NUCLEAR PERSONNEL TRAINING AFTER TMI-2:

THE GPUN RESPONSE

by

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## I. INTRODUCTION

General Public Utilities (GPU) is made up of five corporate entities which provide electricity to approximately half the service areas of the states of New Jersey and Pennsylvania. These include Jersey Central Power & Light, Metropolitan Edison, Pennsylvania Electric, GPU Nuclear (GPUN), and the GPU Service Corporation. GPU Nuclear manages recovery activities at the damaged Three Mile Island-2 plant, restart activities at the Three Mile Island-1 (776 MWe PWR) plant, and continuing operation of the Oyster Creek (650 MWe BWR) plant.

Since the TMI-2 accident, personnel qualifications and training programs for GPUN personnel have undergone significant improvement and expansion. This paper briefly describes the significance of the TMI-2 accident to nuclear personnel training. It then describes in some detail the response of GPUN in the upgrading and expansion of training for all personnel involved in the operations, maintenance, and technical and administrative support of the GPUN power plants.

The training program at TMI-1 has received detailed scrutiny, and in many ways its development has been accelerated as a result of the detailed review by a special Atomic Safety and Licensing Board assigned to conduct hearings on the restart of TMI-1. On the other hand, Oyster Creek continued to operate following the TMI-2 accident; therefore, its training program development has been more deliberately paced. Since the training program at TMI-2 is designed for the very unique recovery operations, it is not discussed in this paper.

## II. SIGNIFICANCE OF TMI-2 TO NUCLEAR PERSONNEL TRAINING

### A. TMI-2 Lessons Learned

A number of investigative reports and NRC documents (bulletins, orders, etc.) were issued in the aftermath of the TMI-2 accident, e.g., Kemeny (1979), Rogovin (1980), NUREG-0578 (1979), NUREG-0585 (1979) NUREG-0660 (1980), Harold Denton letter (1980) and NUREG-0737 (1980). These included many specific findings, recommendations and orders which dealt with training in general and operator training in particular. In addition, GPU Nuclear sponsored detailed reviews of their training programs by several outside groups, Roddis (1980), Uhrig (1980), Witzig (1980), and DDL (1982). These internal reviews contained specific recommendations regarding facilities, training program development, instructor qualifications, breadth and depth of training programs, and management control of training. Although every utility has had to address those items which became regulatory requirements, GPU Nuclear has probably received the most detailed review of its revised and upgraded training programs as a result of the requirement to participate in an Atomic Safety and Licensing Board Hearing, ASLB (1981), prior to being allowed to restart TMI-1, the undamaged PWR at Three Mile Island.

The training programs which have evolved cover all areas of the GPUN organization, including operations, maintenance, radiation protection, shift tech. advisor, chemistry, quality assurance, plant staff, and on- and off-site technical and administrative support personnel and supervisory and manager development. In addition, the programs reach all levels of personnel from utility workers and crafts specialists to engineers, supervisors and senior management.

The GPUN training programs have been developed in close cooperation with the functional groups. Formal and informal tasks and needs analyses have aided in defining behavioral learning objectives for each program. For example, operators are trained to (a) recognize abnormal plant response, (b) identify accident causes from the diverse data sources available to them, and (c) apply their plant knowledge and use procedures effectively to correct the condition. Supervisors are trained to evaluate information and to make the decisions that result in proper action during casualty situations. They are also trained in methods of administering the plant to ensure that operators are always aware of system and equipment status and are prepared to respond to abnormal situations. The plant engineering staff members are trained in plant operations so that they are better equipped to apply their knowledge to support the operations staff in areas of (a) procedure writing, review and implementation; (b) operations review; and (c) evaluating and advising during abnormal plant conditions.

The operator training program has been carefully reviewed to ensure that all operations which might be required are covered in the program, both in classroom training and at the simulator. As a result of this review, training has been expanded in such areas as emergency procedures, heat transfer, and fluid flow. For example, at TMI specific operations which have been added to those previously covered in the training program include conditions under which the plant should be taken solid, methods for operating the plant when solid, transition to natural circulation, and operation under natural circulation. In addition, the training program specifically instructs the operator to respond to a plant condition which does not appear to be covered by the pre-defined events emphasized in the training program. It includes--techniques for diagnosing the problem or problems; identification of plant parameters essential to safety; methods to be used to bring additional technical resources to bear on the problem; and definition of the authority and responsibility of the operating staff to deviate from previous directions when required to respond to unforeseen situations.

The above examples reflect just a few of the changes that have been made in response to both governmental and corporate sponsored training program recommendations. Table 1 is a summary of many of the recommendations made regarding nuclear training in general and GPUN training specifically. This table originally appeared in Uhrig (1980) and included the company responses to each recommendation. The programs described in this paper reflect the total GPUN response to these recommendations.

B. INPO Performance Objectives and Criteria

One of the utility industries' responses to the TMI-2 accident was the formation of the Institute of Nuclear Power Operations (INPO) in late 1979. A primary function of INPO is to promote excellence in the training, education, and qualification of nuclear plant personnel. The INPO "Performance Objectives and Criteria for Plant Evaluation," INPO (1981), includes nine training-related performance objectives and criteria. They cover such general areas as training organization, administration, management control, facilities and equipment, and specific training program areas such as non-licensed operator training, licensed operator initial and requalification training, shift technical advisor training, maintenance personnel training, radiological protection training, and chemistry training.

These INPO training objectives and criteria have been carefully considered in the development of the GPUN training programs, and initial reviews of the Oyster Creek and TMI-1 training programs have indicated a generally satisfactory response to the criteria.

C. Review of the Operator Accelerated Retraining Program

NUREG-0660 (1980), as well as other NRC documents, require the development of an accreditation process for nuclear power plant training programs. Both the NRC, Persensky (1981), and INPO, Mangin (1981), are working on the development of accreditation criteria, and INPO has underway pilot testing of their accreditation process. However, the first trial of an accreditation-type evaluation of operator training was initiated in November 1979, when General Public Utilities asked five persons representing relevant areas of expertise to serve as an "accreditation committee" for the TMI Operator Accelerated Retraining Program (OARP), Long (1980). These consultants from industry and university organizations represented the areas of human factors engineering, educational psychology, nuclear engineering education, nuclear power plant operator training, and nuclear power generation.

Since there was no official accrediting agency nor accreditation criteria for nuclear power plant training programs, the Committee eventually decided to model their evaluation after the process followed by the Accreditation Board for Engineering and Technology (ABET, formerly known as the Engineers Council for Professional Development). As a first step, GPU was asked to prepare a detailed self-evaluation study of its operator training program with appropriate documentation supporting the analysis.

In addition to reviewing this study, members of the Committee attended several days of OARP classes, reviewed videotapes, observed oral examinations simulating an NRC exam, and conducted interviews of both the trainees and the instructors. They also reviewed the training facilities at TMI and other nuclear utilities. One member of the Committee also participated in a one-week training program in decision analysis. Based on these activities, they then prepared a detailed report which presented a series of observations, conclusions, and recommendations, Uhrig (1980).

Briefly, the Committee concluded that the Operator Accelerated Retraining Program was a high-quality, well-executed program, having many features that should be incorporated into the regular Operator Training and Retraining Programs. As has already been pointed out, the recommendations of this Committee have been carefully considered in the development of the training programs described in the remainder of this paper.

D. INPO Accreditation of Utility Training Programs

INPO has developed an accreditation process for the Operations, Maintenance and Technical Support Training Areas. (The Accreditation of Training in the Nuclear Power Industry, May 1982). Selected on-site, off-site and contrasted training programs at a specific utility will be evaluated. By May '84, it proposed to have the three operations areas (licensed, non-licensed and requalification training programs) evaluated. And by May '84, each utility is to have sought accreditation for the Maintenance and Technical Support areas. (STA, I&C, Electrical, Mechanical, Chemistry, Rad Con, Engineering, and Technical Manager Training).

The three step process involves each member utility:

- Conducting a self-evaluation for selected training program.
- Evaluation by INPO's Accreditation Team.
- INPO's Accrediting Board's issuance of their decision.

Training Programs, the training process, and the staff will be evaluated.

## III. GPUN TRAINING & EDUCATION ORGANIZATION

The GPU Nuclear (GPUN) Group was formed in early 1980 to support and operate the GPU nuclear generating stations. A number of the functions, e.g., training, radiation control and licensing, traditionally under the direction and control of the Station Manager, were separated into a functional organization structure to provide the required intensity of direction and management involvement. Specifically, the Nuclear Assurance Division, headed by a Vice President, included Training & Education, Quality Assurance, Emergency Preparedness and Nuclear Safety Assessment.

### A. T&E Organization

The Director of Training & Education manages, coordinates and administers three training departments: Corporate Training, Three Mile Island Training, and Oyster Creek Training. Each of the Training Departments is at a different location, and each is managed by a Training Manager who provides the technical, managerial, and administrative direction of the training at that location. This approach provides the advantages of centralized coord .tion, while allowing maximum flexibility for the local training organization to provide the unique training needs of the specific location.

The Corporate Training Manager coordinates common elements of the site training programs, but each Training Manager and his staff are responsible for providing the training needed at their respective locations. The OC and TMI Training Departments are organized to provide administrative support; training and educational development activities; and training for operators, technicians, maintenance, security, supervisory and management personnel, and general employees/radiation workers.

B. T&E Staffing

Table 2 shows a comparison between the numbers of full-time training personnel before the TMI-2 accident and in March, 1983. The very large increases are representative of the significant commitment to improved training of all personnel involved in nuclear plant operations and support. Because of the breadth and level of training activities, many of the new instructional staff members hold 4-year bacculaureate degrees, a number hold masters's level degrees, and a few hold doctorate level degrees.

Table 3 provides a breakdown of the assignments of training personnel in the Oyster Creek and TMI Training Departments as of March 1, 1983. Generally, the training prior to the accident was focused on operator training with a minimum required effort on general employee and maintenance training.

The present Oyster Creek operator training staff consists of eight individuals, including 6 with SRO licenses and two who are in training for SRO licenses. This staff is devoted to licensed operator training, non-licensed operator training, S.T.A. training, and plant engineer training.

The present TMI operator training staff consists of a manager, a programs specialist, an STA coordinator, an administrative assistant, three supervisors and eight instructors split evenly between licensed and non-licensed operator training. The supervisors and one instructor are SRO licensed; two instructors are RO licensed while a third is awaiting results of his licensing examination. Two of the eight instructor positions are currently vacant.

Additionally, the SRO-licensed Supervisor of Simulator Instruction will devote significant attention to training of licensed operators following delivery of the Basic Principles Trainer (BPT). The manager, program specialist, and STA coordinator are in SRO training programs, and one of the remaining two instructors was SRO licensed at another facility.

## IV. GPUN TRAINING FACILITIES

The significant commitment by GPUN to training has also been reflected in the development of training facilities at the Oyster Creek and TMI sites.

A. Classroom/Training Centers

The TMI Training Department is housed primarily in a new Training Center, completed in August, 1981, located across the river from the Island plant site. Sixteen classrooms, modular offices, two reproduction centers, a library, and other service facilities are contained in the Center.

Training activities which remain on-site consist of laboratory and practical factor programs. Maintenance laboratories and radiation-worker practical factors are conducted in specially outfitted trailers near the plant. Chemistry and radiological controls laboratory exercises are conducted in areas of the actual in-plant facilities.

The Oyster Creek Training Department is housed in several buildings on the Forked River* site, immediately adjacent to the Oyster Creek plant. Eleven classrooms, modular offices, reproduction, library and other service facilities are located in the Administration Building, along with other Oyster Creek support groups. A personnel processing center was opened in July 1982 to centralize all processing activities.

