

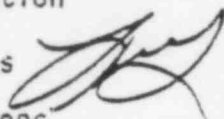
COMMISSIONER ACTION

July 30, 1979

SECY 79-330E

For: The Commissioners

From: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Thru: Executive Director for Operations 

Subject: QUALIFICATIONS OF REACTOR OPERATORS

Purpose: To obtain Commission action regarding improvements in the Operator Licensing Program.

Category: This paper covers a major policy matter. Resource estimates, Category 1, preliminary.

Introduction: In a memorandum from Samuel J. Chilk to Lee V. Gossick dated April 30, 1979, NRR was requested to conduct a thorough review of current NRC requirements and guidance to licensees for qualification of reactor operators. It was further requested that their training and qualifications for off-normal and accident conditions should be particularly addressed. Finally, the staff was requested to review licensee practices for training and testing of operators.

The memorandum also requested information on seven specific items. This information has been provided in separate information papers, SECY 79-330 through SECY 79-330D and in a memorandum from H. K. Shapar to Commissioner Bradford dated April 24, 1979.

On May 15, 1979, GAO issued a report to Senator Schweiker regarding the Operator Licensing Program. The report did not make any recommendations for changes to the program, but raised several questions regarding the program. This paper will also address those questions.

Discussion: We have conducted a detailed review of the Operator Licensing Program. The results of the review, answers to the questions raised on the GAO report and options to the present program are addressed in Enclosure 1. The purpose of this paper is to summarize the results and present our recommendations for your consideration.

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Collins, NRR

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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. Adoption of Option 1 is recommended to achieve this.
2. Establish requirements for applicants for senior operator licenses after the plant achieves criticality to be licensed as an operator for six months. Option 2 is recommended to achieve this.
3. Establish requirements for participation in plant shift operations prior to licensing. Option 3 is recommended to achieve this.
4. Establish requirements that simulators be used in training programs for hot applicants. Option 6 is recommended to achieve this.
5. NRC should audit training programs more closely, including administration of certification examinations. Option 5 that specifies administering some of the certification examinations is recommended rather than Option 4 that specifies administration of all the certification examinations.
6. Develop eligibility requirements for instructors. Option 7 is recommended as a first step to achieve this.

Operator Requalification Program

Our review of the Licensed Operator Requalification Programs results in the following recommendations:

Recommendations

7. In addition to the present operator requalification program requirements, all licensees should be required to participate in periodic retraining and recertification on a full scope simulator representative of their facility. Adoption of Options 8 and 9 are recommended to achieve this.
8. Establish more explicit requirements regarding exercises to be included in simulator requalification programs. Adoption of Option 10 is recommended to achieve this.
9. An increased level of confidence in the effectiveness of requalification programs should be provided by NRC examiners administering annual requalification examinations. We recommend Option 12 that provides for administering some, rather than all requalification examinations as indicated in Option 11.

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%. A grade of less than 70% 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%.

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 applicants' 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.

Our recommendations are as follows:

Recommendations

10. The scope of the written examinations should provide increased emphasis on understanding of thermodynamics, hydraulics, and related matters. Adoption of Option 13 will accomplish this without changing the format of our examinations and is recommended rather than Options 14 and 15 that change the format.
11. Applicants for operator and senior operator license should be examined at a nuclear power plant simulator. Option 16 is recommended to achieve this.
12. Senior operator applicants who hold operator licenses should be required to take an oral test as well as the written examination. Adoption of Option 17 will achieve this.
13. The passing grade of written examination should be increased to 80% or greater overall and 70% or greater in each category. Adoption of Option 18 will achieve this.
14. NRC should inform facility management of the results of each examination so that remedial training may be instituted, as applicable. Adoption of Option 19 will achieve this.

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Nuclear Power Plant Simulators

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

15. ANSI/ANS 3.5-1979, "Nuclear Power Plant Simulators," should be reviewed and revised and a Regulatory Guide reflecting NRC endorsement be developed. Adoption of Option 20 will achieve this.

OLB Examiners

We reviewed the present staffing and training of the Operator Licensing Branch personnel. The Operator Licensing Branch employs nine full-time examiners and 22 part-time examiners. The primary function of an examiner is to develop, prepare, and administer written, oral, and practical examinations to operator and senior operator applicants for critical, research, production, and utilization facilities. In addition, he reviews safety analysis reports as to a facility license applicant's proposed method of training, requalifying, and evaluating plant staff members, and proposed method of procedural control of operations. The examiner also audits the requalification program examinations at the operating facilities. Individuals selected as full-time NRC examiners have many years of nuclear operating experience at National Laboratory reactors, commercial power plants, or military reactors. Several years of this experience has involved training of operators.

Individuals selected as part-time examiners have backgrounds similar to the full-time examiners, except that several have had actual operating experience only at research reactors; although all have studied power reactor design and characteristics.

The staffing objective of OLB has been to provide permanent personnel to accommodate about 80% of the expected workload and part-time personnel for the rest. Thus, the availability of part-time talent has permitted the program to efficiently and expeditiously meet workload fluctuations between 80% and 120% of normal while keeping permanent staff active. Also, the impact of loss of permanent staff members can be eased by use of part-time examiners. However, during the past several years, part-time examiners have been administering up to 40% of the examinations.

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Recommendation

16. The present part-time examiners should be augmented by utility and vendor training personnel and formal training programs should be instituted for examiners. Adoption of Options 21 and 23 will achieve this.

We also considered eliminating all part-time examiners. We believe this would be detrimental to our program. We recommend that Option 22 not be adopted.

Resources Estimates:

The present resources for the Operator Licensing Branch consists of one Branch Chief, nine full-time examiners and 22 part-time examiners. Two secretaries complete the branch complement. We expect that there will be 12 full-time examiners and 22 part-time examiners at the start of FY 1980.

Our forecasted manpower requirements are based on the following assumptions:

1. Full-time examiners will administer 80% of the examinations.
2. Operating tests will be administered at simulators.
3. NRC examiners will administer some of the certification examinations and requalification examinations.
4. NRC will administer examinations to instructors.
5. Examiners participate in additional retraining programs.

During FY 1980, it will be necessary to recruit four additional full-time examiners bringing the total number of examiners to 16 at the start of FY 1981. The OLB full-time examiners will increase by one to two examiners until 23 full-time examiners are employed in FY 1985. During this same period, we will require about two years of technical professional man-years of private consultant manpower each year and contractor consultant costs from the National Laboratories will increase from \$170K to \$300K. We will also require that an administrative assistant position be provided and an additional clerk typist be added to the staff.

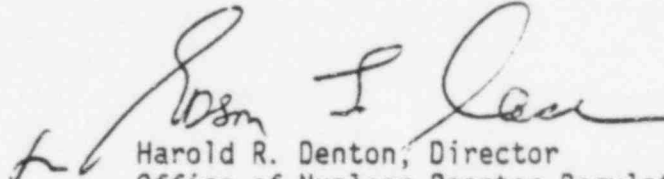
Enclosure 2 provides the manpower requirement details.

Coordination:

The Office of the Executive Legal Director has no legal objection to this paper. The TMI-2 Lessons Learned Task Force has concurred in this paper.

Scheduling:

This paper should be scheduled at an open agenda session.


Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosures:

1. Review of the Operator Licensing Program
2. OLB Manpower Requirements

Commissioners' comments should be provided directly to the Office of the Secretary by c.o.b. Friday, August 10, 1979.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT August 6, 1979, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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ENCLOSURE 1

RESULTS OF A REVIEW OF CURRENT NRC REQUIREMENTS AND GUIDANCE TO LICENSEES FOR QUALIFICATION OF REACTOR OPERATORS

The requirements that reactor operators must demonstrate their qualifications and receive licenses from the NRC to perform their functions were established as a statutory requirement by the U. S. Atomic Energy Act of 1954. Further, pursuant to the Act, the Code of Federal Regulations, Part 50, Chapter 10, "Licensing of Production and Utilization Facilities," provides that the controls of any reactor licensed under Part 50 shall not be manipulated by anyone who is not a licensed operator or senior operator as provided in 10 CFR Part 55, "Operators' Licenses." Part 55 establishes the procedures and criteria for the issuance of licenses to operators and senior operators and therefore governs the regulatory program of operating licensing.

A. Types of Licenses

The Commission presently issues two types of licenses. In general, anyone who manipulates reactor controls must be licensed as a reactor operator, and those who direct the activities of licensed operators must be licensed as senior reactor operators. Practically speaking, the reactor operator in a power station would be the control room operator, and the shift supervisor would normally be the senior reactor operator. Herein, the two types will be referred to as "operator" and "senior operator."

