November 1, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289 SP
	)	(Restart-Management Remand)
(Three Mile Island Nuclear Station, Unit No. 1)	)	
	)	

LICENSEE'S TESTIMONY OF MR. SAMUEL L. NEWTON, MR. BRUCE P. LEONARD AND MR. MICHAEL J. ROSS ON THE ISSUE OF LICENSED OPERATOR TRAINING AT TMI-1

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ON THE ISSUE OF LICENSED OPERATOR TRAINING AT TMI-1

This testimony is sponsored by Mr. Samuel L. Newton, Manager, Plant Training, TMI, Mr. Bruce P. Leonard, Operator Training Manager and Mr. Michael J. Ross, Manager, Plant Operations, TMI-1. The testimony is divided into four sections, which address the following issues:

(1) Is the current TMI-1 licensed operator training program, including staffing, adequate?

(2) Are the training facilities utilized in the licensed operator training program adequate?

(3) What is the attitude of TMI-1 licensed operators towards the licensed operator training program?

(4) What is the status of GPU Nuclear's effort to obtain accreditation of the TMI-1 licensed operator training program by the Institute of Nuclear Power Operations (INPO)?

Our testimony represents a collaborative effort; however, Mr. Leonard has focused primarily on Issues (1), identified above, Mr. Newton has addressed Issues (2) and (4), and Mr. Ross has responded to Issue (3). Attached hereto as Attachments 1 through 3 are our professional qualification statements.

I. THE CURRENT LICENSED OPERATOR TRAINING PROGRAM (BY B. LEONARD)

The operation and maintenance of a nuclear facility such as Three Mile Island Unit 1 must be supported by an extensive and diversified training program, including formal classroom instruction as well as on-the-job training activities. Since the accident at TMI-2, Licensee has embarked upon a major training and retraining effort for licensed TMI-1 personnel. Training for operations staff is emphasized through continuous training and testing.

The purpose of the training programs for licensed operators is twofold. The replacement programs provide a sound theoretical and practical background to ensure that personnel understand how and why they perform specific tasks, understand how their job impacts plant and public safety, and can correctly respond to situations that they might encounter during normal and abnormal situations. The requalification training programs enhance nuclear plant safety and reliability by maintaining a high level of skill and knowledge in licensed senior reactor operators and licensed reactor operators.

To ensure requalification training fulfills its purpose, all TMI-1 Operations shift personnel are scheduled on a six shift work cycle with one of the six shifts dedicated to training. In cases where identified training cannot be completed with the one shift week devoted to training, additional time is scheduled during the operating crews' relief week, or on overtime as necessary to complete required training.

There are three approved training programs which prepare candidates to perform reactor operator or senior reactor operator duties at TMI-1. The licensed operator training programs are the replacement or new reactor operator program, the replacement senior reactor operator program and the requalification program for licensed ROs and SROs.

A. Replacement Reactor Operator Training

Each candidate for the reactor operator (RO) position participates in the replacement program, which is nine months long and consists of two phases. Phase one is primarily on-the-job training (OJT) and classroom training in reactor plant fundamentals. Phase two consists of OJT and classroom training in systems and integrated plant response.

Replacement operator candidates are designated by the Manager, Plant Operations. Each candidate for the program must meet the following qualification requirements:

(1) have a high school diploma or equivalency;

(2) at the time of licensing, have accumulated three years of power plant experience of which one year is at TMI-1. This one year of experience must include three months of performing the duties of a licensed

operator while under instruction as an extra person in the control room;

(3) satisfactorily completed the plant fundamentals training program unless written examination has verified that the knowledge and skill of the individual is comparable to that of individuals who have completed the training;

(4) satisfactorily completed the plant systems training programs; and

(5) satisfactorily met the minimum medical requirements for licensed personnel as specified in 10 C.F.R. Part 55.

The RO program is designed to accommodate new operators from the job market as well as the auxiliary operator (AO) ranks. Newly hired candidates from an outside source, with no auxiliary operator experience, are required to complete sections of the auxiliary operator OJT program as well as complete or validate the fundamentals training received by the AO's during their training program. The completion of AO OJT tasks serves to familiarize the candidates with key operating equipment and procedures while they complete the replacement operator training program.

Classroom training conducted for replacement operators includes coverage in the following topic areas:

a. Systems;

b. Heat Transfer, Fluid Flow, and Thermodynamics;

c. Mechanical Fundamentals;

d. Radiation Control and Safety;

e. Reactor Instrumentation and Control;

f. Reactor Theory;

g. Primary and Secondary Chemistry and Chemistry Control;

h. Emergency Plan;

i. Security;

j. Technical Specifications;

k. Normal, Abnormal, and Emergency Operating Procedures;

l. Recognition and Mitigation of Consequences of Accidents Resulting in Severe Core Damage; and

m. Safety Analysis.

To illustrate the scope of the program, when systems are taught, training includes: (a) purposes of the system and emergency functions; (b) simplified diagram showing the flow paths including instrumentation, interconnections, interlocks, all major components and control room operated equipment; (c) automatic actuation signal setpoints, interlock setpoints, and the purpose and function of these signals; (d) alarms associated with the system including the purpose, setpoint, and required operator actions; (e) limits, precautions, Technical Specifications, and, where applicable, the basis (Technical Specifications or the FSAR); (f) brief description of system operation in all modes, including normal system parameters; (g) power supplies to major components; and (h) interrelations and interfaces with other systems.

During classroom training, a licensed senior reactor operator from the Operations Department is normally assigned to assist the Training Department in candidate training. This SRO provides an additional source of technical plant knowledge for the trainees and assists in counseling when required.

The Operations Department is responsible for the conduct of the OJT programs for candidates. Routinely, training instructors conduct audits of candidate progress and knowledge level. Concerns resulting from these audits are forwarded to both Operations and Training. The OJT training program encompasses the areas of (i) administrative procedures; (ii) periodic surveillances; (iii) normal, abnormal, and emergency operating procedures; (iv) technical specifications; and (v) specific job-related tasks. The length of time of each phase is dependent upon the needs of the specific group of trainees, whose backgrounds are evaluated prior to program commencement. Two phases are utilized to provide the students with an intermixed classroom and OJT program. Prior to commencement of the training program, the schedule is reviewed with Operations management to provide concurrence that the training needs of each specific group of trainees is met.

In phase two of the replacement reactor operator program, three weeks of simulator training are provided for each candidate at a B&W plant simulator in Lynchburg, Virginia. The training is contracted through Power Safety, Inc. (PSI). PSI is the new contractor for training services at the B&W plant simulator in Lynchburg, Virginia. This training is designed to reinforce classroom and OJT concepts, and to develop the operator's knowledge in integrated plant response. Simulator program content is determined prior to the initiation of the training. PSI has developed a standard three-week control room

operator program which it issues to its customers. Using this classroom and simulator schedule as a base, the Operator Training and Simulator Training sections of the TMI Training Department develop a more site-specific program. The Supervisor, Simulator Instruction and Supervisor, Licensed Operator Training provide input to PSI regarding topic selection, planned evolutions and drills, and instructors.

Training conducted at PSI utilizes TMI-1 plant procedures. When candidates are sent to the simulator for training, a senior reactor operator is normally assigned to accompany them. This SRO is tasked with providing TMI-specific input into the Lynchburg classroom and simulator training. In addition, he evaluates the operators and instructors on their performance. Any deficiencies in operator or instructor performance are discussed with PSI and TMI Operations and Training management. In addition, an operational exam is administered by the Manager, Plant Operations or his designee at the completion of the three week simulator program. Drill scenarios are developed by the Manager, Plant Operations and provided to PSI at the time of each exam. The objective of the operational evaluation is to test the candidates ability to safely operate the plant through an assessment of the candidates knowledge of procedural requirements, systems, system response, plant operations fundamentals and integrated plant response. If a candidate fails the operational exam, the Manager, Plant Operations and Operator Training Manager review the candidate's training and performance record and determine required corrective action.

Successful completion of the replacement RO program requires that the candidate

a) satisfactorily complete written examinations with a grade of 80% or better;

b) satisfactorily complete OJT checkouts, including "Final Verification" checkouts;

c) pass simulator startup certification and an operational evaluation conducted by the Manager, Plant Operations or his designee; and

d) pass a final comprehensive written and oral examination. For the written examinatio. a grade of 80% overall and 70% on each section is required. A grade of "pass" must be achieved on the oral examination.

During classroom training, the status of the operator is continuously evaluated through weekly written topical tests, on which a passing grade of 80% is required. Reexams are given within two weeks for all failures. Failure of a second written test requires the Manager, Plant Operations, and the Operator Training Manager to evaluate the student's performance and decide on the corrective action to be taken.

Checkouts given during the OJT phase must be completed using established guidelines. Each candidate must complete all assigned tasks and receive oral checkouts by two levels of Operations personnel. The first checkout received is on each task identified on the OJT task sheets. The second checkout, or Final Verification, is conducted by a senior reactor operator and encompasses several related OJT tasks. If a candidate fails to complete the second level checkout, or Final Verification, the candidate's supervisor will review his performance

and recommend corrective action for reexam. If an individual fails the reexam the Manager, Plant Operations and the Operator Training Manager review the candidate's overall progress and performance and determine the corrective action to be taken.

A comprehensive oral exam is administered at the completion of the program. The exam consists of an oral board on plant fundamentals and a plant walk-through. Personnel from Operations and Training are assigned to the oral board. A licensed or certified senior reactor operator is assigned to conduct the plant walk-through.

A comprehensive written examination is administered at the completion of the program. The minimum passing grade for the examination is 80% overall and 70% in each category. If a candidate fails the comprehensive written examination, the Manager, Plant Operations, and Operator Training Manager review the candidate's training and performance record and determine required corrective action.

Upon completion of the assigned training program, each candidate must be certified by the Director TMI-1 prior to participation in an NRC reactor operator license exam.

B. Senior Reactor Operator Replacement Program

The TMI-1 Manager, Plant Operations, TMI-1 shift supervisors and shift foremen and specified TMI-1 instructors participate in the senior reactor operator replacement program. The replacement program accommodates candidates promoted from the

reactor operator position, as well as individuals directly seeking an SRO license without having been previously licensed as TMI-1 reactor operators. (A majority of the candidates for the direct SRO program are Shift Technical Advisors and degreed training staff. This program also accommodates engineers involved in plant support.) The SRO replacement programs are normally six months in length.

Each candidate for the senior reactor operator program must satisfy the following qualification requirements:

* 1. Have a high school diploma or equivalency;

* 2. Meet (or will meet prior to SRO license application) current Regulatory Guide 1.8 requirements for the minimum number of semester hours of college level education in designated technical subjects;

3. Meet the following experience requirements:

* a. Have four years of responsible power plant experience. Responsible power plant experience should be that obtained as a control room operator (fossil or nuclear) or as a power plant staff engineer involved in the day to day activities of the facility. A maximum of two years power plant experience may be fulfilled by academic or related technical training, on a one-for-one time basis. Two years shall be nuclear power plant experience.