* GPUN cancelled construction of the Forked River Nuclear Plant after the TMI-2 accident.

An adjacent building has been renovated to house facilities for laboratory training programs and development of audio/visual aids. This includes a full-size Oyster Creek control room mockup - made from photographs and plywood - and housed in a room replicating the actual control room. Individual laboratories for mechanical, electrical and instrument/control maintenance technicians; a chemistry laboratory; and a radiation control technician laboratory also support the training effort.

C. <u>Basic Principle Trainers</u>

The various investigations of the TMI-2 accident, including GPUN's own internal review, indicated the need for a special emphasis in operator training programs on basic principles of plant system behavior and interactions. In the summer of 1981, GPUN placed an order with Electronic Associates, Inc. for a Basic Principles Trainer (BPT) or concepts simulator, for the Babcock & Wilcox pressurized water reactors at TMI. The expected delivery date is the second quarter of 1983.

The recently organized Simulator Development Section consisting of three persons, one of whom is an SRO-licensed former Unit 1 shift foreman, has devoted full attention to the project since January 1983.

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:

- Initialization to one of 30 plant conditions.
- Backtrack or ability to return to prior conditions.
- Manual time delay or insertion of malfunctions.
- Fast time - slow time capability.
- Control of certain functions external to the control room.
- Replay of up to 15 minutes in a hands off mode.
- Override of all inputs and outputs on the Control Panel.
- Monitor or change a database variable.

A very important element in the development of the BPT specifications has been the development of detailed behavioral learning objectives for the BPT training program. These objectives are stated in the form of learning goals, describing the specific concepts which the BPT is intended to convey. The goals are followed by a statement of the behavioral learning objectives for each concept, describing the specific actions which the student is expected to take at the BPT console to demonstrate understanding of the concept. In some cases the actions involve presenting explanations of particular evolutions. In other cases, the actions require manipulation of the BPT controls to accomplish a stated objective.

The eighteen topics covered by the learning objectives are displayed in Table 4. After the learning objectives were formulated, they were used to evaluate the proposed design of the BPT simulator to ensure that the BPT could accomplish these objectives. Thus, the statement of the learning objectives is an integral part of the BPT design process.

The next step in the ISD program is to develop a matrix display of the relationship of the learning objectives to the INPO/TMI Operator Job and Task Analysis.

The Oyster Creek BPT is scheduled for delivery in 2nd quarter 1984. It will be similar to the TMI BPT and will be based on behavioral learning objectives. However, the topic organization (see Table 5) evolved around the basic principles taught in the Oyster Creek operator training programs, where as the systems organization was used for the TMI BPT.

C. Replica Simulators

The 1982 GPUN capital equipment budget included funding for the preparation of specifications for a replica simulator of the TMI-1 control room, to be located at TMI. The order for this simulator will be placed early in 1983, and delivery is anticipated in the last quarter of 1985. The procurement of an Oyster Creek replica simulator has been deferred.

Detailed attention is being given to the development of requirements for the plant process model. Behavioral learning objectives will be used to help specify training features and to develop lesson plans for replica simulator training.

D. P-T Plot Trainer

The TMI-1 Pressure-Temperature (P-T) Plot Trainer is the first of a variety of part-task training devices to be developed. A dynamic plot of hot leg temperature vs. primary system pressure, and cold leg temperature vs. steam generator pressure has been introduced into the TMI-1 control room to assist operations personnel - including the shift technical advisor - to analyze plant transients, Broughton (1981).

Using a dedicated microcomputer and interactive color CRT display terminal, a Computer Assisted Instruction (CAI) program has been developed to train personnel in the use of the P-T plot in analysing plant transients. The display on the trainer is an exact duplicate of the CRT presentation in the control room and can simulate various "canned" transients in half, double or real time.

Through the use of CAI, a student is guided through a series of graduated exercises and tested for mastery. The record keeping and test results are automatically maintained in the computer. The instructional design is such that the student knows what the objectives for each segment are, and the student is tested for mastery of these stated objectives. There is no need for prior knowledge of computer programming by the student to effectively use the system. By a branching process, the program can meet the needs of a wide range of students, from the inexperienced to very experienced users. The end result is that everyone can achieve the minimum goal of the program that, "Operators will be able to evaluate plant performance during transients, identifying abnormal performance by comparing displayed parameters to limiting values in real time."

A duplicate P-T Plot trainer has been installed in the Unit I control room. This allows the operations personnel use of the trainer on an off-shift basis and also when not in training.

V. OPERATOR TRAINING AND REQUALIFICATION PROGRAMS

The operator training and requalification programs at Oyster Cree and TMI have been undergoing significant changes since the TMI-2 accident. In the fall of 1979, all licensed TMI-1 personnel were placed in an Operator Accelerated Retraining Program, Uhrig (1980), in preparation for relicensing examinations administered by the Nuclear Regulatory Commission. This Program served as a model for subsequent training program developments.

At the present time at TMI-1, all operators - licensed and unlicensed - as well as all plant maintenance, radiation control, and chemistry technicians are on a six-shift rotation. One week in six, each of these worker categories are in the Training Center for four to five days of requalification instruction. Oyster Creek is in the process of manning up to six shifts and will follow a similar rotation.

A. Oyster Creek Operator Training

The Oyster Creek Equipment Initial Training Program requires two years to complete. This program is progressive and requires the student to accomplish various elements of the training to remain enrolled in the program.

The program is divided into two major components: the instructional component and the apprentice component. A brief description of each is provided below.

Instructional Component - Each employee must satisfactorily complete the Academic and Plant Operations elements of this Training. The sixteen-week academic phase includes training on mathematics, classical physics, basic nuclear concepts, heat transfer, fluid flow, water chemistry, radiation protection, as well as, mechanical, electrical, and instrumentation fundamentals, and conduct of tour training. Following the passing of a comprehensive examination of an oral board the employee then enters the Plant Operations training phase. The thirty-seven week plant operations training phase provides classroom instruction and in-plant assignments to permit each employee to learn each of the fifty-five systems at the station.

The third, and final, phase of the program consists of a oneyear assignment as an apprentice operator. During this period the employee is required to qualify on each system by receiving a practical knowledge examination and checkoff by the operating staff.

The Oyster Creek Reactor Operator Training Program is approximately 12 months long and consists of twenty-five weeks of classroom and simulator training and twenty weeks of on-the-job training. (OJT). The classroom training includes BWR plant fundamentals, Oyster Creek systems and operating characteristics, plant procedures and radiation protection, and safety. During the on-the-job training, trainees are expected to enhance their system and operational knowledge by studying lesson material, tracing out systems and instrumentation, receiving checkouts on twenty-five plant systems, completing a practical factors checkoff sheet, becoming familiar with operating procedures, and reviewing all emergency procedures. The major factors in the successful use of shift time are participation in plant evolutions, careful planning of time, receiving system checkouts, and trainee completion of an OJT Signoff Sheet. After the OJT training, all candidates participate in a six-day simulator "hot license" training program at the GE BWR Simulator, Morris, Illinois. Finally, an approximately three-week review program precedes sitting for the NRC examination.

The Oyster Creek Senior Reactor Operator Training Program consists of twenty-six weeks of classroom study and thirteen weeks of on-shift training as an extra person in the control room. The study program emphasizes advanced level knowledge of theory and system applications which is required of the SRO. Frequent systems examinations are administered on a pre-planned basis, and any detected deficiencies are addressed. Approximately four weeks of lectures covering reactor theory, thermodynamics, heat transfer, and fluid flow are presented.

The on-shift assignment provides the candidate with first hand experience in the operation of the station. The candidate participates in surveillances, testing, system trace outs, and other tasks that add to the candidate's knowledge and ability to serve as a Senior Reactor Operator. Each candidate participates in a pre-NRC exam review program, including one week at the simulator.

All Oyster Creek licensed operators participate in an annual requalification training program which includes classroom lectures, on-the-job training, and three days at the simulator. During each shift cycle the training schedule is arranged to allow time for presentation of the lecture series for each shift of operators.

B. <u>TMI Operator Training</u>

The TMI-1 Auxiliary Operator Training Program is two years long with the first year devoted to classroom training in areas such as math, reactor physics, thermodynamics, heat transfer and fluid flow, chemistry and radiological controls, electrical theory and fundamentals, mechanical fundamentals, plant systems and equipment, and plant procedures. The second year is spent in the plant in on-the-job training and completing task sheets on practical factors, leading to final qualification as Auxiliary Operators.

The TMI-1 Reactor Operator Training Program is nine months long and consists of two six-week classroom phases, each followed by a twelve-week on-the-job training cycle. The classroom training is designed to complement the training the individual has received as an Auxiliary Operator with more in-depth training in the theoretical areas and focusing on instrumentation and control systems and overall plant operations from the control room. Included in the second twelve-week on-the-job training is a three-week B&W simulator start-up certification program.

Provisions are made for candidates with prior experience, e.g., in the nuclear navy or at other plants, to participate in plant specific portions of the auxiliary operator training program as part of their reactor operator training.

The TMI-1 SRO Training Program is six months long and consists of two weeks of classroom training in supervisory development and decision analysis, seven weeks of additional classroom training in overall plant supervision, three months of on-the-job training, and two weeks of B&W simulator training. The classroom training includes an OJT review and an in depth study of pertinent theoretical materials, administrative controls, emergency and abnormal procedures as well as technical specifications and related aspects of overall plant supervision. The on-the-job training phase is designed to both get the former CRO's back in the plant as well as refamiliarize them with the duties and responsibilities of the auxiliary operators. They must also complete sections of selected practical factors as the shift foreman under instruction. The seven week classroom phase is done in half day sessions over fourteen weeks and runs concurrently with a portion of the on-the-job training. The TMI-1 Shift Technical Advisor (STA) training program is twelve months long and consists of twelve weeks of fundamentals training, sixteen weeks of systems training, twenty-one weeks of on-the-job training, and three weeks of training at the B&W simulator.

Fundamentals training is designed to present new concepts and to reinforce concepts presented in the candidate's baccalaureate curriculum. Systems training provides the candidate with a working knowledge of the system's function, flow-path and operation during normal, off-normal and emergency conditions. On-the-job training integrates classroom and systems training and develops the candidate's reasoning ability during credible and non-credible situations. B&W simulator training provides the "hands-on" training to the candidate to evaluate his reasoning and judgement in critical situations. At the end of the training program a final board is given to the candidate to determine his suitability for the STA position.

As mentioned earlier, when the operators have completed their respective training programs and are assigned to operating shifts, they participate in requalification programs one week out of every six. For Auxiliary operators this requalification program consists of review of both theory and systems, changes in the plant and associated procedures, and industry experiences. Licensed operators attend requalification together and receive training in the same areas as Auxiliary Operators, but at the licensed operator level.

All shift supervisors and shift foreman at both Oyster Creek and TMI have also participated in a five-day Supervisor Development Course. In addition at TMI, as a direct result of the evaluation of the TMI-2 accident, all shift supervisors and shift foremen - as well as many other plant supervisory personnel -

have participated in a three-day Decision Analysis Course. These supervisory skill courses are described in Section VII of this paper.

## VI. TECHNICIAN TRAINING

Prior to the TMI-2 accident and consistent with the general practice in the industry, technicians working at Oyster Creek and TMI met the qualifications of job specifications which included educational and experience prerequisites. Subsequent training was accomplished by on-the-job instruction and experience. Responsibility for ensuring the adequacy of a technician's capability rested with the appropriate supervisor, e.g., the Supervisor of Maintenance or of Radiation Protection. The cognizant supervisor was also responsible for providing needed training on new equipment. Thus, the training organization was not substantively involved in technician training.

