July 8, 1988

MEMORANDUM FOR: Edward L. Jordan, Chairman
Robert M. Bernero, NMSS
Jack R. Goldberg, OGC
Carl J. Paperiello, RIII
Denwood F. Ross, RES
James H. Sniezek, NRR

THRU: C. J. Heltemes, Jr., Deputy Director
Office for Analysis and Evaluation
of Operational Data

FROM: Cheryl A. Sakenas, Program Manager
CRGR Staff

SUBJECT: SUMMARY AND ISSUE IDENTIFICATION
CRGR AGENDA ITEM, MEETING NO. 141

Enclosed for your information is an issue sheet prepared for CRGR review of the proposed revision to 10 CFR Part 55 to require degrees for Senior Reactor Operators. The proposed rule was reviewed by the CRGR and the Committee recommended that the proposed rule not be approved for publication (see Minutes for Meeting 48 included as Enclosure 2). The Commission subsequently issued an Advance Notice of Proposed Rulemaking (ANPRM) on May 30, 1986 requesting public comments. An analysis of the public comments is included as Enclosure 3.

This issue is scheduled for CRGR review at Meeting No. 141 on Thursday, July 14, 1988 in Room 6507, MNBB, from 1-4 p.m.

/ s /

Cheryl A. Sakenas, Program Manager
CRGR Staff, AEOD

Enclosures: As stated

cc/w enclosures:
V. Stello

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Enclosure 1

SUMMARY AND ISSUE IDENTIFICATION
FOR
CRGR AGENDA ITEM - MEETING NO. 141
July 14, 1988

IDENTIFICATION

Proposed revision to 10 CFR Part 55 to require degrees for Senior Reactor Operators. This package was submitted in a memorandum dated June 17, 1988 to E. L. Jordan from E. S. Beckjord.

OBJECTIVE

The staff has requested that CRGR review the proposed rule. It should be noted that in the transmittal memo Eric Beckjord and Tom Murley have expressed strong reservations about the advisability of this revision.

DISCUSSION/ISSUES

The ANPRM was issued for public comment on May 30, 1986. Over 200 responses were received, of these, only 5 were in favor of the rulemaking. Enclosure 3 of this memo addresses the staff resolution of these comments. To assist the Committee in evaluating this issue I have included a few of the comment letters with this issue sheet. I selected a representative sampling which included individual operators, utilities, and industry representatives. Almost every facet of the nuclear reactor industry was represented in the comment letters with the possible exception of vendors. The majority of letters were received from individuals. I found Philadelphia Electric's comments to be well thought out and logical and recommend you read their response. I included a letter from a degreed and nondegreed SRO for comparison.

The comments can be grouped into several major issues.

1. The rule revision will result in rapid turnover of operating personnel because degreed SOs will not remain on shift very long, and will migrate to positions with better working conditions.

2. Other parameters are needed to mitigate transients that go beyond technical knowledge, such as logic and ability to handle stress.

3. Improvements already made since the TMI accident are sufficient to address the expressed concerns. For example, operator training has been enhanced, and procedures and hardware have been improved.

4. There will be a loss of competent personnel with experience because those unable to obtain a degree will have their career paths blocked. This would also create a serious morale problem among ROs which may actually have more experience than their degreed supervisors

5. It would be much better to make this a recommendation rather than a requirement.

In addition, I spoke to a representative of NUMARC to obtain a sense of industry's reaction to this rule. He stated that industry strongly opposes this rule. They believe they have sufficiently addressed upgrading operator skills through the inhouse training programs they have developed. They are concerned that they will lose good people and have to hire recent college graduates which they believe will result in rapid turnover rates with a negative impact on health and safety.

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
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September 5, 1986

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OFFICE OF SECRETARY
DOCKETING & SERVICE BRANCH

Mr. Samuel J. Chilk, Secretary
U.S. Nuclear Regulatory Commission
Attn: Docketing and Service Brand
1717 H Street NW
Washington, D.C. 20555

SUBJECT: Advance Notice of Proposed Rulemaking
Degree Requirements for Senior
Operators at Nuclear Power Plants
(51 Fed. Reg. 19561, May 30, 1986)

Dear Mr. Chilk:

This provides the Commonwealth Edison Company's ("Edison") comments on the above-referenced notice by the Nuclear Regulatory Commission ("NRC" or "Commission").