* b. Three months of performing the duties of the senior reactor operator while under instruction as an extra person in the control room; and

c. Have at least one year of experience as a licensed operator at TMI-1;

d. Have at least an RO license or equivalent military experience at some other plant and at least six months at TMI-1, followed by a mock examination to

determine capability of completing a TMI-1 SRO replacement program prior to entering the program; or

* e. Possess a degree in engineering or applicable sciences.

* 4. Satisfactorily meet the minimum medical requirements for licensed personnel as specified in 10 C.F.R. Part 55.

The prerequisites prefaced with an asterisk are for the direct SRO Program. The Manager, Plant Operations designates candidates for the SRO program, using the prerequisites outlined above as a minimum.

The program content for both the replacement and the direct SRO programs is designed to provide classroom, simulator, and on-the-job training in the following areas:

1. supervisory course in decision analysis/supervisory development;
2. supervisory control room and plant operating experience, directed by specific task assignments and licensed senior operators;
3. reactor theory;
4. plant design and operational characteristics;
5. plant control systems;
6. radiation control and safety;
7. plant transients; and
8. recognizing and mitigating core damage.

Classroom training is conducted in order to emphasize the SRO's role in plant control. Specific schedules are developed for each replacement class dependent on candidate experience. The Operations and Training Departments confer on training

schedules prior to issuance to ensure training needs for each class are met.

As part of the classroom training, a three-day training session on Decision Analysis is given to all SROs. Decision Analysis trains individuals (a) to handle complex situations for which written procedures do not exist; (b) to develop a technique to cope with uncertainty, stress, and conflicting information and to make decisions in the face of such circumstances; and, (c) to make "good" decisions, i.e., to consider fully and understand the significance of alternatives, and to factor in the most important considerations. Decision Analysis training develops in control room supervisory personnel the tools and sensitivity to make the right decisions under highly adverse circumstances, and to do so in a systematic and thoughtful manner. In addition, each candidate attends six sessions of the Zenger-Miller Supervisory Course. These sessions include instruction on giving recognition to employees, communicating effectively, listening, employee performance and delegation.

The OJT program for SRO candidates consists of day-to-day tasks which involve participation by the SRO candidate in shift foreman-related activities designed to reinforce classroom study and maximize new learning experiences. The OJT program consists of tasks related to 1) secondary systems; 2) primary systems; 3) administrative procedures; 4) normal, abnormal and emergency operating procedures; 5) technical specifications;

and 6) shift foreman duties. The selection of OJT tasks for the direct SRO program is completed using input from the Operations and Training staffs. The program combines the OJT from the replacement RO and SRO programs, as well as selected tasks from and checkouts on systems listed in the AO program. Each candidate is examined on these tasks. Final verification checkouts are conducted by shift supervisors on groups of related tasks. This verification serves as a second check.

Simulator training for each SRO candidate is conducted by PSI at Lynchburg, Virginia. The program content for the simulator training is determined prior to training being conducted by PSI. PSI has developed a standard two-week SRO program. As with the replacement RO program, the GPUN Operations and Training staffs use this program as a foundation for the development of a TMI-1 specific program. The Supervisor, Simulator Instruction and Supervisor, Licensed Operator Training provide input to PSI regarding topic selection, planned evolutions and drills, and instructors. A section of the OJT qualification card is designated to be completed at the simulator.

Trainees in the direct SRO Replacement Program receive additional simulator training beyond the two weeks normally conducted for replacement SRO candidates. The goal of this additional training is to provide training on control panel operation, expose the candidate to an increased number of normal and abnormal plant operations, and complete a startup certification.

As in the RO program, a licensed senior reactor operator is normally assigned to accompany the SRO candidates to Lynchburg. This SRO is tasked with providing TMI-1 specific input into the simulator and classroom training conducted for the replacement class. In addition, he evaluates the operators and instructors on their performance during the program. Any deficiencies in operator or instructor performance are discussed with PSI and TMI Operations and Training management.

At the completion of the program, an operational evaluation is conducted by the Manager, Plant Operations or his designee. Successful completion of the SRO training program requires that each candidate

1) pass all quizzes given during the classroom phase with a grade of 80% or higher;

2) complete the OJT portion of the programs, including initial checkouts and Final Verification checkouts;

3) complete a comprehensive written and oral examination with a minimum 70% in each section and 80% overall;

4) pass a simulator evaluation administered by the Manager, Plant Operations or his designee; and

5) pass a Startup Certification Exam (direct SRO).

As outlined in the RO program discussion, weekly quizzes, OJT checkouts and comprehensive examinations are conducted, and results of examinations and quizzes are utilized to evaluate the competency of the candidate.

Upon satisfactory completion of the assigned replacement SRO program, the candidate must be certified by the Director, TMI-1 prior to participation in an NRC exam.

C. Licensed Operator Requalification

Upon licensing by the NRC, each operator is assigned to participate in an ongoing requalification program. The goal of the licensed operator requalification program is to enhance nuclear plant reliability and safety by maintaining a high level of skill and knowledge in licensed reactor operators and senior reactor operators. The requalification program is implemented utilizing the following interrelated segments:

1) Pre-Planned Lecture Series;

2) Skills Training and Evaluation;

3) Operational Review Program; and

4) Annual Examination and Evaluation.

The operator requalification program is conducted on a cyclic basis so that all program requirements are completed in a period not to exceed two years.

1. Lectures

The Pre-Planned Lecture Series consists of two types of lecture programs, the Fundamentals Review Lectures and the Operational Proficiency Lectures. The Fundamentals Review training sessions cover areas in which the knowledge required of a licensed individual is relatively constant. The topics presented in the Fundamentals Review series reflect the results of the annual examinations and the performance of the licensed personnel as evaluated by the Manager, Plant Operations and the Operations and Maintenance Director, TMI-1. The depth of

coverage in each topic addresses deficiencies identified by the annual examinations, as well as those identified by the Operations Training Coordinator.

The lecture topics are selected on an as-needed basis from the following list:

1) Theory and Principles of Reactor Operation;

2) Theory and Fundamentals of Heat Transfer, Fluid Flow and Thermodynamics;

3) Features of Facility Design including Plant Systems;

4) Nuclear Plant Operating Characteristics Including Operating Experience;

5) Plant Instrumentation and Control Systems;

6) Plant Protection Systems;

7) Engineered Safety Systems;

8) Radiation Control and Safety and Plant Chemistry;

9) Applicable Portions of Title 10, Chapter I, Code of Federal Regulations; and

10) Fuel Handling.

The Operational Proficiency lecture topics are selected to ensure coverage of essential plant operational guidelines and to ensure operational changes and experiences are integrated into the licensed individuals' training. The lecture topics are selected from the following list:

1) Normal, Abnormal and Emergency Operating Procedures and changes thereto;

2) Administrative Procedures, Conditions and Limitations and Technical Specifications and changes thereto;

3) Major Operational Evolutions;

4) Facility Design and License Changes;

5) Operating History and Problems;

6) Related Nuclear Industry Operating Experience; and

7) Mitigation of Accidents Involving a Degraded Core.

The depth of coverage in each topic reflects the knowledge required of the licensed SRO, as does the material for the fundamental review training.

The Pre-planned Lecture Series is scheduled on an annual basis. The lecture series is held on a continuing basis with a weekly schedule of lectures designed to be repeated for each shift when that shift is designated for its training week. It typically involves up to 240 contact hours of instruction divided among the program topics which are appropriately scheduled throughout the year.

All licensed operators are required to attend the Pre-planned Lecture Series. Absences are approved in advance by the Manager, Plant Operations or the Operations and Maintenance Director, Unit 1, and are normally limited to one training week per year. Additional absences, unless approved by the Manager, Plant Operations, result in individual's removal from licensed duties and placement in an accelerated requalification program until such time as the missed material is made up.

For each training session on the lecture series, a lesson plan is prepared, reviewed and approved in accordance with Training Department procedures. For other subject-areas, permanent instructors are qualified in accordance with Training

Department procedures. An exception to these requirements is made for guest lecturers who are experts in a particular subject-area. Thc scheduling and appearance of guest lecturers must be approved by the Operator Training Manager or Manager, Plant Training.

2. Skills Training

The Skills Training and Evaluation segment of requalification is conducted so that each licensed operator participates in frequent and varied plant evolutions in order to maintain an acceptable level of skills and familiarity associated with the nuclear plant systems, controls, and operational procedures. Each licensed individual must demonstrate operational proficiency by participating in reactivity manipulations and plant evolutions, nuclear plant simulator exercises, and Basic Principles Training Simulator exercises, and the plant drill program. To maintain these skills, licensed operators must actually manipulate plant or simulator controls, while licensed senior reactor operators may either manipulate or actively supervise manipulation of controls. Reactivity manipulations, plant evolutions, and exercises which are considered in the simulator training program include normal plant evolutions, abnormal/emergency plant evolutions, verification of plant operating procedure adequacy, and demonstration of plant response to conditions identified from nuclear industry operating experiences.

In order to provide proficiency training for normal plant evolutions, each individual participates in the plant evolutions identified in Attachment 4 on an annual basis. Individual performance during these plant evolutions is monitored and deficiencies corrected so that satisfactory proficiency is demonstrated. To provide proficiency training in abnormal/emergency plant evolutions, each individual, on an annual basis, participates in training exercises covering the plant abnormal/emergency conditions identified in Attachment 5. These evolutions are conducted either at the simulator or during the plant drill program. On a two-year cyclic basis, each licensed individual participates in training exercises covering the additional plant abnormal/emergency conditions specified in Attachment 6.

Response to abnormal/emergency conditions should include use of alternate methods of accomplishing a given function, such as alternate methods of core cooling. Exercises involving multiple failures and/or operator error are included in the training program. Utilization of applicable plant procedures and technical specifications during the training exercises is emphasized. Individual and operational team performance during the abnormal/emergency training exercises is monitored and deficiencies corrected so that satisfactory proficiency is demonstrated.

Each licensed individual completes nuclear plant simulator training sessions involving a minimum of twenty hours of direct

interaction with the simulator nuclear plant control panel on an annual basis.

Since 1982, lectures at PSI have contained TMI-specific information, e.g., TMI heatup and cooldown curves, fuel mechanical performance, fuel in compression curves, core power peaking, integrated control system failures/operation, emergency feedwater effectiveness, RCP operations guidelines, ATOG, and OTSG tube rupture. The content of these lectures is directly under the control of the Operator Training section, which is a significant improvement to the pre-1982 lectures which were provided by PSI as generic topics. Specifically, the majority of lesson plans have been developed by the TMI Operator Training section.

