted that the recommendations in NUREG-0578 are those deemed by the Task Force to be required in the short term to provide substantial additional protection for the public health and safety.

The Committee has considered both the recommendations themselves and the schedules proposed for their implementation. Regarding the latter, the Committee believes that the orderly and effective implementation and the appropriate level of review and approval by the NRC Staff will require a somewhat more flexible, and in some cases more extended, schedule than is implied by NUREG-0578.

With regard to the requirements themselves, the Committee agrees with the intent and substance of all except those discussed below.

<u>2.1.5 Post-Accident Hydrogen-Control Systems</u>

<u>a</u>. The Committee agrees with the recommendations relating to dedicated penetrations for external recombiners or purge systems for operating plants that have such systems.

<u>b. and c.</u> The majority of the Task Force has recommended rule-making to require inerting of BWR Mark I and II reactors. A minority of the Task Force has recommended rule-making to require that all operating light water reactors provide the capability to use a hydrogen recombiner.

The Committee believes that questions relating to hydrogen generation during and following an accident, the rate and amount of generation, the need to control it, and the means of doing so, need to be reexamined. The Task Force has advised the Committee that it is considering this question further in connection with its longer-term recommendations which are scheduled to be completed by September, 1979. The ACRS believes that decisions concerning possible additional measures to deal with hydrogen should be deferred pending early evaluation of the forthcoming longer-term Task Force recommendations.

2.1.8 Instrumentation to Follow the Course of an Accident

With regard to instrumentation to follow the course of an accident, the ACRS believes that containment pressure, containment water level, and on-line monitoring of hydrogen concentration in the containment should also be considered for implementation for all operating reactors on the same schedule as that recommended by the Lessons Learned Task Force.

2.2.1.b Shift Technical Advisor

The Committee agrees completely with the two closely related objectives of this recommendation. One relates to the presence in the control room during off-normal events of an individual having technical and analytical capability and dedicated to concern for safety of the plant. The other relates to the need for an on-site, and perhaps dedicated, engineering staff to review and evaluate safety-related aspects of plant design and operation. The achievement of these objectives will contribute significantly to the safe operation of a plant.

The Committee believes that there may be difficulty in finding a sufficient number of people with the required qualifications and interest in shift work to fill the Technical Advisor positions. The Committee therefore believes the solution proposed by the Staff should not be mandatory but that alternate solutions also should be considered.

2.2.3 Revised Limiting Conditions for Operation

The Committee agrees with the findings of the Task Force that there are too many human or operational errors resulting in the defeat of an entire safety system, that the number of such occurrences should be and can be reduced, and that the ultimate responsibility for doing this must rest with the licensee.

The Committee, however, is not convinced that the Task Force proposal is the best or only way to increase the licensee's awareness of the need to improve operational reliability, and suggests that measures short of shutdown, such as a rule that requires actions similar to those of a show-cause order, may be equally effective.

Sincerely,

Max W. Carbon
Chairman

References:

1. NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations," Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, July 1979.
2. Letter, D. Knuth, President, KMC, Inc., to Harold Denton, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 8, 1979, Subject: TMI-2 Lessons Learned Task Force Report (NUREG-0578).
3. Letter, Stanley Ragone, President, Virginia Electric and Power Company, to Joseph M. Hendrie, Chairman, U.S. Nuclear Regulatory Commission, August 8, 1979, Subject: Lessons Learned Task Force on TMI-2, NUREG-0578.
4. Letter, Floyd W. Lewis, Chairman, Ad Hoc Nuclear Oversight Committee, to Harold R. Denton, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 1, 1979, Subject: Lessons Learned from TMI-2.
5. Letter, American Nuclear Society, ANS-3 Committee, to Joseph M. Hendrie, Chairman, U.S. Nuclear Regulatory Commission, August 2, 1979, Subject: Lessons Learned Task Force Status Report NUREG-0578.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

August 15, 1979

MEMORANDUM FOR: Chairman Hendrie

FROM: Raymond F. Fraley, Executive Director, ACRS

SUBJECT: ADDITIONAL REFERENCES TO ACRS LETTER ON SHORT-TERM RECOMMENDATIONS OF TMI-2 LESSONS LEARNED TASK FORCE DATED AUGUST 13, 1979

The attached revised Page 3 of the subject letter should be substituted for the one which was originally sent to you. This page incorporates additional references 6, 7, and 8.

Attachment:
Revised Page 3

cc:
Commissioner Gilinsky
Commissioner Kennedy
Commissioner Bradford
Commissioner Ahearne

need to improve operational reliability, and suggests that measures short of shutdown, such as a rule that requires actions similar to those of a show-cause order, may be equally effective.

Sincerely,

Max W. Carbon
Chairman

References:

1. NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations," Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, July 1979.
2. Letter, D. Knuth, President, KMC, Inc., to Harold Denton, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 8, 1979, Subject: TMI-2 Lessons Learned Task Force Report (NUREG-0578).
3. Letter, Stanley Ragone, President, Virginia Electric and Power Company, to Joseph M. Hendrie, Chairman, U.S. Nuclear Regulatory Commission, August 8, 1979, Subject: Lessons Learned Task Force on TMI-2, NUREG-0578.
4. Letter, Floyd W. Lewis, Chairman, Ad Hoc Nuclear Oversight Committee, to Harold R. Denton, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 1, 1979, Subject: Lessons Learned from TMI-2.
5. Letter, American Nuclear Society, ANS-3 Committee, to Joseph M. Hendrie, Chairman, U.S. Nuclear Regulatory Commission, August 2, 1979, Subject: Lessons Learned Task Force Status Report NUREG-0578.
6. Letter, Robert Szalay, Atomic Industrial Forum, Inc. (AIF), to Harold Denton, Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 2, 1979, Subject: "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations," (NUREG-0578).
7. Report by the AIF Policy Committee on Follow-up to the Three Mile Island Accident, July 5, 1979.
8. Memorandum, C. G. Long, Lessons Learned Task Force Member, to R. J. Mattson, Director, TMI-2 Lessons Learned Task Force, July 30, 1979, Subject: Review of LERs for Loss of Safety Function Due to Personnel Error and Defective Procedures, (50-320).