Edison naturally shares the Commission's concern that operating personnel at nuclear power plants have adequate engineering and accident assessment expertise to deal with off-normal operating conditions. As the owner of several plants, Edison has the greatest stake in their safe, efficient operation. Recognizing this, Edison already taken important steps to upgrade the ability of shift operating personnel to respond to off-normal conditions. These include implementation of the Policy Statement on Engineering Expertise on Shift, 50 Fed. Reg. 43621 (October 28, 1985), establishment of Emergency Operating Procedures increases in staffing including at least two Senior Reactor Operators ("SRO") on shift, and the general upgrading resulting from improvements in, and INPO's accreditation of, training programs.

Edison believes that these actions render adequate current expertise on shift. However, the Commission does not appear to share this view. Rather, the NRC has suggested that educational requirements should be upgraded for all senior operators to enhance their ability to deal with accidents beyond design basis conditions. But no explanation has been provided for proposing degree requirements as the appropriate response to the Commission's concern. Thus, it is not clear whether the concern with the ability to respond to conditions beyond the design basis is the sole Commission concern, or whether the Commission also believes as a general matter that degree requirements for all senior operators will somehow improve the safe operation of nuclear power plants.

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Neither belief is supported by operating experience. Rather, as shown by the attached detailed answers to the Commission's questions, the proposed degree requirements would not only fail to enhance current operator ability to deal with conditions beyond the design basis, but also, more importantly, would decrease safety. This decrease in safety would result, in part, from the demoralizing effect of removing the senior operator position from the normal career progression now available to non-degreed power plant personnel and from an anticipated reduction in the level of plant experience by degreed engineers who, after training to be SROs, can be expected shortly thereafter to seek more advanced positions.

Unfortunately, no consideration appears to have been given to these and other practical considerations in developing the proposed degree requirements. Edison is sure that once these considerations are taken into account, the negative consequences and practical difficulties with this proposal will be appreciated by the Commission and the proposal to conduct rulemaking will be withdrawn.

Sincerely,

Dennis Farrar
Director of Nuclear Licensing

att.
2057K

PHILADELPHIA ELECTRIC COMPANY

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SHIELDS L. DALTROFF
VICE PRESIDENT
ELECTRIC PRODUCTION

September 22, 1986

Docket Nos. 50-277
50-278
50-352

Mr. Samuel J. Chilk, Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Attention: Docketing and Services Branch

Subject: Advance Notice of Proposed Rulemaking: Requirements for Applicants for Licenses as Senior Operators

Dear Mr. Chilk:

Philadelphia Electric Company wishes to comment in response to the Commission's advance notice of proposed rulemaking published in the May 30, 1986 Federal Register (51 FR 19561) regarding the establishment of new requirements for Senior Operator licensed applicants. The contemplated rule making would require that after January 1, 1991 applicants should (1) hold a baccalaureate degree in engineering or the physical sciences and (2) possess at least one year of operating experience in a similar commercial nuclear reactor operating at greater than twenty percent power.

We wish to offer the following comments regarding the proposed requirement that applicants for an SO license hold a baccalaureate degree in engineering or physical sciences. The requirement would ultimately result in all shift supervisors being required to hold such a baccalaureate degree. To summarize the overall impact of the Commission's proposal, we believe that the deleterious effects of this staffing requirement would outweigh any possible benefits to the extent of jeopardizing the health and safety of the public. Requiring degreed SO would result in a substantial reduction in operational experience levels, an increase in personnel turnover, and difficulties in attracting qualified personnel. Further, these negative safety implications would degrade the effectiveness and morale of the operating staff immediately following approval of the proposed

rule, while the limited benefits would not be evident until degreed personnel were available to assume the responsibility as Senior Operators (we estimate the implementation period to be at least ten years based on later discussions in this submittal).

Proposed Rule Objectives

As stated in the advance notice, the objective of requiring an baccalaureate degree for Senior Operators is to improve the capability of the operating shift to respond to severe accident conditions. It is our considered opinion that the improved operator training programs, and the emergency response features required by NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability", which have been implemented or are in the process of being implemented at all plants, are the most effective means of optimizing operator's response capabilities to accident conditions. Improvements in operator response capabilities can be accomplished more effectively through revisions in the emergency procedures and training programs, as additional knowledge is acquired, without the adverse effects associated with the engineering degree concept.

The discussion in the Federal Register regarding the advance notice states that "operator training programs and related emergency operating procedures, generally do not consider accident conditions beyond inadequate core cooling". It further states that the Industry Degraded Core Rulemaking Program (IDCOR) industry group for example, has developed arguments that operators could substantially mitigate the effects of severe accidents. IDCOR Technical Report 24.4, December, 1984, emphasizes the importance of the operators role in mitigating severe accident sequences, and we assume this is the IDCOR argument referenced in the Federal Register. We wish to note that the same IDCOR report concluded that the control room instrumentation, symptom-based procedures, and training exercises implemented in response to the TMI lessons learned are effective in terminating and mitigating severe accident conditions. The IDCOR report was particularly positive about the new emergency procedures when it stated: "the procedures describe a large number of alternative actions which the operator could take if the primary systems fail to accomplish their function. Procedural guidance ensures that the operator monitors the consequences of action taken and implements alternative actions if initial attempts to terminate the events are unsuccessful." The IDCOR evaluation was based on a study of operator response capability for the Peach Bottom and Sequoyah plants.