In developing the simulator training program the Operations Department works with the Training Department to establish a list of topics for classroom training as well as an outline for simulator drills. The Operator Training section is assigned to develop lesson plans and objectives for the classroom program and the Simulator Development Section develops drill sequences and drill guides. The two training sections work together to ensure the classroom and simulator sessions provide continuity within the training program. The simulator training program is approved by Operations and Training and sent to PSI for review prior to its commencement. During the 1983 training cycle, simulator training for licensed operators was expanded to include an additional week of ATOG training and

three days for steam generator tube ruptures training. During the 1984 cycle there have been three additional days of operator proficiency training.

Prior to the start of each training cycle, a group of instructors from the Operator Training Section and nonshift licensed operators from Operations participate in a prototype simulator training program. This serves as an evaluation device and allows for program modification prior to the on shift licensed operators participating in the simulator training.

Plant drills are conducted in order that each licensed individual actively participates in drills covering abnormal/emergency plant evolutions which are not adequately covered in the nuclear plant simulator training program. Plant drills are structured to review or carry out actions required to respond to abnormal/emergency plant conditions.

Plant drills are conducted with the approval of the Manger, Plant Operations, on an individual or team basis and usually involve:

1) Reviewing plant procedure steps;

2) Identifying actions required to establish stable plant conditions;

3) Identifying equipment control locations and functions;

4) Identifying expected plant instrumentation and alarm response;

5) Reviewing communications necessary to gather information or coordinate team actions; and

6) Identifying supplementary actions aimed at mitigating results or causes of plant abnormal/emergency conditions.

In addition to meeting the requirements for skills training participation noted above, off-shift licensed personnel assigned to the Operations Department actively participate in control room operation a minimum of one shift per month. Licensed instructors from the Training Department staff and other on-site licensed personnel actively participate in control room operation a minimum of two shifts per month. During this period, these licensed personnel must assume (actual or under instruction) and perform the duties of the on-shift licensed operator. Failure to meet this requirement on a quarterly basis results in placement in an upgrade program.

3. Operational Review

The Operational Review Program provides a system for on-shift review of selected operational experiences and changes to existing operating guidance or equipment. The program enables continuing updating of on-shift personnel, and establishes a means of disseminating new or changing information on a rapid basis.

A continuing system exists to ensure that licensed individuals review documented plant design changes, equipment modifications, procedure changes and technical specification changes. Selected changes and modifications are analyzed and information pertinent to the basis for the changes and their operational implications is collected and formally transmitted to all licensed individuals with acknowledgement of review

required. Changes to emergency procedures and technical specifications require review by licensed operators.

Training is conducted to incorporate operating experience review from TMI-1 and the industry. Selected operational events and reportable occurrences at the facility are analyzed and information pertinent to the event collected. Selected operational information from the nuclear industry is analyzed using Licensee Event Reports, audit, evaluation, and inspection reports, publications and periodicals covering nuclear industry information, and NSAC/INPO Significant Event Reports. Technical Functions personnel assigned to assess plant operating experience and the Training Department specify operating experience to be analyzed for training purposes. Selected nuclear plant accidents/transients from industry operating experience are analyzed and, where applicable, integrated into the simulator exercises, the plant drill program or classroom training. Additionally, information can also be formally transmitted to all licensed individuals with required acknowledgement of review.

4. Annual Examinations

In order to determine each licensed individual's knowledge of topics covered in the requalification program and provide a basis for determining areas in which retraining is needed, an annual examination is given to all licensed individuals prior to the completion of each annual requalification program cycle. It consists of an oral examination and a written examination.

The written examination contains questions covering the topics addressed in the Fundamentals Review Lecture Series and the Operational Proficiency Lecture Series. The examination is structured so that the level of questioning is consistent with the individual's license level (RO or SRO). Each licensed individual receiving a grade of less than 70% in any examination category or an overall grade of less than 80% is relieved of his license duties and placed in an accelerated requalification program. Under special circumstances where a grade of less than 70% has been scored in a single section with the overall average greater than 80%, the Director, TMI-1 may document the special circumstances and authorize an oral and written reexamination of the failed section within one week. If the oral exam is completed satisfactorily and a grade of 70% or greater is scored on the written section, the individual may return to shift in a licensed status with the approval of the Director, TMI-1.

An oral examination is also administered to licensed individuals. The oral examination should contain questions covering many of the following areas:

1) licensed duties and responsibilities of the operating position corresponding to the individual's license level;

2) actions in the event of abnormal conditions;

3) actions in the event of emergency conditions;

4) interpretation of instrumentation responses;

5) plant transient and accident response;

6) plant modifications;

7) procedure changes;

8) technical specifications;

9) emergency plan;

10) plant operating history and problems; and

11) related nuclear industry operating experiences.

Oral examinations are conducted by a licensed senior reactor operator or personnel who have successfully completed education and training programs required for an SRO license. Each oral examination is structured so that the oral examination is at least two hours long; normally, it is considerably longer.

The oral examination involves sessions conducted in the plant control room and in plant areas normally entered by individuals whose actions are directed by the licensed operator. A failing overall oral examination grade requires the licensed individual to be removed from his license duties and be placed in an accelerated requalification program. The content of an accelerated requalification or special retraining program is specifically structured to upgrade knowledge and skills identified as deficient.

D. Staffing

To provide the training defined in the licensed operator training program description the licensed operator training staff has continued to expand. In 1981 the GPUN licensed operator training staff for TMI-1 consisted of one supervisor and two instructors, who were SRO-licensed. There also were two

contractors assigned. None held degrees. Present staffing to conduct licensed operator training includes two parts of the TMI training organization, the licensed Operator Training and Simulator Development sections.

Manpower in the Operator Training section devoted to TMI-1 licensed operator training consists of one manager, one administrative assistant, two staff positions, both with responsibilities as instructors, one supervisor, and three instructors (one who is assigned as Supervisor Non-Licensed Operator Training). Of the six personnel designated to conduct licensed operator training, four have been licensed or certified as senior reactor operators. The cumulative nuclear power plant experience of the staff is forty-eight years, of which twenty-five years are commercial. The cumulative instructor experience for the Operator training staff is twenty-nine years, of which twenty-two years are in the nuclear field. Five of the staff hold bachelor's degrees; one holds a master's degree as well.

In addition to the GPU Nuclear personnel discussed above, two contractors will supplement the Operator Training staff through mid-1985. These contractors previously were licensed as senior reactor operators at TMI-1. One served as a shift foreman and the other as a shift supervisor. They have forty years of nuclear power plant experience, of which twenty-six are commercial. They have eleven years instructor experience in the nuclear field.

The Simulator Development section staff consists of one manager, one supervisor and three instructors. The supervisor is senior licensed, has fifteen years of commercial nuclear power plant experience and seven years experience as an instructor. The three instructors assigned to this section are presently in a senior reactor operator training program in preparation for qualification as simulator instructors. All three have bachelor's degrees and have eighteen years combined nuclear power plant experience, of which twelve is commercial. In addition to the staffing described previously, two licensed reactor operators are assigned from the Operations Department to assist in development of the BPTS and replica simulator programs.

The position of Administrative Assistant in the Operator Training Section was created in 1982 as a result of the administrative workload related to operator training. Previously, administration of routine records was completed by the Supervisor Licensed Operator Training. This included tracking attendance, documentation of examinations and maintaining records required for certification by the Director, TMI-1. The assignment of these tasks to the Administrative Assistant has enabled the Supervisor and Manager to devote more time to non-administrative tasks.

An additional position was also created in response to identified needs within the training department. The staff position of Technical Programs Specialist assists the Operator

Training Manager in ongoing review, evaluation, and revision of licensed operator programs. This position also is assigned to instruct operators in theoretical conceptual areas such as reactor theory, heat transfer, fluid flow and thermodynamics. The addition of this position has provided training with additional instructor availability and has reduced the workload of the Operator Training Manager and Supervisor, Licensed Operator Training in order that they may devote more time to program development and delivery.

Since 1981, GPU Nuclear has been committed to increasing the licensed operator training staff in order to improve the training programs. The present operational and instructor experience in the TMI-1 training department adequately supports the training programs in place.

E. Training Processes

The training programs for licensed operators, both replacement and requalification, incorporate many processes that provide assurance that the operator has the tools to safely operate the plant. The processes addressed in this testimony, which reflect substantive changes since 1981, are: (i) training program development, (ii) training delivery; (iii) examination administration, and (iv) program evaluation and feedback.

1. Program Development

The Training System Development (TSD) model has been implemented at GPUN. TSD describes the construction, implementation and maintenance of GPU Nuclear's training programs. (The NRC calls this process Systematic Approach to Training, or SAT.) The experienced instructors in the Department have been introduced to the TSD system through a dedicated training session. The new instructors are indoctrinated as part of the initial instructor development course.

The TMI Training Department has used a systematic approach to training, albeit informal, since mid-to-late 1980 when the concept was introduced in the first two instructor development courses. Primary emphasis has been on developing behavioral learning objectives to match job needs and on being responsive to meaningful feedback from trainees and user group supervisory/management personnel. Formal development and acceptance of the GPUN-TSD model in the fall of 1983 has upgraded the level of formality in the use of the systematic approach.

The development of licensed operator programs at TMI has followed the then-current version of the Training Department development process. The licensed operator programs were initially developed and reviewed by the Operator Training Section. They were then sent up the Training and Operations chain of command from the Manager, Plant Training, and the Manager, Plant Operations, to the Vice Presidents of Nuclear Assurance and TMI-1. Following their review and comments, the Operator

Training section revised the initial draft to incorporate comments and then sent the programs along with the comments of all reviewers, to the Manager, Plant Training, and the Manager, Plant Operations, for final approvals. By having subject-matter experts comment on the content of the program, an informal task validation was completed.

A validation of the established reactor operator replacement program was conducted in 1981. The generic RO/SRO job task analysis published as an appendix to NUREG/CR-1750, Analysis, Conclusions and Recommendations Concerning Operator Licensing was used as a comparison against the recently issued TMI-1 program. The program showed a close correlation with the generic industry job task analysis. As the other programs were completed, they, as well as the replacement operator program, were compared to the guidelines published by INPO.

In support of the implementation of the TSD model a job analysis has been completed for reactor operators and senior reactor operators. The INPO B&W generic job analysis was used to conduct a survey resulting in a TMI-1 specific job analysis. This analysis has provided a starting point for ongoing activities to further improve the training programs and solidify performance based training.

Activities completed thus far in support of TSD implementation are:

1. System operating procedures and surveillances have been reviewed to determine if the surveys missed any tasks.

2. The task lists have been revised to reword the tasks in such a manner that they can be incorporated into OJT and simulator training programs.

Prior to incorporation into the respective programs additional progress is needed in the areas listed below:

1. The completed task list will be reviewed to eliminate repetition and to standardize, as much as possible, the scope of tasks on the list.