REVISED

ENCLOSURE 2

ALTERNATIVES TO SHIFT TECHNICAL ADVISORS

The recommendation by the Lessons Learned Task Force that an on-shift Technical Advisor be required at operating nuclear power plants has received much comment and attention by the ACRS and industry representatives since NUREG-0578 was published. Several alternative approaches have been suggested. The ACRS has advised and the Director of NRR has decided that alternatives be considered and approved if found by the staff to satisfactorily accomplish the functions described by the Task Force for the Shift Technical Advisor. As an aid to evaluating alternatives, a more comprehensive discussion of the purpose and basis of the Task Force recommendation is provided below. The discussion is in terms of the two principal functions intended to be accomplished and the characteristics thought to be necessary to effectively accomplish these functions. It is intended that the licensing review staff make use of this discussion in evaluating alternatives proposed by licensees and license applicants.

Introduction

As stated in NUREG-0578, the Lessons Learned Task Force has concluded that the need for improved operations is the most important lesson learned from the accident at TMI-2. One key element so far identified is the need to improve the capability in the control room to recognize and diagnose unusual events. Over the next several years, improvements in the capability of the reactor operations staff to respond to unusual events can and will be sought through improvements in plant design, operating procedures and the qualification and training of operators. Improvements in plant design are expected to include improvements in the area of human factors, especially improvements in display and diagnostic systems available to aid operators. For example, the Task Force made a short term recommendation for improvement of the means of assessing inadequate core cooling. The Task Force also made short term recommendations for improvements in emergency procedures and preparations by the plant operations organization. The purpose of these recommendations is to assure that the operators and the onsite operational and technical support personnel are organized both administratively and physically in an effective manner. In addition, improvements in the licensing requirements for operators have been recommended to the Commission. Over the coming months, it is likely that further increases in qualification and training requirements for operators will be developed by the industry's recently announced Nuclear Operations Institute for implementation over the next several years. Because these changes are necessary but difficult to achieve rapidly, the Lessons Learned Task Force has recommended the use of Shift Technical Advisors as a method of immediately improving the operating staff capabilities for response to off normal conditions and for evaluating operating experience.

The consensus of the Task Force is that there are two necessary improvements in the capability to assess the status of a plant during unusual conditions such as a transient or an accident, to realize the significance of the available information such as instrument readings, and to take appropriate action. First, there should be an accident assessment capability based on a comprehensive education in engineering and science subjects related to nuclear power plant design and on training and experience in the dynamic response of the specific plant. This capability must be rapidly available in the control room in the event of an accident. Second, there should be a capability to maintain and upgrade safe plant operations through the cognizance and evaluation of applicable operating experience by an engineering group with diverse technical knowledge, experience, and perspective in relevant areas such as electrical, mechanical and fluid systems and human factors. The addition of Shift Technical Advisors to the plant operating staff is an acceptable means of supplying both of these functions. Alternative manning and organizational schemes will be considered and will be evaluated for satisfaction of the qualifications, training and duty assignment criteria discussed below.

Discussion

In developing the recommendation for the Shift Technical Advisor, the Task Force concentrated on the two functions that needed to be provided, namely, an accident assessment function and an operating experience assessment function. The proper performance of these functions requires the provision of certain characteristics described in the following paragraphs.

A. Accident Assessment Function

1. General Technical Education

The technical education of at least one person in the control room under off normal conditions should include basic subjects in engineering and science. The purpose of this education is to aid the operator in assessing unusual situations not explicitly covered in the current operator training. The following is a tentative list of areas of knowledge that are considered to be desirable:

Mathematics, including elementary calculus
Reactor physics, chemistry and materials
Reactor thermodynamics, fluid mechanics, and heat transfer
Electrical engineering, including reactor control theory

These areas of knowledge should be taught at the college level and would be equivalent to about 60 semester hours. Although a college graduate engineer would have many of these subjects and more that would not be essential, some engineers might be deficient in a few of these specific areas, e.g., reactor physics. Although the time to teach these subjects to a licensed senior reactor operator could be as short as two years, depending on the scope and content of the subjects, the selection of a graduate engineer would likely be a more rapid means of fulfilling this characteristic.

2. Reactor Operations Training

All persons assigned to duties in the control room should be trained in the details of the design, function, arrangement and operation of the plant systems. This training is necessary to assure that the meaning and significance of instrument readings and the effect of control actions are known. A licensed operator or supervisor of an operator would not be required to have further training in order to fulfill this characteristic. A graduate engineer not previously licensed or trained as an operator or senior operator would require additional training in order to fulfill this characteristic.

3. Transient and Accident REsponse Training

In addition to the training in normal operations, anticipated transients, and accidents presently required of operators and senior operators, one person in the control room under off normal conditions should be trained to recognize and react to a wide range of unusual situations including multiple equipment failures and operator errors. This training should not be limited to written procedures or specific accident scenarios, but should include the recognition of symptoms of accident conditions such as complex transient responses or inadequate core cooling and possible corrective actions. The purpose of this training is to broaden the ability for prompt recognition of and response to unusual events, not to modify the instinctive, rapid procedural response to transients and accidents provided by reactor operators. The training is required in recognition of the fact that real accidents inherently are initiated and accompanied by unusual and unexpected events. The training is also to emphasize need to focus on the essential parameters that indicate the status of the core and the primary coolant boundary. This additional training would take up to a year to accomplish for a person not already experienced in nuclear plant transient and accident analysis or evaluation. Both inexperienced graduate engineers and currently licensed operators would require additional training to fulfill this characteristic.

