ASSESSMENT OF SELECTED TMI-1 TRAINING PROGRAMS

VOLUME 1

ASSESSMENT REPORT

SEPTEMBER 10, 1982

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REPORT SUMMARY

1-0. BACKGROUND. The GPU Nuclear Corporation's Three Mile Island Unit 1 (TMI-1) nuclear power plant near Middletown, Pennsylvania has remained shutdown since the March 28, 1979 accident at nearby Three Mile Island Unit 2 (TMI-2). In an August 9, 1979 Order and Notice of Hearing, the Nuclear Regulatory Commission directed that TMI-1, which was undamaged by the accident, remain shutdown until hearings could be conducted by an Atomic Safety and Licensing Board. The hearings would determine whether there is reasonable assurance that the facility could be operated without endangering the health and safety of the public considering accident recovery operations in progress at TMI-2. On July 27, 1982 the Board issued a Partial Initial Decision (Reopened Proceeding) which concluded that the issues in the proceeding reopened by the Board's Order of September 14, 1981 have been resolved in favor of restarting TMI-1.

One outcome of investigations into the TMI-2 accident was recognition of the need to improve significantly the training of nuclear power plant operators at TMI and throughout the nuclear utility industry. Activities to improve training at TMI began in the summer of 1979. In 1981, the determination that some TMI-1 operating personnel had cheated on the April 1981 NRC license examinations and on some examinations administered by GPU Nuclear identified a need to further review and improve the TMI-1 training program with emphasis on testing and evaluation practices.

Also relevant as background to this report is the formation of the Institute of Nuclear Power Operations (INPO) in late 1979 as a direct response by the nuclear utility industry to the TMI-2 accident. This non-profit organization was established by the nation's nuclear utilities to promote high standards of excellence for operating nuclear power plants. Consistent with this function, INPO is establishing quality training standards in two phases. In the first phase, INPO developed guidelines for training plant personnel based on the best programs and practices in the nuclear industry. These guidelines have been published and distributed to member utilities for their use in developing or modifying their training programs. Although limited experience has been accumulated in the application of the guidelines, they represent best industry practices and for this reason were used as a comparison reference in conducting this assessment. In the second phase, INPO is developing a model training program for plant personnel based on a comprehensive and systematic analysis of training and education needs. In this program, the process of job analysis identifies all tasks performed by job incumbents. The process of task analysis identifies all knowledge and skills required to properly perform the tasks of a job. These analyses provide the basis for determining training requirements for plant personnel.

As of spring 1982, job analyses have been completed for the following five plant operating positions and the more detailed task analyses are in progress for positions a, b and c:

a. Shift supervisor
b. Senior control room operator
c. Control room operator
d. Plant equipment operator
e. Shift technical advisor

Job and task analyses are also scheduled and in progress for maintenance and technical positions.

The industry-wide job and task analysis project will produce a comprehensive training data base which will aid utility personnel in designing, developing, and improving their training programs. The procedures, forms, and computer software used for the industry-wide analysis will be made available by INPO for use by utility personnel in performing plant-specific analyses which are necessary to supplement the INPO generic analyses. The first INPO products are expected to be distributed in late 1982.

1-1. INTRODUCTION. GPU Nuclear contracted with Data-Design Laboratories in June 1982 to conduct an independent assessment of selected TMI-1 training programs including operator training programs. Data-Design Laboratories has over 23 years experience in the design, development, delivery, and evaluation of complex technical training programs, mainly in support of U.S. Navy strategic weapons systems. Training products and services contributed approximately $18 million to Data-Design's total sales of $72 million in corporate fiscal year 1982. In training activities associated with the nuclear industry, Data-Design assisted in the development and implementation of training programs for contractor personnel at a nuclear power plant construction site and is contributing to the efforts of INPO in the areas of training and construction project evaluation.

The scope of work as requested by GPU Nuclear contract No. 190069 is quoted as follows:

"Contractor shall provide an independent assessment of the TMI-1 Operator Training Program. The scope of the review shall be as follows:

-- Auxiliary (or equipment) operator training, licensed reactor operator training, licensed senior reactor operator training, radiological control technician training, and general employee training including requalification training for these categories.
-- The technical content of these training programs and a comparison with INPO guidelines.
-- The administration and delivery of the training programs, including effectiveness of organizational structures, modes of teaching (e.g., self-study, videotape, lecture-discussion, plant tour, etc.), on-the-job training organization and effectiveness, simulator training preparation and delivery, and measurements of student knowledge level.
-- Assessment of the results of the training program, including job performance, mock NRC examination and NRC examination performance and drill performance as available."

The assessment consisted of the following phases:

June 7-18, 1982	Develop assessment plan; research background information.
June 15-18, 1982	Collect data on training of TMI-1 personnel at B&W simulator, Lynchburg, Virginia.

June 21-July 2, 1982	Collect data on TMI-1 training programs at Three Mile Island, Middletown, Pennsylvania.
July 2-September 9, 1982	Analyze data and write report. Preliminary findings were reviewed for factual accuracy and discussed with GPU Nuclear at Three Mile Island August 17-20, 1982.

Six Data-Design personnel, Mr. J.H. Biddick, Mr. D.S. Boyd, Mr. A.K. Loposer, Mr. J.E. Malloy, Dr. P.C. Manning, and Dr. M.A. Rhein were divided into three teams to collect and analyze data in assigned functional areas of the assessment. Each team consisted of an instructional technologist and an individual with professional level engineering plant operating experience. The Data-Design personnel were assisted in their data collection efforts on site by the following consultants who provided nuclear power plant technical expertise in specific areas:

Mr. J.J. Holman, Qualification Evaluation System Corp. - auxiliary operator and licensed operator training and qualification, simulator training

Mr. A.T. Sabo, Water Reactor Divisions, Westinghouse Electric Corp. - radiological control technician training

Additionally, Dr. A.J. Abrams, an independent consultant with extensive experience in technical training programs, assisted in development of the assessment plan and the analysis of data.

Dr. R.L. Seale, Professor and Head of the Department of Nuclear Engineering, University of Arizona, reviewed the data, met with Data-Design team members to discuss their work and contributed to the findings, conclusions and recommendations of this report.

1-2. ASSESSMENT APPROACH AND METHODS. In conducting the assessment, Data-Design collected information to support findings in the following broad areas:

a. The existence and adequacy of corporate goals and policies governing the TMI-1 training program.

b. The existence and adequacy of implementation documentation necessary to support the identified corporate training goals and policies.
c. The adequacy of training program resources and procedures to support an effective technical training program.
d. The effectiveness of the instructor training program and the quality of instruction.
e. The existence, completeness and usability of training records.
f. Agreement between training program content and procedures and advisory and regulatory standards. The content of both classroom and on-the-job training was examined in the assessment.
g. The adequacy of lesson plans and instructional materials and the appropriateness of instructional presentation to achieve instructional goals.
h. The determination of training program effectiveness including the performance of TMI-1 personnel on mock NRC examinations and NRC examinations.
i. The development, administration and storage of examinations including measures to ensure proper security.
j. The adequacy and effectiveness of the on-the-job training program.

The INPO guidelines recommend an annual evaluation of licensed and non-licensed operator training programs covering the elements which follow. The operator sections of this report are structured around these elements in order to provide a benchmark by which subsequent assessments may be evaluated. The INPO recommended elements are:

a. Instructors
b. Training materials
c. Presentation techniques
d. Examination techniques
e. Classroom facilities
f. On-the-job training effectiveness
g. Course content
h. Deficiencies observed through examination results and/or job performance
i. Status of deficiencies noted in other evaluations

This assessment effort was supported at all levels in the GPU Nuclear Corporation. Principal GPU Nuclear contacts for information and assistance were Mr. R.C. Arnold, President GPU Nuclear Corporation; Dr. R.L. Long, Vice President Nuclear Assurance; Dr. R.A. Knief, Manager Plant Training TMI; and Mr. D.A. Ross, Manager Corporate Training.

GPU Nuclear provided training program descriptions, training manuals, training organization diagrams, training procedures, administrative procedures, INPO guidelines, reports of special commissions, committees and boards and other training related documents to Data-Design for review and analysis in advance of the on-site visit. At TMI, the Data-Design team was based at the TMI Training Center and remained in close contact with instructors, training staff, administrative staff, trainees, and classroom activities. This enhanced the exchange of information. review of records and training documents and attendance at classes and other training sessions. On completion of the on-site phase, contact was maintained by phone with key individuals in the training organization who continued to provide additional information and to clarify existing information. The preliminary findings of the assessment (not including conclusions and recommendations) were reviewed for factual accuracy by GPU Nuclear and comments on factual accuracy were incorporated in the final report. To ensure independence of the assessment, the conclusions and recommendations of the assessment were not disclosed to or discussed with GPU Nuclear prior to submission of the final report.

The INPO generic guidelines for various training programs were used as a reference in assessing the TMI-1 training programs. Several of the guidelines were issued in 1982 and late 1981 and postdate part of the GPU Nuclear effort in developing current training programs. Although some of the recent INPO guidelines have not been fully incorporated, the comparison included in this assessment can serve as a basis for future training program revisions.

GPU Nuclear and INPO procedures and checklists were used where appropriate in developing data collection instruments and procedures for the evaluation of training sessions, instructor performance, instructional materials, learning objectives, lesson plans, test items, and documents to support lesson plans.

A total of 66 interviews were conducted with GPU Nuclear personnel concerned with TMI-1 training including:

President GPU Nuclear Corporation
Vice President Nuclear Assurance

Vice President Radiological and Environmental Controls
Vice President and Director TMI-1
Operations and Maintenance Director TMI-1
Manager Plant Training TMI
Manager Plant Operations TMI-1
Manager Corporate Training
Operator Training Manager TMI
Manager Radiological Controls TMI-1
Radiological Field Operations Manager TMI-1
Radiological Training Manager TMI-2
12 Training Department instructors
2 Shift supervisors TMI-1
2 Shift foremen TMI-1
3 Control room operators
18 Trainees

Many informal discussions were held with the GPU Nuclear training staff, supervisors, instructors, operators, and trainees. These discussions took place while attending classes, observing simulator sessions and collecting training data.

A total of sixteen training sessions and three four-hour simulator training periods were observed and evaluated. These included classroom lectures, simulator exercises, system walk throughs, practical factor checkouts, and quizzes. The sessions provided valuable inputs for evaluating instructor performance, presentation techniques, trainee participation and attitudes, instructional materials, and classroom facilities.

To obtain additional and different points of view on training at TMI-1 and in the nuclear utility industry, telephone interviews were conducted with the below named individuals. These individuals are active in nuclear utility industry matters and participated in past evaluations of TMI-1 training or provided training services for GPU Nuclear or presently furnish management support services for GPU Nuclear:

Mr. F.L. Kelly, Personnel Qualification Services Company
Dr. W.R. Kimel, College of Engineering, University of Missouri
Mr. M. Miles, Basic Energy Technology Associates

Mr. K.A. Strahm, Institute of Nuclear Power Operations
Dr. R.E. Uhrig, Florida Power and Light Company
Mr. W. Wegner, Basic Energy Technology Associates
Dr. W.F. Witzig, College of Engineering, Pennsylvania State University

1-3. PRINCIPAL FINDINGS. As an introduction to the principal findings presented in this Report Summary, it should be recognized that the assessment has focused on present TMI-1 training programs and highlights those additional steps which should be taken to achieve Data-Design's perception of the highest order of training effectiveness and efficiency. This perception is based on the recommendations of the INPO guidelines and an aggregate of experience in technical training development and evaluation. The assessment does not compare present conditions to prior conditions in TMI-1 training programs except as needed to understand reasons for the present status and the evolution of the training programs.

In examining how TMI-1 training can be improved, the assessment does not examine with equal detail the many significant actions which have already been taken by GPU Nuclear to improve TMI-1 training programs. The historical record shows that TMI-1 training programs have moved ahead. It is the intent of this report to provide informed, broadly experienced recommendations and guidance for the further enhancement of efforts which have been well started by GPU Nuclear.

The complete findings in each assessment area are presented in sections 4 through 12 of the Assessment Report. These sections are titled as follows:

Section 4 - Training Organization and Administration
Section 5 - Instructor Development Program
Section 6 - General Employee Training
Section 7 - Auxiliary Operator Training
Section 8 - Licensed Reactor Operator Training
Section 9 - Licensed Senior Reactor Operator Training
Section 10 - Licensed Operator Requalification Training
Section 11 - Simulator Training
Section 12 - Radiological Controls Technician Training

Sections 4 and 5 address overall administration and delivery of training programs and the remaining sections address specific training programs to be assessed. As in any assessment of this nature, the findings are based on limited observations and may not accurately reflect overall conditions in the various areas examined. The findings describe observed conditions at the time of the assessment and in many cases these conditions are in the process of being modified by GPU Nuclear to improve the training organization, administration and programs.

The principal findings are grouped by assessment area in the following subsections.

1-3.1. Training Organization and Administration.

1-3.1.1. Organization, Criteria Based Training Methods and Management Support.

a. A major function of the GPU Nuclear Corporation Nuclear Assurance Division under the Vice President Nuclear Assurance is to develop and implement all necessary general employee, operator, technician, and management training programs. In the training of TMI-1 personnel, this responsibility is carried out through the Director Training and Education and the Manager Plant Training TMI.

b. The TMI Training Department is organized to be responsive in carrying out its mission. There are some discrepancies in documentation of the organization and the relationships between the TMI Training Department and other departments at TMI.

c. There is a general lack of specific criteria to be used for evaluating training goals, policies, procedures, and practices at various levels in the GPU Nuclear organization. For example, specific criteria are not provided for evaluation of training aids.

d. The TMI Training Department is not provided systematic feedback on job performance of plant personnel for use in making training programs more responsive to job requirements.

e. The number of TMI-1 licensed operator courses conducted concurrently in the first half of 1982 (2 CRO, 1 SRO and requalification for six shifts) overtaxed TMI Training Department instructor resources. This resulted in the temporary assignment of two experienced TMI-1 shift supervisors to assist with instruction. The expected schedule of licensed operator training in the future will permit more time for planning, review of material, and requalification training by instructors.

f. Training records are usable and include required information. Some records are filed by training session and this makes retrieval of information on an individual time consuming. GPU Nuclear is in the process of implementing a computerized training data base to facilitate retrieval of information. Training records held in TMI Training Department files are being microfilmed for vault storage for the life of the plant.

g. The use of contractor supplied training for simulator training and infrequent specialized training is appropriate.

1-3.1.2. Resources and Facilities.

a. The TMI Training Center is located within about one mile of the site. It was constructed as a training center and occupied in the summer of 1981. The center provides approximately 16,600 square feet of space for conducting classroom training. Included in the building are 18 classrooms, modular office spaces for a training staff of 55, a training library, file room, audiovisual aids room, conference room, vending machine area, photocopy, storage, and restroom spaces. Adequate parking is available for staff and trainees. About 3,400 square feet of space in the building are used by Communications Department personnel for public relations and media activities. The training center facilities are in excellent condition and adequate for current needs. The space available for general classroom use will be reduced with the planned installation of a basic principles trainer at the center in late 1982 or early 1983.

b. There are no laboratory or maintenance training facilities at the training center. Four classrooms located in temporary trailer facilities on site are used for this type training and are considered generally adequate. GPU Nuclear stated there are plans to include laboratory and maintenance training facilities in a training center addition which will be built about 1984 to house a full scope replica simulator.

c. Simulator training of TMI-1 personnel is accomplished at the Babcock and Wilcox nuclear power plant simulator at Lynchburg, Virginia. GPU Nuclear stated that procurement and installation of a full scope replica simulator is planned at TMI.

d. TMI Training Center office space is crowded but satisfactory for the present.

e. Audiovisual equipment is in new condition and adequate in numbers and capabilities to satisfy current requirements.

f. Adequate technical reference materials are available from the training center library, training center files, and the TMI station library located on site.

1-3.1.3. Training Delivery and Training Program Development.

a. TMI-1 training programs are in various stages of development and implementation. Several programs have been or are being conducted for the first time in accordance with the current program description. An example is the auxiliary operator training course now in progress. An approved course description exists for each training program.

b. The TMI Training Department is responsive in modifying programs to meet emerging TMI-1 requirements. An example is the recently completed senior reactor operator training course.

c. Training program development is continuing. Training management personnel continue to examine alternatives for improving TMI-1 training programs.

d. In the development and modification of training programs, more dependence is placed on the individual expert opinion of instructors or instructor supervisors than on systematic methodology.

e. There is frequent coordination and exchange of information between the TMI Training Department and the TMI-1 Operations Department and RadCon Department.

f. Learning objectives are not developed from formal systematic analyses of job requirements. The TMI Training Department has participated in the INPO industry wide job and task analysis effort and is aware of INPO plans to begin promulgating generic task analyses in late 1982.

g. TMI Training Department staff personnel are inexperienced in systematic methodology for development of technical training in an industrial setting.

h. Training program learning objectives are, for the most part, stated clearly and concisely.

i. The sequence of training in individual programs is logical with theory instruction followed by systems or equipment training followed by practical application and/or on-the-job training (OJT).

j. Instructional methods are relatively standardized and appropriate for the content being taught. Lectures are used almost exclusively in classroom instruction. Cognitive material is covered using explanations and audio-visual aids. Trainees are encouraged to ask questions and instructors make themselves available to provide additional instruction if needed. Objectives for each class session are presented at the beginning of the lesson and are used as a framework for review at the end of the lesson. Teaching to objectives is a critical element of criterion-referenced instruction toward which the TMI Training Department is moving. Teaching to objectives is a valid method of instruction and is not the same as teaching to a test answer key which is an undesirable method of instruction.

k. Weekly quizzes are given in initial and cyclic or requalification training programs. These quizzes are based on learning objectives provided to trainees in each lesson. Final, comprehensive and mock NRC written examinations cover objectives taught over a period of time in a number of lessons. Oral examinations are based less on learning objectives and reflect more of the examiner's personal expertise and standards.

l. Most written examination questions require short, factual answers. Relatively few questions in operator or technician examinations require diagnosis of symptoms based on plant conditions or analysis of system interrelations.

m. In general, the minimum passing grade on written examinations is 80%. Some operator examinations require a minimum grade of 70% on individual sections and an overall minimum grade of 80%. Oral examinations are graded as pass or fail. Satisfactory completion of OJT tasks is indicated by the examiner's signature on a checkoff list. Trainees who fail examinations are assigned remedial instruction and required to pass reexaminations.

n. TMI Training Department procedures TD 1103, 1104 and 1105 provide direction on development and revision of training program descriptions and lesson plans. Newly developed lesson plans conform to these procedures and older lesson plans are being upgraded to the present criteria.

o. Lesson plans in some form of development exist for all classroom instruction. Lesson plans are prepared and approved before the lesson is presented. Handout material provided to trainees with the lesson is frequently textual in nature and not oriented toward note taking or stimulating a better understanding of the lesson.

p. At the level of individual lesson plans, the subject matter is well arranged and proceeds from the simple to the complex in learning difficulty. New ideas are developed in terms of previously learned knowledge where applicable. Main system functions are taught before subsystem and support system details are taught.

q. Small class sizes and availability of instructors promote instructor-trainee interactions. Proximity of the training center to the plant facilitates direct involvement of trainees in the learning process.

r. Procedures exist so that newly hired personnel who have previous relevant experience can be exempted from certain training based on appropriate examinations and/or review of the individual's experience.

1-3.1.4. Examination Administration and Security.

a. GPU Nuclear procedure 6200-ADM-2600.1, Rev 0, October 21, 1981 provides direction on typing and storing examinations, monitoring examinations, ensuring that unauthorized material is not available to trainees during examinations, and reporting misconduct or cheating during examinations. This procedure assigns to the Director Training and Education overall responsibility for conduct of all GPU Nuclear training programs including administration of examinations. The procedure further assigns to the Manager Plant Training TMI responsibility for implementing training programs and administering examinations at TMI. Assignment of responsibility for security of examinations is implied but not stated explicitly in this procedure.

b. A Manager Plant Training TMI memorandum of June 7, 1982 details examination security procedures and covers security of materials during development, typing, reproduction, and storage prior to administration.
c. A TMI Training Department Document Control/Clerical Supervisor memorandum of June 18, 1982 emphasizes to the clerical staff the importance of properly safeguarding the security of examinations being typed.
d. It was observed during the site visit that written examinations were carefully controlled and security procedures were rigorously followed. After a quiz or test is typed and approved, it is retained by document control in locked storage. Tests are removed from locked storage and provided to the instructor or proctor a short time before the test is to be administered. Tests are reproduced on yellow paper which is used only for this purpose.
e. Two evening checks were made of training center office spaces for examination security. No examination materials were visible in offices. Drawers with locks were locked.
f. The typing stations and copy machines were observed on days when examinations were produced and no examination material was found unattended.
g. The administration of ten quizzes was observed and the same procedures were followed in each class. Trainees were seated one behind the other with space between trainees in the same row. In large classes such as general employee training where trainees sat close together, different examinations were used for adjacent trainees. All quizzes were proctored and in large classes, a second proctor was used. A seating chart was prepared by the instructor and attached to the completed examination package. Prior to passing out the examinations, the instructor read to the class nine standard instructions printed on the cover of each examination booklet. These instructions covered conduct during examinations and the possible consequences of misconduct and cheating. The examinations were conducted in a quiet and orderly manner. On completion of the examination, each trainee signed and dated a statement certifying that all answers were the trainee's own work, that unauthorized assistance was not given or received and that unauthorized references were not used. Trainees left the room after completing the examination.

h. During observation of quizzes being administered July 2, 1982, it was noted that while proctors remained in front of the class and alert for unauthorized activity, several read paperwork which interfered with giving their undivided attention to proctoring.

i. Examination security was discussed during interviews with trainees and instructors. They uniformly expressed opinions and provided answers to questions which indicated they understood and supported the need for examination security and knew that providing or receiving assistance on examinations was unacceptable conduct.

j. Examination grading procedures do not provide for analysis to detect collusion in answers or to detect problems in test items which may reduce validity and reliability.

1-3.1.5. Training Staff Size and Workload.

a. The TMI Training Department staff of 55 is organized under the Manager Plant Training TMI in five sections which are headed by the Operator Training Manager, Supervisor Training and Educational Development, Support Training Manager, Supervisor Technician Training, and Supervisor Training Administrative Support. The span of control of managers and supervisors is appropriate with usually five or fewer personnel reporting to each manager or supervisor. Support and administrative staffing levels appeared to be adequate. Typing, document control and library functions were handled smoothly.

b. TMI Training Department instructor staffing is adequate for expected future training loads. Licensed operator instructor staffing was not adequate for the initial and requalification training load experienced in the first half of 1982 and two experienced shift supervisors were assigned to assist with instruction and supervision. Based on GPU Nuclear plans, licensed operator instructors will become more involved in developing courseware for the basic principles trainer and the replica simulator in the future. This will reduce the time available for other instructor tasks.

c. TMI Training Department support staffing is not adequate in personnel who have experience conducting or managing the extensive job and task analyses which will be necessary if the INPO approach to job performance based training is adopted.

d. The normal work assignments of several TMI Training Department managers and supervisors have been affected over the past 1-2 years by preparing depositions, researching records and giving testimony associated with hearings and litigation concerning the TMI-2 accident and the TMI-1 restart.

e. The instructor to trainee ratio varied from about 1/19 to 1/4. Typical classroom ratios were 1/8 to 1/10 in different classes. The 1/19 ratio was observed when licensed reactor operator and auxiliary operator classes were combined for plant systems lectures.

1-3.1.6. Training Staff Qualifications.

a. The TMI Training Department managers and section heads are well qualified by experience and education for their positions. Members of the staff involved in instruction or supervision of instruction include 14 degreed personnel.

b. Duties, responsibilities and educational and experience requirements for the training staff are set forth in the TMI Training Department Administrative Manual.

c. TMI Training Department instructors meet qualification requirements for their respective positions. Not all Babcock and Wilcox Company instructors who conduct simulator training of TMI-1 personnel are SRO qualified or simulator certified as set forth in NUREG 0737.

1-3.1.7. Training Staff Development and Evaluation.

a. A 40-hour initial instructor development course is provided for TMI Training Department instructors. Instructors normally complete this course within six months after assignment as an instructor. Not all instructors complete the course before being assigned to instruct trainees.

b. A program for advanced and continuing instructor development, based in part on INPO guidelines, is in the early planning stages. The TMI Training Department stated that the first module of advanced training is expected to be a one-week class in late 1982 on criterion-referenced instruction and testing and evaluation.

c. Procedures are not in effect which specify instructor evaluation frequency and criteria. TMI Training Department practices call for evaluation of instructors by section heads annually and supervisors more frequently. This schedule has not been followed consistently.

d. Comments on instruction are submitted weekly to supervisors by trainees during classroom phase training programs. The comments are reviewed and appropriate action is taken.

e. GPU Nuclear sponsors instruction for training staff personnel at vendor facilities in subjects such as RadCon techniques, RadWaste management, maintenance practices, and special engineering subjects.

f. The three licensed operator instructors maintain current SRO qualification in the TMI-1 plant. These requirements include attending requalification lectures, taking requalification quizzes and examinations and working two shifts per month in the plant. They have been assigned to instructor duties an average of five years each.

1-3.2. <u>Instructor Development Program</u>.

1-3.2.1. Instructor Selection and Qualification.

a. Instructors are selected from candidates nominated by the plant departments or from personnel who have demonstrated instructor capabilities in GPU Nuclear assignments or in previous jobs.

b. Candidates are interviewed by the applicable TMI Training Department section head and, if desired, by the plant department which utilizes the training which the candidate will provide. Selection is based on results of interviews and review of personnel records.

c. Individuals selected to be instructors can commence instructing duties when approved by their section head without completing initial instructor training.

1-3.2.2. Initial Instructor Development.

a. The 40-hour initial instructor development course provides complete or partial coverage of approximately 22 of 31 topics contained in the 80-hour associate instructor course recommended by INPO.

b. Videotaped presentations by instructor trainees and critiques of these presentations comprise about 24% of the course.

c. Trainees are graded on their development of a lesson plan, subsequent presentation of the lesson and a final examination.

1-3.2.3. Instructor Certification.

a. There is no procedure for certifying that instructors are ready to commence instructing duties. Certification is accomplished informally by the cognizant section head when the individual is considered to have satisfactory technical knowledge and capability as an instructor.

1-3.2.4. Instructor Evaluation.

a. Instructors are observed in class by their supervisor and evaluated on the technical content of the lesson, the instructor's preparation, presentation technique, communication skills, use of training equipment, and motivational influence.

b. Evaluations are reviewed by section heads and the Manager Plant Training TMI and discussed with the instructor.

c. Procedures are not in effect, but are being developed, to utilize evaluations to identify the need for instructor counseling, additional training or assignment to other duties.

1-3.2.5. Continuing Instructor Development.

a. The TMI Training Department program of continuing instructor development consists of workshops and a voluntary, supervised self-study course based on a text with 17 lessons on criterion-referenced instruction. The course requires approximately 40 hours of study to complete. This program is not consistent with the INPO program for continuing instructor development which recommends an 80-hour Level II course and a follow-on 80-hour Level III course to achieve qualification as a senior instructor.

b. The TMI Training Department stated that it is planned to include parts of the criterion-referenced instruction course in required advanced training for instructors which is now being developed.

1-3.2.6. Program Evaluation.

a. Evaluation data is collected on various training programs. However, there is no systematic means for analyzing this data and applying the results to evaluate and improve the instructor development program as recommended by INPO guidelines.

1-3.3. <u>General Employee Training</u>.

a. The five separate courses which comprise the TMI-1 general employee training and requalification program were attended by 2320 GPU Nuclear and contractor personnel during the period January 1-July 31, 1982.

b. The content of the general employee training courses meets the standards of ANSI/ANS-3.1-1978, "American National Standard for Selection and Training of Nuclear Power Plant Personnel," Section 5.4 and is consistent with recommendations contained in INPO guidelines.

c. The amount of material covered in the general employee training courses requires a rapid pace of instruction. A total of 2181 trainees passed general employee training courses with a minimum grade of 80% during the period January 1-July 31, 1982. This is a 94% successful completion rate.

d. The general employee training instructors are competent, well motivated and convey to new employees an excellent first impression of the GPU Nuclear organization.

e. Learning objectives are used in general employee training courses. Lesson plans are developed around the objectives. Instruction, reviews, and test questions are based on the objectives.

f. Test questions in general do not conform to optimum practices for measurement of achievement and for question construction.

1-3.4. <u>Auxiliary Operator Training</u>.

a. The supervisor and the instructors assigned to TMI-1 auxiliary operator training have the background, technical knowledge and the necessary instructor skills to perform their jobs satisfactorily. They meet the education and experience requirements set forth in the TMI Training Department Administrative Manual for non-licensed operator training positions. All have attended the TMI Training Department initial instructor development course.

b. The TMI-1 auxiliary operator initial training program consists of some 39 weeks of classroom instruction followed by an 11 month on-the-job training (OJT) period to become a fully qualified Auxiliary Operator-A (AO-A). In comparison, the program recommended by INPO guidelines includes about 41 weeks of classroom training plus about 12 weeks of formalized OJT to reach this same level of qualification.

c. Thirty-five of 38 major topic and subtopic areas recommended by INPO guidelines are covered in the TMI-1 auxiliary operator classroom phase of instruction.

d. The structure and sequence of training in the TMI-1 program does not parallel the INPO guidelines. The TMI-1 program begins with a classroom phase of about 39 weeks of instruction followed by an 11 month on-the-job phase and concludes with written and oral comprehensive examinations to fully qualify the auxiliary operator. The program recommended by the INPO guidelines divides training and qualification into three distinct and successive phases, each of which builds on the other and has its own classroom, OJT, qualification, and job assignment progression.

e. Learning objectives are used throughout auxiliary operator classroom instruction. Lesson plans are developed around the objectives. Instruction, reviews, and test questions are based on the objectives.

f. Learning objectives are not based on validated external criteria such as job and task analyses. Learning objectives for classroom instruction are based more on theory and design criteria than on operational criteria.

g. Test questions relate directly to the learning objectives of the course. Test grades average from 85% to 98%. Many of the test questions do not conform with optimum practices for measurement of achievement and for test question construction. Analysis of test question answers is not routinely performed to check validity of questions.

h. Written test security practices are scrupulously followed and firmly enforced.

i. The 11 month on-the-job training program is loosely structured around a combination of individual study assignments and practical factor checkoffs.

j. There are no standards established for satisfactory accomplishment of OJT checkoffs. This makes it difficult to assure that all trainees are performing to the desired standard or to compare the performance of trainees on different shifts.

k. There are no standards established for oral examination questions and responses. These examinations are employed mainly in the OJT phase of training. Qualified operators who examine trainees during OJT have not been trained in testing procedures or tech. ues for conducting OJT. It is important that these TMI-1 Operations Department personnel perceive themselves as adjunct members of the TMI Training Department.

l. Job performance data is not systematically gathered and maintained in personnel records for assessing the effectiveness of the auxiliary operator training program.

m. A formal and active retraining program exists. Auxiliary operators are on a six shift rotation. Approximately one week in seven is used for retraining.

1-3.5. Licensed Reactor Operator Training.

a. The three instructors assigned to TMI-1 licensed operator training maintain current SRO qualification in the TMI-1 plant and meet the education and experience requirements set forth in the TMI Training Department Administrative Manual. They have been assigned as TMI Training Department instructors an average of five years. Two of the three instructors have completed some college work and all three have high school diplomas.

b. The TMI-1 CRO training program is based on regulatory requirements, industry standards, past practices, and the individual expertise and experience of competent individuals involved in developing and approving the program. The content is not based on a systematic, plant-specific analysis of tasks required to be performed by a TMI-1 CRO.

c. In the following subject areas, the TMI-1 course content and instruction hours are consistent with or exceed the recommendations of INPO guidelines:

(1) Reactor heat transfer and fluid flow
(2) Health physics
(3) Plant technology, systems and procedures
(4) Control room training
(5) Simulator training

d. In the following subject areas, the TMI-1 course content includes significantly fewer hours of instruction than recommended by INPO guidelines:

(1) Mathematics

(2) Reactor theory

(3) Reactor chemistry

(4) Materials science

e. In the following subject areas, the TMI-1 course content includes significantly fewer documented hours of instruction than recommended by INPO guidelines, but an additional undetermined amount of instruction is accomplished during OJT.

(1) Transient prevention, mitigation and response

(2) Plant experiences and modifications

(3) Administrative requirements for CRO

f. The 38 week TMI-1 program includes a total of approximately 1405 hours of instruction as compared to approximately 1195 instruction hours in the INPO recommended program.

g. TMI-1 simulator and OJT course content includes the 13 plant evolutions recommended by INPO guidelines to be performed or their performance simulated during OJT or simulator training.

h. The OJT phase of training incluues many tasks which must be accomplished by simulated performance during the present extended shutdown rather than by actual performance as would be expected at a normal operational unit. The TMI-1 OJT is not augmented by observation training at an operational unit or other special training to compensate for the reduced opportunities that trainees have to gain meaningful operating experience in the shutdown plant.

i. The seven-volume Operator Training Manual, while usable, is of limited value as a training document in its present form due to lack of currency, conflicts with other descriptive material, verbiage, illegible illustrations, and incomplete coverage of plant systems.

j. The pressure/temperature plot training program is innovative and effective in its use of computer-aided instruction and the real time visual display which duplicates the display provided for plant operation.

k. In general, most handout material used in the TMI-1 CRO training program is more like lesson plans or technical manual chapters than instructional material to promote trainee interaction or organize note taking.

l. OJT instructional material consists of 22 checkoff sheets listing individual tasks to be accomplished and the required progress rate. Detailed guides are provided for studying nine integrated plant operating procedures. Detailed criteria are not provided for other tasks to guide study by trainees and examinations by staff personnel.

m. Instructors competently explained system details and answered trainee questions during three lecture presentations which were observed. In one of these lectures, the instructor stated heat transfer equations without an explanation to develop an understanding of the principles involved. In another lecture the non-licensed operator instructor maintained poor control of the combined class of CRO and AO trainees.

n. During the site visit, CRO and AO classes attended plant system lectures as a combined group. Instructors and trainees commented that the different backgrounds and learning objectives of the two groups cause effectiveness of the instruction to be reduced.

o. TMI-1 licensed reactor operator trainees are tested throughout the training program with a variety of oral, written and performance quizzes, examinations and checkoffs.

p. Personnel interviewed were well indoctrinated on the absolute requirement not to give or receive help on examinations. Examination security procedures were observed to be followed without exception.

q. Four of five CRO trainees passed the February 1982 NRC written license examination. The fifth trainee failed one section of the examination. All five trainees passed the NRC oral license examination.

r. Licensed reactor operator job performance is not routinely evaluated, documented, and maintained in personnel records.

s. Approved lesson plans in some stage of development are used for all classroom instruction in the CRO training program. About 51 of 64 lesson plans used for CRO training require upgrading to conform with present procedures for lesson plan development and approval.

t. Training records of 15 trainees were reviewed and all records contained required information on training attendance and test results. Some records were filed by training session and not by individual trainee. The retrieval of all training records on an individual is made time consuming by this method of filing.

u. GPU Nuclear has acted positively on recommendations and findings concerning training which are contained in reports of past investigations and evaluations.

1-3.6. Licensed Senior Reactor Operator Training.

a. The TMI-1 SRO training program is based on regulatory requirements, past practices, industry standards, and the individual expertise and experience of competent individuals involved in developing and approving the program. The content is not based on a systematic, plant-specific analysis of tasks required to be performed by a TMI-1 SRO.

b. The 26-week TMI-1 SRO training program includes approximately 862 hours of instruction as compared to 911 hours of instruction in the program recommended by INPO guidelines.

c. The TMI-1 SRO training program is consistent with or exceeds the content recommended by INPO guidelines in the following four of seven subject areas:

   (1) Specialized education - leadership/communication/analytical skills
   (2) Advanced transient and accident analysis
   (3) Plant operations - administrative requirements
   (4) Simulator training

d. The content of the TMI-1 program is less than the content recommended by INPO guidelines in the following three subject areas:

   (1) Training in procedures and the bases for procedures (Administrative procedures for maintenance and technical support; duties of load system dispatcher)
   (2) In-plant training (Instruction in evolutions and SRO duties)
   (3) Advanced electrical components and systems training

e. The OJT for TMI-1 SRO trainees is based on requirements for qualifying personnel at operational units with normally expected operating and shutdown periods. During the present extended TMI-1 shutdown, the OJT phase of the program has not been augmented with observation training at operating units or other special training to compensate for the reduced opportunities trainees have to obtain meaningful operating experience in the shutdown TMI-1 plant.

f. TMI-1 OJT tasks do not include evolutions and operations to be conducted, observed or simulated by SRO trainees as recommended by INPO guidelines.

g. Detailed criteria are not provided for satisfactory accomplishment of OJT tasks.

h. Nine of 24 lesson plans used for SRO training have objectives which reflect SRO level of knowledge requirements. The TMI Training Department stated the remaining lesson plans are being upgraded to provide different objectives for SRO training.

i. Two of four TMI-1 SRO trainees passed the June 1982 NRC written license examination.

j. Training records of two TMI-1 SRO trainees were reviewed and found to contain required information on training attendance and test grades.

k. The TMI-1 program description prerequisites for SRO training permit satisfying experience requirements without having experience as a CRO at TMI-1. This experience prerequisite is not consistent with INPO guidelines which recommend that an SRO candidate have at least six months experience as a CRO at the unit on which the individual is training as an SRO. The INPO guidelines provide for experience waivers on a case-by-case basis.

1-3.7. Licensed Operator Requalification Training.

a. The TMI-1 licensed operator requalification training program is now being conducted for the first time in accordance with the present program description. This program is based on and corresponds closely to the requalification program recommended by INPO guidelines. The TMI-1 program exceeds the INPO program by including approximately 240 hours of instruction per year in the preplanned lecture series compared to the INPO recommended content of 100 hours.

b. The TMI-1 program requires attendance at requalification lectures based on requalification examination grades and provides for excusing absence from requalification training for up to one week per year. The INPO recommendations and 10 CFR 55 Appendix A requirements specify lecture attendance by all licensed operators.

c. The 10 CFR 55 Appendix A requalification program requirements provide for systematic evaluation of licensed operator performance and the inclusion of these evaluations in the records of requalification training. Evaluations of licensed operator performance during simulator exercises have been provided to the TMI Training Department by Babcock and Wilcox Company but these evaluations have not been used as feedback on training program effectiveness or included in training records. There is no program for systematically observing and evaluating licensed operator performance and competency on the job.

d. A review of 16 weekly requalification quizzes indicated that (1) there was good agreement between the grading of quizzes and the answer key, (2) most questions required recall of factual information and relatively few questions tested diagnostic or analytical skills and (3) some of the same questions appeared on both the original quiz and the makeup quiz taken by individuals who failed the original quiz.

e. The first TMI-1 plant drill was conducted in August 1982. A program has been established for conducting plant drills periodically.

1-3.8. Simulator Training.

a. The Babcock and Wilcox (B&W) nuclear power plant simulator has the capabilities and characteristics to support effective initial and requalification training of TMI-1 licensed operators.

b. The TMI simulator startup certification program course description for replacement TMI-1 CRO trainees includes in the course schedule 13 of the 27 exercises recommended by INPO guidelines. As noted below, most of the 27 exercises are actually accomplished during training. The TMI-1 program description includes additional exercises not included in INPO guidelines.

c. Training records for a TMI-1 CRO trainee documented the performance of 22 evolutions of the 27 recommended by INPO guidelines. Of the remaining five evolutions which were not documented, two cannot be simulated realistically and one was accomplished without being documented. Other exercises were accomplished in addition to the exercises recommended by INPO guidelines.

d. The TMI-1 CRO simulator training program includes 60 hours of direct interaction with the simulator control panel and 60 hours of classroom lectures on subjects associated with simulator exercises. This is consistent with INPO guidelines for qualification programs at operational units. Additional simulator training is not provided for TMI-1 personnel to compensate for the reduced opportunity trainees have to obtain meaningful operating experience in the TMI-1 plant which has been shutdown since 1979.

e. The TMI-1 SRO simulator training program includes 40 hours of simulator exercises and 40 hours of associated classroom lectures. This program significantly exceeds the INPO recommended program of 16 hours of simulator exercises. The TMI-1 SRO program includes 22 of 27 exercises included in the INPO program. Two of the remaining five exercises cannot be simulated realistically. The TMI-1 program also includes additional exercises not included in the INPO program.

f. The TMI-1 licensed operator requalification simulator training program includes 20 hours of simulator exercises and 20 hours of associated classroom lectures. This program exceeds the INPO recommended program of at least 20 hours of simulator exercises. All 35 normal and abnormal or emergency plant evolutions recommended by INPO guidelines for inclusion in simulator training are included in the TMI-1 program. A review of sample simulator exercise sheets indicated there is close agreement between reactivity manipulations and plant evolutions actually accomplished at the plant or simulator and those recommended by INPO guidelines and set forth in the NRC (H.R. Denton) letter of March 28, 1980.

g. A simulator training audit team of GPU Nuclear management personnel was formed and members visit the simulator to monitor training of TMI-1 personnel.

h. Not all B&W simulator instructors who train TMI-1 personnel are SRO qualified or certified on the simulator.

i. B&W instruction of TMI-1 personnel at the simulator is not supported with consistent use of lesson plans, drill guides, trainee handouts, and legible training aids.

j. B&W test grades and operational evaluations of TMI-1 trainee performance during simulator training are forwarded to the TMI Training Department, but these evaluations are not included in training records at TMI.

k. GPU Nuclear stated a full scope replica simulator is planned for installation at TMI. The specifications to be included in the request for bid are being reviewed in GPU Nuclear. The request for bid is expected to be issued in the near future.

l. A basic principles trainer (BPT) or concept simulator is under contract and is planned for installation at TMI in late 1982.

m. GPU Nuclear has acted positively on recommendations and findings concerning simulator training which are contained in reports of past investigations and evaluations.

1-3.9. Radiological Controls Technician Training.

a. The TMI Training Department program for initial training of TMI-1 RadCon technicians is being rewritten to comprise a 15 week classroom phase consisting of 11 weeks of instruction in mathematics and basic radiological controls principles followed by four weeks of TMI-1 plant systems and procedures training. The initial training course for TMI-1 RadCon technicians was last conducted in late 1981.

b. A review of the RadCon technician initial training program currently under preparation shows close conformance in all important content areas with the INPO guidelines published in February 1982.

c. RadCon technicians assigned to TMI-1 shifts participate in the technician/foreman cyclic training program with each shift and spend approximately one week out of every six weeks on cyclic training. The TMI-1 cyclic training program meets the recommendations of INPO guidelines for continuing training of RadCon technicians

d. Six RadCon technicians were observed performing detailed job tasks. All followed prescribed procedures in the successful performance of the job tasks.

e. RadCon test questions relate directly to the learning objectives of the courses. Test questions in general do not conform to optimum practices for the measurement of achievement and for question construction.

f. RadCon technician training is organized differently from other training of TMI-1 personnel. The TMI Training Department Administrative Manual states that RadCon training is conducted under the direction of and coordinated with the Radiological and Environmental Controls Division. Other training of TMI-1 personnel is conducted under the direction of the TMI Training Department and is coordinated with the applicable TMI-1 plant department.

g. There are no RadCon laboratories at the TMI Training Center. All RadCon laboratory training is accomplished in facilities at the plant. GPU Nuclear reported there are plans to include laboratory training facilities in an addition to be constructed about 1984 at the TMI Training Center for the replica simulator.

1-4. PRINCIPAL CONCLUSIONS AND DISCUSSION. The conclusions drawn from the principal findings are presented in this Report Summary. Detailed conclusions drawn from all the findings in each assessment area are presented in sections 4 through 12 of the Assessment Report.

As an introduction to individual conclusions, it is an important overall conclusion that GPU Nuclear has made significant progress in the past three years to expand the TMI training capability and to improve the quality of TMI-1 training programs. As examples of this progress, the TMI training staff has been increased from 7 to 55; temporary trailers have been replaced with a modern training center; initial RadCon technician classroom training which was non-existent in 1979 is now being expanded from 11 to 15 weeks; plant personnel are organized in six shifts with classroom retraining and requalification taking place during one week out of every seven weeks; and a basic principles trainer is under procurement. These examples are evidence that GPU Nuclear has committed significant resources and management attention to training.

However, it is also an important conclusion that along with the substantive improvements made in TMI training, certain inadequacies have been allowed to exist - some documentation is outdated, feedback is informal, systematic planning has not been documented, and some needed procedures have not been written. As examples of these conditions, on occasion personnel have been assigned to teach without completion of instructor training or formal certification; a small number of departures from the approved program description have been made in conducting a course; some training actually accomplished is inaccurately described in an outdated program description;

effective continuing development for instructors is not in place; several conflicts exist in descriptions of responsibilities and functions in organization charts and manuals; OJT is accomplished without detailed criteria for instruction and testing; and instruction is not based on a systematic analysis of job requirements.

Conclusions drawn from the principal findings in the Report Summary and presented in the following sections are grouped in five broad categories:

a. Criteria Based Training Methods
b. Organization
c. Training Delivery
d. Training Content
e. Examination Security

Because of the summary nature of the conclusions and recommendations that follow, there is not a direct correspondence between the findings and the conclusions and recommendations. Detailed conclusions and recommendations which are related to individual findings are contained in each section of the Assessment Report. Further, recommendations in this Report Summary are made only where change is considered desirable.

1-4.1. Criteria Based Training Methods. Included in this category are conclusions on the use of criteria or standards to determine training content and to establish criteria based methods and procedures for the design, development, delivery and evaluation of training.

a. The TMI Training Department has made substantial progress in establishing and using criteria based training methods and procedures. Lesson plans formerly were non-standardized and thus quality control was difficult and limited. In establishing a standard format and review criteria for lesson plans, this critical element of a technical training program has been improved. By instituting the development of training objectives for lesson plans, instruction and testing can be more systematically prepared and evaluated. The use of objectives is a simple and effective means to enhance the learning process. Much of the procedural mechanism is in place now to work with detailed and specific job performance criteria as this information becomes available from INPO and TMI efforts.

b. As presently configured, TMI-1 training programs are internally consistent but not systematically validated against objective criteria based on job performance requirements. Objectives are developed; instruction is based on objectives and tests measure mastery of objectives. However, unless the development of objectives is based on a systematic analysis of job requirements, its validity is a matter of opinion and this is an inappropriate measure of adequacy. The current non-job-related testing practices which use subjective criteria would also be hard to defend against an Equal Employment Opportunity (EEO) challenge.

c. The lack of validated job related criteria also makes it difficult to provide appropriate structure for the on-the-job (OJT) phase of training. OJT should be structured in response to established criteria in order to assure consistent performance by trainees and examiners. At present, standards for successfully accomplishing OJT tasks are established to a great extent by individual shifts and this causes variability in standards.

d. Accepted criteria for test item construction and subsequent analysis are not being uniformly applied in the development of test items to measure level of achievement. Test items are not regularly analyzed after use. Such post-hoc analysis or item analysis should be used to identify invalid test items, areas of trainee weakness and/or instructional inadequacy and trainee collusion. There are also accepted criteria for development, administration, and analysis of oral test items and performance checklists. These criteria are not being systematically applied in the areas of oral testing and performance checklists.

1-4.2. Organization. Over the past three years, GPU Nuclear has assembled a well qualified and responsive TMI Training Department. The number of training staff personnel has been increased from seven to 55. The organization of the TMI Training Department is sound, with capable persons in key positions. As in any other organization which has grown rapidly, there are areas where improvement is desirable. These problem areas are mainly caused by insufficient or inappropriate structure in the organization.

a. The placement of the TMI Training Department in the GPU Nuclear organization with the Manager Plant Training TMI reporting to the Vice President

Nuclear Assurance through the Director Training and Education provides appropriate high level corporate visibility and direction for the training function. In this position, the TMI Training Department is responsive to the training needs of TMI-1 departments, but retains the flexibility to allocate its resources between TMI-1 and TMI-2 as necessary.

b. An important conclusion in this area is that the training organization functions satisfactorily to provide a variety and quantity of training services.

c. There is a lack of structured procedures for feedback of information on training effectiveness from departments which use training services to the TMI Training Department which furnishes these services. This is partly due to management/union agreements which restrict job performance evaluations of bargaining unit employees and partly due to dependence on informal means such as regularly scheduled meetings. These meetings are valuable forums for exchange of information, but they lack the structure to ensure that complete feedback is provided to the TMI Training Department.

d. A certain amount of disorder exists in official documentation practices. Some documents, such as training program descriptions, are closely controlled and promulgated with authorizing signatures and dates. Others, such as the corporate goals statements and various organizational charts furnished to the assessment team are undated and not visibly approved. Some aspects of actual organizational relationships, communication channels and feedback loops had to be inferred during the assessment from interviews and other observations rather than being formally and explicitly laid out in documentation.

e. An objective and systematic analysis of TMI-1 training program effectiveness based on job performance was not possible because job performance is not routinely evaluated and there is no formal system to feed back training effectiveness information from departments which use training services to the TMI Training Department. However, there are the following indications of training effectiveness in the programs assessed:

   (1) Test grade averages were 85%-95% on TMI Training Department tests reviewed. These tests measure mastery of TMI Training Department training objectives.

(2) Management personnel in departments which use training services commented favorably about the effectiveness of training provided.

(3) Four of five licensed reactor operator trainees passed the February 1982 NRC license examination.

(4) Two of four licensed senior reactor operator trainees passed the June 1982 NRC license examination.

1-4.3. Training Delivery. The training delivery capability of the TMI Training Department has been improved substantially in the past three years. The present staff of 55 instructors and training support personnel is adequate for present and expected training loads in the areas assessed. The modern training center with over 16,000 square feet of space for classrooms and training offices, together with training facilities on site, are adequate for present needs. GPU Nuclear stated there are plans to build an addition at the training center for laboratory and maintenance training facilities. This addition will also house the full scope replica simulator which GPU Nuclear stated is planned for procurement. A basic principles trainer is under procurement and is scheduled for installation at TMI in late 1982.

a. The motivation of instructors and support staff was observed to be excellent. Instructors are qualified to teach technical subjects competently. Observed instruction in some academic subjects lacked fully developed explanations of basic principles which could be supplied by instructors with appropriate degrees and engineering experience.

b. Licensed operator instructors maintain their SRO qualification in the TMI-1 plant. This includes working two shifts per month in the plant. However, their long assignment as instructors (4-7 years) and comparative lack of close contact with plant operations can degrade their effectiveness. The temporary assignment of two experienced shift supervisors to augment the licensed operator instructors during a high training load period in early 1982 provided current, authoritative expertise on the plant.

c. Training delivery is not adequately supported by present TMI Training Department instructor development and qualification practices. A systematic analysis has not been conducted of specific instructor duties and requirements for training. Instructors are informally certified as ready to teach by use of unspecified criteria. Instructors are not required to complete the 40-hour initial instructor development course before being assigned to teach. Criteria have not been established for training of OJT instructors and examiners in operator training programs. Current advanced instructor development courses have significantly less content than recommended by INPO guidelines.

d. The TMI-1 plant is employed effectively in the training process for tours, system tracing, demonstrations, walk throughs, and checkoffs. There is frequent interaction between TMI Training Department instructors and trainees outside formal classes for extra instruction, counseling, and answering questions.

e. Training programs are implemented using approved program descriptions. Several courses are in development and others are being conducted for the first time or have recently been conducted for the first time Experience gained in the conduct of these courses should be used to develop course modifications.

f. Appropriate types of instructional materials are used in the delivery of training, but the quality of this material is not uniformly high. Approved lesson plans in some stage of development are used for all classroom instruction. Class handout material frequently contains illegible drawings and verbiage of little importance to trainees. The Operator Training Manual is of limited usefulness due to conflicts with other descriptive material, redundancy, poor quality illustrations, and incomplete coverage of plant systems.

g. Although there are major differences in control room arrangements and some differences in systems, the B&W nuclear power plant simulator at Lynchburg, Virginia has capabilities and characteristics necessary for effective training of TMI-1 licensed operators. The types of exercises included in simulator training provided by B&W under contract to GPU Nuclear are in close agreement with types of exercises recommended by INPO guidelines. This training is routinely monitored by GPU Nuclear management personnel. There are several areas which could be improved in the administration and delivery of simulator training:

   (1) The TMI Training Department training program description for TMI-1 replacement CRO training should be changed to accurately describe the training provided.

(2) B&W simulator instructors who train TMI-1 personnel should all be SRO qualified or certified on the simulator.

(3) Instructional practices should always include use of lesson plans, drill guides and legible training aids.

(4) Evaluations of trainee performance should be included in training records.

(5) Exercise summary sheets should accurately list all exercises performed during simulator training.

1-4.4. Training Content. The scope of work for the assessment included a comparison of the technical content of TMI-1 training programs with applicable INPO guidelines. INPO document "The Accreditation of Training in the Nuclear Power Industry," May 1982 notes that INPO training and qualification guidelines are based on best industry practices and that judgment must be applied in determining whether a training program meets the INPO criteria. Such judgments have been made in this assessment and in some cases such as licensed reactor operator training, general employee training and auxiliary operator training, not all recommendations contained in the INPO guidelines were considered appropriate for TMI-1 training programs. The INPO document further suggests that ultimately the content and depth of training programs should be determined systematically based on an analysis of the knowledge and skills required for the job position which the trainee will occupy. This subject is discussed under Criteria Based Training Methods. Lacking a systematic analysis, however, the INPO guidelines are considered the best reference for measuring training content. Training content was also examined for conformance with regulatory requirements and industry standards where applicable.

a. TMI-1 training program content conforms with regulatory requirements and industry standards.

b. In the areas assessed, TMI-1 training program content is, overall, consistent with INPO guidelines. Exceptions to this conclusion are noted separately. The TMI-1 licensed operator requalification training program promulgated in July 1981 is based on and is in close agreement with corresponding INPO guidelines promulgated in October 1980. Other promulgated TMI-1 training programs predate applicable INPO guidelines or were promulgated shortly after the INPO guidelines became available. These programs have not been revised to conform closely with the INPO guidelines.

c. Although the content of the TMI-1 auxiliary operator training program is consistent with the total content of the three phases of the INPO guidelines, the TMI-1 program provides 39 weeks of classroom instruction first, followed by 11 months of OJT. Successful completion of this training results in qualification as an Auxiliary Operator-A. Educational subjects including mathematics, physics, chemistry, and reactor theory are presented at the beginning of the TMI-1 training program at a level which exceeds auxiliary operator job requirements. However, this material is relevant for the auxiliary operator who progresses to licensed reactor operator training 2-3 years after receiving the auxiliary operator academic instruction. The INPO recommended program divides the total classroom instruction and OJT into phases of classroom instruction followed by OJT which lead to intermediate level qualifications before the trainee becomes a fully qualified auxiliary operator.

d. There are deficiencies in content, study guidance and specific evaluation criteria for task checkoffs and oral examinations included in on-the-job training programs for licensed and non-licensed operators.

e. The initial training program for TMI-1 licensed reactor operators lacks sufficient content in the following subjects:

(1) Mathematics

(2) Reactor chemistry

(3) Materials science

This conclusion is based on an evaluation of content differences between the TMI-1 program and the INPO recommended program.

f. The initial training program for TMI-1 licensed senior reactor operators lacks sufficient content in the following subjects:

(1) Training in procedures and the bases for procedures (Administrative procedures for maintenance and technical support; duties of load system dispatcher)

(2) In-plant training (Instruction in evolutions and SRO duties)

(3) Advanced electrical components and systems training

This conclusion is based on an evaluation of content differences between the TMI-1 program and the INPO recommended program.

g. The TMI-1 training programs for licensed operators are based on criteria for training personnel at a unit which has received an operating license. Although this is the status of TMI-1, the plant has remained shutdown for

3½ years which may be unique for a plant with an operating license. The shutdown status has reduced the opportunities for trainees to gain meaningful operating experience during OJT. Additional training has not been provided to compensate for the reduced effectiveness of OJT in the shutdown plant. This condition warrants an analysis of the impact of the long shutdown on the effectiveness of TMI-1 OJT.

1-4.5. Examination Security. The subject of examination security has received close and continuing GPU Nuclear management attention. The assessment inspected this area closely by interviewing staff personnel and trainees, observing security practices, and reviewing relevant documentation.

a. GPU Nuclear and TMI Training Department examination security procedures and actual practices are effective in maintaining the integrity of examinations.
b. Procedures have not been established to check for collusion in examination answers.
c. The present assessment determined that examination security is handled well and personnel concerned are aware of their responsibilities. However, a review of documentation indicated that while responsibility for examination administration is assigned at a managerial level, specific responsibility for examination security is not assigned at this level.

1-5. RECOMMENDATIONS. The recommendations included in this Report Summary are substantive recommendations from the Assessment Report but may be stated differently than the more specific recommendations included in each section of the Assessment Report. Recommendations are made in the broad areas of Criteria Based Training Methods, Organization, Training Delivery, Training Content, and Examination Security. The following categories are established to prioritize the importance of recommendations presented in this Report Summary:

a. Category 1 - Recommendations which deal with new efforts to remedy a void or gap in TMI-1 training.
b. Category 2 - Recommendations which deal with improvements in existing training programs and practices.
c. Category 3 - Recommendations which deal with improvements in training organization, documentation and administration.