2. The task lists will then be reviewed by Operations and Training to determine which are appropriate for inclusion in the training programs and the appropriate method of training, i.e., classroom, OJT or simulator. The efforts along these lines discussed in the preceeding paragraph will be incorporated.

3. For the finalized task lists, determinations of what constitutes satisfactory performance will be made. Reviews will also be conducted to ensure that the knowledge necessary to support task performance is included in classroom training and is supported by the Operations Plant Manual, including the learning objectives. The comparisons already conducted indicate fairly close uniformity between the classroom training and the task lists.

Results of this job task analysis will be incorporated into revisions for the respective programs prior to their next scheduled convening dates.

Each of the training program descriptions described above requires approval by the Manager, Plant Training and Manager, Plant Operations. The approval from the user group and service organizations ensures the training program description addresses the training needs as well as reflects the educational aspects of operator training. Approval by the Manager, Plant Operations, a licensed SRO, provides for a validation of each program by ensuring the program descriptions address the areas

of training necessary for the operators to perform their job. Any changes in training program descriptions require approval by both the Manager, Plant Training and Manager, Plant Operations. This ensures changes are not made without mutual approvals.

Weekly quizzes for replacements and requalification programs are normally reviewed by the Supervisor, Licensed Operator Training and are required to be approved by the Operator Training Manager. This provides for consistency between examinations, technical corrections, and concurrence with the established training program.

Comprehensive examinations are submitted for approval by the Operator Training Manager and Manager, Plant Operations. This concurrent approval provides for review of each exam to ensure that areas of operational significance are addressed correctly in the examination. The review of each exam normally involves a licensed or certified SRO. This review and approval by subject matter experts provide for technical validation of the examination and thus produce a more valid exam.

In addition to having each generic program description responsive to feedback from various sources, the program content, each time it is implemented, also reflects individual needs that have been identified through the operators, training and other management personnel. As noted above, this table-top validation process, although informal, should ensure that the content of the programs reflect the training required to develop the knowledge and skills of each operator.

In addition to the regular training program content, there are circumstances which call for implementation of special training programs. For example, major changes in plant procedures encompassing Once Through Steam Generator Tube (OTSG) Rupture were implemented as a result of the repairs done to the OTSGs at TMI. These procedures reflected conclusions and recommendations contained in technical documents which were issued in conjunction with the repairs and which impacted on the conduct of operations in the event of OTSG Tube Rupture conditions. The significance of these changes and the necessity that each operator be able to safely operate the plant under these conditions dictated that specific training be conducted. A joint effort between Operations, Training and Technical Functions produced a training program which was conducted at the PSI simulator over a three-day period during the summer of 1983. The lesson plans, training objectives and simulator drill guides were developed by GPUN personnel. Each licensed operator received three days of training, including both simulator and classroom. A written and operational test was administered at the end of each training program.

The decision by GPUN to develop procedures based on B&W's Abnormal Transient Operating Guidelines resulted in an additional and substantial effort by the company to incorporate the guidelines into the present procedural structure. Extensive man-hours were expended to revise plant procedures, and a training program was developed to enhance licensed operator

knowledge and skills in support of the procedure change. Since ATOG emphasizes "symptom-oriented" rather than "event-oriented" response, the program was designed to include instruction in this area. The procedural revisions were submitted by a committee consisting of representives from Operations, Technical Functions, and Training. As changes were made, the committee identified topics which would require training. These topics and the revised procedures were used by the training department to develop a training program. A one-week training program for each crew was conducted at PSI in the first quarter of 1984, which consisted of classroom and simulator training. The lesson plans and drill guides for the training program were developed by GPUN personnel and forwarded to PSI for their use. At the completion of each week of training, a written test was administered to each licensed operator and the crews had an operational exam. All of the currently licensed operators satisfactorily completed this special ATOG program.

In addition to development of training programs requiring new knowledge and skills, GPUN has made provisions to address the general area of skill deterioration that can result from a prolonged shutdown. To support training needs in this area, two separate programs were initiated.

A Restart Qualification Card, developed in 1983, is to be utilized during hot functional testing, zero power testing and the power escalation test program. The qualification card contains both individual and crew tasks which are to be

completed. The qualification card is designed to provide each operator with exposure to specific operational situations. Furthermore, the power escalation test program was designed with hold-time periods at 40% and 75% power levels to allow all crews the opportunity to participate in hands-on performance of items identified on the restart qualification card.

Additionally, based on management's observation of crews during the 1984 ATOG simulator training, GPUN considered it beneficial for the crews to receive additional training on routine evolutions associated with operation at power. Another training program was designed to incorporate lessons on startup, power operations, and licensee event reports. The lesson plans and drill guides developed by GPUN for these programs were used during a three-day simulator program in May and June of 1984. Each licensed operator was required to attend. At the end of the training period a written and operational test was administered.

The method for control of the quality of the technical information available to Operations and Training personnel has undergone changes. All lesson plans used by the Operator Training section are required to be reviewed by the Technical Functions Division of GPUN. This review is conducted to ensure that the technical information and scope of material being presented to the operators is correct. The requirement is established in a Technical Functions procedure. Comments on the lesson plans are forwarded to the Operator Training section for

resolution and incorporation into lesson plans where applicable.

A standard reference source document has been created for use by Operations and Training personnel. The Operations Plant Manual (OPM) incorporates technical information such as previous lesson plans, technical manuals, system design descriptions and operating characteristics into a standard document. The OPM was drafted by GPUN personnel and reviewed by designated members of Operations, Training and Technical Functions. The nine volume manual contains one hundred twenty one sections, a few of which are still in the review process, and addresses areas such as primary and secondary systems, support systems and plant fundamentals. Learning objectives, included in each section, have been written for ROs and SROs. The OPM is a controlled document and thus falls under the same administrative requirements as a plant procedure. Periodic reviews are scheduled for each section and an owner is assigned to each section to ensure that it is updated to reflect plant condition. Due to the fact that it is controlled, it serves as a current source of technical information for licensed operators, licensed operator candidates, and training staff.

2. Training Delivery

Training delivery encompasses several different areas. GPU Nuclear has implemented a number of actions to provide the licensed operators with effective training. Actions made which

have impacted on training delivery include: (1) implementation of an instructor development program; (2) implementation of an instructor qualification procedure; (3) implementation of an instructor evaluation procedure; (4) delivery of a full scale control room mockup; and (5) delivery of a Basic Principles Training Simulator.

An instructor development program has been developed and implemented which licensed operator instructors are required to attend. The program includes curriculum development, development of behavioral learning objectives, preparation of lesson outlines and lesson plan formats, utilization of audio visual aids, instructing techniques, preparation of exams, evaluation techniques and counseling techniques. The program requires one week to complete. The instructor development program has been centralized under the control of the Manager, Educational Development.

In addition to providing each instructor with the initial development course each instructor attends continuing training. The Advanced Instructor Development Program provides the instructor with additional skills not presented in the initial course. Advance training has been provided to instructors in examination development, criterion referenced instruction, audio-visual aids, and implementation of the TSD model. Additional offerings are planned primarily on subjects that support the expanded use of the TSD model. Scheduling is determined by the Educational Development Section.

The licensed operator training programs require that each instructor be qualified in accordance with Training Department procedures. Licensed operator instructors are required to complete applicable sections of a qualification card addressing simulator (BPT) and classroom training. The qualification card ensures that each instructor possesses the proper level of technical knowledge prior to being assigned to instruct licensed operations. Instructors for plant fundamentals are required to be licensed operators or have specific educational background and experience. An NRC senior operator license or instructor certification is required to instruct in plant systems and transients, integrated plant response and to function as a simulator instructor.

Included in the instructor qualification card for licensed operator instructors is a list of reading material which each instructor is required to read and discuss with his supervisor. The material includes the control of examination procedures, training program descriptions, 10 C.F.R. Part 55, and several documents describing the TMI cheating incidents. Prior to certifying instructors, the Manager, Plant Training discusses the cheating incidents with them, emphasizing lessons learned, including the responsibilities that each instructor has in ensuring the exam security process is maintained and taken seriously.

A revision to the instructor career development path has resulted in precise specifications for each instructor position

in the Training Department. The mode of progression for instructors now incorporates five separate promotional levels, whereas before there were only two available for licensed operator instructors. The instructor levels are based on experience, education, and accountability. This provides a more structured career path for instructors, has provided a viable career path for Operations personnel and is intended to encourage movement back and forth between Operations and Training.

The classroom performance of each instructor is evaluated on an ongoing basis. An instructor evaluation procedure provides for evaluations of each instructor by upper management and peers. Each instructor is scheduled to be evaluated eight times per year when involved full time in classroom instruction activities. A detailed rating sheet has been developed that permits the evaluation of an instructor on a number of the important factors related to teaching, such as familiarity with technical information, adequate preparation and presentation of materials, establishment of sound learning objectives, selection of appropriate instructional methods, proper use of instructional aids, proper response to questions, classroom management, and instructor characteristics such as voice, diction, enthusiasm, and appearance. The evaluations are reviewed by the instructor, his supervisor, and training management and entered into the instructor's qualification folder. These evaluations are used to upgrade the individual instructor's skills and identify and correct generic deficiencies.

The BPTS and the mock-up are discussed later in this testimony.

3. Exam Administration

The third area of training which has undergone significant change is that of examination administration. A detailed guideline is used in constructing operator training comprehensive examinations at TMI. The guidelines for construction of exams applies to comprehensive examinations conducted at the completion of replacement training programs and annual requalification examinations. The format and content of the examinations are designed to test specific skills and knowledges. The examinations, based upon behavioral objectives related to job and task analyses, are an important element in the performance based training programs. Both informal job and task analyses done by the GPU Nuclear staff and a set constructed by INPO have been used, with a TMI-1 specific format analysis in progress as described earlier. The written examinations are part of GPUN's overall appraisal of a potential operator's competence to function safely in the control room of TMI-1.

Guidelines for examination construction outline responsibilities in exam assembly; exam question coding; exam review and approval; and exam grading. Individuals are designated to fulfill responsibilities as exam writers, exam coordinators and technical reviewers. Each is tasked with

specific responsibilities to ensure that each examination reflects the behavioral learning objectives for the material being examined, contains technically correct information, and meets the specification required for the exam.

A test specification is issued for each comprehensive examination prior to its construction. The specification details the division of point breakdown between topic areas to be addressed in the examination and the breakdown of point values to be addressed in each of the five skill/ability areas for each topic area. The five skill/ability areas which are used to code each question are 1) recall 2) comprehension 3) application of rules and principle 4) analysis and 5) synthesis. The test specification is determined by the Operator Training Manager, with input from the Supervisor Licensed Operator Training. In determining the specification, the objectives used during the training program are utilized. These guidelines ensure that the examinations contain the correct coverage in topic area (e.g., system or fundamental area) and the appropriate skills/abilities.

