November 28, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

REBUTTAL TESTIMONY OF
DR. RONALD A. KNIEF AND MR. BRUCE P. LEONARD

Q.1. Have you, Dr. Knief and Mr. Leonard, read the prefiled testimony of Dr. James J. Regan submitted on behalf of UCS on November 15, 1984 in this proceeding?

A.1. Yes, we have read Dr. Regan's prefiled testimony.

Q.2. Is this testimony responsive to Dr. Regan's testimony?

A.2. Yes.

Q.3. Why are you filing this response?

A.3. We believe it is important to respond to Dr. Regan's testimony because we believe Dr. Regan is unaware of the considerable efforts by GPU Nuclear in the past four and a half years to establish the validity of the TMI-1 licensed operator training program.

Dr. Regan's familiarity with our program apparently is limited to about seven days' exposure to the facts associated with it. See Regan Testimony at 1. Moreover, as Dr. Regan stated in his deposition, he did not know enough about the specific tasks associated with the job of control room operator to apply his personnel performance system to Three Mile Island. Regan Deposition of November 13, 1984, at 157, 159, 168. He therefore did not answer the question, "Is the instruction adequate to prepare the operators to operate the plant safely?" Regan Deposition at 168, referring to ALAB-772. Instead, Dr. Regan's testimony describes the system he would use to validate the program.

We do not fundamentally disagree with the principles articulated by Dr. Regan. In fact, the purpose of this testimony is to demonstrate GPU Nuclear's efforts over the past four and a half years to validate operator training, as Dr. Regan advocates in his testimony.

Q.4. Why is this testimony sponsored by the two of you (Dr. Knief and Mr. Leonard)?

A.4. Each of us contributes a slightly different perspective on and useful information related to the issue of the validity of the TMI-1 licensed operator training program. Dr. Knief was Manager, Plant Training, TMI from mid-1980 to mid-1983 and Manager of Educational Development for a year thereafter. He therefore has a historic perspective on the development of the program. As well, Dr. Knief approaches the

issue with a strong background in university and professional industrial education. Mr. Leonard, whose credentials have been previously described, is a member of this panel because of his detailed familiarity with the current licensed operator training program, including the job/task analyses for the TMI-1 RO and SRO that is underway. Together, we can best respond to Dr. Regan's views. Our qualification statements are attached to this testimony.

Q.5. Describe the validation methods applied by GPU Nuclear to the TMI-1 licensed operator training program.

A.5. To answer this question, it is necessary to provide some historical perspective. As Dr. Regan pointed out in his deposition, relating the content of training to the characteristics of a job "isn't done all that often." Regan Deposition at 144. In Dr. Regan's view, "there ought to be some attempt to recognize the dramatic advances in educational technology that are and have taken place in the last five to ten years." Regan Deposition at 144. Incorporation of these advancements does not ensure that a training program is good. See Regan Deposition at 148-49. Nevertheless, a contemporary vocational training program should have some content validation and, as well, use modern technology, e.g., using computers to manage the training process and to instruct, using feedback mechanisms. See Regan Deposition at 144-47. GPU Nuclear has endeavored to accomplish these goals and others, as the licensed operator training program has evolved over the last four and a half years.

The operator accelerated retraining program (OARP), developed in the aftermath of the TMI-2 accident, was designed and conducted in a manner then typical of the nuclear industry and academia -- it was a traditional, knowledge-based program which emphasized subject-matter topics and prior knowledge of the instructors. As a traditional program, it was diverse and thorough. However, it was not correlated with specific job performance requirements.

In mid-1980, the Training and Education Department of GPU Nuclear was formed, with Dr. Long as Director and Dr. Knief as Manager of Plant Training at TMI. Dr. Long and Dr. Knief were familiar with concepts of validation, and took immediate steps to shift the focus of operator training to a performance basis. Program validity was sought in terms both of subject-matter content and job performance. Information in both areas developed in-house was compared to that available from external sources such as INPO and the NRC. Systematic training development using feedback from a variety of cognizant personnel increased content and performance validity.

Q.6. What method did GPU Nuclear use to improve the validity of its TMI-1 licensed operator training program?