1-5.1. Criteria Based Training Methods.

a. Upon receipt of the INPO generic job and task analysis for each plant position, complete the analysis by making it plant specific for TMI-1. Rewrite learning objectives based on the validated knowledge and skills produced in the plant specific analysis. Reorganize applicable training programs and lesson plans based on the new learning objectives. Using the job performance measures developed for each position, construct new evaluation instruments such as tests, performance demonstrations and on-the-job training checklists. This is a category 1 recommendation.

b. Identify key personnel who will be involved in supervising and producing the plant specific job and task analyses. Provide the necessary training to these key individuals so that the work can be performed correctly and in a timely manner. The INPO Training and Education Division may be able to offer assistance and advice in this regard. This is a category 1 recommendation.

c. For those non-licensed operator, technician and maintenance positions for which INPO job and task analyses will not be ready soon, learning objectives that are being written or modified should be constructed in the context of job relatedness. This is a category 2 recommendation.

d. Promulgate guidance procedures for composing written, oral and performance tests based on the best accepted practices in the field of test development and administration. Rewrite tests based on the procedures adopted. Routinely perform test item analysis to detect invalid questions, areas of learning or teaching difficulties and trainee collusion. This is a category 2 recommendation.

e. Promulgate guidance procedures for the development and quality assurance of various types of instructional material such as trainee handouts, overhead transparencies, system and equipment diagrams, and training manuals to ensure that the instructional quality is adequate and that each item serves its intended function appropriately. This is a category 2 recommendation.

1-5.2. Organization.

a. Establish a formal training feedback system to measure training effectiveness. This system should include reports on job performance problems and job performance evaluations. This is a category 1 recommendation.

b. Establish administrative procedures which will insure that all official documents relating to training are properly authenticated, dated, distributed, and periodically reviewed and updated as necessary. This is a category 3 recommendation.

1-5.3. Training Delivery.

a. Increase the emphasis on instructor development by promulgating instructor certification criteria and by expanding existing programs to provide more effective initial and continuing development of instructors. This is a category 2 recommendation.

b. Increase current plant expertise in the TMI Training Department by establishing a program for rotating experienced operations personnel into instructor assignments. This is a category 2 recommendation.

c. Arrange with B&W to upgrade the quality of instruction provided to TMI-1 personnel during simulator training. These measures should require use of SRO qualified or simulator certified instructors, lesson plans, drill guides, trainee handouts, and legible training aids. This is a category 2 recommendation.

1-5.4. Training Content.

a. Restructure the TMI-1 auxiliary operator training program to incorporate the three phases of training recommended by the INPO guidelines. Phases 1 and 2 of the INPO recommended training should be provided to all auxiliary operator trainees. Phase 3 of the INPO recommended program should be provided to those auxiliary operator trainees who have the potential and motivation to become CRO trainees. A new phase 3 should be developed based on specific job requirements for those trainees who will remain auxiliary operators. This is a category 2 recommendation.

b. Increase content of the TMI-1 licensed reactor operator training program in the subject areas of mathematics, reactor chemistry, and materials science. Consider the recommendations of INPO guidelines in modifying the content of this program. This is a category 2 recommendation.

c. Increase content of the TMI-1 licensed senior reactor operator training program in the subject areas of administrative procedures for maintenance and technical support, duties of load system dispatcher, OJT instruction in evolutions and SRO duties, and advanced electrical systems and components. This is a category 2 recommendation.

d. Upgrade on-the-job training by developing job based objectives, providing criteria for conducting checkoffs, providing study guides for OJT tasks, standardizing training among shifts, and delineating procedures for conduct of OJT by operations personnel. This is a category 2 recommendation.

e. Examine the impact of the extended plant shutdown on the effectiveness of on-the-job training for TMI-1 licensed operator trainees. Augment present OJT as necessary with training such as observation training at an operating plant, additional simulator training or a structured program of training during the startup and test program. This is a category 1 recommendation.

1-5.5. Examination Security.

a. Assign specific responsibility for examination security at a managerial level to enhance continued diligence in this area. Assigned duties should include spot checking security practices, periodically reviewing security procedures, and receiving reports on analysis of test answers for collusion. This is a category 3 recommendation.

SECTION 2
INTRODUCTION

2-0. INTRODUCTION. This section outlines the background and purpose of the assessment, the scope of work, Data-Design Laboratories' qualifications to perform the work, and the organization of the report.

2-1. BACKGROUND. The GPU Nuclear Corporation's Three Mile Island Unit 1 (TMI-1) nuclear power plant near Middletown, Pennsylvania has remained shutdown since the March 28, 1979 accident at nearby Three Mile Island Unit 2 (TMI-2). In an August 9, 1979 Order and Notice of Hearing, the Nuclear Regulatory Commission directed that TMI-1, which was undamaged by the accident, remain shutdown until hearings could be conducted by an Atomic Safety and Licensing Board. The hearings would determine whether there is reasonable assurance that the facility could be operated without endangering the health and safety of the public considering accident recovery operations in progress at TMI-2. On July 27, 1982 the Board issued a Partial Initial Decision (Reopened Proceeding) which concluded that the issues in the proceeding reopened by the Board's Order of September 14, 1981 have been resolved in favor of restarting TMI-1.

One outcome of investigations into the TMI-2 accident was recognition of the need to improve significantly the training of nuclear power plant operators at TMI and throughout the nuclear utility industry. Activities to improve training at TMI began in the summer of 1979. In 1981, the determination that some TMI-1 operating personnel had cheated on the April 1981 NRC license examinations and on some examinations administered by GPU Nuclear identified a need to further review and improve the TMI-1 training program with emphasis on testing and evaluation practices.

Also relevant as background to this report is the formation of the Institute of Nuclear Power Operations (INPO) in late 1979 as a direct response by the nuclear utility industry to the TMI-2 accident. This non-profit organization was established by the nation's nuclear utilities to promote high standards of excellence for operating nuclear power plants. Consistent with this function, INPO is establishing quality training standards in two phases. In the first phase, INPO developed guidelines for training plant personnel based on the best programs and practices in the nuclear industry. These guidelines have been published and distributed to member utilities for their use in developing or modifying their training programs. Although limited experience has been accumulated in the application of the guidelines, they represent best industry practices and for this reason were used as a comparison reference in conducting this assessment. In the second phase, INPO is developing a model training program for plant personnel based on a comprehensive and systematic analysis of training and education needs. In this program, the process of job analysis identifies all tasks performed by job incumbents. The process of task analysis identifies all knowledge and skills required to properly perform the tasks of a job. These analyses provide the basis for determining training requirements for plant personnel.

As of spring 1982, job analyses have been completed for the following five plant operating positions and the more detailed task analyses are in progress for positions a, b and c:

a. Shift supervisor
b. Senior control room operator
c. Control room operator
d. Plant equipment operator
e. Shift technical advisor

Job and task analyses are also scheduled and in progress for maintenance and technical positions.

The industry-wide job and task analysis project will produce a comprehensive training data base which will aid utility personnel in designing, developing, and improving their training programs. The procedures, forms, and computer software used for the industry-wide analysis will be made available by INPO for use by utility personnel in performing plant-specific analyses which are necessary to supplement the INPO generic analyses. The first INPO products are expected to be distributed in late 1982.

In June 1982 GPU Nuclear contracted with Data-Design Laboratories to conduct an independent assessment of selected TMI-1 training programs including operator training programs.

2-2. SCOPE OF WORK. The scope of work as set forth in GPU Nuclear contract No. 190069 is quoted as follows:

"Contractor shall provide an independent assessment of the TMI-1 Operator Training Program. The scope of review shall be as follows:

-- Auxiliary (or equipment) operator training, licensed reactor operator training, licensed senior reactor operator training, radiological control technician training and general employee training including requalification training for these categories.
-- The technical content of these training programs and a comparison with INPO guidelines.
-- The administration and delivery of the training programs, including effectiveness of organizational structures, modes of teaching (e.g., self-study, video tape, lecture-discussion, plant tour, etc.), on-the-job training organization and effectiveness, simulator training preparation and delivery, measurements of student knowledge level.
-- Assessment of the results of the training program, including job performance, mock NRC exam and NRC exam performance and drill performance as available."

2-3. DATA-DESIGN LABORATORIES' EXPERIENCE. Data-Design Laboratories is a diversified, technology oriented company which provides engineering services and engineered products to the defense, communication, electronics, power conditioning and life support industries. The Company's annual report for corporate fiscal year 1981 is provided in Volume 2, Section 2. Data-Design Laboratories has over 23 years experience in the design, development, delivery, and evaluation of complex technical training programs mainly in support of U.S. Navy strategic weapons systems. Training products and services contributed approximately $18 million to Data-Design's total sales of over $72 million in corporate fiscal year 1982. Some representative Data-Design customers and the training services provided to them are:

a. U.S. Navy Strategic Weapons Systems Project Office, Washington, DC. Data-Design has maintained a contractual relationship with this customer for over twenty years. During this time, Data-Design has (1) participated in training system design, and developed criteria for the organization, management, delivery, evaluation, and maintenance of training programs, (2) developed training requirements by task analyses performed on hardware systems still under development, (3) developed specifications for curricula, (4) developed curriculum materials, (5) designed a training evaluation feedback system for personnel and training programs, and (6) performed modifications to the programs.

b. Institute of Nuclear Power Operations (INPO), Atlanta, Georgia. Two Data-Design employees with nuclear power and instructional technology experience are assigned on loan at INPO to participate in the industry-wide job and task analysis effort. A third employee with nuclear power engineering experience is participating in the INPO construction project evaluation effort.

c. U.S. Naval Personnel Research and Development Center, San Diego, California. Data-Design designed and developed a self-paced, structured on-the-job training and qualification program for main propulsion plant operators on board an aircraft carrier. OJT and qualification packages were prepared for fourteen separate watch stations. This project included the development for each watch station of (1) instructional objectives, (2) watch station oriented training material including simplified schematic diagrams of systems and equipment, equipment and component descriptions covering the function, purpose and operation of each system or equipment assigned the watch station, (3) study assignments and written drill guides, (4) practical factor demonstrations, and (5) qualification check-off lists.

d. Wright-Schuchart-Harbor/Boecon Corporation/General Energy Resources, Inc. (WBG), Richland, Washington. Data-Design provided training support for WBG, a major piping and mechanical contractor at a nuclear power plant construction site. This five-month effort began during the period a stop-work order was in effect. The support included managing training while contractor personnel were being organized to assume this function, instructing construction workers in job procedures, upgrading instructional material, and insuring that various categories of workers received required training. The Data-Design effort contributed directly to resumption of safety-related work near the end of the contract.

e. U.S. Naval Sea Systems Command, Washington, DC. Data-Design is currently developing two formal training courses on the operation and maintenance of shipboard air conditioning and refrigeration systems. The development for each course consists of (1) task analysis including development of terminal and enabling objectives, (2) curriculum outline, (3) instructor's guides, (4) student's guides, (5) training aids such as viewgraphs and slides for specific lessons, (6) a bank of test questions, and (7) part task trainer specifications.

f. Charleston Naval Shipyard, Charleston, South Carolina. Data-Design developed a training requirements plan which was used to plan and support the shipyard's first major overhaul of a nuclear powered strategic weapons system submarine. The Data-Design effort included (1) analysis of the submarine's work package to determine specific shipyard tasks, (2) determination of shipyard personnel capabilities to accomplish identified tasks, (3) definition of required training for each group of personnel, (4) analysis of training options, including source of training, scheduling efficiencies and cost effectiveness, and (5) development of a training requirements plan showing required training and all necessary data to accomplish the training.

g. U.S. Army Signal School Ft. Gordon, Georgia and U.S. Army Ordnance School, Aberdeen Proving Grounds, Aberdeen, Maryland. Data-Design developed soldier's manuals and skill qualification tests for these U.S. Army schools. Development of the soldier's manuals included job task analyses to obtain relevant data, verification of tasks, and establishment of the standards of performance and task criticality. Skill qualification tests were prepared using a development plan to analyze each task. Administration guides, scoring booklets, and performance certification components were developed. Additionally, decision measurement system (DMS) sets were developed relating to troubleshooting tasks. The DMS provides a means of evaluating mental skills involved in troubleshooting by presenting simulated situations in written and graphic form rather than requiring insertion of faults into actual equipment.

h. Association of Boards of Certification, Ames, Iowa. Data-Design validated task analyses for sixteen jobs which require certification of job incumbents. These jobs are in the areas of water treatment, water distribution, wastewater treatment, and wastewater collection at water and wastewater facilities. The effort involved the close interaction of instructional technologists from Data-Design and subject matter experts from various water and wastewater facilities in the United States and Canada. The validated task analyses which were produced are used in developing certification tests and training materials.

i. Continental Telephone Company, Victorville, California. Data-Design conducted a series of workshops for supervisory personnel in the telephone company. These workshops produced task analyses on eight different telephone industry crafts plus content-validated tests based on the task analyses. The procedures derived during these workshops yielded the documentation to support Equal Employment Opportunity Commission requirements.

2-4. ORGANIZATION OF THE REPORT. Section 1 of the report has been prepared as a stand alone Report Summary which provides information on the background and assessment methods before highlighting the principal findings, conclusions and recommendations. These are based on the complete findings, conclusions and recommendations included in the section on each assessment area. The broad recommendations presented in the summary are prioritized in three categories. The detailed recommendations included in the section on each assessment area are not prioritized. The introduction of Section 2 is followed by Section 3 which describes the assessment approach, schedule and phases, and the Data-Design and consultant personnel who participated in the effort.

The complete findings, conclusions and recommendations in each assessment area are presented in Sections 4 through 12 of the Assessment Report. These sections are titled as follows:

Section 4 - Training Organization and Administration
Section 5 - Instructor Development Program
Section 6 - General Employee Training
Section 7 - Auxiliary Operator Training
Section 8 - Licensed Reactor Operator Training
Section 9 - Licensed Senior Reactor Operator Training
Section 10 - Licensed Operator Requalification Training
Section 11 - Simulator Training
Section 12 - Radiological Controls Technician Training

The complete report consists of the Assessment Report, Volume 1, Sections 1-12 and the Supporting Material, Volume 2, Sections 2-12.

SECTION 3
ASSESSMENT METHODS

3-0. INTRODUCTION. Prior to commencement of data collection and analysis, Data-Design Laboratories submitted for the approval of GPU Nuclear an assessment plan which included the assessment approach and methods, a schedule and phases of performance, composition of assessment teams, and organization of the report.

3-1. SCHEDULE AND PHASES. The assessment consisted of the following schedule and phases:

June 7-18, 1982	Develop assessment plans; research background information.
June 15-18, 1982	Collect data on training of TMI-1 personnel at B&W simulator, Lynchburg, Virginia.
June 21-July 2, 1983	Collect data on TMI-1 training programs at Three Mile Island, Middletown, Pennsylvania.
July 2-September 9, 1982	Analyze data and write report. Preliminary findings were reviewed for factual accuracy and discussed with GPU Nuclear at Three Mile Island August 17-20, 1982.

3-2. COMPOSITION OF ASSESSMENT TEAMS. Six Data-Design personnel, Mr. J.H. Biddick, Mr. D.S. Boyd, Mr. A.K. Loposer, Mr. J.E. Malloy, Dr. P.C. Manning, and Dr. M.A. Rhein were organized in three teams to collect and analyze data in assigned functional areas of the assessment. Each team consisted of an instructional technologist and an individual with professional level engineering plant operating experience. The instructional technologists are Data-Design employees with extensive experience in such areas as instructional systems design; instructional modeling; task analysis; analysis of training objectives; design, development and production of training programs, training materials and self-paced instructional materials; criterion-referenced job specific test item writing and interpretation of test results; and training evaluation and feedback systems. The instructional technologists have advanced degrees in the following disciplines: Ph.D., Curriculum and

Instruction; Ed.D., Research Methodology and Statistics; M.A., Experimental Psychology. The other members of each Data-Design team possess extensive experience in the U.S. Navy as engineering and commanding officers of nuclear and conventionally powered submarines and surface ships and in the management and supervision of nuclear power training and other technical training programs. The Data-Design personnel were assisted in their data collection efforts on site by the following consultants who provided nuclear power plant technical expertise in specific areas:

Mr. J.J. Holman, Qualification Evaluation System Corp. - auxiliary operator and licensed operator training and qualification, simulator training

Mr. A.T. Sabo, Water Reactor Divisions, Westinghouse Electric Corp. - radiological control technician training

Additionally, Dr. A.J. Abrams, an independent consultant with extensive experience in technical training programs, assisted in development of the assessment plan and the analysis of data.

Dr. R.L. Seale, Professor and Head of the Department of Nuclear Engineering, University of Arizona, reviewed the data, met with Data-Design team members to discuss their work and contributed to the findings, conclusions and recommendations of this report.

Resumes of individuals who participated in the assessment are included in Volume 2, Section 3.

3-3. ASSESSMENT APPROACH AND METHODS. In conducting the assessment, Data-Design collected information to support findings in the following broad areas:

a. The existence and adequacy of corporate goals and policies governing the TMI-1 training program. The INPO document 82-011 titled "The Accreditation of Training in the Nuclear Power Industry" was used as a guideline in this area.

b. The existence and adequacy of implementation documentation necessary to support the identified corporate training goals and policies. INPO 82-011 was used as guidance in this area. The documentation examined concerned criteria for program development, learning objectives, methods of instruction, instructional materials, and trainee evaluation and program evaluation.

c. The adequacy of training program resources and procedures to support an effective technical training program. INPO 82-011 was used as guidance in this area which covered physical facilities and equipment, training equipment, technical references to support lesson plan development, appropriateness of class size, and corporate commitment to training.

d. The effectiveness of the instructor training program and the quality of instruction. The INPO document titled "Nuclear Power Plant Training Personnel Guidelines For Technical Instructor Qualification" was used as guidance in this area. Instructor selection, initial training to prepare the instructor for trainee instruction and evaluation duties, continuing development, and evaluation were examined.

e. The existence, completeness and usability of training records. INPO 82-011 was used as guidance in this area. Records of the training program and individual trainee performance were reviewed for auditability of training content, training schedules, results of past and current programs, and trainee performance and qualifications.

f. Agreement between training program content and procedures and advisory and regulatory documents. This involved examination of 10 CFR 55 and applicable NUREGS, industry standards and INPO guidelines and comparison of training requirements and recommendations contained in the documents with TMI-1 training programs.

g. The adequacy of lesson plans and instructional materials and the appropriateness of instructional presentation to achieve instructional goals. INPO 82-011 and TMI Training Department procedure TD 1103, "Training Department Lesson Plans Development, Presentation, Evaluation and Selection of Training Aids" were used as guidance in this area. The assessment included an examination of learning objectives, lesson plan development and use, instructional references, audiovisual material which supports the lesson plans and objectives, adequacy of trainee handouts, and presentation techniques.

h. The determination of training program effectiveness including the performance of TMI-1 personnel on mock NRC license examinations and NRC license examinations. INPO 82-001 was used as guidance in this area. The review included results of NRC and mock NRC license examinations, simulator performance reports, and feedback from TMI-1 departments which use training services.

i. The administration of examinations including measures to ensure proper security. Examined in this area were GPU Nuclear and TMI Training Department procedures dealing with administration, security, conduct, and supervision of examinations.

j. On-the-job training. TMI Training Department procedures dealing with on-the-job training and its structure, content, delivery, testing, and qualification procedures were examined in this area.

The INPO guidelines recommend an annual evaluation of licensed and non-licensed operator training programs covering the elements which follow. The operator sections of the report are structured around these elements in order to establish a reference for subsequent assessments. The INPO recommended elements are:

a. Instructors
b. Training materials
c. Presentation techniques
d. Examination techniques
e. Classroom facilities
f. On-the-job training effectiveness
g. Course content
h. Deficiencies observed through examination results and/or job performance
i. Status of deficiencies noted in other evaluations

This assessment effort was supported at all levels in the GPU Nuclear Corporation. Principal GPU Nuclear contacts for information and assistance were Mr. R.C. Arnold, President GPU Nuclear Corporation; Dr. R.L. Long, Vice President Nuclear Assurance; Dr. R.A. Knief, Manager Plant Training TMI; and Mr. D.A. Ross, Manager Corporate Training.

GPU Nuclear provided training program descriptions, training manuals, training organization diagrams, training procedures, administrative procedures, INPO guidelines, reports of special commissions, committees and boards and other training related documents to Data-Design for review and analysis in advance of the on-site visit. At TMI, the Data-Design team was based at the TMI Training Center and remained in close contact with instructors, training staff, administrative staff, trainees, and classroom activities. This enhanced the exchange of information, review of records and training documents and attendance at classes and other training sessions. On completion of the on-site phase, contact was maintained by phone with key individuals in the training organization who continued to provide additional information and to clarify existing information. The preliminary findings of the assessment (not including conclusions and recommendations) were reviewed for factual accuracy by GPU Nuclear and comments on factual accuracy were incorporated in the final report. To assure independence of the assessment, the conclusions and recommendations of the assessment were not disclosed to or discussed with GPU Nuclear prior to submission of the final report.

The INPO generic guidelines for various training programs were used as a reference for assessing the TMI-1 training programs. Several of the guidelines were issued in 1982 and late 1981 and postdate part of the GPU Nuclear effort in developing current training programs. Although some of the recent INPO guidelines have not been fully incorporated, the comparison included in this assessment can serve as a basis for future training program revisions.

GPU Nuclear and INPO procedures and checklists were used where appropriate in developing data collection instruments and procedures for the evaluation of training sessions, instructor performance, instructional materials, learning objectives, lesson plans, test items, and documents to support lesson plans. A sample of data collection instruments used is included in Volume 2, Section 3.

A total of 66 interviews were conducted with GPU Nuclear personnel concerned with TMI-1 training including:

President GPU Nuclear Corporation
Vice President Nuclear Assurance
Vice President Radiological and Environmental Controls

Vice President and Director TMI-1
Operations and Maintenance Director TMI-1
Manager Plant Training TMI
Manager Plant Operations TMI-1
Manager Corporate Training
Operator Training Manager TMI
Manager Radiological Controls TMI-1
Radiological Field Operations Manager TMI-1
Radiological Training Manager TMI-2
Twelve Training Department instructors
Two shift supervisors TMI-1
Two shift foremen TMI-1
Three control room operators
Eighteen trainees

Many informal discussions were held with the GPU Nuclear training staff, supervisors, instructors, operators, and trainees. These discussions took place while attending classes, observing simulator sessions and collecting training data.

A total of sixteen training sessions and three four-hour simulator training periods were observed and evaluated. These included classroom lectures, simulator exercises, system walk throughs, practical factor checkouts, and quizzes. The sessions provided valuable inputs for evaluating instructor performance, presentation techniques, trainee participation and attitudes, examination security, instructional materials, and classroom facilities.

To obtain additional and different points of view on training at TMI-1 and in the nuclear utility industry, telephone interviews were conducted with the below named individuals. These individuals are active in nuclear utility industry matters and participated in past evaluations of TMI-1 training or provided training services for GPU Nuclear or presently furnish management support services for GPU Nuclear:

Mr. F.L. Kelly, Personnel Qualification Services Company
Dr. W.R. Kimel, College of Engineering, University of Missouri
Mr. M. Miles, Basic Energy Technology Associates

Mr. K.A. Strahm, Institute of Nuclear Power Operations

Dr. R.E. Uhrig, Florida Power and Light Company

Mr. W. Wegner, Basic Energy Technology Associates

Dr. W.F. Witzig, College of Engineering, Pennsylvania State University

3-4. COMMENTS ON ASSESSMENT APPROACH. As an introduction to the individual sections which follow, it should be recognized that the assessment has focused on present TMI-1 training programs and highlights those additional steps which should be taken to achieve Data-Design's perception of the highest order of training effectiveness and efficiency. This perception is based on the recommendations of the INPO guidelines and an aggregate of experience in technical training development and evaluation. The assessment does not compare present conditions to prior conditions in TMI-1 training programs except as needed to understand reasons for the present status and the evolution of the training programs. As in any assessment of this nature, the findings are based on limited observations and may not accurately reflect overall conditions in the various areas examined. The findings describe observed conditions at the time of the assessment and in many cases these conditions are in the process of being modified by GPU Nuclear to improve the training organization, administration and programs.

In examining how TMI-1 training can be improved, the assessment does not examine with equal detail the many significant actions which have already been taken by GPU Nuclear to improve TMI-1 training programs. The historical record shows that TMI-1 training programs have moved ahead. It is the intent of this report to provide informed, broadly experienced recommendations and guidance for the further enhancement of efforts which have been well started by GPU Nuclear.

SECTION 4

TRAINING ORGANIZATION AND ADMINISTRATION

4-0. INTRODUCTION. A training organization is required to assure that any large and complex technical training program operates efficiently and effectively in meeting organizational goals. The training organization typically has responsibility for developing, conducting and evaluating training; for identifying training resource requirements to corporate management; and for maintaining liaison with operating units to identify training requirements and to monitor the effectiveness cf training. The likelihood of a training program being successful is enhanced by a strong corporate commitment. During the past three years, GPU Nuclear has built up a large scale training effort and has expended considerable resources to improve training.

4-1. ASSESSMENT METHODS. This assessment of the GPU Nuclear training organization and administration as applied to TMI-1 training programs was made by Mr. J.H. Biddick, Mr. A.K. Loposer and Dr. M.A. Rhein all of Data-Design Laboratories. Interviews with key GPU Nuclear corporate managers were conducted to assess corporate commitment to training and awareness of the status of the training program. TMI Training Department personnel were interviewed to define, then assess, organizational structure and procedures. TMI Training Department policies and procedures were reviewed, and training center operations and facilities were observed. Figure 4-1 shows parts of the GPU Nuclear organization concerned with development and administration of training for TMI-1 personnel.

Table 4-1 lists the organizational positions of individuals interviewed to obtain data on their involvement in and responsibilities for training and training support.

Table 4-2 lists the GPU Nuclear training organization and administration documents reviewed.

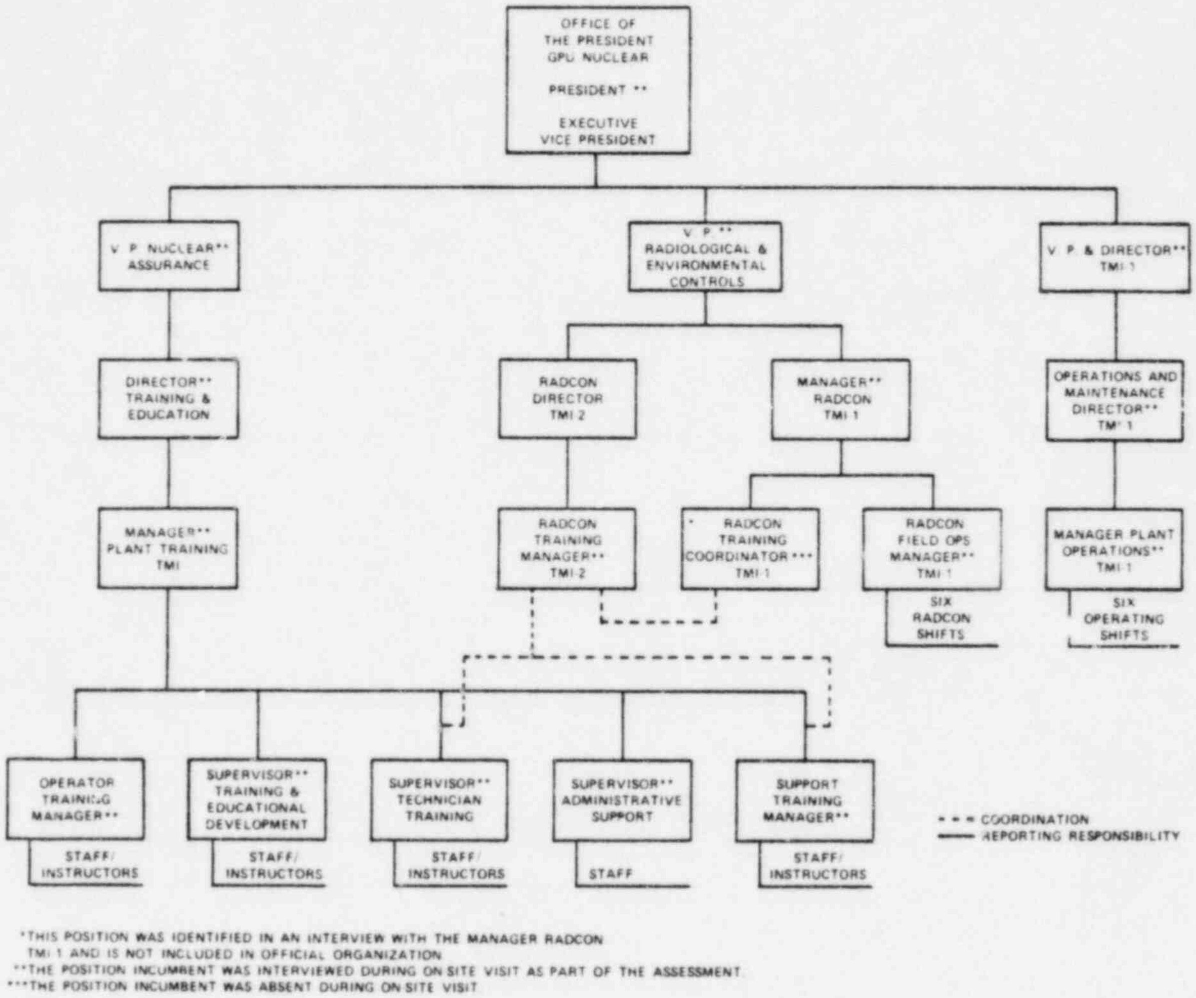

Figure 4-1. Diagram of GPU Nuclear Organization Showing Titles and Relationships of Selected Positions Concerned with Training of TMI-1 Personnel

TABLE 4-1

POSITIONS OF PERSONNEL INTERVIEWED

IN ASSESSING TRAINING ORGANIZATION AND ADMINISTRATION

President GPU Nuclear Corporation

Vice President Nuclear Assurance

Vice President and Director TMI-1

Vice President Radiological and Environmental Controls

Director Training and Education

Manager Plant Training TMI

Operator Training Manager TMI

Training Coordinator TMI-1 (Acting)

Supervisor Training Administrative Support TMI

Support Training Manager TMI

Document Control/Clerical Supervisor TMI

Training Department Library/Purchasing TMI

Training Department Audiovisual and Scheduling TMI

The INPO document titled "The Accreditation of Training in the Nuclear Power Industry", May 1982, (INPO guidelines) was used as a source of criteria for evaluating the training organization and administration. This INPO document also contains criteria for evaluating the instructional staff. Detailed assessments of program content, instructors, instructional materials, and examination practices are found in other sections of this report which address specific training programs. Although INPO accreditation criteria were used, the present effort is an independent assessment and not an examination for accrediting TMI-1 training programs. As a step in preparation for INPO accreditation, the TMI Training Department completed the INPO accreditation self evaluation questionnaire. Information provided in this detailed questionnaire was used in the assessment.

4-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The findings, conclusions and recommendations are organized relative to the INPO accreditation criteria. The INPO accreditation criteria are outlined in an appendix to the INPO guidelines.

TABLE 4-2

TRAINING ORGANIZATION AND ADMINISTRATION DOCUMENTS REVIEWED

Goals, Objectives and Action Items

1. TMI Training Department Goals
2. 1982 GPUN Goals - memo of 2-23-82 by F. Glickman
3. GPU Nuclear Goals and Objective Program Corporate 1982, Nuclear Assurance Division June 15, 1982
4. Memo of March 26, 1981 on NUREG CR/1750 Analysis, Conclusions, and Recommendations Concerning Operator Licensing
5. Table 10-2 Action on Findings and Recommendations of TMI-2 Accident Reports (plus Table 10-1 which is key to reports)
6. Penn State Pedagogical Review Recommendations
7. TMI OARP Review Committee Report
8. Nuclear Assurance Division Restart Commitments May 24, 1982 memo and June 4, 1982 memo

Training Department Documentation

1. TMI Training Center description
2. TMI Training Center layout diagram
3. TMI Training Department Facilities Usage Report, 1st Qtr. 1982 and 2nd Qtr. 1982
4. Sample weekly classroom schedules:
   1/18-1/22 plus weekly cyclic training schedules
   2/15-2/19 5/17-5/21
   3/15-3/19 6/14-6/18 plus weekly cyclic training schedules
   4/12-4/16 (All dates in 1982)
5. TMI Training Department A-V Inventory-Hardware, 2/6/81

Examination Security

1. Adm. Procedure 6200-ADM-2600.1 Administration of Examinations 10-20-81**
2. Draft Procedure on Conduct of Examinations June 25, 1982 memo
3. Exam Security memo June 7, 1982, R. Knief**
4. Working Hours memo June 18, 1982, K Tennis**
5. Examination typing instruction sheet (no date)**

Organizational Structure

1. GPU Nuclear Corp. Position Descriptions for:
   a. Instructor, Management/Supervisory Development
   b. General Employee/RWT Training Supervisor
   c. Group Supervisor, Supervisory/Management Training
   d. Supervisor, Technician Training
   e. Radiation Technician/Chemistry Technician Training Supervisor
   f. Program Development Supervisor
   g. Supervisor, Training and Educational Development
   h. Supervisor, Training Administrative Support
   i. Coordinator, Document Control
   j. Supervisor, Non-licensed Operator Training
   k. Supervisor, Licensed Operator Training
   l. Manager, Operator Training
   m. Manager, Plant Training
   n. Drafts of other position descriptions
2. Nuclear Assurance Division Organization, Rev. 4, June 30, 1981
3. TMI Training Department Administrative Manual promulgated by Manager Plant Training TMI memo of January 27, 1981

Instructional Programs and Materials

1. Training Department Lesson Plan Development Presentation, Evaluation and Selection of Training Aids, TD 1103 Rev. 1, 04/14/81**
2. Review and Approval of Lesson Plans and Topical Outlines, TD 1104 Rev. 0, 01/27/81**
3. Training Department Training Program Development/Revision Guide, TD 1105, Rev. 0, 01/16/81
4. Draft handwritten instructions for backfitting training program descriptions to meet specifications in Training Department Administrative Manual
5. List of Training Programs for 1982
6. Training and Education Department Course Catalog

** These materials are included in Volume 2, Section 4.

Section III of Appendix C to the INPO guidelines is titled Training Process Criteria.

SECTION III SUBHEADINGS	REPORT PARAGRAPH NUMBER
A. Training Organization and Administration	4-2.1
B. Training Resources and Facilities	4-2.2
C. Training Program Development and Implementation	4-2.3

Section IV of Appendix C to the INPO guidelines is titled Training Staff Criteria.

SECTION IV SUBHEADINGS	REPORT PARAGRAPH NUMBER
A. Staff Size and Workload	4-2.4
B. Staff Qualifications	4-2.5
C. Staff Development and Evaluation	4-2.6

In each of the following numbered paragraphs, specific INPO criteria are listed, then the findings relative to the criteria are presented. Conclusions and recommendations follow each numbered paragraph of findings.

4-2.1. INPO Criteria For Training Organization and Administration.

- o The objective of criteria in this section is "To ensure the effective control and implementation of training activities."

4-2.1.1. INPO Criteria For Training Organization Goals, Objectives, and Plans.

a. "Goals, objectives, and training plans are clearly and concisely stated."
b. "The goals, objectives, and training plans are reviewed periodically and revised as needed."
c. "The training organization's performance is evaluated against established goals and objectives."

4-2.1.1.1. Finding on "Goals, Objectives, and Training Plans Are Clearly and Concisely Stated." The goals and objectives of GPU Nuclear and the TMI Training Department are found in several documents. On February 23, 1982, the "1982 Goals for

GPU Nuclear" were published in a memorandum by F. Glickman. Some of these goals apply to the TMI Training Department. Goals for the TMI Training Department are also found in the "Nuclear Assurance Restart Commitments" memorandum and updates thereto by the Vice President Nuclear Assurance. The GPU Nuclear Goals and Objectives Program form includes training goals and objectives. The form as provided was not complete in all respects. In addition, training goals are found in various GPU Nuclear responses to previous assessments and reports.

Goals and objectives related to the training program are provided in several documents, but there is no one central source of goals and objectives. It is difficult to trace the relationship of corporate goals to TMI Training Department goals. It is also difficult to determine the current status of goal attainment because some of the documents lack dates and comments as to progress.

In addition to the GPU Nuclear corporate goal statements, each section within the TMI Training Department is responsible for developing internal goal statements. Some of the internal goal statements provided are status reports on current activities from which it could be inferred that goals had been set. The Technician Training Section and the Training and Educational Development (T&ED) Section provided more measurable goal statements than other sections in the TMI Training Department.

4-2.1.1.1. Conclusion. Corporate and department level goals are not developed and promulgated in a form that facilitates evaluation of attainment. Some of the written goals provided were incomplete or were not actually goal statements. The usefulness of the goals was limited by not being contained in one identifiable document.

4-2.1.1.1. Recommendation. Include all goal statements for training in a single document with clearly identified objectives and standards for identifying attainment. Goals should be dated and identified as official for a specified period of time.

4-2.1.1.2. Finding on "The Goals, Objectives, and Training Plans Are Reviewed Periodically and Revised as Necessary." Periodically, status reports are issued for the corporate goals and goals are revised as required. The internal TMI Training Department goals statements, some of which are in progress report form, are updated periodically.

4-2.1.1.2. Conclusion. Goals are updated periodically in practice. There are no specific procedures that direct the periodic review and/or revision of goals.

4-2.1.1.2. Recommendation. Develop and promulgate procedures for regular review, and revision as necessary, of training related goals.

4-2.1.1.3. Finding on "The Training Organization's Performance Is Evaluated Against Established Goals." The TMI Training Department is formally audited annually by the GPU Nuclear QA Department. This audit determines how effectively the TMI Training Department is meeting applicable QA standards and the audit checks for procedure compliance. Information on guidelines for this audit is promulgated in the Operational QA Plan. In addition to the annual QA audit, there is periodic QA monitoring of day-to-day operations, such as checking compliance with the published training schedule and checking whether lesson plans are being followed. Several QA audit and monitoring reports were reviewed and determined to contain specific recommendations to enhance compliance with various regulations and directives. The report of the QA audit conducted August 11-September 4, 1981 indicated that the audit was terminated in its early stages after major deficiencies were identified.

While there are both corporate and TMI Training Department generated goals, the goals reviewed are of recent origin and there is no formal means of evaluation based on goal attainment. There are a variety of ongoing types of monitoring such as by QA audits, management observations, and written examination performance. However, the criteria are not well defined for evaluating how well a goal is being met. In the biweekly managers' meeting, chaired by the Vice President and Director TMI-1, and attended by the Manager Plant Training TMI, training concerns are regularly discussed.

The TMI-1 Operations Department and TMI Training Department managers and supervisors meet weekly to discuss operator training programs. RadCon, Maintenance, Chemistry and Training Department managers and supervisors meet biweekly to discuss their respective training programs and concerns. Cyclic training meetings are held every six weeks to finalize the content of the upcoming cycle and to discuss training related problems. Input to these meetings comes both from observing trainee performance in the plant and from observing classroom sessions. Suggestions for cyclic training subjects are made by the TMI-1 plant departments to the TMI Training Department. A comprehensive examination is given at the end of initial training programs. Weekly quizzes are given throughout both initial and cyclic training. Licensed operators receive annual oral and written examinations. All of these tests can be used as indicators of training program effectiveness and of the need to make changes in training programs.

TMI program descriptions contain provisions for periodic evaluations of specific programs by the TMI Training Department and the department receiving the training services.

4-2.1.1.3. Conclusion. There are various informal means to evaluate the training organization's services against the users' perceptions of what these services should provide. Trainee performance on various tests provides another means of evaluating success of the training organization in meeting course goals. However, there is insufficient detail in goal statements, particularly in providing standards of performance, for evaluating progress toward meeting goals.

4-2.1.1.3. Recommendation. Develop goal statements for the training organization which have sufficient detail to permit evaluation of progress toward meeting goals. Develop and promulgate procedures that provide for periodic assessment of goal attainment.

4-2.1.2. INPO Criteria for Organizational Structure.

a. "The responsibilities and authority of training personnel are clearly defined in writing."
b. "The relationship of the training organization to the remainder of the corporate structure is clearly defined in writing."
c. "The training organization is structured to enable training personnel to perform their assigned tasks."

4-2.1.2.1. Finding on "The Responsibilities and Authority of Training Personnel Are Clearly Defined in Writing." Information concerning the responsibility and authority of training personnel is found in two official documents. The Nuclear Assurance

Division Organization, Rev. 4, 06/30/81, provides an organization chart, a summary of responsibilities, and descriptions of major functions for the sections within the TMI Training Department. The TMI Training Department Administrative Manual Vol. 1, provides a description of department responsibilities and position specifications including major duties and identifying to whom the position incumbent reports.

Overall, the documents are in general agreement. As might be expected, there are differences in titles of positions contained in different sources which describe the same organizational structure, but which were promulgated at different times.

4-2.1.2.1. Conclusion. There are some minor differences in the official documents describing positions in the TMI Training Department.

4-2.1.2.1. Recommendation. Examine the following two official documents for consistency and bring them into agreement: The Nuclear Assurance Division Organization, Rev 4, 06/30/81, and GPU Nuclear Training Department Administrative Manual, Vol. 1, 1/81.

4-2.1.2.2. Finding on "The Relationship of the Training Organization to the Remainder of the Corporate Structure Is Clearly Defined in Writing." A major function of the GPU Nuclear Corporation Nuclear Assurance Division under the Vice President Nuclear Assurance is to develop and implement all necessary general employee, operator, technician, and management training programs. In the training of TMI-1 personnel, this is carried out through the Director Training and Education and the Manager Plant Training TMI. The TMI Training Department is organized to be responsive in carrying out its mission. There are differences between actual TMI Training Department interfaces with other departments and the interfaces described in organization manuals and procedures. The Nuclear Assurance Division Organization and the TMI Training Department Administrative Manual do not describe formal TMI Training Department coordination interfaces with the TMI-1 Operations Department and the TMI-1 RadCon Department. Yet, both these departments have individuals who act in a training coordination role.

The Nuclear Assurance Division Organization description of major functions of the TMI-1 Technician Training subsection contains the statement that radiological controls training is coordinated with the Radiological and Environmental Controls

Division. In the TMI Training Department Administrative Manual the statement is made that radiological controls training is conducted under the direction of, and coordinated with the Radiological and Environmental Controls Division.

4-2.1.2.2. Conclusion. The placement of the TMI Training Department in the GPU Nuclear organization with the Manager Plant Training TMI reporting to the Vice President Nuclear Assurance through the Director Training and Education provides appropriate high level corporate visibility and direction for the training function. In this position, the TMI Training Department is responsive to the training needs of TMI-1 departments, but retains the flexibility to allocate its resources between TMI-1 and TMI-2 as necessary. An important conclusion is that the training organization functions satisfactorily to provide a variety and quantity of training services. More formal structure is needed to ensure optimum coordination between the TMI Training Department and the TMI-1 Operations and Radcon Departments. The TMI-1 Operations Department training coordinator role is defined in writing, but the TMI-1 RadCon Department training coordinator role is not.

4-2.1.2.2. Recommendation. Define the interfaces between the TMI Training Department and other departments in writing. Identify the roles of such individuals as training coordinators who are responsible for interaction with the Training Department.

4-2.1.2.3. Finding on "The Training Organization Is Structured to Enable Training Personnel to Perform Their Assigned Tasks." All personnel interviewed reported that the training organization was, from each individual's point of view, correct in order to ensure that training met organizational needs in a timely and effective manner. No one indicated frustration with the organization of the TMI Training Department, although several individuals commented that the organization was undermanned for the instructional load being carried.

The Training Department is organized as shown in the partial organization chart in Figure 4-1. An organizational anomaly exists in the manner in which TMI RadCon technician training is developed and implemented as compared to the development and implementation of other training for TMI-1 personnel. RadCon training is essentially under the direction of the Vice President Radiological and Environmental

Controls and not under the Manager Plant Training TMI who reports to the Vice President Nuclear Assurance. There is some sharing of personnel, facilities and equipment between the two organizations. There are different statements in organization descriptions on responsibility for TMI-1 RadCon technician training. The organization of the TMI Training Department provided as attachment C-2 of the preliminary INPO accreditation self evaluation questionnaire prepared by the TMI Training Department, Figure 4-2, includes TMI-1 RadCon technician training under the Manager Plant Training TMI. The basic functional difference between TMI-1 RadCon technician training and other TMI-1 training is that the level of review of training by the user department is much more detailed in RadCon training. For example, the Manager Plant Operations TMI-1 reviews and approves the training program descriptions for all operator training programs. On the other hand, the Radiological Training Manager TMI-2 reviews and approves training at the lesson plan level for all TMI-1 RadCon technician training.

4-2.1.2.3. Conclusion. GPU Nuclear documents differ in description of responsibilities for TMI-1 RadCon technician training.

4-2.1.2.3. Recommendation. Review GPU Nuclear documents describing different responsibilities for TMI-1 RadCon technician training and decide on organizational relationships and responsibilities for this training. Make documents consistent with this decision.

4-2.1.3. INPO Criteria for Procedures.

"(1) Written training procedures are established for the following:

- a. Development, implementation, and revision of training programs and materials
- b. Maintenance of training records
- c. Evaluation of training effectiveness
- d. Development and evaluation of the instructional staff
- e. Assessment of trainee knowledge and skills
- f. Use of feedback from on-the-job performance of trainees

(2) Training procedures are reviewed and revised as needed."

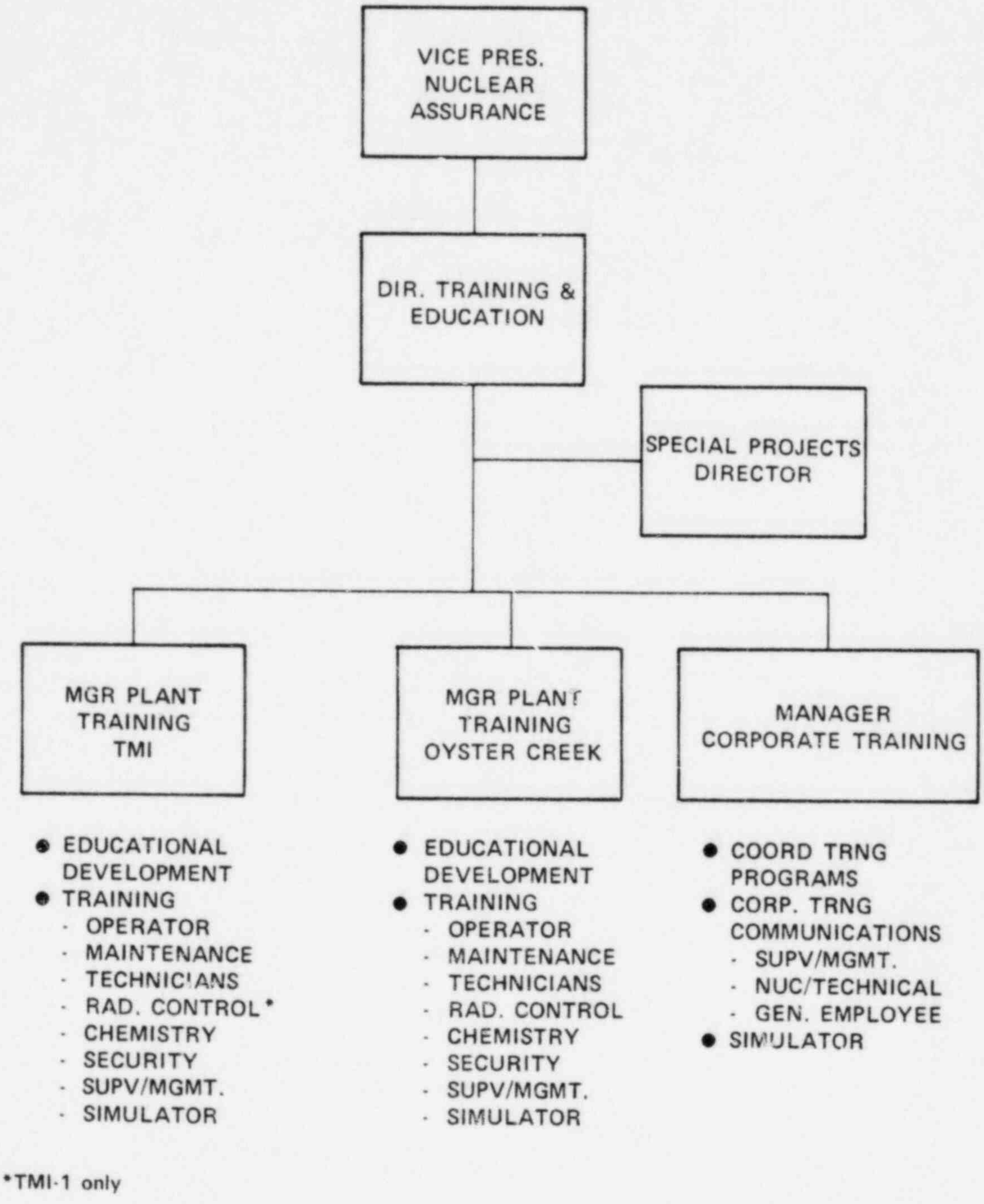

Figure 4-2. Diagram of GPU Nuclear Organization of Nuclear Assurance Division Showing Training and Education Functions

4-2.1.3.1. Finding on "Development, Implementation, and Revision of Training Programs and Materials." Three TMI Training Department procedures cover development, implementation and revision of training programs and material.

a. Procedure TD 1103, Rev. 1, 04/14/81, "Training Department Lesson Plans Development, Presentation, Evaluation and Selection of Training Aids," provides the specifications for lesson plan development. A Manager Plant Training TMI memo of July 12, 1982, notes that it will be cancelled as a procedure and reissued as a guide. Appendix C of this procedure is a "Lesson Plan Development Review Guide" for use by instructors and reviewers. This guide is a detailed checklist of review criteria. It includes criteria for analyzing objectives, content, sequencing of content to be presented, teaching methods and instructional materials to be used, equipment needed, length of time, and type of classroom needed. TD 1103 also includes guidance for setting the passing grade standard. Appendix F provides information concerning the relative ease and difficulty of writing, answering, and grading different types of test questions. However, it does not provide guidance concerning which kinds of test questions are appropriate for different types of intellectual activity required for job performance. Also, it does not provide a means for matching content to an appropriate testing method. It is noted that the TMI Instructor Manual which was promulgated by the TMI Training Department in August 1982 contains guidance on development of appropriate test questions and development of audiovisual aids.
b. Procedure TD 1104, Rev. 0, 01/27/81, "Review and Approval of Lesson Plans and Topical Outlines" as modified by Manager Plant Training TMI memo of July 12, 1982, specifies that the TMI Training Department section head or his designee is responsible for reviewing and approving lesson plans prior to classroom use unless approval of Manager Plant Training TMI is required by the approved program description.
c. Procedure TD 1105, Rev. 0, 01/16/81, "Training Department Training Program Development/Revision Guide," as modified by Manager Plant Training TMI memo of July 12, 1982, provides the specifications for training program descriptions, the review cycle and the revision procedure. The training program originator is responsible to see that any additional approval requirements are met as set forth in individual program descriptions. The

cognizant section head is responsible for ensuring adequacy of program technical content and the Supervisor Training Administrative Support TMI is responsible for including the program in Volume 2 of the TMI Training Department Administrative Manual. The final approval and implementing authority is the Manager Plant Training TMI.

4-2.1.3.1. Conclusion. The training procedures governing development, implementation and revision of training materials exist and are used. The recent memos modifying TD 1105 and TD 1104 reflect actual practices and make these documents current. The documents could be improved by revising them to focus on operational or job relatedness in instructional development. The detailed checklist for lesson plan development contained in Appendix 3 to TD 1103 is excellent and should be routinely used to evaluate actual lesson plans.

The TD 1104 Rev 0 does not specify clearly enough how review and approval of lesson plans and topical outlines are to be accomplished and upon what basis approval is to be granted. The interests of the cognizant user departments could be recognized more in the review process.

4-2.1.3.1. Recommendation. Review TD 1103 and TD 1104 in light of the above conclusions. Revise TD 1103 to reorient instructional developers to a job relevancy context.

4-2.1.3.2. Finding on "Maintenance of Training Records." The procedures for maintaining training records on individuals are not described in detail in any one document. There are a number of forms which are filled out by trainees, instructors, supervisors, oral test examiners, and document control personnel to make inputs to training records. The use of these forms is addressed in training documentation for specific areas. Examples of areas and forms used are: general employee training uses lesson attendance and examination score forms; document control uses resume record entry forms; operational supervisors use training request forms. The TMI Training Department Document Control/Clerical Supervisor was observed to be knowledgeable in the training record keeping system. More information on record keeping is provided in Section 4-2.1.4, Record Keeping.

4-2.1.3.2. Conclusion. The maintenance of training records needs to be systematized and documented. A computerized training data base system is being implemented. Computerization, of course, is no guarantee that a system will achieve improved organization and utility if it lacks structure in a manual mode.

4-2.1.3.2. Recommendation. Develop and promulgate a description of record keeping procedures including the scope, purpose, use, and access to trainee records.

4-2.1.3.3. Finding on "Evaluation of Training Effectiveness." No written procedures direct the process of evaluating training effectiveness. Individual training program descriptions specify periodic program reviews. Training effectiveness as defined by INPO guidelines is an observed improvement in job performance as a result of training. Assessment of trainee knowledge and skills is covered in Section 4-2.1.3.5.

4-2.1.3.3. Conclusion. The evaluation of training effectiveness is an area in need of improvement. The restrictions on performance evaluations of bargaining unit personnel and the lack of formal, written procedures for evaluating training effectiveness make it difficult to obtain training effectiveness information in other than an informal and subjective manner.

4-2.1.3.3. Recommendation. Establish a program for the regular, systematic, and equitable evaluation of nuclear power plant personnel job performance.

4-2.1.3.4. Finding on "Development and Evaluation of the Instructional Staff." This subject is discussed in Section 5 of the report. The initial instructor development course is based on the knowledge and experience of the Trai ng and Educational Development section staff. A systematic analysis has not been conducted of knowledge and skills required by a TMI Training Department instructor in the performance of his job. The TMI Training Department is currently evaluating INPO guidelines for use in developing an advanced instructor training program. It was reported that the program will be consistent with the INPO guidelines while addressing the highest priority TMI needs.

4-2.1.3.4. Conclusion and Recommendation. This subject is discussed in Section 5 of the report.

4-2.1.3.5. Finding on "Assessment of Trainee Knowledge and Skills." A variety of oral and written tests are used to assess trainee knowledge. Performance tests conducted on the job are used to assess trainee skills in the operation of systems and equipment. There is a lack of criteria for successful accomplishment of oral and performance testing. Procedures for tests are identified in the description of each training program.

4-2.1.3.5. Conclusion. Procedures for oral and performance testing need more structure. Much of the oral testing and virtually all performance testing is accomplished by TMI-1 Operations Department personnel with little guidance and training in conducting on-the-job (OJT) and the tests included in this phase of training.

4-2.1.3.5. Recommendation. Develop and promulgate guidance procedures for various types of tests based on the best accepted practices in field of test development and administration. (A useful document for this process is the soon-to-be published <u>Joint Technical Standards for Educational and Psychological Testing</u>, American Psychological Association (APA), American Educational Research Association, and the National Council on Measurement in Education. A draft copy can be obtained from the Scientific Affairs Office of the APA).

4-2.1.3.6 Finding on "Use of Feedback from On-the-Job Performance of Trainees." Feedback from on-the-job performance of trainees is primarily gained from meetings between TMI Training Department and TMI-1 plant department personnel. During the biweekly managers' meetings chaired by the Vice President and Director TMI-1 and attended by the Manager Plant Training TMI, training matters are among the discussion items. An action item list is developed from these meetings and followed up. During the cyclic training meetings held every six weeks, TMI-1 department managers request training in areas where they perceive weaknesses in performance on the job. Some of the requests result from review of qualification and requalification examination grades. Other requests result from plant deficiency reports such as Radiological Investigative Reports. The licensed operator initial training programs include examinations of trainees by TMI Training Department instructors during the OJT phase to check knowledge and progress rate.

4-2.1.3.6. Conclusion. There is informal feedback from on-the-job performance of trainees, but there is little structured feedback available on job performance by qualified operators. Limited sources of data are available and could be used to provide feedback. For example, various types of TMI reports such as License Event Reports, Radiological Investigative Reports, Quality Deficiency Reports, and Radiological Deficiency Reports could be routinely examined for training related deficiencies to be addressed by the TMI Training Department.

4-2.1.3.6. Recommendation. Systematically examine possible sources of information on performance induced problems and develop procedures to ensure regular review of such information as a means of providing feedback to the TMI Training Department.

4-2.1.3.7. Finding on "Training Procedures Are Reviewed and Revised as Needed." TMI Training Department training programs have undergone considerable change in the past three years. Because of the impact of plant requirements and various reports, there has been an almost continuous process of review and revision. For example, the current TMI-1 replacement licensed reactor operator training program was approved in January 1981. Since then, one class has completed this training and two classes are in training now. The courses for all three classes have, because of differing trainee characteristics and time constraints, been variants of the written program. The current TMI-1 auxiliary operator training program is now being used for the first time and will be reviewed and revised between August 1982 and the beginning of the next class in spring 1983. Operator training program descriptions provide for periodic and situational reviews of program content and procedures. TMI Training Department procedure TD 1105 provides guidance for training program review and revision.

4-2.1.3.7. Conclusion. The recent high overall training load and the newness of the current training programs have made systematic training program review difficult.

4-2.1.3.7. Recommendation. Plan and initiate systematic reviews of training programs, taking into account the applicable INPO guidelines and the various findings, conclusions, and recommendations contained in this assessment.

4-2.1.4. INPO Criteria for Record Keeping.

a. "Records of training programs are maintained for effective entry and retrieval."

b. "Records relating to training programs permit review of the content, schedule, and results of past and current programs."

c. "Individual trainee records include a history of performance and permit verification of required qualifications."

d. "Retention periods are specified for training records."