As discussed by Dr. Coe in his testimony, GPU Nuclear has developed and implemented procedures for the prevention of cheating, and for securing the exam process. The procedures cover all aspects of examination preparation, storage, and administration. The responsibilities of the Director of Training and Education, Managers of Training, Section/Group Supervisors, examiners, and proctors are carefully defined. New instructors

meet with the Director of Training and Education who emphasizes, among other things, the importance of preventing cheating. At TMI the VP/Director of TMI-1 personally interviews all operators, stressing the importance of knowledge honestly gained. All new trainees are apprised of the importance of honesty in the program. In addition, supervisors check on the administration of examinations on a random basis.

A supplemental exam procedure in use at TMI improves the accuracy of examination grading and detects suspicious parallelisms that may exist in examination responses. The procedure applies to comprehensive (mock NRC-style) examinations used as course completion examinations for replacement RO and SRO training programs and annual requalification examinations. It includes the following provisions:

1. Each examination is separated into individual sections.
2. The grader is assigned by the Supervisor, Licensed Operator Training to grade an entire section taken by all the examinees from that particular examination. A grader is never assigned to grade his or her own examination.
3. The responses to each question from all examinees are graded before grading the next question. (E.g., all responses from question A.1 shall be graded before any responses to question A.2 are graded.)

4. Once the question has been graded for all examinees, the grader randomly shuffles the order in which he grades individual examinee's responses.

5. A grader may be assigned to grade more than one section of the examination or identical sections of other examinations administered for the same purpose (e.g., annual requalification examinations administered on different days).

6. A matrix is prepared listing the students who took the examination and the graded value of their response to each question.

7. Any change of grades by the grader shall be indicated by lining out the changed grade, dating and initialing the lineout, and listing the revised grade.

8. Objective questions, i.e., true/false, multiple choice, and matching need not be graded as in 3 and 4 above. However, tests or portions thereof, which are completely objective in nature, shall be scrutinized by the grader to detect similar patterns in wrong answers.

9. All graders must continually be aware that their efforts and attentiveness are the primary means of detection and examination improprieties. Regardless of the nature or type of examination, graders must be alert for appearance of copying or collusion while grading, and should review the examinations for

patterns of wrong and right answers or similar responses. The matrix mentioned in 6 above may be helpful in this regards.

There is a similar but somewhat less stringent procedure applicable to grading exams not covered by the procedure described above.

After exams have been graded, an additional measure is taken to ensure that the examination has not been compromised. Comprehensive examinations, as described previously, are reviewed by either the Supervisor, Licensed Operator Training, or the Operator Training Manager, or his written designee. This review consists of the reviewer selecting one half of the questions from one-half of the students. The matrix prepared above (6) is reviewed for suspicious parallelisms.

With respect to exam construction, questions for examinations and quizzes are developed using behavioral learning objectives. The questions addressed during an exam reflect the objectives for which each trainee is held accountable. The behavioral learning objectives for each specific lesson are developed by subject matter experts when determining the material to be taught during each lesson. The subject matter expert, in this case the instructor, conducts an informal job analysis to determine which knowledge and/or skills are required of the operator in the subject area being taught. Additionally, the objectives for requalification training are approved by the Manager, Plant Operations, while those for initial programs are

derived from those in the Operations Plant Manual which has been reviewed by Operations, Training, and Technical Functions. From this the instructor formulates training objectives upon which the lesson plan and examination questions can be developed, if not already done. Approval of the examination includes a review to ensure that the questions reflect objectives presented for the lesson. Review by the Manager, Plant Operations, of the annual requalification examination and comprehensive examinations provides an additional validation process for these examinations.

Oral examinations are conducted as part of the replacement and requalification programs, as addressed previously. Replacement training programs also require Final Verification Oral examinations be conducted at the completion of sections of the OJT program. These examinations encompass the tasks addressed in the section and are conducted by a shift foreman or shift supervisor. The OJT programs outline the knowledge level required for each of the tasks. The examiner uses the outlines to establish the content of the examination. Each examiner, a licensed senior operator, evaluates the candidate's responses and determines an overall grade.

The oral examinations given as part of the licensed operator requalification program are comprehensive, with areas to be addressed determined ahead of time. The Operations and Training Departments jointly establish a list of topics to be addressed during the examination and issue it to assigned

examiners. Licensed or certified SRO's conduct the oral examinations. The results are forwarded to the Supervisor, Licensed Operator Training for review. The examinations are reviewed for generic deficiencies to identify areas which may require training during the following requalification cycle.

4. Program Evaluation and Feedback

The last area to be addressed is that of program evaluation and feedback. Improvements in the areas of training program development, training delivery and examination administration have provided GPUN with quality training programs for licensed operators. The implementation of licensed operator training programs must be sufficiently flexible to incorporate changes prompted by program evaluations and feedback.

In the licensed operator training programs the mechanisms established to provide training and operations management with an evaluation of the effectiveness of the training programs are invaluable. These mechanisms include examinations, periodic internal evaluation, external evaluations and feedback from operations personnel.

a. Examinations

A method by which GPUN evaluates its licensed operator programs is by evaluating the performance of its licensed operators during replacement and requalification programs using operational, oral, and written examinations. Simulator operational examinations are utilized by GPUN to assess the

performance of individuals and groups receiving training. The B&W plant simulator at PSI has been utilized to conduct company administered operational examinations in both replacement and requalification programs. When the NRC announced that it would no longer conduct simulator exams for utilities that did not have replica simulators, GPU Nuclear considered the practice beneficial as a means of evaluating the effectiveness of the program and candidates' qualifications and, accordingly, continued the practice on its own. (The NRC ultimately decided to continue administering simulator exams for TMI-1.)

The examinations conducted by both GPUN and the NRC are evaluated to identify both individual and generic weakness. These are used as input into future changes of program content and/or description.

The results of oral and written examinations are also evaluated to identify weaknesses that may exist in the training program or in individuals. Oral exam summary sheets and written comprehensive exam result matrices are reviewed by the Supervisor, Licensed Operator Training in order to determine if additional training is required or changes are needed in program content. Commonly missed questions can be easily identified and corrective action can be initiated where required.

This aspect of program evaluation by determining if the trainees have been able to master the program's training objectives through application to plant operations provides a valuable analysis of whether the programs are meeting their objectives.

b. Internal Evaluation

Periodic internal evaluations provide an additional means by which programs can be validated. Each of the licensed operator programs requires that an annual audit be conducted. The team conducting the audit is made up of operation and training personnel. The team assesses the adequacy of the program for meeting new requirements, adequacy of records, quality of material and presentations and program effectiveness. In conducting the review, the team may incorporate input from NRC Inspectors, Quality Assurance Audits, Regulatory changes, Industry Experience, license candidate critiques and other audits conducted during the year. The team reports its results to the Manager, Plant Training and Manager, Plant Operations. During 1983 a review of Operator Training Programs was conducted by the Operator Training Review Team. The membership of this team included the Manager, Plant Operations, Operator Training Manager, Training Coordinator, Supervisor, Licensed Operator Training, a Shift Foreman, one instructor, and one licensed CRO. The review team conducted an in depth audit of the CRO and SRO Replacement programs and the licensed operator requalification programs. Individual team members solicited input from both the Operations and Training departments in the following areas:

(1) informal job analysis of each licensed position to ensure training program content adequately prepares candidate through OJT, classroom and simulator training;

(2) method of training delivery;

(3) operations/training communications;

(4) technical content of the programs; and

(5) administration of training programs.

Some of the changes in licensed operator training programs that were effected by the Operator Training Review Team Final Report are:

(1) licensed operator replacement programs are scheduled based on a five-year plan developed by TMI-1 Operations. Class start dates are published for a five-year period. Variations are communicated to training several months in advance;

(2) number of qualified licensed operator instructors has increased;

(3) a revision of the CRO OJT program has been made to include guidance on performance levels for tasks.

(4) the reactor operator replacement program was revised to include additional tasks for direct hires;

(5) reactor operator and senior reactor operator replacement OJT programs were reviewed to reflect recent procedural changes;

(6) additional tasks were added to the senior reactor operator OJT program; and

(7) the control room mockup was delivered and is being used for classroom instruction and study.

In May 1984 the training department conducted a self evaluation of its licensed operator programs. This evaluation was completed in accordance with criteria established in an Institute of Nuclear Power Operations document. Information gained from this self evaluation will provide input into decisions on changes in program content, process and records.

c. External Evaluation

The TMI-1 licensed operator program has been evaluated by persons or organizations outside its structure. These evaluations were completed both in response to requests by GPUN and as a result of GPUN's membership in INPO. These evaluations include those conducted by Data Design Laboratories (DDL), the Operator Accelerated Retraining Program (OARP) Committee, Admiral Hyman G. Rickover, and the Reconstituted OARP Committee.

In September, 1982 DDL issued a report titled "Assessment of Selected TMI-1 Training Programs." GPUN contracted with DDL in June 1982 to conduct an independent assessment of selected TMI-1 training programs, including operator training programs. The scope of the evaluation included (1) a review of the technical content of the licensed operator training programs and a comparison with INPO guidelines, (2) the administration and delivery of the training programs, and (3) an assessment of the results of the training program. The intent of the DDL report was "to provide informed, broadly experienced recommendations and guidance for the further enhancement of efforts which have

been well started by GPU Nuclear." In response to the DDL recommendations, GPU Nuclear established an action item tracking system with tracking responsibility at corporate offices. An individual was assigned to respond to each finding and take appropriate corrective action. The status of the action items is updated on a regular basis.

In 1982 and 1983 INPO conducted evaluations of TMI-1 site activities to make an overall determination of plant safety, to evaluate management systems and controls, and to identify areas needing improvement. As a part of these evaluations INPO examined licensed operator training. Recommendations for improvement were entered into an action item tracking system and individuals were assigned to respond to each and initiate required corrective action. The items are updated on a periodic basis. Although recommendations were made regarding improvements in the programs, the 1983 evaluation reported the following

(1) TMI-1 "is being effectively maintained by qualified personnel;"

(2) "There is a well defined program focused on operational planning and preparation for startup, including the startup qualification program;" and

(3) "Station personnel are well qualified. Their morale, positive attitude, and motivation reflect commitment to improved performance."

In anticipation of operation of TMI-1 in 1983 an assessment of the management at TMI-1 and its qualifications to

operate nuclear power plants was conducted by a team led by Admiral Hyman G. Rickover. Admiral Rickover's final report, titled "An Assessment of the GPU Nuclear Corporation, Organization, and Senior Management and Its Competence to Operate TMI-1" was issued on November 19, 1983. The report encompassed the area of licensed operator training. As with previous external reports, findings were tracked at the corporate level. The following findings relating to operator training were documented in the report:

(1) "present training exceeds regulatory requirements in breadth, depth and diversity of personnel training;" and

(2) management involvement in training is "refreshing."