However, as seen in Table 3, very substantial resources are now committed to new formal programs for training and retraining of technicians in a variety of fields. In addition, many of the courses, previously taught by the cognizant site organization (such as training given by security management to site security personnel), are now designed and implemented by the site Training Departments.

At TMI all assigned crafts personnel, including utility workers, maintenance personnel, radiation control technicians, and chemistry technicians, are on a six-shift rotation schedule. This six-shift manning has not yet been achieved at Oyster Creek but is a management goal for 1983. The descriptions which follow are primarily those programs in place at TMI, but they may be considered representative of on-going activities at Oyster Creek as well.

A. Maintenance Technician Training

The TMI Maintenance Training Program is designed around a six-shift schedule and provides for each discipline up to 160 hours of training and retraining each year. The program provides a progressive update for the technician by reviewing basic concepts and basic skills. And it also provides instruction in plant systems, components, and concepts.

In the Maintenance Training Program, all maintenance personnel are given an appropriate self-study course consisting of fundamental lessons on maintenance tools as well as the major principles involved in mechanical, electrical, I&C, and general maintenance work. Quizzes are given in each area of the subject matter, as it is completed by the trainee, with provisions for repeating the area if weak or unsatisfactory performance is exhibited.

Also, during the Cyclic Training Program, maintenance personnel with emergency duties receive instruction on the emergency plan and their emergency responsibilities. The Cyclic Training Program also incorporates training on selected primary and secondary systems and advanced training in the respective disciplines. Finally, in the future new hire initial training programs will be developed based upon job specifications and needs identified by the Maintenance Department.

B. Radiological Controls Technician Training

The Radiological Controls Technician Training consists of two phases: the Initial Technician Training and the Technician Training/Retraining, called the Cyclic Program.

The Initial Technician Training Program consists of approximately eleven weeks of instruction plus OJT which new radiological control technicians undergo prior to assuming responsibility for radiation control work at TMI-1. Basics of radiological control are taught in classroom sessions. After completing the classroom portion of the training, the Tech spends approximately 18 months in the plant under the direction of a Rad Tech Foreman. During that period the Tech must complete all formal OJT assignments and pass both an oral board and written examination for advancement from "C" to "B" and "B" to "A" level Technician.

At Oyster Creek the Initial Radiological Controls Technician Training Program is a comprehensive six-month program which includes basic principles of health physics, practical applications, and on-the-job training. The Oyster Creek Training Department is working closely with Rutgers University to facilitate offering twelve semester hours of college credit upon successful completion of the Program. Under this arrangement both Training Department and Rutgers instructors would present the Program material.

Once a radiological control technician is assigned on shift at TMI, he or she participates, as assigned, in the Cyclic Program, which is conducted on a six week per cycle basis each year with a one week break between cycles. Approximately every six weeks each shift rotates through the program for one week. The Cyclic Program consists of yearly requalification requirements specified in the Radiological Controls Department qualification procedure. Additionally, the program includes specialized training in the emergency plan, radioactive waste administration, multimedia first aid and CPR, along with other identified needs. Future yearly training cycles will provide progressive training to ensure that the technicians maintain their technical and professional abilities.

Radwaste handling personnel at both sites receive additional training on processing, handling, packaging, receiving, and shipping of radioactive wastes. This includes detailed reviews of the applicable regulations.

C. Chemistry Technician Training

The Chemistry Technician Training Program consists of an initial technical program and a cyclic training/re-training program. The newly hired technician receives approximately seven weeks of classroom lectures. Following the classroom instruction and for approximately the next eighteen months, the technician is assigned to a shift under the direction of a Chemistry Foreman. During the time he/she completes a formal OJT program and attends cyclic training. As the new technician progresses from the "C" to "B" and "B" to "A" level technician, he/she is required to pass a comprehensive written and oral board examination.

The initial program includes basic chemistry principles, corrosion and corrosion control, water processing, chemistry related plant systems, radiological principles and explanations of why certain chemicals are necessary while others are not allowed into the primary and secondary systems. During the OJT portion of their training, the technicians are trained and qualified by their supervision on the Unit specific lab equipment and chemistry procedures.

Like the other cyclic programs, the chemistry retraining program provides up to 128 hours of training per unit each year. The program may consist of a review of important facts and principles, chemistry related plant system changes, industrial experiences, and other specialized training needs. The cyclic program also includes specialized training in emergency plan, lab safety, hazardous materials cleanup, and chemistry related mitigating core damage.

D. Security Training

The Security Training Programs, formerly taught by the site Security Departments, are now under the direction of the site Training Departments. However, they are not on six-shift rotations. In accordance with the requirements of 10 CFR Part 73.55, Appendix B, the programs include training on the guard training and qualification plan, contingency plan, procedure training applicable to unit and duties assigned. Legal issues of import, use of security equipment, weapons training, methods to use in the event of a security alert, and other pertinent information are also included in the programs.

## VII. GENERAL EMPLOYEE AND RADIATION WORKER TRAINING

Basic General Employee Training (GET) consists of an eight hour course for individuals working at Oyster Creek or Three Mile Island. During this session, employees as well as contractors working at the sites receive instruction in: security, safety, site familiarization, quality assurance, emergency response, and basic radiation safety.

Individuals who require access to radiological controlled areas receive radiation worker training of twelve to twenty hours duration. This program provides detailed instruction in radiation protection principles and procedures; methods for minimizing radwaste; and four hours of practical factors training, e.g., procedures to follow in donning and removing the radiation protection clothing required in certain areas. A practical exam, in addition to the written exam, is given on this portion of the GET Program. Those workers who must wear respiratory protection devices complete an additional four to eight hours of lecture and practical factors on the subject.

The annual GET Retraining Programs consist of a review of subject areas covered by the initial programs and is followed by written and practical tests similar in scope to those originally taken. These GET initial and annual retraining programs involve several thousand students per year for each operating unit.

Emergency response training for personnel not having specific duties is taught as a part of the site GET Programs and is repeated as part of annual retraining. In addition, individuals assigned Emergency Response Rules are given training related to their specific responsibilities in the event of an emergency. Although emergency plan implementation training is administered by the Training Departments, Emergency Preparedness technical personnel help teach emergency plan procedures. They also coordinate and evaluate emergency drills.

In addition, appropriate groups such as the fire departments, police departments, rescue squads, hospital emergency staffs, etc. are invited to attend briefings on each site's Emergency Plan, emergency procedures, and the role of these organizations play in the event of a site emergency. Representatives of the Training Departments and Emergency Preparedness Groups also go into the community to provide briefings.

Other programs conducted on-site include training on fire brigade procedures and duties, multimedia first-aid and CPR.

## VIII TRAINING AND EDUCATIONAL DEVELOPMENT PROGRAMS

Each of the site training departments has a Training & Educational Development Section that is responsible for a variety of training programs, e.g., supervisor and manager development, instructor development and evaluation, and course development (such as new engineer training). These departments also evaluate on- and off-site educational activities for possible college credit.

The common denominator at every managerial/supervisory level is the ability to work with and through people. The beginning supervisor is concerned primarily with technical skills involving an ability to use the methods and equipment required to perform specific tasks. However, higher level managers are primarily called on to demonstrate proficiency at conceptual skills. Therefore, as managers/supervisors move upward, the need for conceptual and human relation skills grow, and the emphasis on technical skills declines. Using that concept, the Training & Education Department has designed and implemented a high quality multi-level managerial/supervisory development program for GPUN which is described in the next two sections.

### A. Supervisory Training

The Supervisory Development Programs at Oyster Creek and Three Mile Island are divided into three categories of instruction: (1) a self-paced course in "Fundamentals of Supervision," (2) a five-day Basic Supervisory Development Course, and (3) a group of elective short-duration skill building courses.

The self-paced "Fundamentals of Supervision" course is designed to familiarize the employee with basic supervisory functions and with the methods and techniques most appropriate for effective and efficient supervisory performance. The Basic Supervisory Development Course, offered at both sites, is designed for supervisors who have responsibility for directly supervising non-bargaining and/or bargaining unit personnel. To provide for the continued development of supervisors and managers, selected short duration (1/2 - 3 day) skill courses are developed and presented at the several locations in response to needs identified through discussions with and surveys of line management. An example is the three-day Decision Analysis Course developed at TMI, as a direct response to problems identified in the TMI-2 accident.

This Decision Analysis Course examines in detail the theory, techniques, and methodologies relating to the decision analysis process. Instruction is designed to involve participants actively in proven methods of decision analysis applicable to on-the-job situations. The respective strength and weaknesses of various approaches to problem solving are discussed to stimulate consideration of each. In this format, the participants use these ideas in practice decision making during the course. Participants then identify those techniques they can apply in their job environment.

B. Manager Development Program

After an extensive review of the literature on management development theories, including INPO's report on existing utility programs, the six topics shown in Table 6 have been included with the GPUN Manager Development Program. The six day, three-phase format (two days at each location - TMI, Oyster Creek, and Parsippany) fosters effective interfaces and a greater understanding among sites. In addition to the 13 hours of formal instruction, each phase includes a 2-3 hour site orientation/tour and a two-hour meeting/seminar with the site vice president and other vice presidents, as appropriate. At Corporate Headquarters, this will include a half day session with the Office of the President.

GPUN's goal is to have most of its managers complete the program by the spring of 1984.

To further enhance the existing supervisor and management development programs, the Training and Human Resource Departments are developing a formal supervisor/management progression program which incorporates all aspects of manpower planning, career pathing and counselling as well as supervisor/management development.

In addition to the Management Development Program, a number of other programs have been designed as elective offerings. A majority of a manager/supervisor's activities involves "communicating" with others; therefore, twenty-seven managers/supervisors were asked to perform a departmental communication training needs analysis. With this information, four single topic communication programs were designed and conducted. One gave an overview of the four communication skills (reading, writing, listening, and speaking), but the others specifically addressed improving writing, listening, and interviewing skills.

Another elective supervisory/management program is Leader Effectiveness Training (LET). LET is a high quality, multilevel management development program that has been translated into seventeen languages and is used by many major corporations throughout the country, Gordon (1977).

C. Instructor Training Program

The Instructor Development Program is an integral part of the instructor certification process for all personnel assigned as instructors. The primary goal of the program is to furnish the instructors with an expanded foundation in training design, presentation, and evaluation to enable them to conduct effective employee training which is based on well-defined behavioral learning objectives.

Instructor Development is an ongoing process. The initial effort is directed at certification to ensure that all instructors possess the instructional skills necessary to perform their duties in a manner that promotes safe and reliable plant operation.

Subsequently, instructors are involved in a continuing program of development to ensure they maintain and advance their instructional skills in areas closely related to their specific duties and responsibilities. For example, the majority of instructors at both sites have recently completed training on Test Construction and Evaluation Procedures as part of their continuing training.

The program staff consists primarily of training department personnel who combine college-level educational experience with extensive background in industrial training. Guest lectures are drawn from both within and outside the GPUN corporate structure. "Graduates" of the Program with specialized skills are also recruited to handle particular topics in subsequent courses.

D. Courses for College Credit

The Training and Education Department is involved in an on-going effort to be sensitive to the Corporation's needs, as well as, the needs of its employees for professional growth and development. Therefore, the Training and Educational Development Sections at each site assist employees to acquire College Credits for self-development or toward the earning of an associate, bachelor, or advanced degree. In addition to an overall upgrading of the formal academic training of GPUN employees, this effort contributes to compliance with regulatory requirements, e.g., in the education of shift technical advisors.