4-2.1.4.1. Finding on "Records of Training Programs Are Maintained for Effective Entry and Retrieval." Hard copy training records are maintained by document control/clerical personnel assigned to the Training Administrative Support Section of the TMI Training Department. A program is in progress to microfilm and archive records in vault storage for the life of the plant. A computerized training data base is in the first stage of implementation. This will provide information on attendance at training sessions, examination and evaluation grades and the location of training records. The TMI Training Department reported that the plan is to enter present data and, as resources permit, enter past data.

As defined in GPU Nuclear Administrative Procedures AP 1007 and 1024 and NQA-1, the training records retained in the TMI Training Department files are not "completed" and therefore are not quality assurance records subject to QA storage and control requirements. Procedures have not been promulgated for control of training records until transferred to the QA records system.

4-2.1.4.1. Conclusion. The TMI Training Department record keeping system functions satisfactorily, but it lacks procedures to direct its operation. It is cumbersome and time consuming to gather records on individual trainees using the present system. Computerization of the data base will be an important aid to efficient management of training records if implementation is preceded by a systematic analysis of data inputs and the uses of output data. Procedures should be established for management of training records until these records are transferred to the QA records system.

4-2.1.4.1. Recommendation. Confirm that the present plan for a computerized training data base system has resulted from a systematic analysis of requirements for the system. Develop procedures to direct and control transfer of training records from active status to archive status.

4-2.1.4.2. Finding on "Records Relating to Training Programs Permit Review of the Content, Schedule, and Results of Past and Current Programs." Program descriptions, lesson plans, weekly schedules and weekly quiz results are maintained in the TMI Training Department files or in files of the cognizant TMI Training Department section head if he has assumed responsibility for official TMI Training Department files. All material requested for assessment was retrieved. Results of major examinations, OJT checkoffs, oral tests, and license examinations are retained in TMI Training Department files. The Operator Training Manager and the RadCon Training Manager have recently established banks of test questions on cards. Each time a question is used in a test, an entry is made on the card. Tests can be reconstructed from this data and made up by assembling the desired variety of cards.

4-2.1.4.2. Conclusion. Available data permits review of training programs for content, schedules and test results. Most of the material dates from about 1979.

4-2.1.4.2. Recommendation. Continue to maintain records which will permit review of content, schedules, and results of past and current programs.

4-2.1.4.3. Finding on "Individual Trainee Records Include a History of Performance and Permit Verification of Required Qualifications." The TMI Training Department training file is the official record of all GPU Nuclear sponsored training accomplished throughout the duration of employment of an individual. The resume record is a related file which also includes special recognitions, awards, subsequent outside educational achievements, and related career highlights. The history of performance is basically a listing of time in grade or at a given assignment. Formal performance evaluations are not routinely made on bargaining unit personnel. Some training files which were examined group the material by class session or test rather than by individual person. Therefore, it is difficult to examine the total training record for a specific person without obtaining information from a number of files.

The training record keeping process, starting with the employment application, is diagrammed in general terms in Figure 4-3. The system continues to operate during the period of employment. Training program documentation requirements are identified in TMI Training Department procedure TD 1105.

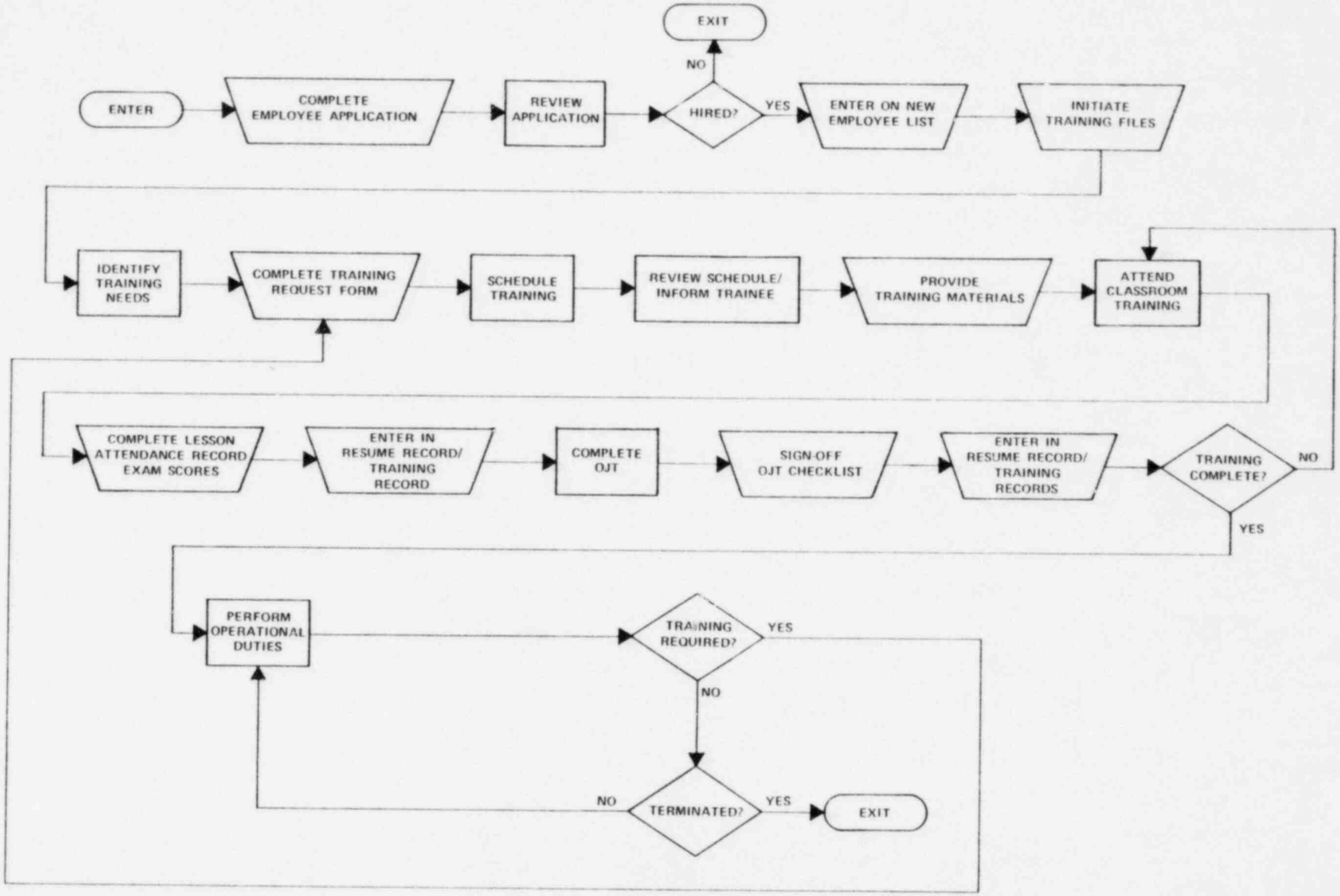

Figure 4-3. Employee Training Records System

4-2.1.4.3. Conclusion. The training files are not well organized to facilitate retrieval of information on a specific individual. A computerized data base management system will help to alleviate this problem if appropriate systems analysis precedes its implementation.

4-2.1.4.3. Recommendation. Ensure computerized training data base system is compatible with data requirements imposed by the various sections of the TMI Training Department and TMI-1 departments.

4-2.1.4.4. Finding on "Retention Periods Are Specified for Training Records." Training records are considered completed and become quality assurance records when turned over to the QA records system for microfilming and vault storage. These records are retained on microfilm in vault storage for the life of the plant.

4-2.1.4.4. Conclusion. The storage of training records for the life of the plant in a vault archive is appropriate.

4-2.1.4.4. Recommendation. Continue the present practice of retaining microfilmed training records in vault storage for the life of the plant.

4-2.1.5. INPO Criteria for Contracted Training.

a. "Contracts for training programs and services are consistent with the training organization's goals, objectives, plans, and policies."
b. "Programs offered under contract remain under the control of the sponsoring utility and are monitored by it to ensure that the INPO Accreditation Criteria are met. Utility monitoring and control should include the following:
   (1) Approval of training program content, evaluation instruments, performance standards, and instructional materials
   (2) Approval of instructor qualifications
   (3) Periodic monitoring of instruction both on-site and off-site by supervisory personnel
   (4) Retention of all training records
   (5) Trainee evaluation of instruction submitted to the utility."

4-2.1.5.1. Finding on "Contracts for Training Programs and Services Are Consistent with the Training Organization's Goals, Objectives, Plans, and Policies." Contractors are used for training in specialized subjects such as maintenance scheduling, simulator training and decision analysis training. Contract instructors are also used to supplement TMI Training Department instructors during high demand periods for general employee training. The TMI Training Department policy is to provide training and training support using primarily GPU Nuclear resources.

4-2.1.5.1. Conclusion. Contracted training is relatively limited and is consistent with the verbally expressed policy to accomplish as much training as possible using GPU Nuclear resources.

4-2.1.5.1. Recommendation. Continue the present policy.

4-2.1.5.2. Finding on "Programs Offered Under Contract Remain Under the Control of the Sponsoring Utility and Are Monitored by It to Ensure That INPO Accreditation Criteria Are Met." The training contractor's curricula and presentations are monitored. Trainees submit evaluations on the contractor's presentations. Trainee records are kept as if TMI Training Department instructors had taught the class.

When contract instructors are used during heavy general employee training loads, they report to the training center two weeks before their first class to learn the material, sit in on classes, and make practice presentations. A TMI Training Department instructor attends the first class a contract instructor teaches to evaluate the presentation and provide guidance.

GPU Nuclear contracts with Babcock and Wilcox Company (B&W) to provide simulator training for TMI-1 personnel at the B&W simulator Lynchburg, Virginia. This training is assessed in detail in Section 11 of the report. Overall the B&W simulator has suitable capabilities and characteristics for training TMI-1 personnel. B&W instructors satisfactorily conduct appropriate simulator exercises and present classroom lectures on subjects associated with the exercises. GPU Nuclear management personnel routinely monitor simulator training of TMI-1 personnel. The training is not consistent with the recommendations of INPO guidelines in certain supporting elements. The cognizance for these elements is divided between B&W and GPU

Nuclear. Examples include the following: (1) not all B&W instructors who train TMI-1 personnel are SRO qualified or certified on the simulator, (2) some training aids are illegible due to clutter or poor reproduction quality, (3) drill guides are not used, (4) lesson plans are not used consistently, (5) the program descriptions are not current, and (6) simulator grades and evaluations are not included in training records.

4-2.1.5.2. Conclusion. Simulator training of TMI-1 personnel which is provided under contract by Babcock and Wilcox Company is satisfactory overall but deficient in some training support areas. Other contracted training is of smaller magnitude and more easily controlled and monitored to achieve desired results.

4-2.1.5.2. Recommendation. Continue present procedures to control and monitor contractor supplied training for TMI-1 personnel. In the case of simulator training, review conditions noted in this assessment. Initiate action as necessary to correct deficiencies.

4-2.2. <u>INPO Criteria for Training Resources and Facilities</u>.

- o The objective of criteria in this section is "To ensure that the training facilities, equipment, and materials support the training activities."

4-2.2.1. INPO Criteria for Physical Facilities and Equipment.

a. "Classroom facilities meet current training needs."
b. "Laboratories and shop facilities are available for scheduled training and are appropriately equipped to provide hands-on training for trainees."
c. "A real-time, full-scope control room simulator is available for providing hands-on training in recognition and control of normal, abnormal, and emergency plant conditions for the operator's plant."
d. "Office space and furnishings are adequate to accommodate the needs of current training personnel."
e. "The training staff has available necessary audiovisual aids and equipment."

f. "Tools and equipment used in training are similar to those used on the job by the trainee."

g. "Facilities and equipment are adequately maintained."

4-2.2.1.1. Finding on "Classroom Facilities Meet Current Training Needs." The modern TMI Training Center, with over 16,000 square feet of space for classrooms and training offices, was occupied in summer 1981. The building houses 18 classrooms including a large dual purpose room which is used as a classroom or small auditorium. The TMI Training Department facilities usage report for the first quarter 1982 indicated that training center facility usage averaged 71% of all classrooms being used for each week during the period January 4-April 2, 1982. The range of weekly usage was 58% to 85%. The second quarter report indicated 78% average usage of training center classrooms throughout the quarter with a range of 47% to 90% weekly usage during weeks of the quarter. The Manager Plant Training TMI reported that on some days each week every classroom and the conference room at the training center are in use. Training requiring laboratory or maintenance facilities is conducted in laboratories and trailers at the plant. On a few occasions, large class meetings are held in a conference room at the plant. On several walk throughs of the classroom area during the period June 21-July 1, 1982, it was observed that classrooms not being used for formal classes were frequently being used by one or more persons to study or view videotapes.

The basic principles trainer is planned for installation at the training center in December 1982. This installation will reduce the space currently available for general classroom use.

Classroom use includes both scheduled classes and self-study periods. 25% of licensed operator classroom phase training is spent in self-study. For auxiliary operators, self-study time is approximately 40% of total classroom phase time. This self-study normally takes place in a classroom with other trainees. Sometimes trainees study in small groups or individually in unused classrooms.

A minor inconvenience noted is that each classroom has only one light switch so that lights are either all on or all off. In rooms which do not have natural lighting, there is not adequate light to take notes when the lights are off and transparencies are being shown.

4-2.2.1.1. Conclusion. The TMI Training Center is modern, well maintained and has adequate space for current needs. Space available for general classroom use will be reduced by the planned installation in December 1982 of the basic principles trainer which is expected to be located in two classrooms.

4-2.2.1.1. Recommendation. Continue to monitor usage of the training center. Consider possible options of expanding into Communications Department space or using the training center on other than day shifts if facilities become overloaded.

4-2.2.1.2. Finding on "Laboratories and Shop Facilities Are Available for Scheduled Training and Are Appropriately Equipped to Provide Hands-On Training for Trainees." At present there are no laboratory or shop facilities at the training center. Laboratory and maintenance facilities at the plant are used for training on a scheduled basis. GPU Nuclear reported it is planned to include laboratory and shop facilities in a training center addition to be built about 1984 for the replica simulator.

4-2.2.1.2. Conclusion. Adequately equipped laboratory and maintenance training facilities are available at the plant. In some cases, training use of laboratories is restricted by operational requirements for use of the facilities.

4-2.2.1.2. Recommendation. Continue present arrangements for training in laboratory and shop facilities at the plant. Review requirements for laboratory and maintenance training facilities at the training center and include them in the budget if confirmed as essential.

4-2.2.1.3. Finding on "A Real Time, Full-Scope Control Room Simulator Is Available for Providing Hands-on Training in Recognition and Control of Normal, Abnormal, and Emergency Plant Conditions for the Operator's Plant." There is no full scope replica simulator at TMI at this time. GPU Nuclear contracts with Babcock and Wilcox Company to conduct simulator training for TMI-1 personnel at the B&W simulator, Lynchburg, Virginia. GPU Nuclear reported it is planned to procure a full scope replica simulator for installation at TMI.

4-2.2.1.3. Conclusion. While simulator training is accomplished satisfactorily at the present time with the current arrangements, the effectiveness and availability of this training could be improved significantly with the installation of a simulator at TMI.

4-2.2.1.3. Recommendation. Continue plans to procure a full scope replica simulator for installation at TMI.

4-2.2.1.4. Finding on "Office Space and Furnishings Are Adequate to Accommodate the Needs of Current Training Personnel." All training staff personnel have a desk in a modular type office space with divider panels approximately 5' high. There is lack of privacy in the general office area for private interviews or counseling. In walk throughs of the office area, the noise level was observed to be satisfactorily low. There are papers and storage boxes on the floor in most cubicles, which may indicate a need for increased storage space. The copy machine room lacks adequate ventilation.

4-2.2.1.4. Conclusion. Office space is somewhat crowded and documents storage is at a premium, but the present arrangements are satisfactory at this time. Accomodations for private interviewing or counseling are lacking unless a classroom is used.

4-2.2.1.4. Recommendation. Survey documents storage requirements and provide adequate facilities. Consideration should be given to providing several small rooms for individual study, private interviewing, counseling, or tutoring.

4-2.2.1.5. Finding on "The Training Staff Has Available Necessary Audiovisual Aids and Equipment." The amount and kinds of audiovisual equipment at the training center meet current instructional needs. Most of the equipment is less than 18 months old. There is no regular outside preventive maintenance contract on the equipment. There are corrective maintenance contracts for equipment such as the video monitors and players, slide projectors, and the overhead transparency maker.

4-2.2.1.5. Conclusion. The TMI Training Center is adequately supported with audiovisual equipment.

4-2.2.1.5. Recommendation. Continue present level of support.

4-2.2.1.6. Finding on "Tools and Equipment Used in Training are Similar to Those Used On-the-Job by the Trainee." In all training sessions observed in general employee training, radiation worker training and RadCon technician training, actual equipment was brought to the classroom or the training was conducted in a laboratory or practical factors area. TMI-1 operator training courses include plant tours to observe and study actual equipment.

4-2.2.1.6. Conclusion. The training program for TMI-1 personnel makes good use of actual equipment.

4-2.2.1.6. Recommendation. Continue the present practices.

4-2.2.1.7. Finding on "Facilities and Equipment Are Adequately Maintained." The TMI Training Center and its equipment are new and well maintained. It was observed during the site visit that rooms are cleaned regularly and lighting and air conditioning are adequate. Classrooms in trailers at the plant are adequately maintained.

4-2.2.1.7. Conclusion. The training facilities and equipment are adequately maintained.

4-2.2.1.7. Recommendation. Continue the present practices for training facilities maintenance.

4-2.2.2. INPO Criteria for Reference Materials.

a. "Technical materials such as the following are available for instructor and trainee reference to support training:
   (1) Academic texts
   (2) Engineering handbooks
   (3) Power plant equipment technology texts and training materials
   (4) Nuclear power plant technology texts and training materials
   (5) Plant-specific documents
   (6) Trade, technical, and engineering journals
   (7) Technical regulations, guides, codes, and standards
   (8) Training-related regulatory guides, industry standards, bulletins, and guidelines
   (9) Materials describing significant industry events
   (10) Reference materials on instructional technology, industrial training, and related topics."

b. "Technical reference materials have the following characteristics:
   (1) Coverage of topics at the level appropriate for the programs and the trainees
   (2) Application to the systems and equipment at the plant
   (3) Current information with respect to plant modifications."

c. "Superseded reference materials are removed from use."

4-2.2.2.1. Finding on "Technical Materials Are Available for Instructor and Trainee Use." There is a technical reference library at the TMI Training Center which is available to instructors and trainees. It contains technical materials such as those included in the INPO criteria. In addition, the library has commercially produced videotape lessons in courses on academic and technical subjects.

The TMI Training Center library can obtain materials from the TMI station library which has a more complete collection of industry and plant specific documents. Copies of appropriate texts on instructional technology and applicable regulatory guides are checked out to instructors for long term use. All TMI-1 Operations Department personnel are issued a copy of plant systems diagrams and all licensed operators and trainees are issued a seven-volume Operator Training Manual. Operating, abnormal and emergency procedures for the TMI-1 plant, which are controlled documents, are available in the locked document room at the training center. Access is obtained through document control personnel. There are no written procedures for operation of the library. Changes to controlled documents are made by personnel who distribute these documents to the library. The librarian is also assigned responsibilities for requisitioning and purchasing supplies. During the site visit, it was observed that the librarian's other duties sometimes caused the library to be closed during normal working hours but this did not appear to be a serious problem. On reviewing the material in the library, an impression was gained that much of it is there by default and not because the material is needed or used to support training.

4-2.2.2.1. Conclusion. The TMI Training Center library is an excellent resource. It is responsive to the needs of trainees and the training staff. It is operated satisfactorily in an informal manner. The library contains material which is not of current value to training.

4-2.2.2.1. Recommendation. Inventory the library and the documents issued to trainees and instructors. Review contents of the library and transfer material which is not of value for reference, professional development, or training. Develop and promulgate procedures for operating the library.

4-2.2.2.2. Finding on "Technical Reference Materials Characteristics." The technical reference materials are vendor supplied or TMI-1 plant documents. In many cases, these documents are not written for training use. Some of the materials obtained from vendors are generic in nature and instructors supply additional details to make the training material plant specific on a given topic such as the emergency diesel generator. Some documents are not current, such as the seven-volume Operator Training Manual.

4-2.2.2.2. Conclusion. A considerable amount of the material in the TMI Training Center library is useful to instructors for reference or to obtain background information on design and construction details. This type of material is not directly usable for training without interpretation and modification.

4-2.2.2.2. Recommendation. As applicable and feasible, include in specifications for technical documentation provided by vendors or GPU Nuclear, the requirement that the documentation include a section with text and graphics for training use. The training material should be written at a level which is appropriate for the education and experience of the trainees who will study the material.

4-2.2.2.3. Finding on "Superseded Reference Materials Are Removed from Use." The relatively few controlled documents in the library are maintained up to date in accordance with applicable procedures. Most of the material in the library is not controlled documentation and its up to date status cannot be easily determined.

4-2.2.2.3. Conclusion. Controlled documents held by the TMI Training Department are maintained up to date and superseded material is removed. Procedures are not in effect to determine when non-controlled material is superseded and to remove superseded material.

4-2.2.2.3. Recommendation. Develop and implement procedures to determine when reference material is superseded and to remove superseded material. Continue present procedures to maintain controlled documents up to date.

4-2.3. INPO Criteria for Training Program Development.

- o The objective of criteria in this section is "To develop and provide valid, effective training programs for plant personnel."

4-2.3.1. INPO Criteria for Program Development.

a. "The development and modification of training programs are performed systematically.
   (1) Program content and depth of knowledge are based on an analysis of the knowledge and skills required for the job position that trainees will occupy.
   (2) Programs are developed giving consideration to the entry skills and knowledge of trainees.
   (3) On-the-job performance problems are analyzed to determine training needs.
   (4) Industry events are analyzed to determine training needs.
   (5) Alternative means of accomplishing training needs are considered, as necessary."

b. "Both training personnel and plant technical personnel participate in identifying training needs and developing training programs."

4-2.3.1.1. Finding on "The Development and Modification of Training Programs Are Performed Systematically." At present, the training programs for TMI-1 personnel reflect varying degrees of a systematic approach to development. In the absence of job and task analysis data, importance is placed on individual expertise in deciding training criteria. An example is on-the-job training of operators. In general, the practice is for shift supervisors not to examine trainees of another shift on OJT tasks. One reason for this practice is that the criteria of the two shift supervisors for successfully passing the checkoff are probably different. The view is that each shift supervisor has to work with his own people and therefore he will train and evaluate them appropriately.

The Operator Training Manager reported that the approach to defining operator training requirements discussed in NUREG/CR 1750 was reviewed for applicability to TMI-1 training needs.

Instructors were queried on how they developed objectives and they responded uniformly that they covered what they considered important. They did not normally engage in a systematic process to determine the required depth of knowledge based on job requirements.

Programs are developed keeping in mind the entry skill and knowledge of the trainees. This is a reason why operator training courses sometimes vary considerably from the promulgated program description. Instructors reported and trainees agreed, that when trainees reported problems or when grades on weekly quizzes fell near or below 80%, the course was extended or otherwise modified to ensure mastery of the material.

On-the-job performance problems are discussed in the biweekly managers' meetings. This often has an impact on a related aspect of the training program. However, cognizant managers interviewed agreed that this approach was not particularly systematic.

Training program descriptions contain provisions for evaluation after the program has been conducted and at least annually.

TMI and industry events are systematically reviewed for applicability to TMI-1 training programs and applicable events are incorporated.

GPU Nuclear training management personnel continue to examine alternatives for improving TMI-1 training.

4-2.3.1.1. Conclusion. In general, the development and modification of TMI-1 training programs are more dependent on the expertise and experience of individuals than on systematic methods to define knowledge and skills required by personnel in the performance of their jobs.

4-2.3.1.1. Discussion. It is frequently difficult to obtain agreement from experts in a field when asked a question such as "What kind of training should be provided for this job?" On the other hand, a systematic approach to determining the required training involves analyzing the job by subdividing it into component parts until one arrives at a level of a single discreet action. At that point, asking the question "What knowledge and skill are required to perform this action?" usually produces a simple, short answer and experts are usually found to be in close agreement on the answer. These lowest level knowledge and skill requirements are then combined with judgments on the criticality, complexity, difficulty, and frequency of performance for each action. From this, valid training requirements can be identified and unnecessary elements of an existing, non-job-performance-based training program may be safely eliminated. In addition, a detailed record is produced as part of this systematic process which provides the necessary data to support an audit of the development process. The method of depending on individual expertise produces little recorded data for tracking the developmental process.

4-2.3.1.1. Recommendation. Apply the methodology of a systematic, job related approach to development and modification of training programs.

4-2.3.1.2. Finding on "Both Training Personnel and Plant Technical Personnel Participate in Identifying Training Needs and Developing Training Programs." In the case of TMI-1 operator training programs, there is continuous exchange of information and coordination between the TMI Training Department and the TMI-1 Operations Department. The Operations Department shift personnel examine trainees for OJT checkoffs and the Manager Plant Operations TMI-1 is in the approval chain for operator training programs. It was reported that Operations Department personnel will help rewrite the seven-volume Operator Training Manual. The Operations Department assigned two experienced shift supervisors to assist in instructing and supervising two classes of licensed operator trainees during the period of high training loads in early 1982. The need for increased instructor attention was identified in comments by trainees and instructors during the first month of the class. The organization responded to this need with the cooperative arrangement described above.

A systematic method is not used to involve operations and training organizations in identifying training needs and developing training programs. Managers respond to problems as they are identified. Communication channels between the two departments are open and regularly used.

There is also close coordination between the TMI Training Department and the TMI-1 RadCon Department in defining training needs and developing training programs. The technical content of TMI-1 RadCon technician training programs is reviewed at the lesson plan level by the TMI-1 RadCon Department.

The major functions of the GPU Nuclear Technical Functions Division include defining technical requirements for training programs. It was reported that Technical Functions personnel have begun review of the training program descriptions and in the future will review lesson plans for technical content.

4-2.3.1.2. Conclusion. The TMI Training Department works closely with user departments in developing and modifying training programs for TMI-1 personnel.

4-2.3.1.2. Recommendation. Continue the present close working relations between the TMI Training Department and TMI-1 departments which use its training services.

4-2.3.2. INPO Criteria for Learning Objectives.

a. "Learning objectives are developed from the systematic analysis of the knowledge and skills required for the job position and are stated clearly and concisely."
b. "Learning objectives are specific, measurable, and job performance based, and they are arranged in a logical sequence."
c. "Learning objectives are used to:
   (1) Determine instructional delivery methods and materials, and
   (2) Determine acceptability of trainee performance."

4-2.3.2.1. Finding on "Learning Objectives Are Developed from the Systematic Analysis of Knowledge and Skills Required for the Job Position and Are Stated Clearly and Concisely." Learning objectives are developed on the basis of personal expertise and experience at all levels from devising the framework of a training program to the formulating of individual objectives in a given lesson plan. Systematic job and task analyses on which to base learning objectives have not been conducted for TMI-1 job positions. GPU Nuclear reported that action on plant specific job and task analyses will be decided after the INPO generic job and task analysis data has been received and reviewed.

The process of systematic analysis of jobs and tasks was discussed with TMI Training Department personnel. The Training and Educational Development section staff interviewed understood the process but lack experience in performing or managing such analyses on a large scale in an actual work setting.

Most learning objectives are stated clearly and concisely. Some of the instructors have been exposed to a brief course in instructional design based on the text by Robert Mager, Criterion-Referenced Instruction: Analysis, Design and Implementation, Mager and Associates, 1980 and each has a copy of Mager's book. The principles for writing objectives specified in the book are followed by developers and reviewers alike.

4-2.3.2.1. Conclusion. Overall, learning objectives are stated clearly and concisely. As presently configured, TMI-1 training programs are internally consistent but not systematically validated against criteria based on job performance requirements. Objectives are developed; instruction is based on objectives and tests measure mastery of objectives. However, unless the development of objectives is based on a systematic analysis of job requirements, its validity is a matter of opinion and this is an inappropriate measure of adequacy.

4-2.3.2.1. Recommendation. Upon receipt of the INPO generic job and task analysis for each plant position, complete the analysis by making it plant specific for TMI-1. Rewrite learning objectives based on the validated knowledge and skill requirements which result from the plant specific analysis. Until learning objectives can be based on systematic analyses of job requirements, objectives which are being written or modified should be constructed in the context of job relatedness.

4-2.3.2.2. Finding on "Learning Objectives Are Specific, Measureable, and Job-Performance Based, and They Are Arranged in a Logical Sequence." Most of the learning objectives reviewed were specific. Few had standards and conditions of performance as an integral part. This results, in large part, from their not being directly derived from job and task analyses. The training sequence in general is theory instruction followed by system or equipment training followed by practical application and OJT. This general approach holds true for all areas of training assessed.

4-2.3.2.2. Conclusion. Learning objectives are specific and arranged in a logical sequence. In general, they are not job performance based as a result of a systematic analysis.

4-2.3.2.2. Recommendation. Same as 4-2.3.2.1.

4-2.3.2.3. Finding on "Learning Objectives Are Used to Accomplish the Following:

a. Determine instructional delivery methods and materials, and

b. Determine acceptability of trainee performance."

Instructional delivery methods are relatively standardized in that lectures are used almost exclusively and the methods are not influenced to any great extent by learning objectives. OJT learning objectives and simulator learning objectives involve demonstration of skills on actual and simulated plant equipment.

Written tests are based closely on objectives provided to trainees in class. Few questions are asked on written operator examinations that require trainees to diagnose or analyze conditions based on actual conditions an operator may face. Questions on listing components, controls, alarms, indicators, and explaining functions and procedures predominate. Questions on decision making or analysis may be covered in oral examinations, but these examinations depend heavily on the preferences of the examiner and are not systematized towards meeting identified, specific objectives.

4-2.3.2.3. Conclusion. Instructional delivery methods and materials are generally appropriate for the learning objectives in the different phases of training. For example, oral checkoffs during OJT frequently include questions on locations of items in the plant. Objectives which involve lists of components and explanations of functions are frequently included in classroom phase lessons. The lecture is an appropriate instructional delivery method for this type of objective.

Trainee performance is measured against learning objectives in written classroom phase tests. There is a lack of documented correlation between learning objectives and oral examination questions.

4-2.3.2.3. Recommendation. Review oral examination practices and determine the extent to which questions are based on learning objectives. Make it a practice in oral examinations to relate questions to learning objectives.

4-2.3.3. INPO Criteria for Instruction.

a. "Methods of instruction are appropriate for the content being taught and the learning objectives."

b. "Subject matter is arranged and taught in a logical sequence."

c. "Training activities permit trainees to become directly involved in the learning process; the methods of instruction permit maximum instructor-trainee interaction."

d. "Opportunities exist for trainees to obtain remedial help."

e. "New techniques for the improvement of instruction are encouraged."

4-2.3.3.1. Finding on "Methods of Instruction Are Appropriate for the Content Being Taught and the Learning Objectives." Instructional methods are generally appropriate for the content being taught. Cognitive material is covered using explanations and audiovisual aids. Trainees are encouraged to ask questions and discuss the concepts being taught. Class sizes are generally under 10 persons, which facilitate this type of interaction. Objectives for each class session are presented at the beginning of the class and provide a framework for review at the end. This teaching to objectives is a critical element of criterion-referenced instruction toward which the TMI Training Department is moving. Teaching to objectives is a desirable instructional method and is not the same as teaching to an answer key. Instructional methods in OJT place much responsibility on the trainee to discover information and organize it. There is little formal instruction involved in OJT. Plant systems training for operators includes plant tours to view the system recently covered in class. The tours observed were generally well conducted. A few trainees paid little attention and tended to drift away from the instructor as he pointed out system features and discussed system functions.

4-2.3.3.1. Conclusion. Methods of instruction are generally appropriate for the subject matter being taught.

4-2.3.3.1. Recommendation. Continue the present methods of instruction.

4-2.3.3.2. Finding on "Subject Matter Is Arranged and Taught in a Logical Sequence." At the level of lesson plans, and on the lesson plans reviewed, the subject matter was taught in a logical sequence. The theory portions of the various training programs build from the simple to the complex. New ideas are developed from previously learned knowledge where possible. Main system functions are taught first, followed by subsystem and support system functions and details, and then followed by system interrelations.

The TMI-1 auxiliary operator training program sequence is 39 weeks of classroom instruction in theory and systems followed by 11 months of OJT. Much of the theory taught in this course exceeds the requirements for the auxiliary operator position. The auxiliary operator training program recommended by INPO guidelines breaks classroom instruction and OJT into three phases with each phase including classroom instruction followed by OJT.

Course material is arranged logically in TMI-1 licensed operator, GET, and RadCon technician training programs.

4-2.3.3.2. Conclusion. At the level of lesson plans, subject matter is arranged and taught in a logical sequence. At the level of training program descriptions, the TMI-1 auxiliary operator program sequence warrants a review. The licensed operator, GET and RadCon courses are logically arranged.

4-2.3.3.2. Recommendation. Review the sequence of training in the TMI-1 auxiliary operator training program and consider changes to make the sequence consistent with the program recommended by INPO guidelines.

4-2.3.3.3. Finding on "Training Activities Permit Trainees to Become Directly Involved in the Learning Process; the Methods of Instruction Permit Maximum Instructor-Trainee Interaction." Small class size and proximity to the plant enhance direct involvement of TMI-1 trainees in the learning process. The location of classrooms close to instructor offices facilitates instructor-trainee interactions. Instructors encourage trainees to ask questions and ask for help outside instruction periods.

4-2.3.3.3. Conclusion. Trainees are involved in the learning process; trainees and instructors interact frequently and effectively. Instructors are visibly interested in making certain that trainees understand the subject matter presented. This interest was expressed by instructors and verified by trainees during individual interviews.

4-2.3.3.3. Recommendation. Continue the present practices . forming small classes, using the plant as a training aid and encouraging instructor concern for trainee understanding of subject matter.

4-2.3.3.4. Finding on "Opportunities Exist for Trainees to Obtain Remedial Help." During every class that was observed, the instructor reminded the trainees that he was available for answering questions or tutoring during study time. At least 25% of each training day is unsupervised study and during this time trainees go to instructors for help. Frequently, if an instructor feels that there may be a lack of understanding on a lecture topic, he attends the study session to offer assistance. Interviews with trainees and instructors indicated this was a useful practice and occurs frequently.

4-2.3.3.4. Conclusion. TMI-1 trainees have excellent opportunities to obtain remedial help and training staff personnel are willing to provide such help.

4-2.3.3.4. Recommendation. Continue the present practice of making remedial help readily available to TMI-1 trainees.

4-2.3.3.5. Finding on "New Techniques for the Improvement of Instruction Are Encouraged." The TMI Training Department is receptive to new techniques for the improvement of instruction. An example is the computer-assisted instruction (CAI) on Pressure/Temperature Plot analysis which was developed as an initiative of the Training and Educational Development section of the TMI Training Department. The planned integration of the basic principles trainer into licensed operator initial and requalification training is another example of an innovative instructional method.

4-2.3.3.5. Conclusion. New techniques for improvement of instruction should be explored and considered. However, it is important not to let interest in innovation of little real significance divert major resources and attention from time tested and traditional instructional methods involving direct interaction between technically qualified instructors and trainees.

4-2.3.3.5. Recommendation. Continue emphasis on proven traditional instructional methods.

4-2.3.4. INPO Criteria for Instructional Materials.

a. "Course descriptions exist for each training program and describe an acceptable level of trainee performance and the method of evaluation."

b. "Lesson plans exist for all courses and should include the following:

(1) Suggested instructor teaching activities appropriate for the content and objectives

(2) Appropriate instructor references, trainee texts, and trainee references

(3) Suggested evaluation methods and instruments for determining trainee performance

(4) Trainee text materials appropriate for the trainees who use them

(5) Audio-visual materials to support the objectives of each program."

4-2.3.4.1. Finding on "Course Descriptions Exist for Each Training Program and Describe an Acceptable Level of Trainee Performance and the Method of Evaluation." Approved course descriptions exist for each TMI-1 training program assessed . An acceptable level of performance is generally defined as 80% for written tests. In some operator examinations, an acceptable level of performance is 70% on individual sections and 80% overall. Oral examinations are generally graded as pass or fail. Written examinations are based on the learning objectives. Oral examinations are wide ranging and much of the scope is determined by the examiner. Mock NRC written and oral license examinations are patterned closely on NRC license examinations.

4-2.3.4.1. Conclusion. Approved course descriptions exist and are used to conduct training programs. In some cases, departures are made from a description because of special conditions. Levels of acceptable performance are specified for written examinations. Levels of acceptable performance are determined by the individual examiner or the board of examiners for oral examinations.

4-2.3.4.1. Recommendation. Provide more definition of acceptable levels of performance for oral checkoffs and examinations. Methods of evaluation should be reevaluated for appropriateness when learning objectives become based on validated job performance requirements.

4-2.3.4.2. Finding on "Lesson Plans Exist for All Courses and Should Include the Following:

a. Suggested instructor teaching activities appropriate for the content and objectives

b. Appropriate instructor references, trainee texts, and trainee references
c. Suggested evaluation methods and instruments for determining trainee performance
d. Trainee text materials appropriate for the trainees who use them
e. Audio-visual materials to support the objectives of each program."

Lesson plans in some form of development exist for all classroom courses. Lesson plans are prepared and approved before the lesson is presented. Sometimes, due to time constraints, the lesson plan may lack substance. Generally, lesson plans include notes by the instructor on points to emphasize, anecdotes to tell and examples to use. Instructor references and trainee texts are identified. Frequently, the instructor includes pages of text and diagrams in a trainee handout. The handouts also contain the lesson objectives. The instructor submits suggested test questions for review and approval along with the lesson plan and objectives. Trainee instructional materials generally come from purchased texts, photocopies of pages from technical manuals or plant technical materials, and text or drawings produced by the TMI Training Department.

Instructional materials produced from technical manuals and plant technical materials are sometimes difficult to read because of complexity or poor reproduction quality. In some cases, the materials used are not completely appropriate for the instructional topic. For example, in the auxiliary operator area, diagrams are copied from technical documentation and used as handouts when teaching system functions, flow paths through a system, and interrelations of systems and subsystems. In some cases, the combination of amount of detail and the reproduction quality make understanding the principles of operation difficult.

Most courses observed used audiovisual support materials. During interviews, some instructors indicated the need for more support in producing instructionally sound audiovisual materials.

4-2.3.4.2. Conclusion. Overall, lesson plans are appropriate. About 51 of 64 lesson plans for operator training courses are being upgraded by instructors to conform with current specifications for lesson plan development. This work has progressed slowly because of the heavy classroom instruction load on instructors during the first half of 1982. The high workload has also resulted in some use of ineffective copied material for audiovisual aids instead of developing material specifically for training use.

4-2.3.4.2. Recommendation. Provide additional resources for developing quality training materials.

4-2.3.5. INPO Criteria for Trainee Evaluation.

a. "Trainees are pretested routinely or otherwise evaluated to ensure that they meet training program prerequisites."
b. "Procedures exist for granting exemptions from training based on previous training or experience when documentation or assessment indicate the individual possesses the required knowledge and skills."
c. "Trainee performance is evaluated regularly against established learning objectives."
d. "Trainee evaluation is conducted throughout each training program."
e. "Trainees whose performance is unsatisfactory are given remedial training, recycled through training, or removed from training."
f. "Procedures exist to ensure that trainees are consistently evaluated while minimizing possible compromise of examinations prior to administration."
g. "Follow-up evaluations of trainee's on-the-job performance are conducted routinely."

4-2.3.5.1. Finding on "Trainees Are Pretested Routinely or Otherwise Evaluated to Ensure That They Meet Training Program Prerequisites." Screening or validation examinations are administered in certain training programs. Training program descriptions include prerequisites which must be satisfied before a trainee enters training. In the case of RadCon technician training, the Manager RadCon TMI-1 is responsible for administering the initial written screening examination for the selection of RadCon technician trainees. Particular attention is paid to recruiting appropriate personnel as operators. It was reported that approximately 200 individuals were interviewed in the recent hiring of eight licensed reactor operator trainees.

4-2.3.5.1. Conclusion. Current GPU Nuclear procedures are adequate for identifying appropriate trainees.

4-2.3.5.1. Recommendation. Continue present practices in evaluating applicants for suitability as trainees.

4-2.3.5.2. Finding on "Procedures Exist for Granting Exemptions from Training." Licensed reactor operator trainees who do not come from the auxiliary operator ranks are required to pass written validation examinations on theoretical fundamentals to exempt them from that portion of auxiliary operator training. Ex-Navy personnel with appropriate RadCon training and experience can be exempted from TMI-1 initial RadCon technician training based on an evaluation of their prior training and experience and passing a challenge examination.

4-2.3.5.2. Conclusion. Procedures exist so that newly hired personnel who have previous experience can be exempted from training based on appropriate examinations and review of the individual's experience.

4-2.3.5.2. Recommendation. Continue present practices in the area of exempting qualified newly hired personnel from redundant training.

4-2.3.5.3. Finding on "Trainee Performance Is Evaluated Regularly Against Established Learning Objectives." Learning objectives are provided in all classroom instruction lessons. Test items are designed to measure attainment of these objectives. Weekly quizzes provide an indication of how well trainees are mastering the objectives. OJT is structured around lists of tasks to be accomplished and some guidance is provided on what to study to pass checkoffs on these tasks.

4-2.3.5.3. Conclusion. Trainee performance is regularly evaluated against objectives which are announced in advance of instruction.

4-2.3.5.3. Recommendation. Continue the present practice of frequently examining trainees against established learning objectives.

4-2.3.5.4. Finding on "Trainee Evaluation Is Conducted Throughout Each Training Program." Trainee performance is evaluated by weekly quizzes during classroom instruction. Comprehensive oral and written examinations are given at the end of training programs. During OJT, the minimum rate of completing task checkoffs is specified. During OJT for operators, the TMI Training Department and the TMI-1 Operations Department conduct periodic written and oral examinations in addition to the oral checkoffs.

4-2.3.5.4. Conclusion. Trainee performance is regularly evaluated in TMI-1 training programs assessed.

4-2.3.5.4. Recommendation. Continue the present practice of regular evaluation of trainee performance in all training programs.

4-2.3.5.5. Finding on "Trainees Whose Performance Is Unsatisfactory Are Given Remedial Training, Recycled Through Training, or Removed from Training." Remedial instruction is provided for trainees who fall below the passing standard as specified in TD 1103 and individual program descriptions. The remediation may include restudy of the material, repeat of the class or sections thereof, and one-on-one tutoring with an instructor. A reexamination is given after the prescribed remediation is complete. Detailed procedures are provided in the TMI-1 licensed operator requalification program description for remedial training in the case of licensed operators. In the class of six TMI-1 licensed reactor operator trainees who completed training in January 1982, one trainee failed the mock NRC oral and written license examinations and was turned back to the next class.

4-2.3.5.5. Conclusion. Provisions exist for meaningful review of personnel in training who are not progressing satisfactorily and remediation is provided by various appropriate means.

4-2.3.5.5. Recommendation. Continue present practices in the area of trainee remediation.

4-2.3.5.6. Finding on "Procedures Exist to Ensure That Trainees Are Consistently Evaluated While Minimizing Possibility of Compromise of Examinations Prior to Administration." In this context, examinations include oral or written tests and quizzes. Consistent evaluation is enhanced by testing on the basis of learning objectives provided to trainees in class. GPU Nuclear procedure 6200-ADM-2600.1, Rev 0, October 21, 1981 provides direction on typing and storing examinations, monitoring examinations, ensuring that unauthorized material is not available to trainees during examinations, and reporting misconduct or cheating during examinations. This procedure assigns to the Director Training and Education overall responsibi'' for conduct of all GPU Nuclear training programs including administration of examinations. The procedure further assigns to the Manager Plant Training TMI responsibility for implementing training programs and administering examinations at TMI. Assignment of responsibility for security of examinations is implied but not stated explicitly in this procedure.

A Manager Plant Training TMI memorandum of June 7, 1982 details examination security procedures and covers security of materials during development, typing, reproduction, and storage prior to administration.

A TMI Training Department Document Control/Clerical Supervisor memorandum of June 18, 1982 emphasizes to the clerical staff the importance of properly safeguarding the security of examinations being typed.

It was observed during the site visit that written examinations were carefully controlled and security procedures were rigorously followed. After a quiz or test is typed and approved, it is retained by document control in locked storage. Tests are removed from locked storage and provided to the instructor or proctor a short time before the test is to be administered. Tests are reproduced on yellow paper which is used only for this purpose. Two evening checks were made of training center office spaces for examination security. No examination materials were visible in offices. Drawers with locks were locked. The typing stations and copy machines were observed on days when examinations were produced and no examination material was found unattended.

The administration of ten quizzes was observed and the same procedures were followed in each class. Trainees were seated one behind the other with space between trainees in the same row. In large classes such as general employee training where trainees sat close together, different examinations were used for adjacent trainees. All quizzes were proctored and in large classes, a second proctor was used. A seating chart was prepared by the instructor and attached to the completed examination package. Prior to passing out the examinations, the instructor read to the class nine standard instructions printed on the cover of each examination booklet. These instructions covered conduct during examinations and the possible consequences of misconduct and cheating. The examinations were conducted in a quiet and orderly manner. On completion of the examination, each trainee signed and dated a statement certifying that all answers were the trainee's own work, that unauthorized assistance was not given or received and that unauthorized references were not used. Trainees left the room after completing the examination. During observation of quizzes being administered July 2, 1982, it was noted that while proctors remained in front of the class and alert for unauthorized activity, several read paperwork which interfered with giving their undivided attention to proctoring.

Examination security was discussed during interviews with trainees and instructors. They uniformly expressed opinions and provided answers to questions which indicated they understood and supported the need for examination security and knew that providing or receiving assistance on examinations was unacceptable conduct.

Examination grading procedures do not provide for analysis to detect collusion in answers or to detect problems in test items which may reduce validity and reliability.

During a review of lesson plans, three of eleven lesson plan folders in the TMI Training Department Document Control/Clerical Supervisor's office were found with the instructor's proposed quiz questions in them. The questions were not protected from unauthorized access and two of the three folders also included quiz answers. One of the three sets of suggested quiz questions was on white paper vice yellow. In accordance with current procedures, it is the practice for suggested quiz questions to accompany the lesson plan through approval and typing. It was reported that a change to this procedure is being drafted to require separation of suggested examination questions from lesson plans to maintain the security of proposed examination questions.

4-2.3.5.6. Conclusion. GPU Nuclear and TMI Training Department examination security procedures and actual practices are effective in maintaining the integrity of examinations. Responsibility for examination administration is assigned at a managerial level but specific responsibility for examination security is not assigned at this level. Procedures have not been established for detecting collusion in examination answers.

4-2.3.5.6. Recommendation. Assign specific responsibility for examination security at a managerial level to enhance continued diligence in this area. Assigned duties should include spot checking security practices, periodically reviewing security procedures and receiving reports on analysis of test answers for collusion.

4-2.3.5.7. Finding on "Follow-up Evaluations of Trainee's On-the-Job Performance Are Conducted Routinely." The GPU Nuclear agreement with bargaining unit employees precludes evaluation and documentation of their job performance.

4-2.3.5.7. Conclusion. On-the-job performance evaluations are important to assessment of training effectiveness.

4-2.3.5.7. Recommendation. Establish a program for the regular, systematic, and equitable evaluation of plant personnel job performance.

4-2.3.6. INPO Criteria for Program Evaluation. "A systematic evaluation process exists for all training programs. This evaluation process includes the following:

a. Achievement of stated goals and objectives
b. Compatability of the trainees and the program
c. Development and modification of program content
d. Sequence of instruction and time allocations
e. Instructional strategy and materials
f. Feedback from on-the-job performance."

4-2.3.6.1. Finding on "A Systematic Evaluation Process Exists for All Training Programs." TMI Training Department procedures TD 1103, 1104, and 1105 provide review criteria for training program descriptions and lesson plans. Revision procedures are also included. Individual training program descriptions establish program evaluation procedures for specific programs.

Newly developed training program descriptions and lesson plans consistently adhere to the design criteria specified in TD 1103. The TMI Training Department reported there are plans to upgrade old lesson plans by December 1982 to meet the present criteria.

Some of the TMI-1 training programs are being taught for the first time or have just been taught for the first time. Examples are TMI-1 auxiliary operator and TMI-1 senior reactor operator training programs. Others, such as the TMI-1 RadCon technician initial training program are being revised. New training programs are evaluated on completion of the first class and all continuing training programs are evaluated in accordance with the program description and the above procedures.

4-2.3.6.1. Conclusion. Procedures exist and are effective for evaluation of training programs. The lack of test item analysis procedures makes it difficult to assure reliability and validity of test questions. Potential problems which may be identified using test item analysis include invalid test items, instructional gaps, patterns indicating possible cheating, and unreliable or confusing test items.

4-2.3.6.1. Recommendation. Continue present procedures for the evaluation of training programs. Design and implement a test item analysis procedure, preferably using a computer to increase capability and reduce clerical tasks associated with manually performed item analysis.

4-2.4. <u>INPO Criteria for Training Staff Size and Workload</u>.

- o The objective of criteria in this section is "To provide sufficient training manpower to perform all necessary functions."

4-2.4.1. INPO Criteria

a. "To implement the training programs, the training staff includes an adequate number of qualified personnel to perform the following activities:
   (1) Management
   (2) Supervision
   (3) Instruction
   (4) Program development."

b. "The workload of the instructional staff allows time for the following:
   (1) Instructor preparation
   (2) Materials development
   (3) Program improvement

(4) Trainee evaluation

(5) Trainee counseling

(6) Staff professional development."

c. "The instructor-to-trainee ratio is consistent with the training situation."

4-2.4.1.1. Finding on "To Implement the Training Programs, the Training Staff Includes an Adequate Number of Qualified Personnel." The TMI Training Department staff of 55 is organized under the Manager Plant Training TMI who reports to the Director Training and Education in the Nuclear Assurance Division of the GPU Nuclear corporate staff. The Director Training and Education reports to the Vice President Nuclear Assurance who in turn reports to the Office of the President GPU Nuclear. The TMI Training Department staff organization consists of five sections which are headed by the Operator Training Manager, Supervisor Training and Educational Development, Support Training Manager, Supervisor Technician Training, and Supervisor Training Administrative Support. The span of control of managers and supervisors is appropriate with usually five or fewer personnel reporting to each manager or supervisor. Support and administrative staffing levels were observed to be adequate. Typing, document control and library functions were observed to be handled smoothly.

The TMI Training Department instructor staffing is adequate for expected future training loads. Licensed operator instructor staffing was not adequate for the initial and requalification training load in the first half of 1982 and two experienced shift supervisors were assigned to assist with instruction and supervision. The TMI Training Department reported that licensed operator instructors will become more involved in developing co seware for the basic principles trainer and the replica simulator in the future. This will reduce the time available for other instructor tasks.

TMI Training Department support staff lacks personnel who have experience conducting or managing the extensive job and task analyses which will be necessary if the INPO approach to job performance based training is adopted.

The normal work assignments of several TMI Training Department managers and supervisors have been affected over the past 1-2 years by preparing depositions, researching records and giving testimony associated with hearings and litigation concerning the TMI-2 accident and the the TMI-1 restart.

During high training load periods in general employee training, the TMI Training Department staff instructors are augmented temporarily with contract instructors. An administrative assistant was recently added to the Operator Training Section and this helps to take some of the licensed operator training record workload off instructors.

Members of the training staff involved in instruction or supervision of instruction include 14 degreed personnel.

An organization chart of the TMI Training Department is provided in Volume 2, Section 4.

4-2.4.1.1. Conclusion. The number of qualified individuals in the TMI Training Department is appropriate to satisfy present and projected TMI-1 training needs. Temporary augmentation of the staff during a typically high training load is appropriate. It is important to maintain high standards of instructor competence when using temporary instructors. For example, the two experienced shift supervisors did not receive instructor training before assuming duties instructing and supervising licensed operator trainees. The workload of licensed operator instructors will be affected by increased involvement in simulator training in the future in connection with the basic principles trainer and replica simulator to be installed at TMI.

If the INPO approach to job performance based training is adopted, more resources will be required in the training staff to conduct plant specific job and task analyses or to manage this effort using GPU Nuclear and contractor resources.

4-2.4.1.1. Recommendation. Continue to review TMI Training Department staff workloads and reallocate resources to meet emerging needs. Conduct an analysis of the impact on instructor workload of planning and preparing for the introduction of the basic principles trainer and the replica simulator into TMI-1 training programs. Provide additional resources in this area if needed. To assist in making knowledgeable decisions on the INPO approach to job perforance based training, identify key personnel who would be involved in supervising and producing plant specific job and task analyses. Provide the necessary training to these key individuals in the INPO job and tasks analysis model. The INPO Training and Education Division may be able to offer assistance and advice in this regard.

4-2.4.1.2. Finding on "The Workload of the Instructional Staff Allows Time for the Following:

a. Instructor preparation
b. Materials development
c. Program improvement
d. Trainee evaluation
e. Trainee counseling
f. Staff professional development."

Licensed operator instructors estimated the percent of their time spent on various activities as shown in Table 4-3. The non-licensed operator instructors interviewed reported that their time was spent in a similar fashion over the past several months.

TABLE 4-3
LICENSED OPERATOR INSTRUCTORS WORKLOAD

TASK	PERCENT TIME SPENT ON TASK
Instructor preparation and presentation	37%
Materials development	13%
Program improvements	7%
Trainee evaluation	13%
Trainee counseling	9%
Professional development and requalification	12%
Administration	9%
TOTAL	100%

The general employee training (GET) instructors, because of the short course length and repetitive nature of the GET classes, spend approximately 80% of their time instructing and the remainder on the other areas including about 9% on administrative work. The three TMI-1 RadCon technician training instructors conduct part of the radiation worker training (RWT) in the GET program. The RadCon instructors interviewed reported that they spend most of their time actually instructing with little time left for developmental activity.

The Manager Plant Training TMI and the Operator Training Manager TMI were interviewed separately concerning their workloads. They both stated that preparing for and giving testimony or depositions in connection with hearings and litigation concerned with the TMI-2 accident and the TMI-1 restart have been a significant interference with their regularly assigned work.

4-2.4.1.2. Conclusion. The first half of 1982 has been a peak training load period for the TMI Training Department. As the manning levels in the various plant departments stabilize, more time is expected to be available for program and materials improvement and for professional development including gaining or maintaining expertise in the plant.

4-2.4.1.2. Recommendation. Systematically evaluate upcoming training requirements and identify goals to be accomplished in the areas of professional development and program and materials development in the time made available by the expected reduction in instruction load. Managers and supervisors should spend more time observing training sessions, evaluating the performance of instructors and providing guidance as needed.

4-2.4.1.3. Finding on "The Instructor-to-Trainee Ratio Is Consistent With the Training Situation." The instructor-to-trainee ratio varied from about 1/19 to 1/4. The 1/19 ratio was observed when the replacement licensed reactor operator and auxiliary operator classes were combined for some of the plant systems lectures. More typical classroom ratios were 1/8 to 1/10. GET classes sometimes include up to 35 trainees, at which time extra instructor help is provided. In the practical factors portion of GET, there were typically five or fewer trainees per instructor. The replacement senior reactor operator class which recently completed training consisted of four trainees. The RadCon training observed was cyclic retraining. At one RadCon training session, respirator classes from TMI-1 and TMI-2 were combined, which made a total of 16 trainees. Typically, however, such classes consisted of five to eight individuals.

4-2.4.1.3. Conclusion. The instructor-to-trainee ratio is appropriate for the training situations.

4-2.4.1.3. Recommendation. Continue the present policy of maintaining typical instructor-to-trainee ratios in the range of 1/8 to 1/10.

4-2.5. INPO Criteria for Training Staff Qualifications.

- o The objective for this criteria is "To ensure the training staff has the qualifications necessary to provide effective training."

4-2.5.1. INPO Criteria

a. "The duties and responsibilities of the training staff are clearly defined."

b. "The Training Manager has appropriate educational, technical and experience qualifications for the position."

c. "The Training/Instructional Supervisor has appropriate educational, technical, and experience qualification for the position."

d. "Technical instructors (utility and contracted training) possess the following qualifications:

   (1) Technical training and experience consistent with the subject matter being taught

   (2) Instructional skills appropriate for assigned instructional duties."

e. "Staff members responsible for program development have appropriate education, training, and experience qualifications for the position."

f. "When instructors have not yet attained the required instructional qualifications or only instruct occasionally, the training quality is maintained through appropriate and qualified assistance and supervision."

4-2.5.1.1. Finding on "The Duties and Responsibilities of the Training Staff Are Clearly Defined." The TMI Training Department Administrative Manual promulgated by a Manager Plant Training TMI memorandum of January 27, 1981 sets forth for each position on the training staff the position title, reporting chain, function, minimum and additional desired education/experience/licenses and certificates, minimum and desired additional training, technical duties, managerial duties, and administrative duties. A draft revision of the administrative manual containing major changes is under review at the present time.

The GPU Nuclear specification and description for each position also describe duties and responsibilities for training staff positions.

4-2.5.1.1. Conclusion. The duties and responsibilities of TMI Training Department personnel are clearly defined in writing.

4-2.5.1.1. Recommendation. Continue the present practice of providing current clear statements of responsibilities and duties for TMI Training Department personnel. Complete review and promulgate the revision to the TMI Training Department Administrative Manual.

4-2.5.1.2. Finding on "The Training Manager Has Appropriate Educational, Technical and Experience Qualifications for the Position." The GPU Nuclear position specification for the Manager Plant Training TMI requires:

a. Bachelor's degree in engineering, science, education or management.
b. Five years experience in the areas of nuclear engineering, plant operations or maintenance, training, quality assurance, or health physics.
c. No license or certificate is required.