On April 19, 1984, a followup report was issued by Admiral Rickover which centered on actions which had been taken by the GPUN management in implementing recommendations from the previous assessment. The conclusion, as stated in the report, was that the "actions of GPU Nuclear Corporation management give further evidence of the competence to safely restart and operate the plant."

Aside from the independent assessments contracted by GPUN, assessments have been conducted by the NRC. Two of the evaluations conducted recently by the NRC are a Systematic Assessment of Licensee Performance (SALP) dated April 24, 1984, and an Operational Readiness Evaluation (ORE) (Inspection No. 50-289/84-05) dated April 13, 1984.

The purpose of the SALP with regard to licensed operator training was to provide valid indications of the adequacy and effectiveness of training of personnel. Although some recommendations were made regarding the training program the following observations were made in the report:

(1) "A large number of dedicated training personnel, detailed procedures, specialized manuals, technical courses, and well maintained and retrievable records reflect a high degree of management attention to implementation of the training program."

(2) "Control procedures established last year in response to ASLB Partial Initial Decision on the Reopened Proceeding on cheating were well thought out and properly implemented."

(3) "Interfacing between the plant staff and the training staff is evident with frequent feedback of practical information into the training program."

(4) "Personnel training on numerous restart modifications was found to be generally well developed, timely and supplemented by training briefs prepared and presented by the Operations Department. These briefs were initiated by the licensee and demonstrated a desire to ensure the plant staff's knowledge of the numerous restart modifications."

The ORE was specifically oriented toward obtaining an improved understanding of the state of knowledge and readiness of

NRC licensed personnel at TMI-1. Based on the results of the evaluation, licensed personnel at TMI-1 were found by the NRC to be "knowledgeable and well trained." In addition the results also indicated "an effective requalification program" and "a sound and effective training approach." Measures to compensate for any decline in operational skills have been integrated into the requalification program, and are addressed in classroom and simulator training.

In addition to the evaluations outlined previously, an established feedback mechanism is maintained with operator training. This is enhanced by frequent meetings with shift personnel during requalification training, off-shift tours, management evaluations of training programs, and student critiques.

II. TRAINING FACILITIES (BY S. NEWTON)

One indication of GPUN's continued commitment to training is the improvement in facilities and resources available to the instructors from those noted by the OARP Committee in 1980. The majority of classroom training for licensed operators is conducted in a modern training center, which was occupied in the summer of 1981. The center occupies 20,000 square feet, all of which is utilized for the total training effort, including licensed operator training. In addition to fifteen classrooms, including a large dual-purpose room which is used either as a small auditorium or two classrooms, the building houses the

Basic Principles Training Simulator (BPTS) and its support equipment, a control room mockup, modular office spaces for a training staff of 62, a training library, file room, A-V equipment room, conference room, vending machine area and photocopy, storage and rest room areas.

The training center is supplied with central air conditioning and heating systems. Each classroom is equipped with zoned lighting and wall screens for projection. Audio-visual equipment available to instructors includes overhead, opaque and slide projectors, videotape players and monitors, movie and videotape cameras, photographic equipment and transparency and lettering machines. The inventory of equipment most frequently used by instructors has been significantly increased since 1980, e.g., in 1980 there were 7 videotape players, 8 videotape monitors, 8 overhead projectors, and 2 slide projectors. Now there are 27, 32, 24, and 10 respectively. A monthly maintenance schedule has been developed and the equipment is maintained and repaired by the plant instrumentation and control shop, providing more rapid turnaround than when commercial resources were utilized. Administrative support work for licensed operator training is done on word processing equipment and training record data is stored on GPU's main frame IBM computer in Reading, Pennsylvania. Access to the main frame is via terminals located in the training center.

A second building, identical in size to the existing training center, has been designed. The contract is out for

bid, with construction scheduled for next spring to support the arrival of the replica simulator. The building will also house the BPTS and provide additional instructor work spaces and storage capacity, freeing three rooms in the existing building to be restored to classroom use. Approximately one third of the building will be utilized by the Communications Division. In addition to the obvious benefits of having the replica simulator on site, the new facilities will create the opportunity to have individual instructor work areas rather than the shared facilities that presently exist. Individual work areas should improve efficiency through fewer distractions and provide better conditions for one-on-one instructor-student tutoring or counseling.

In addition to utilizing the facilities at the training center, space is made available on the TMI-1 site for the conduct of training. An increasing emphasis on in-plant training has moved some classroom training to component locations. This emphasis is designed for situations where practical, hands-on training has been developed as part of the requalification program. In-plant training done over the past two years includes training on circuit breakers, the emergency diesel generators, the remote shutdown panel, the loose parts monitor, and the plant process computer. When conducting in-plant training, conference rooms in the plant are utilized as classrooms to reduce time losses due to transportation to and from the site.

Facilities at the GPU Service Corporation building in Reading, Pennsylvania, have also been utilized to conduct requalification training for licensed operators. The operators have been shown the system power grid distribution center and provided with training on the role of and their interfaces with the system dispatchers.

The Basic Principles Training Simulator was delivered in February 1984. Based on the delivered condition of the simulator, extensive deficiency correction and testing have limited the machine's availability for instructor qualification to instruct on the simulator. After an introductory lesson, covering a portion of the reactor and plant startup process designed to familiarize the operators with the capabilities of the BPTS, was conducted in April-May of this year, requalification training for licensed operators resumed in October 1984.

The BPT simulation of plant operation is based on full scope simulator software of a nuclear generating station similar in design to TMI-1. It provides the capability to simulate in real time normal and abnormal conditions, both transient and steady state. The trainee console consists of a vertical display panel and horizontal control panel. The display panel contains a mimic drawing illustrating TMI systems and appropriate actuation switches, parameter display meters and annunciators. The control panel contains major controls and some parameter displays. Three CRT's are also available for trend

display of plant parameters as well as selected calculated data, like spatial xenon concentration or axial and radial core power distribution.

An instructor's console with a CRT provides a means of controlling and monitoring the BPT's operation. The instructor can utilize such features as:

(1) Initialization to one of 30 plant conditions.

(2) Backtrack or ability to return to prior conditions.

(3) Manual time delay or insertion of malfunctions.

(4) Fast time -- slow time capability.

(5) control of certain functions external to the control room.

A control room mockup has been installed in the training center and is utilized for procedure reviews, oral examinations, and classroom systems training. The mockup, which was previously located in the TMI-1 turbine building and used in human factors reviews, is a full scale plywood model of the console and control panels and has been renovated with new photographs of the panels, which show meter indications and readings to approximate full power operation.

The replica simulator is scheduled for delivery in late 1985. Until then, the simulator at PSI's training center at Lynchburg, Virginia, continues to be the best facility for simulator training for TMI-1 operators.

The replica simulator is being manufactured by Singer-Link's Simulation Systems Division and will duplicate the

appearance and configuration of the TMI-1 control room. It will provide a complete and accurate simulation of the systems monitored and/or controlled in the main control room and will display normal plant operations and abnormal conditions (malfunctions). The associated instructor's station console provides the instructor with the means to monitor and control training through the use of CRT's, keyboards, and associated equipment. There will also be a hand-held remote control device which will allow the instructor to manipulate the major instructor's station control features without returning to the CRT keyboard, in response to student activities during the course of an exercise.

An extensive specification for the replica simulator was prepared by GPUN and, following an exhaustive review of the bids, Singer-Link was chosen, largely on the basis of advances that they had made in plant process software modeling. The TMI-1 replica is a first-principles simulator, which basically means that it will be predictive rather than programmed, such that unanticipated or heretofore unrecognized transients will be capable of being simulated. A specific malfunction does not have to be pre-programmed into the software in order for the simulator to respond accordingly. The most important advancement was the development of the advanced core model, which implements the complexities of core physics and thermohydraulics into 24 radial and 9 axial regions. This model permits high iteration rate, yields a more accurate depiction of diffusion

effects, and provides greater accuracy and precision in calculating local anomalies and asymmetric conditions. The primary advantages gained are in the area of modeling of potential fuel failure from locally high heat flux, and more accurate depiction of core flux patterns and the thermohydraulics of accident conditions.

The simulator models will be tested utilizing engineering models which calculate plant behaviors in off-normal conditions using realistic engineering assumptions. Most of the current generation of simulators have not used first principles models and the off-normal behaviors have been compared with (or actually used data generated from) the worst case assumptions used in the Final Safety Analysis Report hypothetical accident analyses.

III. ATTITUDE OF LICENSED OPERATORS ABOUT TRAINING (BY M. ROSS)

Based on my daily contacts with the TMI-1 licensed operators, it is my judgment that the current TMI-1 licensed operators accept and have a positive attitude about the licensed operator training program. I attribute this to the maturing of the program, and the efforts that have been made by GPU Nuclear to provide operators with the opportunity for input into the program's development.

Perhaps the most conspicuous evidence of operators' acceptance of the training program and the demands it makes on them is their steady improvement on weekly quizzes and on

requalification examinations. It is my perception that this improvement reflects a more positive approach to participation in the program. This view is based not only on my own observations, but also on the feedback Operations and Training management have received.

GPU Nuclear has instituted changes designed in part to improve operator attitude and to establish better communications between operators and their management. The Vice President of TMI-1 now interviews all licensed operator candidates prior to certifying them for re-licensing or for their initial license. At a minimum, each licensed operator is interviewed by the Vice President of TMI-1 annually whether or not he/she is applying to be re-licensed during that year. This process clearly establishes the accessibility of the Vice President to the operators, and ensures an open communications link with senior management is maintained. This process tends to improve operator morale and attitude about their work, generally, and in particular about training, because senior management is accessible to them on an on-going basis. The Vice President of TMI-1 encourages the operators to express their concerns, such as criticisms of the training they receive, and comments to the operators that such concerns will be evaluated and, as appropriate, action taken to resolve them.

Visibility of management in the training center is a positive ingredient in ensuring a good training program and helps to demonstrate to the operators the importance placed on

training by their management. Various senior managers attend training, including periodic attendance by the Vice President of TMI-1.

I personally attend training in the status of a student and have increased my own knowledge from my exposure to the Training Program. During my training attendance periods I schedule my training such that I participate in training with different crews throughout the training cycles. While this exposure improves my knowledge as an operator, it also keeps me abreast of the feelings of the operators. Additionally, I am able to observe first hand the conduct of training and the reactions to the program of Operations personnel.

During simulator training, management's interest in the quality of training and the development of proper control room skills is demonstrated by the attendance of all Emergency Directors and various other GPU management level personnel. An operational examination is administered by one of the Emergency Directors to each requalification crew during simulator training periods. This process not only improves and verifies operator skills, but, in my view, it also positively affects operators' views about the importance of their training and management's interest in continually improving it. Similarly, management's participation in simulator classroom training allows early detection of training problems or operators' concerns, and ensures that the proper material is being taught and tested.