B. License Application and Eligibility

Applicants for operator and senior operator licenses must submit a signed application to the Commission pursuant to Section 55.10(a) of 10 CFR Part 55. In addition, an authorized representative of the facility at which the applicant will be working must certify that the applicant has a need for the license, has completed a training program (supplying the details of such), and has learned to operate the reactor controls competently and safely. A report of medical examination of the applicant on an NRC form must also be submitted.

Eligibility of an applicant for examination is determined after receipt of the application. However, in order to provide utility management with guidance regarding eligibility to be administered an examination, Subcommittee ANS-3, Reactor Operations, of the American Nuclear Standards Committee prepared a standard, ANSI N18.1-1971 entitled, "Selection and Training of Nuclear Power Plant Personnel." The standard has been endorsed by Regulatory Guide 1.8, "Selection and Training of Personnel." These documents provide guidance regarding education, experience and training for applicants.

In addition, Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," provides guidance regarding information required in SAR submittals for training programs for the plant staff, including operator and senior operator applicants. These plans are reviewed by the OLB

staff using the criteria contained in NUREG-75/087, Standard Review Plan, Section 13.2, "Training." Finally, NUREG-0094, "NRC Operator Licensing Guide," provides additional guidance regarding the operator licensing program.

The present operator licensing eligibility requirements include the following:

1. Education

- a. Operator: High-School graduate or equivalent.
- b. Senior Operator: High-School graduate or equivalent.

There is presently no definition of "equivalent."

2. Experience

- a. Operator: Two years of power plant experience or its equivalent, provided that a minimum of 1 year is at a nuclear power plant.
- b. Senior operator: Four years of responsible power plant experience, of which a minimum of 1 year must be nuclear power plant experience. A maximum of 2 years of the remaining 3 years of power plant experience can be fulfilled by academic or related technical training on a one-for-one basis.

There is no definition for "responsible power plant experience."

C. Minimum Training for Applicants for Licenses Prior to Fuel Loading (Cold Applicants)

Section 55.25(b) of 10 CFR Part 55 requires that individuals who apply for licenses prior to initial criticality must have extensive actual operating experience at a comparable reactor, as one requirement to be administered a cold examination.

An applicant meets the requirements of Section 55.25(b) provided:

- (1) he has, or had, an operator's license at a comparable facility;
- (2) he has a certification of the necessary experience if the comparable facility was not subject to licensing (e.g., reactor operated by the Department of Defense); or (3) he has successfully completed an NRC approved training program that utilizes a nuclear power plant simulator.

It should be stressed that most trainees receive experience in excess of the simulator programs outlined herein to acquire the desired competence. However, examinations are administered to individuals who meet these requirements.

Applicants with no previous nuclear experience are required to complete the entire training program as indicated below: Individuals who have previous nuclear experience are factored into these programs as appropriate.

Phase I - This phase is a basic fundamental course, including a 2-week laboratory course at a research reactor during which a trainee performs at least 10 reactor startups. The time required to complete this phase is normally 12 weeks.

Phase II - This phase of the training consists of a design lecture series that is intended to familiarize the trainee with the general design features of the NSSS and then that of the facility. The time required is normally 6 weeks.

Phase III - This phase consists of observation of the day-to-day operation of a nuclear power plant and operation of a nuclear power plant simulator. The observation is under the direction of knowledgeable individuals and the trainee is required to observe a minimum of operations, surveillance testing, and radiation procedures as evidenced by a completed, previously approved checklist. The time required varies from 1 to 2 months based on the overall training program that has been approved.

The operation of a nuclear power plant simulator must be conducted on one similar in design to the facility for which the trainee will be seeking a license. The

time for these programs varies from 2 to 3 months based on the overall training program that has been approved. Approximately 30% of the simulator programs is devoted to abnormal and emergency procedures. However, the NRC does not require that each individual be required to cope with a minimum number of abnormal and/or emergency procedures.

The minimum Phase III time is 4 months of combined power plant and simulator training in all cases. The training must be administered consecutively and by one organization.

Phase IV - This phase consists of a combination of on-the-job training and classroom study at the site. The applicants participate in construction check-out activities, preoperational testing, procedure and technical specification writing and study of facility oriented reactor theory, core parameters and specific operating characteristics. Usually the minimum time in Phase IV is 1 year. Approximately 2 months prior to fuel loading, the applicants return to the simulator for a 1-week refresher course.

These programs are presently offered by the four principal vendors. Utilities that have or will purchase their own simulators will conduct these programs for individuals who will sit for "cold" examinations at future facilities within their systems.

A unique feature of these programs is that the vendors, training firms and utilities administer examinations at the completion of Phase III, that certify that applicants have "extensive" actual operating experience. NRC examiners have conducted some certification examinations for the first few classes to assure that the training programs were appropriate.

D. Actual Licensee Training Programs for Applicants for Licensing Prior to Fuel Loading

All cold training programs exceed the minimum programs described above. Many key staff personnel receive additional observation training at operating stations to witness items such as fuel loading and major maintenance activities. Frequently, individuals with previous nuclear experience attend Phases II and III, even though there is no requirement that they do so. Finally, almost all applicants attend Phase III, regardless of their previous nuclear experience.

Throughout the course of the training program, the trainees are administered quizzes and examinations. Deficiencies in their knowledge and understanding are corrected through special tutoring. Individuals whose progress is consistently unsatisfactory are dropped from the program.

All trainees receive a final examination at the conclusion of the offsite training and again at the conclusion of the final onsite training program. These examinations are similar in scope to the NRC examinations. The results of the first examinations are used to establish that the individuals have "extensive actual operating experience." The results of the second examination are used to support management's certification regarding the competency of the applicants.

E. Minimum Training for Applicants for Licenses After Fuel Loading
(Hot Applicants)

In order to be eligible to sit for an examination after a facility achieves criticality, an individual must receive formal classroom training and on-the-job training. Training programs for hot applicants that utilize simulators are described below:

Individuals who participate in these programs have been employed at the facility as auxiliary operators or as staff personnel.

The classroom training consists of lectures on reactor theory, facility design, operating characteristics, normal and emergency procedures commensurate with the type of license for which the applicants will apply. The minimum time required for this training is 500 hours.

The on-the-job training consists of training on shift during which time the applicants manipulate controls through five reactivity changes under the direct supervision of a licensed operator or senior operator. Two of these manipulations may be reactor startups. However, the applicants usually perform the reactor startups on the simulators.

The on-the-job training must be at least 3 months duration. There are no specific NRC requirements regarding tasks to be performed other than the control manipulations.

The simulator course includes training in abnormal and emergency operations, as well as performing reactor startups. The minimum time for this training is 1 week.

The final portion of the training program consists of a 40-hour review, including a written examination and oral test similar in scope to an NRC examination.

F. Actual Licensee Training Programs for Applicants for Licensing After Criticality

All of the Utility Training Programs meet these requirements. However, there are many variations on how the training programs are conducted.

The maximum time devoted to classroom training is 600 hours.

On-the-job training varies up to 4 months.

The trainees at most plants are assigned to the training group for this training with no other concurrent duties. These training programs normally require between 6 months and 8 months.

About 10 percent of the plants do not assign their people to full-time training. These people are trained concurrently with their normal shift work. Normally, they will receive the lectures as they rotate on to the day shift and receive the on-the-job portion of the training on the back shifts. Their training may be interrupted at any time for any reason. Consequently, some individuals will require 2 years to complete the programs. As part of the training programs at the facility, and at the different vendor training centers, our review found the trainee spends about 25% of his time on the off-normal, emergency and accident conditions that could occur at the plant.

The training programs are normally administered by the utility staff. However, utilities utilize the services of training organizations to conduct parts of the training. In a few cases, utilities have contracted to have an entire class of trainees trained by a training organization.

Typically, 80% of the training is administered by the utility staff, and the other 20% is by the training organization.

At the conclusion of all training programs, each trainee is administered written examinations and oral tests similar in scope to the NRC examinations. Frequently, utilities will request training organizations to conduct these examinations to assure impartiality.

The training staff members are normally licensed senior operators. If they do not have a current license, they have previously been licensed. However, there are not specific criteria regarding instructor qualifications.