A.6. Instructor training, which started in 1980, placed special emphasis on the development and use of behavioral learning objectives. In addition, instructors were introduced to the principles of training needs analysis, job and task analysis, and testing and evaluation -- topics which were

later formalized as key elements in GPU Nuclear's and INPO's training system development (TSD) models and the NRC's systematic approach to training (SAT). Subsequent revisions to the replacement and requalification operator training programs incorporated these principles.

Q.7. Do you have a model that can be used to evaluate the development of training at TMI?

A.7. Yes. The TSD model is a method to develop a performance-based training program.

The TSD model includes five basic elements -- analysis, design, development, implementation, and evaluation. In summary, the TSD model recommends that a new training activity be constructed using the following steps: (1) Front-end analyses first identify the nature and extent of the training needs and then identify the elements of the job and tasks of which the job is composed. (2) The design phase focuses on developing behavioral learning objectives and job performance measures which correspond to the tasks required to perform the job. (3) The development component is primarily involved with developing curricula, training strategies, and lesson plans and other materials. (4) Implementation includes the actual scheduling and delivery of the training to the subject audience. (5) Although evaluation is listed as the final step of the TSD process, and indeed in its summative form can be a final wrap-up exercise, formative (in-line) evaluations should be conducted during and between each of the other steps to assess consistency and

provide for in-line feedback to modify and improve the resulting training program.

When a TSD approach is applied to an existing training program, in contrast to a new program under development, the initial focus is logically on the evaluation step. Strengths and weaknesses should be identified with the latter becoming the primary focus of attention and resources.

Q.8. How was the TSD approach applied at TMI?

A.8. Beginning in 1980, application of these principles to the licensed operator training programs at TMI-1 showed that the development and implementation phases were already conducted effectively. In our view, however, analysis, design, and evaluation could benefit from additional attention to assure proper focus on job performance. It was to these matters that our attention turned. Use of the TSD model was formalized in 1983.

The transition to performance-based training at TMI began through emphasis on behavioral learning objectives. These objectives identify not only subject areas required, but skills or cognitive behaviors to be mastered. See Regan Testimony at 6. The behavioral learning objectives for the licensed operator were developed or revised by job incumbents or other subject matter experts. This approach included an inherent element of informal or "table-top" job/task analysis.

Q.9. Did the use of behavioral learning objectives affect the performance evaluation process?

A.9. Evaluation in a performance-based setting is based on matching test items directly to the behavioral learning objectives. Focus on objectives paid the immediate dividend of allowing progress to be made simultaneously on three of the phases of the TSD model (analysis, design, and evaluation).

Q.10. How did you ensure that instructors unfamiliar with the use of behavioral learning objectives properly utilized them in the classes they taught?

A.10. Instructors and supervisors were trained on writing and use of behavioral learning objectives as a means of focusing instructional and student attention on training performance requirements and of communicating program content to Operations management personnel for their added input and ultimate concurrence. Instructor training courses, given routinely, continue the process of educating instructors in the performance-based methods utilized at TMI. In addition, when the program was instituted, the Manager of Plant Training worked with Training staff on improving the quality of the behavioral learning objectives through instructor classroom evaluations and review of selected lesson plans.

Q.11. Did the validation process used at TMI evolve further in the 1980 to 1982 time-frame?

A.11. With the issuance of NUREG/CR-1750, "Analysis, Conclusions, and Recommendations Concerning Operator Licensing" (January 1981), generic job analysis information for the licensed-operator job was available for the first time. GPU

Nuclear reviewed this document carefully. It was used to assess the content of the TMI-1 licensed operator training program. It also was used to assess new qualification cards developed to support on-the-job training activities.

INPO Guidelines (initially christened "benchmarks of excellence") for licensed operator training also were issued in this time-frame. Comparison of their subject matter to that of the TMI-1 program showed substantial agreement and content validity. The two programs also matched in terms of administrative requirements, such as the types of evaluations and review and approval mechanisms, which enhance performance validity.

In addition, in 1980 GPU Nuclear instituted a program of evaluation of simulator training by management. Due to their inherent integration of the entire range of job-performance skills, simulator drills and evolutions have been especially important evaluation methods providing feedback to both the training and operational arenas. They are also important mechanisms in performance validation.