I attend simulator training and administer the majority of the operating examinations to new trainees and experienced requalification crews. In the past several years, I hav observed a sincere desire on the part of the operators to better their operating skills, and a highly professional and serious approach to this type of training.

Several management programs ensure that the licensed operator training program is kept up-to-date and reflects changes to equipment and procedures. A management interface meeting is held once each training cycle for each crew. During this meeting one of the three senior TMI-1 site personnel is in attendance, in addition to a selected department manager. Changes in company policies or procedures are discussed and recent plant events are reviewed. The shift crews are afforded an opportunity to directly interface with the managers and ask senior personnel questions and discuss problems encountered in the field during these sessions. The sessions not only update our personnel, but also provide a mechanism through which their views can be heard by and discussed with management.

Operators are kept abreast of plant modifications first by training handouts generated by Operations management, and later by formal classroom training on these plant changes. This approach immediately informs operators in the field when a system change takes place so they can be aware of its proper operation. Later in their normal requalification training this material is presented in a formal classroom atmosphere.

To ensure operators are kept informed on plant procedure changes a revision review book is required to be reviewed by each on-coming shift of licensed operators. This process ensures significant procedure changes are pointed out promptly to the operating crews.

The Operations Department receives notification of incidents and equipment problems which occur at other operating plants throughout the country through the Technical Functions Division of GPU Nuclear. Publications such as NRC Bulletins are also either routed to the operating crews through an Operations Department Training Memo or placed in a crew reading book. Documents routed in this manner to operators are also forwarded to the Operator Training Manager for distribution to Training Instructors. This procedure ensures Training Instructors are kept abreast of significant industry and plant incidents or changes.

Operators at TMI-1 have a voice in their training; this improves the program and prevents operators from being disgruntled or frustrated by the training in which they must participate. Meetings at the completion of each requalification training week have been instituted. In attendance at these meetings are operating personnel from that week's training class, the Training Supervisors, the Training Coordinator, and, when possible, the upcoming week's Shift Supervisor who is scheduled for training. Problems with the week's training are discussed, and corrections are made based on the operators' input.

The Licensed Operator Training Program effectively provides timely training requested by the Operations Department designed to resolve industry problems that are applicable to our plant. An example of this would be a fulfilled Training Request for lectures on recovery from mispositioned control rods, which was a recent published industry problem. This responsiveness to current issues is of importance to the operators.

It is inevitable and appropriate that we as operators will always have some negative comments about the Training Program. It is my view, however, which I believe the TMI-1 operators share, that the licensed operator training program is of high quality and is accepted by the licensed operators. The operators understand that training not only is a job function, but it is their responsibility to be committed to participating in it in order to properly discharge their licensed duties. We as an Operations group are working jointly with the Training Department to continually improve the program and to maintain the high standards now established in the licensed operator training program.

IV. THE INPO ACCREDITATION PROCESS (BY S. NEWTON)

The purpose of the INPO Accreditation Program is to assist member utilities in developing training programs that will provide well-qualified, competent personnel who will operate their nuclear power plants with quality and excellence. To obtain

accreditation, a utility must demonstrate that its training meets the INPO accreditation criteria. INPO has established criteria for training programs, the training process, and the training staff.

The criteria by which each program is assessed are divided into (i) program content, and (ii) trainee evaluation and qualification methods. Training process criteria are divided into (i) organization and administration, (ii) resources and facilities, and (iii) program development and implementation. Criteria for the training staff are divided into (i) size and workload, (ii) qualification, and (iii) development and evaluation.

The INPO accreditation process itself consists of three major parts:

Accreditation self-evaluation conducted by the utility and resulting in a self-evaluation report submitted to INPO in a prescribed format. The self evaluation is conducted based on the INPO accreditation criteria and a comparison of the utility's training programs to training and qualification guidelines issued by INPO for these specific programs.

Accreditation team evaluation conducted by peer evaluators from INPO and other utilities and resulting in an accreditation team report. The accreditation team is composed of a group of peers with collective expertise in nuclear power plant operations, nuclear utility training, instructional processes, and training evaluation. During the visit, the team interviews

training and other personnel; observes training activities, examines facilities, equipment, and training materials; reviews instructor qualification procedures; and examines training program content and training records. It reviews the conclusions of the self evaluation and provides an independent check on its thoroughness, and evaluates how well the training programs meet the related INPO accreditation criteria and compare against the state of the art. The team prepares its conclusions and recommendations and writes a report that is provided to the utility. The utility submits a written response to the report providing clarification or describing any corrective actions taken, if required. The accreditation team report and the utility's response are submitted in a joint report to the INPO Accrediting Board.

Accreditation decision by the INPO Accreditating Board. The Accrediting Board consists of five members: two persons from INPO member utilities, one person from a non-nuclear industrial training organization, one person from the post-secondary education community, and one person recommended by the NRC. Alternate members are selected to facilitate the scheduling of meetings. No two individuals are affiliated with the same organization. The Chairman, who normally remains in office for two years, and the other members and alternates are approved by the President of INPO.

Licensee has sought INPO accreditation for its TMI-1 licensed operator, non licensed (auxiliary) operator, shift

technical advisor and radiological controls technician training programs.

The initial self evaluation report for these TMI-1 programs was submitted to INPO on June 1, 1984. A revised report under cover letter dated October 11, 1984, was provided to the accreditation team upon their arrival at TMI on October 15, 1984. The thirteen-man accreditation team spent the week of October 15, 1984, at TMI, finishing their evaluation with their final debrief on the morning of October 19, 1984. Several members of the team also visited the simulator facility at Lynchburg, Virginia, during the week of September 17, 1984, to observe the TMI-1 RO training program in progess.

Licensee anticipates receiving the Accreditation Team report in November. It is expected that the follow-up actions of Licensee's response, the joint report, and Accrediting Board action will then take place over the next several months.

V. CONCLUSIONS

In this testimony, we have described in detail the TMI-1 licensed operator training program and how it is implemented at TMI. We have discussed the facilities available to ensure that the program is implemented effectively. It is our judgment that the operators are respectful of the program and consider it sound. Finally, we presently are working towards INPO accreditation of the program. On the basis of this information, we believe that there is ample evidence that the TMI-1 operators are trained to operate TMI-1 in a safe manner.

RESUME

NAME: Samuel L. Newton DATE: September 12, 1984

FUNCTIONAL TITLE: Manager, Plant Training, TMI

EMPLOYEE EXPERIENCE:

Present:

Manager, Plant Training, June 1983 to present - Responsible for the overall supervision and performance of approximately sixty managers, supervisors, instructors, and administrative support staff in the conduct of training for operators, technicians, maintenance personnel and shift technical advisors for Three Mile Island Nuclear Generating Station.

Previous:

September 1980 - June 1983 - Operator Training Manager - Responsible for the overall supervision of approximately 15 supervisors and instructors in their performance of training for licensed and non-licensed operators and shift technical advisors at Three Mile Island.

April 1980 - September 1980 - Supervisor Licensed Operator Training - Responsible for the supervision of approximately six instructors in the performance of training for licensed operators at Three Mile Island.

December 1976 - March 1980 - LCDR, USN - Chief Engineer - USS CAVALLA, (SSN 684) - Responsible for the Supervision of the operation and maintenance, including chemistry and radiological controls of a submarine nuclear propulsion plant and auxiliary mechanical and electrical sytems. Responsibilities also included training and qualification of plant operators and watchstanders including complete retraining and requalification during a shipyard overhaul. Successfully completed two Operational Reactor Safeguards Examinations and one Post Overhaul Reactor Safeguards Examination. Awarded Navy Commendation Medal by Commander, Sixth Fleet for performance during deployment to the Mediterranean Sea. Certified as qualified for command in submarines by Commander, Submarine Force, U. S. Pacific Fleet.

June 1976 - December 1976 - LT, USN - Submarine Officer Advanced Course, Naval Submarine School, Groton, Connecticut - Student in curriculum focused on submarine operations, including sonar, weapons, fire control, and navigational systems to prepare for Department Head responsibilities. Awarded David Lloyd award for excellence.

May 1974 - June 1976 - LT, USN - Company Officer, United States Naval Academy, Annapolis, Maryland - Responsible for all aspects of performance of a group of approximately one hundred and twenty Midshipmen of all four classes. Responsibilities included making the final recommendation to the Commandant and Superintendent regarding retention or dismissal for Midshipmen experiencing academic, aptitude, and/or disciplinary problems. Responsibilities also included formal teaching assignments in a professional course entitled "The Professional Officer and Human Person." Formal training included two, one-week seminars on counseling techniques.

September 1970 - April 1974 - LTJG and LT, USN - Department Head and Division Officer, USS NAUTILUS (SSN 571)
Reactor Controls, Electrical and Interior Communications Division Officer Responsible for the technical operation, maintenance and testing of the ship's reactor controls, electrical and Interior Communications systems. Responsbilities included training of divisional personnel. Reported to Chief Engineer.

Damage Control Assistant - Responsible for technical operation, maintenance, and testing of the ships' auxiliary systems, including hydraulics, air, air conditioning and refrigeration and atmosphere control systems. Duties also included functioning as Ship's Diving Officer, and Quality Control Officer. Responsibilities including training of divisional personnel and Ships Diving Officers of the Watch. Reported to Chief Engineer.

Weapons Officer - Responsible for the technical operation, maintenance and testing of the ship's sonar, fire control, and weapons handling and delivery systems. Responsibilities included training and qualification of department personnel. Reported to Executive Officer and Commanding Officer.

Qualified as Engineering Officer of the Watch, Officer of the Deck and in Submarines, 1971.

Qualified as Chief Engineer Officer by Naval Reactors in 1972. Upon completion of qualification was assigned to devise and implement the ship's overhaul retraining and requalification program for all Engineering Department Watchstanders.

Awarded Commanding Officer's Letter of Commendation for performance while qualifying as Engineering Officer of the Watch.

Awarded Navy Achievement Medal by the Secretary of the Navy for performance as Damage Control Assistant and Weapons Officer during the ship's overhaul.

MILITARY EXPERIENCE:

USN - June 1964 to March 1980 - See Above

USNR - June 1980 to present - Assignments have included serving as Commanding Officer for three different reserve units each consisting of approximately fifty-five officers and enlisted men. While responsibilities have included all facets of the unit's performance, the primary focus is on the training of the reservists in order to qualify them to man specific assigned billets in the event of mobilization. Promoted to the rank of Commander in September, 1982.

EDUCATIONAL AND SPECIALIZED TRAINING

High School:
Farrell High School, Farrell, PA - 1964 - graduated as Salutatorian

College:
B.S. U.S. Naval Academy June 1968 (degree unspecified, major was in Political Science and Economics) graduated in top 50 of class of approximately 850.