Current On-Shift Engineering Expertise

The Federal Register notice fails to note or give adequate weight to the fact that personnel with a broad range of

engineering and technical expertise have been integrated into shift operations and into the emergency response plans at all facilities since the TMI accident. For example:

- The various emergency response facilities (Emergency Operation Facility, Technical Support Center, and Emergency Support Center) are amply staffed with engineering personnel during an emergency to support the control room operators in responding to severe accident conditions. These facilities are generally staffed within the first hour following the initiation of an transient or accident, well before the onset of severe accident conditions.

- Shift Technical Advisors (STA) with engineering degrees are assigned to each shift at most plants to provide added support to the operating shift. The STAs are trained in the use of the emergency procedures for accident response on plant simulators, and subject material related to accident behavior characteristics.

We are in agreement with the statement in the Federal Register notice that the "Commission encourages the STA take an active role in shift activities". Since the inception of the STA concept in 1980, Philadelphia Electric Company, as have many other utilities, has factored the STA into the everyday activities of the operating shift. Although not involved in the operation of equipment, the STA monitors the status of safety systems, ensures compliance with operating limits, investigates operational problems, and evaluates operating experience.

Value of Engineering Degree

Commissioner Asselstine, in his comments on the proposed rule, expressed the concern that a baccalaureate degree in engineering may not provide the best means for assuring that senior reactor operators have the knowledge needed to carry out their responsibilities. We agree with this concern in that most subject material associated with an engineering curriculum is unrelated to the development of effective response capabilities to severe accident conditions as follows:

- Approximately a third of the subject material in an engineering curriculum is non-technical; e.g. courses in literature, English, economics

- Courses in advanced mathematics such as calculus are of little apparent value to power plant operators

- Many of the technical courses involve pure sciences, laboratory, and theoretical subject material that is

more oriented to the design and research arena, and of little apparent value to power plant operators.

Theoretical courses of value to plant operators such as thermodynamics, heat transfer, and fluid flow have been incorporated into the operator training programs, and can be improved if deemed necessary. While these courses are basic to a Mechanical Engineering degree, they are not necessarily included in other engineering, engineering technology, or physical science curriculums.

Commissioner Asselstine further stated that some of the engineering knowledge and reactor theory needed to understand and cope with design basis accident situations will not be covered by the courses needed to obtain an engineering degree. We agree with this assessment since an engineering curriculum generally does not address the skills needed by plant operators. Reactor technology is normally addressed only briefly in most engineering and science curriculums. In those curriculums where it is taught in some depth, the emphasis is on general theory and does not deal with the plant specific characteristics and knowledge needed by operators for emergency response. Practically all of the training material presented in current operator training programs would need to be retained; consequently, the engineering curriculum would represent an additional training burden for operators.

Emergency Procedures/Training Improvements

The Federal Register notice states that the various TMI studies concluded "that greater technical and academic knowledge among shift operating personnel would be beneficial to the safety of nuclear power plants". Dramatic improvements in operator training and qualification standards, as well as in the emergency response procedures, have provided shift operating personnel with the tools needed for responding to severe accident conditions.

Utility Owners Groups have developed generic operating guidelines for each type of reactor that simplify the operator's approach to analyzing and responding to plant transients. Before the guidelines could be developed, it was necessary to perform extensive transient and accident analyses to better understand specific plant behavior and the relationship between system parameters for the entire spectrum of possible accidents. Further, it was concluded during the initial phases of the guideline development that a new approach for use by the operators in evaluating transients was necessary to reflect the real world relationship between the operator and plant conditions as observed on the instrumentation. This resulted in the development of "symptomatic" rather than "event" oriented procedures. In effect, the human factors concept was integrated

into the operating procedures. The use of symptomatic procedures takes the guess work out of operational transient response and directs the operator's attention to correcting the symptoms. Symptomatic oriented procedures, unlike event oriented procedures, provide the operator with the capability to respond to all possible accident scenarios.

Philadelphia Electric Company implemented these new symptomatic emergency procedure guidelines at its Peach Bottom plant in early 1983, and other utilities have either implemented or are in the process of implementing the new guidelines. The utilities can be expected to continue to refine the procedures based on additional information and insight. The successful development of improved emergency procedures demonstrates the capability of utilities to respond to the most significant TMI lessons learned.