In addition, in 1982 the formal process for operator certification as ready to operate the plant was established to consist of an integration of several training-related performances--classroom quizzes and examinations, on-the-job qualification, simulator and plant drills, and final written and oral examinations. Assistance was provided to instructors for their roles in these activities through a workshop on testing and evaluation. Based initially on consultation by Dr.

Eric Gardner with the TMI Training Department, the workshop provided some specific guidance on construction and use of a variety of written and oral examination methods. During the workshop, the instructors developed a TMI-specific taxonomy of cognitive skills against which existing quizzes and examinations were compared to assess relative balance between memorization and higher order mental processes, such as problem solving and decision-making. This training provided background for developing test specifications for annual requalification examinations.

Q.12. When did the INPO industry-wide job/task analysis effort begin and what was GPU Nuclear's involvement in that effort?

A.12. In 1981, INPO began its industry-wide job/task analysis project. TMI-1 supported the effort by having licensed operators complete surveys and participate in validation exercises conducted at INPO headquarters in Atlanta. Educational technologists from both the TMI and Oyster Creek Training Departments participated in workshop sessions at INPO to become trained on the process in support of plant-specific validation of the job/task lists.

Q.13. Have the INPO guidelines for accreditation been utilized at TMI?

A.13. INPO's 1982 draft guidelines for accreditation of nuclear power plant training programs were reviewed by Training and Education Department management and educational

technologist personnel in terms of consistency with the TMI-1 licensed operator training program. GPU Nuclear contracted with Data Design Laboratories (DDL) to perform an extensive evaluation of these programs using the draft INPO criteria as a basis. Their assessment of program strengths provided assurance of overall validity, while identification of specific weaknesses provided guidance for program improvement.

Q.14. Was the 1983 INPO generic job/task analysis used in the continued development of the TMI licensed operator training program?

A.14. The 1983 publication by INPO of generic job/task analysis results for licensed operators allowed comparison of the analyses to TMI-1 licensed operator OJT task sheets. Through this process, TMI Training revised the on-the-job training program using the performance requirements established by INPO.

Perhaps even more importantly, the INPO analysis provided a useful benchmark for developing training materials for the Basic Principles Training Simulator (BPTS). The design of the BPTS itself owes much of both its hardware configuration and instructor-console software to upfront table-top task analysis and resulting behavioral learning objectives developed by Operations, Training, and Technical Functions personnel. BPTS training development used the much more detailed INPO results to identify those tasks for which the device is best suited. At the same time, tasks suited for training on a full scope

simulator were also identified. This process supported on-going training at what was then the B&W simulator and also was used in the development of specifications for the TMI-1 replica simulator ultimately ordered from Singer-Link.

The Training Department also has taken the INPO generic job/task analysis results and prepared a job-analysis task list for the licensed operator. This was done using the plant-specific information provided previously to INPO by the TMI-1 licensed operators and a supplemental job analysis conducted by GPU Nuclear. Using this list, tasks are being identified which are appropriate for inclusion in the licensed operator training program. A matrix will identify whether each task is taught in the classroom and/or on the job. The matrix also will be used to upgrade the task descriptions and performance standards contained on the OJT qualification cards.

Q.15. Has TMI applied for INPO accreditation?

A.15. Yes. The TMI Training Department has completed a self-evaluation report in support of INPO accreditation for the licensed operator training programs. An accreditation team visited the site in early October, 1984 and is currently preparing its report.

Q.16. How is the operations plant manual used to further facilitate performance-based training?

A.16. The operations plant manual (OPM), the majority of which was issued in early 1984, provides a single reference for the base subject-matter that licensed operators need for

their jobs. Developed primarily by Operations personnel, it has been supplemented through reviews by Training and Technical Functions. The presence of behavioral learning objectives for each section of the OPM provides focus not only on the key subject matter but also on the important cognitive levels associated with each element. It is extremely useful to training personnel, operators and operator candidates as a reference tool that corresponds to both the training subject-matter and the job performance requirements.

Q.17. Are the performance-based training methods used by GPU Nuclear identical to the method recommended by Dr. Regan?