4. Detachment from Operations

The plant response assessment function requires a measure of detachment from the manipulation of controls or immediate supervision of operators. This is intended to provide the perspective and the time for assessing plant conditions and advising on appropriate operator actions. It has been called a safety monitor characteristic. Currently only three operators would normally be in the control room at the time an unusual event occurred, and it is allowed that at times there would be fewer. This number is only enough to satisfy the demands for prompt control and supervisory actions under off normal conditions. The time necessary to make a considered assessment and permit independent monitoring of plant safety require one more person in the form of the Shift Technical Advisor or some alternative in the control room.

5. Independence from Operations

In order to provide both perspective in assessment of plant conditions and dedication to the safety of the plant, this function should have a clear measure of independence from duties associated with the commercial operation of the plant. In an accident situation where command authority should not be diluted, complete independence is not desirable and is not necessary to the safety assessment function.

6. Availability

This capability should be readily available in the control room, preferably immediately at all times, but at most within ten minutes. Having this capability on duty for each shift is the best approach.

B. Operating Experience Assessment Function

1. Independence from Operations

A measure of independence is required to provide for effective safety monitoring of operating experience at the individual plant and at plants of like design. The assessment of operating experience at the assigned plant and other similar plants and the routine monitoring of the safety of plant operations is usually compatible with and necessary for efficient operations. However, the demands of commercial operation can sometimes distract from or appear to override safety judgments. An independent monitoring of the safety of plant operations is intended to counter-balance the immediate and pressing needs of commercial operation.

2. Dedication

Personnel should be dedicated to the function of safety monitoring of operating experience as their primary responsibility and duty. Although reactor operating personnel have a commitment to safety that derives from self interest as well as regulatory requirements, it is only one of two primary responsibilities, the other being the continuous production of power. The assignment of safety evaluation of operating experience as a primary responsibility for certain specified individuals will reduce potential conflicts and assure adequate time to discharge the duties.

3. Diversity of Technical Knowledge

The technical knowledge of those assessing operating experience should be diverse and encompass all technical areas important to safety. The types of problems that can affect safety include all areas related to the design and operation of nuclear power plants; e.g., mechanical, electrical and fluid systems and reactor physics, chemistry and metallurgy. Recognition and understanding of a problem and its significance requires some knowledge in the relevant technical specialities and cannot depend solely on the descriptions and judgements of the persons identifying and reporting the problem. Because of the broad scope of possible technical areas and the possible interactions of components, equipment and systems, the people engaged in operating experience review should have experience in areas usually designated as systems engineering. They should also be graduate engineers, or equivalent. In addition, because of the importance of operator actions in the safety of plant operations, familiarity with or routine access to persons with the principles of human engineering or human factors should be provided.

Alternatives

As discussed in NUREG-0578, several alternative means of providing the accident assessment function were considered by the Lessons Learned Task Force. They were:

1. Upgrade the requirements for reactor operators and senior reactor operators to include more engineering and plant response training.
2. Provide additional on-shift personnel with science or engineering training and specific traning in plant design and response.
3. Provide on-call assistance to the control room by identified personnel in the plant engineering organization having the training described in alternative 2.

Although the Task Force initially assumed that the accident assessment function would be combined with the operating experience assessment function, it is possible that the two functions could be separated. Some have suggested that people with the education, training, and experience required for both the operating experience assessment function and the safety monitoring function would be more easily obtained and retained if not required to work on shift. Others believe that such people can be retained if sufficient incentives are provided. The advantages and disadvantages of these alternatives are discussed below. Although no alternative other than a group of dedicated Shift Technical Advisors has so far been found acceptable, it is possible that innovative improvements in the other alternatives could be found acceptable.

Discussion of Alternatives

1. Upgrade the training and qualifications of the senior reactor operator. This alternative would require no change in the present number or organization of control room operators. The debilitating feature of this alternative is that the senior operator would be busy directing the reactor operators or taking actions himself during an accident and not have sufficient time or perspective to make the desired assessment of plant conditions; i.e., perform the safety monitor function. This arrangement would also not provide a clear independence from commercial operation. However, the capability would be readily available when needed. It is unrealistic to expect the senior operator to fulfill the operating experience assessment function. A separate group could be established to accomplish that function on the day shift when interaction with offsite experts and utility management would be enhanced. If schemes are proposed to accomplish the two functions separately, then they should include mechanisms

for sufficient coupling of the two to assure continuous feedback of and ready access to the knowledge being acquired in operating experience evaluation.

2. Additional on-shift personnel

This alternative would require the addition of one person to the on-shift control room staff. If the person is to be a Shift Technical Advisor, no license would be required, thus making the position easier to fill quickly. However, detachment from first-line commercial operations decisions can be attained by either a line or advisory position. For example, instead of the Shift Technical Advisor proposed by the Task Force, there may be acceptable methods of using a Shift Engineer, who normally has authority over a Shift Supervisor, to perform the accident assessment function. Either approach would utilize people on shift so they would be readily available. Since the Shift Engineer would have normal duties other than operating experience assessment, a separate day shift group would be required to fulfill that function if the shift engineer was found to be an acceptable source of the accident assessment (safety monitor) function.

3. On-call assistance

This alternative would require no additional on-shift personnel. Others have susggested that provision of the recommended technical education and training would be most easily accomplished with this alternative since degreed engineers with intimate knowledge of the plant design basis and accident response characteristics are available in the utility technical staff. Since these personnel would be remote from the control room, a requirement to be licensed does not appear to be consistent. Knowledge of accident response might also be more easily found among vendor personnel who have extensive experience in accident analysis and systems design. This alternative also provides detachment from actual operation and some independence from commercial operation. However, these people would not be readily available when needed. The use of utility or vendor personnel not at the site would increase the difficulties of communication. Although there is need for backup assistance from these other organizations, it is doubtful that they would be able to provide for the prompt response needs of the accident assessment function and they do not have sufficient plant unique experience and familiarity to satisfy the operating experience assessment function.