G. Medical Requirements

Section 55.10(a)(7) of 10 CFR Part 55, "Operators' Licenses," requires an applicant for an operator license to submit a report of a medical examination by a licensed medical practitioner. Section 55.11 lists the physical and mental conditions that may constitute sufficient cause for denial of an application.

American National Standard, ANSI N546, "Medical Certification and Monitoring of Personnel Requiring Operator Licenses for

Nuclear Power Plants," was issued in 1976. The standard was developed by Working Group ANS-3.4 of the American Nuclear Society Standards Committee. The Working Group consisted of three industry physicians, an ERDA physician, a National Laboratory physician, a NRC representative and an industry representative.

This standard provides the minimum requirements necessary for an examining physician to determine that the physical condition and general health of the operators are not such as might cause operational errors. This standard was endorsed in 1979 by Regulatory Guide 1.134, "Medical Evaluation of Nuclear Power Plant Personnel Requiring Operator Licenses."

10 CFR Part 73, "Physical Protection of Plants and Materials," requires that facility management have employee screening procedures. ANSI N18.7-1976 entitled, "Industrial Security for Nuclear Power Plants," requires examinations by a licensed psychiatrist or physician or other person professionally trained to identify aberrant behavior. In addition, Regulatory Guide 1.134 and ANSI N546-1976 address mental conditions that could be disqualifying conditions.

Form NRC-396, "Certificate of Medical History," has not been revised since the issuance of Regulatory Guide 1.134.

GAO Questions on Eligibility, Including Training

Q1. The Commission has no minimum eligibility requirements, but endorses recommendations made by the American Nuclear Society. Should the Commission have minimum eligibility requirements? If so, what should those requirements be?

A1. The regulatory guides provide one method for the utilities to provide reasonable assurance that safe and competent individuals will operate nuclear power plants. If utilities do not wish to follow the guidance then they must provide an acceptable alternative that would have to be approved by NRC. In order to be approved, the education, experience and programs would be comparable to those described above. The guidance is sufficient without the need to cast it in concrete in a regulation.

Q2. Is a person with a high school education suited to operate the controls of a nuclear power plant? Should that person be better educated?

A2. The American Nuclear Society Standards Subcommittee ANS-3 is reviewing and recommending changes to the ANSI/ANS Standards for which they are responsible. One of the standards is ANSI/ANS 3.1-1978, that addresses the selection and training of nuclear power plant personnel. One area to be reviewed

will be the education requirements for operators and senior operators. However, individuals who presently operate nuclear power plants, because of their participation in the training programs, have more education than a high school education. The extensive evaluations of the operator's competency by the facility management during training and by NRC examiners after training are much more significant than the formal education requirements for selection into training.

Q3. The term "equivalent" high school education is not defined. Should it have a specific meaning?

A3. This item will be reviewed by ANS-3. During our review of the revised ANSI/ANS 3.1, we will assure that "equivalent" is defined.

Q4. "Power plant experience" can pertain to that experience acquired during any stage of a power plant's life including the design and the construction. Should "power plant experience" be more specifically defined?

A4. In the definition of power plant experience, the standard provides that experience during design and construction may be given credit for some positions. It would not normally be given credit for operating positions, except when it included conducting preoperational test programs. However,

for a position such as reactor engineer, experience in design of nuclear power plants may be highly relevant. For a position such as maintenance manager or mechanic, experience in power plant construction may be very valuable. The standard is structured to permit credit for this experience when applicable and we believe that this approach is correct. However, we will review, and ask ANS-3 to review, the definition to see if it needs sharpening.

Q5. The term "responsible power plant experience," when referring to a senior operator, is not defined. Should it have a specific meaning?

A5. This question is addressed in Option 1. We recommend that responsible power plant experience be defined better than at present.

Q6. Should medical examinations for nuclear power plant operators be more stringent? Should psychological profiles be developed for these operators, analyzing their response capabilities in stress situations?

A6. The medical requirements enumerated in the documents listed above are sufficiently stringent for us to have reasonable assurance that the physical condition and the general health of the applicant are not such as might cause operational errors endangering public health and safety. A review of LERs,

abnormal occurrence reports, information contained in individual dockets and inspection reports involving personnel errors do not reveal any instances where undue stress was a contributing factor. Further, the training programs in which the applicants participate are demanding. This subjects the applicants to stressful situations. Also, the NRC written and oral examinations place an individual in a stressful situation. Finally, the requirements of the requalification programs are such as to place the operator in stressful situations and we are instituting changes to increase the variety and complexity of casualty situations encountered at simulator training centers. Therefore, we believe that explicit psychological testing for stress is not warranted.

Q7. The Commission basically performs a paper-review of a utility's training program. Should the Commission establish its own minimum training requirements? Should the Commission have its staff personally inspect the training program?

A7. The staff has been very involved in developing the scope, content and times allotted for the cold training programs. The "cold" training programs were developed by the vendors and reviewed in detail by the staff to assure that the subjects enumerated in Sections 55.20 through 55.23 of 10 CFR Part 55 were adequately addressed. Indeed, many of the items spelled out in training programs are the direct result of NRC input. These programs have, over the years,

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been changed due to technological changes and as safety concerns have changed. Each change in the programs has been reviewed and approved by the staff prior to its implementation. Hence, we do, in effect, have minimum requirements, although not spelled out in a regulation. However, NUREG-0094, "NRC Operator Licensing Guide," indicates the acceptable expected qualifications for applicants. NRC examiners conduct audits of the training programs by administering examinations to all the graduates of the program and informing the trainers of any weak areas in their programs, based on the examination results. The same technique is employed to evaluate a utility cold training program. We do not believe there would be any specific benefit in developing more detailed regulations. The subject of training programs for hot applicants is further addressed in Option 2.

Q8. The plant operating organization is very much involved in training operator applicants. Should the Commission re-review and approve the individuals who give this training?

A8. Most of the utility instructors and simulator training instructors have senior operator licenses; we have advocated this approach as a demonstration of competence but have not made it a requirement. We believe that the subject of instructor qualifications and demonstrated competence deserves further investigation and possible change. One

aspect of this question is addressed in Option 7. Even beyond that aspect, we are exploring the matter with the Subcommittee ANS-3 and the newly formed Nuclear Operations Institute of the Atomic Industrial Forum.

Q9. Replacement applicants do not necessarily participate in the simulator training program. Should it be a requirement that they do so?

A9. This question is addressed in Option 6.

Options to the present eligibility requirements are valued as follows:

Option 1

Require the following experience for senior operator applicants: Applicants for senior operator licenses shall have 4 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 2 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 6 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.)

PRO: a) Have more assurance regarding the qualifications of individuals selected for senior operators, by requiring that experience is truly relevant.

b) Prevent auxiliary operators from applying for senior operator licenses without having relevant experience.

CON: a) May restrict the advancement opportunity of some individuals.

b) May result in some valuable experience gained in construction and design not receiving ample credit.

Option 2

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 6 months experience as a licensed operator before applying for a senior operator license.

- PRO:
- a) The requirement to have licensed operator experience prior to applying for a senior operator license will result in more experienced people applying for senior operator licenses.
 - b) Improved training programs will result if the delineation between an operators' and senior operators' duties is stressed and training is conducted appropriate to these duties.
 - c) Utility management will be able to better select senior operator candidates if they observe their personnel in a licensed operator capacity prior to making the selection.

- CON:
- a) Increased OLB examiner workload to administer examinations if the present one step senior operator examinations are eliminated.
 - b) There would be no guarantee that the individual would be performing licensed duties full time because of excess of operators.
 - c) Could create severe management - bargaining unit problems if control room operators were supplemented with professional staff personnel.
 - d) May delay highly qualified personnel in obtaining senior operator licenses.

Option 3

Require that the 3-month continuous on-the-job training for hot operator applicants be as an extra man on shift in the control room. Require the hot senior operator applicants to have 3 months continuous on-the-job training as an extra man on shift in training.

PRO: Provide more formal and complete training for operators and senior operators by exposure to, and participation in, day-to-day operational experiences and problems at the facility under application.

CON: a) Require increasing plant staffs.

b) Training could be diluted for large groups of people due to control room restrictions.

Option 4

NRC examiners should administer all the cold certification examinations at the simulator training centers.

PRO: a) NRC examiners would be unbiased in their evaluations.

b) Provide for immediate feedback to the trainers regarding deficiencies in the training programs.

- c) Have an opportunity to observe applicants manipulate controls.
- d) Provide a method to assure that the latest operating experience has been programmed into the simulators.

CON: a) Substantial additional NRC manpower would be required.