In parallel with the improved emergency procedures, operator training programs have been substantially improved with regards to both the quality and quantity of the training process. For Philadelphia Electric Company's Limerick and Peach Bottom plants, initial training for a Licensed Operator candidate is now 55 weeks. A candidate for a Senior Operator License receives an additional 32 weeks of training. All licensed operators receive requalification training involving approximately 28 days each year. Additional training requirements such as fire protection, radwaste handling, and management training, when combined with requalification training total approximately 20% of a licensed operators work schedule.

Plant simulators to train operators in the use of emergency procedures during accidents are used extensively in the licensed operator initial and requalification training programs. A factor that would significantly improve operator response capability that was not discussed in the Federal Register is the use of plant specific simulators for all plants.

The extent of the training which SO are currently subjected to during their careers is in excess of that experienced by most degreed engineers. Operator candidates are subject to an initial screening process prior to their assignment as an auxiliary operator. The process involves training and examinations in the area of nuclear and power technology to permit an evaluation that the candidate is qualified to ultimately advance to a position as a licensed SO. The training is on-going during the individuals progression, is accelerated during the licensing process, and continues as part of the requalification training programs. The extensive training and stringent qualification requirements, along with the formal licensing process, establishes the professional nature of the SO position. The authority granted the SO, as well as his financial compensation, exceeds that of many professional engineers. All

of these factors contribute to the professionalism of the SO position.

Impact of Proposed Rule

In evaluating the effects of the proposed rule, two options need to be considered for implementation of a degreed SO concept. The first option involves having present and future plant operators pursue and obtain an engineering college degree. The second option involves the assignment of currently degreed engineers to the Senior Operator positions.

The first option involving the acquisition of engineering degrees by current operators is not practicable for the following reasons:

1. Experience with operator training has shown that most operators would not be able to master the advanced mathematics associated with an engineering curriculum. In the past some operators required remedial courses or were denied the opportunity to license based on their inability to master the principles of algebra. The need to be proficient in a calculus based engineering curriculum would present much greater obstacles.

2. The logistics associated with developing a supply of degreed operators as candidates for a Senior Operator license will require a time schedule that will extend well beyond 1991. The training and progression of operators would need to be accelerated to increase the number of available licensed operators so that there is a sufficient manpower pool to permit operator participation in an engineering degree curriculum while maintaining an adequate operating staff. It is estimated that three years would be necessary to provide a sufficient pool of operators to support the initiation of an engineering program, as well as plant operations and other training requirements. The anticipated schedule for a full time and a part time engineering degreed program follows:

   a) Participation in a full time engineering program, assuming that they would qualify for admission, will probably require four years. This estimate considers the need to provide study periods to complement the classroom requirements. Consequently, the earliest date in which degreed operators would be available for SO training is 1993. As stated above, a delay in the initiation of the engineering program until 1989 is necessary to develop a sufficient manpower pool. A full time

engineering program would result in a loss of operating experience due to the individuals absence from plant operations. Consequently, the degreed operator would need to requalify for shift operations. Approximately two years would be expected to requalify for shift operators, and complete an SO training program. Based on this time schedule, 1995 would be the earliest date in which degreed operators would be available as SO applicants.

b) A part time engineering program must recognize other training requirements and the need to maintain job experience levels. To maintain adequate job experience levels, it is estimated that participation in training programs should be limited to an average of twenty hours per week (50% of the work week). Since current training requirements account for 20% of the job assignment, only 30% (12 hours per week) of the job is available for an engineering degree program. Based on this schedule, at least 7 1/2 years would be required to acquire a degree. Allowing an additional six months for an SO licensed training program, 1997 would be the earliest date in which degreed operators would be available as SO applicants using a part time engineering program. These schedule estimates for both the full time and part time degreed training program assume that there are a sufficient number of candidates that are qualified and motivated to participate in such a program. We do not believe this to be a realistic assumption.

3. A requirement that SO applicants have an engineering degree would have a severe impact on operator morale since it establishes an obstacle to their career progression, and deviates from long standing established career opportunities and goals. Operator inability or reluctance to participate in the engineering program would result in a shortage of qualified personnel. The personnel turnover rate would increase, severely degrading the experience level. The few operators able or willing to obtain degrees would most likely opt for a traditional engineering job with normal working hours in lieu of a shift oriented position as an SO. The expanded life style choices associated with an engineering or physical science degree would introduce a personnel turnover rate, regardless of economic incentives, that would diminish the experience levels of the shift. For these reasons, we agree with Commissioner

Asselstine's concern, as stated in his comments on the proposed rule, that imposing a degree requirement for SO is likely to result in the loss of some experienced and skilled reactor operators.