A.17. No. However, our methods are consistent with Dr. Regan's recommendations and certainly have involved many of the same elements that he recommends. Moreover, it is important to recognize that there are practical and legitimate constraints on our ability to implement a performance system such as Dr. Regan recommends. The licensed operator training programs in place at TMI-1 are ongoing programs, implemented on a continuous basis to a fairly small group of individuals. In this framework, test reliability, for example, is not readily established on a statistical basis. Standardization also may be impractical, as training needs change rather quickly.

Perhaps it is stating the obvious to note that when we decided to introduce performance-based training at TMI, it was not possible to shut down the operator training programs while

we thoroughly analyzed, designed and developed them. Instead, it was necessary to continue to train operators. Over the past four and a half years, particularly with the development of the INPO job/task analyses, we have expended considerable resources and effort to correlate our program with and revise it on the basis of performance criteria. In our opinion, accomplishing this effort in an evolving manner has been both necessary and advantageous.

Q.18. Do you have any concluding remarks?

A.18. Yes. The TMI-1 licensed operator training program is performance-based. Notwithstanding the shutdown of TMI-1, the program's validity has been and continues to be tested by various means, such as the capabilities of the trainees on-the-job, at the simulators, in-plant drills and on examinations (oral and written). Independent evaluations have occurred, as well, e.g., by the NRC Staff, OARP Committee, DDL, Rickover and INPO. Numerous feedback mechanisms from trainees and Operations management to Training exist to factor in the users' views of the program. In short, the program does prepare operators to safely operate TMI-1.

RONALD ALLEN KNIEF

Professional Experience

Current Position 1984-Present	Manager, Special Projects -- Permanent member of TMI-2 Programmatic Safety Overview Committee (PSOC); GPU Nuclear Corp.; Middletown, Pennsylvania
1983 - 1984	Manager, Educational Development; GPU Nuclear Corp.; Middletown, Pennsylvania
1980 - 1983	Manager, Plant Training; Three Mile Island Nuclear Station; GPU Nuclear Corp.; Middletown, Pennsylvania
1977 - 1980	Associate Professor; Department of Chemical and Nuclear Engineering; University of New Mexico; Albuquerque, New Mexico
1975 - 1980	Licensed Senior Reactor Operator for UNM AGN-201M Training Reactor (Chief Reactor Supervisor 1976 - 1980)
1977	Consulting Fuel Facility Inspector; U.S. Nuclear Regulatory Commission, Region III; Glen Ellyn, Illinois
1974 - 1977	Assistant Professor; Department of Chemical and Nuclear Engineering; University of New Mexico; Albuquerque, New Mexico
1972 - 1974	Senior Physicist; Reactor Physics and Computational Analysis; Combustion Engineering, Inc.; Windsor, Connecticut
Summer 1969	Research Associate; Nuclear Safeguards Research & Development Group; Los Alamos Scientific Laboratory; Los Alamos, New Mexico
Summer 1968	Research Associate; Fission Physics Research Group; Lawrence Livermore Laboratory; Livermore California
1965 - 1967	Laboratory Teaching Assistant; Department of Physics; Albion College; Albion, Michigan

Ancillary Educational Activities

1975 - 1979/ Present	Director/Consulting Director; Short Courses on Nuclear Criticality Safety (Seven courses through 1979/Three through 1983)
1980 - Present	Adjunct Associate Professor; Department of Chemical and Nuclear Engineering; University of New Mexico; Albuquerque, New Mexico

1981 - Present	Adjunct Associate Professor; Nuclear Engineering Department; Pennsylvania State University; State College, Pennsylvania
1984	Lecturer; IAEA Nuclear Power Course on Safety and Reliability in Nuclear Power Plant Operation; Co-Sponsored by Argonne National Laboratory and the International Atomic Energy Agency; Argonne, Illinois
1983	Lecturer; DOE Course on Prevention of Significant Nuclear Events; U.S. Department of Energy; Gaithersburg, Maryland, Salt Lake City, Utah, and Knoxville, Tennessee
1978 - 1981	Staff Member and Lecturer; International Training Courses on Physical Security for Nuclear Facilities; Co-Sponsored by Sandia Laboratories, U. S. Department of Energy, and International Atomic Energy Agency; Albuquerque, New Mexico
1975 - 1980	Instructor; Nuclear Engineering Orientation (1975 - 1977) and Nuclear Energy Technology (1978 - 1980) courses; Sandia Laboratories; Albuquerque, New Mexico
1976 - 1980	Director; Citizens Workshops on Energy and Environment for New Mexico (over 200 presentations to school, civic, and professional groups)
1980	Staff Member and Lecturer; International Training Course on Nuclear Materials Accountability for Safeguards Purposes; Co-Sponsored by Los Alamos Scientific Laboratory, U. S. Department of Energy, and International Atomic Energy Agency; Santa Fe, New Mexico
1972 - 1974	Adjunct Faculty Member; Physics Department; University of Hartford; West Hartford, Connecticut