Enclosure 3.

Instrumentation to Monitor Containment Conditions During the Course of an Accident

1. INTRODUCTION

General Design Criterion 13, "Instrumentation and Control," of Appendix A to 10 CFR 50, requires instrumentation to monitor variables "for accident conditions ... including containment and associated systems." Specific requirements are included in Standard Review Plan Section 6.2.5, "Combustible Gas Control in Containment," for the capability to monitor hydrogen concentration in the containment atmosphere. Instrumentation to sense or monitor containment conditions already exists to some degree (e.g., automatic containment isolation on high containment pressure at TMI-2). However, it is clear that all information necessary to assess the response of the containment to the accident conditions at TMI-2 was not available to the operator.

It has been the contention of some applicants that General Design Criterion 13 applies to only those accidents listed in Chapter 15 of Regulatory Guide 1.70. Again, based on conditions experienced at Three Mile Island, it is clear that situations can arise which produce containment conditions beyond those postulated for the Chapter 15 events.

2. DISCUSSION

Approximately 10 hours after the start of the accident at TMI-2, a 28-psig pressure spike occurred in the containment building. Although it is now believed that the pressure spike was due to the rapid burning of hydrogen gas in the containment atmosphere, the staff on duty in the control room apparently did not attach any special significance to the pressure spike at the time. At the time of the occurrence, the plant staff attributed the event to various causes, including electrical problems and relief valve opening. It is now known that the pressure spike represented a much more serious condition within containment and the pressure indication itself could have been, but was not then accepted as, critical information to the plant operators. The events at Three Mile Island clearly reaffirm the need for containment pressure indication in the control room. Furthermore, it is clearly cost effective and necessary that the instrumentation range include the expected failure level for the containment.

The sequence of events during the accident at Three Mile Island indicate a second item of information which could have been, but was not immediately accepted as, critical information in the diagnosis of the accident. This information was the free liquid inventory in the containment building. During the accident, reactor coolant drain tank quench water and primary coolant water vented through the drain tank relief valve and flowed to the reactor building sump. Water within the containment sump was then discharged to the auxiliary building sump tank and thus resulted in some transfer of radioactive material outside of the containment building. Because sump pump operation was expected several times a day before the accident due to routine accumulation, the transfer process was not recognized as an indication of contaminated water in containment. Furthermore, the accumulation of water in the TMI-2 containment probably contributed to equipment failure due to flooding. The events clearly establish a need for accurate containment water level indication in the control room, with instrument ranges which include accident flooding levels.

The third item of information which was subsequently considered to be of critical importance in determining containment conditions at TMI-2 was the hydrogen concentration in the containment atmosphere. The hydrogen gas was produced as a result of the reaction of zirconium metal and primary coolant water in the reactor core. The gas was vented, to some extent, from the reactor coolant system to the containment atmosphere. The free hydrogen in containment further resulted in a rapid burn and pressure spike event in the containment. Samples of containment atmosphere were taken following the accident at Three Mile Island, but the process involved some risk to workers and did not yield real-time information. The events clearly show a need for such information on a continuous basis following an accident. It is essential that the operator have continuous information as to the hydrogen concentration for an indication of the need and use of reactor pressure vessel venting or containment combustible gas control systems.

It is concluded that containment pressure, containment water level, and continuous indication of hydrogen concentration in the containment atmosphere will provide critical information to the operator on containment conditions during and following an accident. These parameters should be provided in the control room of all reactor power plants.

We further note that an effort is currently underway to revise Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident." The revision will include additional parameters that should be provided to the operator in order to assess plant conditions during the course of an accident. The list of parameters will take into account all recommendations, including those from the nuclear industry and the public, and will supplement those itmes recommended by the TMI-2 Lessons Learned Task Force.

3. POSITION

Consistent with satisfying the requirements set forth in General Design Criterion 13 to provide the capability in the control room to ascertain containment conditions during the course of an accident, the following requirements shall be implemented:

(1) A continuous indication of containment pressure shall be provided in the control room. Measurement and indication capability

shall include three times the design pressure of the containment for concrete,

four times the design pressure for steel, and minus five psig for all containments.

(2) A continuous indication of hydrogen concentration in the containment atmosphere shall be provided in the control room. Measurement capability shall be provided over the range of 0 to 10% hydrogen concentration under both positive and negative ambient pressure.

(3) A continuous indication of containment water level shall be provided in the control room for all plants. A narrow range instrument shall be provided for PWRs and cover the range from the bottom to the top of the containment sump. Also for PWRs, a wide range instrument shall be provided and cover the range from the bottom of the containment to the elevation equivalent to a 500,000 gallon capacity. For BWRs, a wide range instrument shall be provided and cover the range from the bottom to 5 feet above the normal water level of the suppression pool.

The containment pressure, hydrogen concentration and wide range containment water level measurements shall meet the design and qualification provisions of Regulatory Guide 1.97, including qualification, redundancy, and testibility. The narrow range containment water level measurement instrumentation shall be qualified to meet the requirements of Regulatory Guide 1.89 and shall be capable of being periodically tested.

ENCLOSURE 4

INSTALLATION OF REMOTELY OPERATED HIGH POINT VENTS IN THE REACTOR COOLANT SYSTEM

1.0 Introduction

10 CFR Part 50.46 requires that after any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extented period of time required by the long-lived radioactivity remaining in the core. Additionally, Criterion 35 of 10 CFR Part 50 Appendix A requires that a system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) metal-water reaction is limited to negligible amounts.