4. The additional training associated with an engineering degree would have the effect over the next ten years of accelerating the progression rate, and reducing non-training time on the job. These factors will significantly lower the overall experience level of shift personnel.

The second option involving the assignment of currently degreed engineers to the Senior Operator positions offers little benefit and will have a severe impact on the overall quality of the operating shift as discussed below:

1. Considering the assignment of a Shift Technical Advisor to the operating shift, and the availability of many engineering disciplines at the emergency response facilities, the addition of engineering degreed Senior Operators offers little additional benefit.

2. The assignment of engineers to shift positions conflicts with established career goals and living patterns for both the individual and their families. For these reasons, most engineers would be reluctant to accept a long term shift position. While a short term assignment will meet with less reluctance, the associated reduction in the experience level of the shift renders this option unacceptable.

3. The reduction in career opportunities for non-degreed operators would result in a substantial deterioration in morale and create severe personnel problems.

4. Resentment of the new staffing requirements would be focused on the degreed SO resulting in personnel conflicts. A class system could develop between the degreed individuals and the operating group which would strain communications and cooperation. This effect would reduce operating capabilities and could be safety concern during the transition.

5. Engineers assigned to the Senior Operator position will lack some of the practical power plant knowledge and skills acquired from the hands-on job assignments, and reactor console operating experience. Engineers will have little hands-on experience, and little or no reactor console experience, within the facility.

6. Experienced engineers are currently needed to fill vacancies in senior staff and management positions. Consequently, degreed SO applicants would have to be selected from recent college graduates. Considering the lack of operating and particularly management experience, this option would be unacceptable. Experience indicates that a period of nearly ten years would be necessary to develop a sufficient manpower pool of experienced engineers for consideration as SO applicants

7. The routine nature of a shift position would not be sufficiently challenging to an engineer on a long-term assignment. Those with personal goals and the intellectual curiosity desired for these positions will not tolerate the life style schedular requirements for much more than two years.

The Federal Register notice concluded that the January 1, 1991 implementation date permitted sufficient time to complete a degree before application. The assessments provided above of the time necessary to implement the proposed rule supports our belief that degreed requirement would require a significantly longer period for implementation.

Cost of Proposed Rule

The integration of a program to provide college experience culminating in a degree awarded by an accredited institution to current operating personnel would be extremely expensive due to the need to integrate the education into the shift operating schedule, the need to limit the term of the degreed SO shift assignment, and the expected high academic drop out rate. The Attachment based on one scenario estimates the cost of the contemplated rule could be as much as 3 million per year. The scenario presented in the Attachment is based on utility experience that individuals with engineering degrees will not remain in a rotating shift position for more than about 4 years. A typical two unit nuclear plant has approximately 18 senior operators. The required production rate of degreed SO's must, therefore, be 18 individuals every 4 years.

Proposed Policy Statement

As stated in the Federal Register Notice, the Commission plans to issue a policy statement which will encourage licensees to: (1) Implement personnel policies that emphasize the opportunities for licensed operators to assume positions of increased management responsibility; (2) Develop programs that would enable currently licensed senior operators and reactor

operators to obtain college degrees; and (3) Obtain college credit for appropriate nuclear power plant training and work experience through arrangements with the academic sector. Considering the obstacles to obtaining college degrees for operating personnel, and the comprehensive training and qualification requirements currently in-place, as previously described in our comments on the proposed rule, the second and third policy provisions would not be beneficial to improving operating shift effectiveness. Philadelphia Electric Company encourages part time participation in college degree programs with its fully paid tuition refund program available to all employees, including plant operators. Very few operators have elected to participate in this program. The current training obligations of nuclear plant operators, the incompatibility of shift schedules with college programs, and the career path choice of operators, are all factors that impede the acquisition of college degrees.

We agree with the first policy provision; however, it is our understanding that most utilities currently select candidates for licensed positions based on the individuals ability to progress to a management position as a shift supervisor, and with the individuals understanding that management opportunities are available. Philadelphia Electric Company strongly endorses, and has implemented into its training program, professional management training for prospective and present supervisors.

Experience With Degreed Engineers

We recognize that the Navy's nuclear reactors are staffed with degreed Senior Operators. However, there are dissimilarities between a military assignment and a career in private industry that inhibit the application of this concept to commercial reactors. These dissimilarities involve (1) the inability to easily apply a military discipline to private industry, (2) the greater complexity of commercial nuclear plants which necessitate higher experience standards for operating supervision, and (3) the short term nature of a military assignment versus the very long term nature of a career in private industry.