- b) To a very large extent, previous certifications from training centers have been validated by subsequent NRC examinations.

Option 5

NRC examiners should routinely administer some (approximately 10%) of the certification examinations at the simulator training center.

PRO: a) All of those listed in Option 4.

- b) To a very large extent, previous certifications from training centers have been validated by subsequent NRC examinations.

CON: Additional NRC manpower would be required, but not as many as in Option 4.

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Option 6

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.

PRO: Assure all applicants observe and demonstrate this ability to cope with abnormal and emergency conditions.

CON: Individuals from some older plants may not receive much benefit from training at the simulators that presently exist or are planned; in some cases, requiring such training could be counterproductive.

Option 7

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.

PRO: a) Initially assure a competent staff at the training centers and facilities.

b) Assure that the instructors review the latest applicable operating experiences, LERs and abnormal occurrences to factor into the programs.

c) Provide a cadre of backup personnel to assist a facility in an emergency.

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CON: Increased NRC manpower to administer examinations.

H. Licensee Practices Regarding Requalification Programs

Licensed Operator Requalification Programs are conducted at all nuclear power plants pursuant to Appendix A to 10 CFR Part 55.

These training programs require annual written examinations and systematic evaluations of actions taken by licensed personnel. Based on the results of these examinations, individuals are required to attend lectures and/or participate in accelerated programs.

The requalification programs also require each licensee to manipulate the controls through a minimum number of reactivity changes every 2 years. Other requirements include systematic review of procedures, technical specifications and design features, including changes thereto. The programs are administered by the facility and audited by NRC.

At present, 85% of the facilities surveyed have sent some of their operating staff to a simulator for refresher training. Simulator training is not a requirement of the requalification programs and the frequency and number of individuals receiving simulator training varies at each plant. Normally, the personnel assigned to shift work do not go to a simulator, because they perform their required reactivity changes at the plant. Consequently, staff personnel who hold licenses may receive simulator training in abnormal and emergency situations, while many of the control operators only walk-through their abnormal and emergency procedures at the facility.

The requalification programs are jointly audited by IE and OLB. IE reviews the record of accomplishment to determine that the facility is conducting their program in accordance with the approved program. OLB audits the annual examinations to assure that they are comparable to the NRC examinations in depth and content, and to ensure that the grading is also comparable. OLB also audits the quizzes administered as part of the lecture series.

GAO Questions

Q1. The Commission requires that a nuclear power plant operator undergo examination once a year. Is one year, or a much shorter period, appropriate? For example, the Federal Aviation Administration requires that airlines pilots be examined every 6 months.

A1. The annual examination is followed up by lectures in subjects in which the individual scored below 80%. The lecture series is preplanned and scheduled throughout the year. The licensees are required to be administered quizzes at the conclusion of each lecture. In addition, continuous evaluation of on-the-job performance is required. Therefore, training and evaluations are continuous, rather than once a year. We believe that an annual overall written examination is sufficient but that strengthening the means of on-the-job evaluation merits attention. We have discussed this with ANS-3 and they are considering a standards revision of this type.

Q2. To a large extent, the Commission relies on utility management to certify that an operator should have his license renewed. Should the Commission independently check this certification?

A2. This question is discussed in Options 11 and 12.

Options to the present requalification programs are evaluated as follows:

Option 8

In addition to the present operator requalification program requirements, we shall require that all licenses 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.

PRO: a) Increased assurance that licensees are maintaining their competency regarding the handling of abnormal and emergency situations.
b) Permit licensees the opportunity to perform normal evolutions that they have not performed recently at their facility.

CON: a) Increased cost to the utilities.
b) Appropriate simulators do not exist for a few older facilities.

Option 9

Presently, individuals who have not been performing licensed duties for 4 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 his facility. Licensees at older facilities may be excepted, providing suitable alternatives are provided.

PRO: Increased assurance that the licensee will be able to perform his licensed duties in a safe and competent manner as soon as he reports back to work.

CON: Increased operating expenses to the utility.

Option 10

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.

- PRO: a) Increased assurance that those items considered important to safety by NRC are covered in each training program.
- b) Increase scope of training to assure that the scope of evolutions performed is sufficiently broad and that realistic considerations are included.
- CON: If the requirements are structured too rigidly, the resultant training could be too standardized and thereby decrease emphasis on response to unexpected events.

Option 11

NRC to administer and grade all the annual written examinations and administer all the oral evaluations associated with requalification programs.

- PRO: a) The administration of examinations would be more uniform and assure that NRC concerns were addressed.
- b) The examinations would be separated from the training program and serve as a measure of the training program's effectiveness as well as individual competency.
- CON: Substantial additional OLB personnel will be necessary for NRC to assume the responsibility for administering these examinations.

Option 12

NRC administer some (approximately 10%) of the requalification examinations and oral evaluations, rather than all of the examinations, as indicated in Option 11.

- PRO:
- a) Serve as a check on requalification program effectiveness.
 - b) Form a basis for administration of complete examination of the individuals.
 - c) Continue to emphasize that facility management has the responsibility to assure effective administration of the program.

CON: Additional CLB personnel will be required.

I. NRC Examinations

The NRC examiners administer both written examinations and oral tests to evaluate the knowledge and understanding of applicants. The written examination for the operator consists of the following seven categories:

- A. Principles of Reactor Operation,
- B. Features of Facility Design,
- C. General Operating Characteristics,
- D. Instrumentation and Controls,
- E. Safety and Emergency Systems,
- F. Standard and Emergency Operating Procedures, and
- G. Radiation Control and Safety.

The examination is designed so that the average applicant can complete the examination in 8 hours. However, no time limit is imposed. An individual passes the examination if he receives an overall grade of 70%. He may receive less than 70% in any category.

The written examination for the senior operator consists of the above seven categories plus the following:

- H. Reactor Theory;
- I. Radioactive Materials Handling, Disposal, and Hazards;
- J. Specific Operating Characteristics;
- K. Fuel Handling and Core Parameters; and
- L. Administrative Procedures, Conditions, and Limitations.

The examination is designed to be completed in 5 hours by the average applicant. However, no time limit is imposed. An individual passes the examination if he receives an overall grade of 70%. He may receive less than 70% in any category.

The operating test at a nuclear power station normally 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 attend the simulator. Therefore, NRC examiners do not normally witness applicants manipulating the controls. The scope of both portions of the operating test is the same for both operators and senior operators, except that the senior operator is expected to answer questions as if he were the operator's supervisor. 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) his knowledge and understanding of radiological safety practices and radiation monitoring equipment. The tests do not have a numerical grade, but rather each answer received

in response to a question is considered satisfactory or unsatisfactory. The examiner evaluates the overall performance and recommends passing or failing the individual.

J. Administration of Examinations

Approximately 2 months prior to fuel loading, NRC written examinations are administered to the cold applicants. The operator and senior operator examinations are administered on consecutive days. Approximately 1 month prior to fuel loading, the oral examinations are administered.

This practice has the advantage of permitting the chief examiner to receive an orientation tour of the facility at the time of the written and to become familiar with the equipment and its location and to permit the examiner to personally assess when the facility will be sufficiently complete for the conduct of the oral examinations.

Also, it permits the examiner time to grade the written examinations so that those who fail the examination will be issued a denial letter and the number of oral examinations will be reduced.

After a facility is operating, written and oral examinations are administered consecutively on the same visit to the facility. This reduces the number of visits to a facility.

Individuals who do not hold an operator's license for that facility, who apply for senior operator licenses and fail the senior portion of the examination are issued operator licenses if they pass the operator portion.

Individuals who hold an operator license who apply for a senior operator license normally are granted a waiver of the oral portion of the examination and are administered only the five part senior operator written examination.

Individuals who pass only the written examination or the oral test may request a waiver of that part of the examination when he reapplies. This request for waiver is usually granted.

K. Written Examination Grades

We have conducted a survey of the written exams given during the period January 1977 through March 1979. The purpose of the survey was to determine the impact of changing the passing grade on the written examination from the present 70%. We recognize that the full impact that is indicated would probably not have actually occurred if the postulated criteria had been in effect, since the training and evaluations by facility management would have been altered. We reviewed the results of 508 operators and 484 senior operator written examinations.

The following is a summary of what the effects would be for those applicants if various criteria had been in effect. The percent denied include those that were denied based on present passing grades of 70% overall.

Impact of increasing overall total grade, expressed as % denied.