The Manager Plant Training TMI is well qualified for his position by reason of his doctorate level nuclear engineering academic background, his extensive and varied experience in the university and commercial nuclear reactor field and his continuing active participation in nuclear industry matters. His experience in technical training at the technician and operator level includes two years at TMI and four years instructing university research reactor operators.

4-2.5.1.2. Conclusion. The Manager Plant Training TMI is well qualified to fill his position.

4-2.5.1.2. Recommendation. Continue to depend on the present incumbent as Manager Plant Training TMI.

4-2.5.1.3. Finding on "The Training/Instructional Supervisor Has Appropriate Educational, Technical and Experience Qualifications for the Position." The TMI Training Department staff includes five section heads who report to the Manager Plant Training TMI and who each carry out the duties of a Training/Instructional Supervisor in a specific area of training. This arrangement is appropriate due to the TMI Training Department's size. The five sections heads are the Operator Training

Manager, Support Training Manager, Supervisor Technician Training, Supervisor Training and Educational Development, and Supervisor Administrative Support. Their qualifications are discussed in this subsection.

The GPU Nuclear position specification for the Operator Training Manager TMI requires:

a. Bachelor's degree in engineering, science, education or management.
b. Two years experience in technical training.
c. Six months experience in PWR operator training.
d. No license or certificate required.

The Operator Training Manager TMI has a bachelor of science degree with majors in political science and economics and a master's degree in management. He completed Navy nuclear power training and has extensive experience in Navy nuclear power assignments. The incumbent is not qualified in the TMI-1 plant. The incumbent meets the requirements set forth in the specification.

The GPU Nuclear position specification for the Support Training Manager TMI requires:

a. Bachelor's degree or equivalent experience.
b. Four years experience in nuclear power plant operation, emergency planning, health physics, security training and/or technical management of which six months shall be in the on-site training organization.
c. No license required.

The current incumbent meets these requirements.

The GPU Nuclear position specification for the Supervisor Technician Training TMI requires:

a. Bachelor's degree or equivalent experience.
b. Four years experience in nuclear power plant operation, and/or technical management, with six months experience in the TMI training organization.

The current incumbent meets these requirements.

The GPU Nuclear position specification for the Supervisor Training and Educational Development TMI requires:

a. Bachelor's degree in engineering, science, education, or business administration.
b. Four years experience in education, supervisory or management training, power plant training, or training program administration.
c. No license required.

The current incumbent meets these requirements.

The GPU Nuclear position specification for the Supervisor Training Administrative Support TMI requires:

a. Bachelor's degree or equivalent experience.
b. Six years experience in power plant operations, technical training, administration or audio-visual production.

The current incumbent meets these requirements.

Two other key supervisors report to the Operator Training Manager TMI. They are the Supervisor Licensed Operator Training TMI-1 and the Supervisor Non-Licensed Operator Training TMI.

The GPU Nuclear position specification for Supervisor Licensed Operator Training TMI-1 requires:

a. High school diploma.
b. Four years experience in the operation, maintenance, training, or design of a nuclear power plant.
c. Two years experience in technical training.
d. NRC SRO license on the plant or equivalent qualification for a civilian or military power reactor.

The current incumbent meets these requirements and maintains a current NRC SRO qualification on the plant.

The GPU Nuclear position specification for the Supervisor Non-Licensed Operator Training TMI requires:

a. High school diploma.
b. Four years experience in operation and maintenance of a nuclear power plant including experience as an auxiliary operator.
c. No license required.

The current incumbent meets these requirements and is SRO qualified on TMI-2.

The GPU Nuclear position specifications for instructors vary with the subject matter taught. In general, all require at least a high school diploma and two to three years of appropriate experience. Instructors who teach systems, integrated responses and transient courses to licensed operator trainees are required to be SRO qualified. In all cases, the TMI Training Department instructors meet or exceed the position specification requirements and meet regulatory requirements.

4-2.5.1.3. Conclusion. The five section heads in the TMI Training Department are well qualified to perform their various functions. Although not required for his present position, the Operator Training Manager TMI would gain increased creditability with plant personnel if he were SRO qualified in the TMI-1 plant. The TMI Training Department organization does not designate successors to act in the absence of key individuals.

4-2.5.1.3. Recommendation. Continue to depend on the present section heads in the TMI Training Department. Establish a study and OJT program to qualify the Operator Training Manager TMI as an SRO in the TMI-1 plant. Designate successors to act in the absence of key individuals in the training organization.

4-2.5.1.4. Finding on "Technical Instructors (Utility and Contracted Training) Possess the Following Qualifications:

a. Technical training and experience consistent with the subject matter being taught.
b. Instructional skills appropriate for assigned instructional duties."

TMI Training Department licensed operator instructors maintain current SRO qualifications in the TMI-1 plant. They average 11 years experience at TMI and five years experience as instructors. These instructors are qualified to teach technical subjects competently. However, observed classroom lessons in academic subjects taught by these instructors lacked fully developed explanations of basic principles which could be supplied by instructors with appropriate degrees and engineering experience.

Two TMI Training Department non-licensed operator instructors have not completed the TMI-1 auxiliary operator training program or its equivalent.

Not all TMI Training Department instructors have completed the one-week initial instructor development course. The TMI Training Department reported that those who have not will attend the next class of the course which is held every six months.

TMI Training Department instructors and support staff personnel interviewed displayed excellent motivation and interest in their work. The overall feeling of the training organization was observed to be positive during the two-week site visit.

Babcock and Wilcox Company instructors who teach systems, integrated responses and transients to TMI-1 licensed operators and trainees during training at the B&W simulator are not all SRO qualified or simulator certified.

4-2.5.1.4. Conclusion. The technical training and experience of the technical instructors is satisfactory. Although licensed operator instructors maintain their SRO qualification in the plant, their long assignment as instructors and comparative lack of close contact with plant operations can degrade their effectiveness. The temporary assignment of two experienced shift supervisors to augment the licensed operators during the high training load period in early 1982 provided current authoritative expertise on the plant. Two of the TMI-1 auxiliary operator instructors should become qualified as auxiliary operators in the TMI-1 plant. Instructional skills could be improved with continuing instructor development. There are personnel in the TMI Training Department staff who are better qualified than present licensed operator instructors to teach academic subjects to licensed operators and licensed operator trainees. The effectiveness of simulator training could be increased by use of all SRO qualified or simulator certified instructors for training TMI-1 personnel.

4-2.5.1.4. Recommendation. Establish goals for early completion of initial instructor development training for all instructors who have not completed this training. Establish goals for auxiliary operator instructors to complete auxiliary operator qualification in the TMI-1 plant. Increase current plant expertise in the TMI Training Department by establishing a program for rotating experienced operations personnel into instructor assignments. Arrange with B&W to use all SRO qualified or simulator certified instructors for training of TMI-1 personnel. Utilize training staff with appropriate degrees and engineering experience to teach academic subjects to licensed operators and licensed operator trainees.

4-2.5.1.5. Finding on "Staff Members Responsible for Program Development Have Appropriate Education, Training and Experience Qualifications for the Position." Several of the TMI Training Department Training and Educational Development section personnel have high school teaching backgrounds and experience with industrial training programs. There is a lack of qualifications and experience in instructional systems development and in the conduct of large scale job and task analyses.

4-2.5.1.5. Conclusion. If the INPO approach to job performance based training is adopted, additional training will be required for personnel who will conduct or manage the conduct of job and task analyses in the plant.

4-2.5.1.5. Recommendation. To assist in making knowledgeable decisions on the INPO approach to job performance based training, identify key personnel who would be involved in supervising and producing plant specific job and task analyses. Provide the necessary training to these key individuals in the INPO job and task analysis model. The INPO Training and Education Division may be able to offer assistance and advice in this regard.

4-2.5.1.6. Finding on "When Instructors Have Not Yet Attained the Required Instructional Qualifications or Only Instruct Occasionally, the Training Quality Is Maintained Through Appropriate and Qualified Assistance and Supervision." New instructors are approved to begin duties as an instructor, including developing lessons and teaching classroom lessons, by their section head based on informal criteria for qualification as an instructor. It is a goal that instructors complete the 40-hour initial instructor development course before being assigned duties to instruct, but this is not required. Instructors typically attend the next offering of the course after being assigned to instruct. There are no procedures directing observation and coaching for new instructors during this interim period before attending the course. The licensed operator training program descriptions contain procedures for approving the use of guest lecturers in training sessions.

4-2.5.1.6. Conclusion. Procedures are needed to qualify and assist guest lecturers and instructors who have not yet attained required instructional qualifications.

4-2.5.1.6. Recommendation. Develop procedures to assist and supervise individuals who only instruct occasionally or instructors who have not yet attained required instructional qualifications.

4-2.6. <u>INPO Criteria for Staff Development and Evaluation</u>.

- o The objective for this criteria is "To maintain an effective and qualified training staff."

4-2.6.1. INPO Criteria.

a. "Initial and continuing training of instructional staff members is developed and implemented."
b. "Criteria and procedures for evaluating and ensuring the qualifications of the training staff are established and implemented."
c. "Instructor performance is evaluated at least annually."
d. "Opportunities for continuing development are provided for training staff in response to both individual and organizational needs."
e. "Those who regularly provide technical training maintain their technical qualifications and their familiarity with job requirements through in-plant activities."

4-2.6.1.1. Finding on "Initial and Continuing Training of Instructional Staff Members Is Developed and Implemented." The TMI Training Department conducts a 40-hour initial instructor development course for personnel assigned as TMI Training Department instructors. Typically this course is completed within six months of assignment as an instructor. There is a supervised self-study course of approximately 40 hours on criterion-referenced instruction, which four instructors have taken. The TMI Training Department reported that a program for advanced and ongoing instructor development, based in part, on the INPO guidelines, is in the early planning stages. It is now contemplated that advanced instructor training will be provided in one-week modules with the first to be presented in late 1982. It will include two to three days on criterion-referenced instruction and two to three days on testing and evaluation.

4-2.6.1.1. Conclusion. Continued improvement is needed in the TMI Training Department instructor development programs. The length of the initial instructor development course is not of sufficient duration to achieve mastery of course objectives without substantial follow-up observation and critique after the instructor is in the classroom and giving and preparing instruction. The planned advanced instructor training program of one week on criterion-referenced instruction and testing and evaluation is a good first step, but a one week exposure to complex new material is not adequate to ensure mastery under real working conditions without follow-up observation and critique. This subject is discussed further in Section 5 of the report. The TMI Training Department courses for instructor development include significantly less time and content than recommended by the INPO guidelines.

4-2.6.1.1. Recommendation. Upgrade the initial and advanced instructor development programs based on an analysis of job performance based requirements for a TMI instructor. Consider the recommendations of INPO guidelines in structuring new programs. Establish procedures for follow-up observation and critique of new instructors in the performance of instructing duties.

4-2.6.1.2. Finding on "Criteria and Procedures for Evaluating and Ensuring the Qualifications of the Instructional Staff Are Established and Implemented." A TMI Training Department practice calls for section heads and training management personnel to observe and evaluate instructors on a regular basis. Evaluation criteria and procedures have not been established and promulgated. The TMI Training Department reported that a procedure is being developed.

4-2.6.1.2. Conclusion. There is a lack of specific evaluation criteria promulgated for assessing the qualifications of the instructional staff.

4-2.6.1.2. Recommendation. Establish specific evaluation criteria for instructors. Implement a program for the regular and systematic evaluation of instructors.

4-2.6.1.3. Finding on "Instructor Performance Is Evaluated at Least Annually." A TMI Training Department practice calls for supervisors to evaluate instructors semi-annually and section heads to perform annual evaluations. A schedule of evaluations was reviewed and there has not been consistent compliance with the schedule. The Operator Training Manager TMI and the Manager Plant Training TMI performed a total of eight instructor evaluations in the training programs assessed since January 1981. Procedures are in place and effectively operating for trainees to provide weekly comments on operator replacement and requalification training classes to the TMI-1 Operations Department Training Coordinator. Similar trainee evaluations are also used within the TMI Training Department for general employee training, TMI-1 auxiliary operator and RadCon technician training programs. Twenty-seven of these evaluations were reviewed. They contained candid, constructive and responsible comments which were investigated and, where appropriate, acted on by TMI-1 Operations Department and TMI Training Department managers.

4-2.6.1.3. Conclusion. An effective instructor evaluation program has not been established. Trainee evaluations of classroom instruction are effectively used as a feedback tool by the TMI Training Department.

4-2.6.1.3. Recommendation. Establish and implement an effective instructor evaluation program. Continue trainee evaluations as a means of feedback to the instructors and the TMI Training Department.

4-2.6.1.4. Finding on "Opportunities for Continuing Development Are Provided for Training Staff in Response to Both Individual and Organizational Needs." GPU Nuclear sponsors off-site instruction for training staff personnel in RadCon techniques, RadWaste management, respirator certification, maintenance practices, and special engineering subjects. TMI Training Department personnel are encouraged to enroll in GPU Nuclear sponsored college and university programs on their own time.

4-2.6.1.4. Conclusion. GPU Nuclear sponsors a variety of opportunities for continuing development and makes good use of local educational institutions in this effort.

4-2.6.1.4. Recommendation. Continue present policies of encouraging the continuing development of training staff personnel.

4-2.6.1.5. Finding on "Those Who Regularly Provide Technical Training Maintain Their Technical Qualifications and Their Familiarity With Job Requirements Through In-Plant Activities." Instructors who hold NRC reactor operator and senior reactor operator licenses in the TMI-1 plant participate in the licensed operator requalification program which includes working two shifts per month in the plant. As with most off-shift personnel, this is not sufficient to maintain adequate proficiency to be assigned licensed operator duties without additional retraining. RadCon instructors participate in some in-plant activity. Auxiliary operator instructors spend time in the plant conducting tours and preparing lesson plans on plant systems. GET instructors regularly observe RadCon practices in-plant to ensure their instruction is current and job related.

4-2.6.1.5. Conclusion. Continuing emphasis is needed to ensure that instructors develop and maintain their expertise in the plant.

4-2.6.1.5. Recommendation. Develop procedures for ensuring that TMI Training Department personnel concerned with technical instruction develop and maintain expertise in the plant commensurate with their assigned duties.

SECTION 5
INSTRUCTOR DEVELOPMENT PROGRAM

5-0. INTRODUCTION. The overall effectiveness of technical training within an organization is largely influenced by the knowledge, skill and motivation of the instructional staff. Thus, the development and maintenance of a high level of instructor competence is vital in achieving an effective technical training program. Although not identified as a specific assessment area in the scope of work, the instructor development program is considered sufficiently important to be assessed in a separate section of this report.

5-1. ASSESSMENT METHODS. The instructor development program was assessed by Mr. J.H. Biddick and Dr. P.C. Manning of Data-Design Laboratories. Draft 10 of INPO document titled "Nuclear Power Plant Training Personnel Guidelines for Technical Instructor Qualification," April 12, 1982, was used as a reference for assessing the TMI Training Department instructor development program. Draft 10 of these guidelines had not been received by the TMI Training Department at the time of the assessment.

In addition to the INPO guidelines, information on which to base the assessment was also obtained from the following sources:

a. Interviews with the Supervisor Training and Educational Development (T&ED) and the Training and Educational Development Section instructors
b. Training schedules
c. TMI Training Department instructor training program descriptions
d. TMI Training Department instructor training lesson plans
e. American Electrical Power (AEP) Manual for Instructors

The data from these sources was organized and displayed using an instructor training program evaluation checklist and instructor training program content audit work-sheets.

Copies of these forms and the TMI Training Department program descriptions for initial instructor development and proposed advanced instructor development are included in Volume 2, Section 5.

Contact with the Supervisor T&ED was limited during the site visit because he is on long-term assignment as GPU Nuclear project leader for the basic principles trainer project and is normally located at the vendor's plant at West Long Branch, New Jersey. In his absence, discussions continued with the Acting Supervisor T&ED.

5-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The current status of the TMI Training Department instructor development program is assessed in terms of selection and qualification of instructor candidates, initial development, certification, evaluation and continuing development, program evaluation, and records. Conclusions and recommendations accompany the findings in each area.

5-2.1. Instructor Selection and Qualification. Training and Educational Development (T&ED) section personnel reported that TMI Training Department instructor duty is considered a desirable assignment. Interviews with personnel outside the TMI Training Department indicated general agreement that the position of TMI Training Department instructor is viewed as necessary and important to the TMI organization. Several well qualified and experienced TMI-1 shift operations personnel have made known their desire for assignment to instructor duty. Depending on position, experience and qualifications, some shift operations personnel would receive less pay as instructors than they now receive. The Supervisor T&ED stated that the TMI Training Department assigns priority to selecting technically qualified and well regarded technicians for instructor duty. Instructors are selected from personnel nominated by their supervisors or who have otherwise demonstrated their instructional capabilities in GPU Nuclear positions or in previous jobs. Nominees are interviewed by the appropriate TMI Training Department section head who is responsible for assessing the individual's technical and instructional capabilities. During interviews with the section head, instructors and managers, candidates are sometimes required to make a 3-5 minute extemporaneous instructional presentation. Interpersonal, presentation, and technical skills are considered essential for assignment to instructor duty. Instructor candidates are also interviewed as desired by the TMI-1 department which utilizes the training which the candidate will provide. Selection is based on results of interviews and a review of work experience and qualifications.

5-2.1. Conclusion. Selection of personnel for instructor positions is based primarily on motivation and on technical experience and ability. The main responsibility for selecting appropriate individuals as instructors rests with the cognizant

TMI Training Department section head. There are no detailed criteria for assessing technical or instructional capabilities of instructor candidates. Placing an instructor in a training status until all criteria for technical and instructional capabilities are met would improve control of the selection process.

5-2.1. Recommendation. Develop a set of criteria for selection of individuals to fill specific instructor positions. Use these criteria for assessing technical and instructional capabilities of instructor candidates. Consider establishing an instructor-in-training status for instructor candidates who do not meet all criteria.

5-2.2. Initial Development. As the first step in instructor development, instructor trainees study the AEP Manual for Instructors for one week using a take-home open-book test as a study guide. The take-home test results are reviewed by the trainee's section supervisor and members of the T&ED staff. If the individual's performance is considered unsatisfactory, the trainee is directed to study material in the areas of weakness and correct observed deficiencies.

The second step in instructor development, which normally occurs within the first six months of instructor duty, is completion of the TMI Training Department initial instructor development course. Table 5-1 lists the lesson topics and instruction times in this course. During the one-week course in basic instructional concepts and techniques, each trainee develops a lesson plan and a 20-minute videotaped presentation. These products are evaluated using the TMI Training Department guide for evaluation of instruction and the lesson plan development review guide. The course is conducted by T&ED section personnel and includes lectures in addition to the videotaped presentations and critiques. In comparison, the INPO guidelines recommend an 80-hour Level I associate instructor training program for an individual without previous instructor experience.

On completion of the course, instructor trainees take a final written examination. The grade on this test is averaged with grades on the lesson plan and the videotaped presentation. If the average grade is less than 80%, remediation is prescribed and the trainee is required to demonstrate improved performance. After fulfilling all requirements, the instructor receives a certificate of completion and begins or resumes instructor assignments.

TABLE 5-1

TOPICS AND INSTRUCTION TIMES INCLUDED IN

ONE WEEK TMI TRAINING DEPARTMENT INITIAL INSTRUCTOR DEVELOPMENT COURSE

TOPIC	CLASSROOM TIME (MINUTES)
Orientation, Course Objectives, and Clarification of Terms	60
Effective Speaking	45
Impromptu Presentation	60
The Learning Process	60
Principles of Learning	105
Planning and Running Effective Training	60
Determining Training Needs	60
Making a Training Needs Analysis	60
Making a Task Analysis	60
Preparing Instructional Objectives	150
Making a Training Analysis	60
Selecting Media and Materials	120
Selecting Training Methods	60
Classroom Arrangement	45
Testing and Evaluation	75
Preparing Lesson Plans	210
Presentations and Critiques	480
Final Exam	45
Film: What You Are Is Where You Were When	105
Course Evaluation	30
Exam Review	30

Note: These times do not include breaks and required study.

A content analysis of the lesson plans for the TMI Training Department initial instructor development program compared to the content recommended by INPO guidelines provided the results shown in Table 5-2. The TMI initial instructor development course includes instruction on principles of adult learning, characteristics of an effective instructor, motivation and discipline, and common methods of instruction. Trainees also receive instruction on recognized methods and procedures for effective classroom instruction. These latter areas include training needs analysis, instructional objectives, methods of instruction, lesson plan development, classroom presentation, and evaluating adult trainees. Videotaped student presentations and critiques comprise about 24% of initial instructor development training.

Analysis of TMI Training Department lesson plans indicated that instructor trainees receive very little instruction on the social and behavioral learning characteristics of adults, the differences between terminal and enabling objectives, and techniques to optimize learning. There were no TMI Training Department lesson plans, training aids, or discussion points on the following INPO suggested topics: instructor-trainee relationships, resourcefulness and creativity; fitting into the total training effort; advantages and disadvantages of different instructional methods, criteria for selecting various methods, instructional pacing, presenting laboratory instruction; and maintaining and using training program records. The last named subject is covered during indoctrination for all new TMI Training Department personnel.

5-2.2. Conclusion. Steps have been taken in the right direction, but there is need for further improvement in initial instructor development. The 40-hour initial instructor development course provides complete or partial coverage of approximately 22 of 31 topics contained in the 80-hour associate instructor course recommended by INPO guidelines. The TMI Training Department initial instructor course focuses on lesson plan preparation and platform delivery of instruction. Considerable class time, 210 minutes, is devoted to lesson plan development. A total of 480 minutes of class time is allotted for platform presentations by the instructor trainees. The presentations are videotaped and reviewed during the critiquing process. This is an excellent program to prepare new instructors with proper lecture techniques. However, the initial training is not of sufficient duration to ensure trainee mastery under various expected conditions. Without coaching and feedback subsequent to the course and over a period of time during which the new instructor produces a number of lesson plans on varying topics and delivers lectures based on these lesson plans, it is not assured that uniformly high quality lesson plans and lectures will result.

TABLE 5-2

TMI TRAINING DEPARTMENT BASIC INSTRUCTOR COURSE CONTENT COMPARED TO CONTENT RECOMMENDED BY INPO GUIDELINES FOR LEVEL 1 ASSOCIATE INSTRUCTOR

INPO Content Area Subject	Subject Material in INPO Content Areas Which Is: Included in TMI Training Department Lesson Plans	Not Identified in TMI Training Department Lesson Plans, but Is Implicit in Lesson Content	Not Included in TMI Training Department Lesson Plans or Content
A. The Role of the Instructor	Competent instructor The desire to teach		Instructor-Trainee relationships Resourcefulness and creativity Fitting into the total training effort
B. Principles of Adult Instruction	How adults learn Common characteristics of adult learners Motivational & disciplinary factors	Social behavioral problems of adults	
C. Instructional Development	Training needs Instructional objectives Correctly sequenced objectives	Differences between terminal and enabling objectives	
D. Methods of Adult Instruction	Common methods of instruction Techniques to maximize effectiveness		Advantages and disadvantages of methods Criteria to use when selecting a method
E. Lesson Plans	Purpose of lesson plans Types, components, use		
F. Training Aids	Training aids - Types, rate, selection and use		
G. Presenting Classroom Instruction to Adults	Presenting classroom instruction to adults - speech techniques, response to trainees, control of the classroom, good learning environment	Techniques to optimize learning	Instructional pacing
H. Presenting Laboratory Instruction to Adults			Presenting laboratory instruction to adults, safety control techniques to optimize learning
I. Evaluating Adult Trainees	Evaluating adult trainees - purpose and methods		
J. Maintaining and Using Trainee and Program Records			Maintaining and using training program records (included in indoctrination for all new TMI Training Department personnel)

The duration of the TMI course by itself is not sufficient for new instructors to master the skills currently required of a TMI instructor who is expected to be an effective lecturer, preparer of high quality lesson plans, developer of instructionally sound training aids, designer and developer of new topics or areas of instruction, developer of tests, and tutor of trainees requiring remedial assistance.

The topics included in the TMI initial instructor development course cover most of the information required for an instructor to be effective in these areas. However, the presentation length of most topics is so short that only the barest essentials can be introduced. There is no time for the practice and feedback required to develop competence. For example, 60 minutes on making a task analysis is barely enough to explain what a task analysis is. The knowledge and skill required to perform a task analysis require much instruction and coaching. Many of the trade-offs that are made in converting task analysis data into training objectives require considerable judgment and experience in training.

5-2.2. Discussion. The term instructor does not really describe the position, and areas of special expertise are required to assure that instruction is effectively and efficiently developed, presented and evaluated. A clear cut distinction exists between the training, experience and viewpoint of an experienced technician and that of an instructional technologist. By training and experience, a technician is procedurally oriented. It may be difficult for a technician to step back and systematically organize his knowledge. The technology of instruction has its own tools and methods which are more conceptual than procedural. It is considered that technicians, particularly highly qualified and experienced technicians, may have difficulty in making the transition from the technician viewpoint to the conceptual viewpoint of the instructional technologist. It takes considerable time and experience to master the tools of instructional technology. During the time an experienced technician takes to obtain such mastery, his technical knowledge and skill decrease from lack of application. It is important that the technical expertise of the actual instructor in the TMI Training Department be at a high level. The systematic, analytical, and conceptual expertise required to develop valid and reliable job performance based training can be provided by persons who work with the instructor technician.

The three levels of instructor development recommended by the INPO guidelines may not be well suited to providing this expertise. A more effective method of accomplishing the range of activities required in developing and presenting high quality technical training may be to use a team approach for various aspects of design and development. In a team approach, persons with instructional expertise work with subject matter experts so that both the technical content and instructional issues are addressed. In the team approach, a smaller number of individuals require intensive training and experience in instructional technology.

It has been found that teaming an experienced instructional technologist with two or three subject matter experts can produce sound training design and materials at a reasonable cost. This approach does not require extensive training and education of technicians in instructional development techniques. It leaves the technician more time to become and remain competent in a field and, coupled with a training program in teaching techniques, the technician can become a competent instructor.

5-2.2. Recommendation. Increase the time in the TMI Training Department initial instructor development course allotted to training and practice in presenting various kinds of instruction. Consider the recommendations of INPO guidelines in changing content and instruction hours. Establish procedures for the regular observation and coaching of new TMI Training Department instructors in the performance of their classroom instructor duties. Consider adopting a team approach to instructional development and revision efforts which combines instructional technology with subject matter expertise. This will become increasingly important if INPO generic job and task analyses are used to develop job performance based training. In this approach, instructors would be subject matter experts and teachers but not instructional developers. The instructional technologists needed in this approach may already reside in the T&ED section or can be developed in that section.

5-2.3. Certification. It is a TMI Training Department goal that all new instructors successfully complete the one-week initial instructor development program before being assigned instructing duties. However, this is not a requirement. In general, there are no procedures for certifying TMI Training Department instructors before they begin instructing trainees. An exception to this is in the RadCon training area. The RadCon technician instructor is required to successfully complete an extensive indoctrination and qualification program before being formally certified to teach by the Radiological Training Manager TMI-2. This program includes attending and successfully completing the TMI Training Department initial instructor development course. Certification in other cases is accomplished informally by the instructor's section head. The INPO guidelines recommend that, as part of a formal certification process, instructor trainees be given written tests during instructor training and that there be a formal objective observation of classroom presentation both during training and in an actual class presentation after the conclusion of the training. TMI Training Department instructors are given a written test and are observed in a classroom presentation during training. However, there is no formal process of certification.

5-2.3. Conclusion. The TMI Training Department goes through much of the activity recommended by INPO guidelines for certification without actually having a formal certification process.

5-2.3. Recommendation. Develop a process to certify TMI Training Department instructors.

5-2.4. Instructor Evaluation. Evaluators observe a class session and complete an instructor evaluation form. A copy of this form is included in Volume 3, Section 5. During these reviews, instructors are rated on a 4-point scale on the technical content of the lesson, preparation by the instructor, presentation techniques, communication skills, use of training equipment, and motivational influence. Completed instructor evaluation forms are routed to the instructor's supervisor, section head, Manager Plant Training TMI, and the Supervisor Training Administrative Support. Instructor evaluations are discussed by the instructor who was evaluated and the evaluator. Procedures are being formalized to use evaluation results to identify individuals for counseling, additional training in observed areas of deficiency, or assignment to other duties. The subject of instructor evaluations is also discussed in Section 4 of the report.

5-2.4. Conclusion. The TMI Training Department has not been systematic in its evaluation of instructors. Procedures are currently under development to improve this process.

5-2.4. Recommendation. Complete the development of procedures to ensure systematic evaluation of instructor performance in all areas of assigned duties.

5-2.5. Continuing Development. Continuing instructor development is provided through the TMI Training Department advanced instructor self-study course and continuing education workshops. The purpose of the advanced instructor course is to provide familiarization in criterion-referenced instruction. The self-study course is based on the text Criterion-Referenced Instruction: Analysis, Design and Implementation, Mager and Associates, 1980. Of the 17 course modules, six address writing performance objectives, four cover preparing test items to appraise the skills of the learner at the beginning and the end of the course, three show how to identify materials relevant to the course objectives and learner needs, and four describe the differences between conventional and criterion-referenced instruction (CRI) and how these differences affect the actions of the instructor. The course is made available for instructor use, if desired. The TMI Training Department stated that parts of the course will be incorporated in the required advanced instructor training course which is now being developed.

In April 1982, four supervisors from maintenance, technician, and instructor training areas completed this CRI self study course. Presently there are no instructors participating in the course. The CRI course requires approximately 40 hours of study to complete.

The INPO guidelines recommend an 80-hour Level II instructor training course followed by a 80-hour Level III senior instructor course to achieve qualification as a senior instructor. TMI Training Department instructors typically receive 40 hours of initial instruction, with no present requirement for advanced instruction.

There are no procedures or practices to provide a regular on-going assessment of instructor capabilities in any area except review of lesson plans and classroom presentations. There is no system for coaching or remedial training of instructors who have problems. As an example of the need in this area, the Supervisor Non-Licensed Operator Training TMI-1 commented during an interview that two of his instructors had received poor evaluations from qualified auxiliary operators attending retraining classes. The supervisor felt that the comments were unwarranted.

However, further action was not taken to get help from training specialists in the T&ED Section to identify and solve the problem. One of these instructors was observed by an assessment team member during a lecture on the emergency diesel generator. The instructor prefaced his lecture by stating that all he knew came from the technical manual and then proceeded to give a lecture that demonstrated that he was intimately familiar with the function and the location of components, piping runs, and controls and alarms. Although frequently challenged, the instructor could describe colors, positions and locations so clearly that the trainees, who were all experienced auxiliary operators eventually agreed with him. In an interview with the instructor after the class, the effect of his needless apology was pointed out. In a class a few days later, with the same class of experienced auxiliary operators, the instructor was observed by an assessment team member to exhibit a much more positive self-image with a corresponding improvement in class attitude and less disruption by challenges to his instruction.

5-2.5. Conclusion. The focus of current advanced instructor development is a supervised self-paced module on criterion-referenced instruction. The TMI Training Department stated that a one-week module is being developed which covers both criterion-referenced instruction and testing and evaluation. Both of these topics need to be covered so that an instructor can effectively participate in developing high quality technical training. A basic understanding of these areas is important even in the team approach to instructional development which was discussed previously. Overall, the content of the TMI Training Department advanced instructor development program is significantly less than the content recommended by INPO guidelines for two 80-hour courses in continuing instructor development.

5-2.5. Recommendation. Conduct a systematic analysis to identify the knowledge and skills required by a TMI Training Department instructor in the performance of his duties and structure a continuing instructor development program to satisfy these requirements. Consider the recommendations of INPO guidelines in developing this training.

5-2.6. Instructor Training Program Evaluation. The TMI Training Department routinely collects evaluation data on various training programs, instructor delivery, and trainee knowledge and performance, but there is no systematic process for analyzing and applying this data to evaluate the instructor development program. The INPO guidelines recommend regular periodic review in the following areas:

a. Technical and instructional qualification guidelines for each instructor position
b. Methods to determine instructor qualifications
c. Instructor certification procedures
d. The objectives, content and methods of initial and advanced instructor training
e. Methods to evaluate the on-the-job performance of instructors.

5-2.6. Conclusion. A systematic periodic review of instructor qualification requirements, initial and advanced instructor training and instructor evaluation procedures is not being accomplished.

5-2.6. Recommendation. Develop procedures to accomplish systematic periodic reviews of instructor qualification requirements, initial and advanced instructor training and instructor evaluation procedures. The recommendations of INPO guidelines should be considered in developing these procedures.

SECTION 6
GENERAL EMPLOYEE TRAINING

6-0. INTRODUCTION. ANSI/ANS-3.1-1978, "American National Standard for Selection and Training of Nuclear Power Plant Personnel," provides the following criteria in Section 5.4 for general employee training at nuclear power plants:

"General Employee Training. All persons regularly employed in the nuclear power plant shall be trained in the following areas commensurate with their job duties:

General Description of Plant and Facilities
Job Related Procedures and Instructions
Radiological Health and Safety Program
Station Emergency Plans
Industrial Safety Program
Fire Protection Program
Security Program
Quality Assurance Program

Temporary maintenance and service personnel shall also be trained in the above areas to the extent necessary to assure safe execution of their duties."

The TMI Training Department program for initial general employee training (GET) includes:

a. GET-101. An eight-hour basic course for GPU Nuclear and contractor employees who will perform their jobs in any TMI area except those designated as radiologically controlled areas. During this course, trainees receive instruction in subjects required by ANSI/ANS-3.1-1978.

b. GET-102. A 20-hour course for individuals who require access into radiologically controlled areas. GET-102 includes a more detailed survey of radiation protection principles and procedures than GET-101; methods for minimizing RadWaste; and four hours of practical factors training on procedures for donning and removing the protective clothing required in designated areas. A practical examination, in addition to the written examination, is given on this portion of the GET program.

c. GET-103. A course provided for those workers who are required to wear respiratory protection devices in the performance of their jobs. GET-102 is a prerequisite for this course which consists of a basic four hour session plus one additional hour of instruction for each type respirator device that the trainee needs to be qualified to use.

Annual continuing or requalification training is required for all GPU Nuclear and contractor employees who completed initial GET. The continuing training courses consist of:

a. GET-201. A four-hour course for personnel who completed GET-101 in initial training.
b. GET-202. An eight-hour course for personnel who completed GET-102 in initial training.

Both courses include a review of key portions of the respective initial GET course including emergency related procedures, recent changes relevant to GET, questions and answers, and tests similar to those taken in the initial training courses. GET-202 also includes four hours of practical factors training.

Several thousand personnel complete initial and continuing training in the TMI GET courses each year.

6-1. ASSESSMENT METHODS. General employee training was assessed by Mr. J. H. Biddick and Mr. J. E. Malloy of Data-Design Laboratories. These personnel completed the 20-hour GET-102 course, Indoctrination for Radiologically Controlled Area Workers, including the practical factors session. Both completed TMI-1 check-in procedures and were issued TLDs and access badges for non-airborne radioactivity areas.

The assessment focused on:

a. The content of the TMI general employee training program and the program recommended by the INPO document titled "General Employee Training," INPO 82-004, February 1982 (INPO guidelines).
b. The educational soundness of TMI GET practices including: methods for deriving teaching objectives, appropriateness of the objectives in both content and communicative clarity, suitability of training materials, expertise of instructors in teaching, suitability of examination methods

for each of the various kinds of content, methods of instruction and their suitability for the content covered, and feedback and management of the program.

Data was gathered from various sources using the following approaches:

a. A section by section comparison was made of content in the TMI GET program and the program recommended by INPO guidelines. The results of the comparison are summarized and discussed in the findings section.
b. A sample of lesson plans and lists of objectives were evaluated to determine their adequacy.
c. Classroom sessions were observed to evaluate instructors, training materials, presentation techniques, and classroom facilities.
d. Discussions were conducted with trainees, instructors, supervisors and managers in order to gain a variety of feedback and perspective on the TMI GET program.

Sample checklists used to gather data are included in Volume 2, Section 3.

General employee training was assessed in the following areas:

a. Comparison of the content of the TMI GET program and the program recommended by INPO guidelines.
b. Adequacy of program resources and procedures to support training.
c. Appropriateness of lesson plans and instructional materials for presentations.
d. Evaluation of training sessions for conformance with lesson plans, instructor effectiveness, and instructional techniques.
e. Effectiveness of end-of-course examinations as a measure of achieving course objectives.
f. Effectiveness of examination security.
g. Effectiveness of evaluations of practical ability.

In performing the assessment, information was obtained from the following documentation:

Program Descriptions

a. General Employee Training Program — Rev. 0, 12/01/80 with Amendment 1, 03/25/81

b. General Employee Training Program Course Description — Rev. 04/01/82

These program descriptions are included in Volume 2, Section 6.

Lesson Plans

a.	Lesson Plan GET-101	Rev. 1, 00/00/81
b.	Lesson Plan GET-201	Rev. 0, 12/15/81
c.	Lesson Plan GET-202	Rev. 0, 12/21/81
d.	Lesson Plan GET-103	Rev. 0, 06/16/82
e.	Lesson Plan and Student Handout GET-102	Rev. 1, 11/01/81

Examinations

a.	GET-101/201	General Employee Training Exam Form "A"	Rev. 05/11/82
b.	GET-102/202	Exam Form "2C"	
c.	GET-102/202	Exam Form "2A"	
d.	GET-103	Exam Form "B-13"	Rev. 0, 10/01/81

Training Records

a.	GET-101	Training Attendance Form for 06/29/82 class
b.	GET-201	Training Attendance Form for 06/24/82 class
c.	GET-202	Training Attendance Form for 06/28/82 class
d.	GET-102	Training Attendance Form for 06/22/82 class
e.	GET-102	Training Attendance Form (Practical Factors) for 06/30/82 class
f.	GET-202	Training Attendance Form (Practical Factors) for 06/29/82 class

6-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. Findings, conclusions and recommendations for the general employee training program are addressed in each of the following assessment areas.

6-2.1. Comparison of the Content of the TMI GET Program and the Program Recommended by INPO Guidelines.

6-2.1.1. Finding on Comparison of TMI GET Program with INPO Guidelines. Tables 6-1 and 6-2 present summary data comparing INPO course content and time allocation recommendations with TMI General Employee Training (GET) courses. Volume 2, Section 6 contains a completed content commonality checklist which compares the TMI GET program with the program recommended by INPO guidelines.

A comparison between the program recommended by INPO guidelines and the TMI GET program requires some subjective judgment. The training subject matter is generally common to both programs, but in some cases, it is organized differently in the two programs. INPO Category I personnel are those who have access to the protected area but do not enter areas that are controlled for radiological protection purposes unless continuously escorted by Category II trained workers. INPO Category II personnel have access to the protected area and work in areas controlled for radiological protection purposes. At TMI, three general access categories have been established as represented by training courses GET-101, GET-102, and GET-103. GET-101 qualifies personnel to perform jobs in any TMI area except those areas designated as radiologically controlled areas. This category equates closely to INPO Category I. GET-102 qualifies personnel to perform jobs in any TMI area except those areas requiring the use of respiratory protection devices. This category equates to INPO Category II, less respirator qualification. GET-103 qualifies radiological workers, previously qualified in GET-102, who are required to wear respiratory protection devices in the performance of jobs. The basic GET-103 training is supplemented by a separate one hour course for each type respiratory device required to be worn. Six separate device courses are offered. The combination of GET-102 and GET-103 equates to INPO Category II with greater emphasis in the TMI course on respirator qualifications.

By broad topic areas, the TMI Training Department GET courses generally match the recommendations of INPO guidelines except that the TMI program provides additional instruction in Non-Essential Employee Emergency Plan Procedures (.75 hours) and TMI Procedures (.5 hours). The recommended INPO instruction times differ from the TMI instruction times for all subjects, particularly for industrial safety. INPO recommends 8 hours of instruction for this subject in training for both Category I and Category II personnel, whereas the TMI coverage is 1 hour of industrial safety

TABLE 6-1

INPO CATEGORY I and TMI GET-101 PROGRAM SUMMARY

Subjects from INPO Guidelines and TMI GET Program Description	Number of Instruction Hours INPO Category I	GET-101
Plant Organization and Administration	1	.5
Plant Description	2	.5
Industrial Safety	8	1.0
Radiological Protection Training	3	5.0
Quality Assurance and Quality Control	1	.5
Plant Security	1	.5
Additional Sections in TMI GET Program Description		
TMI Procedures		.5
Emergency Plan Procedures		.75
Total Hours	16	9.25

The GET 101 lesson plan shows 9.25 hours of total instruction time in the categories listed and the scheduled course duration is 8 hours.

TABLE 6-2

INPO CATEGORY II AND TMI GET-102 AND GET-103 PROGRAM SUMMARY

Subjects from INPO Guidelines and TMI GET Program Description	Number of Instruction Hours: INPO Category II	GET-102	GET-103
Plant Organization and Administration	1	1.5	
Plant Description	2	.5	
Industrial Safety	8	1.0	
Radiological Protection Training	16#1	14.75	4#2 + 1 hr per respirator type
Quality Assurance and Quality Control	1	.5	
Plant Security	1	.5	
Additional Sections in TMI GET Program Description			
TMI Procedures		.5	
Emergency Plan Procedures		.75	
Total Hours	29	20.00	4#2 + 1 hr per respirator type

Note #1 This includes respiratory protection training.

Note #2 4 hour basic respirator training course plus 1 hour practical training course for each respirator type to be qualified on. GET-102 is a prerequisite for GET-103.

instruction in both basic general employee training courses. In the 1 hour, the TMI GET courses cover subjects recommended by the INPO guidelines, including personnel injuries, protective tagging, fire protection, chemical hazards, electrical safety, scaffolds, ladders and safety devices, working in confined spaces, and material handling and safety. The TMI-1 auxiliary operator training program also provides 16 hours of industrial safety instruction near the end of the classroom phase before trainees go in the plant for OJT. INPO guidelines recommend a total of 16 hours for Category I training and 29 hours for Category II training. In comparable courses, the TMI Training Department provides 8 hours of training in GET-101 and 24 hours of training plus 1 additional hour for each type respirator device in GET-103 training.

6-2.1.1. Conclusion. The technical content of the TMI Training Department general employee training program is consistent with the content recommended by INPO guidelines except for the depth of coverage in industrial safety. The TMI GET courses are well balanced and allocate appropriate instructional time in the lesson plans for the subjects covered. The additional subjects of TMI Procedures and Emergency Plan Procedures for Non-Essential Personnel are appropriate for inclusion in general employee training at TMI. ANSI/ANS-3.1-1978 training requirements are covered in the TMI GET courses.

The one hour allocated to industrial safety in the TMI program is considered sufficient coverage of this subject for general employee training.

6-2.1.1. Recommendation. Maintain the present structure and content of the TMI Training Department general employee training courses.

6-2.1.2. Finding on Consistency in Technical Content Between TMI Trairing Department Training Policy Documents and Training Support Material. In examining the materials used to establish and conduct the TMI GET courses, it was observed that the TMI Training Department document "General Employee Training Program," Rev. 0 12/01/30 with Amendment 1, 03/25/81, which is intended to be the document describing the GET courses, does not reflect the latest revisions to lesson plans and course descriptions. The following discrepancies were noted:

a. The descriptions of training courses GET-101, GET-102 and GET-103 in paragraphs 6.1.4.1.1, 6.1.4.2.1 and 6.1.4.3.1 of the general employee training program document do not agree with descriptions in the TMI Training Department document "General Employee Training Program Course Description," Rev 4/1/82.

b. The outline for training courses GET-101 and GET-103 contained in paragraphs 6.1.4.1.3 and 6.1.4.3.3 of the general employee training program document does not reflect the content of the latest lesson plans for these courses.

c. The training waiver for personnel previously trained in radiological controls provided in paragraph 6.1.6 of the general employee training program document is superseded by course GET 102.1, Authorized Challenge of GET-102. This is a variation of GET-102 included in the General Employee Training Program Course Description, Rev 4/1/82.

6-2.1.2. Conclusion. The TMI Training Department document "General Employee Training Program," Rev 0, 12/01/80 with Amendment 1, 03/25/81, which is the course description, does not reflect current training, qualification and training waiver policies and procedures.

6-2.1.2. Recommendation. Update the TMI Training Department document "General Employee Training Program" to reflect current policies and procedures.

6-2.2. Adequacy of Program Resources and Procedures to Adequately Support Training.

6-2.2.1. Finding. The TMI Training Department facilities and equipment observed during the conduct of the classroom phase of GET-102 are adequate to support the present training load. A review of course attendance forms for five GET classes indicated an average class size of 15 trainees with a range of 5-21 trainees. Classes of this size are within the capabilities of present instructor and classroom resources. The TMI Training Department Support Training Manager reported that 2,320 students participated in various general employee training courses during the period January 1-July 31, 1982. To support this training, GET instructors were usually assigned seven to eight half-day contact periods with students per week. This heavy instructional load is feasible because of the repetitive nature of the training and the numerous practical factors sessions included which do not involve significant preparation or platform time. Occasionally, contract instructors are used temporarily for heavy general employee training loads. They report to the TMI Training

Department two weeks before teaching their first class to learn the material, sit in on classes, and make practice presentations. A TMI Training Department instructor attends the first class a contract instructor teaches to evaluate the presentation and provide guidance.

6-2.2.1. Conclusion. The TMI Training Department general employee training instructors are currently working at close to maximum capacity with most of their time spent on duties immediately concerned with classroom instruction. They have very little time for instructional materials development, program improvement, trainee evaluation, trainee counseling, and staff professional development.

6-2.2.1. Recommendation. Monitor workload of the GET instructional staff and ensure sufficient time is provided for duties such as instructional materials development, program improvement, trainee evaluation, trainee counseling, and staff professional development in addition to classroom instruction.

6-2.3. Appropriateness of Lesson Plans and Instructional Materials for Presentations. Lesson plans and instructional materials were examined to assess their effectiveness in achieving training program objectives. The appropriateness of instructional presentations for the education and experience level of the trainees and the depth of coverage to meet the stated lesson objectives were considered in this examination.

6-2.3.1. Finding. Lesson plans are currently developed in accordance with TMI Training Department procedure TD 1103 which is consistent with recognized practices in technical training. The lesson plans are followed closely by instructors in conducting the classes. Each module of instruction contains objectives which identify the important information to be learned. Course content is consistent with the stated objectives. In the classes observed, trainees were made aware of the objectives at the beginning of each lesson. The end-of-course examinations which were reviewed appeared to test trainee understanding in only the stated objective areas. In the classes observed, slides and transparencies were used to complement and add emphasis to the instructors' presentations. The Data-Design personnel who attended GET-102 considered that the content was covered at a rapid rate of instruction. Trainees in the class observed were mainly recent college graduates in engineering fields or college students in summer intern programs. Additional work outside of class was required by this group of trainees with high educational background in order to thoroughly learn the material presented during class. A review of the lesson plan, Rev 1, 00/00/81, for GET-101 indicated that a rapid rate of instruction is also necessary to cover the material presented in that course. The lesson plan has 12 parts with specific instruction times allocated to each part. The sum of the instruction times for this course is 9.25 hours. The time scheduled for the course is eight hours.

6-2.3.1. Conclusion. The instruction time of 9.25 hours allocated by the lesson plan is more than necessary to cover the subject matter presented in the TMI Training Department course GET-101. Scheduling this course for an eight-hour period including examination time means that instructors arbitrarily adjust presentation time and coverage for individual topics in order to complete in eight hours. The low failure rate for this course indicates that trainees are mastering the material presented in the time scheduled.

6-2.3.1. Recommendation. Adjust the instruction times for individual topics covered in the GET-101 lesson plan to conform with the scheduled eight-hour period. Consider reducing the time allocated for the radiological protection training topic from 5 hours to 3.75 hours. The time recommended by INPO guidelines for this topic is three hours.

6-2.3.2. Conclusion. TMI Training Department course GET-102 is challenging in terms of amount of material covered in the time allocated. The failure rate for GET-102 is 9.7%, the highest for the several GET courses.

6-2.3.2. Recommendation. The instruction time allocated for TMI Training Department course GET-102 is satisfactory in view of the course content, the quality of instruction and the motivation of trainees. Maintain course GET-102 as currently structured.

6-2.4. Evaluation of Training Sessions for Conformance with Lesson Plans, Instructional Effectiveness, and Instructional Techniques.

6-2.4.1. Finding. Three of four instructors assigned to general employee training were observed conducting training sessions during attendance of GET-102.

These instructors properly introduced each instructional module, emphasized objectives, followed the lesson plan, distributed appropriate handouts, effectively used training aids, and asked timely questions of trainees. The positive attitude of the instructors conveyed to new employees an excellent first impression of the GPU Nuclear organization.

6-2.4.1. Conclusion. The assignment of highly competent and motivated instructors to teach indoctrination courses such as TMI Training Department courses GET-101 and GET-102 is important to create in new employees an excellent first impression of GPU Nuclear.

6-2.4.1. Recommendation. Continue to assign highly competent and motivated instructors to teach indoctrination courses such as GET-101 and GET-102.

6-2.5. Effectiveness of End-of-Course Examinations as a Measure of Achieving Course Objectives. End-of-course examinations were reviewed for their relevance to material covered in the courses, depth of questions, extent of content coverage, and relationship to course objectives. Test item construction and format were examined to determine the extent of memorization, application and recall required. Examination results were reviewed and examination security procedures were observed.

6-2.5.1. Finding. The GET end-of-course examinations which were reviewed covered material presented in the courses with emphasis on the more important course objectives. However, GET course objectives have not been validated with respect to job requirements. The GET-101 and GET-201 examinations reviewed used 39 multiple choice questions in the 40-question examination. The GET 102 and GET-202 examinations employed primarily true/false, fill-in-the-blank, and short essay type questions. The essay and fill-in-the-blank type questions required the memorization of details on procedures.

Several of the examination questions provided information which could be used to answer other questions on the same examination. The true/false items were frequently expressed in the negative, which can be confusing. Answers to the true/false questions were guessed correctly at a level above 80% by Data-Design personnel with no nuclear power plant experience who had not attended the course. The recall questions were difficult to guess and the same personnel scored below 50% even with the help of questions which contributed information. The multiple choice questions could be easily guessed correctly or answered by using common sense. For example:

"7. Proper acceptance of components, parts, and systems is indicated by:
   A. Red - out of service tag
   B. Yellow - defective tag
   C. Blue - out of service tag
   D. Green - Quality Control accept tag"

The word acceptance in the test item and the word accept in answer D give this answer away.

An example of a readily guessed question is:

"11. Which of the following items are prohibited on TMI?
   A. Drugs/Narcotics
   B. Weapons
   C. Alcoholic beverages
   D. All of the above"

If any two choices are true, then D has to be the correct answer.

As an example of one question helping to answer another question, 7 above is a give away and later in the same test, question 38 asks:

"38. A green QA tag means that:
   A. The item is acceptable according to QA requirements
   B. The item cannot be used at TMI
   C. The item is contaminated
   D. All of the above"

Information provided by the TMI Training Department reported 139 failures in tests taken by 2320 GPU Nuclear and contractor employees who attended various GET courses during the period January 1-July 31, 1982. This is an overall failure rate of 6.0%. A passing score of 80% is used by the TMI Training Department compared to a passing score of 70% recommended by INPO guidelines for general employee training. Using a passing score of 70% would have reduced the TMI failure rate to approximately 2%. A review of failure rates for individual courses indicated that 39 of 931 trainees failed GET-202 for a 4.2% failure rate; 34 of 350 failed GET-102 for a 9.7% failure rate; 13 of 403 failed GET-201 for a 3.2% failure rate; 6 of 113 failed GET-101 for a 5.3% failure rate, and 47 of 523 failed GET-103 for a 9.0% failure rate.

6-2.5.1. Conclusions. The overall failure rate of 6.0% for TMI Training Department general employee training courses is considered reasonable. The TMI passing grade of 80% is appropriate for the type of examination questions currently being used. Questions used in TMI Training Department GET examinations relate to course objectives but are generally not well constructed. True or false questions are easy to guess as are some multiple choice questions. A number of the multiple choice questions use distractors which are easily eliminated or use patterns which are predictable such as "all of the above." Essay and fill-in-the-blank questions are appropriate to test recall of specific information, but some type of column matching could be used when the recall of specific information is less critical.

6-2.5.1. Recommendations. Review examination questions used in TMI Training Department GET courses and rewrite as necessary to conform with accepted test writing principles. Provide additional training for GET instructors in testing and evaluation including test item construction and analysis.

6-2.6. <u>Effectiveness of Examination Security</u>.

6-2.6.1. Finding. Various examination security measures were observed during attendance of the GET-102 course. A seating chart was used along with alternating forms of the examination. Examination booklets were reproduced on yellow paper. The standard examination precautions and procedures were read by the instructor prior to the examination and signed by each trainee on completion of the examination. The instructor and an additional proctor were present during the entire examination period. Instructors displayed a serious, no-nonsense attitude toward examination security.

6-2.6.1. Conclusion. Provisions of GPU Nuclear procedure "Administration of Examinations," No. 6200-ADM-2600.1, 10/20/81, were observed to be followed in letter and spirit during GET examinations.

6-2.6.1. Recommendation. Conduct periodic audits of examination security and periodically reinstruct personnel in this subject to ensure that high standards of examination security are not gradually degraded through time and repetition.

6-2.7. Effectiveness of Practical Factor Evaluation. A four-hour practical factors session was attended as part of the GET-102 course. The instruction, practical use of forms, donning and removal of protective clothing and the employment of RadCon equipment were evaluated during this session.

6-2.7.1. Finding. The problem presented in the practical factors session of the GET-102 course was realistic and led to the demonstration of mastery of the practical factors described in the objectives. The instructors were competent in demonstrating proper procedures and positive in their observations and corrections of trainee actions. On completion of the session, all of the trainees had properly demonstrated mastery of the objectives. The objectives, however, had not been validated as being job related.

6-2.7.1. Conclusion. The practical ability evaluation included in TMI Training Department course GET-102 was conducted in an effective, controlled and competent manner.

6-2.7.1. Recommendation. Continue the practice of using small groups, clearly stated objectives and close instructor control in practical ability evaluation sessions which are included in TMI Training Department Course GET-102.

SECTION 7
AUXILIARY OPERATOR TRAINING

7-0. INTRODUCTION. The TMI-1 auxiliary operator, although a non-licensed individual, is recognized as an important contributor to the safe and efficient operation of the plant.

To enhance training of TMI-1 auxiliary operators, the TMI Training Department revised the training program in 1981. The current program as described in TMI Training Department document "Auxiliary Operator Training Program Description, TMI-1," 5/81, includes a 39-week classroom instruction phase which replaced the previous 11-week classroom instruction phase. The first class to be conducted in accordance with the present program description commenced the classroom instruction in August 1981 and completed this phase of training in August 1982.

The TMI-1 program description also covers the auxiliary operator retraining program to update qualified operators. This program is being conducted for the first cycle in accordance with current program description.

There are no graduates of the present program at this time and therefore it was not possible to evaluate training program effectiveness based on job performance by graduates. A major part of the assessment concerned the classroom phase of training which was being conducted during the June 22-July 2, 1982 site visit.

The purpose of the TMI-1 auxiliary operator training program as stated in the program description is "to maximize plant operating efficiency and ensure the safety of the plant personnel and the general public by developing and maintaining a staff of in-plant operating personnel with the theoretical and practical background necessary to enable them to:

a. Understand how and why specific tasks are performed.
b. Understand the consequences of their actions on overall plant operation.
c. Respond correctly to situations they may encounter during normal, abnormal and emergency conditions."

This assessment focused on an analysis of:

a. The agreement between the TMI Training Department program for TMI-1 auxiliary operator training and the program recommended by the INPO guidelines for auxiliary operator training.

b. The educational soundness of the TMI-1 program practices and procedures. This was assessed by examining methods for deriving teaching objectives, appropriateness of the objectives in both content and communicative clarity, suitability of training materials, expertise of instructors in teaching students, suitability of examination methods for each of the various kinds of content, methods of instruction and their suitability for the content covered, and feedback and management of the auxiliary operator training program.

The assessment of TMI-1 auxiliary operator training addressed the following evaluation areas:

a. Instructors
b. Training materials
c. Presentation techniques
d. Examination techniques
e. Classroom facilities
f. OJT effectiveness
g. Course content
h. Deficiencies observed through examination results and/or job performance
i. Status of deficiencies noted in other evaluations

These areas are recommended for annual evaluation by the INPO guidelines.

7-1. ASSESSMENT METHODS. TMI-1 auxiliary operator training was assessed by Mr. J.H. Biddick and Mr. J.E. Malloy of Data-Design Laboratories assisted by Mr. J.J. Holman, a consultant to Data-Design Laboratories. Assessment methods included interviews, classroom observations and review and analysis of course material and training documentation. Samples of checklist forms which were used for gathering data from different sources are contained in Volume 2, Section 3.

In comparing the recommendations of INPO guidelines for auxiliary operator training and the TMI-1 auxiliary operator training program description, a section by section content commonality checklist was developed based on the INPO guidelines. This checklist contained three auxiliary operator categories -- Class A, Class B, and Class C as designated in the INPO recommended program. The comparison of content has been made at the topic level. Differences between the two programs made a more detailed comparison of content impractical. Also, a draft copy of the TMI-1 auxiliary operator/control room operator progression program was compared with the progression recommended by INPO guidelines. The comparisons are summarized and discussed in the findings. The TMI-1 auxiliary operator training program description is provided in Volume 2, Section 7.

Samples of lesson plans and lists of objectives were evaluated using a checklist which includes items of importance in instructional design. The instructional material sampled included (1) lesson plans for training sessions which were observed so that instructors and presentation techniques could be evaluated and (2) lesson plans in topics of major importance to plant operation. Additionally, a lesson plan on a theory subject in the program was evaluated for instructional value. A qualitative comparison was made between samples of objectives recommended by the INPO guidelines and lesson plan objectives developed by the TMI Training Department. This analysis of lesson plans provided information for an evaluation of instructors, training materials, presentation techniques, and course content.