Many of the comments regarding the use of engineers on shift are based on Philadelphia Electric Company's experience with this concept during the startup and early operation of Peach Bottom Unit 1. For approximately four years (1964-67) the Senior Operator in charge was a degreed engineer. Of the five engineers selected for this position, two left the Company, with their objection to shift work a major factor. Shift work was tolerated by the other engineers only because of the anticipated short term nature of the assignment, and the shift work nature of the position was a major factor in terminating the requirement for a

degreed SO at Peach Bottom Unit 1. Resentment of the degreed SO by the non-degreed shift personnel was very evident and was a persistent personnel problem requiring constant management attention.

Summary

In summary, the degreed SO concept would greatly expand the training requirements well beyond the already extensive training requirements imposed on the licensed supervisors. The result will be to saturate the individual with an enormous spectrum of knowledge, much of which would not be utilized during operations or during responses to emergencies. It is our belief that the INPO accreditation program for licensed operators is the best approach since it focuses on the essential skills and knowledge needed to avoid and respond to accidents, using a training process (plant simulators) that best duplicates actual conditions. The current training and staffing philosophy recognizes the importance of job experience in all aspects of power plant operations, and the distinction in career goals and job expectations between degreed and non-degreed personnel.

A program for current operators to obtain engineering degrees is expected to have a very poor success rate. The few operators that are successful in obtaining degrees would probably opt for a non-shift position in the engineering and training profession. The obstacles imposed by the proposed rule on operator progression would impact morale and encourage job transfers. The higher turnover in plant personnel would probably increase job overtime and fatigue stress levels. To meet the provisions of the proposed rule, current graduate engineers would be needed. Experienced engineers would be reluctant to accept a long-term assignment in a shift position, and the large number of Senior Operators required to staff a nuclear plant would preclude short-term assignments since the organization would not be able to absorb the shift engineer at the conclusion of their assignments (currently 15 Senior Operators are needed to staff Peach Bottom, with an increase in that number planned).

Improvements in the operator's performance can best be implemented in a timely manner by refinements in the existing symptom based emergency procedures and INPO accredited operator training programs. While the current procedures and training programs establish severe accident response capabilities, we would welcome the establishment of a working group, with the NRC, INPO, and an owners groups as primary participants, to identify specific improvements to existing emergency procedures and training curriculums.

proposed Operating Experience Rule

The remaining comments deal with the proposed requirement that Senior Operator licensed applicants possess at least one year of operating experience in a similar commercial nuclear reactor:

1. For BWR plants, "similar commercial nuclear reactor" should not be restricted to a particular General Electric product line. This interpretation recognizes the similarity in operational characteristics for all General Electric BWRs, while maximizing the availability of qualified applicants for SO licensees.

2. The proposal to require one year of operating experience in a similar commercial nuclear reactor may impose unnecessary restraints on the staffing and licensing of personnel at a facility prior to initial startup. For this reason, consideration should be given to limiting the experience requirement to one SO per shift.

We trust that the enclosed comments will assist you in your considerations of the proposed rule.

Very truly yours,

Attachment

cc: Dr. Thomas E. Murley, Administrator, Region I, USNRC

Docket Nos. 50-277
50-278
50-352
September, 1986

PHILADELPHIA ELECTRIC COMPANY

ATTACHMENT

IMPACT OF NEW DEGREED
SENIOR OPERATOR REQUIREMENT
ON STAFFING

A typical two unit BWR (maybe PWR) has the following shift staffing.

NO/SHIFT	POSITION	LIC
1	Shift Supervisor	SO
2	Shift Foremen	SO
3	Reactor Operator	RO
9	Non-Licensed Operator	

In this example, we assume that all positions rotate thru all shifts as a team and that 6 full teams exist. This results in the need for shift operations personnel as follows:

NO/SHIFT	POSITION	LIC
6	Shift Supervisor	SO
12	Shift Foremen	SO
18	Reactor Operator	RO
54	Non-Licensed Operator	
90	TOTAL	

The above personnel would devote one week of every six to training which includes:

Requalification Training for SO or RO License
Emergency Preparedness Training
First Aid Training/CPR
Fire Brigade Training
Radwaste Shipping Training
Simulator Training
General Employee Requalification
General Respiratory Requalification
Mitigation of Core Damage
Specialized System Training

On a yearly basis, this training represents 8 and 2/3 weeks per year or 17% of their time.

In this example, we will further assume that all operators average another 3 weeks off each year for vacations, sick and leave time. This time off the job, coupled with their training, leaves only 78% of time available to perform shift work activities. In reality, the senior individuals (Shift Supervisors) will in most cases be eligible for 4 to 5 weeks/year vacation. This would reduce their availability for shift operations to 74%.