M.S. U.S. Naval Postgraduate School, Monterey, California - June 1969 - (Management)

Other:
U.S. Naval Nuclear Power School - June 1969 - December 1969 - Bainbridge, Maryland

U.S. Naval Nuclear Power Prototype Training - January 1970 - July 1970 - West Milton, New York

U.S. Naval Submarine School - July 1970 - August 1970 - Groton, Connecticut

CERTIFICATES/LICENSES

Present: None

Past: Certified qualified for supervision and operation of naval nuclear propulsion plant - 1972 (Chief Engineer Certification)
Certified qualified for command of submarines - 1979

Publications: "Training Requirements at TMI: Harbinger for the Nuclear Industry?," R. A. Knief, R. L. Long, S. L. Newton, Vol. 45, 1983 Winter Meeting, Trans. American Nuclear Society, 45, 195 (1983).

Professional Applications:

Member: B & W Owners Group Committee, Operator Support Subcommittee

Member: Middle Atlantic Nuclear Training Group

RESUME

NAME: Bruce P. Leonard DATE: 11/1/84

FUNCTIONAL TITLE: Operator Training Manager

EMPLOYEE EXPERIENCE:

PRESENT:
Operator Training Manager - 5/83 to present. Responsible and accountable for the overall management, development, and implementation of high-quality, efficient, and effective Licensed Operator, Non-Licensed Operator, and Shift Technical Advisor (STA) Training programs which comply with regulatory and corporate training requirements.

PREVIOUS:
Technical Programs Specialist - 11/82 to 5/83. Assist Operator Training Section Head in on-going review, evaluation, and revision of training programs for Licensed and Non-Licensed Operators and STA's.

Staff Training Officer, S3G Prototype, Naval Nuclear Power Training Unit, Ballstonspa, NY, 12/91 - 10/82. Military Department Head for approx. 150 qualified Nuclear Operators/Instructors. Responsible for Implementation and Enforcement of Training Programs including Chemisitry, Radiological Controls, Maintenance and Operations for 150 staff.

Leading Engineering Officer of the Watch, S3G Prototype. 10/80 - 12/81. Responsible for coordination of training of 35 staff operators and 60 students. Responsible for maintenance assigned to crew. Responsible for operational readiness of crew.

Damage Control Assistant, Communicator, USS Daniel Webster S5BN 626, 10/78 - 9/80. Division Officer.

MILITARY EXPERIENCE:

U.S. NAVY, Highest Rank: Lieutenant, Active Duty Commissioned 6/76 - 10/82.

Schools Included: Naval Nuclear Power Training, 1 yr. 10/76 - 10/77; Submarine Officers School, 3 mo. 10/77 - 02/78; Quality Assurance School, 2 weeks, 10/78; Communicators School, 1 week 2/80; Drug and Alcohol Program Advisor School, 2 weeks, 6/79; Controlled Material System School, 1 week, 2/80; Engineer Officer School, 4 weeks, 6/80; Damage Control School, 1 week, 6/78; Water Chemistry Control School, 2 weeks, 12/79. Instructor Development 11/80.

EDUCATIONAL AND SPECIALIZED TRAINING:

HIGH SCHOOL:
Corning West High School, Corning, NY 14830; Graduated 1972

NON-DEGREE COLLEGE
N/A

DEGREES:
Bachelor of Science-Engineering - Naval Architecture; US Naval Academy 1976.

MAJOR TMI JOB RELATED COURSES:
See Military Schools above under military.
Decision Analysis - 7/83
Instructor Development - 9/83
Manager Development - 4/84

CERTIFICATES/LICENSES:

PRESENT: Engineer in Training, State of Pennsylvania
PAST: Qualification as Engineer Officer, US Navy (Nuclear) Start-up Certificate B & W 4/84

PUBLICATIONS:
None

PROFESSIONAL AFFILIATIONS:
NONE

ADDITIONAL INFORMATION:
N/A

RESUME

MICHAEL J. ROSS

I. PERSONAL DATA

A. NAME
Michael John Ross

B. ADDRESS AND TELEPHONE
225 Delta Street
Mount Joy, PA 17552

Phone: 717-653-5109 - Home
717-948-8015 - Work

C. HEALTH
Excellent health

D. INTERESTS
Hunting, Fishing, Motorcycle Enthusist, High School Sports

II. EDUCATION

High School Graduate - Class of 1960 - Academic Course

U.S. Navy Electronics Technician School - 26 weeks of Basic and Advanced Electronic Theory

U.S. Navy Nuclear Power School - 25 weeks of Math., Physics, Chemistry, Nuclear Reactor Theory, and Electronic Theory

U.S. Navy Operating Nuclear Power Plant Training - 24 weeks of Instruction in Operation & Maintenance of Nuclear Power Plants

College Course - Working toward an Associate Degree in Electrical Engineering. Received 15 credits to date by correspondence and an additional 12 by local college attendance.

III. QUALIFICATION

I have a broad background in both electronics and all phases of nuclear power plant operation. My background includes over twenty years of proven power plant operations and supervision.

While in the U.S. Navy I spent over 6 years operating and maintaining nuclear power plants at sea and on land based power plants. I achieved qualification as Engineering Officer of the Watch (Navy designation for Shift Supervisor), and also spent 1 1/2 years assigned to the Atomic Energy Commission as a Technical Representative.

My civilian nuclear power experience began in December of 1968 when I came to work at Saxton Nuclear experimental Corporation as a Reactor Plant Technician. In July of 1969, I obtained my Atomic Energy Commission Operators License. In September of 1970, I was assigned as a Shift Foreman at Three Mile Island Nuclear Generating Station. I presently hold the Position of Manager, Plant Operations and have a Senior Operators License in Unit I.

Please see the attached chronological list of all jobs held for more detailed information.

IV. EMPLOYMENT HISTORY

A. CIVILIAN EMPLOYMENT

DATE	PLACE	DUTIES
Dec. 1968 Aug. 1970	Saxton Nuclear Experimental Corp.	Licensed operator of pressurized water reactor and support facilities, fuel handling, training of customer personnel.
Sept. 1970 July 1972	Three Mile Island Nuclear Generating Station	Shift Foreman prestartup duties, writing of plant test and operating procedures.
July 1972 Jan 1978	Three Mile Island Nuclear Generating Station	Station Shift Supervisor Duties: Senior management representative on shifts, weekends and holidays. Coordinate and supervise the operation of two 900 megawatt nuclear power plants. Supervise three Foremen, twenty Operators and twenty-five Maintenance and Health Physics and Security Personnel.
Jan. 1978 Present	Three Mile Island Nuclear Generating Station	Manager Plant Operations Duties: Overall operational supervision of a 900 megawatt nuclear power plant. Responsible for department scheduling, planning and discipline. Supervise a staff of twenty-two Supervisors and eighty-five Union Personnel. Responsibilities include in addition to plant operation the supervision of Radwaste Processing and Solidification.

B. NAVY JOB HISTORY

DATE	PLACE	DUTIES
Dec. 28, 1960	Naval Training Center San Diego, California	Recruit Training
March 1961 Nov. 1961	Naval School Command San Francisco, California	Electronic Technician School
Nov. 1961 Jan. 1962	Naval Submarine Base New London, Connecticut	Basic Submarine Course trained for submarine duty.
March 1962 June 1962	USS Diablo (SS479)	Qualified in submarines, radar, sonar, operation and maintenance.

B. NAVY JOB HISTORY - CONTINUED

DATE	PLACE	DUTIES
June 1962 Dec. 1962	Nuclear Power School Bainbridge, Maryland	Instruction in Nuclear Power Plant Theory, Math., Physics, etc., graduated 64 in class of 216
Jan. 1963 Aug. 1963	Nuclear Power Training Unit Schenectady, N.Y.	Operational Nuclear Power Plant Training. Instruction in theory, operation and maintenane.
Sept. 1963 Jan. 1966	USS HADDO (SSN 604)	Operation and Maintenance of reactor and control equipment.
Jan. 1966 Dec. 1966	Nuclear Power Training Unit Schenectady, N.Y.	Instructor/Operator Landbased nuclear plant. Supervision of maintenance and control on operating power plant. Trained students for input to nuclear fleet.
Dec. 1966 Sept. 1967	Nuclear Power Training Unit Schenectady, N.Y.	Qualified as Engineering Watch Officer (EOOW) supervised operating shift comprised of 20 Staff Operators and 30 to 40 enlisted and officer students.
Sept. 1967 Nov. 1968	West Milton Field Office Schenectady Naval Reactors	Atomic Energy Commission Technical Assistant duties include: assuring safe and efficient operation of a nuclear power plant, ensuring all required work is accomplished safely and at minimum cost, reviewing and approving power

C. LICENSE/CERTIFICATES

PLACE

Saxton Nuclear Experimental Corporation

Type: RO Number OP-2642 Issue Date: 30 July 1969

Three Mile Island

Type: SRO Number SOP-2053 Issue Date: 23 February 1974

Current License Number: 2053-7 Issue Date: 23 February 1984

ATTACHMENT 4

1) Plant or reactor startup and power escalation to a range where reactivity feedback from nuclear heat addition is noticeable and heatup rate is established.
2) Plant shutdown.
3) Manual control of steam generator water level and/or feedwater flow during plant startup and/or shutdown.
4) Boration and/or dilution during power operation.
5) Reactor power changes of 10% or greater where rod control is manual.
6) Reactor power changes of 10% or greater where load change is performed with load control in manual.
7) Operation of turbine controls in manual during turbine startup.
8) Decay heat removal system operation.
9) Incore monitoring system operation.
10) Control room calculations including heat balance, coolant inventory balance, and reactivity balance.

ATTACHMENT 5

1) Reactor trip.

2) Turbine or generator trip.

3) Loss of coolant including:

   a) Significant steam generator leaks.

   b) Significant pressurizer leaks.

   c) Large and small leaks located inside and outside primary containment (including leak rate determination for small leaks inside containment).

   d) Saturated reactor coolant system response.

4) Loss of coolant flow/natural circulation.

5) Loss of all feedwater (normal and emergency).

6) Control room inaccessibility.

7) Loss of shutdown cooling.

ATTACHMENT 6

1) Nuclear instrumentation failure(s).
2) Loss of protective system channel(s).
3) Mispositioned control rod(s) (or rod drops).
4) Inability to drive control rods.
5) Conditions requiring use of emergency boration or standby liquid control system.
6) Fuel cladding failure or high activity in reactor coolant or offgas.
7) Malfunction of reactor coolant pressure/volume control system.
8) Loss of instrument air.
9) Loss of electrical power and/or degraded power sources.
10) Loss of condenser vacuum.
11) Loss of service water.
12) Loss of component cooling system or cooling to an individual component
13) Loss of normal feedwater or normal feedwater system failure.
14) Main steam line break (inside or outside containment).