	PRESENT				
	70%	75%	80%	85%	90%
Operators	5.7%	6.3%	31.5%	57.4%	88.6%
Senior Operators	4.1%	8.2%	28.9%	59.2%	89.0%

Impact of requiring a minimum grade in each category, expressed as % denied.

	70%	75%	80%
Operators	43.7%	57.7%	81.2%
Senior Operators	32.9%	43.6%	69.4%

Impact of maintaining the overall passing grade at 70% with no more than one category below 70%, expressed as % denied.

Operators	20.7%
Senior Operators	9.9%

Impact of increasing the overall passing grade to 75% with one category below 70%, expressed as % denied.

Operators	15.0%
Senior Operators	11.4%

Impact of increasing the overall passing grade to 75% with one category below 75%, expressed as % denied.

Operators	34.4%
Senior Operators	19.4%

Impact of increasing the overall passing grade to 75% with two categories below 75%, expressed as % denied.

Operators	21.0%
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Senior Operators	8.2%
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Impact of increasing the overall grade to 80% with no more than one category below 75%, expressed as % denied.

Operators	38.6%
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Senior Operators	32.2%
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Impact of increasing the overall grade to 80% with no more than two categories below 75%, expressed as % denied.

Operators	31.9%
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Senior Operators	28.9%
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Impact of increasing the overall grade to 80% with no category below 70%, expressed as % denied.

Operators	49.0%
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Senior Operators	40.3%
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The following two items were indicated during our review:

The review indicated that operators with an overall grade as high as 88.7% received less than 70% in one category. The review also indicated that senior operators with an overall grade as high as 90% had less than 70% in one category.

If we had required a grade of 70% in every category, 32 instant seniors would have passed the senior portion of the examination, but would have failed the operator portion.

GAO Questions

- Q1. The difference between the examination given to the senior operator and the operator appears ill-defined. Questions asked of an applicant for a senior operator's license supposedly are more difficult and more indepth. Should specific criteria be developed addressing the difference in degree of the difficulty and complexity?
- A1. The scope of the examinations are enumerated in Sections 55.21, 55.22 and appropriate sections of NUREG-0094, "NRC Operator Licensing Guide." These documents define the differences between operator and senior operator questions. However, NUREG-0094 will be revised to more clearly define the responsibilities of the senior operator.
- Q2. An average score of 70 percent overall is passing on the written examination. However, a person could fail one or more categories and still pass overall. Is this appropriate?

A2. This question is addressed in Option 18.

Q3. A person who fails one or more parts of the written examination but passes overall does not have to receive additional training on those parts that he failed. Is this appropriate?

A3. This question is addressed in Option 19.

Q4. Approximately 90 percent of those persons who take the written examination pass on the first try. Is the examination too easy and should it be revised?

A4. A review, of NRC examination results at nuclear power plants from 1960 to 1978, indicates that the denial rate for applicants for operator licenses had decreased from 16.6% to 11.5% and for applicants for senior operator licenses from 21.1% to 11.2%.

We believe that the decrease in the denial rate is due to: (1) the development of better screening procedures by the utilities when selecting trainees; (2) the formalizing of training programs content, particularly those involving the use of nuclear power plant simulators; (3) the weeding out of the trainees, based on interim evaluations during the course of the training program; and (4) withdrawal of applicants, based on the results of utility administered final written examinations and oral/operating tests.

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Further, when a group of applicants at a facility do poorly on an examination that indicates a breakdown in the training program, we take immediate corrective action to improve the training program and avoid a repetition of poor results.

Therefore, it is not surprising the 89% of the applicants who are administered NRC examinations are successful and receive licenses; this high rate of success is indicative of careful selection and meaningful evaluations during training and at the completion of training.

Options as related to this issue are evaluated as follows:

Option 13

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 using the same categories that now exist for the RO and SRO examinations. The length and complexity of the written examinations will increase from the present requirements.

- PRO:
- a) Will provide added assurance of understanding of phenomena associated with unexpected events.
 - b) Can be accomplished rapidly without a change to the regulations.
 - c) Will provide for examination in these technical disciplines in the same manner as other disciplines.
 - d) Is consistent with published guidance, NUREG-0094, regarding the Operator Licensing Program.
 - e) The analysis of category-grade acceptance criteria will still be meaningful.
- CON:
- a) Does not provide high visibility regarding this change in emphasis in our examinations.
 - b) May require depth of understanding of technology that the operator will never encounter in practice.

Option 14

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 creating new categories for the RO and SRO examinations as appropriate. The length and complexity of the written examinations will increase.

- PRO: a) Will provide added assurance of understanding of phenomena associated with unexpected events.
- b) Can be accomplished rapidly without a change to the regulations.
- c) Provides high visibility to this change in examination emphasis.
- CON: a) Would result in overemphasis on this subject, in order to provide sufficient content in a category of the exams.
- b) Would lengthen the examination time unnecessarily.
- c) Will moot the result of the analysis of category-grade criteria.
- d) Is not consistent with published regulatory guidance, NUREG-0094, concerning the Operator Licensing Program.
- e) May require depth of understanding of technology that the operator will never encounter in practice.

Option 15

NRC should adopt a different approach to the written examination, such as one that would relate to only elemental questions and leave the exploratory questions to the oral examination. Such an examination could be restructured to include multiple choice and true and false type questions.

- PRO: a) The multiple choice - true-false question type examination has the ability to cover a greater variety of questions within a given time frame.

- b) This type of examination could be prepared from standard questions and graded by overlays or automatic grader thus reducing the present man-hours to prepare and grade a essay-type examination.

- CON:
- a) This type of examination would be generic in nature. Hence, the oral examination would be the only way to explore plant specifics.
 - b) The confirmation aspect of the written and the oral-operating test would be greatly reduced.
 - c) Development would require time and expense to compile a sufficient bank of questions.
 - d) Inherent disadvantages of these types of tests would be introduced (e. g., subtle semantical distinctions, importance of guessing) which would tend to alter the purpose of the examination.

Option 16

Require part of the oral/operating test to be administered using existing nuclear power plant simulators.

- PRO:
- a) Evaluation of applicants would be made, based on their demonstrated ability to manipulate controls and diagnose and respond to abnormal and emergency situations.
 - b) Indicate that actual response to abnormal situations is as important as knowledge and understanding of the situations.

- CON:
- a) Increased NRC examiner manpower to administer the examinations.
 - b) Most applicants would have to learn two facilities, their own and that for which the simulator is modeled, in order to be evaluated properly. The validity of that portion conducted at a non-identical simulator could be questioned.
 - c) Increased cost to the utilities.
 - d) Difficulty of scheduling the examinations at simulators.
 - e) Probably would not include individuals from some of the older plants.

Option 17

Require senior applicants who hold an operator's license to take an oral test in addition to the senior portion of the written examination.

- PRO:
- a) Obtain better evaluation of the individual's ability as a senior operator.
 - b) Provides for emphasis of managerial responsibilities of the senior operator (i.e., command and control).

CON: Increased examination time with resultant increase in NRC manpower needs.

Option 18

Increase the overall passing grade for operator and senior operator written examinations to 80% and require at least 70% in each category.

PRO: Prevent individuals from obtaining licenses who have a lack of knowledge in specific areas.

CON: a) Deny individuals for minor lack of knowledge that could be addressed in requalification programs.

b) Each category consists of six or seven questions. Receiving a grade less than 70% in categories may not be statistically significant.

Option 19

OLB should provide facility management with the detailed results of NRC initial examinations so that individuals may be immediately enrolled in the requalification programs.

PRO: a) The facility training department can administer training to the individual in weak areas.

- b) Provide feedback to utilities regarding general weaknesses in training programs.

CON: The privacy act may preclude divulging this information without the individuals' permission.

L. Nuclear Power Plant Simulators

In the late 1960's, the General Electric Company proposed that a nuclear power plant simulator be incorporated in a training program to provide trainees with the necessary control manipulations to meet our eligibility requirements. The simulator was built and became operational in 1970.

Since that time, we have reviewed and approved training programs incorporating nuclear power plant simulators for Combustion Engineering, Babcock and Wilcox and Westinghouse and for five utilities which have purchased their own simulators. An additional five utility-owned simulators are under construction and four more are proposed.

Our decision to accept a training program using a nuclear power plant simulator was based upon several pertinent considerations, including:

- a) The completeness and accuracy with which the simulator is constructed.
- b) The extent to which the simulator provides various types of control room experience to the trainee, including the ability to simulate normal startup and shutdown operations, as well as a multitude of casualty drill situations.

c) The extent of operating experience of the simulator instructors.