One method for employees to obtain college credits is to have universities teach courses on-site, at convenient hours and available to all employees. Since the TMI-2 accident, six such courses have been offered at the TMI site: (1) Pennsylvania State University has taught courses in Radiation Shielding and Elements of Nuclear Engineering; (2) Iowa State University has taught a course in Heat Transfer and Fluid Flow in Nuclear Reactor Systems; and (3) Harrisburg Area Community College has taught courses in English Composition, Speedwriting and Business Writing Skills. At Oyster Creek, Monmouth College is currently offering a MBA program on-site. OC Training is also working with Monmouth College evaluating the possibility of offering an undergraduate engineering degree on-site.

GPUN, of course, sponsors employee participation in after-hours off-site courses at a variety of colleges and universities near the several employee work locations.

University Correspondence courses have been used to acquire college credit and assist the individual who has shift/work or family commitments. Three such courses in math and physics have been specifically offered at TMI with classroom instruction and tutorial assistance provided by T&E section staff members.

External degree programs, such as the New York Board of Regents, Thomas Edison College, and Elizabethtown University Adult External Degree Programs, allow employees to earn associate or bachelor degrees in various fields. Credit may be acquired through the evaluation of military training (about 25 credits recommended for Navy Nuclear Schools), College Level Examination Program (about 25 credits granted for the CLEP general battery), traditional classroom experience, correspondence courses, and work/life experience assessments.

Both site Training Departments are planning to have those training programs, which are fully developed and tested, evaluated by an accrediting agency, such as the American Council on Education, Thomas Edison College, New York Regents, Reilly (1981). This would permit granting of college credits at the appropriate level for a variety of in-house training programs such as those described in this paper. As was mentioned earlier, Oyster Creek employees have received twelve college credits for satisfactory completion of portions of the radiation technician training program which was taught in cooperation with Rutgers University. TMI intends to submit selected training programs late in 1983.

E. Engineer/Technical Training

Several courses have been developed to familiarize new professional employees with nuclear technology. A 36-hour course based on the text, Nuclear Energy Technology, Knief (1981), is used to provide a broad base of understanding of the fuel cycle and light water reactor design. This course has been taught for college credit (P.S.U.) by Dr. R. A. Knief, adjunct professor.

This has been followed by more specialized instruction in BWR Systems, specifically for the Oyster Creek Nuclear Generating Station. A special 40-hour BWR/PWR Technology Course has been taught to plant engineers at Oyster Creek and TMI respectively. The TMI systems course for plant engineers will be conducted on-site in June '83.

With the recognition that there will be an ongoing need for new engineers from various disciplines to compensate for organization growth and attrition, a new engineering graduate training program is being developed. This will be an ongoing program for approximately 25 engineers per year. A combination of formal training and work assignments in various departments will provide a thorough background in nuclear power plant technology and in the variety of engineering activities associated with the support of nuclear power plants. The program content will range from the nuclear and plant technology courses already discussed to licensing, regulation, and communication skills. This program is expected to extend over a two year period with approximately 25% of the time spent in the classroom. On-the-job training and classroom instruction generally will take place at the Parsippany Headquarters and one or the other nuclear plant sites.

Another program worth special note is the Senior Management TMI-1 Training Program which was presented to the TMI-1

Emergency Support Directors*, Emergency Directors*, and other appropriate GPUN technical Division Directors. This program provided about 36-hours of formal training on TMI-1 plant systems which is required for the control and mitigation of adverse effects of abnormal plant operating conditions. Using staff members from the technical divisions as instructors, the TMI Manager of Training coordinated the course, particularly the development of carefully stated behavioral learning objectives appropriate to the roles of the Directors during activation of the site emergency plan.

## VIII. SUMMARY

GPUN has made a significant commitment to improved training of all personnel involved in nuclear plant operations and support. This dynamic effort is demonstrated by the large increases in the numbers and quality of training personnel, improvements in training facilities, commitment to purchase basic principles trainers and replica simulators, implementation of a six-shift rotation with a five-day training week, revision and upgrading of operator training and requalification programs, and the significant expansion of training for all categories of GPU Nuclear personnel.

* These are positions held by senior management personnel during activation of the site emergency plan.

## ACKNOWLEDGMENT

The authors gratefully acknowledge the direct contributions of many Training and Education Department Staff Members who helped prepare this paper. In addition, we want to further acknowledge that this paper only modestly reflects the dedication and enthusiasm of the GPUN instructors and staff who have designed and delivered the programs described in this paper.

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TABLE 1

SUMMARY OF TRAINING RECOMMENDATIONS*

A. Operator training needs to be added or improved in the following areas:

1. Methods which would be employed to keep plant in post-accident safe shutdown condition.

2. Stress on the proper perspective between reactor safety and equipment protection.

3. Fundamental processes and basic subjects including physics, chemistry, heat transfer, thermodynamics and their interactions in plant operation for abnormal conditions and transient responses.

4. Recognition of significance of high radiation levels.

5. Recognition of loss of coolant accident and response for the first several hours.

6. Diagnosing and controlling unexpected equipment malfunction, serious transients and events that cannot be easily understood.

7. Comprehensive ongoing training and retraining of all levels to maintain their level of knowledge.

8. Formally defined training for all operators (should not be self-study).

9. Supervisory skills training for all supervisory personnel.

10. Interactions of surveillance and maintenance activities.

11. Integration of operating experience.

12. Direct training of skills and knowledge required of the operators to satisfy job requirements.

13. Include the use of plant systems already installed to control or mitigate the consequences of accidents in which the core is severely damaged.

14. Include additional training of the combined shift crew.

*This includes recommendations from the following references: Kemeny (1979), NUREG-0578 (1979), NUREG-0585 (1979), NUREG-0660 (1980), Roddis (1980), and Rogovin (1980).

15. Shift managers knowledgeable in reactor engineering and physics should be provided training in plant characteristics at least equivalent to SRO with special emphasis on integrated response and investigation techniques and reporting methods for events involving human behavior.

16. Training should recognize events beyond current licensing design basis events can occur.

17. Regular, improved simulator training should be included in operator training including how to diagnose and control transients, small break LOCA's and when or if going solid is permissible.

18. Are the desired objectives of simulator training being fulfilled?

19. Adequate and timely training on procedures and their revisions should be provided, not just placement in a required reading book.

20. Procedure training lesson plans should include covering objectives that appear in the procedures.

21. Assure that all plant operations personnel understand their responsibilities regarding procedures and know how to initiate corrections to procedures.

22. Shift foremen are unable to give adequate attention to their training responsibilities.

23. Training of operators should be more closely associated with the procedures they use and include instructions on what to do if procedures do not apply.

B. Emergency Plan training should provide for training in the following areas:

1. Ensure that all plant and staff personnel are thoroughly familiar with their responsibilities in the revised Emergency Preparedness Plan.

2. Personnel should be instructed in how to perform routine evolutions in a high radiation environment, e.g., drawing samples, surveying, etc.

3. Establish drills and provide training which involve Federal, State and Local agencies.

4. Training in proper communication techniques and practices is needed.

C. Training of personnel other than operating personnel should be reviewed and adequate programs established. This should include interactions with Operations during testing and maintenance activities.

D. General Employee Training in the area of personnel and radiation safety should be improved as well as training on procedures which involve all site personnel.

E. In the area of training administration and control, the following areas have been identified as needing improvement:

1. Integrate the entire Nuclear Training System within a single organizational framework to realize the opportunities for improved operational performance through training.

2. Establish a local training center at TMI.

3. Determine the need for and types of training needs, including differentiation of problems that can be solved by training from other management, personnel and operating weaknesses.

4. Justify the acceptability of training programs on the basis that these programs provide assurance that safety-related functions will be effectively carried out. Documentation of review and justification should be retained on site. The preferred method is task analysis with tasks and responsibilities defined and training in conjunction with education and experience identified to provide assurance that tasks can be effectively carried out.

5. Determination of the characteristics and capabilities of trainees (participant analysis).

6. Establishment of criteria or objectives for each course in consonance with plant requirements.

7. Design and document courses to extend the capability of trainees to meet the criteria or objectivbes for specific courses.

8. Provide for training and periodic updating as well as supervision of course developers and instructors, including how to reinforce lesson objectives and how to assist trainees in understanding materials, to ensure efficient and effective delivery of well-designed courses.

9. Development of techniques and procedures for evaluating the quality of course material and instruction as well as the students' success in meeting course objectives, including tests and quizzes which measure trainees' ability to perform effectively.

10. Provide for feedback to trainees on their own strengths and weaknesses.

11. Provide for evaluation of trainees' performance during simulator training to determine competence to function during emergencies.

12. Management observation of training at the simulator and site should be practiced to enhance the training attitude and stress the importance associated with training.

F. In the area of Training Resources and Facilities, the following items of concern have been indicated:

1. Evaluation and establishment of the resources required for training in terms of both staff and availability of student time for training.

2. Evaluation of establishment of adequate facilities on a temporary basis and long-term in which to present broadly based training for management personnel, control room operators, other operators, technicians and maintenance personnel. Facilities should include control room simulator(s) which duplicate every significant feature which the operator observes or manipulates, as well as other equipment needed to provide adequate part-task training in operations and maintenance.

TABLE 2

GPUN FULL-TIME TRAINING PERSONNEL

| | PRE-TMI-2 ACCIDENT | March, 1983 |
|---|---|---|
| Corporate Headquarters | 0 | 5 |
| Oyster Creek | 3 | 37 |
| Three Mile Island | 7 | 55 |
| Totals | 10 | 97 |

*Includes 6 and 5 contractors at Oy
respectively.

TABLE 3

BREAKDOWN OF NUMBER OF SITE TRAINING PERSONNEL

| TRAINING FUNCTION | OYSTER CREEK | TMI |
|---|---|---|
| Manager and Admin | 9 | 11 |
| Operating Training | 8 | 15 |
| Technician Training | 8 | 12 |
| Training & Education Development[1] | 4 | 4 |
| Support Personnel Training[2] | 8 | 10 |
| Totals | 37 | 52 |

Simulator Development

[1] Includes instructor and management/superviso

[2] Includes security, fire brigade, and emergency response training.

TABLE 4

LEARNING OBJECTIVE TOPICS
FOR
TMI BASIC PRINCIPLES TRAINER

Reactor Principles

Integrated Plant Operations

RCS Pressurizer Operations

Feedwater System

Emergency Feedwater

Main Steam System

Turbine Generator System

Make-up and Purification System

Emergency Safeguards Actuation System

Decay Heat Removal System

Integrated Control System

Core Flood System

Condensate System

Condenser Circulating Water (Vacuum) System

Reactor Coolant System

Reactor Coolant System Drain Tank

Control Rods, Reactor Core

Once Through Steam Generators

## TABLE 5

## LEARNING OBJECTIVE TOPICS
## FOR
## OYSTER CREEK BASIC PRINCIPLES TRAINER

Reactor Principles

Reactor Kinetic Principles

Thermodynamic Principles

Fluid Flow Principles

Physical Science Principles

Electrical Principles

Instrumentation Principles

Control System Principles

Integrated Relationships of Overall Plant Principles

## TABLE 6

## GPUN MANAGER DEVELOPMENT PROGRAM

<u>Phase 1</u>

Roles and Functions of Managers
Intrapersonal Processes
Meeting/Seminar with VP TMI-1, Director TMI-2, and other VPs, as appropriate

<u>Phase 2</u>

Interpersonal Processes
Organizational Processes
Meeting/Seminar with VP, OC, and other VPs, as appropriate

<u>Phase 3</u>

Organizational Processes
Goals and Objectives/GPUN as an Organization
President/OOP Roundtable

courses in systems, integrated responses, or transients, a limitation which comforms with the current guidance provided by the NRC (e.g., in NUREG-0660).