During the TMI-2 accident, a condition of low water level in the reactor vessel and inadequate core cooling existed and was not rectified for a long period of time. The resultant high core temperatures produced a metal-water reaction with the subsequent production of significant amounts of hydrogen. The collection of noncondensable gases impaired natural circulation cooling capability. Additionally, the collection of noncondensable gases limited reactor coolant pump operational capability because of coolant voids in the system occupied by the gases. Even when reactor coolant pump operation was possible, the installed plant venting system was capable of removing the non-condensable gases only through an extremely slow process.

The purpose of this recommendation is to provide reactor coolant system and reactor vessel head high point vents remotely operated from the control room for the purpose of removing noncondensable gases collected in the system in order to allow satisfactory long-term core cooling.

2.0 Discussion

The collection of noncondensable gases in the reactor coolant system at TMI-2 significantly degraded natural circulation cooling capability. There is indication that these gases were predominantly hydrogen and collected at high points in the pressurizer, in the reactor vessel dome, and in the reactor coolant system piping. For other accident sequences, in addition to hydrogen generated by metal water reaction, other noncondensible gases could be of concern. For example, nitrogen is available from PWR accumulators, and helium or other fill gases and fission gases are available from ruptured fuel elements.

Venting of the reactor coolant system was accomplished at TMI-2 through the vent located at the top of the pressurizer, and to some degree through the makeup tank. Neither of these paths provided expeditious venting capability unless the reactor coolant pumps were operational. Reactor coolant pump operation permitted the degassification of reactor coolant through the pressurizer spray in the steam space. As noncondensable gases were collected in the steam space of the pressurizer, they were vented through the vent located at the top of the pressurizer. The reactor coolant pumps provided forced circulation and aided in the dispersion of the noncondensable gases throughout the reactor coolant such that the flow through the makeup tank provided another vent path. Reactor coolant pump operation was not possible for a significant period of time, however, due to voids in the reactor coolant system. These voids were probably the result of noncondensable gases as well as steam voids. Even when the reactor coolant pumps were operational, this rather slow method of venting prevented a more orderly plant cooldown.

Since continued reactor coolant pump operation cannot be assumed during transients or accidents, tha capability for natural circulation cooling must in PWRs must be maintained. The addition of remotely operated high point reactor coolant system and reactor vessel head vents is, therefore, required so that the accumulation of non-condensable gases does not impair natural circulation capability. It is recognized that BWRs provide venting capability through the use of the Automatic Depressurization System (ADS). The requirements below are applicable for BWRs as well as PWRs in order to demonstrate the adequacy of any currently installed venting capability.

3.0 Position

Each applicant and licensee shall install reactor coolant system and reactor vessel head high point vents remotely operated from the control room. Since these vents form a part of the reacıor coolant pressure boundary, the design of the vents shall conform to the requirements of Appendix A to 10 CFR Part 50 General Design Criteria. In particular, these vents shall be safety grade, and shall satisfy the single failure criterion and the requirements of IEEE-279 in order to ensure a low probability of inadvertent actuation.

Eash applicant and licensee shall provide the following information concerning the design and operation of these high point vents:

1. A description of the construction, location, size, and power supply for the vents along with results of analyses of loss-of-coolant accidents initiated by a break in the vent pipe. The results of the analyses should be demonstrated to be acceptable in accordance with the acceptance criteria of 10 CFR 50.46.
2. Analyses demonstrating that the direct venting of noncondensable gases with perhaps high hydrogen concentrations does not result in violation of combustible gas concentration limits in containment as described in 10 CFR Part 50.44, Regulatory Guide 1.7 (Rev. 1), and Standard Review Plan Section 6.2.5.

3. Procedural guidelines for the operators' use of the vents. The information available to the operator for initiating or terminating vent usage shall be discussed.

ENCLOSURE 5

NUREG-0578 ERRATA

1. Section 2.1.5.a, page A-16, fifth line from bottom of page:

Change to read, ". . . 25,000 SCFM (Standard Cubic Feet per Minute). . ."

Reason: Editorial change.

2. Section 2.1.5.b, page A-20, first line at top of page:

Change to read, "However, as an interim measure pending the comprehensive longer term review which must be done in this regard, it is prudent to require inerting . . ."

Reason: Clarify intent.

3. Table A-1, page A-25, column entitled "BWRS":

Delete "Shoreham(OL)"

Reason: Plant has recombiners.

4. Section 2.1.6.b, page A-28:

Change title to read, "Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems Which May Be Used in Post Accident Operations."

Reason: To more clearly reflect that degradation of safety equipment by radiation during post-accident operation is also a principal concern addressed in this section.

5. Section 2.1.6.b, page A-28, fourth line from bottom of page:

Following "Regulatory Guides 1.3 and 1.4" add "(i.e., the equivalent of 50% of the core radioiodine and 100% of the core noble gas inventory are contained in the primary coolant), . . ."

Reason: Clarify intent.

6. Section 2.1.8.b, page A-39, paragraph 1.b:

Change to read, "Noble gas effluent monitoring shall be provided for the total range of concentration extending from normal condition (ALARA) concentrations to a maximum of 10^5 Ci/cc (Xe-133). Multiple monitors are considered to be necessary to cover the ranges of interest. The range capacity of individual monitors should overlap by a factor of ten."

Reason: To better reflect the intent of the Task Force and practical considerations regarding current state-of-the-art for low concentration effluent monitoring.

7. Section 2.1.8.c, page A-41, "Position" paragraph at bottom of page:

Change to read, "Each licensee shall provide equipment and associated training and procedures for accurately determining the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident."

8. Section 2.2.1.b, page A-49, subparagraph 3 under DISCUSSION:

Delete the word "and" between "identified" (in the first line of the sentence) and "personnel" (in the second line of the sentence).

Reason: Typographical error.