Classroom observations were recorded on a checklist designed to provide a consistent analysis of various facets of classroom presentation. Areas evaluated included training aids, training equipment, trainee handouts, instruction time, and details of the actual presentation. These observations provided information for an evaluation of instructors, training materials, presentation techniques, and classroom facilities.

7-1.1. <u>Training Program Documentation</u>. Principal documents which were reviewed in connection with this assessment included:

a. TMI Training Department document "Auxiliary Operator Training Program Description TMI-1," 5/81

b. INPO document "Nuclear Power Plant Non-Licensed Operators: Guideli[illegible] for Qualification Programs," Rev. 0, 3/19/81

c. INPO document "Nuclear Power Plant Operating Staff: Guideline [illegible] Heat Transfer, Fluid Flow, and Thermodynamics Instruction," Rev. 1, 12/5/80

d. GPU Nuclear Auxiliary Operator/Control Room Operator Progression Program, 3/15/82 draft

e. TMI-1 job descriptions for:
   (1) Auxiliary Operator A Nuclear Power Station, 6/24/69
   (2) Auxiliary Operator B Nuclear Power Station, 6/24/69
   (3) Auxiliary Operator C Nuclear Power Station, 6/24/69

f. TMI Training Department lesson plans for:
   (1) Feedwater Pumps and Turbines
   (2) Emergency Feedwater, Unit I
   (3) RadWaste Disposal System - Gas, Unit I
   (4) Diesel Generator

g. Lesson plan for Nuclear Energy Training (NET) program Module 3, Units 1 and 2, published by NUS Corporation

h. Objectives for:
   (1) NET Module 2, Basic Nuclear Concepts
   (2) NET Module 6, Water and Waste Treatment
   (3) NET Module 7, Instrumentation and Safety Analysis

7-1.2. Interviews. Interviews were conducted with the following GPU Nuclear personnel to gain feedback on various facets of the auxiliary operator training program. A checklist was filled out for portions of the interviews. The majority of each interview was spent discussing the individual's opinions about the auxiliary operator training program.

a. Manager Plant Operations TMI-1
b. Supervisor Non-Licensed Operator Training
c. Two non-licensed operator instructors
d. Two Auxiliary Operators - C (AO-C) (trainees in initial training)
e. Three Auxiliary Operators - A (AO-A) (qualified operators in retraining)

7-1.3. Classroom Observations. The following TMI-1 auxiliary operator training sessions were observed:

a. Lecture on RadWaste Disposal - Gas (combined AO-C and CRO class)
b. Plant tour on Waste Gas Disposal (AO-C initial training class)
c. Lecture on Emergency Diesel (AO-A retraining class)

7-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The findings, conclusions and recommendations concerning auxiliary operator initial training and retraining cover instructors, training materials, presentation techniques, examination techniques, classroom facilities, OJT effectiveness, course content, deficiencies observed through examination results and/or job performance, and status of deficiencies noted by other sources.

7-2.1. Instructors.

7-2.1.1. Finding. There are four TMI Training Department non-licensed operator instructors assigned to the classroom phase of the TMI-1 auxiliary operator training program. They report to the Supervisor Non-licensed Operator Training who is SRO qualified in TMI-2. On occasion, the supervisor instructs auxiliary operator trainees, particularly in the theory portions of the course. Two of the instructors do not have TMI-1 plant operating experience. Their credentials are based on a combination of prior Navy nuclear experience and other civilian nuclear experience. The third instructor has a background as a high school physics teacher, experience as an Auxiliary Operator-A in TMI-1 and recently completed TMI-1 CRO training. He took the NRC license examination in February 1982 and failed one section. He passed the NRC license reexamination in June 1982. The fourth instructor has experience as an Auxiliary Operator-A in TMI-1. These instructors meet the educational and experience requirements set forth in the TMI Training Department Administrative Manual for the position of Instructor, Non-Licensed Operator Training. All have completed the TMI Training Department initial instructor development course.

All of the instructors were rated as very competent by their supervisor. The instructors who were observed and interviewed were motivated to improve their proficiency as instructors. They welcomed feedback and discussion of techniques of presentation and preparation. They expressed a desire for more coaching and feedback as a means of improving performance. They also expressed a need for more training and guidance in the area of instructional technology including testing. The instructors stated that they would like to spend more time on classroom lecture preparations but since the classes are being taught on a first time basis, most of their time is required for researching references, preparing lesson plans, and developing class handouts.

7-2.1.1. Conclusion. The TMI Training Department supervisor and the instructors assigned to auxiliary operator training are qualified, competent and motivated. The instructors interviewed expressed a need for continuing development as an instructor. Interviews and discussions with qualified auxiliary operators and auxiliary operator trainees indicated a general opinion that an instructor without experience and qualification in the plant lacks credibility.

7-2.1.1. Recommendation. Increase the effectiveness of TMI Training Department non-licensed operator instructors by providing continuing instructor development training and developing a program for qualifying instructors who lack plant experience.

7-2.2. <u>Course Content</u>.

7-2.2.1. Finding. The TMI Training Department document "Auxiliary Operator Training Program Description TMI-1," 5/81 outlines the complete training program as follows:

a. Initial shift assignment for individuals selected for Auxiliary Operator-C (AO-C) training. During this 90-day probationary period, the candidate trainee is assigned to the TMI-1 Operations Department where the individual completes the general employee training program, the administrative requirements section of the auxiliary operator on-the-job training program, and is evaluated by the shift supervisor and shift foreman. After successful completion of the 90 day probationary period, the trainee is assigned to assist a qualified auxiliary operator on shift until the beginning of the classroom training program.

b. Formal classroom training period of about 39 weeks duration under the administrative control of the TMI Training Department. Training times in this classroom phase are listed as contact hours of instruction and are compared to the recommendations of INPO guidelines under the same subject heading. A contact hour of instruction is defined in INPO guidelines as a one-hour period of education in which the course instructor is present or readily available for instructing or assisting trainees. Lectures, quizzes, supervised study periods, and review periods are considered contact periods under this definition. In the classroom training period, approximately 40% of the contact hours are assigned for study in a classroom with other trainees. Areas of instruction covered in the classroom phase are:

Area	Contact Hours of Instruction*
(1) Nuclear power orientation	24
(2) Mathematics review	80
(3) Basic nuclear concepts	120
(4) Reactor physics	120
(5) Fluid flow/heat transfer/thermodynamics	170
(6) Mechanical fundamentals	20
(7) Electrical fundamentals	152
(8) Radiation protection	72
(9) Chemistry and waste water treatment	68
(10) Instrumentation and control fundamentals	52
(11) Safety analysis	40
(12) Plant systems	480
(13) Procedures	80
(14) Fire protection	24
(15) Industrial safety	16
TOTAL	1518

* Includes approximately 40% study time

On successful completion of this classroom training phase, the trainee is designated an Auxiliary Operator-B (AO-B).

c. AO-B on-the-job training period of approximately 11 months duration assigned to the TMI-1 Operations Department during which time the trainee must demonstrate competence in the following areas:

(1) Administrative requirements
(2) Plant support systems (out-buildings)
(3) Secondary plant readings
(4) Secondary plant operations
(5) Primary plant readings
(6) Primary plant operations
(7) Nuclear fuel handling

Trainees acquire work experience by performing specific tasks on their own after satisfactorily completing the checkoff on each specific task.

On successful completion of all OJT tasks and satisfactory performance on written and oral examinations, the trainee is designated an Auxiliary Operator-A (AO-A). The individual is now a fully qualified TMI-1 auxiliary operator. AO-A's and AO-B's participate in the regular retraining cycle which consists of one week of classroom instruction every seventh week. This seven-week cycle provides the instructors one week to prepare for the next cycle of one-week training periods for the six shifts and it staggers the order of attendance for shift personnel. In this way, the same shift does not lead off the training for each cycle. The TMI-1 auxiliary operator retraining program of approximately six weeks instruction per year significantly exceeds the two-week program recommended by INPO guidelines. The TMI-1 program includes general employee retraining, systems review, procedures review, and fundamentals retraining.

7-2.2.2. Finding. The INPO document "Nuclear Power Plant Non-Licensed Operators: Guidelines for Qualification Programs" (INPO guidelines) divides the training for each class of Auxiliary Operator C, B and A, into a classroom phase followed by on-the-job training and then work experience and qualification. After qualifying in each phase, the auxiliary operator enters the next sequential phase of training and progresses in this manner from AO-C to AO-B to AO-A.

The INPO guidelines recommend training in the following broad areas for each classification of auxiliary operator. The contact hours of instruction listed include actual instruction time plus a 40% allowance for study, reviews and quizzes. This 40% allowance corresponds to the time allocated for these factors in the TMI-1 auxiliary operator training program.

Auxiliary Operator Class C Training		Contact Hours of Instruction*
a. General training		140
b. Power plant fundamentals		125
c. Reactor plant familiarization		55
d. Position training		115
	TOTAL	435

Auxiliary Operator Class B Training		Contact Hours of Instruction*
a. Educational topics (including mathematics, physics and nuclear physics)		280
b. Power plant fundamentals		110
c. Reactor plant familiarization		55
d. Position training		140
	TOTAL	585

Auxiliary Operator Class A Training		Contact Hours of Instruction*
a. Educational topics (includes mathematics, chemistry, metallurgy, and reactor theory)		225
b. Power plant fundamentals		90
c. Introduction to reactor safety		55
d. Position training		225
	TOTAL	595

GRAND TOTAL 1615 hours

* Includes approximately 40% study time.

On-the-job training recommended by the INPO guidelines consists of a total of approximately 12 weeks of OJT divided among the Auxiliary Operator Class A, B and C training phases.

In summary, based on contact hours of instruction, the INPO guidelines recommend a total of approximately 41 weeks of classroom instruction and approximately 12 weeks of OJT for auxiliary operators. In comparison, the TMI-1 auxiliary operator training program provides approximately 39 weeks of classroom instruction and approximately 47 weeks of OJT.

7-2.2.2. Conclusion. In total time assigned to auxiliary operator training, the TMI training program exceeds the INPO guidelines, particularly in the area of OJT. OJT is more formalized in the program recommended by INPO guidelines than in the TMI-1 training program.

7-2.2.2. Recommendation. Revise TMI-1 auxiliary operator OJT by developing job oriented objectives; providing specific training material; developing and using study guides; and standardizing training, examinations and qualifications among the shifts.

7-2.2.3. Finding. The structure and sequence of training in the TMI-1 auxiliary operator initial training program does not parallel the program recommended by INPO guidelines. The TMI-1 program begins with a classroom phase of about 39 weeks of instruction followed by an 11-month on-the-job phase and concludes with written and oral comprehensive examinations to fully qualify the auxiliary operator. The program recommended by the INPO guidelines divides training and qualification into three distinct and successive phases, each of which builds on the other and has its own classroom, OJT, qualification, and job assignment progression.

7-2.2.3. Conclusion. Although the content of the TMI-1 auxiliary operator training program is consistent with the total content of the three phases of the INPO guidelines, the TMI-1 program provides 39 weeks of classroom instruction first, followed by 11 months of OJT. Successful completion of this training results in qualification as an Auxiliary Operator-A. Educational subjects including mathematics, physics, chemistry, and reactor theory are presented at the beginning of the TMI-1 training program at a level which exceeds auxiliary operator job requirements. However, this material is relevant for the auxiliary operator who progresses to licensed reactor operator training 2-3 years after receiving the auxiliary operator academic instruction. The INPO recommended program divides the total classroom instruction and OJT into phases of classroom instruction followed by OJT which lead to intermediate level qualifications before the trainee becomes a fully qualified auxiliary operator.

7-2.2.3. Recommendation. Restructure the TMI-1 auxiliary operator initial training program to incorporate the three phases of training recommended by the INPO guidelines. Phases 1 and 2 of the INPO recommended training should be provided to all auxiliary operator trainees. Phase 3 of the INPO recommended program should be provided to those auxiliary operator trainees who have the potential and motivation to become CRO trainees. A new phase 3 should be developed based on specific job requirements for those trainees who will remain auxiliary operators.

7-2.2.4. Finding. The INPO guidelines and the TMI training program for auxiliary operators were compared for instructional content. Detailed topic and time comparisons required subjective judgement because topic headings were not always the same in the two programs. In addition, the topics and time allocations recommended by INPO guidelines are spread through training for Class A, B and C auxiliary operators which further complicates comparisons. The comparison indicated that, of 38 major topic or subtopic areas for classroom instruction included in the INPO guidelines, 35 are covered in part, in whole, or to a greater extent in the TMI-1 auxiliary operator training program classroom phase. Trigonometry, one of the subjects not included in the TMI-1 program, is a prerequisite for selection as a TMI-1 auxiliary operator trainee. Trainees who score below average in the auxiliary operator screening examination are encouraged to enroll in GPU Nuclear sponsored correspondence courses. One of the two Auxiliary Operator-C trainees interviewed was enrolled in both physics and mathematics correspondence courses. The following INPO recommended subject areas are not included in the TMI-1 auxiliary operator classroom phase instruction:

Topic	Recommended INPO Instructional Hours
Trigonometry	40
Metallurgy	20
Effective communications	60

7-2.2.4. Conclusion. The instructional content of the TMI-1 auxiliary operator initial training program is consistent with the program recommended by INPO guidelines except in the areas of metallurgy and effective communications. The trigonometry prerequisite included in the TMI-1 program is considered to meet the intent of the INPO program. A review of examination answer sheets and written comments submitted by trainees on weekly training sessions, and observations of note taking during class sessions and dialogue between trainees and instructors all reflect a need for instruction in written and oral communications.

7-2.2.4. Recommendation. Include in the TMI-1 auxiliary operator classroom curricula, instruction in basic metallurgy which directly relates to skills and knowledge required by a TMI-1 auxiliary operator in the performance of his job.

Provide early in the classroom phase of TMI-1 auxiliary operator training a short course covering effective oral and written communications. This should include instruction on filling out forms, making reports, taking notes, and asking questions.

7-2.2.5. Finding. The content of TMI-1 auxiliary operator training program lessons was evaluated by examining lesson plans, lesson objectives, instructional material, trainee handouts, and quizzes in sample areas chosen for their importance to plant operation. The lessons examined were Feedwater Pumps & Turbines, Emergency Feedwater, Waste Gas Disposal System, Waste Liquid Disposal System, Diesel Generator, and several NET modules covering theory and basic nuclear concepts.

Lesson plans with objectives are prepared by the instructor assigned to teach the class, reviewed by the Supervisor Non-Licensed Operator Training and approved by the Operator Training Manager. The Operator Training Manager maintains a master file of approved lesson plans and backup material. Each lesson plan contains clearly stated objectives which are based on a variety of factual material. The objectives are not based on a formal job and task analysis and in some cases the objectives appeared to be based more on design or construction criteria than on job performance requirements. Some instructional materials, transparencies, and trainee handouts appeared to be hastily put together to meet a tight schedule for presenting the lessons. Test items covered course objectives and are based on what is important to the instructor. The recall of names, functions, procedures, and construction details is frequently required to answer test questions.

7-2.2.5. Conclusion. Since TMI-1 auxiliary operator training classes are being taught for the first time in accordance with the present program description, most of the course material is newly developed. Instructors with a busy classroom schedule have had limited time to prepare new course material.

7-2.2.5. Recommendation. Review TMI-1 auxiliary operator training material and revise as necessary to provide high quality, instructionally sound training material. Provide instructors with additional training in test item construction.

7-2.3. Presentation Techniques.

7-2.3.1. Finding. The primary presentation technique observed was a lecture employing transparencies as the main visual aid. All instructors observed had personalized some of their principal transparencies; the unpersonalized versions of these transparencies were almost always included in the trainee handouts. Many of the diagrams used for transparencies appeared to be difficult for trainees and instructors to follow due to the complexity of the drawings and the small size of details on the drawings. However, the Auxiliary Operator-C trainees interviewed reported no difficulty in following the diagrams and lecture although considerable confusion was observed in class sessions.

The instructors directed few questions to individuals, particularly in the auxiliary operator retraining classes. Upon questioning, they voiced the concern that a trainee who felt singled out could complain to his union. This resulted in questioning the class at large rather than questioning individuals.

All instructors emphasized to trainees that they were available to answer questions and encouraged trainees to seek them out if they needed help. One trainee interviewed reported he missed two weeks of classroom instruction because of illness. He had high praise for the time and effort devoted by the instructors to help him catch up.

The format of each class observed was similar. The instructor begain the class with an announcement of the topic followed by a brief explanation of the coverage of the topic. This was followed by reading the objectives to the trainees and asking for any questions about the objectives. Then the lecture followed. At the end of the lecture, there was a brief review and a question and answer period.

The presentation of the NET theory portion of the course was not observed since this phase had already been completed at the time of the site visit. A large part of the NET instructional material is presented by videotaped lectures. The TMI Training Department instructors ensure that the trainees understand the instruction by conducting question and answer sessions and providing study aids. The objectives written by TMI instructors are used as the basis for determining whether trainees are mastering the instruction.

Instructor interviews and observations indicated that instructors are frequently involved in scheduled and unscheduled question and answer or review sessions with trainees. Extra help is provided in areas where trainees are having problems. Instructors and trainees indicated this is a valuable practice.

Plant tours were observed to be usually led by instructors who had taught the subject in the area which was being toured. This provided an opportunity for the instructor to point out actual equipment and describe actual operations in the plant. The attention and interest of the students were observed to vary from active to passive and inattentive. The tours were not tightly structured and appeared to lack guidelines for what the instructor pointed out or explained. Objectives were not stated at the beginning of the tour as is done in class to focus the trainees' attention on the important areas.

7-2.3.1. Conclusion. The primary presentation technique of a lecture supplemented by use of overhead projector transparencies is effective for the type of material presented. Many of the transparencies are copied from technical manual pages or engineering drawings. Some of these transparencies are overly complicated for training use and/or are difficult to follow because of clutter or poor reproduction quality. There is a reluctance on the part of instructors to question auxiliary operators individually because the operators might complain to their union.

7-2.3.1. Recommendation. Review overhead projector transparencies for TMI-1 auxiliary operator training and upgrade as necessary to ensure transparencies are legible and relevant to the associated lecture. As necessary, employ graphics and media support personnel to produce instructionally sound transparencies. Require questioning of trainees individually as part of generally accepted educational practices.

7-2.3.2. Conclusion. Plant tours, which are an effective method of instruction, could be improved by the use of specific objectives developed for the system and equipment to be observed and reviewed during the tour.

7-2.3.2. Recommendation. Include specific learning objectives in each plant tour. Announce the objectives at the beginning of the plant tour. Question trainees on the objectives during the plant tour.

7-2.4. Examination Techniques.

7-2.4.1. Finding.

a. Written tests. A majority of the test questions reviewed were of the short answer type. Definitions and identification of components or functions predominated in questions on plant systems. Questions involving calculations and explanations were used frequently in the theory portion of classroom instruction. Test questions and the objectives they tested were not written based on an analysis of knowledge and skills required by the TMI-1 auxiliary operator in the performance of his job. Instructors reported that they looked at the objectives and thought up test questions related to the objectives. A comprehensive written examination was administered at the end of the classroom phase of instruction.

   The instructors and supervisors interviewed indicated that little or no analysis is made of examination questions to gather information on student comprehension, completeness of instruction and test item clarity. Although an overall examination grade is high, an individual question in the examination which is missed in whole or in part by a significant number of trainees is an indicator which should be followed up.

   A brief item analysis was made of questions on the Auxiliary Operator-C Systems Examination for week #2. The overall test average was 90.1%, with most answers receiving partial credit. Only three questions were missed all or in part by a significant number of trainees. In the section of the examination on Decay Heat Closed, the questions "What is the function of

DC-V-2A/B and DC-V-65 A/B? What is the normal position during normal operation? (100% power) (1.0 pt)" were missed all or in part by 50% of the trainees. In the section of the examination on NSCC, the question "List the components cooled by NSCC inside the Reactor Building (1.0 pt)" was missed all or in part by 70% of the trainees. In the section of the examination on Spent Fuel Cooling, the question "How is cleanup of the water in the Spent Fuel Pool accomplished? (1.0 pt)" was missed all or in part by 70% of the trainees.

It is considered that post-hoc analysis of questions like these can provide feedback to instructors and help identify invalid test questions, areas which are not being taught adequately or areas where students are having difficulty.

b. Oral tests. These tests are administered by the TMI Operations Department shift supervisor and/or shift foreman during the on-the-job training (OJT) or Auxiliary Operator-B phase of training. There is no guidance provided to trainees and examiners on criteria for questions and answers. An Oral Examination Summary Sheet is filled out by the examiner. It records questions asked, systems covered and administrative information. As commonly used, the summary sheet does not contain detailed information on the level of mastery demonstrated during the oral checkoff. The sheet provides space to list questions asked and some examiners use additional sheets of paper to document performance by trainees.

c. Security of written tests. Written test security procedures were observed to be scrupulously followed on two test days during the site visit. Only tests are printed on yellow paper. Trainees were spaced apart for tests and a seating chart was routinely made out and filed. All test files examined contained the seating chart. Tests were observed to be kept in a locked storage and only given to instructors shortly before the examination period. The test instruction sheet was read aloud by the instructor and signed by each trainee. All tests in all files examined contained signed disclaimer sheets stapled to the test answer sheets. Proctors were observed to be present during all tests and trainees and instructors stated this is standard procedure. When questioned about the tendency toward carelessness which can accompany a repetitive routine, trainees and instructors stated that they were certain GPU Nuclear meant business and that jobs were on the line for a breach of these rules.

7-2.4.1. Conclusion. Test questions are written to cover learning objectives listed in the lesson plans. Most of the questions reviewed were the short answer type and tested the recall of factual information. Post-hoc analysis of examination results is not performed to detect invalid questions, areas of learning or teaching difficulties, or possible trainee collusion.

7-2.4.1. Recommendation. Provide instruction to TMI Training Department non-licensed operator instructors on test item writing and grading. Appendix G of the newly published TMI-1 Instructor Training Manual provides useful information on test item construction, test administration and scoring. Review test questions used in the TMI-1 auxiliary operator training program and upgrade as necessary to include more questions on the application of factual information to auxiliary operator job activities.

7-2.4.2. Conclusion. TMI-1 auxiliary operator job performance is closely associated with knowledge of locations and plant details. An oral examination in the plant which includes locating controls and indications, simulating operation of equipment and using plant documentation to answer situation type questions can be a particularly informative measure of the trainee's capabilities.

7-2.4.2. Recommendation. Provide guidance for standardizing oral examinations administered to auxiliary operator trainees during OJT. Base oral examination questions on knowledge and skills required by a TMI-1 auxiliary operator in the performance of his job. Document questions and score answers for oral examinations.

7-2.4.3. Conclusion. Provisions of GPU Nuclear procedure No. 6200-ADM-2600.1, October 20, 1981 regarding examination security were observed to be complied with in all respects during administration of examinations.

7-2.4.3. Recommendation. Ensure that the present high standards of examination security are not gradually degraded through time and repetition. Conduct periodic audits of examination security and on a continuing basis reemphasize GPU Nuclear's strong commitment in this area.

7-2.5. Classroom Facilities.

7-2.5.1. Finding. The number and size of classrooms were observed to be adequate to accommodate current auxiliary operator training requirements. The proximity of instructor offices to classrooms in the TMI Training Center facilitates trainee-instructor interactions, particularly during study periods which account for approximately 40% of total instruction time. The TMI Training Center and the classrooms are well ventilated and air conditioned. Copy machines are conveniently located and can be used by trainees with few restrictions. A vending machine area, telephones, adequate restrooms, and parking are included in the facilities.

7-2.5.1. Conclusion. The TMI Training Center offers excellent facilities for classroom training and training support activities.

7-2.5.1. Recommendation. Ensure that future laboratory and simulator space requirements do not encroach on existing facilities.

7-2.6. <u>OJT Effectiveness</u>.

7-2.6.1. Finding. The TMI Training Department program description for TMI-1 auxiliary operator training includes an 11-month on-the-job training (OJT) period which follows successful completion of the classroom phase of training. The program is administered by the TMI-1 Operations Department and consists of a combination of individual study assignments and practical evaluations or checkoffs in the following general areas:

a. Administrative requirements
b. Plant support systems (out-buildings)
c. Secondary plant readings
d. Secondary plant operations
e. Primary plant readings
f. Primary plant operations
g. Nuclear fuel handling

A qualification checklist is provided for each of these areas. Satisfactory completion of the individual tasks included on each qualification checklist is verified by a task examiner, usually an Auxiliary Operator-A. Upon completion of all tasks on a qualification checklist, the trainee is examined by the shift supervisor or shift foreman with oral and/or written questions. Operational tasks which cannot be performed in the shutdown plant are checked by a simulated performance of the task.

The initial session of OJT, as presently configured, commenced in August 1982 when the current Auxiliary Operator-C class completed the classroom phase of instruction. This analysis of OJT was based on a review of the training program description and interviews with Manager Plant Operations TMI-1 and three qualified Auxiliary Operator-A's.

Training material and scheduled training sessions oriented toward OJT are not provided in the program. The guidance provided consists of checklists which list tasks and related procedure numbers. The checklists include spaces for recording the task examiner's signature, date and hours spent on the task by the trainee. The tasks selected for OJT are not based on a formal analysis of knowledge and skills required by a TMI-1 auxiliary operator in the performance of his job. The OJT tasks were developed by experienced Auxiliary Operator-A's and approved by line supervisors and managers. The trainees learn on their own and are assisted by qualified auxiliary operators as time and shift activities permit. Task checkoffs are performed primarily by oral questioning and simulated performance of tasks in the shutdown plant. Successful completion of checkoffs in a task, system, or area is based on the individual standards and expertise of each shift supervisor and shift foreman. There are no standards established for evaluation. Consequently, it is difficult to compare the performance of trainees assigned to different shifts or, more importantly, to assure that all trainees perform to a desired standard. Qualified operators who examine trainees during OJT have not been trained in testing procedures or techniques for conducting OJT.

7-2.6.1. Conclusion. TMI-1 auxiliary operator on-the-job training (OJT) lacks content based on validated job requirements, study guidance, and specific evaluation criteria for task checkoffs and oral examinations.

7-2.6.1. Recommendation. Revise TMI-1 auxiliary operator OJT by developing job oriented objectives; providing specific training material; developing and using study guides; and standardizing training, examinations and qualifications among the shifts. In addition, make available supplemental training material for the highly motivated auxiliary operator who aspires to become a CRO trainee. Provide instruction to qualified operators in procedures for conducting OJT. It is important that these TMI-1 Operations Department personnel perceive themselves as adjunct members of the TMI Training Department.

7-2.7. Training Materials.

7-2.7.1. Finding. The following types of training materials used in the auxiliary operator training program were reviewed:

a. Nuclear Energy Training (NET) text published by NUS Corporation
b. NET videotapes which are used with the NET text
c. Lists of objectives for each class session
d. Trainee handouts consisting of (1) selected pages from technical manuals, (2) plant engineering drawings and (3) instructor prepared information
e. Overhead projector transparencies

NET text. The NUS Corporation produced text is designed to support videotape-based instruction of the Nuclear Energy Training course. The instructor introduces a segment and reviews the objectives with the class. The TMI Training Department staff prepared objectives which are more clearly stated, specific and measurable than those provided in the text. Instructors have also written test questions based on the objectives they prepared. The text lacks information for self study, but it does provide explanations of formulas and some practice questions. The practice questions reflect the general nature of the NET text objectives. Answers are provided in the instructor's version of the text. The NET text material on nuclear theory is presented at a level appropriate for licensed reactor operator trainees. Questions in the text are similar to NRC license examination questions.

NET videotapes. The NET videotapes are used for most of the instruction in the nuclear theory part of initial auxiliary operator training. The videotapes are produced in the format of a lecture videotaped in color with some supporting graphics. In the videotapes reviewed, explanations are adequate and the narrator is convincing. The videotapes appeared to cover material more related to control room operator tasks than to auxiliary operator tasks. Class participation in the NET program was not observed since this phase of instruction had already been completed at the time of the site visit. Examination scores in early sections of this phase were below the desired levels of achievement. For example, in NET module 3 section 1, Nuclear Energy Technology, the class mean was 80.24% with scores ranging from 100% to 64.2%. This situation was remedied by increased participation by instructors in the class and study periods and by instituting guided study and review sessions. This action brought the mean scores for subsequent classes up to the high eighties.

Lesson objectives. Observation of classes and examination of lesson plans and tests indicated that written objectives exist; that the instruction focuses on the objectives; and that the tests measure trainee mastery of the objectives. The relationship of objectives to the training program is discussed in paragraph 7-2.2 on course content.

Trainee handouts. A large number of handouts are provided to trainees during initial training and retraining on plant systems. The handouts contain a variety of material including drawings made by the TMI Training Department staff, text and illustrations copied from technical manuals, reduced blueprints of systems or subsystems, and cross sections of components. The instructional quality of the handouts varies greatly and is often dependent on the quality of the reproduction and the amount of detail in a drawing. In general, the drawings reviewed which were developed by training staff personnel were satisfactory and considerably more effective training aids than the copies of pages from technical manuals or reductions of system blueprints and drawings which were being used in the classroom instruction. Ten drawings from the trainee handout on the Emergency Diesel Generator were analyzed in detail for their instructional value. This analysis is included in Volume 2, section 7.

7-2.7.1. Conclusion. The NET text and the companion NET videotapes are effectively incorporated into the auxiliary operator training program with TMI Training Department instructors supplementing the NET instruction with additional instruction, review sessions, and detailed objectives. Learning objectives form an important part of the auxiliary operator training process, but these objectives are not based on a systematic analysis of duties required to be performed by a TMI-1 auxiliary operator. Trainee handouts examined, which were frequently photocopies of material related to the subject such as technical manual excerpts, frequently had little instructional value.

7-2.7.1. Recommendation. Continue use of the NET text and videotapes in future TMI-1 auxiliary operator initial training classes. Base new or revised learning objectives on knowledge and skills required by a TMI-1 auxiliary operator in the performance of his job. Review trainee handouts and upgrade as necessary to ensure handouts are instructionally sound, relevant and legible.

7-2.8. Deficiencies Observed Through Examination Results and/or Job Performance.

7-2.8.1. Finding. Weekly quiz scores on TMI-1 auxiliary operator classroom lessons ranged from 85% to 98%. The high scores on quizzes reflect mastery of the objectives tested.

7-2.8.1. Conclusion. A strict adherence to providing objectives to trainees, teaching to those objectives and testing to those objectives normally produces a high mean score. Until such time as the objectives are derived from a valid plant specific job and task analysis, examination results will continue to reflect a knowledge of objectives whose validity is unsubstantiated.

7-2.8.1. Recommendation. Conduct a plant specific job and task analysis for the TMI-1 auxiliary operator position when INPO generic job and task analysis data becomes available. In the meantime, select learning objectives which reflect job required knowledge.

7-2.8.2. Finding. Data was not available for analysis of training program effectiveness based on TMI-1 auxiliary operator job performance.

7-2.8.2. Conclusion. The present management agreement with the union prevents routine, formal evaluation of auxiliary operator job performance. This information would be helpful to use in assessing training program effectiveness.

7-2.8.2. Recommendation. Establish a program to provide feedback on auxiliary operator job performance to the TMI Training Department for use in assessing training program effectiveness.

7-2.9. Status of Deficiencies Noted by Other Sources.

7-2.9.1. Finding. TMI-1 auxiliary operator trainee critique sheets are an effective feedback mechanism for bringing problems to the attention of management. Twelve critique sheets on auxiliary operator training were reviewed. The trainees were candid in their comments and the training staff considered the comments important. An example of the critique system in action was the recent change made in auxiliary operator retraining as a result of trainee input. Trainee comments on the high concentration of theory courses in retraining were concurred in by the Manager Plant Operations TMI-1 and led to making changes to increase coverage of plant systems. Trainees interviewed were satisfied with the new lessons which related more directly to their jobs. They also expressed satisfaction that their comments were acted upon.

7-2.9.1. Conclusion. The TMI trainee critique sheets are an effective mechanism for providing feedback on training activities.

7-2.9.1. Recommendation. Continue the present program of encouraging comments by trainees on training activities and taking appropriate action on the comments.

SECTION 8

LICENSED REACTOR OPERATOR TRAINING

8-0. INTRODUCTION. As stated in the TMI Training Department document titled "Replacement Operator Training Program Description TMI-1," 1/81, "The purpose of Replacement Operator Training is to prepare operator candidates for licensing by providing a sound theoretical and practical background to ensure that personnel understand how and why they perform specific tasks, understand how their job impacts plant and public safety and can correctly respond to situations that they might encounter during normal and abnormal situations."

Personnel who satisfactorily complete this training and pass the NRC reactor operator license examinations are prepared to assume duties as a qualified TMI-1 control room operator (CRO) and be responsible for assigned plant operations. A principal objective of this training is to prepare personnel to take and pass the oral and written NRC reactor operator license examinations. Possession of the license is a prerequisite to actually being assigned duties as a qualified CRO. TMI-1 replacement operator training is synonymous with initial operator training. Licensed reactor operator training is the same as control room operator (CRO) training and these terms are used interchangeably in this report. Requalification training for licensed reactor operators is discussed in Section 10 of this report.

The prerequisites for entering the TMI-1 licensed reactor operator program are:

a. High school diploma or equivalency.

b. Satisfactory completion of TMI-1 auxiliary operator training or:

   (1) Validate knowledge of fundamentals portion of auxiliary operator program by passing eight one-hour examinations or receive additional training in fundamentals.

   (2) Satisfactory completion of systems and procedures portion of auxiliary operator program consisting of 280 hours of classroom lectures and 280 hours of study with 14 weekly two-hour examinations.

   (3) Satisfactory completion of designated portions of auxiliary operator on-the-job (OJT) task sheets within three months.

c. Satisfactorily meet minimum medical requirements for licensed personnel as specified in 10 CFR 55.

TMI-1 CRO training as set forth in the program description is 38 weeks in duration and consists of the following phases conducted in the sequence indicated:

a. Phase 1 - Classroom Training - 6 weeks
b. Phase 1 - On-The-Job Training (OJT) - 12 weeks
c. Phase 2 - Classroom Training - 6 weeks
d. Phase 2 - OJT - 12 weeks including 3 weeks of simulator startup certification training
e. Audit Exams - 2 weeks

The simulator portion of the training program is discussed in Section 11 of this report.

The TMI-1 CRO training program has evolved to its present state over several years. The program now in effect has not yet been conducted entirely as written because modifications have been required for the three classes enrolled in training since the program was promulgated in 1981. These classes were modified to meet particular plant needs and to optimize training for the background and experience levels of the trainees. It is expected that the next CRO class will begin training in mid 1983. Therefore, this assessment examines (1) the training program as written, (2) the present two different versions of the program, (3) instructional materials developed over several years, and (4) results of mock NRC and NRC license examinations taken by graduates of a past course.

One of the ongoing CRO classes began in November 1981 and will complete in September 1982. It consists of four trainees with the following backgrounds:

a. One ex-Navy nuclear trained individual with brief TMI-2 auxiliary operator experience and two plus years of college engineering courses.
b. Two experienced TMI-1 auxiliary operators.
c. One experienced TMI-1 auxiliary operator who began CRO training in March 1981 with a previous class but was not considered ready for the license examination with that class.

The one individual who completed TMI-2 auxiliary operator training and has Navy nuclear experience is expected to learn basic TMI-1 systems information with the help of instructors, shift personnel and others in his class as he progresses through the CRO course. This class started with on-the-job training in November 1981 and then began a six-week classroom phase of theory and systems lectures in February 1982. One week of simulator training with startup certification was included in this classroom period. In mid-March 1982, the class commenced about ten weeks of OJT. This was followed by two weeks of classroom lectures and two weeks of simulator training. The class is completing theory lectures and preparing for NRC written and oral license examinations in fall 1982.

The second ongoing CRO class began in February 1982 with a self-paced programmed instruction review of reactor theory, mathematics, heat transfer, chemistry, wastewater treatment, radiological controls, physics, and electrical theory. The Nuclear Energy Training (NET) lessons developed by NUS Corporation were used for the review. Understanding of the material was checked with eight one-hour validation examinations. The classroom phase began in March 1982 and the entire course will complete in late 1982 or early 1983. This class consists of eight ex-Navy nuclear trained personnel who have no TMI-1 experience and one experienced TMI-1 procedure writer and coordinator. The CRO trainees attend system lectures with auxiliary operator trainees and will complete both phases of classroom training before starting OJT. About five weeks after beginning the classroom phase, it became apparent from concerns expressed by trainees and instructors that the class needed more instruction and guidance. This resulted in the TMI-1 Operations Department assigning an experienced shift supervisor full time to the TMI Training Department to instruct and supervise this class. The shift supervisor provides CRO level information to supplement material the CRO trainees receive in auxiliary operator systems lectures and he makes up the quizzes for the CRO trainees.

8-1. ASSESSMENT METHODS. TMI-1 licensed reactor operator training was assessed by Mr. D.S. Boyd and Dr. P.C. Manning of Data-Design Laboratories assisted by Mr. J.J. Holman, a consultant to Data-Design Laboratories. The assessment was based on reviewing relevant documentation, interviews with GPU Nuclear personnel involved in or concerned with this training and its training content, analysis of course content, and attending selected licensed reactor operator training classes during the site visit June 21-July 2, 1982.

8-1.1. Training Program Documentation. Principal documents which were reviewed in connection with this assessment included:

a. TMI Training Department document "Replacement Operator Training Program Description TMI-1," 1/81 (TMI-1 program description)
b. INPO document "Nuclear Power Plant Licensed Operator - Guidelines for Qualification Programs at Operational Units" (INPO guidelines)
c. TMI Training Department procedure "Training Department Lesson Plan Development, Presentation, Evaluation and Selection of Training Aids," TD 1103, Rev 1, 4/14/81
d. GPU Nuclear Training and Education procedure "Administration of Examinations," 6200-ADM 2600.1, 10/20/81
e. 10 CFR 55
f. ANSI/ANS-3.1-1978, 1981, "American National Standard for Selection and Training of Nuclear Power Plant Personnel"

8-1.2. Interviews. The following GPU Nuclear personnel were interviewed to obtain data on licensed reactor operator training:

a. President GPU Nuclear Corporation
b. Vice President Nuclear Assurance
c. Vice President and Director TMI-1
d. Manager Plant Training TMI
e. Operations and Maintenance Director TMI-1
f. Manager Plant Operations TMI-1
g. Operator Training Manager TMI
h. Two shift supervisors TMI-1
i. Two shift foremen TMI-1
j. Three licensed operator instructors (one of whom is the Supervisor Licensed Operator Training TMI-1)
k. Nine licensed reactor operator trainees

The interviews of management personnel provided information on their training responsibilities, involvement, concerns, perceptions, and recommendations. TMI Training Department licensed operator instructors were asked questions on how they were selected for instructor assignment, their technical and educational backgrounds, their role in licensed operator training, the percent of time spent in various instructional tasks, trainee attitudes, and specific suggestions for improving the training program. Interviews of nine CRO trainees in both classes provided data on trainee background, criteria for entering the CRO training program, course content, attitude toward the training program and examination security.

8-1.3. Course Content Analysis. The basic reference for assessing TMI-1 course content was the INPO guidelines. Data on actual classroom instruction hours for various subject categories included in the TMI-1 CRO training program was provided by the TMI Training Department and used in a comparison with instruction hours in the same categories recommended by INPO guidelines. Other assessments of content were made by comparing TMI-1 program description topics and lesson plan objectives with the training content topics and objectives of INPO guidelines.

A principal objective of the TMI-1 licensed reactor operator training program is to prepare trainees for the oral and written NRC license examinations. As another measure of training program content and effectiveness, the performance of TMI-1 trainees on mock and actual NRC reactor operator license examinations taken in January and February 1982 was reviewed.

8-1.4. Classroom Observations. Three licensed reactor operator class sessions were attended to observe instructor performance, lesson content, trainee participation, and the use of training aids.

8-2. FINDINGS, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS. The findings, conclusions, discussion, and recommendations cover course content, instructors, instructional materials, presentation techniques, examination practices, lesson audits, training records, classroom facilities, and status of past findings.

8-2.1. Course Content. The results of an analysis of the TMI-1 program content compared with the program content recommended by INPO guidelines are summarized in this section. The current TMI-1 program description was promulgated in January 1981 and two changes have been made to it. A copy of this document is included in Volume 2, Section 8.

8-2.1.1. Finding. The TMI-1 CRO training program is based on regulatory requirements, past practices, and the individual expertise and experience of competent individuals involved in developing and approving the program. The content is not based on a systematic analysis of tasks required to be performed by a TMI-1 CRO. The NUREG/CR 1750 analysis of licensed operator tasks was considered in structuring the current TMI-1 program course content.

8-2.1.1. Conclusion. The validity of the TMI-1 CRO training program can be improved by basing its content on a systematic analysis of tasks required to be performed by a TMI-1 CRO.

8-2.1.1. Discussion. Many technical training programs have traditionally been based on experience only. When correct job performance is critical as it is in operation of a nuclear power plant, then it becomes important to base the training for a job on a systematic analysis of tasks the job incumbent is expected to perform. The need for job and task analysis has been generally recognized by the nuclear utility industry.

INPO, as part of its work to develop and coordinate programs aimed at improving the education, training and qualification of nuclear utility personnel, has undertaken an industry-wide job and task analysis project. This project involves the systematic analysis of the knowledge and skills required for plant personnel and it will produce detailed information for use by utilities in developing valid performance based training programs.

8-2.1.1. Recommendation. Use INPO generic job and task analysis data when available as a basis for conducting plant specific job and task analyses of TMI-1 plant positions to develop a performance based TMI-1 CRO training program.

8-2.1.2. Finding. The TMI-1 program description topics, lesson plan topics and classroom instruction hours were compared with the topics and instruction hours recommended in INPO guidelines for licensed operator qualification programs at operational units.

In the following subject areas, the TMI-1 course content and instruction hours were determined to be consistent with or exceed the recommendations of INPO guidelines:

a. Reactor heat transfer and fluid flow
b. Health physics
c. Plant technology, systems and procedures
d. Control room training
e. Simulator training

In the following subject areas, the TMI-1 course content includes significantly fewer hours of instruction than recommended by INPO guidelines:

a. Mathematics
b. Reactor theory
c. Reactor chemistry
d. Materials science

In the following subject areas, the TMI-1 course content includes significantly fewer documented hours of instruction than recommended by INPO guidelines, but an additional undetermined amount of instruction is accomplished during OJT:

a. Transient prevention, mitigation and response
b. Plant experiences and modifications
c. Administrative requirements for L

The following table compares total hours of instruction recommended by INPO guidelines with instruction hours allocated by the TMI-1 program description for the same subjects. The TMI-1 column lists classroom instruction hours except for OJT control room training and simulator training on the control panel.

TABLE 8-1

SUBJECT	INPO TOTAL INSTRUCTION HOURS	TMI-1 INSTRUCTION HOURS
Mathematics	60	20*
Reactor Theory	120	61
Reactor Chemistry	30	4
Reactor Heat Transfer & FLuid Flow	70	75
Materials Science	40	10*
Health Physics	40	42
Plant Technology, Systems and Procedures	120	171**
Administrative Requirements for CRO	25	8**
Control Room Training (OJT)	520	840
Transient Prevention, Mitigation and Response	80	46**
Simulator Training (control panel manipulations)	60	60
Simulator Training (classroom lectures)		60
Plant Experiences and Modifications	30	8**
TOTALS	1195	1405

*Estimate since subject is not addressed specifically in TMI-1 program.

**Subject is also covered during OJT.

The following observations address those subjects where there are significant differences in hours and/or content between the INPO recommendations and the TMI-1 training program.

a. Mathematics (INPO 60 hours, TMI-1 20 hours). Mathematics is not addressed as a specific subject in the TMI-1 program. It is estimated that 20 hours of instruction in mathematics are associated with classroom instruction in other subjects in the TMI-1 program such as reactor kinetics and radioactive decay. TMI-1 trainees are required to have completed the mathematics fundamentals section of the TMI-1 auxiliary operator training program or pass a written validation examination covering mathematics as a prerequisite to beginning licensed reactor operator training. The mathematics level recommended by INPO guidelines for licensed reactor operator training includes basic differential and integral calculus. The mathematics level in the TMI-1 program includes algebra, logarithms and solution of exponential equations, but not calculus.

b. Reactor Theory (INPO 120 hours, TMI-1 61 hours). TMI-1 trainees are required to have completed the reactor physics fundamentals section of the TMI-1 auxiliary operator training program or pass a written validation examination covering reactor theory as a prerequisite to beginning licensed reactor operator training. TMI-1 on-the-job training includes a two-week period during which trainees perform reactivity balance calculations. The same general topics are included in the reactor theory subject area in both the INPO recommended program and the TMI-1 program.

c. Reactor Chemistry (INPO 30 hours, TMI-1 4 hours). The TMI-1 program lesson plan on this subject covers corrosion mechanisms, oxidation and reduction, general corrosion theory, types of corrosion, corrosion resistant materials, radiolysis, synthesis reactions, activation reactions, and fission products. The TMI Training Department instructor for this lesson stated that a rapid rate of instruction was necessary in order to cover the amount of material in the lesson in four hours. Additional instruction in metal-water reactions and hydrogen gas properties and precautions is included in TMI-1 program instruction on mitigating core damage. TMI-1 trainees are required to have completed the chemistry fundamentals section of the auxiliary operator training program or pass a written validation examination in chemistry as a prerequisite to beginning licensed reactor operator training. TMI-1 CRO on-the-job training includes drawing and analyzing primary and secondary chemistry samples. The topics recommended by INPO guidelines in this subject area include corrosion; effects of corrosion; water chemistry control and limits; radiochemistry; sampling techniques and equipment; analytical techniques, equipment and results; metal-water reactions; radiolysis and recombination; hydrogen gas properties and precautions. Chemistry topics covered in the TMI-1 auxiliary operator program include basic chemistry concepts, corrosion of plant materials, effects of nuclear operations, chemistry control equipment, primary water chemistry, secondary water chemistry, radioactive waste and RadWaste discharge.

d. Materials Science (INPO 40 hours, TMI-1 10 hours). This is not addressed as a specific subject in the TMI-1 program. Discussion of some important materials topics such as brittle fracture is included in TMI-1 program lectures on associated equipment. INPO recommended topics include structure of metals, properties of metals, alloying and alloys used in the reactor plant, selection and applications of plant materials, brittle fracture, plant materials problems and concerns.

e. Plant Technology, Systems and Procedures (INPO 120 hours, TMI-1 171 hours). INPO guidelines note that only 120 hours would typically be required since the trainee will have previously received training and experience in most of this material. TMI-1 trainees are required to have completed the plant systems section of the auxiliary operator training program or its equivalent in special instruction as a prerequisite to beginning licensed reactor operator training. This subject is also covered during TMI-1 OJT.

f. Control Room Training (INPO 520 hours, TMI-1 840 hours). This reflects the two TMI-1 OJT phases of 12 weeks each (less three weeks for simulator training during the second OJT phase).

g. Transient Prevention, Mitigation and Response (INPO 80 hours total, TMI-1 46 hours classroom); Plant Experiences and Modifications (INPO 30 hours total, TMI-1 8 hours classroom); Administrative Requirements for CRO (INPO 25 hours total, TMI-1 8 hours classroom). Additional instruction in these subjects is accomplished during the OJT phase of the TMI-1 program by discussion, walk throughs and demonstrations in connection with accomplishing OJT tasks.

h. Heat Transfer and Fluid Flow (INPO 70 hours, TMI-1 75 hours). The TMI-1 program includes instruction in principles of heat transfer as applied to the reactor and other equipment. The INPO program includes topics on reactor heat transfer only.

i. Simulator Training (INPO 60 hours, TMI-1 60 hours on the control panel and 60 hours of classroom lectures). The TMI-1 simulator training program includes 60 hours of classroom lectures on subjects associated with exercises conducted at the simulator.

8-2.1.2. Conclusion. The TMI-1 licensed reactor operator training program content as assessed by comparison of topics and instruction time is consistent with or exceeds the INPO recommended program in eight of 12 subject areas. These areas are:

a. Reactor heat transfer and fluid flow
b. Health physics
c. Plant technology, systems and procedures
d. Control room training
e. Simulator training
f. Transient prevention, mitigation and response
g. Plant experiences and modifications
h. Administrative requirements for CRO

In one subject area, reactor theory, the instruction time is significantly less in the TMI-1 program than recommended by INPO guidelines, but the instruction is effective and sufficient as measured by trainee performance on the reactor theory section of the February 1982 NRC license examination.

In the following subject areas, TMI-1 program topics and instruction time provide less content than recommended by INPO guidelines. The TMI-1 program should be improved by increasing content in these subject areas:

a. Mathematics
b. Reactor chemistry
c. Materials science

8-2.1.2. Discussion. The following discussion addresses subject areas where there are significant differences in instruction time or topics between the TMI-1 and INPO programs:

a. Mathematics. This subject should be mastered by licensed reactor operator trainees at a level which will (1) aid their understanding of the theory of reactor kinetics, fission product poisons, heat transfer, and radioactive decay and (2) enable them to make calculations associated with these studies and the performance of their job tasks. This level of mathematical knowledge is considered to include a basic understanding of the concepts of non-uniform rates of change with respect to different variables, limits and the area under a curve as a summation of parts. The necessary level of mathematical knowledge is considered not to require a study of differential and integral calculus.
b. Reactor theory. Since generally the same topics are covered in the TMI-1 program in half the time allocated by the INPO recommended program, the overall depth of coverage is probably less in the TMI-1 program. The instruction of TMI-1 licensed reactor operator trainees in reactor theory was sufficient to enable all five candidates to score above 90 on this section of the February 1982 NRC license examination. It is considered that NRC examination results are one measure of training program effectiveness. Therefore, the present coverage is concluded to be adequate in the absence of job and task analysis data which would indicate the need for change.
c. Reactor chemistry. The present four hours allocated to lectures on primary chemistry and corrosion are considered insufficient to adequately cover topics in the TMI Training Department lesson plan on the subject. Also, the importance of secondary plant chemistry to equipment integrity justifies including instruction on this topic in the chemistry lectures.
d. Materials science. Properties of plant materials have an important effect on determination of plant specifications for chemistry parameters, pressure-temperature relationships and heatup-cooldown rates. Plant integrity depends in part on operator adherence to these specifications. Therefore, the importance of properties of plant materials warrants more instruction in this subject than presently included in the TMI-1 program.
e. Plant technology, systems and procedures. Considering that TMI-1 licensed reactor operator trainees have already completed instruction in systems

at the auxiliary operator level before studying the subject at the CRO level, it may be acceptable to reduce the time allocated to this subject and still maintain adequate coverage.

f. Control Room Training. The significantly greater amount of time allocated to this phase of training in the TMI-1 program warrants an examination of the organization and delivery of OJT.

g. Transient prevention, mitigation and response; plant experiences and modifications; administrative requirements for CRO. The combination of classroom instruction and OJT discussions, walk throughs and demonstrations in the TMI-1 program is considered to be consistent with the INPO recommended instruction in these subjects.

h. Heat transfer and fluid flow. The TMI-1 program includes instruction in principles of heat transfer as applied to the reactor and other equipment. This is considered superior in concept to the INPO recommended program which includes topics on heat transfer as applied to the reactor only.

i. Simulator training. The TMI-1 program is three weeks in duration. Each day of training includes four hours of classroom lectures followed by four hours of simulator exercises applying the lecture material. The TMI-1 program is considered superior to the INPO recommended program which addresses only simulator exercises.

8-2.1.2. Recommendations.

a. Incorporate increased instruction in reactor chemistry and materials science in the TMI-1 training program for licensed reactor operator trainees. The coverage recommended by INPO guidelines should be considered in making changes to the TMI-1 program.

b. Provide instruction in mathematics at a level which will provide licensed reactor operator trainees a basic understanding of the concepts of (1) non-uniform rates of change with respect to different variables, (2) limits and (3) the area under a curve as a summation of parts.

c. Review the need for the present amount of time allocated to plant technology, systems and procedures training and to on-the-job training in the TMI-1 CRO training program. These times significantly exceed the times recommended by INPO guidelines. The INPO recommended times should be considered in making changes to the present program.

d. Continue instruction in other subjects consistent with the present program description.

8-2.1.3. Examination of Lesson Plan Objectives. A feel for the depth of knowledge required in various subjects was gained by reviewing objectives for 64 lesson plans used in the classroom phase of the TMI-1 program and comparing them with INPO objectives.

8-2.1.3.1. Finding.

a. In special education subjects such as reactor theory, reactor heat transfer, fluid flow, and health physics, the TMI-1 lesson plan objectives expected the trainee to describe, list, define, explain, recite, and calculate. INPO objectives were similar and expected the trainee to describe, discuss, explain, relate, and predict.
b. In plant technology, systems and procedures training subjects, the TMI-1 lesson plan objectives expected trainees to state functions or purposes; sketch; label a diagram; identify or describe components and operations; list important parameter values, interlocks, and alarms; discuss operation; and know locations. INPO objectives for this material were more comprehensive and expected the trainee to be able to discuss additional information such as system power supplies, interrelations with other systems, alternate/manual/local methods of system operation, failure modes, associated rules of thumb, related technical specifications, related operating procedures, and related surveillance procedures. Some of the additional material included in INPO objectives is covered during the TMI-1 on-the-job phase of training where system descriptive material can be related to operation of the system.

8-2.1.3.1. Conclusion. The scope of TMI-1 lesson plan objectives for instruction in special education subjects is consistent with objectives contained in INPO guidelines. In plant technology, systems and procedures training subjects, the INPO objectives are more comprehensive than TMI-1 lesson plan objectives and include knowledge of system interrelations, specifications and procedures.

8-2.1.3.1. Recommendation. Revise lesson plans for instruction of CRO trainees in plant technology, systems and procedures to include objectives on system interrelations, specifications and procedures. The recommended objectives contained in INPO guidelines should be considered in making changes to the TMI-1 program.

8-2.1.4. On-the-Job Training (OJT).

8-2.1.4.1. Finding. TMI-1 control room operator trainees are assigned to plant operating shifts for two 12-week periods of on-the-job training (OJT). The second OJT period includes the three-week simulator training period at the B&W simulator, Lynchburg, Virginia. During OJT, trainees accomplish tasks which require them to learn information and skills and to demonstrate this knowledge and proficiency to qualified operator examiners. Observation of or participation in job related activities is designed to reinforce classroom study, provide new learning experiences in the plant and stimulate interest. The two OJT phases follow respective six-week classroom phases. OJT is accomplished by the trainee studying procedures, locating equipment, learning from qualified operators, and performing or simulating the performance of normal, abnormal and emergency operations. The trainee is then examined orally on individual tasks by a qualified operator, examined orally on a section or group of individual tasks by a designated SRO qualified section examiner, and in a third evaluation, examined orally or with written questions on a section of tasks by the SRO qualified shift supervisor.

The TMI-1 Division organization includes the position of Training Coordinator TMI-1 with reporting responsibility to the Operations and Maintenance Director TMI-1. This position is now vacant and some of its functions are performed on a part time basis by another position incumbent. Checkoffs of trainees compete with other demands on the time and attention of the qualified operators who have not received training in OJT instructor and examiner duties. The tasks are grouped in sections with one task sheet per section. Successful completion of an OJT checkoff is indicated by the examiner's signature on the task sheet. The task sheets indicate the requirements for the number of checkoffs to be accomplished over a period of time to maintain a satisfactory progress rate. The training program also provides for periodic oral and written checks of trainee OJT progress and knowledge by TMI Training Department licensed operator instructors.

CRO trainees are members of the bargaining unit and do not have free access to the plant. As a consequence of the management-union agreement, they are not permitted in the plant unless they are on authorized working hours.

Phase I OJT tasks familiarize the trainee with procedures and operations. To pass the task checkoffs, the trainee is required to read and discuss or walk through procedures; perform and discuss surveillance tests; assist in the operation of equipment; demonstrate the ability to point out and describe components; and, under the direction of a qualified operator, perform or simulate performance of system operations.

In Phase 2 OJT, the trainee walks through and discusses procedures of increasing complexity and, under the direction of a qualified operator, performs or simulates the performance of more integrated operations.

The course content for on-the-job training was reviewed with the following results:

a. An analysis of 13 plant evolutions, recommended by INPO guidelines to be performed or their performance simulated during control room on-the-job training or performed during simulator training, indicates that all are included in the TMI-1 program during OJT or simulator training phases. The TMI-1 program includes a total of some 86 tasks in OJT which require checking, calculating, starting up, pointing out, and performing actions in addition to walking through and discussing operating, abnormal and emergency procedures.

b. TMI-1 OJT requirements include performing at least five reactivity changes at the plant or simulator. The five changes consist of at least one reactor startup or shutdown plus at least four reactivity changes from the following list of evolutions:

   (1) Power level change of at least 10% with control rods in manual.

   (2) Boration or deboration during critical operation.

   (3) Operation of refueling bridge to change core geometry during refueling.

c. The OJT phase of the TMI-1 licensed reactor operator training program includes many tasks which must be accomplished by simulated performance during the present extended shutdown rather than by actual performance as would be expected at a normal operational unit. The TMI-1 OJT is not augmented by observation training at an operational unit or other special training to compensate for the reduced opportunities that trainees have to gain meaningful operating experience in the shutdown plant.