Auxiliary operators are the most junior members of the shift operating staff. There are approximately 42 auxiliary operators employed at TMI-1. These individuals are divided into three levels, C, B, and A, based upon seniority, associated training, and level of responsibility. In order to be admitted into the auxiliary operator training program, an individual must have graduated from high school, with a course in algebra or hold an equivalency certificate. Prospective auxiliary operators are interviewed by the Supervisor of Operations, who considers their maturity and their potential for advancement through the shift operating chain of responsibility. During his first 90 days as an auxiliary operator, an individual is on "probation" and can be removed from the program by the Supervisor of Operations for unsatisfactory performance.

Before describing the present operator training program, the previous program will be briefly reviewed. In the past the Aux Operator "C" would spend approximately 13 weeks in formal classroom training on areas including basic steam cycle, mechanical fundamentals, electrical fundamentals, secondary plant systems, switching and tagging, and plant safety rules/practices. During this classroom training weekly tests and a final comprehensive examination were administered. Seventy percent (70%) overall with no minimum qualification per section was the minimum passing grade and failures were reexamined approximately one week later. Failure of both the initial exam and reexam of a weekly test or the final exam resulted in dismissal from the program. Following this initial training the operator would spend the rest of his first year as an auxiliary operator in the plant performing on-the-job training and qualification under the supervision of Operations Department personnel. At the end of the first year a comprehensive oral and written exam was administered. The oral exam was graded on a pass/fail basis and the written exam guidelines were the same as those for the initial classroom phase. Additionally, a high school level trigonometry course had to be completed.

When all these prerequisites were met, the auxiliary operator was promoted to Aux Operator "B" and advanced to the next stage of training. Failure to meet the prerequisites resulted in his being dropped from the program. During his second year the Aux Operator "B" returned to the classroom for approximately seven weeks of instruction on primary systems and advanced health physics, with the examination being administered in the same manner as those during the initial classroom phase, except that failures were evaluated on a case-by-case basis rather than resulting in automatic removal from the program. The remainder of the second year was spent on shift conducting on-the-job-training as before. At the end of the second year oral and written exams were administered as at the end of the first year. Also, during the second year the operator must have completed a high school level physics course. Meeting all these prerequisites resulted in promotion to the highest level of Auxiliary Operator "A"; failure to do so resulted in removal from the program.

A new formal training program for auxiliary operators has been developed and is undergoing management review. This formal training program, scheduled to be in effect in January 1981, and starting semi-annually thereafter, will be two years in duration and will begin with approximately one year of classroom instruction followed by approximately one year of on shift on-the-job training and experience. (In this program, it is possible for the new auxiliary operator trainee to spend as much as six months on shift prior to commencement of the formal training program, during which the trainee would serve as a helper under the supervision of a certified aux operator.) The trainee must satisfactorily complete the entire two year program prior to classification as a fully qualified Auxiliary Operator "A". During the initial (classroom) phase of the program the Auxiliary Operator "C" attends lectures, receives assignments, has specified study periods and is periodically tested for eight hours each day, five days each week, in a

Navy may be accepted directly into the CRO replacement training program; however, it is required that these individuals go through the primary- and secondary-systems training programs developed for the TMI-1 auxiliary operators and spend approximately 12 weeks on shift in on-the-job training in addition to participating in the regular CRO replacement training program.

As with the AO trainees, the previous training program will be briefly reviewed. CRO candidates formerly embarked upon a nine month program consisting of self-study, classroom and on-the-job training in areas including primary and secondary plant systems, support systems, normal, abnormal, and emergency procedures, technical specifications, reactor theory, fuel handling, heat transfer, fluid flow, and thermodynamics. The self-study program was divided into six sections with each section requiring completion of questionnaires, two written exams and an oral exam. The oral exam was graded on a pass/fail basis and the written exams required a 70% overall passing score. Failures resulted in a reexam. Failures on the reexam were handled on a case-by-case basis. The on-the-job training was supervised on-shift by Operations Department personnel and consisted of a practical evaluations sheet requiring discussions, simulation, and performance of procedures and evolutions. In preparation for his simulator startup certification and licensing examination, the CRO candidate received approximately five weeks of classroom training near the end of his nine month program. The classroom training consisted of a review of many of the items noted above and was the vehicle for the training in reactor theory and heat transfer, fluid flow, and thermodynamics.

Following the classroom training, the CRO candidate underwent three weeks of simulator training including a startup certification examination by the simulatory instructors at the Babcock & Wilcox simulator in Lynchburg, Virginia. At the completion of this training the candidate took a mock NRC written and oral examination. Successful completion of this examination or a reexamination (70% overall for the written) was a requirement for taking the licensing examination administered by the NRC.

Under the new program, scheduled in conjunction with the new auxiliary operator program to be in effect in January 1981, the candidate CRO will participate in a nine month training program consisting of four phases. Phase one will be six weeks of classroom training mainly in primary, secondary and support systems. During this phase weekly written topical exams will be given, with a passing grade of 70% required. Reexams will be given for all failures within ~~one~~ two weeks. Failure of a second written examination will require the Supervisor of Unit 1 Operations and the Supervisor of Operator Training to evaluate the student's performance and decide on the corrective action to be taken.

The TMI-1 Supervisor of Operations, shift supervisors, and shift foremen are required to hold a senior reactor operator (SRO) license which, like the CRO license, is awarded by the NRC upon successful completion of SRO examinations. SROs must also be requalified every two years. In order to qualify to become an SRO, an individual must have served as a TMI-1 CRO for a minimum of one year. In the past, Licensee's SRO training programs were primarily self-study programs specified to meet the needs of the individual. Initially, the candidate SRO was given a mock NRC written and oral exam. From these exams, Licensee could discern the subject areas in which the candidate SRO needed additional training. An approximately two hundred hour training program, consisting largely of self-study and homework was designed for the candidate SRO, ending with a second mock NRC exam. The candidate SRO also paralleled an on-duty shift foreman in order to get on-the-job training. In addition to fully revising its replacement and requalification programs for CROs, Licensee is in the process of devising a more formal program for new SROs. Licensed SROs presently participate in the regular operator requalification program, but are required to have a higher level of comprehension as demonstrated on the examinations.

BY WITNESSES LONG, KNIEF, NEWTON AND ROSS

The requalification program described above is the program Licensee had in place or has implemented as part of the regular

Chuck, Bruce, Ed, & Scott
Info/comment on ~~[illegible]~~ use of trng dept in any/all of the required evolutions Jan

Date April 13, 1983

Subject TMI-1 RESTART QUALIFICATION CARD

3200-83-197

To Shift Supervisors, TMI-1
R. E. Boyer
T. L. Crouse
D. C. Janes
B. A. Mehler
L. G. Noll
D. E. Smith

Location TMI Nuclear Station

The enclosed qual card is to be used by you to document in plant training exercises and evolutions performed by your crew. Over the next 3-4 months, many opportunities will exist to perform this training. You should ensure that every opportunity is utilized for training your crews.

This card was developed for several reasons:

1. There are a number of people who, in their present positions have never seen the plant at power.

2. There are a number of evolutions that, if performed incorrectly, could result in an undesirable transient.

3. It has been over four years since our experienced operators have performed many of the evolutions listed.

4. The simulator goes only so far in simulating an operating plant; also, AOs don't receive the benefit of this training.

5. It is conceivable that with a six shift schedule some operators may not be at the right place at the right time. Therefore, they will not have a sufficient amount of hands on training.

The card is divided into four sections: Primary, Secondary, PE/LPPT, and Surveillance TEsting. Attachment 1 lists several instructions to follow in performing the training and completing the card. Attachment 2 is a summary of all requirements that you may want to give to your crews.

I have a great deal of confidence in our crews to safely operate the unit. However, we have all expressed the benefits of this type of training. The qual cards will help us keep track of who has done what. I do not intend this card to place a significant amount of additional burden on either plant personnel or equipment.

M. J. Ross

M. J. Ross
Manager-Plant Operations, TMI-1

RJ Toole

R. J. Toole
Operations & Maintenance
Director, TMI-1

RJT/MJR/RSH/amh
attachments

cc H. D. Hukill, Vice President-TMI-1
R. S. Harbin, Training Coordinator, TMI-1
S. Newton, Operator & Tech Training Manager
CARIRS

# RESTART QUAL CARD INSTRUCTIONS

1. Each Shift Supervisor is to maintain his crew's qual card. However, the Shift Supervisor should make every operator on his shift aware of their responsibility for participating in evolutions that take place and ensuring it is properly documented.

2. Participation will be documented by the Shift Supervisor by entering the name of the operator that performed the evolution under the appropriate column.

3. Some evolutions may be done once by a crew. These are identified by a (C). Enter the names of only those who directly participated ie. don't enter the name of your primary AO when the remainder of the crew participates in startup of the CW system.

4. It is not the intent to have every individual and every crew signed off for each item. The intent is for you to give each operator and each crew an opportunity to participate in evolutions they would benefit from. However, you will have to justify any blanks on the card before it will be considered complete. If you have people on your crew that are very experienced in an evolution, this will be justification for excluding them from participation. These people should be placed to stand primary watche: when secondary evolutions are in progress and vice versa. It will be up t( you to ensure that those who need the training participate.

5. An individual must participate in the majority of an evolution to be signe( off (ie. the critical steps of the evolution).

6. All evolutions are to be performed and not simulated, although it may be necessary and appropriate to have each operator simulate parts of an evolution (ie don't walk through startup of the CW system - do it when it is scheduled).

7. Some evolutions are to be performed by each individual. These are indicated by an (I).

8. You should do everything possible to ensure as much hands on experience as possible without unnecessarily starting and stopping equipment. You shoul( become sufficiently familiar with the PE/LPPT/HFTT schedule to know when evolutions will be performed for testing. If, at the end of this testing, some of the evolutions have not been performed by your crew, I will evalua: performing these strictly for the sake of training.

9. Several of the surveillances are primarily I&C in scope. The I&C departme: has developed a similar card for their techs. We should ensure our crews participate with I&C when the surveillances are scheduled. Because this participation often consists of simply having one person on a headset and during a two hour period pushing two or three buttons, you should discuss the aspects of the surveillance that may affect operations (sound alarms, place the plant protective system in a more limiting mode, etc.).