QUALIFYING EXISTING ROs TO DEGREE REQUIREMENT

Assuming a utility chooses to qualify personnel to the baccalaureate degree level by qualifying existing ROs, the following must be considered:

Number of Degreed SO Required Per Year

Our example shows a staffing of 18 SOs on shift to support a 2-unit plant. Industry experience indicates that degreed personnel will only accept a shift work assignment for a period of 3 to 5 years. The required production rate of Degreed SOs must, therefore, be 18 individuals every 4 years.

Number of ROs to be Trained for Degrees

In order to produce 18 degreed SOs every 4 years, the following must be considered:

a) Union Work Rules for Candidate Selection

Union or company work rules may require that the senior individual be selected for this training. This would inhibit selection of the candidate with the highest potential for success in an academic training program.

b) Anticipated Successful Completion Rate

Based on some utilities efforts to gain academic credits for ROs, a 50% success rate in completing a collegiate level program appears to be optimistic. Individuals in these positions did not pursue a college degree following high school. The graduating class at many universities with the appropriate selection of

candidates is only 30% to 40% of the freshman class. With the added burden of supporting an RO license and increased family responsibility of the average person who has been out of high school for 5 years or more the success rate of 50% used in this example is very optimistic.

c) Turnover Rate of Degreed SOs

Since the individuals entering this program are not committed (as in the Navy) to work as an SO for a defined period, some successful candidate could seek other day work employment immediately after gaining their degree. In some utilities, ambitious operators have pursued degrees primarily to obtain a day work assignment. For this example, we will optimistically assume that only one of every ten successful candidates never work the SO position.

Based on the above, the number of ROs entering a program each year to produce 18 degreed SOs every 4 years (4 1/2/year) is 10 individuals/year on a continuing basis.

$$4\ 1/2\ \text{SO/Year} = \frac{\text{Candidate}}{2} \times \frac{9}{10}$$

$$\text{Candidate/Year} = \frac{4.5 \times 2 \times 10}{9} = 10\ \text{candidates/year}$$

DISPOSITION OF ACADEMIC DROP OUTS

In this example, we assumed that 50% of the candidates that enter the Degreed SO program drop out after one or two years. These individuals would return to an on-shift RO assignment. This program would produce 4 1/2 unsuccessful candidates each year. After 4 to 5 years, all RO positions would be permanently filled with unsuccessful candidates. This would cause a morale problem, a class distinction problem, and would make it difficult to train and gain RO experience for new ROs who are on a path to degreed SO status. This situation may also result in these unsuccessful ROs leaving their positions. Eventually, the RO positions would be staffed with disrungtled ROs and ROs in training for the degreed SO position. In any case, the program would tend to reduce cooperation between SOs and ROs. The time spent by a SO candidate working in an RO position would eventually decrease to that required to obtain a SO license.

TRAINING PERIOD FOR RO to DEGREED SO

Let us assume that a utility elects to place an RO in a university training program 50% of the time. A typical schedule for such a candidate would then be:

26 weeks/year	-	university training
3 weeks/year	-	remedial RO training prior to resuming RO licensed duties
23 weeks/year	-	on shift assignment at RO

During the 23 weeks of shift assignment, the RO would also have time away from operational duties as follows:

6 weeks/year	-	Requalification & Simulator Training
3 weeks/year	-	Vacation, Sick, Leave

This results in the operator actually performing RO duties 14 weeks/year.

In this example, we will estimate that an individual must complete 11 quarters of academic credits to obtain a degree.

Based on past utility experience with academic training of nuclear plant operators, some remedial courses at the high school level may be required for many candidates. Remedial courses in Math, Physics, and English are contemplated. This would add 2 quarters to any academic program.

Since these individuals already have extensive training in some areas, some college credit may be available from certain institutions for knowledge obtained via an INPO accredited utility training program. For this example, we will shorten the degree program by 1 quarter for this knowledge.

This results in the need for a candidate to attend 12 quarters of university instruction over a 6-year period based on attending 50% of the time. Once the Degree is received, the candidate would then take another 9 months to train for and receive a SO license.

Total training period for each successful candidate would then be about 7 years.

NUMBER OF ROs IN UNIVERSITY PROGRAM

To generate this number, we will assume that unsuccessful candidates all drop out after one year of effort. This means that 10 people enter the program each year but only 5 continue for the remaining 5 years. This results in an average of 35 individuals in this university training program on an equilibrium basis.

Each of these would work shift work 14 weeks per year as a reactor operator. This accounts for 490 manweeks of the required 780 manweeks per year of RO duty requirements. The remaining RO duties would be covered by individuals not in the program or drop-outs. It is reasonable to assume that eventually, the only experience ROs in the degreed program will get is during this 14 week period each year.