9. Section 2.2.2.b, page A-58, second paragraph of position statement:

Change to read, "Records that pertain to the as-built conditions and layout of structures, systems and components shall be stored and filed at the site and accessible to the technical support center under emergency conditions. Examples of such records include system descriptions, general arrangement drawings, piping and instrument diagrams, piping system isometrics, electrical schematics, wire and cable lists, and single line electrical diagrams. It is not the intent that all records described in ANSI N45.2.9-1974 be stored and filed at the site and accessible to the technical support center under emergency conditions; however, as stated in that standard, storage systems shall provide for accurate retrieval of all pertinent information without undue delay."

10. Table B-1, page B-2, footnote (b):

Change ". . . after July 1, 1982" to ". . . after July 1, 1981."

Reason: Typographical error.

11. Table B-1, page B-4, item 2.1.8.b:

Change abbreviated title from "High Range Effluent Monitor" to "High Range Radiation Monitors."

Reason: Editorial correction to make title consistent with that used in referenced discussion section.

12. Table B-1, page B-5, item relating to Section 2.2.1.b:

Change abbreviated title from "Shift Safety Engineer" to "Shift Technical Advisor."

Reason: Editorial correction to make title consistent with that used in referenced discussion section.

13. Table B-1, footnote a, on pages B-2, B-3, B-4, and B-5:

Add the words, ", whichever is later." after "or prior to OL."

Reason: Clarify intent.

ENCLOSURE 6

IMPLEMENTATION OF REQUIREMENTS FOR
OPERATING PLANTS AND PLANTS IN OL REVIEW

Sect. No.	Position: Abbreviated Title	Position: Position Description	Implementation Category[a]
2.1.1	Emergency Power Supply Requirement	Complete implementation.	A
2.1.2	Relief and Safety Valve Testing	Submit program description and schedule.	A
		Complete test program.	By July 1981[b]
2.1.3.a	Direct Indication of Valve Position	Complete implementation.	A
2.1.3.b	Instrumentation for Inadequate Core Cooling	Develop procedures and describe existing inst.	A
		New level instrument design submitted.	A
		Subcooling meter installed.	A
		New level instrument installed.	B
2.1.4	Diverse Containment Isolation	Complete implementation.	A
2.1.5.a	Dedicated H_2 Control Penetrations	Description and implementation schedule.	A
		Complete installation.	B

[a]Category A: Implementation complete by January 1, 1980, or piror to OL, whichever is later
Category B: Implementation complete by January 1, 1981

[b]Relief and safety valve testing shall be satisfactorily completed for all plants prior to receiving an operating license after July 1, 1981.

IMPLEMENTATION TABLE (Continued)

Sect. No.	Position: Abbreviated Title	Position: Position Description	Implementation Category[a]
2.1.5.c	Recombiners	Review procedures and bases for recombiner use.	A
2.1.6.a	Systems Integrity for High Radioactivity	Immediate leak reduction program.	A
		Preventive maintenance program.	A
2.1.6.b	Plant Shielding Review	Complete the design review.	A
		Implement plant modifications.	B

[a]Category A: Implementation complete by January 1, 1980, or prior to OL, whichever is later.

Category B: Implementation complete by January 1, 1981

IMPLEMENTATION TABLE (Continued)

Sect. No.	Position Abbreviated Title	Position Description	Implementation Category[a]
2.1.7.a	Auto Initiation of Auxiliary Feed	Complete implementation of control grade.	A
		Complete implementation of safety grade	B
2.1.7.b	Auxiliary Feed Flow Indication	Complete implementation	A
2.1.8.a	Post Accident Sampling	Design review complete.	A
		Preparation of revised procedures.	A
		Implement plant modifications.	B
		Description of proposed modification.	A
2.1.8.b	High Range Radiation Monitors	Installation complete.	B
2.1.8.c	Improved Iodine Instrumentation	Complete implementation	A
2.1.9	Transient & Accident Analysis	Complete analyses, procedures and training	**
	Containment Pressure Monitor	Installation complete	B
	Containment Water Level Monitor	Installation complete	B
	Containment Hydrogen Monitor	Installation complete	B
	RCS Venting	Design submitted	A
		Installation complete	B

[a]Category A: Implementation complete by January 1, 1980, or prior to OL, whichever is later.
Category B: Implementation complete by January 1, 1981.

**Analyses, procedural changes, and operating training shall be provided by all operating plant licensees and applicants for operating licenses following the attached schedule.

IMPLEMENTATION TABLE (Continued)

Sect. No.	Position: Abbreviated Title	Position: Position Description	Implementation Category[a]
2.2.1.a	Shift Supervisor Responsibilities	Complete implementation.	A
2.2.1.b	Shift Technical Advisor	Shift technical advisor on duty.	A
		Complete training.	B
2.2.1.c	Shift Turnover Procedures	Complete implementation.	A
2.2.2.a	Control Room Access Control	Complete implementation	A
2.2.2.b	Onsite Technical Support Center	Establish center.	A
2.2.2.c	Onsite Operational Support Center	Complete implementation	A

[a]Category A: Implementation complete by January 1, 1980, or prior to OL, whichever is later.

Category B: Implementation complete by January 1, 1981.

ANALYSIS AND TRAINING SCHEDULE

	Task Description	Completion Date
1.	Small Break LOCA analysis and preparation of emergency procedure guidelines	July-September 1979*
2.	Implementation of small break LOCA emergency procedures and retraining of operators	December 31, 1979
3.	Analysis of inadequate core cooling and preparation of emergency procedure guidelines	October 1979
4.	Implementation of emergency procedures and retraining related to inadequate core cooling	January 1980
5.	Analysis of accidents and transients and preparation of emergency procedure guidelines	Early 1980
6.	Implementation of emergency procedures and retraining related to accidents and trainsients	3 months after guidelines established
7.	Analysis of LOFT small break tests	Pretest (Mid-September 1979)

*Range covers completion dates for the four NSSS vendors

ENCLOSURE 7

NEAR TERM REQUIREMENTS FOR IMPROVING EMERGENCY PREPAREDNESS

While the emergency plans of all power reactor licensees have been reviewed in the past for conformance to the general provisions of Appendix E to 10 CFR Part 50, the most recent guidance on emergency planning, primarily that given in Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants", has not yet been fully implemented by most reactor licensees. Further, there are some additional areas where improvements in emergency planning have been highlighted as particularly significant by the TMI-2 accident.