To determine that the simulator meets the requirements of (a) and (b) above, we compare the proposed simulator to the information contained in the Final Safety Analysis Report of the facility after which it is modeled and detailed drawings of the facility's control room.

Our comparison includes the number of systems simulated, the degree of simulation, and the fidelity of simulation. In addition, we determine that the number and types of malfunctions are adequate for the intended training purposes. Our final acceptance of the nuclear power plant simulator depends upon the comparison of the simulator's response to various transients to that of the plant's response as determined during the startup testing program.

An industry standard was issued early in 1979, which specified minimum functional requirements for nuclear power plant simulators. This standard is ANSI/ANS-3.5-1979, "Nuclear Power Plant Simulators for Use in Operator Training." (Note: Subcommittee ANS-3, that developed this standard, has met and initiated a revision to the standard in light of the TMI-2 experience.)

The four phase training program described previously was designed for applicants with no previous experience. Simulator training, per se, is not required for those applicants with previous nuclear experience. It is strongly encouraged, however, by the NRC. NUREG-0094, "A Guide for the Licensing of Facility Operators, Including Senior Operators," contains the following statements:

- "However, it is highly desirable that previously licensed individuals participate in a short course utilizing a nuclear power plant simulator similar to the facility for which the applicant will be seeking a license. This training should take place as close to fuel loading as practicable."
- "In addition, it is highly desirable that ex-military personnel participate in a short course utilizing a nuclear power plant simulator to the facility for which the applicant will be seeking a license."
- "Applicants who have been certified at ERDA-owned reactors and lack power plant experience are required to attend an appropriate nuclear power simulator course or participate in the day-to-day operations of a plant similar to the one for which he seeks a license for a period of two months."

Several years ago, we modified our programmatic requirements to permit an individual to be licensed without having to perform a reactor startup on the examination in certain circumstances.

Basically, the training program substitutes a certification of competency in the area of reactor startup for the actual startup demonstration witnessed by an NRC examiner. An applicant would be eligible for examination without a reactor startup if, among other training requirements, "The applicant has satisfactorily completed an NRC approved training program that includes at least one week at a nuclear power plant simulator. The application shall contain a certification from the simulator training center."

At the present time, many use this startup certification program for hot applicants.

Nuclear power plant simulators are used in many of the licensed operator requalification programs. However, the NRC position has been to strongly encourage their use but has not required them.

Many utilities routinely incorporate simulator training in their requalification programs. They send all personnel to a simulator on an annual or biennial cycle. At the simulator, emphasis is placed on non-routine activities and casualty drills. Other utilities use simulators only where it is obvious that certain of their operators will not meet the 10 reactivity manipulations requirements of the requalification program at the plant. The few remaining utilities do not use simulators because they make special effort to meet all requalification program requirements at the facility or they make the determination that there is no applicable simulator for their facility.

Several years ago, General Electric Company proposed an "advanced" control room (Nuclenet) which represented a major departure from the existing control room. The Nuclenet control room makes extensive use of CRT displays for providing information to the operators. Instead of the hardwired instruments presently in use, the Nuclenet relies heavily on computer-generated information.

OLB performed a review of the physical features and intended uses of the Nuclenet and compared this with the features of the existing simulators. Our conclusion was that no existing simulator would lend itself to the training of Nuclenet operators - GE would have to provide a Nuclenet simulator. OLB has maintained this

position. As each of the other reactor vendors have proposed advanced control rooms, we have specified, where necessary, that a simulator must be constructed to provide the required training.

Option 20

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

PRO: Assure lessons learned from TMI-2 are incorporated in existing and future simulators and that operating personnel are afforded this training capability.

CON: Reprogramming of existing simulators and possible hardware changes.

M. Operator License Examiners, Including Part-Time Examiners

The Operator Licensing Branch employs nine full-time examiners and 22 part-time examiners. The primary function of an examiner is to develop, prepare and administer written, oral and practical examinations to operator and senior operator applicants, for critical, research, production and utilization facilities. In addition, he reviews safety analysis reports as to applicant's proposed method of training, requalifying and evaluating plant staff members and proposed method of procedural control of operations. The examiner also audits the requalification program examinations at the operating facilities.

Individuals selected as full-time NRC examiners have many years of nuclear operating experience at National Laboratory Reactors, commercial power plants or military reactors. Several years of this experience has involved training of operators.

New examiners to the staff are processed through an orientation and training program commensurate with their experience prior to assuming their responsibilities. This consists of the new examiner observing an experienced senior OLB member prepare and administer written and oral examinations at research reactors. The new examiner then prepares and administers an examination on a similar reactor under the specific guidance of the senior OLB member. This procedure is followed at a nuclear power plant until the examiner is fully familiar with OLB procedures and practices. Following orientation, he is assigned to administer examinations under the general guidance of a senior examiner. Only after demonstration of his capabilities is he assigned as a solo examiner; even then, his activities are subject to audit by the group leader and branch chief.

Examiners attend nuclear power plant technology courses conducted by the IE Career Management Branch to increase their knowledge of power plant systems of facilities that they have not operated.

Individuals selected as part-time examiners have backgrounds similar to the full-time examiners, except that several have had actual operating experience only at research reactors, although they have studied power reactor design and characteristics. In the latter cases, the individuals are facility directors.

New part-time examiners are provided orientation and training in the same manner as new headquarters examiners, except that they do not attend IE courses. Their training also requires a longer period of time due to the need to accommodate their principal job duties. After their initial orientation and training, part-time examiners participate in continuous training programs, albeit mostly informal. Their written examinations are reviewed and critiqued by a senior OLB examiner, usually a group leader, prior to their administration. Periodic audits of their performance are conducted by senior OLB members, either by accompanying them during the administration of an oral examination, or observing their performance during the course of an examination conducted on a simulator. Their evaluations of individuals are reviewed by senior OLB members to assure conformance with OLB examining standards. Simulator training is provided when it can be accommodated in conjunction with the administration of examinations.

The staffing objective of OLB has been to provide permanent personnel to accommodate about 80% of the expected workload and part-time personnel for the rest. Thus, the availability of part-time talent has permitted the program to efficiently and expeditiously meet workload fluctuations between 80% and 120% of normal, while keeping permanent staff active. Also, the impact of loss of permanent staff members can be eased by use of part-time examiners.

Each year, OLB conducts a conference for all examiners where 2 or 3 days are devoted to training relative to administering

written and oral examinations. Conferences are held at simulator training centers when possible so that demonstration and hands-on training may be conducted using the simulator.

GAO Questions

Q1. The examiners who prepare, give, and evaluate the examinations are not all Commission employees--they are often part-time consultants who work full-time for the national laboratories. Often these part-time examiners themselves have not taken commercial power plant licensing examinations, and do not hold licenses. Many have not had experience in commercial nuclear power plants. Many have not been through simulator training for nuclear power plants. Is this appropriate? Can this lead to examination problems?

A1. Individuals that are selected as part-time examiners have many years of reactor operating experience and are extremely knowledgeable regarding reactor theory, core parameters, operating characteristics and radiation protection and control, nuclear instrumentation and safety and emergency systems. Consequently, they need only apply their knowledge and understanding to the specific design of power plants, as applicable to their assignments. OLB orientation and training programs are designed to assist in making this transition. Also, full-time examiners conduct thorough reviews of their work. We believe that the use of individuals with this background is appropriate. We have not had problems regarding examination validity due to the use of these individuals, probably because

we have recognized that special attention is needed. Additional training and retraining of examiners is discussed below.

In addition, the part-time examiners from universities provide valuable input into the program by providing the latest thinking regarding teaching and testing. However, reconsideration of the need for specialized training of these persons is addressed in Option 21.

Options relative to this issue are evaluated as follows:

Option 21

The present part-time examiners will continue to be recruited from universities and national laboratories. Formal training and retraining programs shall be developed for all OLB examiners. The training programs will be prepared and conducted by OLB with assistance from the IE Career Management Branch. Training shall also be provided at simulator training centers. In order to remain as a part-time examiner, the individual must make himself available for this training, in addition to the time previously required for the normal examining workload; thus, a commitment of about 55 days per year will become a requirement.

- PRO:
- a) Provide for more competent examiners, particularly in those areas involving system transients and thereby provide for better evaluations during examinations.
 - b) Senior staff members can conduct more comprehensive evaluations of the examiners by observing their performance during training sessions.

- c) Part-time examiners recruited from universities and national laboratories are unbiased and have no apparent conflicts of interest.