Education

B.A.	Physics, Mathematics, Economics	Albion (Michigan) College	1967
Ph.D.	Nuclear Engineering	University of Illinois at Urbana-Champaign	1972

Specialized Education and Training

DOE Course on Prevention of Significant Nuclear Events, March 1983

Introduction to Power Plant Operations for Utility Executives, Westinghouse POTC Simulator, 1982.

TMI Emergency Director/Emergency Support Director Courses, 1982.

TMI-1 Safety Review Course, 1982.

Sr. Management TMI-1 (Systems) Training Program, 1981.

GPUN Management Development Program, 1981.

Public Speaking and Issue Development Program, Smith & Harnoff, 1981.

Faculty Institute on LMFBR Safety, Argonne National Laboratory, 1978.

Faculty Institute on Light Water Reactor Safety, Argonne National Laboratory, 1976.

CSUI/ANL Student Research Participation Program, Argonne National Laboratory, Spring Semester, 1966.

Honors and Awards

Who's Who in the East 1981 - Present

Who's Who in Technology Today 1979 - Present

Who's Who in the West 1979-1981

Outstanding Young Man of 1979 (U.S. Jaycees)

U.S. Atomic Energy Commission Special Fellowship in Nuclear Engineering, University of Illinois, 1968-71

Woodrow Wilson National Fellowship for College Teaching, University of Illinois, 1967-68

Albion College
- Highest Honors (Magna Cum Laude) and Departmental Honors in Physics, 1967
- Sigma Pi Sigma and DeNooyer Prizes in Physics, 1967
- Phi Beta Kappa Academic Honor Society, 1966
- Omicron Delta Kappa Leadership Honor Society, 1967
- Sigma Pi Sigma (Physics), Kappa Mu Epsilon (Mathematics), and Omicron Delta Kappa (Economics) Honor Societies, 1965
- Phi Eta Sigman Freshman Honor Society, 1964

Books

Knief, R. A., Nuclear Energy Technology: Theory and Practice of Commerical Nuclear Power, Hemisphere Publishing Corp. and McGraw-Hill Book Co., 1981

Knief, R. A., Nuclear Criticality Safety: Theory and Practice (manuscript submitted to the American Nuclear Society for 1984 publication)

Knief, R. A., "Nuclear Steam Supply Systems," in Elliott, T. C. (Ed.), Standard Handbook of Powerplant Engineering, McGraw-Hill Book Co. (in preparation)

Papers, Reports, and other Presentations

Knief, R. A., Long, R. L., and Newton, S. L., "Training Requirements at TMI -- Harbinger for the Industry?," Trans. Am. Nucl. Soc., 45, 195 (1983).

Knief, R. A., Long, R. L., and Newton, S. L., "Training Requirements at TMI -- Lessons for Nuclear Industry?," 2nd Annual International Nuclear Education Conference, Rochester, NY, Sept. 27-29, 1983.

Knief, R. A. and Masia, B. B., "New Perspectives on Testing and Evaluation at GPU Nuclear," 2nd Annual International Nuclear Education Conference, Rochester, NY, Sept. 27-29, 1983.

Knief, R. A., "Nuclear Criticality Safety Training for TMI-2 Operators," Trans. Am. Nucl. Soc., 44, 306 (1983).

Long, R. L., Gaines, D. P., and Knief, R. A., "Nuclear Personnel Training After TMI-2: The GPUN Response," Prog. Nucl. Energy, 10, 349 (1982).

Knief, R. A., "Achieving and Maintaining Training Quality at TMI," Westinghouse POTC Institute Day, Monroeville, PA, October 5, 1982.