PRIMARY

1. CRD - Transfer rods to aux power supply (I).
2. CRD - Walk thru dropped rod recovery & location of S2 bypass, safety, rod out bypass, dilution permit bypass (C).
3. CRD - Adjust relative rod position IW CR (I).
4. RCPS - Verify prerequisites for pump start (seal flow, IC flow etc.) & set up pump for startup including oil system operation. Discuss starting interlocks (I).
5. RCPS - Operate RC pumps in parallel with the DH removal system (C).
6. Int Closed Cooling - Shift int closed pump (C).
7. Int Closed Cooling - Verify proper Δ P across CRDM filters: discuss limits (C).
8. Int Closed Cooling - Walk thru or perform CRD filter isolation & draining (2 AOs at a time).
9. Makeup & Purif - Establish normal makeup & letdown - re iew limits on number of filters & demins VS letdown flow (C).
10. Makeup & Purif - Shift makeup pumps including transfer of B pump breakers to alt bus (C).
11. Makeup & Purif - Verify proper seal injection & return filter Δ P. Discuss how to isolate & change supply & return filters. Review limits (I).
12. Makeup & Purif - Establish daisy chain letdown & Makeup paths thru the bleed tanks to clean the RCS system (C).
13. Makeup & Purif - Regulate RCP seal leakoff adjustment at PI-39 (I).
14. Makeup & Purif - Make an addition to the makeup tank. Include a calculation to deborate by 2 ppm. Use batch controller & discuss interlocks (I).
15. Makeup & Purif - Regulate makeup tank overpressure. Discuss reason for max makeup tank pressure (I).
16. Pressurizer - Control pzr spray & heaters. Discuss input signal source (C).
17. Pressurizer - Discuss new T.S. on PORV operability (C).
18. Pressurizer/RCS - Control RCS presssure in bank to allow simultaneous operation of RCP's & DH removal system (C).
19. RCS - Plot 1/m curve during rod withdrawal & deboration (C).
20. Pressurizer - Discuss how to shift signal inputs to pressurizer controls & ICS inputs (I).
21. Pressurizer - Transfer group 8 or 9 heater to P or S 480v bus (C).
22. Participate in plant heatup & cooldown as specified by operating procedures (C).

SECONDARY

1. Startup/shutdown CW System (C).
2. Place amertap in service and secure (C).
3. Place CW Cl & Acid Sys in service & secure (C).
4. Establish condensate sys on recirc. Shift one condensate pump. No flow thru heaters unless authorized (C).
5. Fire Aux Boilers & perform valve lineup to support vacuum operations (to seals) (C).

SECONDARY (continued)

6. Place condensate chemical feed in service & secure (C).
7. Place main turbine on turning gear (C).
8. Place main feed pumps on turning gear (C).
9. Demonstrate how to regulate main turbine exhaust hood spray (I).
10. Establish seals & vacuum on main turbine (C).
11. Establish seals & vacuum on both feed pumps (C).
12. Demonstrate makeup to condensate tanks from IWT (C).
13. Shift to standby main & aux vacuum pumps (C).
14. Demonstrate how to makeup to the condensate head tank (C).
15. Run one feed pump turbine on aux steam (uncoupled or coupled - as directed) (C).
16. Run one powdex vessel thru a regen cycle (with or without resin - as directed) (C).
17. Establish FW heating & flow thru heaters (if authorized) (C).
18. Run one cond booster pump or recirc (if authorized) (C).
19. Operate the powdex system bypass valve from the control room. Verify holding pump operation on powdex vessel (C).

PE/LPPT/HFT

1. Participate in or observe natural cicrulation (C).
2. Startup & parallel a main feed pump with a running pump (C).
3. Place a powdex vessel in service. Coat the vessel removed. Operate the backwash recovery system (I).
4. Walk thru or complete a plant precritical checkoff per 1102-2 (C).
5. Complete a turbine plant startup. This includes bring Rx power up, putting turbine & generator on line & increasing power to approximately 40% (C).
6. Complete main turbine & feed pump valve testing (C).

SURVEILLANCES

1. 1303-4.11. HPI/LPI logic & analog channels (C).
2. 1403-4.14. Rx bldg 30 psig analog channels (C).
3. 1303-4.19. HPI/LPI analog channels (C).
4. 1303-5.1. Rx bldg cooling & isolation logic channel & component test (C).
5. 1303-5.2. Loading sequence & component test (C).
6. 1303-11.8. HPI injection (C).
7. 1303-11.9. Rx bldg emergency cooling (C).
8. 1303-11.10. ESAS sequence & power transfer (C).
9. 1303-11.54. LPI injection (C).
10. 1302-1.1. Power range calibration (CRO portion only).
11. 1303-4.1. Rx protection sys (C).
12. 1301-1. Shift & Dailys in cold shutdown (C).
13. 1301-1. Shift & Dailys in hot shutdown (C).
14. 1301-1. Shift & Dailys at 40% power (C).

GPU NUCLEAR

# THREE MILE ISLAND

## NUCLEAR GENERATING STATION

UNIT 1

RESTART

QUALIFICATION CARD

TMI-1

RESTART QUALIFICATION CARD

CREW A

| | |
|---|---|
| SHIFT SUPERVISOR: | L. G. Noll |
| SHIFT FOREMAN: | D. A. Smith<br>S. W. Brantley |
| CONTROL ROOM OPERATORS: | B. J. Keller<br>J. W. Randisi<br>J. L. Masters<br>D. G. Treadway |
| AUXILIARY OPERATORS: | M. B. Snyder<br>R. A. Gingrich<br>T. P. Stackpole<br>D. R. Dougherty<br>G. Herneisey<br>C. F. McKinney, Jr.<br>D. R. Klinepeter |

TMI-1

RESTART QUALIFICATION CARD

CREW B

| | |
|---|---|
| SHIFT SUPERVISOR: | D. E. Smith |
| SHIFT FOREMAN: | H. K. Olive |
| CONTROL ROOM OPERATORS: | M. B. Bezilla<br>D. B. Mayhue<br>M. E. Wynne |
| AUXILIARY OPERATORS: | J. E. Kimmey<br>D. T. Calnan<br>D. A. Trump<br>D. E. Althouse<br>C. S. Bulger<br>J. E. Boltz<br>G. S. Flowers<br>J. C. Enders |

TMI-1

RESTART QUALIFICATION CARD

CREW C

| | |
|---|---|
| SHIFT SUPERVISOR: | B. A. Mehler |
| SHIFT FOREMAN: | G. M. Davis |
| CONTROL ROOM OPERATORS: | R. S. Campbell<br>D. Hass<br>J. E. Moore |
| AUXILIARY OPERATORS: | C. W. Keyser<br>J. Stupak<br>R. E. Neff<br>D. J. Gorse<br>C. H. Good<br>R. E. Kennedy<br>K. E. Lutz |

TMI-1

RESTART QUALIFICATION CARD

CREW D

SHIFT SUPERVISOR: D. C. James

SHIFT FOREMAN: J. C. Herman

CONTROL ROOM
OPERATORS:
N. J. Monson
P. F. Chalecki
R. H. Maag
D. T. Niland

AUXILIARY
OPERATORS:
R. N. Boehmer
D. F. Spath
S. L. Turns
F. R. Waple
C. L. Youtz
R. E. Hahn
J. E. McKinney, Jr.

TMI-1

RESTART QUALIFICATION CARD

CREW E

| | |
|---|---|
| SHIFT SUPERVISOR: | R. E. Boyer |
| SHIFT FOREMAN: | W. A. Fraser |
| CONTROL ROOM OPERATORS: | R. A. Heilman<br>M. D. Willenbecher<br>J. R. Gallagher<br>J. J. Walsh |
| AUXILIARY OPERATORS: | F. M. Ditzler<br>A. M. Horney<br>J. L. Fishell<br>H. L. Carr<br>S. M. Fuhrman<br>C. D. Glusco<br>R. M. Stotz |

TMI-1

RESTART QUALIFICATION CARD

CREW F

| | |
|---|---|
| SHIFT SUPERVISOR: | T. L. Crouse |
| SHIFT FOREMAN: | S. K. Martin |
| CONTROL ROOM OPERATORS: | T. H. Goodlavage<br>G. J. Bixler<br>R. C. Bugelholl<br>R. J. Lane |
| AUXILIARY OPERATORS: | M. R. Baynard<br>K. A. Lebo<br>E. W. Tennis<br>J. P. Levengood<br>M. VanWinkle<br>J. J. O'Donnell<br>J. A. Flowers |

## PRIMARY

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 1. CRD - Transfer rods to aux. power supply. (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 2. CRD - Walk thru dropped rod recovery & location of S2 bypass, safety, rod out bypass, dilution permit bypass. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 3. CRD - Adjust relative rod position in C.R. (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

# PRIMARY

| | SRO/CRO | Date | AO | Date | AO | Dat |
|---|---|---|---|---|---|---|
| 4. RCPs - Verify prerequisites | | | N/A | | N/A | |
| for pump start (seal flow, | | | N/A | | N/A | |
| IC flow etc.) & set up pump | | | N/A | | N/A | |
| for startup including oil | | | N/A | | N/A | |
| system operation. Discuss | | | Comments: | | | |
| starting interlocks. (I) | | | | | | |
| | | | | | | |
| 5. RCPs - Operate RC pumps | | | N/A | | N/A | |
| in parallel with the DH | | | N/A | | N/A | |
| removal system. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 6. Int. Closed Cooling - | | | N/A | | N/A | |
| Shift int. closed pump. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## PRIMARY

| | SRO/CRO | Date | AO | Date | AO | Dat |
|---|---|---|---|---|---|---|
| 7. Int. Closed Cooling - Verify | | | | | | |
| proper $\Delta P$ across CRDM | | | | | | |
| filters: discuss limits. | | | | | | |
| (C) | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 8. Int. Closed Cooling - Walk | N/A | | | | | |
| thru or perform CRD filter | N/A | | | | | |
| isolation & draining. | N/A | | | | | |
| (Do this in groups of | N/A | | | | | |
| 2 at a time) | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| 9. Makeup & Purif. - Establish | | | N/A | | N/A | |
| normal makeup & letdown - | | | N/A | | N/A | |
| review. limits on number of | | | N/A | | N/A | |
| filters & demins. vs. | | | N/A | | N/A | |
| letdown flow. (C) | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

# PRIMARY

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 10. Makeup & Purif. - Shift | | | N/A | | N/A | |
| makeup pumps including trans- | | | N/A | | N/A | |
| fer of B pump breakers to | | | N/A | | N/A | |
| alt. bus. (I - if possible) | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 11. Makeup & Purif. - Verify | N/A | | | | | |
| proper seal injection & | N/A | | | | | |
| return filter ΔP. Discuss | N/A | | | | | |
| how to isolate & change | N/A | | | | | |
| supply & return filters. | N/A | | Comments: | | | |
| Review limits. (I) | N/A | | | | | |
| | N/A | | | | | |
| 12. Makeup & Purif. - Establish | | | | | | |
| daisy chain letdown & makeup | | | | | | |
| paths thru the bleed tanks | | | | | | |
| to clean the RCS system. (C) | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 13. Makeup & Purif. - Regulate | N/A | | | | | |
| RCP seal leakoff adjustment | N/A | | | | | |
| at PI-39. (I) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| 14. Makeup & Purif. - Make an | | | N/A | | N/A | |
| addition to the makeup tank. | | | N/A | | N/A | |
| Include a calculation to | | | N/A | | N/A | |
| deborate by 2 ppm. Use | | | N/A | | N/A | |
| batch controller & discuss | | | Comments: | | | |
| interlocks. (I) | | | | | | |
| | | | | | | |
| 15. Makeup & Purif. - Regulate | | | N/A | | N/A | |
| makeup tank overpressure. | | | N/A | | N/A | |
| Discuss reason for max. | | | N/A | | N/A | |
| makeup tank pressure. (I) | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |



0576K

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 16. Pressurizer - Control pzr. | | | N/A | | N/A | |
| spray & heaters. Discuss | | | N/A | | N/A | |
| input signal source. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 17. Pressurizer - Discuss new | | | N/A | | N/A | |
| T.S. on PORV operability. | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 18. Pressurizer/RCS - Control | | | N/A | | N/A | |
| RCS press. in bank to allow | | | N/A | | N/A | |
| simultaneous operation of | | | N/A | | N/A | |
| RCP's & DH removal sys. (C) | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

| | SRO/CRO | Date | AO | Date | AO | D |
|---|---|---|---|---|---|---|
| 19. RCS - Plot 1/m curve during rod withdrawal & deboration. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 20. Pressurizer - Discuss how to shift signal inputs to pressurizer controls & ICS inputs. (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 21. Pressurizer - Transfer group 8 or 9 heater to P or S 480v bus. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 22. Participate in plant heatup & cooldown as specified by operating procedures. (C) | | | | | | |

Comments:

SECONDARY

| | SRO/CRO | Date | AO | Date | AO | Dat |
|---|---|---|---|---|---|---|
| 1. Startup/Shutdown C.W. Sys. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 2. Place amertap in service and secure. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 3. Place C.W. Cl & Acid Sys. in service & secure. (C) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |

# SECONDARY

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 4. Establish condensate sys. on recirc. Shift one condensate pump. (No flow thru heaters unless authorized.) (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 5. Fire Aux. boilers & perform valve lineup to support vacuum operation (to seals). (C) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| 6. Place condensate chemical feed in service & secure. (C) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 7. Place main turbine on turning gear. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 8. Place main feed pumps on turning gear. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 9. Demonstrate how to regulate main turbine exhaust hood spray.. (I) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## SECONDARY

| | SRO/CRO | Date | AC | Date | AO | D |
|---|---|---|---|---|---|---|
| 10. Establish seals & vacuum on main turbine. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 11. Establish seals & vacuum on both feed pumps. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 12. Demonstrate makeup to condensate tanks from IWT. (C) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |

| Item | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 13. Shift to standby main & aux. vacuum pumps. (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 14. Demonstrate how to makeup to the condensate head tank. (C) | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| 15. Run one feed pump turbine on aux. steam (uncoupled or coupled - as directed). (C) | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## SECONDARY

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 16. Run one powdex vessel thru | N/A | | | | | |
| a regen. cycle (with or | N/A | | | | | |
| without resin - as directed). | N/A | | | | | |
| (C) | N/A | | | | | |
| | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |
| 17. Establish F.W. heating & | | | | | | |
| flow thru heaters (if | | | | | | |
| authorized). (C) | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 18. Run one cond. booster pump | | | N/A | | N/A | |
| or recirc. (if authorized). | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 19. Operate the powdex system | | | N/A | | N/A | |
| bypass valve from the control | | | N/A | | N/A | |
| room. Verify holding pump | | | N/A | | N/A | |
| operation on a powdex vessel. | | | N/A | | N/A | |
| (C) | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## POWER EXCALATION/PHYSICS TESTING EVOLUTIONS

| | SRO/CRO | Date | AO | Date | AO | Dat |
|---|---|---|---|---|---|---|
| 1. Participate in or observe | | | N/A | | N/A | |
| natural circulation. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 2. Startup & parallel a main | | | | | | |
| feed pump with a running | | | | | | |
| pump. (I - if possible) | | | | | | |
| | | | | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 3. Place a powdex vessel in | N/A | | | | | |
| service. Coat the vessel | N/A | | | | | |
| removed. Operate the | N/A | | | | | |
| backwash recovery system. | N/A | | | | | |
| (I) | N/A | | Comments: | | | |
| | N/A | | | | | |
| | N/A | | | | | |

POWER EXCALATION/PHYSICS TESTING EVOLUTIONS

| | SRO/CRO | Date | AO | Date | AO | Da |
|---|---|---|---|---|---|---|
| 4. Walk thru or complete a | | | N/A | | N/A | |
| plant precritical checkoff | | | N/A | | N/A | |
| per 1102-2. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 5. Complete a turbine plant | | | | | | |
| startup. This includes | | | | | | |
| bringing Rx power up, | | | | | | |
| putting turbine & generator | | | | | | |
| on line & increasing power | | | Comments: | | | |
| to approximately 40%. (C) | | | | | | |
| | | | | | | |
| 6. Complete main turbine & | | | N/A | | N/A | |
| feed pump valve testing. | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## SURVEILLANCES

| | SRO/CRO | Date | AO | Date | AO | Date |
|---|---|---|---|---|---|---|
| 1. 1303-4.11 | | | N/A | | N/A | |
| HPI/LPI logic & analog | | | N/A | | N/A | |
| channels. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 2. 1403-4.14 | | | N/A | | N/A | |
| Rx. Bldg. 30 psig analog | | | N/A | | | |
| channels. (C) | | | N/A | | | |
| | | | N/A | | | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 3. 1303-4.19 | | | N/A | | N/A | |
| HPI/LPI analog channels. | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## SURVEILLANCES

| | | SRO/CRO | Date | AO | Date | AO | Date |
|---|---|---|---|---|---|---|---|
| 4. | 1303-5.1 | | | N/A | | N/A | |
| | Rx. bldg. cooling & isolation | | | N/A | | N/A | |
| | logic channel & component | | | N/A | | N/A | |
| | test. (C) | | | N/A | | N/A | |
| | | | | Comments: | | | |
| | | | | | | | |
| | | | | | | | |
| 5. | 1303-5.2 | | | N/A | | N/A | |
| | Loading sequence & component | | | N/A | | N/A | |
| | test. (C) | | | N/A | | N/A | |
| | | | | N/A | | N/A | |
| | | | | Comments: | | | |
| | | | | | | | |
| | | | | | | | |
| 6. | 1303-11.8 | | | N/A | | N/A | |
| | HPI injection. (C) | | | N/A | | N/A | |
| | | | | N/A | | N/A | |
| | | | | N/A | | N/A | |
| | | | | Comments: | | | |
| | | | | | | | |
| | | | | | | | |

## SURVEILLANCES

| | SRO/CRO | Date | AO | Date | AO | Date |
|---|---|---|---|---|---|---|
| 7. 1303-11.9 | | | N/A | | N/A | |
| Rx. Bldg. emergency cooling. | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 8. 1303-11.10 | | | N/A | | N/A | |
| ESAS sequence & power | | | N/A | | N/A | |
| transfer. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 9. 1303-11.54 | | | N/A | | N/A | |
| LPI injection. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

## SURVEILLANCES

| | SRO/CRO | Date | AO | Date | AO | Date |
|---|---|---|---|---|---|---|
| 10. 1302-1.1 | | | N/A | | N/A | |
| Power range calibration | | | N/A | | N/A | |
| CRO portion only. | | | N/A | | N/A | |
| (C) | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 11. 1303-4.1 | | | N/A | | N/A | |
| Rx protection sys. (C) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 12. 1301-1 (Shift & Dailys) | | | N/A | | N/A | |
| Perform in cold shutdown. | | | N/A | | N/A | |
| (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

SURVEILLANCES

| | SRO/CRO | Date | AO | Date | AO | Dat |
|---|---|---|---|---|---|---|
| 13. 1301-1 (Shift & Dailys) | | | N/A | | N/A | |
| Perform in hot shutdown. | | | N/A | | N/A | |
| (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |
| 14. 1301-1 (Shift & Dailys) | | | N/A | | N/A | |
| Perform at 40% power. | | | N/A | | N/A | |
| (I) | | | N/A | | N/A | |
| | | | N/A | | N/A | |
| | | | Comments: | | | |
| | | | | | | |
| | | | | | | |

# Inter-Office Memorandum

GPU Nuclear

Date June 13, 1983

Subject OTSG TUBE RUPTURE TRAINING

To Sam Newton, Manager Plant Training

Location TMI Nuclear Station
6211-83-0516

During the period of June 6-9, 1983, the pilot program for OTSG Tube Rupture Guidelines was conducted at the Babcock and Wilcox Simulator in Lynchburg, Va. This program was held as an initial review for the training to be completed for operations personnel.

Classroom training was conducted on the following topics:
- Pressurized Thermal Shock
- Transient RCP Operation
- HPI Throttling Criteria
- EFW Throttling Criteria
- OTSG Tube Rupture Procedure
- Operations with OTSG Tube Leaks

Harry Heilmeier was receptive to the concept of having TMI prepare lesson plans for B&W use. In most cases the instructors were well prepared and a productive exchange of information occurred between the TMI training and operations personnel present and the B&W representative. This method of implementing simulator training was very effective and allowed TMI to outline those areas which required emphasis.

As the classroom sessions were presented some changes were made to the lesson plans being used, mainly to emphasize changes from previously established guidance. Major changes which were made are summarized below:

1. Changes from previous practices were indicated by bars in indices on lesson plans and transparencies.

2. EP 1202-5 was revised to reflect experiences gained at the simulator. These changes will be covered in future training.

3. Transparencies were developed to outline major changes from all areas in order to summarize major points to the operators for the three day program.

A0000648

Due to the number of changes made and the significance of the material covered, Denny Boltz was assigned to remain and observe the next training session. His goal was to ensure that training conducted by B&W was that which was agreed upon by Operations, Technical Functions, and Operator Training. During the period of June 13-17, Chuck Husted will be assigned as an observer with the same goal. Any changes to be made to the program are to be approved by the Operator Training Manager.

The instructors assigned by B&W should carry out the program as intended. Our goals for this program have been clearly stated to them. In my opinion, this program should be very effective.

Bruce Leonard
B. P. Leonard
Operator Training Manager

BPL/kvr

cc: CARIRS

# DRILL GUIDE

1. <u>General Description of the Drill</u> - Normal Reactor Startup from $10^{-8}$ amps to 50% power, including second MFP starting and Rod Surveillance Testing.

2. <u>Drill Objectives</u>

   A. Using OP 1102-2 perform plant startup from $10^{-8}$ amps to 50% full power.

   B. Place second feedpump in operation per OP 1106-3.

   C. Perform Control Rod Surveillance Testing on Rod Group 1 and Rod Group 5 per SP 1303-3.1.

3. <u>Method of Initiation</u>

   A. Initialize the simulator I.C. Number 6. $10^{-8}$ amps on the I.R. Boron 877 ppm.

4. Sequence of Expected Actions

   A. Place both letdown coolers in service.

   B. Increase reactor power to 5%, commence turbine warmup.

   C. At 15% power place turbine on grid.

   D. At 20% I.C.S. in auto. Verify available S.D.M.

   E. At 40% place second MFP in operation.

   F. Perform Rod Surveillance Testing per Tech. Specs on a Safety Group 1 and Regulating Group 5.

5. Point of Termination

   A. Reactor power greater than 50% and Rod Surveillance Testing completed on Group 5 and Group 1.

6. Documentation Requirements

   A. Drill 1 - Plant Starttup to 15% to 100%.

   B. Special Assignments:

| | |
|---|---|
| Reactor Operator | Plant Temperature Change Due to Heatup |
| Aux. Reactor Operator (Shift Tech. Advisor) | Plot Heatup Rate |

# DRILL GUIDE

1. General Description of the Drill - Loss of coolant accident with loss of subcooling.

2. Drill Objectives:

   A. Implement EP 1202-6A and 1202-6B, including:

      (1) Reactor Power Reduction

      (2) Reactor Shutdown

      (3) HPI Actuation

      (4) RCP Trip on Low SCM

      (5) HPI Throttling Criteria

      (6) RCP Restart Criteria

      (7) EFW Throttling Criteria

   B. E-Plan Implementation

3. Method of Initiation

   A. Initialize the simulator, I.C. Number 1 98% power steady state conditions.

   B. Malfunction number 15 with an initial flow rate of 0 lbm/sec and final flow rate of 300 lbm/sec over a time period of 200 secs.