- CON:
- a) Will require additional manpower to adequately staff and maintain the Operator Licensing Program.
 - b) Will require special authorization to provide training to part-time examiners (e.g., consultants).
 - c) Will require additional time for part-time examiners; this will result in the immediate loss of some personnel that cannot commit to the requisite time.
 - d) Additional funds will be required to purchase simulator time.

Option 22

Eliminate all part-time examiners and increase OLB manpower to meet all operator licensing requirements. Manpower hiring requirements should restrict hiring to those individuals who have held or currently hold a senior operator license or equivalent for a nuclear power plant. Examiners should be assigned to administer examinations at specific types of reactors. Only after proper training should they be assigned to examine on other types of facilities.

- PRO:
- a) Increasing the headquarters staff to conduct all licensing functions would provide an independent, unbiased cadre of highly qualified examiners.
 - b) Would increase specialization within OLB to better carry out the responsibilities of the branch.

- CON:
- a) Elimination of the part-time examiners would require increased staffing of headquarters personnel, with additional cost to maintain.

- b) Loss of part-time examiners would eliminate the cushion to accommodate large short-term increase in workload and the impact of loss of permanent staff.
- c) Would result in loss of independent perspective the part-time examiners introduce into the program.

Option 23

Augment the part-time examiners that are currently employed by OLB. Obtain from the utility and vendor training staffs licensed SROs to assist OLB in licensing activities. This select group of "Check Senior Operators" would be comparable to the FAA's "Check Airmen." The "Check Airmen" are considered the elite among the airline pilots. Usually they are selected from the better flight instructors and are given additional training. They are certified by the FAA as being qualified to evaluate other crew members. They assist FAA examiners in recertifying pilots. All initial FAA examinations are administered by FAA employees. Likewise, the "Check Senior Operators" would be the elite of nuclear plant training staffs. They would be used to administer the requalification examinations, including that portion using simulators.

All initial examinations would be administered by headquarters examiners.

PRO: a) The use of check examiners, such training coordinators and other SROs, as examiners would increase the effectiveness of the requalification programs because of their intimate involvement with administering programs at their facilities with their associated understanding of items in which operators need retraining.

- b) A large pool of well-qualified experienced examiners would be available for conducting examinations.
 - c) Provide excellent operating experience expertise to OLB.
- CON:
- a) The fact that a "Check Senior Operator" of one utility may be making a decision concerning the qualifications of personnel from another utility raises questions of potential bias.
 - b) A full description of the responsibilities and qualifications of the Check Senior Operators will require rule changes to effect appropriate regulatory control over these persons and possibly to provide training and instruction.
 - c) Examinations may become too manipulative with little emphasis on principles of reactor theory, hydraulics, etc.
 - d) Part-time examiners from utilities could appear to create conflict of interest problems.

N. Additional GAO Questions

The GAO report raised several questions that are indirectly related to the Operator Licensing Program, but not the direct responsibility of the Operator Licensing Branch. The appropriate organizations have supplied the following responses to the GAO questions.

- Q1. Nuclear power plant management, maintenance, and other technical personnel are not required to be licensed. Only the operators are required to hold licenses to manipulate the controls of a power plant. Since virtually many, if not all, of the unlicensed personnel may critically affect plant operation, should other plant personnel also be required to hold licenses?

A1. Quality Assurance Branch Response

We are currently assessing the need to upgrade the qualification requirements for all members of the plant staff. One of the means to upgrade qualifications that we are currently considering is the periodic determination of continued qualification by the NRC of the following plant staff positions. They are listed below as functional levels as described in ANSI/ANS 3.1-1978:

Plant Manager - Section 4.2.1

Maintenance Manager - Section 4.2.3

Technical Manager - Section 4.2.4

Supervisor Not Requiring NRC License - Section 4.3.2

Reactor Engineering - Section 4.4.1

Instrumentation and Control - Section 4.4.2

Chemistry and Radiochemistry - Section 4.4.3

Technician - Section 4.5.2

Maintenance Personnel - Section 4.5.3

Auxiliary Operator - Proposed Rev. 2, R.G. 1.8 - Section C

For the above noted positions, we currently require that the persons filling these positions meet the ANSI N18.1 requirements regarding, basically, education and experience. We also require (Section 5.1) that the entire plant staff be trained. The acceptance criteria is in the SRP reference Regulatory Guide 1.8 which endorses ANSI N18.1. However, Section 5.1 is very general and, therefore, the acceptance criteria

are very general. It is recommended that the staff establish NRC accepted training programs for each of the above noted functional positions which should be keyed to the plant at which they are assigned and which would include special emphasis on systems affecting safety, plant procedures, and license requirements. Their continued qualification would be audited by the NRC through review and evaluation of the curricula for the required annual retraining programs. The initial training and the retraining determination of qualifications could also be accomplished by the auditing of formal quizzes which would be required at the completion of training and retraining sessions, but would be administered by the licensee.

In addition, we have had discussions with the Subcommittee ANS-3 which is, in view of recent events, considering revisions to ANSI/ANS 3.1-1978, "Selection and Training of Nuclear Power Plant Personnel." In addition to consideration of the imposition of stricter standards regarding qualifications of personnel, we have initiated discussions with the newly formed Nuclear Operations Institute of the Atomic Industrial Forum concerning the certification of various categories of employees.

- Q2. Commission regulations require that only one licensed operator be in the control room at all times. Should the Commission amend its regulations and require that a senior operator plus one or more additional operators be continually present?

A2. QAB Response

At this point in time, we do not consider that the number of personnel required in the control room as a prime concern, since there is hardly ever only one person actually present. More relevantly, we see the need to upgrade the qualifications of the operating staff, to enhance the administrative controls that govern their operation and to ensure availability of specialized technical support to the operating staff. Comprehensive proposals regarding these activities are under consideration by the staff, the Subcommittee ANS-3 and the Nuclear Operations Institute.

- Q3. Commission regulations do not require that a nuclear engineer be on duty at a nuclear power plant at all times. If this were required, there would be one "key" individual available at all times to cope with an emergency situation that may require nuclear engineering knowledge. Should this be required?

A3. QAB Response

As indicated in the response to question 2 above, the need for a "nuclear engineer" to be on duty at a nuclear power plant or available on call at all times is under consideration. Another alternative under consideration is to upgrade the qualifications of one or more persons on shift. This would provide a means for assuring that someone with training and/or qualifications in the field of thermal-hydraulics and systems will be available to provide guidance to operators during unusual events such as those related to pipe break analysis and natural circulation modes for the reactor.

Q4. Licensee event reports identify errors or other problems that develop in reactor operations. When an operator makes an error, it has to be reported to the Commission through a licensee event report. However, the reports do not provide the names of operators who commit the errors. Therefore, it appears that the Commission cannot maintain operational error records based on what specific operators committed the errors. How effective is this? How can the Commission effectively monitor operator errors?

A4. IE Response

IE does not maintain a file of operational errors, either identified through the Licensee Event Report (LER) system or otherwise, that identify a specific operator to a specific error. LERs were not intended or designed to be used as a tool for evaluation of individual operator performance. Also, "personnel errors," when identified as a cause for an LER occurrence, do not always refer to errors by licensed operators.

LERs are reviewed at the IE regional offices for completeness, safety significance, appropriateness of licensee actions, and adequacy of the report. Based on the inspector's judgment and the safety significance of the event, onsite follow-up of aspects of the event may be conducted. If IE followup of the event clearly indicates poor performance by a licensed operator, this information is reported to NRR:OLB for information and action, if appropriate, as specified in NRR:OLB procedure, "Consideration of Performance of Licensed Operators and Senior Operators," that was forwarded to all the regions.

In general, IE efforts are directed toward assuring that facility licensee management is taking adequate corrective action for operator initiated events.

Nevertheless, presently, if an operator commits a serious violation for actions for which he holds a license to perform them, a full range of sanctions can be applied and will be applied as appropriate. Other licensing actions taken against individual licensed operators and senior operators include those initiated by NRR:OLB. To support these actions, IE has provided regional offices with guidance for providing OLB information regarding significant information concerning individual operator performance. IE plans to further evaluate the current methods for assuring this information is adequately provided.

Q5. In completing licensee event reports, the utilities have considerable discretion in how they classify each event. Should the Commission require more specific details so that it can clearly distinguish human/operator error from a technical design problem?