Irizarry, C. A., Jones, J. W., and Knief, R. A., "Instructor Development at Three Mile Island," Personnel Selection and Training Bulletin, 3, 81 (1982).

Knief, R. A., "Radiation Protection Training at TMI," ANS/HPSA Meeting on Radiation Safety Training, Pittsburgh, PA, March 5-6, 1982.

Knief, R. A., Boltz, D. J., and Irizarry, C. A., "Behavioral Learning Objectives for Plant Simulation at TMI," Trans. Am. Nucl. Soc., 39, 281 (1981).

Knief, R. A. and Long, R. L., "Behavioral Learning Objectives for Simulator Training," Society for Applied Learning Technology Conference on Simulation and Training Technology for Nuclear Power Plant Safety, Arlington, VA, September 17 - 18, 1981.

Irizarry, C., Jones, J., and Knief, R. A., "Instructor Development Program at TMI," ANS Symposium on Training of Nuclear Facility Personnel, Gatlinburg, TN, CONF-810411, April 27 - 29, 1981.

Professional Societies

American Association for the Advancement of Science (1976 - Present)

American Nuclear Society (1971 - Present)
- Member, Student Affairs Subcommittee (1976 - Present)
- Member, Engineering & Technology Accreditation Registration & Professional Development Committee (1982 - Present)
- Chairman, Central Pennsylvania Section (1983-84)
- Chairman, Nuclear Criticality Safety Division (1980-81)
- Chairman, New Mexico Trinity Section (1977-78)

American Physical Society (1967 - 1982)

Institute of Nuclear Materials Management (1977 - Present)

Society of Sigma Xi (1972 - Present)

Other Professional Activities

Consultant, Sandia National Laboratories (1974 - Present)

Reviewer, McGraw-Hill Book Company (1979 - Present)

Evaluator, New York Regents' Program on Non-Collegiate Sponsored Instruction (1980 - Present)

Reviewer, U.S. Department of Energy Traineeship Programs (1980 - Present)

Visitor, Accreditation Board for Engineering and Technology (1982 - Present)

Reviewer, Hemisphere Publishing Corporation (1982 - Present)

Visitor, INPO Accreditation (1983 - Present)

Consultant, United Nuclear Corporation (1979)

Consultant, Argonne National Laboratories (1977)

Community Activities

Member, TMI Speakers Bureau	1980 - Present
American Red Cross Water Safety Instructor	1964 - 1981
YMCA Specialist Instructor in Water Safety	1976 - 1980
Member, Nuclear Medicine Committee, Veterans Administration Hospital, Albuquerque, New Mexico	1976 - 1980

Teaching Record

University Courses [No. of times]

University of Hartford

Physics 111: General Physics I	[2]
Physics 112: General Physics II	[2]

University of New Mexico

Engr. 101: Intro. to Engineering	[1]
N. E. 420: Fundamentals of N. E. (Nuclear Physics)	[1]
N. E. 423L: Radiation Measurements Laboratory	[1]
N. E. 430: Intro. to Nuclear Engineering	[2]
N. E. 461: Reactor Design Analysis	[2]
N. E. 465: Nuclear Power Systems	[1]
N. E. 465: Nuclear Energy Technology	[1]
N. E. 466: Environmental Safety Analysis	[1]
N. E. 502: Methods of Nuclear Safety and Safeguards	[2]
N. E. 510: Reactor Theory I	[4]
N. E. 511: Reactor Theory II	[5]

Pennsylvania State University, Capitol Campus

ET 497A: Nuclear Energy Technology	[1]

GPUN Courses/Sessions [No. of times]

TMI-1 Licensed-Operator Candidates	Basic Reactor Theory	16 hr
TMI-2 Licensed-Operator Requalification	Nuclear Criticality Safety	4 hr [7]
TMI-1 Licensed-Operator Requalification	Risk Assessment	4 hr [5]
Shift Technical Advisors	Advanced Reactor Theory	20 hr
Engineering Staff - Hdqtrs	Nucl. Energy Tech. Topics	4 hr
- Reading		8 hr
- TMI		4 hr
TMI-2 Safety Review Group	Nuclear Criticality Safety	2 hr

Reilly, K., Getty, C., and Knief, R. A., "College Credits for In-House Training," ANS Symposium on Training of Nuclear Facility Personnel, Gatlinburg, TN, CONF-810411, April 27 - 29, 1981.