4. Sequence of Expected Actions

   A. Attempt to locate and isolate leak.

   B. Leakrate determination

   C. Reactor power reduction - shutdown per EP 1202-6A.

   D. Implementation of EP 1202-6B.

5. Point of Termination

   The unit has been shutdown and cooldown to approximately 450°F and controlled cooldown in progress and subcooling greater than 25°F.

# DRILL GUIDE

1. General Description of the Drill - Loss of coolant accidents without loss of subcooling.

2. Drill Objectives

   A. Implementation of EP-1202-6A and EP 1202-6B, including:

      (1) Reactor Power reduction

      (2) Reactor Shutdown

      (3) HPI Actuation

      (4) RCP's remain running after HPI Actuation

      (5) HPI Throttling Criteria

      (6) Maintenance of OTSG Heat Sink

      (7) Cooldown Initiation

3. Method of Initiation

   A. Initialize the simulator I.C. Number 1 98% power. Steady state conditions.

   B. Malfunction Number 15 with an initial flow rate of C lbm/sec and a final flow rate of 40.0 lbm/sec over a time period of 200 secs.

4. <u>Sequence of Expected Actions</u>

   A. Attempt to locate and isolate leak

   B. Perform Leak Rate Calculation

   C. Perform Power Reduction - Reactor Shutdown

   D. Implementation of 1202-6B - RCP's remain running

   E. Controlled cooldown initiation.

5. <u>Point of Termination</u>

   A. The unit has been shutdown and cooldown to approximately 500°F and controlled cooldown in progress and subcooling greater than 25°F.

# DRILL GUIDE

1. General Description of Drill - Reactor trip by I&C error.

2. Drill Objectives -

   A. Implementation of Reactor Trip EP 1202-4

3. Method of Initiation - Reactor trip by initiating Failure 185. Inform operators I&C working in RPS Cabinets.

4. Sequence of Expected Actions -

   A. All rods (except Group 8) insert.

   B. Turbine trip, stop valves, close, generator breakers open.

   C. Source range high voltage energized at $5 \times 10^{-10}$ amps on N.I. -3 or 4.

   D. Trubine bypass valves open.

   E. Manually trip reactor.

   F. Trip turbine.

   G. Maintain pressurizer level.

H. Verify OTSG levels decreasing to 30".

I. Verify that turbine bypass control valves are maintaining header pressure at 1010 psig.

5. Point of Termination

A. Plant cooled down to 550°F.

B. Pressurizer level is maintained at 100".

C. Low level limits are being maintained in both OTSG's.

DRILL GUIDE

1. General Description of Drill - Tube leak "B" OTSG which is initially large enough to require a plant shutdown. During shutdown leak rate escalates to approximately 200 gpm.

2. Drill Objectives:

   A. Operator recognition of OTSG Tube Leak Shutdown Criteria.

   B. Implementation of EP 1202-5.

   C. E-Plan implementation.

3. Method of Initiation

   A. Initialize the simulator at 100% steady state power conditions (IC-1) (549 ppm boron).

   B. Use Drill 7 Malfunction 14. Initially set leak at 0.25 lb/sec, then escalate to 30 lb/sec after shutdown has been started.

   C. In response to operator questioning

      (1) OTSG Boron - approximately 25 ppm.

      (2) RM-A5 leak rate - approximately 2 gpm.

   D. Fail condenser off-gas monitor in alarm if it does not alarm in a reasonable period.

4. Sequence of Expected Actions

   A. Perform leak rate calculation.

   B. Isolate letdown

   C. Maintain makeup tank.

   D. Maintain pressurizer level above 100" with high pressure injection.

   E. Conduct normal plant shutdown.

   F. Operator uses appropriate procedures.

5. Point of Termination

   The unit is shutdown and cooled down to less than 500°F and less than 1000 psi.

# DRILL GUIDE

1. General Description of Drill - Steam rupture leading to P.T.S. concern.

2. Drill Objectives

   A. Implementation of Steam Line Rupture EP 1203-24.

   B. Recognition of overfeed to "A" OTSG.

   C. Demonstration of porper response to a P.T.S. Event

   D. E-Plan Implementation.

3. Method of Initiation

   A. Initialize the simulator in Mode 1. Stable conditions 98% reactor power.

   B. Fail "A" S/U Feedwater Control Valve is 100% open. Failure #87.

   C. Steam rupture outside reactor building Failure #190 with a 290 lblbm/sec over 10 seconds.

   D. Initiate reactor trip Failure # 185 after steam leak has completed initiating.

4. Sequence of Expected Actions

   A. Operator evaluation of steam leak.

   B. All control rods except Group 8 will drop into core.

   C. Turbine trip and output breakers open. Auxiliaries shifted to startup transformers.

   D. Maintain pressurizer leve.

   E. Verify OTSG levels.

   F. Operator corrects feedwater problem by tripping MFW pumps or shutting block valve on a S/G.

   G. Evaluate P.T.S. concerns.

5. Point of Termination

   A. A S/G is steamed down pressure less than 425.

   B. Plant temperature stable and pressure stable.

   C. Evaluated concerns for cooldown.

      (1) S/G Tube to shell temperature difference.

      (2) P.T.S. violation if any.

# DRILL GUIDE

1. General Description of Drill - Station blackout with diesels available.

2 Drill Objectives

   A. Implementation of EP 1202-2

   B. E-Plan implementation.

3. Method of Initiation - Initiate Failure #37.

4. Secuence of Expected Actions

   A. Reactor trip, turbine trip

   B. Diesels start and emergency feedwater pumps start.

   C. OTSG Levels at 50% for natural circulation.

   D. Close letdown isolation.

   E. Verify diesel generator operation.

   F. Verify RCS Subcooling.

   G. Declare unusual event.

   H. Verify natural circulation

      (1) $\Delta T$ between Tc and Tn approximately 30°F to 50°F.

(2) Cold leg temperatures approach saturation temperature for secondary side pressure.

(3) Verify heat removal from OTSG's.

(4) Incore thermocouple temperatures stable.

5. Point of Termination

A. Reactor Coolant System is being cooled by natural circulation and cooldown in progress.

# DRILL GUIDE

1. General Description of Drill - Loss of shutdown cooling.

2. Drill Objectives

   A. Implementation of Loss of Decay Heat Removal System 1202-35.

3. Method of Initiation

   A. Initialize the simulator using IC 14. (Decay Heat Cooling)

   B. Start with one Decay Heat Pump out of service and lose second Decay Heat Pump.

   C. Place Decay Heat at 100% eq with push button.

4. Sequence of Expected Actions

   A. Attempt to restore decah heat cooling.

   B. Perform operations necessary to achieve OTSG cooling.

   C. Establish OTSG cooling.

5. Point of Termination - The unit is in a controlled condition with no further temperature increase.

# DRILL GUIDE

1. General Description of Drill - Tube rupture in one OTSG leading to loss of subcooling margin, accompanied by high off-site doses.

2. Drill Objectives

   A. Implementation of EP 1202-5 including:

      (1) Reactor Shutdown

      (2) HPI Actuation

      (3) RCP Trip on Low SCM

      (4) EFW Throttling Criteria

      (5) HPI Throttling Criteria

      (6) RCP Restart Criteria

      (7) OTSG Isolation/Steaming Criteria

   B. E-Plan Implementation

3. Method of Initiation

   A. Initialize the simulator at 100% steady state power conditions. (ICI)

B. Use drill #7 malfunction 13 to initiate event. The initial leak rate is 0, elevating to 120# per sec.

C. Inform SRO of high off-gas levels (greater than 8000 CPM).

OR

Main Steam Line Radiation Monitors - In Alarm.

NOTE:

(1) The above requires site emergency by emergency plan.

(2) Offsite Rad Monitoring reports to achieve site emergency:

(a) Greater than or equal to 50 mR/Hr gamma but

(b) Less than 1 Rem/Hr gamma

OR

Greater than or equal to 4.2 E-08 $\mu$ci.cc but,

Less than 8.5 E-06 $\mu$ci/cc $I^{131}$ activity

4. <u>Sequence of Expected Actions</u>

A. Determine if LOCA or SG Tube Leak

(1) Reactor Building Conditions

(2) Main Steam Line Monitors

(3) Condenser Off-Gas Monitor

B. Trip RCP's on loss of subcooling margin.

C. Balance HPI Flows

D. HPI Throttle criteria during tube leak.

(1) Regain 25°F Subcooling margin

(2) Pressurizer level on scale

(3) Other criteria remain the same

E. OTSG Level - 95% on both operating ranges

F. Maximum tube to shell ΔT 70°F.

G. Cooldown rate 1.67°F/min (100°F/hr.)

H. New NPSH Curves for reactor coolant pump.

I. Steaming Criteria

(1) To maintain pressure less than 100 psig or within 10-50 psi of RCS pressure (whichever is lower)

(2) To maintain level less than 95%.

(3) To maintain natural circulation.

J. If OTSG are about to fill

(1) Open and leave open ADV's until subcooling margin regained and plant cooled down.

K. OTSG Isolation due to High Offsite Doses.

5. <u>Point of Termination</u> - OTSG's isolated, cooling down on one OTSG, RCS less than 490°F.

# DRILL GUIDE

1. General Description of Drill - Tube rupture in both OTSG's leading to loss of subcooling margin, accompanied by high off-site doses.

2. Drill Objectives

   A. Implementation of EP 1202-5 including:

      (1) Reactor Shutdown

      (2) HPI Actuation

      (3) RCP Trip on Low SCM

      (4) EFW Throttling Criteria

      (5) HPI Throttling Criteria

      (6) RCP Restart Criteria

      (7) OTSG Isolation/Steaming Criteria

   B. E-Plan Implementation

   C. PORV/HPI Cooling

3. Method of Initiation

   A. Initialize the simulator at 100% steady state power conditions. (ICI)

B. Use drill #7 malfunction 13 and 14 to initiate event. The initial leak rate is 0, elevating to 120# per sec. each OTSG.

C. Inform SRO of high off-gas levels (greater than 8000 CPM).

OR

Main Steam Line Radiation Monitors - In Alarm.

NOTE:

(1) The above requires site emergency by emergency plan.

(2) Offsite Rad Monitoring reports to achieve site emergency:

(a) Greater than or equal to 50 mR/Hr gamma but

(b) Less than 1 Rem/Hr gamma

OR

Greater than or equal to 4.2 E-08 μci.cc but,

Less than 8.5 E-06 μci/cc $I^{131}$ activity

4. <u>Sequence of Expected Actions</u>

A. Determine if LOCA or SG Tube Leak

(1) Reactor Building Conditions

(2) Main Steam Line Monitors

(3) Condenser Off-Gas Monitor

B. Trip RCP's on loss of subcooling margin.

C. Balance HPI Flows

D. HPI Throttle criteria during tube leak

   (1) Regain 25°F Subcooling margin

   (2) Pressurizer level on scale

   (3) Other criteria remain the same

E. OTSG Level - 95% on both operating ranges

F. Maximum tube to shell ΔT 70°F.

G. Cooldown rate 1.67°F/min (100°F/hr.)

H. New NPSH Curves for reactor coolant pump.

I. Steaming Criteria

   (1) To maintain pressure less than 100 psig or within 10-50 psi of RCS pressure (whichever is lower)

   (2) To maintain level less than 95%.

   (3) To maintain natural circulation.

J. If OTSG are about to fill

   (1) Open and leave open ADV's until subcooling margin regained and plant cooled down.

K. OTSG Isolation and PORV/HPI Cooling due to High Offsite Doses.

5. <u>Point of Termination</u> - OTSG's isolated, PORV/HPI Cooling in progress.