A5. IE Response

Guidance for filling out LERs is presented in NUREG-0161. Specific instructions for determining the cause code are provided in this document. While there is room for subjective judgment, we consider that the guidance provided is

sufficient. IE inspection procedures provide for regional review, and in some cases inspector followup of LERs, which includes a check of the cause code for accuracy. If apparent discrepancies in cause code reporting are noted, practice has been to bring these discrepancies to the licensee's attention with the intent of providing better accuracy of future reports.

Recently, an NRC task force on Operational Data Analysis and Evaluation, established at the request of the Executive Director for Operations, reported the results of their review to EDO. This report, which includes consideration of GAO recommendations in their January 26, 1979 report, "Reporting Unscheduled Events at Commercial Nuclear Facilities," specifies recommendations for improvement of NRC's review and evaluation of operating data. Concurrently, operational reporting requirements are under review by ACRS. It is expected that these efforts will result in changes that will improve the reporting of operational data, of which LERs play an important role, and NRC's review and evaluation of this information. It is expected that these efforts will result in improvement in identification and accurate reporting of the cause of an event.

- Q6. The Commission has found it necessary to suspend one operator's license and require six other operators to be reexamined. What criteria has the Commission established to determine if enforcement action must be taken against an operator?

A6. IE Response

IE is currently developing more detailed criteria that apply specifically to enforcement actions as they apply to licensed reactor operators. The proposed criteria, which reflects past IE practice, establishes certain conditions under which a licensed operator would be cited. This criteria are currently being applied in determining if enforcement actions should be taken against licensed operators. Since the facility licensee is responsible for the conduct of personnel in their employ, it has been IE practice to cite the facility licensee management for minor operator transgressions when the event resulted from inadequacies in the training program or unless the operator knowingly or repeatedly committed an act of potential significant safety consequences. We consider enforcement emphasis on the facility licensee program to be more effective than enforcement actions directed at the individual. However, in light of the events at Three Mile Island Unit 2, the criteria for citing operator licensees are being further evaluated.

Nevertheless, presently, if an operator commits a serious violation for actions for which he holds a license to perform a full range of sanctions can be applied and will be applied as appropriate. Other licensing actions taken against individual licensed operators and senior operators include those initiated by NRR:OLB. To support these

actions, IE has provided regional offices with guidance for providing OLB information regarding significant information concerning individual operator performance. IE plans to further evaluate the current methods for assuring that this information is adequately provided.

Q7. In light of the apparently low number of enforcement actions and high percentage of operator errors, should the Commission's criteria for enforcement actions be strengthened?

A7. IE Response

As stated in previous responses, there are few enforcement actions directed toward individual operator licensees in relation to operator errors because enforcement emphasis is directed more toward facility licensee management. The numbers, however, do not reflect enforcement actions taken against facility licensees that are directly or indirectly related to personnel errors. We consider IE's present approach for use of enforcement actions as they relate to personnel errors to be the better approach. However, specific criteria for citing licensed operators are presently being developed and should provide more definitive guidance.

Q8. How effective are the utilities in self-enforcing operator violations?

A8. IE Response

Estimating the level of effectiveness for utilities in enforcing or correcting operator performance problems is a subjective matter. IE inspections are intended to verify that the licensee is complying with their approved operator qualification programs. IE review of these programs, LERs and licensee responses to noncompliance items has indicated that facility licensee programs and corrective actions are effective and adequate. As a result of the recent incident at TMI, further emphasis in these areas may be required. Methods for determining the adequacy and effectiveness of the facility licensee's operator qualification program are subjects that warrant further IE review and consideration. We plan to examine the licensee's actions and methods for selection, training, and retraining of the plant staffs.

Q9. When a new nuclear power plant becomes operational, the Commission has statistics which indicate that approximately 30 personnel are assigned to operate the facility. However, the statistics indicate that many times as few as six operators have had actual commercial power plant operating experience. Is this a sufficient number?

A9. OLB & QAB Response

The quoted numbers are not representative. The "cold" training programs described in the paper were designed to provide individuals with "extensive actual operating experience." They have been successful programs and

many of the presently operating plants have been loaded with fuel and have gone through successful startup testing with a majority of the licensed individuals having participated in these programs. However, when the staff has believed that the licensed individuals required assistance during this phase of operations, we have assured that they have been supplemented with non-licensed startup engineers with considerable nuclear power plant experience, including experience as a licensee at an operating plant.

Q10. Control rooms in nuclear power plants are not standardized. There are often considerable variations in the controls of the facilities. If the controls were standardized by the Commission, would this make operation easier for the operators? Would there be less chance for error?

A10. OLB Response

Individuals are licensed for a specific facility. The licenses are nontransferable. The transference of knowledge from one control room design to another is a legitimate concern, but is not considered to be a paramount problem. Nonetheless, the standardization of control rooms, including displays, indicators, controls and alarms, has potential advantages in training although this aspect would be achieved only over a long term. The concept deserves, and is receiving, attention from the industry and the NRC. The obvious drawback, however, like all standardization, is the inhibition of valid improvements.

ENCLOSURE 2

OPERATOR LICENSING BRANCH

MANPOWER REQUIREMENTS

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	<u>FY80</u>	<u>FY81</u>	<u>FY82</u>	<u>FY83</u>	<u>FY84</u>	<u>FY85</u>
	<u>Manpower, Man-Years</u>					
Operator Licensing Examiners	16.0	18.0	19.0	20.5	21.3	23.0
	<u>Program Support (\$1,000)</u>					
Contractor Consultants	150	170	215	245	275	300

In addition, 2 technical professional man-years of private consultant operator licensing examiner manpower are required for each year during the period.

This includes a significant increase in operator licensing exam scope which is required as a result of the Three Mile Island accident. We expect that this increased scope will be started in FY79 and FY80 as supplemental effort and carried on as continuing effort for the period FY81-85.

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There are four categories of operator licensing examinations. Cold exams are given 2 months before fuel loading. Each such exam requires 78 man-days for an average group of 24 applicants. As a result of TMI, a supplemental simulator portion has been added to the basic exam. This adds 16 man-days to the basic manpower if the simulator is offsite and 5.5 man-days if the simulator is onsite. The estimated number of cold exams each year is as follows:

	<u>FY80</u>	<u>FY81</u>	<u>FY82</u>	<u>FY83</u>	<u>FY84</u>	<u>FY85</u>
With Offsite Simulators	7	5	7	3	6	4
With Onsite Simulators	0	2	1	2	0	0

Initial hot exams are given 2 months after fuel loading. Each such exam requires 61 man-days for an average group of 24 applicants. As a result of TMI, a supplemental simulator portion has been added to the basic exam. As with the cold exams, this adds 16 and 5.5 man-days, respectively, for offsite and onsite simulators. The estimated number of initial hot exams each year is as follows:

	<u>FY80</u>	<u>FY81</u>	<u>FY82</u>	<u>FY83</u>	<u>FY84</u>	<u>FY85</u>
With Offsite Simulators	2	5	6	9	10	8
With Onsite Simulators	2	2	2	2	1	5

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Power facility replacement exams and requalification audits are given at operating stations as needed. The current average is 2.25 visits per year per operating station and five visits per year total to the simulator training centers. Each visit requires an average of 14 man-days. As a result of TMI, supplemental simulator portions have been added to the basic exams. These add 4 mandays and 1.5 mandays, respectively, for offsite and onsite simulators. Exams at second and third units at operating sites also are included. The number of operating stations each year is as follows:

	<u>FY80</u>	<u>FY81</u>	<u>FY82</u>	<u>FY83</u>	<u>FY84</u>	<u>FY85</u>
With Offsite Simulators	48	53	61	69	72	77
With Onsite Simulators	6	8	7	7	9	10

Nonpower exams are given at research and test reactors and critical facilities. Each visit to such a facility requires 10 mandays and an average of 50 total visits per year is needed.

The final category of examination-related workload is auditing and is required as a result of the TMI accident. Requalification programs are audited at half of the operating sites once each year and each visit requires 5 man-days. Similarly, half of the vendor and utility operated training centers are audited once each year and each visit requires 10 man-days. Six visits are required each year during the period of interest. Auditing the

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administration of exams at the 12 training centers requires two visits per year to each center and each visit requires 8 man-days.

The total examination workload is done by headquarters examiners in OLB, by contractor consultants in the DOE labs and industry, and by individual private consultants who are "special employees" of the NRC. By definition, we plan for 20% of the exam workload to be done by consultants. Of this 20%, a constant 2 man-years per year will be assigned to the individual private consultants and the balance will be done under contract through the DOE labs.

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