We plan to undertake an intensive effort over about the next year to improve licensee preparedness at all operating power reactors and those reactors scheduled for an operating license decision within the next year. This effort will be closely coordinated with a similar effort by the Office of State Programs to improve State and local response plans through the concurrence process and the efforts of the Office of Inspection and Enforcement to verify proper implementation of licensee emergency preparedness activities. Further, the Commission has initiated a rulemaking procedure, now scheduled for completion in January 1980, in the area of Emergency Planning and Preparedness. Additional requirements are to be expected when this rulemaking is completed and some modifications to the emergency preparedness requirements contained in this letter may be necessary.

Our near term requirements in this effort are as follows:

(1) Upgrade licensee emergency plans to satisfy Regulatory Guide 1.101, with special attention to the development of uniform action level criteria based on plant parameters.

(2) Assure the implementation of the related recommendations of the Lessons Learned Task Force involving instrumentation to follow the course of an accident and relate the information provided by this instrumentation to the emergency plan action levels. This will include instrumentation for post-accident sampling, high range radioactivity monitors, and improved in-plant radioiodine instrumentation. The implementation of the Lessons Learned Task Force's recommendations on instrumentation for detection of inadequate core cooling will also be factored into the emergency plan action level criteria.

(3) Determine that an emergency operations center for Federal, State and local personnel has been established with suitable communications to the plant, and that upgrading of the facility in accordance with the Lessons Learned Task Force's recommendation for an in-plant technical support center is underway.

(4) Assure that improved licensee offsite monitoring capabilities (including additional thermoluminescent dosimeters or the equivalent) have been provided for all sites.

(5) Assess the relationship of State/local plans to the licensees' and Federal plans so as to assure the capability to take appropriate emergency actions. Assure that this capability will be extended to a distance of ten miles. This item will be performed in conjunction with the Office of State Programs and the Office of Inspection and Enforcement.

(6) Require test exercises of approved emergency plans (Federal, State, local and licensees), review plans for such exercises, and participate in a limited number of joint exercises. Tests of licensee plans will be required to be conducted as soon as practical for all facilities and before reactor startup for new licensees. Exercises of State plans will be performed in conjunction with the concurrence reviews of the Office of State Programs. As a preliminary planning bases, assume that joint test exercises involving Federal, State, local and licensees will be conducted at the rate of about ten per year, which would result in all sites being exercised once each five years. Revised planning guidance may result from the ongoing rulemaking.

ENCLOSURE 8

NEAR TERM EMERGENCY PREPAREDNESS IMPROVEMENTS

IMPLEMENTATION SCHEDULE

Item	Implementation Category1/
1. Upgrade emergency plans to Regulatory Guide 1.101 with special attention to action level criteria based on plant parameters.	A1
2. Implement certain short term actions recommended by Lessons Learned task force and use these in action level criteria.2/	
2.1.8(a) Post-accident sampling	
Design review complete	A
Preparation of revised procedures	A
Implement plant modifications	B
Description of proposed modification	A
2.1.8(b) High range radioactivity monitors	
Methods for estimating release	A
High range monitors	B
2.1.8(c) Improved in-plant iodine instrumentation	A
3. Establish Emergency Operations Center for Federal, State and Local Officials	
(a) Designate location and alternate location and provide communications to plant	A1
(b) Upgrade Emergency Operations Center in conjunction with in-plant technical support center	B

1/
Category A: Implementation prior to OL or by January 1, 1980 (see NUREG-0578).
Category A1: Implementation prior to OL or by mid-1980.
Category B: Implementation by January 1, 1981.

2/
The implementation of the Lessons Learned task force recommendation item 2.1.3(b), instrumentation for detection of inadequate core cooling, will also be factored into the action level criteria.

Item	Implementation Category
4. Improve offsite monitoring capability	A[1]
5. Assure adequacy of State/local plans	
(a) Against current criteria	A[1]
(b) Against upgraded criteria	B
6. Conduct test exercises (Federal, State, local, licensee)	
(a) Test of licensees emergency plan	A[1]
(b) Test of State emergency plans	A[1]
(c) Joint test exercise of emergency plans (Federal, State, local, licensee)	
New OL's	B
All operating plants	Within 5 years

ENCLOSURE 9

IMPROVEMENTS IN OPERATOR TRAINING

The following staff recommendations have been made to the NRC Commission in the area of operator training to improve the operator licensing program. These recommendations are undergoing Commission review, and are expected to be adopted as requirements in the near future. Further Commission review in the areas of operator training and qualification can be expected to result in substantial additional requirements.

A. Eligibility and Training

Eligibility to sit for a license examination consists of education, experience, and training requirements.

ANSI N18.1-1971 entitled, "Selection and Training of Nuclear Plant Personnel," and Regulatory Guide 1.8, "Selection and Training of Personnel," provide guidance regarding education, experience, and training for applicants for operator and senior operator licenses. A revised ANSI N18.1 was issued as ANSI/ANS 3.1-1978. A revised Regulatory Guide 1.8 endorsing the standard has been issued for comment. The ANS-3 Subcommittee is revising ANSI/ANS 3.1-1978 based on recent events. The NRC has requested additional public comment on Regulatory Guide 1.8 and the endorsed standard. In addition, NUREG-0094, "NRC Operator Licensing Guide," provides additional guidance regarding the operator licensing program.