8-2.1.4.1. Conclusion. The two twelve-week OJT phases of the TMI-1 licensed reactor operator training program are formally organized in the program description. This document assigns responsibilities for carrying out the training, provides lists of training tasks for trainees to satisfactorily accomplish by demonstrating knowledge and skills to designated examiners, and specifies required progress rates for completing the checkoffs. The six individual shift supervisors implement the OJT program on their own shifts and to a great extent set their own criteria for satisfactory accomplishment of the training tasks. Standardization of criteria and overall coordination of OJT in the shifts can be enhanced by filling the now vacant position of Training Coordinator in the TMI-1 Division organization. The present position description for the Training Coordinator includes appropriate functions and responsibilities for coordination of shift training.

The TMI-1 training program for licensed reactor operators is based on criteria for training personnel at a unit which has received an operating license. Although this is the status of TMI-1, the plant has now been shut down since 1979 and the effectiveness of on-the-job training is reduced by this continuing shutdown status. Most of the current licensed reactor operator trainees have no experience at TMI-1 or any nuclear utility plant during power operations. This unusual condition warrants an examination of what additional training at an operational unit or simulator or during the startup and test program may be desirable to augment the present OJT and compensate for reduced training opportunities in the shutdown TMI-1 plant.

8-2.1.4.1. Recommendations.

a. Fill the vacant position of Training Coordinator in the TMI-1 Division organization and assign the incumbent full-time responsibility for standardizing, facilitating, and coordinating on-the-job training in the six operating shifts.

b. Examine the impact of the extended plant shutdown on the effectiveness of on-the-job training and augment this training as necessary with observation training experience, additional simulator training or participation in evolutions for training during the startup and test program. Any additional training requirements should be formalized by a change to the TMI-1 training program description.

8-2.2. Instructors.

8-2.2.1. Finding. There are three licensed operator instructors assigned to the TMI-1 replacement control room operator, replacement senior reactor operator, and licensed operator requalification training programs. All three instructors are SRO qualified in the TMI-1 plant and meet the education and experience requirements set forth in the TMI-1 Training Department Administrative Manual. One instructor has a heavy administrative workload as Supervisor Licensed Operator Training TMI-1. A second instructor is assigned additional duties in connection with developing courseware for the basic principles trainer and he will also assume other duties in connection with developing plans for procurement of the full scope replica simulator. These instructors are required to spend two shifts per month in the plant and to participate in the operator requalification program to maintain their TMI-1 qualification. In connection with this, the Manager Plant Operations TMI-1 commented that two shifts per month were not sufficient to maintain adequate operator proficiency without additional retraining in the plant. During the first half of 1982 the simultaneous licensed operator training load consisted of two replacement CRO classes, one replacement SRO class and requalification training for six shifts. Two experienced TMI-1 shift supervisors were temporarily assigned from the TMI-1 Operations Department to the TMI Training Department to assist with the instruction and supervision of one CRO class and the SRO class.

The licensed operator instructors report to the Operator Training Manager TMI who has been in this assignment about two years. He is degreed and has extensive Navy nuclear power experience. He is not CRO or SRO qualified in the TMI-1 plant.

Instructor interviews provided the following information about the three licensed operator instructors:

a.	Years at TMI	11 years mean (range 5-13 years)
b.	Years as TMI Training Department instructor	5 years mean (range 4-7 years)

c. Prior power plant experience — One instructor has five years Navy nuclear experience

d. Highest operator position attained — One instructor was a shift foreman; two instructors were control room operators

e. Education — All three instructors are high school graduates and two have completed some college level courses.

f. Percent of time spent on assigned tasks:

Class preparation and presentation	37 mean (range 10 to 50)
Training materials development	13 mean (range 5 to 20)
Program improvements	7 mean (range 0 to 20)
Trainee evaluation	13 mean (range 10 to 15)
Trainee counseling	9 mean (range 1 to 25)
Professional development and requalification	12 mean (range 5 to 20)
Administration	9 mean (range 0 to 24)

g. The licensed operator instructors appeared to be well motivated, expressed the belief they are doing important jobs, and reported that they work 40-50 hours per week. Their recommendations for improving TMI-1 licensed operator training included:

(1) Add 1-2 licensed operator instructors to the TMI Training Department staff to permit instructors to spend more time on trainee counseling, training materials development, plant requalification, and program improvements.

(2) Provide competent assistance to upgrade lesson plans.

(3) Modify the licensed operator requalification training classroom schedule to allocate 50% of the time to review of theory and complex systems and 50% of the time to self-study.

(4) Upgrade the Operator Training Manual to eliminate verbiage, simplify drawings and make illustrations legible.

8-2.2.1. Conclusion. The three TMI Training Department licensed operator instructors for TMI-1 programs are satisfactorily carrying out their duties. However, in view of the length of time (4-7 years) they have been assigned as instructors, it is considered that the effectiveness of the training program can be improved by their augmentation and later, their phased replacement with highly qualified and motivated TMI-1 shift supervisors and SRO qualified shift foremen. It may be desirable to begin this action by the temporary assignment of TMI-1 Operations Department personnel to the TMI Training Department for 6-12 months as was done to augment the TMI Training Department instructor staff in the first half of 1982.

Based on limited observations including interviews of trainees and instructors, review of instructor backgrounds and attendance at several lectures on specialized education subjects presented by licensed operator instructors, it is considered that the quality of instruction in the licensed operator training programs can be improved by employing TMI Training Department staff with appropriate degrees and engineering experience to teach specialized education subjects.

8-2.2.1. Recommendations.

a. Establish a program for rotating highly qualified and motivated TMI-1 shift supervisors and SRO qualified shift foremen into TMI Training Department assignments as licensed operator instructors for TMI-1 training programs.
b. Employ TMI Training Department staff with appropriate degrees and engineering experience to teach specialized education subjects to licensed reactor operator trainees.

8-2.3. Instructional Materials. Sample instructional materials including the Operator Training Manual, the Pressure/Temperature (P/T) Plot Training Program, selected trainee handouts, lesson plans, and OJT guidelists were reviewed for content, use, and effectiveness.

8-2.3.1. Operator Training Manual (OTM).

8-2.3.1.1. Finding. The Operator Training Manual (OTM) is organized in seven volumes and issued to licensed operators and licensed operator trainees. Volumes I-IV were written by a contractor and cover:

I Fundamentals in mathematics, chemistry, electricity, classical physics, nuclear physics, power plant physics, and instrumentation and control
II Reactor theory
III Heat transfer and fluid flow
IV Radiation protection

Volumes V-VII consist of combined instructor lesson plans and trainee handouts covering TMI-1 systems and equipment, transient analysis, and the TMI-2 accident. Some of the material in these volumes includes lessons on heat transfer, fluid flow, reactor theory, and radiation protection, but the approach and content differ from that in Volumes I-IV. Much of the material in Volumes V-VII was originally developed by various contributors for the Operator Accelerated Retraining Program conducted in 1979-1980 at TMI-1 following the TMI-2 accident. The material in Volumes V-VII contains hand-written and cut-and-paste changes from an earlier version. Some sections carry the notation that the text is a videotape script. The sections on systems usually include many design, construction, and operational details.

Overall, the OTM is a usable training document. However, it contains confusing duplication in material on reactor theory, drawings that are illegible due to clutter and poor reproduction quality, and descriptions that conflict with class handouts. Some plant systems are not covered in the OTM. The role of the OTM as a training document is not defined. Several specific OTM deficiencies are noted in Volume 2, Section 8.

8-2.3.1.1. Conclusion. The seven volume Operator Training Manual (OTM), while usable, is of limited value as a training document in its present form due to lack of currency, conflicts with other descriptive material, verbiage, illegible illustrations, and incomplete coverage of plant systems. The OTM is issued to all licensed operators and licensed operator trainees and it is used to some extent as a reference document in licensed operator training programs.

8-2.3.1.1. Recommendation. Overhaul the Operator Training Manual and establish it as a principal text for TMI-1 operator training programs. Provide procedures to maintain the OTM up to date.

8-2.3.2. Pressure/Temperature (P/T) Plot Training Program.

8-2.3.2.1. Finding. The Pressure/Temperature (P/T) Plot Training Program is a programmed self-paced, computer-assisted instruction (CAI) course consisting of 17 lessons. It was developed for the TMI Training Department by a contractor. The course is designed to assist personnel, who have knowledge of basic principles and who are familiar with the plant, to analyze 18 normal and abnormal plant transients.

The trainee taking the instruction diagnoses conditions by comparing simulated real time plant temperature and pressure traces on a color graphics terminal with limiting values displayed on the terminal. The trainee identifies the transient, interprets the plots, states the procedure(s) which applies and, if it is an abnormal transient, gives the immediate action(s) to mitigate the condition.

Lessons are delivered using an Apple II computer, 2 disc drives, and a color graphics terminal. An accompanying workbook introduces the course, describes the organization of material, lists the goals and objectives, and provides sign-on and lesson procedures. The trainee selects a diskette and the desired lesson and receives the overview, lesson objectives, subject matter, and on-line quiz. This material is used as part of the instruction on mitigation of core damage included in the licensed reactor operator training program. Other TMI-1 personnel who have a need for this information also take the course.

The P/T plot training program is innovative and effective in its use of CAI and the real time visual display which duplicates the display provided for plant operation. It provides an excellent means to reinforce learning by application of classroom instruction to actual plant situations. At present, trainee performance on the lesson quizzes is not included in grades for the course and the CAI uses linear logic not branching logic.

8-2.3.2.1. Conclusion. The Pressure/Temperature (P/T) Plot Training Program is an example of innovative and effective computer aided instructional (CAI) material developed under sponsorship of the TMI Training Department. This material satisfies a specific need for training in identifying normal and abnormal plant conditions by analyzing real time pressure-temperature plots displayed on a graphics terminal.

8-2.3.2.1. Recommendation. Continue use of the P/T Plot Training Program. Consider increasing the value of the computer-aided instruction by replacing the linear logic with branching logic and including trainee performance on this instruction in course grades.

8-2.3.3. Class Handout Material.

8-2.3.3.1. Finding. Generally, the handout material used in the TMI-1 CRO training program is more like lesson plans or technical manual chapters than instructional material developed to pose problems, stimulate discussion, promote trainee interaction, or organize note taking. Several handouts were reviewed and the following conditions were noted:

a. Mechanical Fundamentals-Heat Exchangers. This handout facilitates learning by listing objectives, providing blanks for filling in definitions, noting important equations, sketching different heat exchanger types, and providing a diagram of temperature changes vs. heat added per pound of water for changes in state. The temperature-heat diagram is incorrectly reproduced so that it is incomplete.

b. Diesel Generator. This handout is 69 pages of text and, aside from the first page which lists objectives, it appears to be reproduced from part of a technical manual. The handout contains detailed construction information and is useful as a source of reference information. Some of the drawings are illegible.

c. Feedwater System Rev 0, April 19, 1980. This handout is 79 pages of text plus accompanying diagrams. It appears to be appropriate as a chapter in the Operator Training Manual or a reference publication.

8-2.3.3.1. Conclusion. Class handouts are utilized in TMI-1 licensed reactor operator lectures generally as reference or study material and not effectively to stimulate discussion or organize note taking. In some cases, the handout material on plant systems presents different information than contained in the Operator Training Manual.

8-2.3.3.1. Recommendation. Structure revised or newly developed class handouts as aids to lecture presentations and not as text material. Include review for technical accuracy by GPU Nuclear Technical Functions.

8-2.3.4. On-the Job Training (OJT) Material.

8-2.3.4.1. Finding. Instructional material for OJT consists of 22 checkoff sheets listing individual tasks to be accomplished and the number of tasks to be accomplished per week. Blanks are provided for the examiner's signature when each task is satisfactorily accomplished. Licensed reactor operator trainees are provided task sheets in Appendix A of the TMI-1 program description.

As examples of OJT tasks, the trainee is required to read and discuss eight administrative procedures, ten surveillance tests or checks and 16 operating procedures. No criteria are provided for guiding trainees and examiners on accomplishing these items.

A list of general knowledge requirements is provided to guide study by trainees and examinations by staff personnel in 33 emergency and abnormal procedures. The trainee is required to walk through the procedure and note indicators, check automatic actions and simulate performing manual actions from memory. Detailed study guides are provided for nine integrated plant operating procedures. These guides require the trainee to discuss specific items in the procedures. Questions requiring analysis of unusual conditions or explanation of interrelations are not included.

8-2.3.4.1. Conclusion. TMI-1 on-the-job training lacks structure in that instructional material does not provide detailed criteria for guiding trainees and examiners in accomplishing training tasks. This causes variations in requirements among the six shifts as manifested by a general reluctance to have trainees assigned to one shift examined by qualified operators of another shift.

8-2.3.4.1. Recommendation. Develop detailed criteria to guide trainees and examiners in accomplishing OJT tasks. The study guides provided for nine integrated plant operating procedures are a good model for developing these criteria.

8-2.4. <u>Presentation Techniques</u>. The CRO training program class schedule includes 12 weeks of classroom instruction in two six-week phases. A class day is six hours of supervised study in lectures, examinations, videotapes, and reviews conducted during the periods 0700-1100 and 1130-1330. This is followed by two hours of self-study from 1330 to 1530. The present agreement between GPU Nuclear and its bargaining unit employees, which include licensed reactor operator trainees, does not permit assignment of homework to be done outside the normal workday. Consequently, 90 hours or 25% of the 360 hour classroom phase is spent in self-study. Of the remaining 270 hours, 24 hours are used for examinations, 58 hours for the Babcock and Wilcox videotape series on the Integrated Control System, and 188 hours for lecture presentations.

8-2.4.1. Finding. The following CRO classroom lectures were assessed. Due to the short observation period, these lectures may not be representative of presentations to CRO trainees:

a. Mechanical Fundamentals-Heat Exchangers
b. RadWaste Gas Disposal
c. Heat Engines

In these lectures, the instructors followed lesson plans and maintained a pace appropriate for the lesson difficulty and trainee background. The instructors asked questions to assess and clarify trainee understanding. In one lecture, heat transfer theory and equations associated with the lesson material were stated without developing a simplified derivation or explanation of the principles involved. In another lecture, the non-licensed operator instructor was observed to allow talking by trainees in the combined CRO-AO class to interfere with an orderly lesson opening. He continued his presentation when it was apparent to the observer that only a small number of trainees were paying attention.

8-2.4.1. Conclusion. Instructors competently explained system details and answered trainee questions during three lecture presentations which were attended. In this very limited sample, one instructor stated heat transfer principles without developing a derivation or explanation of the principles which would have aided trainee understanding of the material presented. Another instructor maintained poor control of his class and permitted trainee conversations to interfere with his presentation.

8-2.4.1. Recommendation. Establish a program for frequent, continuing evaluation of instructor performance in the classroom by TMI Training Department managers and supervisors followed by coaching to correct specific deficiencies.

8-2.4.2. Finding. The nine-member licensed reactor operator class attended plant system lectures with the ten-member auxiliary operator (AO) class. The material was presented at the auxiliary operator level of detail by non-SRO qualified instructors. Following each lecture, the licensed reactor operator trainees met with an experienced shift supervisor who was temporarily assigned by the TMI-1 Operations

Department to the TMI Training Department. This SRO qualified instructor provided further information on the system at the CRO level of detail. Weekly quizzes on systems for CRO trainees were made up by their SRO qualified instructor and were different from quizzes for auxiliary operator trainees.

The stated reasons for following this practice are to make more efficient use of instructor resources, to complete system training at the AO level for the CRO trainees who are Navy nuclear trained but who have no TMI-1 experience, and to promote mutual understanding of the duties and responsibilities of the licensed reactor operators and auxiliary operators. Instructors and trainees commented that the different backgrounds and different learning objectives of the two groups cause effectiveness of instruction to be reduced when lessons are presented to the combined group. CRO trainees who were interviewed stated they felt held back as basic principles were being taught to AO trainees. The AO trainees who were interviewed stated they were reluctant to ask questions that might seem trivial to CRO trainees.

8-2.4.2. Conclusion. Although there may be valid reasons for presenting lectures on plant systems to combined groups of licensed reactor operator trainees and auxiliary operator trainees, this practice is demotivating in its effects on both groups of trainees. The different backgrounds and learning objectives of the two groups inhibit learning by both groups of trainees.

8-2.4.2. Recommendation. Discontinue the practice of presenting lectures on plant systems to combined groups of licensed reactor operator trainees and auxiliary operator trainees.

8-2.5. Examination Practices. Examination administration, content, grading, and correlation with performance on NRC license examinations were reviewed for the TMI-1 licensed reactor operator training program. Examinations are considered to include oral and written examinations, quizzes, tests and checkoffs. The following examinations are included in the TMI-1 program:

a. Seventeen two-hour quizzes administered by Training Department SRO qualified instructors (12 during classroom phases and 5 during OJT).
b. One six-hour written final examination administered by Training Department SRO qualified instructors.

c. Over 220 individual checkoffs of varying difficulty by Operations Department qualified operators during OJT. Final checkoffs are conducted by Operations Department SRO qualified personnel.
d. One two-hour oral board examination administered by Training and Operations Department SRO qualified personnel.
e. One three hour walk through the plant administered by Operations Department SRO qualified personnel.
f. Simulator startup certification and operational evaluation administered by Babcock and Wilcox.

A bank of examination questions on separate cards has been established for licensed reactor operator subject areas. This will facilitate composing different examinations and will provide a convenient means for recording examination question use.

8-2.5. Conclusion. TMI-1 licensed reactor operator trainees are extensively tested by a variety of oral, written and performance quizzes, examinations, and checkoffs.

8-2.5. Recommendation. Continue present testing practices in the TMI-1 licensed reactor operator training program.

8-2.5.1. Administration of Examinations.

8-2.5.1.1. Finding. Nine TMI-1 licensed reactor operator trainees and three licensed reactor operator instructors were interviewed individually about security and integrity of examinations. They stated that examination practices include the following:

a. No examinations are to be taken home or answered as a group effort.
b. Security briefing sheets are consistently used and understood.
c. Seating is designated and documented.
d. Time limits are stated and enforced.
e. Participants are separated from non-participants and those who have finished the examination.
f. External distractions are minimized.
g. Proctors remain in the room throughout the examination.
h. Leaving the room by examinees is controlled.

i. Examinees are given the opportunity to ask questions prior to the beginning of the examination.

j. Yellow paper is recognized as examination material.

All personnel interviewed were well indoctrinated on the absolute requirement not to give or receive help on examinations. They knew the serious consequences of violating this rule. Examination procedures were observed in use on two Fridays when weekly quizzes were administered; no security discrepancies were noted. Proctors remained at the front of the room and could see all examinees. They frequently observed the activities of the examinees. However, most proctors graded quizzes or did other paperwork while proctoring. This prevented them from giving their complete and undivided attention to examination security.

8-2.5.1.1. Conclusion. TMI-1 licensed reactor operator trainees and instructors who were interviewed are well indoctrinated on procedures to maintain examination integrity. These procedures were observed to be followed in the administration of weekly quizzes during the site visit. Guidance should be provided to proctors on doing paperwork while proctoring.

8-2.5.1.1. Recommendation. Continue present examination administration procedures. Make periodic audits to ensure that high standards for examination security are maintained. Provide guidance to examination proctors on doing paperwork while proctoring.

8-2.5.2. Trainee Perceptions about Examinations.

8-2.5.2.1. Finding. The nine TMI-1 CRO trainees interviewed about weekly quizzes commented that:

a. Test content representatively samples what is taught in class and learned from studying.

b. Memorization is not stressed at the expense of understanding. However, "key words and tricky phrases" were mentioned as characteristics of some examinations.

c. Trainees are notified far enough in advance of examinations for sufficient preparation.

d. Most questions require short factual answers. There are few questions on interrelations or questions that require analysis.

e. Review material should be included in the weekly quizzes to check retention of subjects studied earlier in the course.

8-2.5.2.1. Conclusion. The nine TMI-1 licensed reactor operator trainees who were interviewed generally perceived their weekly quizzes in a favorable light as providing fair and worthwhile evaluations of their understanding of the material presented during classroom lectures. Their constructive comments included the need to further deemphasize "key words and tricky phrases," to include questions on review material and system interrelations, and to add questions requiring analysis.

8-2.5.2.1. Recommendation. Consider and implement appropriate TMI-1 licensed reactor operator trainee comments to improve weekly quizzes.

8-2.5.3. Review of Mock Oral and Written NRC License Examinations.

8-2.5.3.1. Finding. TMI Training Department mock oral and written NRC license examinations administered to six licensed reactor operator trainees were reviewed with the following results:

a. GPU Nuclear made objective determinations about trainees who demonstrated lack of knowledge on the mock examinations.

b. The mock oral examination questions were well documented and comprehensive. However, vital elements of correct answers were not indicated as an aid in grading. Two individuals failed the oral examinations. The report indicated their areas of weakness and provided guidance on required remedial work. One individual was reexamined and passed.

c. The mock written examinations were representative of actual NRC examinations in scope and content. Five of six individuals failed the written mock examination. In several cases the reasons for deducting points were not stated and this reduced the value of the graded test as a learning aid. A comprehensive reexamination, equal in difficulty to the original examination, was administered after appropriate retraining was conducted. Two questions on the reexamination were verbatim repeat questions from the original examination. One individual failed the reexamination. Since he had also failed the oral examination, he was dropped back to a later class. One reexamination was borderline passing. Review of the answer sheets indicated that a number of answers had been regraded. The revised grading changed the outcome of the test from fail to pass. In several instances, justification was provided for revising the points assigned; in other cases the justification was not clear.

8-2.5.3.1. Conclusion. Mock oral and written NRC license examinations administered to TMI-1 licensed reactor operator trainees in January 1982 were representative of actual NRC license examinations and were used effectively to help select trainees to take the February 1982 NRC license examinations. Review of sample examinations indicated several instances of not showing reasons for deducting points in grading, not clearly documenting the justification for changed grades, and including verbatim repeat questions on reexaminations.

8-2.5.3.1. Recommendation. Continue present practices in the use of mock oral and written NRC license examinations to prepare TMI-1 licensed reactor operator trainees for NRC license examinations. Continue improvement of examination practices by indicating reasons for deducting points in grading, clearly justifying changed grades and eliminating verbatim repeat questions on reexaminations.

8-2.5.4. Results on Mock and Actual NRC License Examinations.

8-2.5.4.1. Finding. The following results were noted on mock and actual NRC license examinations taken by six TMI-1 licensed reactor operator trainees in the first class to complete a variant of the current TMI-1 training program:

Examinee	January 1982 Mock NRC Written Examination Grade	January 1982 Mock NRC Written Reexamination Grade	February 1982 NRC Written Examination Grade	February 1982 NRC Oral Examination
1	81.2	82.6 (Elected to take reexamination)	93.1	Pass
2	77.9	83.8	94.6	Pass
3	77.1	80.3	90.4	Pass
4	83.5		90.4 Failed section on general operating characteristics; passed reexamination on section with grade of 87.5 June 1982	Pass
5	63.7	81.6	90.1	Pass
6	64.6	72.3	Was not recommended to take NRC examinations.	

These examinees made the following grades on individual sections of the February 1982 written NRC license examination:

Section	Examinee 1	2	3	4	5
A. Principles of reactor operation	91.7	100.0	92.1	93.3	100.0
B. Features of facility design	100.0	100.0	81.7	100.0	89.2
C. General operating characteristics	87.5	95.8	83.0	66.7	88.8
D. Instruments and controls	86.0	94.4	88.0	97.2	90.4
E. Safety and emergency systems	100.0	91.3	96.5	91.3	80.9
F. Standard and emergency operating procedures	94.1	87.3	95.0	95.0	93.2
G. Radiation control and safety	96.5	98.0	98.0	87.5	88.0
H. Principles of heat transfer and fluid mechanics	90.0	90.0	90.8	91.7	90.0

Note: Minimum passing grade is 80 overall and 70 for each section.

The high success rate on the February 1982 NRC examination suggests that the mock examinations had value in preparing trainees for the NRC examination. However, insufficient examination data exists for meaningful analysis.

8-2.5.4.1. Conclusion. The TMI-1 licensed reactor operator training program is effective as measured by four of five trainees passing the February 1982 NRC written license examination and five of five trainees passing the February 1982 NRC oral license examination. One trainee failed one section of the eight section written NRC license examination.

8-2.5.4.1. Recommendation. Continue the present TMI-1 licensed reactor operator training program with modifications as recommended by this assessment.

8-2.5.5. Analysis of Training Program Effectiveness.

8-2.5.5.1. Finding. It was planned to include in this assessment an analysis of training program effectiveness based upon licensed reactor operator job performance. This analysis was not possible because job performance is not evaluated, documented and maintained in personnel records for TMI-1 licensed reactor operators.

8-2.5.5.1. Conclusion. Training program effectiveness cannot be assessed with respect to operator performance on the job because licensed reactor operator performance is not periodically documented and maintained in personnel records.

8-2.5.5.1. Recommendation. Establish a program for the periodic evaluation of licensed reactor operator job performance and for the use of this information to measure training program effectiveness.

8-2.6. Lesson Audits.

8-2.6.1. Finding. Some 64 lesson plans are used in the TMI-1 operator training programs. All classroom instruction is conducted using lesson plans. About 51 of the 64 lesson plans require upgrading to conform with present procedures for lesson plan development and approval. Lesson plans written in accordance with past procedures have not been reviewed and approved in accordance with present procedures. In some cases, including the following systems, handwritten preliminary lesson plans are used for instruction: solid waste disposal system, RadWaste evaporators, and gaseous waste disposal system.

The following three TMI Training Department lesson plans used in the TMI-1 licensed reactor operator training program were reviewed for content and conformance with TMI Training Department procedures on lesson plan development and approval, TD 1103 and TD 1104:

a. Heat Exchanger Fundamentals, Rev 0, 8/25/81
b. Mitigating Core Damage: Core Cooling Mechanics, Rev 0, 5/6/81
c. Mitigating Core Damage: Radiation Hazards and Monitor Response, Rev 0, 5/12/81

The three lesson plans conform generally with TMI Training Department procedures for lesson plan development:

a. Lesson objectives in the sample lesson plans clearly communicate instructional goals in straight-forward statements. TD 1103 identifies the need to base objectives on job data and this was not evidenced in the sample plans. Objectives do not include criteria for acceptable performance.
b. The sample lesson plans were approved by the Manager Operator Training TMI in accordance with TMI Training Department procedures.
c. The sample lesson plans outlined the prescribed presentations and sequenced the material from broad concepts and easily learned topics to more complex material.
d. No opportunities for trainee practice were called out in the sample lesson plans. No discussion points or questions designed to probe trainee understanding or to stimulate trainee participation were included in the lesson plans.

The lesson plan content was reviewed as follows:

a. Heat Exchanger Fundamentals. A three-hour lecture period is assigned to this subject. The lesson plan was noted to be complete and well organized. It included sample quiz questions and calculations with answers. The lesson covered descriptions of various types of heat exchangers, heat transfer principles and definitions, heat transfer effects, heat exchanger thermodynamics, equations for different heat transfer applications, calculations using log mean temperature difference, heat balance in a heat exchanger, laminar and turbulent flow, Reynolds Number, Fouriers Law, calculations to compare effectiveness of parallel and counterflow heat exchangers, and once through steam generator features.

b. Mitigating Core Damage: Core Cooling Mechanics. A two-hour lecture period is assigned to this subject. The INPO guidelines for training to recognize and mitigate the consequences of core damage recommend approximately 12 contact hours to cover core cooling mechanics. The TMI-1 lesson plan objectives expect the trainee to list or designate various core cooling methods and their disadvantages and advantages. The INPO objectives expect the trainee to be able to explain or describe these elements of the lesson. The TMI-1 lesson covers four of eight applicable objectives in the INPO guidelines. Topics in the TMI-1 presentation include alternate methods of core cooling; natural circulation including conditions requiring it, mechanics, requirements and verification, and methods of control; effects of voiding and gas bubble formation; and RCP restart criteria.

c. Mitigating Core Damage: Radiation Hazards and Monitor Response. A four-hour lecture period is assigned to this subject. The INPO guidelines for training to recognize and mitigate the consequences of core damage recommend approximately ten contact hours to cover radiation hazards and monitor response. The TMI-1 lesson plan covers four of six objectives recommended by the INPO guidelines. Topics in the TMI-1 presentation include the radiation monitoring system (RMS), RMS failure modes, potential high radiation areas and sources, potential airborne activity areas and sources, sampling procedures, and calculating containment radiation levels.

8-2.6.1. Conclusion. TMI Training Department lesson plans in some stage of development are used for all TMI-1 licensed reactor operator training lectures. About 51 of the 64 lesson plans used in this training program require upgrading to conform with present procedures for lesson plan development and this upgrading is in progress.

Three sample lesson plans were reviewed in detail. All conformed closely with TMI Training Department procedures for lesson plan development and could be used effectively in classroom presentations. In two of the three lesson plans, Heat Exchanger Fundamentals and Mitigating Core Damage: Core Cooling Mechanics, the amount of material contained appeared to be too much for the assigned time periods to achieve necessary understanding and retention by licensed reactor operator trainees. There was fair agreement between objectives in the two lesson plans on mitigating core damage and the recommended INPO objectives on this subject.

8-2.6.1. Recommendation. Continue lesson plan upgrading. Review lesson plans on mitigating core damage for consistency with INPO guidelines on this important subject.

8-2.7. Training Records.

8-2.7.1. Finding. Training records held in TMI Training Departu nt files for 15 CRO's and CRO trainees were reviewed for types of information included. Some of the records were filed by training session instead of by individual. Training records which have been microfilmed and placed in vault storage were not reviewed. All of the records reviewed contained oral and written examination grades and instruction attendance forms for training received. Data appeared to be entered in the training records at a reasonable frequency. Records of simulator training are maintained separately. Official college and university transcripts are required for all employees reporting higher education and these records are retained by the Personnel Department. A computerized training data base system is being implemented to improve record retrieval.

8-2.7 1. Conclusion. Sample training records for 15 licensed reactor operators and reactor operator trainees were reviewed and found to contain attendance forms and examination grades for training received. Filing of some training records by training session instead of by individual trainee makes it time consuming to gather all training records on one individual for review.

8-2.7.1. Recommendation. Continue implementation of computerized training data base with provisions to facilitate retrieval of training data on individual trainees.

8-2.8. Classroom Facilities.

8-2.8.1. Finding. Overall classroom facilities and training equipment were observed to be excellent. The classroom phase includes two hours per day of self-study. This study takes place in classrooms with other trainees and the resulting conversations were observed to reduce study effectiveness. At times when classroom loading permitted, trainees were also observed to use empty classrooms for study in small groups or alone.

8-2.8.1. Conclusion. Overall classroom facilities and training equipment are in excellent condition and adequate overall for present licensed reactor operator training needs. Present unsupervised group study in classrooms which typically constitutes 25% of a classroom phase day is of questionable effectiveness.

8-2.8.1. Recommendation. In future changes or additions to TMI Training Center facilities, consider providing a small number of cubicles or a quiet room for more effective study.

8-2.9. Status of Findings and Recommendations from Past Investigations and Evaluations.

8-2.9.1. Finding. Since the TMI-2 accident in 1979, investigations and evaluations have been conducted and, as a consequence, actions have been directed or recommended to improve training at TMI-1 and other nuclear power plants. Findings and recommendations concerning training have been taken from the following reports and the remarks noted are based on this assessment. GPU Nuclear sponsored the evaluations reported in references 4 and 5 and maintains an up-to-date status on action taken in response to all directives and recommendations which affect training:

1. "Report of the President's Commission on the Accident at Three Mile Island" (Kemeny Report)

2. NRC, NUREG 0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations"

3. NRC, NUREG/CR-1250, "Three Mile Island, A Report to the Commission and to the Public," Vols. I and II (Rogovin Report)

4. Nuclear Engineering Department, College of Engineering, Pennsylvania State University, "A Pedagogical Review of Reactor Operator Training at Three Mile Island Nuclear Plant," July 1980, Report No. NE-61

5. "Report of the TMI-1 Operator Accelerated Retraining Program Review Committee," June 1, 1980

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
TMI-2 Accident Reports		
Include in the training program, fundamental processes and basic subjects including physics, chemistry, heat transfer, thermodynamics and their interactions in plant operations for abnormal conditions and transient responses.	1	Specialized education subjects are included in the training program where related to understanding nuclear power plant operation and performing operator duties.
Training should be formally defined for all operators.	1	TMI Training Department training program descriptions formally define training requirements.
Include supervisory skills training for all supervisory personnel.	2	TMI-1 SRO replacement training includes two weeks of decision analysis and supervisory development training.
Integrate operating experience into training programs.	1	GPU Nuclear procedures provide for review of industry experience reports and including applicable items in training programs.
Train in skills and knowledge required to satisfy operator job requirements.	2	Present operator training is based on best industry practices and emerging needs.
Other Reports		
Use well developed problem sets in areas other than reactor theory and health physics.	4	Problems are also used in thermodynamics, heat transfer and fluid flow lessons.
Raise mathematical level: RO - college algebra; SRO - college calculus.	4	Present TMI-1 CRO and SRO training is at the college algebra level.
Use a rigorous set of screening tests for all control room operators.	4	GPU Nuclear stated that use of screening tests is being considered. Validation tests are used in the CRO training program as a basis to waive requirements for prerequisite training.
Implement criteria and qualifications for reactor operators as they are issued from NRC and INPO.	4	GPU Nuclear stated that criteria are evaluated for applicability to TMI training programs as they are issued.

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
Use instructors well qualified as teachers.	4	TMI Training Department licensed operator instructors maintain qualifications in the plant. Initial and continuing instructor development training courses are provided for TMI Training Department instructors.
GPU Nuclear Tech Functions, RadCon and other cognizant groups should review training.	4	The RadCon Department reviews technical content of TMI-1 RadCon training material. GPU Nuclear Technical Functions does not routinely review technical content of training material.
To achieve uniformity and reliability of oral examinations, it would be desirable to study the standardization of probes, promptings, and responses during oral examinations.	5	Questions used in final oral examinations are documented. Key elements of correct answers are not recorded and standardization of probes and promptings has not been accomplished.

8-2.9.1. Conclusion. GPU Nuclear is responsive to recommendations and directives for improvement of training programs.

8-2.9.1. Recommendation. Continue present review and upgrading efforts.

SECTION 9

LICENSED SENIOR REACTOR OPERATOR TRAINING

9-0. INTRODUCTION. INPO and GPU Nuclear recognize three levels of responsibility and authority for licensed operators assigned to operating shifts in the TMI-1 plant. INPO designates these levels as control room operator, senior control room operator, and shift supervisor. Corresponding TMI-1 levels of responsibility are control room operator, shift foreman, and shift supervisor. Before TMI-1 personnel are assigned SRO operational responsibilities as a shift foreman or shift supervisor by the TMI-1 Operations Department, they must complete the senior reactor operator (SRO) training course, hold a NRC senior reactor operator license and satisfy additional training and indoctrination requirements specified by the TMI-1 Operations Department. This section of the report assesses the SRO training program but does not assess the additional TMI-1 Operations Department requirements for shift foreman or shift supervisor. TMI-1 SRO trainees are not members of the bargaining unit.

As stated in the TMI Training Department document titled "Senior Reactor Operator Replacement Training Program Description TMI-1," 5/81, the purpose of the senior reactor operator training program is "to prepare licensed reactor operators to perform senior reactor operator duties, improve skills in situation and problem assessment, and develop supervisory abilities."

TMI-1 SRO training as set forth in the program description is 26 weeks in duration and consists of the following phases conducted in sequence:

a. Decision Analysis/Supervisory Development - 2 weeks
b. Phase 1 On-The-Job training (OJT) - 6 weeks
c. Classroom Training - 8 weeks
d. Phase 2 OJT - 6 weeks
e. Simulator Training - 2 weeks
f. Audit Examinations - 2 weeks

The simulator phase of the training program is discussed in Section 11 of this report.

The TMI-1 SRO training program has undergone major upgrading in the past several years. A modified version of the SRO training program as presently written was used for the four trainees who completed the course in June 1982. This class consisted of two individuals with CRO experience at TMI-1 and two individuals who passed the NRC reactor operator license examinations in February 1982. The group commenced SRO training in March 1982 and the nominal six month course was compressed to four months by working ten hours per day with classroom lectures in the mornings and OJT in the afternoons. The training was accelerated to meet the NRC requirements which stipulated effective July 1982, two SRO qualified personnel will be assigned to each shift when the plant is above 200°F. The TMI-1 Operations Department assigned an experienced shift supervisor full time to instruct and supervise the activities of the SRO trainees. He modified the course as needed and the program description is now being revised based on this experience. The assessment contained in this report is based on the training program description as presently written and not as it was modified for the class which completed training in June 1982.

9-1. ASSESSMENT METHODS. Licensed senior reactor operator training was assessed by Mr. D.S. Boyd and Dr. P.C. Manning of Data-Design Laboratories assisted by Mr. J.J. Holman, a consultant to Data-Design Laboratories. The assessment was based on reviewing relevant documentation and interviews with GPU Nuclear personnel concerned with this training and its training content. At the time of the site visit, the four SRO trainees were taking the NRC operational examination at the B&W simulator and the NRC written and oral license examinations at TMI. There were no SRO classes in session to observe.

9-1.1. Training Program Documentation. Principal documents which were reviewed in connection with this assessment included:

a. TMI Training Department document "Senior Reactor Operator Replacement Training Program Description TMI-1," 5/81 (TMI-1 program description)
b. INPO document "Nuclear Power Plant Licensed Operator - Guidelines for Qualification Programs at Operational Units" (INPO guidelines)
c. TMI Training Department procedure, "Training Department Lesson Plan Development, Presentation, Evaluation and Selection of Training Aids," TD 1103, Rev 1, 4/14/81
d. GPU Nuclear Training and Education procedure, "Admini tion of Examinations," 6200-ADM-2600.1, 10/20/81

e. 10 CFR 55

f. ANSI/ANS-3.1 - 1978, 1981, "American National Standard for Selection and Training of Nuclear Power Plant Personnel"

A copy of the TMI-1 program description is included in Volume 2, Section 9.

9-1.2. Interviews. The following GPU Nuclear personnel were interviewed to obtain data on licensed senior reactor operator training:

a. President GPU Nuclear Corporation
b. Vice President Nuclear Assurance
c. Vice President and Director TMI-1
d. Manager Plant Training TMI
e. Operations and Maintenance Director TMI-1
f. Manager Plant Operations TMI-1
g. Manager Corporate Training
h. Operator Training Manager TMI
i. Two shift supervisors TMI-1
j. Two shift foremen TMI-1
k. Three licensed operator instructors (one of whom is the Supervisor Licensed Operator Training TMI-1)
l. One senior reactor operator trainee

The interviews of management personnel provided information on their training involvement, concerns, perceptions, and recommendations. TMI Training Department licensed operator instructors were asked questions on how they were selected for instructor assignment, about their technical and educational backgrounds, their role in licensed reactor operator training, percent of time spent in various instructional tasks, trainee attitudes, and specific suggestions for improving the training program. The TMI-1 senior reactor operator trainee was interviewed for his perceptions about the training program.

9-1.3. Course Content Analysis. The basic reference used for assessing TMI-1 course content was the INPO guidelines. An analysis was made by taking subjects and instruction hours from the SRO classroom schedule in the program description, grouping them in the recommended INPO categories for SRO training and comparing the content and instruction hours with the INPO guidelines. The SRO class which completed the program in June 1982 was trained using a modified version of the approved course. Experience from this class will be incorporated into the curriculum for future SRO classes.

9-2. FINDINGS, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS. The same assessment procedures used for the replacement control room operator training program were employed to assess the status of TMI-1 senior reactor operator training. There were no SRO classes in session to evaluate during the two-week site visit. The findings cover course content, instructional materials, examination practices, training records, and prerequisites. Comments on instructors and classroom facilities included in Section 8 also apply to SRO training.

9-2.1. Course Content. Findings reported here are based on the TMI-1 program description. The sequence of training is described and similiarities or differences in course content between INPO recommendations and the TMI-1 training program are identified.

9-2.1.1. Finding. The TMI-1 SRO course consists of the following phases conducted in sequence:

a. Decision Analysis/Supervisory Development Training - 2 weeks (40 hours supervisory development, 24 hours decision analysis)
b. Phase 1 OJT - 6 weeks (240 hours)
c. Classroom Training - 8 weeks (240 hours classroom lectures, 80 hours self-study)
d. Phase 2 OJT - 6 weeks (240 hours)
e. Simulator Training - 2 weeks including an operational evaluation on the simulator (40 hours classroom lectures, 40 hours simulator exercises)
f. Audit Exams - 2 weeks

9-2.1.2. Finding. Table 9-1 compares the TMI-1 SRO training program content and instruction hours taken from the program description class schedule with instruction hours recommended by INPO guidelines for various subjects. The grouping of classroom lecture subjects in segments of training corresponding to the outline contained in INPO guidelines is, in some cases, subject to interpretation.

TABLE 9-1

Subjects	Total Recommended INPO Instruction Hours	TMI-1 Instruction Hours from Class Schedule in Program Description
Segment 1: Specialized Education		
Leadership/Communication/ AnalyticalSkills	80 classroom	64 classroom
Segment 2: Procedures and Bases Training	120 classroom and OJT	42 classroom (plus OJT)
Segment 3: Advanced Transient and Accident Analysis	80 classroom	90 classroom
Segment 4: Advanced Operating Practices Training		
Phase 1 Plant Operations	15 classroom and OJT	24 classroom (plus OJT)
Phase 2 In-Plant Training	520 OJT	480 OJT
Phase 3 Simulator Training (Control panel manipulations)	16	40 40 classroom
Segment 5: Advanced Electrical Components & Systems Training	80 classroom	2 classroom 80 (instruction in additional topics which do not correspond to INPO topics)
Total Hours	911	862

Content was examined by comparing the subjects listed in the INPO guidelines with the subjects included in the TMI-1 program description. The INPO program is organized with five segments of instruction in (1) specialized education, (2) procedures and bases training, (3) advanced transient and accident analysis, (4) advanced operating practices training, and (5) advanced electrical components and systems training. These segments contain training goals, objectives, and topics. Table 9-2 groups TMI-1 SRO classroom schedule lecture subjects in the segments of SRO training recommended by INPO guidelines. TMI-1 OJT tasks which are associated with the classroom subject areas are also included. No estimate of instruction hours is made for OJT associated with classroom subject areas.

TABLE 9-2

Segments and Subjects		TMI-1 Instruction Hours
a. Segment 1: Specialized Education		
Leadership/Communication/Analytical Skills Training		64
	TOTAL	64
b. Segment 2: Procedures and Bases Training		
10 CFR 50		4
Gas tank release, RB purge		6
Liquid releases		4
10 CFR 100		2
Radioactive decay, shielding, dose rate calculations		6
Technical specifications bases		12
Plant limits, precautions, setpoints		6
Environmental technical specifications		2
	TOTAL	42
The TMI-1 OJT phase includes the requirement to read and discuss the Radiation Protection Manual		
c. Segment 3: Advanced Transient and Accident Analysis		
Reactor thermal-hydraulics		30
Accident analysis		12
FSAR safety analysis		12
TMI-2 transient and small break LOCA		6
Reactor core construction and characteristics		6
Fuel handling system and requirements		6
Accident mitigation		6
ESAS instrumentation redundancy		4
Meteorology instrumentation		2
Seismic monitoring		2
Major plant interlocks		4
	TOTAL	90
The TMI-1 OJT phase includes the requirement to read and discuss 37 emergency and abnormal procedures.		

TABLE 9-2 (Continued)

Segments and Subjects		TMI-1 Instruction Hours
d. Segment 4: Advanced Operating Practices Training		
Plant Operations		
RWP procedures		2
Emergency plan		14
Security		2
Switching and tagging		2
X/Q calculations		4
	SUBTOTAL	24
The TMI-1 OJT phase includes the requirement to read and discuss the following administrative procedures:		
Document Control		
Tagging		
Station Organization and Chain of Command		
Technical Specification Surveillance Program		
Shift Relief and Log Entries		
Bypass and Safety Functions and Jumper Control		
Operator at the Controls		
In-plant Training		480
Simulator Training		
Control board manipulations		40
Classroom lectures or discussions		40
	TOTAL	584
e. Segment 5: Advanced Electrical Components and Systems Training		2
	TOTAL	2
The TMI-1 OJT phase includes the requirement to read and discuss the following emergency and abnormal procedures:		
Blackout		
Low System (grid) Voltage		

TMI Training Department instructional materials such as lesson plans and training objectives incorporating specific material for TMI-1 SRO training are not sufficiently complete as yet to permit detailed content comparison. Findings are thus limited to the following qualitative assessment of the extent to which INPO topics are included in the TMI-1 program description.

a. Segment 1: Specialized Education

The TMI-1 program content is consistent with the content of INPO guidelines for leadership, communication and analytical skills training. The supervisory development part of this TMI-1 training is presented in a workshop setting and is 40 hours in length. The TMI-1 decision analysis training is provided by a contractor and is 24 hours in length.

b. Segment 2: Procedures and Bases Training

The TMI-1 classroom phase includes topics corresponding to the following INPO topics:

- o Radioactive material control procedures - policies and procedures regarding off-site release of radioactive effluents
- o Facility license and design bases, including applicable portions of 10 CFR 50 and 100
- o Technical specifications
- o Environmental technical specifications

The TMI-1 OJT phase includes topics corresponding to with the following INPO topics:

- o Radioactive material control procedures
- o Administrative procedures for health physics

The TMI-1 program does not include topics corresponding to the following INPO topics:

- o Administrative procedures for maintenance and technical support
- o Duties of system load dispatcher related to on-site equipment and relationship with plant operators

c. Segment 3: Advanced Transient and Accident Analysis. All INPO topics are covered in the TMI-1 training program.

The TMI-1 classroom phase includes topics corresponding to the following INPO topics:

- o Reactor thermal-hydraulics
- o Containment of radioactivity
- o Accident assessment
- o Atmospheric dispersion of radioactivity (INPO 8 hours, TMI-1 2 hours)

The TMI-1 OJT phase includes topics corresponding to the following INPO objectives:

- o State the anticipated indications, automatic actions, and immediate operator actions for each accident.
- o Describe the long-term actions required for core cooling and plant stabilization.
- o Describe alternate power supplies and system lineups available to cope with the accident.

The TMI Pressure/Temperature Plot Training Program and training in the Abnormal Transient Operations Guide (ATOG) both include topics corresponding to the following INPO objectives:

- o Given a set of control room indications, explain what accident conditions exist.
- o Recognize a condition for which no procedures exist and recommend operator actions to maintain core cooling and stabilize the plant.

GPU Nuclear reported that training in the ATOG is to be completed prior to restart.

d. Segment 4: Advanced Operating Practices Training

Section 1 - Plant Operations
The TMI-1 classroom phase includes topics corresponding to the following INPO topics:

- o Radiation work permit procedures
- o Equipment tagout and clearance procedures

- o Emergency plan implementation
- o Routine and emergency communications capabilities
- o Routine and emergency reporting and notification requirements
- o Relationship to utilty, local, state, and federal officials

The TMI-1 OJT phase includes topics corresponding to the following INPO topics:

- o Shift duties and responsibilities
- o Corporate policies affecting SRO and subordinate positions
- o Radiation work permit procedures
- o Equipment tagout and clearance procedures

Section 2 - In-Plant Training

INPO guidelines recommend that the SRO trainee receive approximately 520 hours of experience in-plant in a training status. During this time, the trainee should carry out the duties of a senior control room operator under the direct supervision and guidance of a qualified senior control room operator. This training should emphasize the supervisory role of the senior control room operator during normal and emergency conditions.

The INPO guidelines further recommend that check-sheets be prepared to provide guidance and structure for in-plant training. The check-sheets should emphasize the supervisory role of the senior control room operator and state evolutions and operations to be conducted, observed, or simulated by the trainee as well as items which the candidate should discuss with a qualified senior control room operator or shift supervisor. Examples of such items are:

- o Preparations and administrative requirements for reactor startup and shutdown
- o Fuel handling and inspection
- o Emergency and routine maintenance practices
- o Calculations of off-site radioactive releases during emergencies
- o Requirements concerning radioactive releases and shipments
- o Chemistry sample and radiation survey frequency and interpretation
- o Emergency communication equipment and procedures
- o Coordination of surveillance testing

The INPO guidelines recommend that the trainee's performance be monitored and deficiencies discussed and corrected so that satisfactory proficie.cy is demonstrated. The senior control room operator or shift supervisor will indicate satisfactory completion by signing the trainee's check-sheet.

The OJT portion of the TMI-1 SRO program is organized in two six-week phases (480 hours total):

Phase 1 - the trainee reviews and takes log readings on the support, secondary, and primary plant systems and reviews the tasks involved in their operation. No task sheets or other guidance is provided for this training which is intended to refamiliarize SRO trainees with systems and equipment they did not come in contact with as CROs.

Phase 2 - the trainee completes the requirements set forth on seven task sheets. These include reading and discussing eight administrative procedures related to SRO duties and 37 emergency and abnormal procedures. For the check-offs on emergency and abnormal procedures, the trainee is expected to walk through the procedure from memory and note indicators, check automatic actions and simulate performing manual actions.

SRO trainees are administratively assigned as shift foreman trainees in the TMI-1 Operations Department. In this capacity they carry out duties of a senior control room operator under instruction, conduct evolutions under instruction and discuss items of the nature recommended by INPO guidelines. These items focus on the supervisory role of the senior control room operator. No OJT tasks are included in the program description to cover this training.

The TMI-1 SRO trainee is examined on each specific OJT task by a designated task examiner. A final verification of all tasks on a checkoff sheet is made by the shift supervisor or if designated, the SRO qualified shift foreman.

The OJT phase of the TMI-1 program is based on requirements for qualifying personnel at operational units with normally expected operating and shutdown periods. During the present extended TMI-1 shutdown, the OJT phase of the

TMI-1 training program has not been augmented with observation training at operating units or other special training to compensate for the reduced opportunities for trainees to obtain meaningful operating experience in the shutdown TMI-1 plant.

e. Segment 5: Advanced Electrical Components and Systems Training

The TMI-1 classroom phase includes the topic Electrical Theory Review and Safety. Available information indicates the following topics recommended by INPO guidelines for this segment are not included in the TMI-1 instruction:

- o Motor, generator, and transformer design types and characteristics
- o Main generator capability curves, operating limits and precautions
- o Control circuits for in-plant electrical switchgear
- o Control circuits for utility grid switchgear
- o Utility grid and inter-connections with other grids
- o Electrical ground detection systems (including main generator field)
- o Protective relaying theory and application

The TMI-1 OJT phase includes a topic corresponding to the INPO topic on procedures for restoring station power following blackout.

In addition to the topics discussed above, the TMI-1 classroom phase includes the following lectures and quizzes which are not associated with a particular segment:

Subject		TMI-1 Instruction Hours
LER's		2
Primary/Secondary Chemistry Review		2
Operating Procedures		12
Change Mods		2
10 CFR 21		2
10 CFR 55		2
ICS Transients		18
Reactor Theory		30
Quizzes		10
	TOTAL	80

9-2.1.2. Conclusion. The content of the TMI training program for TMI-1 licensed senior reactor operators is consistent with or exceeds the content recommended by INPO guidelines in the following four of seven subject areas:

a. Specialized Education - Leadership/Communication/Analytical Skills
b. Advanced Transient and Accident Analysis
c. Plant Operations - Administrative Requirements
d. Simulator Training

The content of the TMI program is less than the content recommended by INPO guidelines in the following three subject areas:

a. Procedures and Bases Training
b. In-Plant Training
c. Advanced Electrical Components and Systems Training

9-2.1.2. Discussion. The following discussion addresses subject areas where the TMI-1 program content is considerably less than the INPO recommended content:

a. In the subject area of procedures and requirements and the bases for them, the TMI-1 program includes approximately 42 hours of classroom instruction plus OJT instruction while the INPO program recommends 120 classroom and OJT instruction hours. The TMI-1 program does not include topics which correspond to the following INPO recommended topics:
   - o Administrative procedures for maintenance and technical support
   - o Duties of load system dispatcher related to on-site equipment and interactions with plant operators

   The TMI-1 program should be strengthened by addition of instruction in these subjects.
b. The INPO program recommends 520 hours of in-plant OJT carrying out the duties of an SRO under the supervision of a qualified SRO. This instruction includes evolutions and operations to be conducted, observed or simulated by the trainee as well as items to be discussed with a qualified SRO.

The TMI-1 program includes 480 hours of in-plant OJT of which 240 hours are associated with log keeping and equipment operating duties outside the control room. The remaining 240 hours include walking through and discussing 45 administrative, emergency and abnormal procedures in addition to carrying out SRO duties under instruction. The TMI-1 program does not include evolutions and operations to be conducted observed or simulated by the trainee. These differences in OJT requirements between the TMI-1 and INPO programs combined with the reduced opportunities for meaningful in-plant training during the extended TMI-1 shutdown indicate a need to strengthen the TMI-1 program in this subject area.

c. In the advanced electrical components and systems training area, the TMI-1 program does not include topics which correspond to the following INPO recommended topics:

- o Motor, generator and transformer design types and characteristics
- o Main generator capability curves, operating limits and precautions
- o Control circuits for in-plant electrical switchgear
- o Control circuits for utility grid switchgear
- o Utility grid and interconnections with other grids
- o Electrical ground detection systems (including main generator field)
- o Protective relaying theory and application

These topics are considered appropriate for inclusion in the TMI-1 program.

9-2.1.2. Recommendation.

a. Provide additional instruction in the TMI-1 SRO training program in the following subject areas:

(1) Administrative procedures for maintenance and technical support.

(2) Duties of load system dispatcher related to on-site equipment and interactions with plant operators.

(3) Advanced electrical components and systems.

b. Restructure the OJT phase of the TMI-1 SRO training program to provide:

(1) Additional instruction in SRO duties under the supervision of a qualified SRO.

(2) Evolutions and operations to be conducted, observed, or simulated by SRO trainees.

(3) Detailed criteria for satisfactory accomplishment of checklist tasks.

(4) Reduced emphasis on taking equipment log readings.

(5) Additional training such as observation training at an operating plant, additional simulator training or a structured program of training during the startup and test program to compensate for reduced opportunities to obtain meaningful operating experience in the shutdown TMI-1 plant.

9-2.2. Instructional Materials.

9-2.2.1. Finding. The TMI Training Department reported that 15 of 24 lesson plans used with the recently completed TMI-1 SRO class were lesson plans developed for CRO training. These lesson plans do not contain additional material for SRO level of instruction. The remaining lesson plans have material added to meet SRO requirements for more depth of knowledge.

9-2.2.1. Conclusion. Fifteen of 24 lesson plans used for TMI-1 SRO lectures were developed for CRO instruction and do not contain additional material for SRO level of instruction. The TMI Training Department reported these lesson plans are being upgraded.

9-2.2.1. Recommendation. Continue upgrading TMI Training Department lesson plans to include different levels of instruction which are appropriate for licensed reactor operators and licensed senior reactor operators.

9-2.3. Examination Practices.

9-2.3.1. Finding. Examination administration, content, and grading were reviewed for the SRO training program. Examinations are considered to include oral and written examinations, quizzes, tests, and checkoffs. The following examinations are included in the SRO training program:

a. Ten two-hour quizzes administered by TMI Training Department SRO qualified instructors (eight during classroom phase and two during OJT)

b. One six-hour written final examination administered by Training Department SRO qualified instructors

c. One two-hour oral board examination administered by TMI Training Department and TMI-1 Operations Department SRO qualified personnel

d. One three-hour walk through the plant administered by TMI-1 Operations Department SRO qualified personnel

e. Fifty-five checkoffs of varying difficulty in Phase 2 of OJT administered by TMI-1 Operations Department SRO qualified personnel

9-2.3.1. Conclusion. The TMI Training Department program for TMI-1 licensed senior reactor operators includes a sufficient number and variety of oral, written and performance tests to adequately determine the knowledge and skills imparted to trainees.

9-2.3.1. Recommendation. Continue the present scope of testing in TMI-1 licensed senior reactor operator training program.

9-2.4. Review of Mock Written NRC License Examination.

9-2.4.1. Finding. The examination taken by one of the SRO trainees consisted of five sections covering reactor theory; theory of fluids and thermodynamics; plant systems--design, control and instrumentation; procedures--normal, abnormal, emergency, and radiological control; and administrative procedures, conditions and limitations. The scope of examination, point assignment and grading methods were considered satisfactory. However, there were no explanations for points taken off and this reduced the usefulness of the examination for review purposes and remedial study. The examination contained questions which required an understanding of basic principles and others which required recall of detailed factual information on plant characteristics and immediate operator actions in response to transients. Recognizing that no job and task analysis of TMI-1 SRO duties has been accomplished, questions were considered to have a good association with on-the-job duties and responsibilities of a TMI-1 SRO. Six hours were allowed for the examination and the examinee completed it in four hours eight minutes.

9-2.4.1. Conclusion. The mock written NRC license examination which was reviewed is considered representative of NRC license examinations and of value in preparing TMI-1 SRO trainees to take the NRC license examinations.

9-2.4.1. Discussion. The NRC license examinations are considered a final independent and accurate measure of (1) the capability of an operator and (2) the effectiveness of the training program which produced the operator. The mock NRC oral and written license examinations are part of the final steps to determine if a trainee is ready to take the NRC license examinations and thus they are an important element of the licensed operator training program. These examinations include questions which require detailed knowledge of plant systems, procedures, characteristics, and specifications. Other parts of the examinations require an understanding of fundamentals of reactor theory, heat transfer and fluid flow.

Some NRC type license examination questions have been criticized as requiring rote memorization to answer. It is important not to disqualify this kind of question out of hand without first understanding the type of situation the question is intended to address. However, it may be necessary to redesign the methods used in the examination even if the reason for the type of question is still valid.