COST OF UNIVERSITY PROGRAM

Tuition = $5000 per individual for attending a university 2 quarters

Expenses = $50 per day per individual while attending a university for 160 days per year or $8000 per individual

Payroll = $25,000/year payroll per individual for 1/2 year while in the university program

With 35 men/year in the program, costs would be:

Tuition	=	35 x $5,000/year	=	$175,000/year
Expense	=	35 x $8,000/year	=	$280,00/year
Payroll	=	35 x $25,000/year	=	$875,000/year
TOTAL	=	$1,330,000/year		

PRODUCTION OF RO PERSONNEL

This example defines a need to place 10 individuals in a degreed RO program each year. To accomplish this, the utility must qualify 10 ROs each year. To train and qualify a new hire to the RO level while supporting outside operator work requirements takes a minimum of 5 years. During the equilibrium period, 10 new hires would enter the non-licensed operator training program each year. This program includes classroom training, on-th-job training. and assignment to shift positions during the five-year period. It is estimated that during the 5-year period, the operator would be assigned shift duties for only 2.5 years.

Our example shows that 54 non-licensed operators are needed to support plant operation. Since half of these individuals are always in training, a total payroll complement of 108 people will be needed to support the non-licensed duties. Experience level will also be minimal since rapid flow thru will occur.

COST OF ADDITIONAL NON-LICENSED OPERATORS

Payroll = 54 additional non-licensed operators on payroll each year at an estimated salary of $30,000/year
= $1,620,000

Training = 10 Trainers to instruct 54 operators each year at an estimated salary of $40,000/year
= $400,000/year

TOTAL = $2,020,000/year

FEASIBILITY OF TRAINING RO TO DEGREE LEVEL

The above illustrates that it is not feasible to produce all degreed SO by training ROs. This is based on:

1) High turnover rate and severe reduction of experience level in all job classifications

2) Excessive cost of program ($3,350,000/year)

3) Reduced plant reliability and safety due to inexperienced shift personnel and low operator morale

QUALIFYING DEGREED ENGINEERS TO SO POSITION

Since the above program is not feasible, utilities will be forced to hire graduate engineers, provide the appropriate experience, license to the SO level and assign these individuals to SO positions for a finite length of time (3-5 years). This solution possesses the following disadvantages:

1) SO experience level will be 3-5 years maximum.

2) Degreed engineers in most utilities will have difficulty gaining good hands on operating experience inside and outside the control room due to union rules.

3) Operators will see promotional opportunities vanish, thereby, causing poor morale and higher turnover rates (reduced on shift experience level).

4) Since commercial plants only refuel every 18 months, most SOs will have limited outage type operational experience.

5) SO will probably be less mature than control operators. This could create poor working relationships.

The above disadvantages make this program somewhat unacceptable to utilities since it reduces plant safety and causes poor morale which eventually translate into increased number of forced outages, longer outages and poor INPO and NRC evaluations.

COST OF STAFFING WITH DEGREED ENGINEERS

If we assume the engineers hired to this position do useful work while gaining operating experience during the first 3 to 4 years of employment, the cost of this option are estimated as follows:

Salary = 1 1/2 years during entry level and SO training
= program at $40,000/year
= 1 1/2 x $40,000/year x 18 individual every 4 years
= $270,000/year average

Added Salary = To keep an Engineer on shift instead of an SO without a degree, a premium salary of $10,000/year per individual is estimated $180,000/year

These degreed SOs would reduce the present SO training program costs. Turnover of present SO is estimated at 18 every 10 years. Training time for present ROs to SO is estimated at 9 months.

Savings = Salary of RO = $50,000/year
= 3/4 year x $\frac{\$50,000}{10\ \text{yrs}}$ x 18 individuals
= $70,000/year

Total Estimated Cost of this option is $380,000/year

$270,000 + $180,000 - $70,000 = $380,000/yr

COST DIFFERENTIAL

The above shows a relative cost saving of about $3,000,000 to utilities by implementing the proposed rule by hiring degreed engineers. This would provide a strong incentive for utilities to select this option in spite of the disadvantage identified.

CONCLUSION

The present concept of providing engineering expertise on shift via STA or SLO/STA is appropriate. Engineering personnel with lesser experience coupled with experienced SO, RO and non-licensed personnel using TMI enhanced procedures and instrumentation, provide a high degree of safety for nuclear plant operations. This has been verified to a degree by the shift performance during the more significant transients which have occurred since TMI. We believe the proposed rule to be unnecessary and negatively impacts plant safety.