Knief, R. A., "Potential Impacts on Material Safeguards on Nuclear Criticality Safety," Trans. Am. Nucl. Soc., 35, 291 (1980).

Knief, R. A., "Education in Nuclear Criticality Safety," Proc. ANS Topical Meeting on Nuclear Criticality Safety, El Paso, Texas, SAND80 - 1675, April 8 - 10, 1980.

Knief, R. A., "Nuclear Fuel Cycle Education Module on Nuclear Criticality Safety," Trans. Am. Nucl. Soc., 33, 119 (1979).

Morel, J. E., Allen, R. C., and Knief, R. A., "Particle Transport in an Anisotropic Medium," Trans. Am. Nucl. Soc., 30, 249-350 (1978).

Bradshaw, D. T., Taylor, O. W., and Knief, R. A., "Preliminary Fuel Component Price Sensitivity Analysis of Alternative Reactor Fuel Cycles," Trans. Am. Nucl. Soc., 30, 305-307 (1978).

Knief, R. A., Five lectures on nuclear fuel cycle, reactors, and reactor operations, "International Training Course on the Physical Protection of Nuclear Facilities and Materials," SAND 79-1090, Albuquerque, NM, May 1979.

Knief, R. A., "Nuclear Safeguards for Waste Management Facilities" International Fuel Cycle Evaluation, Working Group 7, Sandia Laboratories Internal Report RS 1754/1023, December 1978.

Knief, R. A., "Overview of the Nuclear Fuel Cycle," Proc. ASME Symposium on Non-Proliferation, Albuquerque, NM (1978).

Knief, R. A., "University Activities in Criticality Safety Education," Trans. Am. Nucl. Soc., 27, 402-403 (1977).

Knief, R. A., "Equation of State Studies Required for Fast Reactor Safety Analysis," University of New Mexico Report, April 1977.

Knief, R. A., "Nuclear Criticality Safety Workshops for Graduate Students," Trans. Am. Nucl. Soc., 24, 67-68 (1976).

Knief, R. A., Wehring, B. W., and Wyman, M. E., "Measurements of Time-Dependent Energy Spectra of Beta Rays from Cf-252 Fission Fragments," Nucl. Sci. Eng., 53, 47 (1974).

Augustson, R. H. Holm, D. H., and Knief, R. A., "Detailed Gamma Scan of SEFOR Fuel Rods," Los Alamos Scientific Laboratory Report LA-4227-MS, 1969.

Augustson, R. H., Menlove, H. O., and Knief, R. A., "Non-Destructive Assay of SEFOR Fuel Rods," Los Alamos Scientific Laboratory Report LA-4227-MS, 1969.

Menlove, H. O., and Knief, R. A., "Neutron Self-Indication Assay for SEFOR Fuel Rods," Los Alamos Scientific Laboratory Report LA-4315-MS, 1969.

Sr. Management	Risk Assessment	2 hr
Communications Staff	Basic Theory and Practice	4 hr [4]
Instructor Development	Testing & Evaluation	2 hr [5]
	Role of the Instructor	2 hr
	Training System Design	2 hr
	Principles of Instruction	4 hr

(See Also Ancillary Educational Activities)

RESUME

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

FUNCTIONAL TITLE: Operator Training Manager

EMPLOYEE EXPERIENCE:

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

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

Staff Training Officer, S3G Prototype, Naval Nuclear Power Training Unit, Ballstonspa, NY, 12/81 - 10/82. Military Department Head for approx. 150 qualified Nuclear Operators/Instructors. Responsible for Implementation and Enforcement of Training Programs including Chemisitry, Radiological Controls, Maintenance and Operations for 150 staff.

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

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

MILITARY EXPERIENCE:

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

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

EDUCATIONAL AND SPECIALIZED TRAINING:

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

NON-DEGREE COLLEGE
N/A

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

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

CERTIFICATES/LICENSES:

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

PUBLICATIONS:
None

PROFESSIONAL AFFILIATIONS:
NONE

ADDITIONAL INFORMATION:
N/A