The operator is a key contributor to the process of responding to transients that may be encountered in operation of a nuclear power plant. Many of the conditions which may lead to plant transients have low but significant probabilities and the means to respond to these transients have been designed into the engineered safeguards of the plant. Operator action is in many cases an integral part of the steps taken in the engineered systems response to a transient; certainly the function of engineered safeguards requires that operators not take certain actions which would frustrate intervention by the engineered safeguards.

The operator testing requirements which tend to be rote in character are an attempt to address the need for proper response at the proper time from the operator where identified plant upset conditions are encountered. The expectation that the operator be capable of and prepared to make the appropriate responses under such conditions is reasonable and desired. The adequacy of the rote response to such questions as a validation of the desired capability is open to argument. The need for the operator to have the capability to function as part of the plant safeguards process in upset situations is clear.

Since the TMI-2 accident there is more emphasis on an expanded expectation of operators' capabilities. The basic desire is to have operators who can also recognize transients initiated by unforeseen events and develop a response using the available plant systems such that a safe and stable condition can be reached with minimum adverse effects. To realize that expanded operator goal, the common wisdom is that the operator should have a knowledge of the engineering fundamentals in subjects such as reactor physics, thermodynamics, fluid flow, and water chemistry. There is no argument with either the goal of expanded operator versatility or with the idea that a better understanding of fundamentals is the way to realize that goal.

In testing operators using an expanded concept, it is necessary to address the full scope of the expectations of operator capability. The testing of response to identified transients is necessary and requires the examiner to provide some description of the situation confronted by the operator when the transient takes place. The response from the operator must be specific and timely. A simulator operational evaluation or oral questioning may be more revealing ways to test this capability than a written examination.

Testing an operator's knowledge of fundamentals is a different process. The questions asked should not be predictable. Basic processes should be addressed, not the behavior of complex systems.

9-2.4.1. Recommendation. Consider the points made in this discussion in structuring mock oral and written NRC license examinations.

9-2.5. <u>Results on Mock and Actual Written NRC License Examinations</u>.

9-2.5.1. Finding. Table 9-3 shows the results obtained on mock NRC written examinations taken by the four SRO trainees in the class which completed a modified version of the current SRO training program in June 1982.

TABLE 9-3

	June 1982 Mock Written NRC Examination Grades for Sections and Overall Grade					
Examinee	Reactor Theory	Thermodynamics	Plant Systems	Plant Procedures	Admin. Procedures	Overall
1	93.8	100.0	70.9	86.8	79.1	84.1
2	84.4	86.7	87.3	90.9	85.0	87.0
3	78.1	94.2	72.7	82.7	85.0	81.6
4	73.1	93.3	90.0	93.6	87.7	87.9

NOTE: Minimum passing grade is 80 overall and 70 in each section.

Four SRO trainees took the NRC written license examination the week of June 28, 1982. At the time of this report, it was known that two of four trainees passed the examination.

9-2.5.1. Conclusion. The 50% pass rate on the June 1982 written SRO NRC license examination taken by four TMI-1 SRO trainees indicates a need to review the training program and the circumstances of the trainees who failed. This analysis should determine what conditions contributed to the failures and what changes should be made to the TMI-1 SRO training program to improve the success rate in future NRC license examinations. Insufficient data was available to correlate performance on the mock examination with performance on the NRC license examination.

9-2.5.1. Recommendation. Review the TMI-1 SRO training program and the circumstances of the trainees who failed the examination to determine what conditions contributed to the failures and what changes should be made to the TMI-1 SRO training program to improve the success rate in future NRC license examinations.

9-2.6. Review of Weekly Quizzes Administered in TMI-1 SRO Training Program.

9-2.6.1. Finding. Quizzes covering one week's material taken by four TMI-1 SRO trainees were reviewed with the following results:

a. Overall the scope, point value and grading method were satisfactory. Comments were provided when points were taken off.
b. In one case, three trainees failed a quiz which included non-nuclear instrumentation and this subject was not covered in the makeup quiz.

9-2.6.1. Conclusion. The SRO quizzes which were reviewed provided a satisfactory check on TMI-1 SRO trainee understanding of material presented during one week of classroom lectures. The makeup quiz did not include questions on subjects which were failed on the original quiz.

9-2.6.1. Recommendation. Include questions in TMI-1 SRO training program makeup quizzes on subjects which were failed on the original quiz.

9-2.7. Training Records.

9-2.7.1. Finding. Training records of two TMI-1 SRO trainees were reviewed for types of information included. These records contained oral and written examination grades, attendance records and log sheets from Phase 1 OJT. The training records did not include separate quizzes for classroom and OJT phases because the two phases were combined for this class with classroom lectures in the morning and OJT in the afternoon on a typical day. The weekly quizzes included questions on classroom lectures and related OJT.

9-2.7.1. Conclusion. Training records of two TMI-1 SRO trainees were reviewed and considered satisfactory. In some cases, training records are filed by training session and not by individual. This makes time consuming the retrieval of records on an individual. A computerized training data base system is being implemented to improve management of training records.

9-2.7.1. Recommendation. Continue implementation of computerized training data base system to provide improved management of training records.

9-2.8. Prerequisites for Qualification as a TMI-1 SRO.

9-2.8.1. Finding. The INPO recommended prerequisites for qualification as an SRO include the provision that the candidate have at least six months experience as a CRO at the unit on which the individual is training as an SRO. During this time, the candidate should have participated in specified operations as a CRO. This experience requirement can be waived on a case-by-case basis at a high management level.

The TMI-1 program description prerequisites for SRO training permit satisfying experience requirements without having experience as a CRO at TMI-1.

9-2.8.1. Conclusion. An option in the TMI program description prerequisites permits a candidate for SRO qualification at TMI-1 to satisfy experience requirements without having experience as a CRO at TMI-1. This differs from the INPO recommended prerequisites for SRO qualification which include the requirement for experience as a CRO at the unit on which the individual is qualifying as an SRO. The INPO recommended prerequisites provide for waiver of experience requirements on a case-by-case basis at a high management level if the candidate has comparable previous nuclear power plant experience. It is considered that the TMI-1 SRO qualification would be strengthened by requiring CRO experience as a prerequisite with the provision for waiver on a case-by-case basis.

9-2.8.1. Recommendation. Restructure prerequisites for TMI-1 SRO qualification to include the requirement for CRO experience at TMI-1 with a provision for waiver of this requirement on a case-by-case basis at a high management level.

SECTION 10

LICENSED OPERATOR REQUALIFICATION TRAINING

10-0. INTRODUCTION. As stated in the TMI Training Department document titled "Licensed Operator Requalification Training Program Description TMI-1," 7/81, the goal of the operator requalification program is "to enhance nuclear plant safety and reliability by maintaining a high level of skill and knowledge in licensed senior operators and licensed operators."

This program is the means for assuring that licensed operators demonstrate their continued competence to support NRC license renewal at two year intervals as discussed in 10 CFR 55 Appendix A. The present requalification program has replaced previous requalification efforts such as the Operator Accelerated Retraining Program (OARP) which responded to specific one-time requirements following the TMI-2 accident.

Except where noted otherwise, the term licensed operators as used in this section includes licensed senior reactor operators and licensed reactor operators.

The TMI Training Department requalification program for TMI-1 licensed operators consists of the following four segments conducted on a cyclic basis so that all requirements are completed in a period not to exceed two years:

a. Preplanned lecture series which includes fundamental review lectures and operational proficiency lectures.
b. Skills training and evaluation which include reactivity manipulations and plant evolutions, nuclear power plant simulator exercises and plant drills to be performed at one and two year intervals.
c. Operational review program which provides a system for continuing on-shift study of selected operational experiences and changes to existing operating guidance or equipment.
d. Annual requalification examinations administered to all licensed personnel with the level of questioning appropriate to the individual's RO or SRO license level and consisting of a written and an oral examination.

The annual cycle of requalification is to be completed in 12 months, not to exceed 15 months, to accommodate plant operations. The present requalification cycle will end in December 1982. This cycle is the first to be conducted in accordance with the present program.

In addition to the normal requalification process described above, the TMI Training Department program provides for special retraining programs which cover:

a. Accelerated requalification for licensed individuals with identified deficiencies requiring assignment to a special retraining effort.
b. Inactive status retraining for individuals who have not actively carried out licensed duties for a period in excess of four months.
c. Newly licensed individuals who successfully complete their NRC license examination less than three months prior to the annual requalification examinations. These individuals may be excused from taking the written and oral requalification examinations. In other respects, newly licensed individuals enter the requalification program and participate in the annual program cycle upon receipt of their license.

In addition to discussing the above subjects, the TMI-1 program description also sets forth requalification program evaluation procedures, responsibilities of cognizant GPU Nuclear personnel, requalification program records, and the program approval process.

The simulator training phase of the requalification program consists of one week annually of classroom instruction (20 hours) and simulator exercises (20 hours) at the Babcock and Wilcox nuclear power plant simulator, Lynchburg, Virginia. This phase is discussed in Section 11 of the report.

Cycle 9 of the requalification program for licensed operators is now in progress. Requalification training material is presented over a six-week period to the six operating shifts in succession. This training occurs during one week sessions at the TMI Training Center. Each six week training period is followed by one week during which instructors prepare new material for presentation during the next six sessions. The one week break in requalification training also has the desirable effect of changing the shift which receives the new material first. As following shifts receive the training, minor changes are incorporated to improve the presentations. The annual requalification examinations are now planned to be given in December 1982. The plant drill segment of the requalification program was commenced in August 1982. Few of the normal, abnormal and emergency plant evolutions included in the requalification program can be accomplished with the plant in its present shutdown condition and they are conducted instead at the simulator. The TMI-1 Operations Department is responsible for the operational review segment of the program. This is carried out by routing to all licensed individuals, documented plant design changes, equipment modifications, procedure changes, technical specification changes, selected operational events, and reportable occurrences at TMI-1 and elsewhere in the industry. Licensed operators are required to read and acknowledge their understanding of the material.

10-1. ASSESSMENT METHODS. TMI-1 licensed operator requalification training was assessed by Mr. D.S. Boyd and Dr. P.C. Manning of Data-Design Laboratories assisted by Mr. J.J. Holman, a consultant to Data-Design Laboratories. The assessment was based on reviewing relevant documentation, interviews with GPU Nuclear personnel involved in or concerned with this training and its training content, and attending licensed operator requalification classes during the period June 21 - July 2, 1982.

10-1.1. Training Program Documentation. Principal documents which were reviewed in connection with this assessment included:

a. TMI Training Department document "Licensed Operator Requalification Training Program Description TMI-1," 7/81 (TMI-1 program description)
b. 10 CFR 55 Appendix A
c. INPO document "Nuclear Power Plant Requalification Program for Licensed Personnel - Guidelines for Requalification Training and Evaluation" (INPO guidelines)

A copy of the TMI-1 program description is included in Volume 2, Section 10.

10-1.2. Interviews. The following GPU Nuclear personnel were interviewed to obtain data on licensed operator requalification training:

a. President GPU Nuclear Corporation
b. Vice President Nuclear Assurance
c. Vice President and Director TMI-1
d. Manager Plant Training TMI
e. Operations and Maintenance Director TMI-1
f. Manager Plant Operations TMI-1
g. Manager Corporate Training
h. Operator Training Manager TMI
i. Two shift supervisors TMI-1
j. Two shift foremen TMI-1
k. Three control room operators TMI-1
l. Three licensed operator instructors (one instructor is the Supervisor Licensed Operator Training TMI-1)

The interviews of management personnel provided information on their training responsibilities, involvement, concerns, perceptions, and recommendations. TMI Training Department licensed operator instructors were asked questions on how they were selected for instructor assignment, their technical and educational backgrounds, role in licensed operator training, the percent of their time spent in various instructional tasks, operator attitudes about the requalification program, and specific suggestions about the requalification program. Interviews of TMI-1 shift supervisors, shift foremen and control room operators provided information on scheduling, course content, and recommendations for improvement.

10-1.3. Course Content Analysis. The basic reference used for assessing content of the TMI-1 licensed operator requalification program was the INPO guidelines. Many of the requalification training program lectures included in the one-week classroom periods are reviews of fundamentals and systems. The instructional material used for these lectures is the same as used for licensed reactor operator and senior reactor operator initial training. Comments on that material are included in Sections 8 and 9 of this report.

10-1.4. Classroom Observations. Two licensed operator requalification class sessions were attended to observe instructor performance, lesson content, operator participation, and the use of training aids.

10-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The findings, conclusions and recommendations cover program description and course content, instructors, preplanned lecture series, and sample weekly quizzes.

10-2.1 Program Description and Course Content. The TMI Training Department requalification program for TMI-1 licensed operators is based on and corresponds closely to the requalification program recommended by INPO guidelines. Therefore these findings will only note differences where they occur. When appropriate, conclusions and recommendations follow specific findings.

10-2.1.1. INPO Criteria for Preplanned Lecture Series.

a. Recommends 100 contact hours of instruction in preplanned lectures scheduled throughout the year.
b. Requires all licensed individuals to attend every lecture series topic included in the annual program.
c. Absences are made up within 12 weeks by rescheduling lecture attendance or by utilizing self study and discussion with knowledgeable personnel designated by the Training Supervisor.
d. Absentees are required to pass a quiz covering material presented during the missed lectures.
e. Self-study and discussion sessions should not be used for attendance make-up on more than 20% of the scheduled lecture series topics missed by the licensed individual.

10-2.1.1.1. Finding. The TMI-1 preplanned lecture series involves approximately 240 hours of instruction throughout the year as compared to the 100 hours of instruction considered sufficient by INPO guidelines. In addition to subjects recommended by INPO guidelines for operational proficiency lectures, the TMI-1 program includes a lecture on mitigation of accidents involving a degraded core.

Lectures in the series are presented to each shift every seven weeks. Two schedules for sample requalification training week activities covering the same general material for two shifts were reviewed. These documents scheduled lectures, self-study and quizzes during the 0700-1500 work day. No lunch period is included but the scheduled 1100-1130 study period is used as a lunch break. This is consistent with the normal shift practice of eating lunch on company time as the job permits. The two weekly schedules allocate the following times to:

a. Lectures - 31 and 34 hours
b. Self-Study (including lunch periods) - 5½ and 3½ hours
c. Quiz and Review - 3½ and 2½ hours

The lecture subjects included the integrated control system, non-nuclear instrumentation, industrial experience review, emergency procedures, reactor theory, heat transfer/fluid flow, and nuclear instrumentation. A weekly meeting of the Supervisor Licensed Operator Training TMI-1, TMI-1 Operations Department Training Coordinator, and the shift supervisors completing and beginning requalification lectures is held to discuss the schedule and make necessary changes in content and scheduling. After all six shifts receive the same material during their requalification training week, there is a one-week break for instructors to prepare new material. This break also causes a different shift to receive new material first when requalification training continues during the week following the break.

In addition to reviewing sample schedules, the following licensed operator requalification lectures were attended and instructor presentations were assessed:

a. Industrial Experience Review
b. Nuclear Instrumentation

In the Industrial Experience Review lecture, the instructor covered events of interest to TMI-1, including voiding in RCS hot leg, rupture of component cooling water line, fracture of a core component bolt, and amplifying information on the Ginna steam generator tube rupture. Training aids consisted of an overhead transparency stating objectives of the lesson and diagrams and photos which were passed around the class. Several detailed questions were asked by attendees about a relief valve. These questions were answered by the attendees and instructor studying the diagram and tracing out operation of the valve. The instructor asked questions to check understanding of trainees. In the summary, the lesson was reviewed and main points were emphasized.

In the Nuclear Instrumentation lecture, the instructor reviewed principles, ranges, and physical locations of instruments. He displayed detailed knowledge of equipment details. At one point in the lecture, the presentation deviated from the lesson plan in a discussion about details of the detector installation. Questions were asked by trainees and resolved in a discussion. The instructor asked questions to check understanding of trainees. The Manager Plant Operations TMI-1 attended this lecture for his own requalification training and as part of a continuing program of monitoring the training.

10-2.1.1.1. Conclusion. Based on limited observations, the TMI-1 licensed operator requalification training program preplanned lecture series is being effectively administered to assist in maintenance of licensed operator competence.

10-2.1.1.1. Recommendation. Continue the present preplanned lecture series program as presently constituted. Consider operator recommendations to include material in lectures which is important on the job but not included in requalification examinations.

10-2.1.1.2. Finding. The TMI-1 program description for requalification training of licensed operators provides the following guidance on preplanned lecture series attendance and make-up work:

a. Personnel whose annual written requalification examination grades are less than 80% in any section must attend the applicable lecture presentation.
b. Absences are to be approved in advance by Manager Plant Operations TMI-1 or Operations and Maintenance Director TMI-1 and should be limited to one training week per year.
c. Additional absences unless approved by Manager Plant Operations TMI-1 result in individual being removed from licensed duties and placed in an accelerated requalification program until missed material is made up. Mandatory attendance requirements shall be determined by the Supervisor Licensed Operator Training TMI-1.
d. Individuals who miss training are responsible for missed material and take the quiz that was given on the material.

10-2.1.1.2. Conclusion. The TMI-1 licensed operator requalification program is not consistent with the recommendations of INPO guidelines in basing required attendance at preplanned lectures on requalification examination grades. The INPO recommended program requires that all licensed operators attend all preplanned lectures.

10-2.1.1.2. Recommendation. As a minimum, require attendance of licensed operators at a core group of requalification lectures covering essential subjects in the lecture series without consideration of annual requalification examination grades.

10-2.1.2. INPO Criteria for Lecture Series Quizzes.

a. After each lecture or group of lectures, all trainees take a written and/or oral quiz covering the lecture topics.

10-2.1.2.1. Finding. The TMI-1 program description for requalification training specifies that all trainees take a written closed book quiz covering the lecture topics after each week of lectures. In addition to lecture topics, the weekly quizzes include questions from selected abnormal and emergency procedures as designated by Supervisor Licensed Operator Training TMI-1 such that all procedures are included in tests over a two year period.

A sample of 16 weekly quizzes administered to licensed operators in requalification cycle 9-1 were reviewed. This review indicated the following:

a. In one section of makeup quizzes, 4.5 out of 6.5 total points were assigned to identical questions contained in the quiz which the operator failed to pass originally.
b. Over a several month period, identical questions were included in quizzes administered to different shifts.
c. Most questions required recall of detailed factual information. Relatively few questions tested diagnostic or analytical skills and knowledge of system interrelations. Questions for SRO's did not require more depth of knowledge than questions for CRO's.
d. Two hours were allocated for these quizzes but actual times taken varied from 43 to 90 minutes with a mean of 70 minutes.

e. There was good agreement between the grading of quizzes and the answer key. However, in some cases full credit was given for answers which did not include all elements listed in the key. In some cases, points were deducted without indicating the correct answer.

10-2.1.2.1. Conclusion. A sample of weekly quizzes administered to TMI-1 licensed operators in requalification cycle 9-1 indicated areas where improvements can be made.

10-2.1.2.1. Recommendation. Modify TMI-1 requalification program weekly quiz practices to:

a. Use all different questions on makeup quizzes.
b. Include more questions which test diagnostic skills and knowledge of system interrelations.
c. Require more depth of knowledge from SRO's than CRO's.
d. Ensure grading indicates the reasons for deducting points and requires all answer key elements for full credit.

10-2.1.3. INPO Criteria for Assignment of Personnel to Simulator Exercises.

a. Not more than four licensed individuals should be assigned to participate in a simultor training session which is a direct interaction with the nuclear plant control panel.

10-2.1.3.1. Finding. In the TMI-1 licensed operator requalification program, licensed individuals are assigned to simulator training on a crew basis with other licensed individuals integrated into the crews not to exceed one additional individual per crew. Review of the composition of one TMI-1 shift crew assigned to simulator training indicated that seven personnel participated in simulator exercises with one crew. The crew included CRO trainees and the shift technical advisor. The TMI-1 shift supervisor of the crew was interviewed. He reported that extra personnel were assigned supporting roles during simulator exercises and this contributed to the realism and training value of the exercises.

10-2.1.3.1. Conclusion. In addition to personnel assigned to perform control panel manipulations during simulator exercises, other personnel can be assigned supporting functions to enhance overall training value of the exercises. These functions include checking procedures, making simulated reports to persons off-site and simulating duties of operators outside the control room. The number of observers present during simulator training periods should be controlled to prevent a negative impact on training.

10-2.1.3.1. Recommendation. Review the number and category of TMI-1 personnel included in shifts assigned to simulator training for each training period to ensure that specific meaningful roles can be assigned to all personnel to maximize the value of the training.

10-2.1.4. INPO Criteria for Training Exercises.

a. Licensed individuals shall participate in the plant drill program on an annual basis.
b. In connection with participation in training exercises at the simulator or during plant drills, utilization of applicable plant procedures and technical specifications should be maximized.

10-2.1.4.1. Finding. The TMI-1 plant drill program was commenced in August 1982. GPU Nuclear reported that plant drills will be conducted periodically.

10-2.1.4.1. Conclusion. A plant drill program has been established and is functioning. The shutdown status of the TMI-1 plant provides reduced opportunities for licensed operators to obtain meaningful training from plant drills.

10-2.1.4.1. Recommendation. Examine the impact of the shutdown status of the TMI-1 plant on the training value of plant drills included in the TMI-1 requalification program. As necessary, augment present training of licensed operators in plant drills with additional training during the startup and test program.

10-2.1.4.2. Finding. The TMI-1 program description for requalification training states that utilization of applicable plant procedures and technical specifications during training exercises should not be minimized.

10-2.1.4.2. Conclusion. There is a difference in orientation between the recommendations of INPO guidelines and the TMI-1 program description for requalification training regarding the use of plant procedures and technical specifications during plant drills. The INPO approach appears to be more procedure oriented.

10-2.1.4.2. Recommendation. Maximize utilization of plant procedures and technical specifications in connection with TMI-1 training exercises.

10-2.1.5. INPO Criteria for Annual Written Requalification Examination Performance Standards.

a. Licensed individuals receiving a grade of less than 70% in any examination category or an overall grade of less than 80% shall be placed in an accelerated requalification program.
b. Within two weeks of the annual wr tten examination, individuals in the above category shall undergo an oral examination. The Training Supervisor shall notify plant management of the oral and written examination results and provide a recommendation regarding the individual's removal from censed duties.

10-2.1.5.1. Finding. The TMI-1 program description for requalification training states that a licensed individual who receives a grade of less than 70% in any examination or an overall grade of less than 80% shall be relieved of his licensed duties and placed in an accelerated requalification program.

Under special circumstances where a grade of less than 70% has been scored in a single section, the Director TMI-1 may document the special circumstances and authorize an oral and written reexamination of the failed section within one week. If the oral examination is completed satisfactorily and a grade of 80% or greater is scored on the written reexamination, the individual may return to shift in a licensed status with the approval of the Director TMI-1.

10-2.1.5.1. Conclusion. The TMI-1 requalification program standards are more stringent than the recommendations of INPO guidelines concerning action in the event a licensed individual fails the annual written requalification examination.

10-2.1.5.1. Recommendation. Continue the present TMI-1 requalification program action if a licensed individual fails the annual written requalification examination.

10-2.1.6. INPO Criteria for Annual Oral Examination Performance Standards.

a. A failing overall oral examination grade shall require the licensed individual to participate in an accelerated requalification program. Within two weeks, licensed individuals who received an overall failing grade shall undergo an oral reexamination. The Training Supervisor shall notify plant management of the oral and written examination results and provide a recommendation regarding the individual's removal from licensed duties.

10-2.1.6.1. Finding. The TMI-1 program description for requalification training states that a licensed individual receiving a failing overall oral examination grade shall be relieved of licensed duties and placed in an accelerated requalification program.

10-2.1.6.1. Conclusion. The TMI-1 requalification program standards are more stringent than the recommendations of INPO guidelines concerning action in the event a licensed individual fails the annual oral requalification examination.

10-2.1.6.1. Recommendation. Continue the present TMI-1 requalification program action to be taken if a licensed individual fails the annual oral requalification examination.

10-2.1.7. INPO Criteria for Requalification of Newly Licensed Individuals.

a. Newly licensed individuals successfully completing their NRC licensing examination less than six months prior to the annual requalification examinations may be excused from taking the current annual written and oral examinations.

10-2.1.7.1. Finding. The TMI-1 program description for requalification training states that a newly licensed individual is excused from taking current written and oral examinations if the license is received within three months of the annual examinations.

10-2.1.7.1. Conclusion. The TMI-1 requalification program standards are more stringent than the recommendations of INPO guidelines concerning the exemption of newly licensed individuals from requalification examinations.

10-2.1.7.1. Recommendation. Continue the present TMI-1 requalification program provision for exemption of newly licensed individuals from requalification examinations.

10-2.1.8. Additional Materials in the Program Description.

10-2.1.8.1. Finding. The TMI-1 program description for requalification training includes additional material for plant-specific use such as references, definitions of annual and anniversary date as these pertain to the program, responsibilities, and provisions for program approval and evaluation. This material is not included in the generic program description provided by INPO guidelines.

10-2.1.9. Operator Comments on TMI-1 Requalification Training.

10-2.1.9.1. Finding. TMI-1 licensed operators who were interviewed commented on the content of requalification training as follows:

a. The training is valuable because it provides an opportunity away from shift duties to review seldom used theory, learn more details about plant systems and stay current on changes in the industry.
b. Systems which are important in their work but which may not count heavily in the requalification examinations should be covered. Examples are liquid waste evaporator, powdex, and stator cooling.
c. Heat transfer and fluid flow lectures were stimulating because new concepts were brought out.
d. Reactor theory lectures reviewed the same material as studied many times in the past.

10-2.1.9.1. Conclusion. TMI-1 licensed operators who were interviewed had a favorable perception of requalification training as helpful in maintaining their competence in the plant and in preparing them for the annual requalification examinations.

10-2.1.9.1. Recommendation. Consider TMI-1 licensed operator comments in structuring the requalification program.

10-2.2. Agreement with Requirements of 10 CFR 55 Appendix A.

10-2.2.1. Finding. The TMI-1 licensed operator requalification training program is in agreement with requirements of 10 CFR 55 Appendix A except that:

a. Attendance of all licensed individuals at requalification lectures is not mandatory in the TMI-1 program.
b. A retention period of two years for requalification records is not specified in the TMI-1 program.
c. TMI-1 program requirements for requalification records do not include results of evaluations and documentation of additional training administered in areas in which an operator or senior operator has exhibited deficiencies.

10-2.2.1. Conclusion. The TMI Training Department program for TMI-1 licensed operator requalification training is not in complete agreement with the requirements of 10 CFR 55 Appendix A.

10-2.2.1. Recommendations.

a. As a minimum, require attendance of licensed operators at a core group of requalification lectures covering essential subjects in the lecture series without consideration of annual requalification examination grades.
b. Specify a required retention period of two years for requalification records.
c. Include documentation of additional training in requalification records.
d. Establish a program for systematically observing and evaluating licensed operator performance. Include the results of these evaluations in training or personnel records.

10-2.3. Conclusion on Overall TMI-1 Licensed Operator Requalification Training Program. The TMI Training Department program for TMI-1 licensed operator requalification training is superior in design and implementation. A key element in successfully accomplishing this training is the six-shift organization of the TMI-1 plant staff. This schedule provides enough working time when personnel are not on duty in the plant for them to attend approximately six weeks per year of requalification instruction at the TMI Training Center. The TMI-1 program is based on and corresponds closely with the program recommended by INPO guidelines. Additional material is included in the TMI-1 program to meet specific needs at TMI.

10-2.3. Recommendation. Continue the TMI-1 licensed operator requalification training program as presently structured with modifications as recommended in this assessment.

SECTION 11
SIMULATOR TRAINING

11-0. INTRODUCTION. GPU Nuclear contracts with Babcock and Wilcox Company (B&W) to conduct simulator training for TMI-1 personnel, including licensed operators, shift technical advisors and management personnel. This training takes place at the full scope nuclear power plant simulator which is located at the B&W Nuclear Training Center, Lynchburg, Virginia. The reference plant for the B&W simulator is the Rancho Seco nuclear power plant which is similar, but not identical, to the TMI-1 plant. The B&W Nuclear Training Center includes classrooms near the simulator and is located in the same building as the B&W Nuclear Power Group. This proximity facilitates close contact between B&W design engineers responsible for the TMI-1 nuclear steam supply system and B&W simulator instructors and TMI 1 personnel in training.

GPU Nuclear stated there are plans to procure and install a full scope replica simulator at TMI for training TMI-1 personnel. Specifications to be included in the request for bid are under review. GPU Nuclear stated that the request for bid is expected to be issued in fall 1982. The stated goal is to have the simulator installed at TMI in 1985.

To complement both classroom instruction and full scope simulator training, GPU Nuclear has contracted with Electronic Associates Inc. (EAI), West Long Branch, New Jersey to design and manufacture a basic principles trainer (BPT). This is a concepts simulator for a B&W PWR reactor similar to TMI-1. GPU Nuclear stated that the BPT will be located at the TMI Training Center and that it is scheduled for installation in late 1982. The BPT will be used to provide systems training under normal and abnormal conditions associated with operation of a B&W nuclear steam supply system with once-through steam generators and an integrated control system.

Simulator training programs conducted by B&W for training TMI-1 licensed operators include a three-week course for replacement control room operators (CROs), a two-week course for replacement senior reactor operators (SROs) and a one-week course for requalification training of licensed operators. B&W simulator training programs are conducted during eight-hour shifts with discussions, problem sets, lectures, examinations, and tours scheduled in the first four hours followed by a lunch break and then four hours of simulator exercises. Work at the simulator frequently continues 24 hours per day to satisfy requirements for training personnel from various utilities with B&W nuclear steam supply systems.

In addition to its role as an instructional device, the simulator is also used for evaluation of personnel proficiency in replacement and requalification training programs.

As stated in the TMI Training Department document titled "TMI Replacement Operator Simulator Startup Certification Program," Rev 1, June 16, 1980, the course for replacement licensed reactor operators is intended "to follow the utility training program and serve as both a review and a mechanism for applying previously taught material to the operation of a nuclear power plant under dynamic conditions. The course provides training on B&W supplied systems, plant transient behavior and the fundamentals required for safe operation of the plant under startup, steady state, and accident conditions. Simulator training sessions are utilized to reinforce concepts discussed in the classroom."

The purpose of the course for replacement senior reactor operators as stated in the TMI Training Department program description is "to give Reactor Operators experience in supervising the operations of shift personnel."

The TMI Training Department program descriptions for replacement control room operator training, and replacement senior reactor operator training, mention simulator training as a part of these programs.

11-1. ASSESSMENT METHODS. Simulator training was assessed by Mr. D. S. Boyd of Data-Design Laboratories assisted by Mr. J. J. Holman, a consultant to Data-Design Laboratories. Mr. Boyd visited the B&W simulator June 16-18, 1982 and Mr. Holman visited the simulator June 15-18, 1982 while training of three TMI-1 replacement CRO trainees and four TMI-1 replacement SRO trainees was in progress. The CRO trainees were in the second week of the three-week course and the SRO trainees were in the first week of the two-week course. An experienced TMI-1 shift supervisor was also present during this period to monitor and assist the training.

The assessment was based on attending classroom lectures for CRO trainees which took place between 2000-2400 hours, observing simulator exercises which were conducted between 0000-0400 hours for CRO and SRO trainees, interviews with B&W and GPU Nuclear personnel involved in or concerned with this training, and reviewing relevant documentation. Discussions with GPU Nuclear personnel regarding simulator training were continued during data collection at TMI June 21-July 2, 1982.

11-1.1 Training Program Documentation. Principal documents which were reviewed in connection with this assessment included:

a. INPO document "Simulator Training," 2/82
b. ANSI/ANS-3.5-1981, "American National Standard for Nuclear Power Plant Simulators for Use in Operator Training"
c. Regulatory Guide 1.149, "Nuclear Power Plant Simulators for Use in Operator Training"
d. TMI Training Department document "Replacement Operator Training Program Description TMI-1," 1/81
e. TMI Training Department document "Licensed Operator Requalification Training Program Description TMI-1," 7/81
f. TMI Training Department document "Senior Reactor Operator Replacement Training Program Description TMI-1," 5/81
g. USNRC Atomic Safety and Licensing Board Partial Initial Decision (Procedural Background and Management Issues) Docket No. 50-289 (Restart), August 27, 1981
h. Report of the TMI-1 Operator Accelerated Retraining Program Review Committee, June 1, 1980
i. NUREG-0737, "Clarification of TMI Action Plan Requirements"
j. INPO document "Nuclear Power Plant Licensed Operators - Guidelines for Qualification Programs at Operational Units"
k. INPO document "Nuclear Power Plant Requalification Program for Licensed Personnel - Guidelines for Requalification Training and Evaluation"
l. B&W Training Simulator Exercise Sheets for a TMI-1 CRO trainee who attended the three-week startup certification course at the B&W simulator 10/19/81-11/06/81
m. B&W Training Simulator Exercise Sheets for a TMI-1 shift crew which participated in requalification training at the B&W simulator 1/4/82-1/8/82

n. NRC (H.R. Denton) letter "Qualifications of Reactor Operators," March 28, 1980

o. ANSI/ANS-3.1-1978, "American National Standard for Selection and Training of Nuclear Power Plant Personnel"

p. ANSI/ANS-3.1-1981, "American National Standard for Selection, Qualification and Training of Personnel for Nuclear Power Plants"

q. TMI Training Department document "TMI Replacement Operator Simulator Startup Certification Program," Rev 1, June 16, 1980 (TMI-1 program description)

r. TMI Training Department document "Senior Reactor Operators Course Simulator Evolutions" (TMI-1 program description)

Copies of the last two documents are included in Volume 2, Section 11.

11-1.2. Interviews. The following GPU Nuclear and B&W personnel were interviewed to obtain data on simulator training:

GPU Nuclear

a. President GPU Nuclear Corporation
b. Vice President Nuclear Assurance
c. Manager Plant Training TMI
d. Manager Plant Operations TMI-1
e. Manager Corporate Training
f. Operator Training Manager TMI
g. Two shift supervisors TMI-1
h. Two shift foremen TMI-1
i. Three licensed operator instructors TMI-1 (one instructor is the Supervisor Licensed Operator Training TMI-1)
j. Three licensed reactor operators TMI-1
k. One licensed senior reactor operator trainee TMI-1
l. Three licensed reactor operator trainees TMI-1

B&W

a. Manager of Instruction Services
b. Four simulator instructors

The interviews of GPU Nuclear and B&W management personnel provided information on their responsibilities, involvement, concerns, perceptions, and recommendations regarding simulator training. TMI-1 instructors, operators and trainees were asked questions about course content and recommendations for improving simulator training. B&W instructors were asked questions about course content, their technical backgrounds, duties, trainee knowledge and attitudes, and suggestions for improving simulator training.

11-1.3. Course Content Analysis. The basic references for assess ng TMI-1 simulator training course content were the INPO guidelines. The INPO guidelines for simulator training discuss management and conduct of this training while the INPO guidelines for licensed operator training and requalification programs recommend exercises and instruction times for simulator training.

11-1.4. Simulator Capabilities Analysis. The basic reference guidance for assessing simulator capabilities is contained in ANSI/ANS-3.5-1981 as endorsed with certain exceptions by Regulatory Guide 1.149. These documents establish the minimum functional requirements for simulators used for this purpose.

11-1.5. Classroom Observations. Four sessions of the CRO trainee classes were attended to observe instructor performance, lesson content, trainee participation, and use of training aids.

11-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The findings, conclusions and recommendations cover training device capabilities, course content, management involvement, instructors, presentation techniques, lesson plans, drill guides, examination practices, classroom facilities, training records, and status of past findings.

11-2.1. Capabilities of the B&W Simulator.

11-2.1.1. Finding. Capabilities and characteristics of the B&W simulator which relate to its effectiveness as a training device for TMI-1 personnel include the following:

a. Currently, the simulator provides 19 fixed and 5 snapshot initial conditions covering a variety of plant operating conditions, fission product poison concentrations and time in core life. The simulator has the capability to provide other additional initial conditions as desired. ANSI/AN-3.5-1981 requires a minimum capability of 20 initialization points.

b. Some 250 malfunctions can be inserted and terminated in single and multiple sequences. ANSI/ANS-3.5-1981 requires a minimum of 75 malfunctions. Insertion of a simulated plant malfunction does not alert the operator in any manner other than what would occur in the reference plant. All malfunctions required by ANSI/ANS-3.5-1981 can be inserted with the exception of loss of instrument air which is plant specific in nature.

c. The simulator can freeze the operation, perform evolutions in fast or slow time in addition to real time, take a snapshot of plant conditions, and backtrack to earlier conditions.

d. While positioned at the instructor's console, the instructor can simulate actions of an auxiliary or other operator outside the control room.

e. The simulator accurately models response characteristics of the Rancho Seco reference nuclear power plant. These responses are similar to responses of the TMI-1 plant.

f. B&W staff personnel reported that the simulator met the requirements of ANSI/ANS-3.5-1981 except for update of control room hardware to match the present configuration of the reference plant. B&W staff personnel reported the simulator performance characteristics have been documented in accordance with ANSI/ANS-3.5-1981.

g. Simulator equipment problems described as computer lockups prevented completion of some planned exercises and degraded responses on several other exercises during the observation period. B&W staff reported later that these problems were corrected and that overall the simulator is inoperative due to material problems less than 1% of the time. The TMI Training Department confirmed that simulator material problems have not degraded training effectiveness.

There are major differences between the TMI-1 control room and the B&W simulator in the following areas:

a. Layout of ICS stations on the console
b. Mockup of component equipment controls for primary and secondary systems
c. Mockup of secondary plant systems, turbine generator and controls

d. Instrumentation readout locations for primary and secondary parameters and emergency safeguards
e. Emergency safeguards system - location of controls, type of display, mechanics of operation
f. Control room size, orientation, alarm display including alarm sound, RMS, and meteorlogical information

The experienced TMI-1 shift supervisor present during the observation period commented that he remembered significant differences in responses of the simulator and TMI-1 for transients caused by control rod movement and feedwater system malfunctions. The B&W staff reported later that most of these differences have been resolved and that the simulator responses are in close agreement with TMI-1 plant responses.

Four experienced TMI-1 licensed operators were interviewed at TMI about the effectiveness of the B&W simulator as a device for training TMI-1 operators. Overall, they considered that it was effective for developing an operator's capability and confidence in handling various normal and abnormal evolutions. Their approach to coping with plant differences between the simulator and TMI-1 is to consider the simulator a different plant they must become proficient in operating.

TMI-1 personnel require refamiliarization with the simulator control room arrangement at the start of each simulator training period.

11-2.1.1. Conclusion. There are major differences in control room arrangements and some differences in responses and systems between the B&W nuclear power plant simulator and the TMI-1 plant. Notwithstanding these differences, the B&W simulator has the capabilities and characteristics to support effective initial and requalification training of TMI-1 licensed operators.

11-2.1.1. Recommendation. Continue training TMI-1 licensed operators at the B&W simulator until a full scope replica simulator is available at TMI.

11-2.2. <u>Course Content</u>. Comparisons were made of simulator exercises recommended by INPO guidelines, exercises included in TMI-1 program descriptions, and exercises actually accomplished in licensed operator training programs.

11-2.2.1. Simulator Training for Replacement CROs. Table 11-1 compares simulator exercises recommended by INPO guidelines with simulator exercises included in the TMI-1 program description for CRO trainees and simulator exercises actually accomplished by a representative TMI-1 CRO trainee during the three-week startup certification program. The sources of data for this analysis were:

a. INPO document "Nuclear Power Plant Licensed Operators - Guidelines for Qualification Programs at Operational Units"
b. TMI Training Department document "TMI Replacement Operator Simulator Startup Certification Program," Rev 1, June 16, 1980
c. B&W Training Simulator Exercise Sheets for a TMI-1 CRO trainee who attended the three-week startup certification course 10/19/81-11/06/81

Due to differences in exercise names and descriptions in the several documents, the data entered in Table 11-1 required some interpretations in making comparisons.

11-2.2.1.1. Finding. As displayed in Table 11-1, the sample B&W simulator exercise summary sheets for a representative TMI-1 CRO trainee documented the performance of 22 of the 27 evolutions which are recommended by INPO guidelines for replacement CRO training. The INPO recommended exercises not accomplished were:

a. Reactor shutdown (B&W staff reported this is included in small OTSG tube leak or small steam leak exercises)
b. Loss of instrument air (cannot be simulated)
c. Loss of shutdown cooling
d. Loss of component cooling
e. Reactor coolant pump seal failure (cannot be simulated realistically)

As Table 11-1 indicates, many exercises were performed multiple times. The sample TMI-1 CRO trainee participated in 202 exercises or evolutions as reactor operator, 27 as assistant reactor operator, 25 as shift supervisor, and 8 as shift foreman. In some cases, a single initiating casualty resulted in accomplishing several exercises. In some instances, the same exercise was repeated several times during one exercise period. The following additional types of exercises not included in the INPO guidelines were also accomplished:

TABLE 11-1

SIMULATOR TRAINING EXERCISES FOR INITIAL CRO TRAINING

Exercise	Exercise Included in INPO Guidelines	Exercise Included in TMI Program Description	Number of Times Exercise Was Accomplished by TMI-1 CRO Trainee in Each Operator Position			
			SS	SF	CRO	ARO
Reactor Plant Startup	X	X			14	5
Reactor Shutdown	X					
Reactor Trip	X	X	2	1	24	4
Turbine or Generator Trip	X		2	1	20	4
Loss of Coolant Including:					9	3
Steam Generator Leaks	X	X				
Pressurizer Leaks	X	X				
Large and Small Leaks Inside and Outside Primary Containment (including leak determination)	X	X				
Loss of Coolant Flow/Natural Circulation	X	X	2	2	7	3
Loss of All Feedwater (normal and emergency)	X	X	2		2	
Nuclear Instrumentation Failure(s)	X	X	1		1	
	and/or					
Non-nuclear Instrumentation Failure(s)	X	X			9	
Loss of Protective System Channel(s)	X				1	
Mispositioned Control Rod(s) (or rod drops)	X				4	
Inability to Drive Control Rods	X	X			2	
Conditions Requiring Use of Emergency Boration or Standby Liquid Control System	X				5	2

TABLE 11-1

SIMULATOR TRAINING EXERCISES FOR INITIAL CRO TRAINING (Continued)

Exercise	Exercise Included in INPO Guidelines	Exercise Included in TMI Program Description	Number of Times Exercise Was Accomplished by TMI-1 CRO Trainee in Each Operator Position			
			SS	SF	CRO	ARO
Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas	X				1	
Malfunction of Automatic Control System(s) Which Affect Reactivity	X				24	
Malfunction of Reactor Coolant Pressure/ Volume Control System	X				3	
Loss of Instrument Air (cannot be simulated)	X					
Loss of Electrical Power and/or Degraded Power Sources	X	X	2		3	
Loss of Condenser Vacuum	X				2	
Loss of Service Water	X		2			
Loss of Shutdown Cooling	X					
Loss of Component Cooling System or Cooling to an Individual Component	X					
Loss of Normal Feedwater or Normal Feedwater System Failure	X	X			10	2
Main Steam Line Break (inside or outside containment)	X	X	2		7	1
Reactor Coolant Pump Seal Failure (cannot be simulated realistically)	X					

TABLE 11-1

SIMULATOR TRAINING EXERCISES FOR INITIAL CRO TRAINING (Continued)

Exercise	Exercise Included in INPO Guidelines	Exercise Included in TMI Program Description	Number of Times Exercise Was Accomplished by TMI-1 CRO Trainee in Each Operator Position			
			SS	SF	CRO	ARO
Non LOCA Overcooling Event		X				
Manual/Auto ICS Operations at Power		X				
Unannounced Casualties		X				
TMI-2 Demonstration		X			1	
Solid Operations		X	2		7	
Overcooling Event		X				
Operational Exam		X				
Draw a Bubble			1		1	1
Boration and/or Dilution During Power Operation					6	
Any Significant (greater than 10%) Power Changes in Manual Rod Control			2		12	
Any Reactor Power Change of 10% or Greater with Load Control on Manual			3	2	19	1
Manual Control of Steam Generator Water Level and/or Feedwater Flow During Startup or Shutdown			2	2	17	1

Notes: Shift Supervisor - SS
Shift Foreman - SF
Control Room Operator - CRO
Assistant Reactor Operator - ARO

a. TMI-2 demonstration
b. Solid operations
c. Draw a bubble
d. Boration and/or dilution during power operation
e. Reactor power change of 10% or greater in manual rod control
f. Reactor power change of 10% or greater with load control on manual
g. Manual control of steam generator water level and/or feedwater flow during startup or shutdown

ANSI/ANS-3.1-1981 is the current revision of the American National Standard which contains criteria for selection, qualification and training of nuclear power plant personnel. It incorporates lessons learned from the TMI-2 accident as well as changing regulatory requirements. The simulator exercises recommended by INPO guidelines agree with the evolutions considered acceptable for licensed reactor operator training by ANSI-ANS-3.1-1981 with the exception that ANSI/ANS-3.1-1981 does not include Reactor Coolant Pump Seal Failure. Therefore, the simulator exercise summary sheets documented the performance of 22 of the 26 evolutions which are considered acceptable by ANSI/ANS-3.1-1981. The recommended exercises not accomplished were:

a. Reactor shutdown (B&W staff reported this is included in small OTSG tube leak or small steam leak exercises)
b. Loss of instrument air (cannot be simulated)
c. Loss of shutdown cooling
d. Loss of component cooling

11-2.2.1.1. Conclusion. Assuming the sample B&W exercise summary sheets provided are representative, there is close agreement between simulator exercises actually accomplished during replacement TMI-1 CRO training and exercises recommended by INPO guidelines or considered acceptable by ANSI/ANS-3.1-1981. Documentation indicated that 22 of 27 exercises recommended by INPO guidelines were accomplished. The remaining five exercises included two which cannot be simulated or simulated realistically by the simulator, two which can be simulated and one which was accomplished but not documented. Simulator training effectiveness is degraded to some extent by omission of the exercises not accomplished.

Simulator training actually accomplished also included exercises based on industry experiences and infrequent evolutions which are in addition to exercises recommended by INPO guidelines.

11-2.2.1.1. Recommendation. Accomplish loss of shutdown cooling and loss of component cooling exercises in simulator training for replacement CRO trainees. Continue the present practice of including additional exercises in simulator training which are based on industry experiences and infrequent evolutions.

11-2.2.1.2. Finding. As displayed in Table 11-1, the TMI simulator startup certification program course description for replacement TMI-1 CRO trainees includes in the course schedule 13 of the 27 exercises recommended by INPO guidelines. The INPO recommended exercises not included in the TMI program description are:

a. Reactor shutdown
b. Turbine or generator trip
c. Loss of protective system channel(s)
d Mispositioned control rod(s) (or rod drops)
e. Conditions requiring use of emergency boration
f. Fuel cladding failure or high activity in reactor coolant or offgas
g. Malfunction of automatic control system(s) which affect reactivity
h. Malfunction of reactor coolant pressure/volume control system
i. Loss of instrument air (cannot be simulated)
j. Loss of condenser vacuum
k. Loss of service water
l. Loss of shutdown cooling
m. Loss of component cooling
n. Reactor coolant pump seal failure (cannot be simulated realistically)

As discussed in Section 11-2.2.3, most of these exercises are actually accomplished during training of TMI-1 CRO trainees.

Although not included in INPO guidelines, the following are contained in the TMI program description:

a. Non LOCA overcooling event
b. Manual/Auto ICS operations at power

c. Unannounced casualties

d. TMI-2 demonstration

e. Solid operations

f. Overcooling event

g. Operational examination

11-2.2.1.2. Conclusion. There is significant lack of agreement between exercises contained in the TMI Training Department program description for replacement TMI-1 CRO simulator training and the simulator exercises recommended in INPO guidelines. Thirteen of 27 exercises recommended by INPO guidelines are included in the TMI program description. Twelve of the 14 exercises not included in the program description can be simulated realistically by the B&W simulator. Exercises important to training effectiveness are among those not included in the program description. The program description also includes exercises based on industry experiences and infrequent evolutions which are in addition to exercises recommended by INPO guidelines.

11-2-2-1.2. Recommendation. Revise the TMI Training Department program description for replacement TMI-1 CRO simulator training to make it consistent with INPO guidelines. Continue the present practice of including additional exercises in CRO simulator training which are based on industry experiences and infrequent evolutions.

11-2.2.1.3. Finding. The replacement TMI-1 CRO training course includes 60 hours of direct interaction with the simulator control panel and 60 hours of classroom lectures on subjects associated with the simulator exercises. INPO guidelines for qualification programs at operational units recommend that approximately 60 hours of control manipulations be included in replacement CRO simulator training. The typical simulator training program for replacement CROs at a unit which has not received an operating license is approximately eight weeks in length.

11-2.2.1.3. Conclusion. The simulator training program for TMI-1 replacement CROs is consistent with the INPO recommended program for personnel at operational units. Eight of nine CRO trainees in the class which will complete in late 1982 or early 1983 have no experience in the TMI-1 plant during power operations. The adequacy of the present three-week simulator training program for TMI-1 replacement CROs is not assured in view of reduced opportunities for trainees to obtain meaningful operating experience in the shutdown plant.

11-2.2.1.3. Recommendation. Review the present length and scope of simulator training for TMI-1 replacement CROs to determine if changes should be made to compensate for the reduced opportunities CRO trainees have to obtain meaningful operating experience in the shutdown TMI-1 plant. As necessary, augment present simulator training with additional simulator training.

11-2.2.2. Simulator Training for Replacement SROs. The INPO guidelines recommend that simulator training emphasize the SRO role in transients and casualty response. Evolutions such as those recommended for CRO simulator training should be included. Exercises involving multiple failures and/or operator error enhance the training. Designation of other abnormal/emergency conditions for inclusion as a training exercise is encouraged. The INPO recommended program includes approximately 16 operating hours in the simulator control room.

11-2.2.2.1. Finding. The TMI Training Department program description for replacement TMI-1 SRO simulator evolutions is taken from the program developed for training Oconee nuclear power plant personnel. The TMI program includes 40 hours of simulator exercises and 40 hours of associated classroom lectures. The exercises focus on multiple failures and complex evolutions and test the trainee's ability to diagnose unusual conditions and to direct the actions of shift personnel outside the control room. The course outline includes 22 of the 27 exercises recommended for CRO and SRO simulator training and displayed in the first column of Table 11-1. The INPO recommended exercises not included in the TMI-1 SRO program are:

a. Conditions requiring use of emergency boration
b. Fuel cladding failure or high activity in reactor coolant or offgas
c. Loss of instrument air (cannot be simulated)
d. Loss of shutdown cooling
e. Reactor coolant pump seal failure (cannot be simulated realistically)

Although not included in INPO guidelines, the following additional exercises are contained in the TMI program description:

a. Fire in a circuit breaker
b. Overcooling accident

c. Turbine building flooding

d. TMI-2 demonstration

e. Steam rupture complicated by personnel injuries

B&W exercise summary sheets for the TMI-1 SRO trainees who completed simulator training in June 1982 were not available for analysis of actual exercises accomplished during their training.

11-2.2.2.1. Conclusion. There is close agreement between exercises contained in the TMI Training Department program description for replacement TMI-1 SRO simulator training and the simulator exercises recommended by INPO guidelines. Twenty-two of 27 exercises recommended by INPO guidelines are included in the TMI program description. Of the five omitted exercises, two cannot be simulated. Exercises important to training effectiveness are among those not included in the program description but which can be simulated. The TMI training program significantly exceeds INPO recommendations by including 40 hours of simulator exercises and 40 hours of associated classroom lectures. The INPO guidelines recommend approximately 16 operating hours in the simulator control room. The program description also includes exercises based on industry experiences and infrequent evolutions which are in addition to exercises recommended by the INPO guidelines.

11-2.2.2.1. Recommendation. Revise the TMI Training Department program description for replacement TMI-1 SRO simulator training to include exercises recommended by INPO guidelines which can be simulated. Continue the present practice of including additional exercises in SRO simulator training which are based on industry experiences and infrequent evolutions.

11-2.2.3. Requalification Simulator Training for Licensed Operators. Table 11-2 compares reactivity manipulations and plant evolutions to be performed at the plant or simulator for licensed operator requalification training as contained in the following documents:

a. INPO guidelines

b. TMI-1 program description

c. NRC (H.R. Denton) letter of March 28, 1980

TABLE 11-2

REACTIVITY MANIPULATIONS AND PLANT EVOLUTIONS TO BE PERFORMED AT THE PLANT OR SIMULATOR FOR LICENSED OPERATOR REQUALIFICATION TRAINING

Exercise	Exercise Frequency Included in INPO Guidelines	Exercise Frequency Included in TMI Program Description	Exercise Frequency Included in NRC (H.R. Denton) Letter 3/28/80	Number of Times Exercise Was Accomplished During Sample Requalification Training
Plant Reactor Startup to Establish Heatup Rate	Annual	Annual	Annual	1
Plant Shutdown	Annual	Annual	Biennial	2
Manual Control of SG and/or Feedwater During Startup or Shutdown	Annual	Annual	Annual	13
Boration and/or Dilution During Power Operation	Annual	Annual	Biennial	4
Reactor Power Changes of 10% of Greater in Manual Rod Control	Annual	Annual	Annual	5
Reactor Power Changes of 10% or Greater Performed with Load Control on Manual	Annual	Annual	Biennial	14
Operation of Turbine Controls in Manual During Turbine Startup	Annual	Annual	Not documented, but B&W staff reported this exercise is accomplished.	
Decay Heat Removal System Operation	Annual	Annual	Accomplished on the plant.	
In Core Monitoring System Operation	Annual	Annual	Accomplished on the plant.	
Control Room Calculations	Annual	Annual	Not documented but B&W staff reported this exercise is accomplished.	

TABLE 11-2

REACTIVITY MANIPULATIONS AND PLANT EVOLUTIONS TO BE PERFORMED AT THE PLANT OR SIMULATOR FOR LICENSED OPERATOR REQUALIFICATION TRAINING (Continued)

Exercise	Exercise Frequency Included in INPO Guidelines	Exercise Frequency Included in TMI Program Description	Exercise Frequency Included in NRC (H.R. Denton) Letter 3/28/80	Number of Times Exercise Was Accomplished During Sample Requalification Training
Reactor Trip	Annual	Annual	Biennial	11
Turbine or Generator Trip	Annual	Annual	Biennial	11
Loss of Coolant including:				
Significant Steam Generator Leak	Annual	Annual	Annual	4
Significant Pressurizer Leak	Annual	Annual		
Large and Small Leaks Inside and Outside Primary Containment (including leak determination)	Annual	Annual	Annual	2
Saturated Reactor Coolant System Response	Annual	Annual	Annual	2
Loss of Coolant Flow/Natural Circulation	Annual	Annual	Annual	8
Loss of All Feedwater (normal and emergency)	Annual	Annual	Annual	4
Control Room Inaccessibility (cannot be simulated)	Annual	Annual		
Loss of Shutdown Cooling	Annual	Annual	Biennial	5
Nuclear Instrumentation Failure(s)	Biennial	Biennial	Biennial	1
Loss of Protective System Channel(s)	Biennial	Biennial	Biennial	1
Mispositioned Control Rod(s) (or rod drops)	Biennial	Biennial	Biennial	2
Inability to Drive Control Rods	Biennial	Biennial	Biennial	1

TABLE 11-2

REACTIVITY MANIPULATIONS AND PLANT EVOLUTIONS TO BE PERFORMED
AT THE PLANT OR SIMULATOR FOR LICENSED OPERATOR REQUALIFICATION TRAINING (Continued)

Exercise	Exercise Frequency Included in INPO Guidelines	Exercise Frequency Included in TMI Program Description	Exercise Frequency Included in NRC (H.R. Denton) Letter 3/28/80	Number of Times Exercise Was Accomplished During Sample Requalification Training
Conditions Requiring Use of Emergency Boration or Standby Liquid Control System	Biennial	Biennial	Biennial	5
Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas	Biennial	Biennial	Biennial	4
Malfunction of Automatic Control System(s) which Affect Reactivity	Biennial	Biennial	Biennial	5
Malfunction of Reactor Coolant Pressure/Volume Control System	Biennial	Biennial	Biennial	3
Loss of Instrument Air (cannot be simulated)	Biennial	Biennial	Biennial	
Loss of Electrical Power and/or Degraded Power Sources	Biennial	Biennial	Biennial	3
Loss of Condenser Vacuum	Biennial	Biennial	Biennial	
Loss of Service Water	Biennial	Biennial	Biennial	3
Loss of Component Cooling System or Cooling to an Individual Component	Biennial	Biennial	Biennial	1
Loss of Normal Feedwater or Normal Feedwater System Failure	Biennial	Biennial	Biennial	2

TABLE 11-2

REACTIVITY MANIPULATIONS AND PLANT EVOLUTIONS TO BE PERFORMED
AT THE PLANT OR SIMULATOR FOR LICENSED OPERATOR REQUALIFICATION TRAINING (Continued)

Exercise	Exercise Frequency Included in INPO Guidelines	Exercise Frequency Included in TMI Program Description	Exercise Frequency Included in NRC (H.R. Denton) Letter 3/28/80	Number of Times Exercise Was Accomplished During Sample Requalification Training
Main Steam Line Break (inside or outside containment)	Biennial	Biennial	Biennial	1
Solid Operations				2
Draw a Bubble				1

Table 11-2 also lists the recommended frequency of conducting the exercises and the number of times exercises were conducted during requalification training for a representative shift January 4-8, 1982.

Since the plant is shutdown, all reactivity manipulations and most plant evolutions are accomplished at the simulator.

11-2.2.3.1. Finding. As displayed in Table 11-2, all 35 normal and abnormal or emergency plant evolutions to be considered in establishing a simulator training program as set forth in INPO document "Nuclear Power Plant Requalification Program for Licensed Personnel - Guidelines for Requalification Training and Evaluation" are included in the TMI Training Department program description for TMI-1 licensed operator requalification training. The TMI frequencies for performing the evolutions agree with INPO recommended frequencies.