We believe that programmatic changes as indicated below, should be made:

Recommendations

(1) The experience requirements regarding power plant operations for senior operator applicants should be increased as follows. Applicants for senior operator licenses shall have four years of responsible power plant experience. Responsible power plant experience should be that obtained as a control room operator (fossil or nuclear) or as a power plant staff engineer involved in the day-to-day activities of the facility, commencing with the final year of construction. A maximum of two years power plant experience may be fulfilled by academic or related technical training, on a one-for-one time basis. Two years shall be nuclear power plant experience. At least six months of the nuclear power plant experience shall be at the plant for which he seeks a license. (Note: The ANS-3 is currently considering changes in the experience requirements; the results of this effort should be considered as an alternative to the above.)

(2) Establish requirements for applicants for senior operator licenses, after the plant achieves criticality, to be licensed as an operator for six months as follows. Modify the hot training programs so that the training concentrates on the responsibilities and functions of the operator, rather than the senior operator. All individuals

who satisfactorily complete this hot training program will be allowed to apply for an operator license, but must have at least six months experience as a licensed operator before applying for a senior operator license.

(3) Establish requirements for participation in plant shift operations prior to licensing as follows. Require that the three month continuous on-the-job training for hot operator applicants be as an extra man on shift in the control room. Also require the hot senior operator applicants to have three months continuous on-the-job training as an extra man on shift in training.

(4) Establish requirements that simulators be used in training programs for hot applicants as follows. In addition to the presently approved training programs, require that all replacement applicants participate in simulator training programs, as applicable for their facility. Exception may be made for licensees at older facilities whose facility features and operating characteristics are not similar to present facilities, providing suitable alternatives are substituted.

(5) NRC should audit training programs more closely, including administration of certification examinations. In this regard, NRC examiners should routinely administer some (approximately 10 percent) of the certification examinations at the simulator training center.

(6) Develop eligibility requirements for instructors as follows. Require that Phase II, III and IV cold training program instructors and all hot training program instructors that provide instruction in nuclear power plant operations hold senior operator licenses and be required to successfully participate in applicable requalification programs to maintain their instructor status.

B. Operator Requalification Program

Our review of the licensed operator requalification program has resulted in the following recommendations:

Recommendations

(1) In addition to the present operator requalification program requirements, all licenses should be required to participate in periodic retraining and recertification on a full scope simulator representative of their facility. The frequency of training should be on an annual basis. Exceptions may be made for licensees at old facilities, whose facility features and operating characteristics are not similar to present facilities, providing suitable alternatives are substituted.

(2) Presently, individuals who have not been performing licensed duties for four months or longer, are required to participate in an accelerated requalification program and receive our approval, prior to resuming

licensed duties. In addition to the present requirements, these individuals should be required to be recertified on a full scope simulator, representative of their facility. Licensees at older facilities may be excepted, providing suitable alternatives are provided.

(3) Establish more explicit requirements regarding exercises to be included in simulator training programs. These requirements should assure performance of exercises in a broad spectrum of normal and abnormal operations and response to transients and emergencies and shall include consideration of multiple failures, compound abnormalities and imperfect initialization. The requirements should not be rigid so that the flexibility and spontaneity in training programs are precluded. We, and ANS.3, have initiated effort in this direction.

(4) An increased level of confidence in the effectiveness of requalification programs should be provided by NRC examiners administering annual requalification examinations. In this regard, NRC should administer some (approximately 10 percent) of the requalification examinations and oral evaluations.

C. NRC Examinations

The NRC examiners administer both written examinations and oral/operating tests to evaluate the knowledge and understanding of applicants. The written examination for the operator consists of seven categories. An individual passes the examination if he receives an overall grade of 70 percent. A grade of less than 70 percent in a category is not grounds for failure.

The written examination for the senior operator consists of the above seven operator categories plus an additional five-category written examination. An individual passes the examination if he receives an overall grade of 70 percent.

The oral/operating test at nuclear power stations consists of both an oral examination during a plant walk-through and an actual demonstration at the reactor console during a reactor startup, if the applicant has not been to a simulator. Most applicants have attended simulator courses. Therefore, NRC examiners do not normally witness applicants manipulating the controls.

The scope of the oral and operating test consists of testing the applicant's ability to (1) read and interpret the control instrumentation, (2) manipulate the control equipment, (3) operate other facility equipment, and (4) determine his knowledge and understanding of radiological safety practices and radiation monitoring equipment.

We have given reconsideration to the passing grade. In addition, we have conducted a survey of the written exams given during the period of January 1977 through March 1979. The purpose of the survey was to assess the impact of revised criteria for passing the examination as applied to those examination results.

As a result of our review, our recommendations are as follows:

Recommendations

(1) The content of the existing written examination should be expanded to include more selective essay type questions on thermodynamics, hydraulics, fluid flow, and heat transfer. This should be done by using the same categories that now exist for the RO and SRO examinations. The length and complexity of the written examinations would increase from the present requirements.

(2) A part of the oral/operating test to be administered on applicants for operator and senior operator licenses should be performed by using existing nuclear power plant simulators.

(3) Senior applicants who hold an operator's license should be required to take an oral test in addition to the senior portion of the written examination.

(4) The overall passing grade for operator and senior operator written examinations should be increased to 80 percent and at least to 70 percent in each category.

(5) The Operator Licensing Branch should provide facility management with the detailed results of NRC initial examinations so that individuals may be immediately enrolled in the requalification programs.

D. Nuclear Power Plant Simulators

We have reviewed the requirement regarding simulators and their use in training programs and recommend the following.

Recommendation

(1) In order to receive credit in operator training and licensing activities, requirements should be established that ensure that simulators have the capability to accommodate a sufficient number and variety of abnormal and emergency conditions. This can be accomplished by appropriate revision to the ANSI/ANS 3.5-1979 Standard or by separate NRC requirements.