All control manipulations and plant evolutions contained in the NRC (H.R. Denton) letter of March 28, 1980, concerning qualifications of reactor operators are included in the TMI program description.

11-2.2.3.1. Conclusion. Simulator exercises contained in the TMI Training Department program description for TMI-1 licensed operator requalification training are in complete agreement with reactivity manipulations and plant evolutions to be performed at the plant or simulator as recommended by INPO guidelines and set forth in the NRC (H.R. Denton) letter of March 28, 1980.

11-2.2.3.1. Recommendation. Continue the present reactivity manipulations and plant evolutions included in the TMI-1 licensed operator requalification program.

11-2.2.3.2. Finding. The sample simulator exercise sheets for a representative TMI-1 shift crew requalification program documented the performance of 28 evolutions of the 35 evolutions which are recommended by INPO guidelines and included in the TMI-1 requalification program description. Those not documented were:

a. Operation of turbine controls in manual during turbine startup (B&W staff reported this is accomplished but not documented on exercise sheets)
b. Decay heat removal system operation (accomplished at the plant)

c. Incore monitoring system operation (accomplished at the plant)

d. Control room calculations including heat balance, coolant inventory balance and reactivity balance. (B&W staff reported that this is discussed in classroom lectures and performed on the simulator but not documented on exercise sheets)

e. Control room inaccessibility (cannot be simulated)

f. Loss of condenser vacuum (this exercise is required every two years and the previous year's requalification exercise summary sheets indicated the exercise was conducted last year for this shift)

g. Loss of coolant through a significant pressurizer leak

11-2.2.3.2. Conclusion. Assuming the sample exercise sheets provided are representative, there is close agreement between reactivity manipulations and plant evolutions actually accomplished at the plant or simulator and those recommended by INPO guidelines and set forth in the NRC (H.R. Denton) letter of March 28, 1980. One of 35 recommended evolutions cannot be simulated and one was not accomplished although it can be simulated. The remaining 33 of 35 recommended evolutions were accomplished at the plant or simulator with the prescribed frequency as part of TMI-1 licensed operator requalification training.

11-2.2.3.2. Recommendation. Institute a monitoring system to ensure that all reactivity manipulations and plant evolutions included in the TMI-1 licensed operator requalification program are accomplished at the plant or simulator with the prescribed frequency.

11-2.2.3.3. Finding. Analysis of data obtained on TMI-1 licensed operator requalification simulator training also indicated the following:

a. During the one-week annual licensed operator requalification program at the B&W simulator, the sample exercise sheets documented participation by the shift supervisor in 121 exercises or evolutions. In some cases, a single casualty resulted in documenting several exercises. Fourteen of the 15 exercises to be performed at least biennially were performed at least once during this requalification period. The remaining biennial exercise was performed last year by this shift crew.

b. In addition to recommended exercises set forth in the various documents, the exercises actually accomplished included solid operations and drawing a bubble in the pressurizer.

c. The shift crew, whose exercise sheets were examined, consisted of the shift supervisor, shift foreman, two CROs, two CRO trainees and the shift technical advisor. INPO guidelines recommend that the team concept be utilized in requalification training.

d. The requalification training program consists of 20 hours of simulator exercises and 20 hours of associated classroom lectures. INPO guidelines recommend at least 20 hours of simulator exercises.

11-2.2.3.3. Conclusion. The annual one-week TMI-1 licensed operator requalification simulator training program is in agreement with INPO guidelines in providing 20 hours of simulator exercises and assigning shift crews to training as teams. The TMI-1 program exceeds the INPO recommended program by including 20 hours of associated classroom lectures.

11-2.2.3.3. Recommendation. Continue the present TMI practice of assigning TMI-1 shift crews to requalification simulator training as teams. Continue the present TMI-1 licensed operator requalification simulator training program as modified by the recommendations of this assessment.

11-2.3. Management Involvement in Simulator Training.

11-2.3.1. Finding. A simulator training audit team of GPU Nuclear management personnel was formed and members visit the simulator to monitor training of TMI-1 personnel. Reports of three visits made since January 1982 were reviewed. The reports contained comments on effectiveness of training and recommendations for improvements. The Manager Plant Training TMI has used a checklist for evaluating training of GPU Nuclear personnel at another simulator. A checklist or other guidance has not been provided for evaluating the effectiveness of training at the B&W simulator. GPU Nuclear reported that an experienced TMI-1 SRO qualified operator is assigned to each group of TM[illegible] trainees to monitor and assist the training.

11-2.3.1. Concl[illegible] GPU Nuclear management personnel are actively involved in monitoring si[illegible]raining of TMI-1 personnel. The monitoring efforts lack focus which would [illegible]d by using an evaluation checklist similar to the one used by the Manage[illegible]ining TMI for evaluating training at another simulator.

11-2.3.1. Recommendation. Continue active GPU Nuclear management involvement in simulator training. Increase effectiveness of monitoring efforts by developing and using a checklist.

11-2.4. B&W Simulator Instructors.

11-2.4.1. Finding.

a. There are 15 instructors assigned to simulator and classroom training duties at the B&W Nuclear Training Center, Lynchburg, Virginia.

b. Some classroom lectures are presented by other personnel from the B&W simulation services and engineering sections who are experts in particular areas.

c. Instructors are assigned on a rotating basis to train TMI-1 personnel. One instructor is SRO qualified on the TMI-1 plant and serves as a source of accurate TMI-1 plant information for other instructors. Eight of the instructors are SRO qualified or certified on the simulator. The remainder are working toward this objective in accordance with a B&W instruction on the subject. The number of SRO qualified instructors assigned to train TMI-1 personnel depends on the overall workload. Non-SRO qualified instructors are checked out by SRO qualified instructors in the material they present. During the observation period, some B&W instructors who conducted simulator exercises for TMI-1 personnel were not SRO qualified. NUREG 0737 states that pending accreditation of training institutions, licensees will assure that training center instructors who teach simulator courses demonstrate SRO qualifications and be enrolled in appropriate requalification programs.

d. Instructors are evaluated by the B&W Manager of Instruction Services four times per year - twice during classroom lectures and twice during simulator exercises.

e. The B&W Manager of Instruction Services stated that he considers that the B&W instructor qualification program meets the intent of the INPO nuclear power plant instructor certification program.

11-2.4.1. Conclusion. GPU Nuclear has not assured that all B&W instructors who conduct simulator training for TMI-1 personnel have demonstrated SRO qualifications as discussed in NUREG 0737. B&W instructors are enrolled in a requalification program and their performance is periodically evaluated by B&W.

11-2.4.1. Recommendation. Arrange with B&W to use all SRO qualified instructors for training TMI-1 personnel.

11-2.5. P entation Techniques.

11-2.5.1. Finding. The following observations were made while attending classroom lectures for TMI-1 CRO trainees during the June 15-18, 1982 assessment visit. No classroom lectures were conducted for TMI-1 SRO trainees during this period:

a. June 15, Integrated Control System
   (1) The instructor used personalized notes as a lesson plan.
   (2) The material was clearly explained and the instructor displayed detailed knowledge of the subject.
   (3) Handout diagrams used as training aids were not legible due to poor reproduction quality.
b. June 16, Natural Circulation
   (1) No lesson plan was used.
   (2) An effort was made to correlate the lecture with follow-on simulator exercises.
   (3) TMI-1 CRO trainees attending the lecture had not received instruction in heat transfer and fluid flow during TMI-1 replacement CRO training course prior to attending this lecture. They were not prepared for the lecture which was intended to build on a basic knowledge of these subjects.
   (4) The instructor was a simulation systems engineer who displayed interest in helping trainees understand material which they had not studied before. There was no noticeable impact on subsequent simulator exercises because of not studying the material.
c. June 16, Reactor Protection System
   (1) The instructor used personal notes as a lesson plan.

(2) The instructor, who also conducted follow-on simulator exercises, was not SRO qualified or certified on the simulator.

(3) An overhead transparency of a wiring diagram was not legible due to clutter and poor reproduction quality.

(4) There was a disagreement between the instructor and trainees on TMI-1 plant modifications which changed some setpoints. B&W staff personnel commented that information on TMI-1 plant changes is not received in a timely manner at the simulator. This can lead to trainees taking advantage of instructors who do not know of recent changes with resulting decrease in the credibility of B&W instruction.

(5) The instructor did not stimulate trainees with discussion and questions.

d. June 17, Instrument Failures

(1) A lesson plan was not used. The instructor taught the lesson by tracing signals through several wiring diagrams.

(2) An overhead transparency was not legible due to poor reproduction quality.

(3) No handouts were provided.

(4) The instructor was knowledgeable and motivated to help trainees understand these systems.

11-2.5.1. Conclusion. B&W instructors observed making classroom presentations displayed detailed technical knowledge and excellent effort in instructing TMI-1 personnel. Effectiveness of the presentations could be increased by use of trainee handouts, lesson plans and improved training aids.

11-2.5.1. Recommendation. Review B&W classroom lecture instructional material used when training TMI-1 personnel. Arrange with B&W to make necessary revisions so as to support lectures with trainee handouts, lesson plans, and legible, instructionally sound training aids.

11-2.5.2. Conclusion. In one lecture observed, the TMI-1 CRO trainees had not received prerequisite instruction before attending the lecture at the simulator.

11-2.5.2. Recommendation. Coordinate TMI-1 CRO training to ensure that prerequisite instruction has been completed before the start of simulator training.

11-2.5.3. Conclusion. B&W instructor knowledge of TMI-1 plant specifications may be improved by more timely forwarding of plant modification information to the B&W simulator.

11-2.5.3. Recommendation. Review procedures to ensure that the B&W simulator receives plant modification information in a timely manner.

11-2.6. Lesson Plans and Drill Guides.

11-2.6.1. Finding.

a. A master lesson plan file with background material is maintained by B&W for all lecture subjects. These lesson plans includes information to be used in giving different lectures on the same subject. For example, the Integrated Control System master lesson plan includes material for an overview and four lectures on details of this system. Individual lesson plans are not developed for each lecture.
b. GPU Nuclear contracts with B&W to provide a specified number of hours of control manipulations on the simulator and accompanying classroom lectures which support the simulator training exercises. B&W staff personnel stated they consider they are responsive to GPU Nuclear requests for lectures on various subjects by instructors and design engineers.
c. B&W has developed drill guides for conducting 15 simulator exercises. Each guide includes a general description of the exercise, method of initiation, sequence of expected actions and point of termination. The guides are used by inexperienced instructors as an aid to becoming proficient in conducting exercises. B&W does not require that instructors use the guides and none were used during the observation period.

11-2.6.1. Conclusion. Quality of instruction provided by B&W in classroom lectures and simulator exercises for TMI-1 personnel can be improved through consistent use of lesson plans for individual classroom lectures and drill guides for simulator exercises. Without these aids, instructors do not have an effective means to ensure that important points are covered in the instruction.

11-2.6.1. Recommendation. Arrange with B&W to use lesson plans for classroom lectures and drill guides for simulator exercises when training TMI-1 personnel.

11-2.7. B&W Examination Practices.

11-2.7.1. Finding.

a. B&W administers a written examination to TMI-1 trainees covering classroom lecture material presented during the three-week replacement TMI-1 CRO training course. Grades on this examination are forwarded to the TMI Training Department. Examinations were reviewed for the CRO class which completed in January 1982. These examinations were not included in the training records for the individuals concerned.

b. B&W administers a startup certification examination on the simulator to TMI-1 CRO trainees on day 5 of the three-week course. As documented on a sample trainee's exercise sheet, this examination consisted of conducting one reactor startup to 5% power as assistant reactor operator and plotting an inverse count rate curve. The pass or fail outcome of this examination is reported to GPU Nuclear and the NRC.

c. B&W administers an operational evaluation on the simulator to TMI-1 CRO trainees on the last day of the three-week course. The operational evaluation checklist shown in Volume 2, Section 11 is used to determine overall trainee performance by rating in 11 grading areas. As documented on a sample trainee's exercise summary sheet, this examination consisted of taking action on 18 evolutions or malfunctions while assigned as reactor operator. B&W provides a report to the TMI Training Department on the evolutions administered to each trainee in various assignments and this information is entered in the training records for the individuals. B&W fills out operational evaluation checklists on TMI-1 CRO trainees to determine a pass or fail grade on the operational evaluation. The checklists are forwarded to the TMI Training Department. The checklists were reviewed for the TMI-1 CRO class which completed in January 1982. These evaluations were not included in the training records for the individuals concerned.

d. B&W uses the operationa evaluation checklist described above to assess the overall performance shift crews during requalification training.

B&W evaluations of shift performance and the performance of TMI-1 personnel compared with personnel from other utilities are discussed with the Manager Plant Operations TMI-1 who attends the operational evaluation of all shift crews during requalification simulator training. He also assesses shift crew performance using the operational evaluation checklist. These evaluations of shift crew performance were not included in training records for the individuals concerned.

11-2.7.1. Conclusion. The B&W operational evaluation checklist is an effective aid in assessing trainee performance during simulator exercises. Documentation of training accomplished at the simulator can be improved by including results of class.uum examinations and operational evaluations in the training records of TMI-1 licensed operators and licensed operator trainees.

11-2.7.1. Recommendation. Include results of B&W simulator classroom examinations and operational evaluations in the training records of TMI-1 licensed operators and licensed operator trainees.

11-2.8. Classroom Facilities.

11-2.8.1. Finding. Classroom facilities and equipment at the B&W Nuclear Training Center were observed to be excellent.

11-2.9. Training Records.

11-2.9.1. Finding. Simulator exercises actually accomplished are documented on computer printouts which are generated as the exercises are conducted. B&W provides these exercise sheets to the TMI Training Department and the sheets become part of the training records. The sheets are generated for each trainee or operator and show the exercises participated in and the operator position during the exercise. As discussed in Sections 11-2.2.1.1 and 11-2.2.3, some exercises actually accomplished are not documented on the sheets.

11-2.9.1. Conclusion. The computer generated exercise sheets are an excellent means of documenting the training of TMI-1 personnel which is accomplished at the simulator. However, the computer program omits the recording of some important evolutions such as reactor shutdowns which are included in other evolutions.

11-2.9.1. Recommendation. Arrange with B&W to have computer generated exercise sheets accurately and completely record evolutions accomplished during the training of TMI-1 personnel at the simulator.

11-2.10. Basic Principles Trainer (BPT). GPU Nuclear stated that the BPT is intended to have the characteristics to be an effective training device in operator training programs. It is designed to (1) demonstrate and reinforce reactor plant principles taught in the classroom, (2) optimize use of full scope simulator time by familiarizing replacement operator trainees with elementary generic system evolutions, and (3) help to maintain qualified operator knowledge of plant responses and characteristics between requalification exercises on the full scope simulator. Functions and design requirements are described in Volume 2, Section 11.

11-2.10.1. Finding. The TMI BPT will have broad scope software and use the Oconee nuclear power plant replica simulator data base instead of using a less powerful data base developed specifically for the BPT. The Oconee and TMI-1 plant characteristics are similar enough to permit the effective training of TMI-1 personnel in non-plant-specific operations using the Oconee replica simulator data base with the TMI BPT.

Development of software for the TMI BPT is tied to completion of the Oconee replica simulator. Acceptance testing of the Oconee simulator is now in progress at EAI.

Completion status of the BPT as of July 1982 was reported by GPU Nuclear as follows:

a. Hardware 97% (EAI responsibility)
b. Software 40% (EAI responsibility)
c. Courseware 10% (GPU Nuclear responsibility. Detailed learning objectives have been written for 18 systems or operations)

Scheduled milestone dates were reported by GPU Nuclear as follows:

a. EAI train TMI software maintenance personnel	Completed
b. EAI train TMI personnel on operation of BPT	August 1982
c. TMI personnel conduct pre-acceptance testing of BPT	August 1982
d. TMI personnel conduct acceptance testing of BPT	September 1982

e. TMI personnel develop BPT courseware to support learning objectives already written — October 1982 through March 1983

f. EAI ship BPT to TMI Training Center — October or November 1982

g. TMI/EAI install BPT and put in operation — December 1982

h. TMI fully integrate BPT in replacement and requalification training programs for operators — 2nd Quarter 1983

Note: As of the time of this report, GPU Nuclear reported that a delay of 1-2 months in key events was expected.

TMI Training Department personnel are not experienced in developing simulator courseware. Guidelines have not been written to assure the quality of this courseware. TMI Training Department staff reported that the nuclear utility industry generally lacks personnel who are experienced in developing simulator courseware.

Unresolved BPT issues include:

a. Designating a location at the TMI Training Center for installation of the BPT. Present plans are for the trainee and instructor consoles to be located in a separate room from the computer which supports the BPT. Modifications to the electric power and air conditioning services in the training center are required for the installation.

b. Development of a hardware maintenance plan for the BPT. Support by TMI personnel or contracting for maintenance service by EAI is being considered.

c. Assignment of sufficient appropriately experienced personnel to write BPT operating procedures, conduct pre-acceptance and acceptance testing, develop courseware, and integrate the BPT into TMI-1 operator training programs. In addition to the TMI representative assigned full time at EAI with project management responsibilities, one TMI Training Department licensed operator instructor is assigned as Supervisor Simulator Training in addition to instructing licensed operator personnel.

11-2.10.1. Conclusion. The basic principles trainer (BPT) now under procurement with installation planned at TMI in late 1982 is planned to have capabilities which will make it an important addition to the training capability at TMI. Several issues need to be resolved to properly support the installation and incorporate the BPT in TMI training programs.

11-2.10.1. Recommendation. Support installation of the basic principles trainer (BPT) at TMI and its incorporation in TMI-1 training programs by the following actions:

a. Designate a location at the TMI Training Center for installation of the BPT.
b. Develop a hardware maintenance plan for the BPT.
c. Review personnel support requirements and assign sufficient, appropriately qualified personnel to write procedures, conduct acceptance testing, develop courseware, and integrate the BPT into TMI-1 operator training programs.

11-2.11. Status of Findings and Recommendations from Past Investigations and Evaluations. Since the TMI-2 accident in 1979, investigations and evaluations have been conducted and, as a consequence, actions have been directed or recommended to improve training at TMI-1 and other nuclear power plants. Findings and recommendations concerning simulator training have been taken from the following reports and the remarks noted are based on this assessment. GPU Nuclear sponsored the evaluations reported in references 4 and 5 and maintains an up-to-date status on action taken in response to all directives and recommendations which affect training:

1. "Report of the President's Commission on the Accident at Three Mile Island" (Kemeny Report)
2. NRC, NUREG 0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations"
3. NRC, NUREG/CR-1250, "Three Mile Island, A Report to the Commission and to the Public," Vols. I and II, (Rogovin Report)
4. Nuclear Engineering Department, College of Engineering, Pennsylvania State University, "A Pedagogical Review of Reactor Operator Training at Three Mile Island Nuclear Plant," July 1980, Report No. NE-61
5. "Report of the TMI-1 Operator Accelerated Retraining Program Review Committee," June 1, 1980
6. NUREG-0585, "TMI-2 Lessons Learned Task Force Final Report"
7. ASLB Docket No. 50-289 (Restart) Partial Initial Decision (Procedural Background and Management Issues)

11-2.11.1. Finding.

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
a. Add or improve operator training in the following areas:		
Diagnosing and controlling unexpected events;	1, 3	Diagnostic training is included in simulator exercises;
Include use of plant systems already installed to control or mitigate core damage;	5	Natural circulation exercises are included in simulator training;
Include additional training of the combined shift crew in team responses;	3	Each shift crew participates in requalification training as a team;
Regular, improved simulator training should be included in operator training including how to diagnose and control transients, small break LOCAs, and when going solid is permissible.	1, 3	Simulator training is included in licensed operator initial and requalification training. Training includes recommended evolutions and casualties.
b. Provide for evaluation of trainees' performance during simulator training to determine competence to function during emergencies.	1	B&W conducts startup certifications of TMI-1 CRO trainees and these certifications are included in training records. B&W provides evaluations of trainee and licensed operator performance during simulator training. These evaluations are reviewed by TMI Training Department and TMI-1 Operations Department personnel. The evaluations have not been included in training records.
c. Management observation of training at the simulator and site should be practiced to enhance the training attitude and stress the importance associated with this training.	1	GPU Nuclear management personnel monitor simulator training for each group of TMI-1 trainees and licensed operators.

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
d. Improve simulator training as follows:	4	
Emphasize the "why" of transient progression;		This was included in training observed;
Integrate with classroom, self study, OJT;		Simulator training is integrated with other phases of training in the TMI-1 training program descriptions. Prerequisites are planned to be accomplished during training at TMI prior to simulator training;
Certification at end of program should include abnormal operations and unannounced casualties;		Abnormal operations and unannounced casualties are included in simulator operational examinations. Performance evaluation information is provided to the TMI Training Department;
SRO qualified TMI instructors should lead or co-instruct at B&W to assure TMI plant specifics and practices are incorporated in all simulator activities.		Experienced TMI-1 SRO qualified personnel are assigned to monitor and assist in instruction of TMI-1 trainees at the simulator;
Incorporate plant differences into lesson plans and lectures;		Plant differences are incorporated into lectures and exercises;
More time should be allocated to simulator training including emphasis on equipment failures and malfunctions with important components "tagged out;"		Simulator training includes equipment failures and malfunctions;
Provide SRO's with additional simulator training;		Present 80 hour course includes 40 hours of control manipulations and significantly exceeds INPO recommendations;

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
Tighten GPU Nuclear/B&W liaison.		A B&W senior instructor periodically visits TMI for liaison. Simulator training is planned by the TMI Training Department in coordination with B&W.
e. Evaluate individuals as well as team at the B&W simulator.	4	B&W provides evaluations on individuals to the TMI Training Department. These evaluations are not included in training records.
f. Increase emphasis on operator detection of unexpected events.	4	Emphasized in simulator training programs.
g. TMI-1 OARP Review Committee recommendations:	5	
GPU Nuclear should assure that content and conduct of B&W simulator programs are what they want, are complementary to the operator's other training and are responsive to changes in TMI-1 control room design and/or procedures. This should include assurance that all supporting materials are adequate and current.		Simulator training is planned by TMI Training Department in coordination with B&W. GPU Nuclear management personnel monitor simulator training. Some supporting material is not adequate.
Important "lessons learned" should be incorporated as quickly as possible.		Control manipulations and plant evolutions of NRC (H.R. Denton) letter of March 28, 1980 have been incorporated in requalification program.
GPU Nuclear should send crews together for simulator training.		Shift crews participate as a team in requalification training.
Differences between the simulator world and the real world should be emphasized.		This was included in training observed.

Substance of Finding or Recommendation	Reference	Remarks Related to TMI-1 Based on This Assessment
h. Prior to restart, the licensee shall demonstrate to the NRC staff that licensee has contracted for a basic principles trainer (BPT) for TMI-1 anticipated to be installed 1982.	7	BPT was placed under contract in 1981 and GPU Nuclear reported that delivery is scheduled for late 1982.
i. Following availability of this trainer, licensee shall provide for each operator as a part of annual requalification training at least one week of training per year on this trainer in addition to the week each year at B&W's simulator, at least until exact replica simulator is available.	7	GPU Nuclear reported plans to modify Administrative Procedure 1058, "Requirements for Certification of Candidates for NRC Operator Licenses," to require participation in a minimum of 20 hours of full scale simulator exercises and 40 hours of BPT training annually as the basis for license renewal certification.
j. Prior to April 1, 1982, licensee shall prepare for bid and distribute specifications for a TMI-1 exact replica simulator. Licensee shall make reasonable and diligent efforts to have the simulator installed by 1985.	7	GPU Nuclear reported that specifications to be included in the request for bid are under review. The request for bid is expected to be issued in fall 1982.

11-2.11.1. Conclusion. GPU Nuclear has been responsive in acting on various recommendations and directives to improve training. An exception to this conclusion is the delay in preparing specifications and issuing the request for bid on procurement of the full scope replica simulator for TMI.

11-2.11.1. Recommendation. Complete preparations and issue the request for bid to procure the full scope replica simulator for TMI.

SECTION 12

RADIOLOGICAL CONTROLS TECHNICIAN TRAINING

12-0. INTRODUCTION. Prior to the TMI-2 accident and consistent with the general practice in the industry, there was no formal radiological controls (RadCon) technician training at TMI. Radiological controls technicians were required to meet the qualifications of job specifications which included education and experience prerequisites. Training was accomplished by on-the-job instruction and experience. The shift supervisor was responsible for ensuring that his technicians possessed adequate abilities to perform their jobs.

Today, radiological controls technician training at TMI is formalized and extensive. The TMI document "Radiological Controls Personnel Training Program," Rev 0, 00/00/82 establishes training programs as follows:

a. Radiological Controls Technician Initial Training Program

b. Radiological Controls Technician/Foreman Cyclic Training Program

Radiological controls technicians progress from "C" to "B" to "A" level through the completion of practical factors training, time in service, attendance in the established training programs, and completion of oral, written and practical factor examinations under the direction of the TMI-1 Radiological Controls Department. Basics of radiological controls are taught in classroom sessions. The classroom phase of initial training which consisted of 11 weeks of instruction in subjects including basic radiological control principles, mathematics, plant systems, and emergency plant procedures is currently being reorganized and expanded to 15 weeks. The theory phase of this revised course is being rewritten using pertinent parts of the Health Physics Training Manual recently prepared by NUS Corp. and augmented by TMI Training Department lesson plans. This course will include the latest requirements of NUREG 0761.

When assigned to a shift at TMI-1, a RadCon technician participates in the Technician/Foreman Cyclic Training Program which is conducted continuously over a 42 week period with each shift receiving training for one week every six weeks. The cyclic program consists of requalification requirements, specialized training in the emergency plan, RadWaste administration, first aid, and other identified needs.

12-1. ASSESSMENT METHODS. An assessment of TMI-1 radiological controls technician training was performed by Mr. A.K. Loposer, Mr. J.E. Malloy, and Dr. M.A. Rhein of Data-Design Laboratories, assisted by Mr. A.T. Sabo, a consultant to Data-Design Laboratories. The assessment included:

a. Determining the commonality and differences between training program descriptions and text material for the TMI-1 RadCon technician initial training program compared with the program recommended by INPO Guideline 82-006, "Radiological Protection Training Qualifications," February 1982.

b. Analyzing five cyclic training lesson plans for completeness and teachability. A checklist based upon Appendix C to TMI Training Department procedure "Training Department Lesson Plan Development, Presentation, Evaluation and Selection of Training Aids," TD 1103, Rev 1, 4/04/81 was developed for the analysis. TD 1103 Appendix C is an expansion of the instructional materials and lesson plan criteria found in Appendix C of INPO Guideline 82-011, "The Accreditation of Training in the Nuclear Power Industry," May 1982.

c. Analyzing three cyclic training sessions for appropriate instructional presentation. A checklist based upon both TD 1103 Appendix C and INPO Guideline 82-011 was developed for the analysis.

d. Reviewing a sample of chapters in the NUS Health Physics Training Manual, February 1982 and test items which have been developed from objectives in those chapters. One purpose of this review was to match test items to objectives. Another purpose was to analyze the test items for sound test item writing practices.

e. Observing RadCon technicians, as well as other workers, performing procedures in radiologically controlled areas. These observations were made on two shifts June 30, 1982, as a measure of training effectiveness.

f. Interviewing various plant, corporate and training personnel to determine the TMI-1 RadCon Department/TMI Training Department organizational interface and the training effectiveness of the organization.

12-1.1. Documents Reviewed. Table 12-1 lists the documents which were reviewed in connection with this training assessment.

TABLE 12-1
DOCUMENTS REVIEWED FOR RADCON TRAINING ASSESSMENT

NRC and INPO Documents

a. NRC (H.R. Denton) letter dated 3/28/80, "Qualifications of Reactor Operators"

b. NRC Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," 10/76

c. INPO Guideline 82-006, "Radiological Protection Training Qualifications," 2/82

d. INPO Guideline 82-011, "The Accreditation of Training in the Nuclear Power Industry," 5/82

TMI-1 RadCon Department Procedures

a. TMI-1 RadCon Procedure 1690, "Training Requirements," Rev 8, 7/30/81*

b. TMI-1 RadCon Procedure 1690.1, "Radiological Controls Personnel Qualification/Training Standard," Rev 1, 11/21/80*

c. TMI-1 RadCon Procedure 1690.2, "Drills for Radiological Controls Technicians and Foremen," Rev 1, 1/24/81

d. Radiological Field Operations Personnel Qualification/Training Program TMI-1, 12/81*

e. TMI-2 RadCon Procedure 4023, "Oral Examinations for Technicians and Foremen," 6/5/82. (TMI-1 RadCon Procedure 1690.3 is identical and was being typed during the assessment visit.)

RadCon Training Program Description, Lesson Plans, and Handouts

a. TMI-1 Training Program #15.3.01/15.3.02, "Radiological Controls Personnel Training Program," Rev 2, 5/13/82*

b. RadCon Technician Review - Qual Exam Handout for RadCon technician Review Seminar Cyclic Training Session (no date)

c. RadCon Cyclic Training Program Lesson Plan and Handout, "Counting Statistics Review," Rev 0, 6/17/82

d. GET-203.1, "Radiological Controls Technician - Respiratory Protection Training Program" Lesson Plan and Handout, Rev 0, 6/7/82

e. Lesson plan on Mitigating Core Damage - Radiation Hazards and Monitoring Response

TABLE 12-1

DOCUMENTS REVIEWED FOR RADCON TRAINING ASSESSMENT (Continued)

f. RadCon Tech Lab on On/Offsite Monitoring

g. Major Studies on the Effects of Exposure to Ionizing Radiation, 05/03/82 (BIER III Report)

Other Documents

a. RadCon Training Meeting Minutes memos from November 23, 1981 through May 18, 1982

b. Radiological Investigative Reports (RIRs) and Radiological Deficiency Reports (RDRs) from February through May 1982

c. NUS Health Physics Training Manual, February 1982 and associated test questions

d. RadCon Technician Training Schedules, Cycles 1-82, 2-82, 3-82, 4-82, and 5-82

e. TMI Training Department Administrative Manual Volume I, Organization

* Documents included in Volume 2, Section 12.

12-1.2. Persons Interviewed. The following personnel were interviewed as part of the assessment:

a. Vice President Radiological and Environmental Controls

b. Vice President and Director TMI-1

c. Vice President Nuclear Assurance

d. Manager Plant Training TMI

e. Manager Corporate Training

f. Manager Radiological Controls TMI-1

g. Radiological Field Operations Manager TMI-1

h. Radiological Training Manager TMI-2

i. Supervisor Technician Training (TMI Training Department)

j. Radiological Controls Assessment TMI

k. Lead Instructor RadCon Training (TMI Training Department)

l. Various RadCon technicians and foremen

12-2. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS. The findings, conclusions and recommendations which follow cover training program content; lesson plans; instructional presentation; examinations; training effectiveness as observed in job performance; the TMI Training Department/TMI-1 RadCon Department interface, management and administration; and management interest and involvement.

12-2.1. Commonality Between TMI-1 RadCon Training and INPO Guideline 82-006.

12-2.1.1. Finding. The TMI-1 RadCon Procedure 1690.1, "Radiological Controls Personnel Qualification/Training Standard," Rev 1, 11/21/80, and the new initial training program being developed using the NUS Corp. text were compared with INPO Guideline 82-006, "Radiological Protection Technician Qualifications," 2/82 (INPO guidelines). Seventy-nine percent of the INPO recommended topics are adequately covered by RadCon Procedure 1690.1. All of the important INPO requirements are contained in the new initial training program text. Those specific INPO recommended topics for which a RadCon Procedure 1690.1 match could not be ascertained are listed below, by INPO guidelines paragraph number. When the topic is included in the new TMI-1 RadCon technician initial training program text, a note to that effect is made.

a. 5.1.2 -- Algebra - First item in INPO paragraph is covered in new initial training text but not in TMI-1 RadCon Procedure 1690.1.
b. 5.1.3 -- Mechanics - Second item is not covered.
c. 5.1.5 -- Nuclear Physics is covered in new initial training but not in TMI-1 RadCon Procedure 1690.1.
d. 5.1.6 -- Reactor Technology is covered in the systems portion of new initial training text (except item 3) but not in TMI-1 RadCon Procedure 1690.1.
e. 5.1.8 -- Communications is partially covered. The written portion is covered in new initial training text.
f. 5.2.12-- Airborne Radioactivity Control - Items 7 and 8 are covered in the systems portion of new initial training text, but not in TMI-1 RadCon Procedure 1690.1.
g. 5.4 -- Plant Systems - Items 5, 24, and 25 are not covered.
h. 5.5 -- Plant Operations and Maintenance - Only startup and shutdown portions of item 1 are covered. Item 2 is not covered. Item 3 is covered in general employee RWP training.

i. 5.6 -- Plant Procedures - Item 4 is covered in general employee training. Items 2, 5, and 6 are not covered.

12-2.1.1. Conclusion. A review of the NUS Health Physics Training Manual, system training material, and TMI-1 RadCon Procedure 1690.1 "Radiological Controls Personnel Qualification/Training Standard" shows close conformance with the INPO guidelines which were issued in February 1982. RadCon Procedure 1690.1, Rev 1, 11/21/80, which establishes the qualification and training standards does not reflect all the changes now being made in the TMI-1 RadCon technician initial training program.

12-2.1.1. Recommendation. Since the TMI-1 RadCon technician initial training program is currently being rewritten, all applicable recommendations of INPO guidelines should be included. Update TMI-1 RadCon Procedure 1690.1 to reflect provisions of the new TMI-1 RadCon technician initial training program.

12-2.2. <u>TMI-1 RadCon Technician Initial Training Course</u>.

12-2.2.1. Finding. The TMI-1 RadCon technician initial training course was not in session during the site visit. The course was last conducted in December 1981. The initial training course is being revised significantly to meet the requirements of NUREG 0761. Pertinent parts of the NUS Corp. Health Physics Training Manual, augmented by TMI Training Department lesson plans, will cover nine to eleven weeks of theory instruction. Additional training modules covering plant specific systems, equipment and components form the remainder of the course. These modules are being prepared by the TMI Training Department.

The NUS text is well organized and readable. It has the following characteristics:

a. Objectives are given at the beginning of each chapter.
b. Short sentences predominate.
c. Non technical words are used whenever possible.
d. Underlining is used to stress important points and terms.
e. A large print size is used.
f. Functional drawings are used which support the narrative.

This new TMI-1 RadCon technician initial training course of 15 weeks replaces the previous initial training course of 11 weeks.

12-2.2.1. Conclusion. The NUS Corp. Health Physics Training Manual and the training modules being prepared by the TMI Training Department should provide adequate content and depth for TMI-1 RadCon technician initial training.

12-2.2.1. Recommendation. Since the TMI-1 RadCon technician initial training program is currently being rewritten, include all of the applicable content recommended by INPO guidelines in the new initial training course.

12-2.3. <u>RadCon Technician/Foreman Cyclic Training Program</u>.

12-2.3.1. Finding. When a TMI-1 RadCon technician is assigned to a shift, he participates in the cycle training program during one week every six weeks. The cyclic training program is organized over a span of seven sessions in a 42 week period. The RadCon Field Operations Manager TMI-1, using inputs from the shift foremen, identifies what topics should be covered during the upcoming cyclic training. This information is provided to the Manager Radiological Controls TMI-1, and then to the Radiological Training Manager TMI-2 who works it into the cyclic training schedule through the TMI Training Department Lead Instructor RadCon Training. Additional inputs are provided through the twice monthly training meetings. Requalification requirements, specialized training in emergency conditions, and RadWaste administration are examples of subjects covered in cyclic training.

Cyclic training does not include structured training for foremen in how to manage OJT effectively. The RadCon Field Operations Manager TMI-1 stated that he uses informal means to monitor and assist foremen in their performance of instructing duties, conduct of OJT checkoffs and supervision of qualification examiners.

The TMI-1 cyclic training program is consistent with the recommendations of INPO guidelines for continuing training of RadCon technicians. Regarding this program, management personnel interviewed expressed a concern about whether the TMI Training Department could provide meaningful continuing training to a stable work force over a long period of time without becoming repetitive to the point of demotivating technicians.

12-2.3.1. Conclusion. The cyclic training program for TMI-1 RadCon technicians provides an excellent vehicle for periodic refresher, requalification and advanced training. The program is ambitious and reflects a strong corporate commitment to training. Considerable imagination and innovation are required to continue to provide useful, meaningful cyclic training without becoming repetitive and boring.

12-2.3.1. Recommendation. Continue to seek out ways to keep the TMI-1 RadCon technician cyclic training interesting, useful and professionally broadening.

12-2.3.2. Conclusion. The informal methods used to monitor TMI-1 RadCon foremen in the performance of their various training and qualification duties is working but this practice is not conducive to ensuring consistent, high standards in training functions.

12-2.3.2. Recommendation. Develop, document, and promulgate standardized methods and techniques to be applied in TMI-1 RadCon technician training and qualification processes. Assess the performance of foremen in accomplishing these tasks using the promulgated methods and te[illegible]s as standards.

12-2.4. <u>Lesson Plan Review</u>.

12-2.4.1. Finding. The following RadCon technician training lesson plans were reviewed. (a, b, c, and d were originated by the TMI RadCon Training Department and e was originated by the TMI-2 RadCon Department):

a. Counting Statistics Review, Rev 0, 6/17/82
b. Radiological Controls Technician - Respiratory Protection Training Program, Rev 0, 6/7/82 (GET 203.1)
c. Mitigating Core Damage - Radiation Hazards and Monitoring Response
d. RadCon Tech Lab on On/Offsite Monitoring
e. Major Studies on the Effects of Exposure to Radiation, 05/03/82 (BIER III Report)

The lesson plans reviewed are based on regulatory or TMI-1 RadCon Department procedure requirements. Other job-related requirements based on a job and task analysis are not reflected in the lesson plans. The Ma''ger Radiological Controls TMI-1 indicated that an analysis of RadCon technician training needs was being developed. The lesson plan objectives were clearly written and covered important points. The sequencing of content was appropriate and easy to follow. In some of the lesson plans, points to highlight, transparencies to use and references to mention were noted in a margin as an aid to the instructor.

The one significantly different lesson plan covered the BIER III Report. This is a National Academy of Sciences Report on the effects of exposure to low levels of ionizing radiation. The report is prepared in outline form with a number of supporting figures and tables. The format and organization of the report lend themselves to direct use in classroom instruction. A TMI-2 RadCon Department lesson plan cover sheet approving the BIER III Report as a lesson plan was appended. No objectives or points to be highlighted were added, however, to guide the instructor and the class.

The Mitigating Core Damage lesson plan appeared somewhat general in its coverage. This was a familiarization lesson and only selected material on this extensive subject was considered appropriate for RadCon technician training.

An agreement was reached effective June 1, 1982 between the TMI Training Department and the TMI-2 RadCon Training Department regarding standardization of lesson plan format.

12-2.4.1. Conclusion. Material in the BIER III report and the mitigating core damage lesson may be insufficiently covered in instruction for TMI-1 RadCon technicians.

12-2.4.1. Recommendation. Review the instruction of TMI-1 RadCon technicians in the BIER III report and the mitigating core damage lesson to ensure these important subjects are adequately covered.

12-2.4.2. Conclusion. The TMI-2 RadCon Training Department lesson plans which were reviewed followed accepted instructional practices. The agreement between the TMI Training Department and the TMI-2 RadCon Training Department to standardize lesson plan format in accordance with TD 1103 will help to improve the overall quality of TMI-2 RadCon Training Department lesson plans.

12-2.4.2. Recommendation. Utilize TMI Training Department Procedure TD 1103 in the preparation of RadCon technician lesson plans.

12-2.5. Observation of Training Sessions.

12-2.5.1. Finding. The TMI-1 RadCon technician initial training course was not in session during the site visit. Four cyclic training sessions were observed.

a. Counting Statistics Review. This session was held to aid RadCon technicians prepare for their requalification examinations which will be held in October-November 1982. This was basically a lecture session although some class discussion took place. The objectives were well prepared and fully covered. The pace of instruction was appropriate for a review session. The trainees did not perform any calculations in class, although the procedures to perform the calculations were included in a handout. Some calculations were reviewed on the board by the instructor.

b. RadCon Qualification Examination Review. This was a classroom review session in preparation for a requalification examination. A trainee handout was provided which listed the lesson objectives and provided very adequate coverage of the material in support of the objectives. The lesson plan and the lecture followed the objectives, but on several occasions the class discussion drifted well away from the lesson plan topics and involved questions and issues which could not be resolved within the class. TI-30 calculators were passed out for use in making computations. Several of the calculators were inoperable because of low batteries. There were sufficient spare calculators to replace the inoperable ones, but the exchange was time consuming.

c. Respiratory Protection for RadCon Technicians (Lecture Session). This was a requalification lecture session. The lecture contained recently developed material which was being presented for the first time by a new instructor. The characteristic advantages and disadvantages of each type of respirator were covered in the lecture. However, the handout did not include this information which would be of assistance to trainees for personal study and review. The smoke test procedure was read to the class. No audiovisual aids were used to complement the lecture.

This lecture session was a combined TMI-1 and TMI-2 class attended by 16 RadCon technicians. It was not a qualification session. Because of the large number of trainees in the class, it was difficult for the instructor to adequately observe all of the trainees when they were putting on full face respirators and checking for fit. Two trainees were observed not to follow the correct procedures. All trainees were given upchecks by the instructor after small discrepancies were discussed. The quiz which was administered at the end of this session is discussed in paragraph 12-2.7.1. Changes have reportedly been made from experience gained in this class.

d. Respiratory Protection for RadCon Technicians (Practical Session). This session covered six types of respiratory protection devices and was conducted in the plant. The stated purpose for conducting this session in the plant rather than at the training center was to give a demonstration of an air line blowdown prior to connecting a portable distribution manifold and filter apparatus. This demonstration applied to one of the six respirator types covered in the lesson. However, the blowdown demonstration was not observed by all of the trainees, since some were distracted by other nearby activities. Two of the trainees operated the valve for the blowdown; none of the trainees held the filter cloth during the blowdown. The instructor passed the filter cloth around, but not all of the trainees observed the cloth's discoloration which was a key element of the demonstration.

The environmental conditions in the plant made it difficult to see and hear the instructor. Lighting in the demonstration area was dim and there was a relatively high ambient noise level, punctuated by frequent PA announcements. The trainees stood in a group around the instructor as he demonstrated the various respirators. Only those trainees closest to the instructor saw the details of his demonstration.

On several occasions, the instructor donned a respirator and continued his description or instruction while wearing the mask. At these times, it was impossible for anyone more than three feet away to understand him.

The actual donning, use, and removal of the respirators by the trainees were performed as a group. Consequently, the instructor was unable to observe each person's individual performance. Several were observed to make errors and/or fail to follow the instructor's directions. This observation was discussed with the instructor who stated he believed that he had adequately covered the errors with the trainees.

12-2.5.1. Conclusion. The effectiveness of the respirator requalification session conducted in the plant was degraded by adverse noise and lighting conditions, the absence of a seating area or a raised position for the instructor, and distractions in the area. The advantages of conducting the lesson and requalification in the plant may have been outweighed by the disadvantages discussed.

12-2.5.1. Recommendation. Conduct classes in an environment conducive to learning. Use a second instructor or a videotape demonstration to preclude having a single instructor continuing to instruct while wearing a respirator mask. Alternatively, a single instructor could use a trainee to demonstrate donning the respirator, leaving the instructor free to talk and to point out key elements of the operation. Conduct individual qualification or requalification checkoffs in life support equipment such as respirators. Each individual should demonstrate positively and individually his performance to the complete satisfaction of the instructor. A group demonstration leaves much to be desired.

12-2.6. RadCon Technicians Observed Performing Procedures.

12-2.6.1. Finding. In order to assess the effectiveness of RadCon training, RadCon spaces and activities were observed. The activities included the performance of work functions by six RadCon technicians who were either selected by their foreman on an as-available basis or were observed on the job during a plant tour. The spaces and activities observed included:

a. Main RadCon Laboratory. This area was visited and observed to be well organized and clean. The personnel performing RadCon operations in the laboratory were observed to be alert, well-trained and conscientious concerning their tasks.

b. Area Swiping for Surface Contamination Followed by Counting the Swipes in the Laboratory. A RadCon Technician "C" was observed performing an area swipe survey. The technician had been qualified as a "C" for one week. In his swipe survey, he worked methodically. He was serious and intent on performing the task exactly in accordance with the procedure. All of his observed actions were in accordance with sound RadCon practices. In counting the swipes, he again was orderly and precise. He conducted frisking procedures correctly on departing the counting area.

c. Gas Sampling of the Reactor Containment Building. The same RadCon technician "C" was asked to do a gas sampling of the reactor containment building. As it turned out, this particular technician had not yet performed this procedure in his qualification program. However, his performance under the direct supervision of his foreman indicated a thorough understanding of how a procedure should be used. He obtained the procedure, reviewed it, and made copies of part of it to take to the sampling apparatus. His actions were slow and it was obvious this was the first time he had followed this particular procedure. Nonetheless, he was able to see where he needed help and did not hesitate to request help. He kept the shift supervisor in the control room apprised of his actions.

d. Roof Removal on Liquid Waste Solidification Room. This procedure was performed by a RadCon technician "C". The procedure, described to the observers prior to the roof removal, was followed. Plastic covering was used throughout the area involved. The technician swiped the area prior to roof removal. He also used a remote type survey meter in accordance with sound RadCon practice. The area CAM was operating. In addition, the workers in the building were using a portable dose rate meter. Due to the installation of a new roll-up door on a nearby building, there were a large number of workers in the area. However, the technician was observed to have the situation under control.

e. Main RadCon Check Point. This station was observed over a period of time. The area was well organized with a minimum of paper on the table. Active RWPs were at the sign-in table. The RadCon technician was observed to be efficient in processing workers through the check point. The workers were not aware they were being observed. The RadCon technicians used computer terminals to check personnel qualifications, verify exposures, and obtain other data. A RadCon technician read and recorded each self-reading dosimeter prior to issuing it. The dosimeters were read by a RadCon technician when the workers left the area. A technician checked workers to insure that they were properly dressed in protective clothing. The hand and foot monitor was used correctly by workers exiting from the controlled area.

f. Worker Exiting the Primary Coolant Laboratory. A worker was observed as he left the primary coolant laboratory. He checked his protective clothing and placed it on a rack near the door. A survey meter (HP-210 probe) was available at the laboratory door in accordance with sound RadCon practice. The worker used the HP-210 probe to check his shoes, hands, face, neck, and head. These checks were made in an orderly manner. Dosimetery items were checked on the meter for contamination.

g. Tent Containment Around the HEPA Filter Compression Area. A tent containment around the HEPA filter compression area had been set up. The compression process was to prepare the filters for disposal. The tent was substantial and well constructed. Local exhaust ventilators were used. Continuous air samples were being taken in the general work area adjacent to the exhaust ventilation system. The area was properly posted; a step off pad was in place and signs were appropriate.

h. General On-The-Job Observations of RadCon Practices. Overall, RadCon technicians were observed to follow sound RadCon practices. Portable survey meters were being used in work areas; area posting was current and the signs were dated and signed. RWPs were complete and an ALARA assessment was attached, if applicable. The RadCon technicians were cognizant of RWPs and were present at all active work areas to monitor the workers. Area contamination control was good. Plastic floor covering was used. Contaminated items were bagged in plastic and tied closed. Items leaving a Radioactive Material Area (RMA) were checked by a RadCon technician. Items which were classified clean were permitted to leave the area for unrestricted use. High radiation areas were locked.

12-2.6.1. Conclusion. RadCon technicians observed closely followed prescribed procedures and were well trained in the performance of their tasks.

12-2.6.1. Recommendation. Continue to emphasize the importance of strict adherence to procedures.

12-2.7. Examination Techniques.

12-2.7.1. Finding. Written, oral and practical factors examinations are used in RadCon training. Written examinations are used in initial training and for some sessions in cyclic training. Oral examinations are used for qualification and requalification certification. These oral, written and practical examinations are administered by the TMI RadCon Training Department. The written examinations are kept in locked storage when not in use. Written qualification examinations are under the cognizance of the Radiological Training Manager TMI-2. Examinees are seated by chart and the examinations are closely proctored. Examinees are told what materials they may have at written examinations. For oral examinations, examinees have access to calculators and plant drawings.

a. Written Examinations. Questions used in the RadCon Respiratory Protection requalification examination were reviewed. Questions written to cover RadCon subjects in general employee training and to meet objectives stated in the NUS Health Physics Training Manual were also reviewed. All questions were analyzed in terms of sound test item writing practice.

   A number of test items for RadCon Respiratory Protection requalification were not well constructed. Eleven out of the 30 multiple choice questions had "all" or "none of the above" as a distractor and in each instance it was the correct answer. One question was worth 40% of the examination grade. The question asked the examinee to list all respirators used at TMI and the protection factors of each. Although the area questioned is important, and partial scores were given in the fourteen parts, the answers required memorization. This area could be tested in a job related manner by asking which type respirator would be used under different conditions. If memorization of respirator information is a desired goal, then the type question used satisfies that goal.

   Questions written to cover RadCon subjects in general employee training included easily guessed questions, questions which required memorization of procedures and questions with inappropriate distractors.

The test items being written for the NUS course exhibited sound test item writing practices. Many of the items involved performing calculations or explaining reasons. An example was explain why one survey instrument is superior to another in a given situation.

b. Oral Examinations. Oral qualification boards for RadCon Technicians are headed by the Radiological Training Manager TMI-2 assisted by two other persons selected by him. Appointment to board membership is by individual letter signed by the Manager Radiological Controls TMI-1.

The oral examination question bank was reviewed. The questions were written on cards and each usage of the question was annotated with the date. Many of the questions had been used numerous times while many others had never been used. Because of a change of the requalification period from one year to two years, very few questions showed usage in the previous 8-10 months.

Many questions dealt with injury or other unusual situations to verify that the technician has the knowledge to respond properly under pressure. Questions covering day-to-day situations were not included. No model answers were provided.

12-2.7.1. Conclusion. Some test questions used in written RadCon technician examinations, although they relate to the objectives, are generally not well constructed.

12-2.7.1. Recommendation. Provide additional training to RadCon training instructors in testing and evaluation including test item construction and analysis.

12-2.7.2. Conclusion. Oral examinations used in RadCon technician training should cover day-to-day situations as well as injury and unusual situations. Criteria for questions and answers have not been established for oral examinations used in RadCon technician training.

12-2.7.2. Recommendation. Provide standard promptings and probes and model answers for use in RadCon technician oral examinations. Include day-to-day situations in oral examinations. Some suggested situations include:

a. Worker loses dosimeter

b. TLD badge contaminated

c. Worker has contaminated face

d. Worker found smoking in RMA area

e. Worker cuts or punctures hand in RMA area

f. Worker has contaminated personal clothing at exit

g. Survey instrument reads high due to contamination

12-2.8. <u>RadCon Training Organizational Interfaces</u>.

12-2.8.1. Finding. The division of responsibility between the TMI Training Department and the TMI RadCon organization was observed to be different from the division of responsibility between the TMI Training Department and other departments using its training services. In addition, there are inconsistencies in the several organization charts and descriptions which set forth the responsibilities of the TMI Training Department and the TMI RadCon organization for RadCon training. Examples of these differences and inconsistencies are discussed below.

a. The responsibilities of cognizant department managers for RadCon training are set forth in the TMI document "Radiological Controls Personnel Training Program," Rev 0, 00/00/82 as follows:
 (1) Manager RadCon TMI-1
  (a) Administration of the initial written screening examination for the selection of RadCon technicians.
  (b) Certification of RadCon personnel by written and oral examinations as specified in RCP 1690.1.
  (c) Administration of the Practical Factors program specified in RCP 1690.1.
 (2) Manager Plant Training TMI
  (a) Ensure that the Training Department provides the training and retraining programs required to qualify RadCon technicians and foremen and to maintain their qualifications in accordance with the TMI-1 Radiation Protection Plan and RCP 1690.1.
  (b) Under the Manager Plant Training TMI, the Supervisor Technician Training and the Group Supervisor Radiological Controls Technician Training or designated Lead Instructor Radiological Controls Technician Training have responsibilities for developing, implementing, and evaluating the RadCon training programs.

(3) Radiological Controls Training Manager

(a) Development and administration of the qualification pr ram for RadCon technicians and foremen

(b) Certification of course content

(c) Certification of the instructors for the program

(d) Approval of examination question banks used within the programs

(e) Approval of all lesson plans for technical accuracy

(f) Maintenance of training records

In contrast to this division of responsibilities for RadCon training, the division of responsibilities for the TMI-1 licensed reactor operator training program is considerably different. The Manager Plant Operations TMI-1 retains the responsibility to ensure that the overall level of training of plant operators is satisfactory through the approval of program content, schedules and administrative procedures. The TMI Training Department is responsible for developing and implementing the program in other respects.

b. Interviews conducted during the site visit identified a RadCon Training Coordinator TMI-1 position which is presently filled by a radiological engineer assigned to the TMI-1 RadCon Department. This position is not shown on organization charts. The incumbent coordinates TMI-1 RadCon training with the Radiological Training Manager TMI-2. The incumbent was not present during the site visit to discuss his functions and responsibilities.

c. A comparison of position titles indicated that the Radiological Controls Training Manager position in TMI document "Radiological Controls Personnel Training Program," Rev 0, 00/00/82 corresponds to the Radiological Training Manager TMI-2 position in the GPU Nuclear Radiological and Environmental Controls Division organization chart dated 5/01/82. This position is in fact responsible for RadCon training at TMI-1 and TMI-2, not just TMI-2.

d. The TMI Training Department Administrative Manual states that RadCon training is conducted under the direction of and coordinated with the Radiological and Environmental Control Division.

e. The GPU Nuclear organization description includes among major functions of the Nuclear Assurance Division, "Develop and implement all necessary general employee, operator, technician, and management training programs."

f. The Nuclear Assurance Division organization description, 3/01/82, includes under major functions of the TMI-1 Technician Training Subsection, radiological controls training. A note adds that this training is coordinated with the Radiological and Environmental Controls Division.

g. TMI-1 RadCon training records are maintained by the TMI-1 RadCon Department. In general, other training records are maintained by the TMI Training Department.

h. The GPU Nuclear organization description does not include a training function among the major functions of the Radiological and Environmental Controls Division.

i. The effectiveness of the present RadCon training arrangements and organization was discussed in interviews conducted during the site visit. There was overall agreement that the present organization functions satisfactorily in conducting TMI-1 RadCon technician training. A general impression was gained from the interviews that the TMI Training Department now has considerably more RadCon training expertise than at the time responsibility for TMI-1 RadCon technician training was originally placed under the TMI RadCon organization. Actions such as the recent agreement on the standardization of lesson plans are bringing the two organizations closer together on training matters.

12-2.8.1. Conclusion. The TMI Training Department and TMI RadCon organizations are conducting TMI-1 RadCon technician training satisfactorily. However, the responsibilities and the organization for conducting this training are not clearly defined.

12-2.8.1. Recommendation. Develop and promulgate a clearly defined description of responsibilities, authorities, interfaces, and positions involved in TMI-1 RadCon technician training.

12-2.8.2. Conclusion. The organization for conducting TMI-1 RadCon technician training is different from the organization for conducting other training of TMI-1 personnel. The TMI RadCon organization exercises more detailed control over training of TMI-1 RadCon technicians than is exercised by other TMI organizations over the training of their personnel.

12-2.8.2. Recommendation. Review the reasons for the present TMI-1 RadCon technician training organizational relationships. Determine if these reasons continue to make the present arrangements necessary and desirable. Consider an objective of assigning responsibility for TMI-1 RadCon technician initial training to the TMI Training Department and responsibility for advanced and plant specific RadCon technician training to the RadCon organization.

12-2.9. Training Records.

12-2.9.1. Finding. A sample of TMI-1 Radcon Department training related files, records, and procedures were reviewed and found to be in order with the following exceptions:

a. Training files are not maintained in a uniform manner and a number are incomplete. A major effort is in progress to correct this condition. Requested information was readily retrieved from sample files which had been upgraded. This information was observed to be complete and accurate.
b. Some RadCon technician cyclic training is being missed and not made up as required.

12-2.9.1. Conclusion. TMI-1 RadCon Department training files are being upgraded and consolidated to make them complete and consistent.

12-2.9.1. Recommendation. Continue upgrading of TMI-1 RadCon Department training files.

12-2.9.2. Conclusion. The requirement to make up missed cyclic RadCon technician training including missed examinations is not being consistently enforced.

12-2.9.2. Recommendation. Consistently enforce the requirement to make up missed cyclic RadCon technician training including missed examinations. Specify a time period for making up missed training.

12-2.10. Training Facilities.

12-2.10.1. Finding. There are no RadCon laboratory training facilities at the TMI Training Center. All laboratory training of TMI-1 RadCon technicians is accomplished at the main RadCon laboratory at the plant. This situation has an advantage in that personnel are trained under actual plant conditions in the laboratory where they will work as RadCon technicians. There are also the disadvantages of conflicts with operational use of the laboratory and the distance from the classroom training location. GPU Nuclear reported there are plans to provide a RadCon training laboratory at the TMI Training Center in an addition to be constructed about 1984 for the replica simulator.

12-2.10.1. Conclusion. The requirement for RadCon training laboratory facilities at the TMI Training Center is not firmly established at this time. Some basic RadCon practical factor training can be accomplished at the TMI Training Center if space can be provided for activities such as accomplishing respirator qualifications, cleaning up colored water spills, practicing use of monitoring equipment with non-controlled sources, conducting mock surveys, and training in the use of protective clothing.

12-2.10.1. Recommendation. Continue to review and evaluate requirements for providing RadCon training laboratory facilities at the TMI Training Center.

ATTACHMENT